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Sen. Dennis Kruse
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Rep. Kreg Battles
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Rep. Scott Reske
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Rep. Jack Lutz
Rep. Robert Behning
Rep. David Frizzell
Rep. Eric Koch
Rep. Ed Soliday

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Authority: IC 8-1-2.5-9

REGULATORY FLEXIBILITY COMMITTEE

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MEETING MINUTES[1]

Meeting Date:	**September 14, 2010**
Meeting Time:	**9:30 A.M.**
Meeting Place:	**State House, 200 W. Washington St., House Chamber**
Meeting City:	**Indianapolis, Indiana**
Meeting Number:	**1**

Members Present: **Sen. James Merritt, Co-Chairperson; Sen. Beverly Gard; Sen. Dennis Kruse; Sen. Jean Leising; Sen. Scott Schneider; Sen. Jean Breaux; Sen. Robert Deig; Sen. Sue Errington; Sen. Lonnie Randolph; Rep. Win Moses, Co-Chairperson; Rep. Matt Pierce; Rep. Sandra Blanton; Rep. Dan Stevenson; Rep. Jack Lutz; Rep. Robert Behning; Rep. David Frizzell; Rep. Eric Koch; Rep. Ed Soliday.**

Members Absent: **Sen. Edward Charbonneau; Sen. Marlin Stutzman; Sen. Carlin Yoder; Rep. Kreg Battles; Rep. Ryan Dvorak; Rep. Scott Reske.**

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[1] These minutes, exhibits, and other materials referenced in the minutes can be viewed electronically at http://www.in.gov/legislative Hard copies can be obtained in the Legislative Information Center in Room 230 of the State House in Indianapolis, Indiana. Requests for hard copies may be mailed to the Legislative Information Center, Legislative Services Agency, West Washington Street, Indianapolis, IN 46204-2789. A fee of $0.15 per page and mailing costs will be charged for hard copies.

I. Call to Order

Co-chair Representative Moses called the meeting to order at 9:40 a.m.

II. Annual Reports by the Indiana Utility Regulatory Commission

Indiana Utility Regulatory Commission (IURC) chairman David Lott Hardy began his presentation by describing the structure and responsibilities of the IURC and noting the disparity between the IURC's workload and its budget. Chairman Hardy highlighted the IURC's accomplishments during the last year, including handling the Indianapolis Water Company rate case, investigating demand side management programs, and reviewing the universal service program for gas utilities. Chairman Hardy also described what he termed an embarrassment to the IURC, the overpayment of $40.5 million by customers of an electric utility that was brought to the IURC's attention by intervenors rather than the IURC itself. Chairman Hardy testified that IURC review of the case resulted in a full refund, less fees and costs, to the utility's customers but no penalty to the utility due to the IURC's lack of fining authority; he also proposed conducting more frequent rate cases to avoid similar problems in the future. Chairman Hardy informed the Committee that the IURC has intervened in a rate case before the Federal Energy Regulatory Commission (FERC) concerning the Pioneer transmission line project proposed by Duke Energy and AEP; there is no consumer advocate in FERC proceedings, and the IURC determined that the project and the proposed rate of return were not appropriate for Indiana electric utility customers. Finally, Chairman Hardy directed the Committee members' attention to the IURC's 2010 report, containing detailed reports from the electric, natural gas, water/wastewater, and communications divisions of the IURC. See Exhibit A.

Representative Moses posed several questions concerning the Edwardsport integrated gasification combined cycle (IGCC) station. First, Representative Moses asked if utilities are required to use a least-cost approach during the planning process and to what extent the IURC enforces the use of that approach. Chairman Hardy answered that the least-cost approach is used during the planning process and that the IURC can disapprove costs that are inconsistent or disproportionate. Next, Representative Moses asked if construction work in progress (CWIP) costs had been factored into the IGCC plant's projected rate base. Chairman Hardy replied that CWIP costs had been allowed for $2.3 billion of the IGCC plant's costs but could be disallowed in the $530 million that the plant is seeking in additional costs; he also stated that he believes this approach saves utility customers money over time. Finally, Representative Moses asked if the reversion of 15% of the IURC's budget goes to utility customers or companies. Chairman Hardy explained that the reverted funds will be credited against fees paid by the investor owned utilities.

Senator Randolph asked Chairman Hardy if the IURC would like to have fining authority; Chairman Hardy noted that past legislative attempts to authorize fines have failed but that he believes it would be appropriate. Senator Randolph next inquired about the process by which the IURC learns of FERC proceedings. Chairman Hardy testified that FERC gives public notice and that an IURC attorney and various staff members follow the FERC docket. Chairman Hardy also agreed to inform Senator Randolph about the IURC's involvement, if any, in a waste disposal dispute in Lake County.

Chairman Hardy clarified for Senator Errington that the proposed Pioneer transmission line will help move electricity loads within Indiana and reiterated that both the MISO and PJM regional transmission organizations (RTOs) oppose construction of the line. Representative Frizzell and Chairman Hardy discussed the pros and cons of water utilities opting out of IURC jurisdiction. In response to a question from Representative Moses, Chairman Hardy stated his belief that there will be a need for additional plant construction because new environmental source performance standards will reduce overall production.

At the request of Representative Moses, Chairman Hardy summarized the results of the IURC's report on the deployment of video services as required by HEA 1279-2006. See Exhibit A, Appendix D. Representative Moses asked whether the passage of HEA 1279-2006 had resulted in new investments by video service providers, lower bills to video service customers, or increased availability of video services in rural and low income areas. Chairman Hardy replied no to each question. Representative Pierce questioned whether, as stated in the IURC report, new video service entrants have deployed significant infrastructure in metropolitan statistical areas (MSAs) across Indiana; Chairman Hardy answered that the IURC used data from zip codes and census blocks to reach this conclusion. Representative Pierce and Chairman Hardy discussed the process by which the IURC resolves complaints concerning the provision of public, educational governmental (PEG) programming by new video service providers. Chairman Hardy also agreed to investigate the proprietary status of the boundaries of AT&T's service area.

III. Annual Report by the State Utility Forecasting Group

Doug Gotham, director of the State Utility Forecasting Group (SUFG), presented the SUFG's 2010 renewable resources study, which addressed the following issues:

- Renewable energy trends, including renewable shares of Indiana's electricity consumption and generation.
- Barriers and incentives to renewable energy development, including cost, limited availability, and intermittent generation.
- Individual renewable resources, including wind developments, energy crops, organic waste biomass, solar energy/photovoltaics, fuel cells, hydroelectric power, and algae.

See Exhibits B and C.

Senator Gard asked whether there is a statutory definition of renewable energy resources. Mr. Gotham directed her to the definition enacted in SEA 29-2002 (codified at IC 8-1-8.8-10). Senator Gard also asked about the actual wind capacity of Indiana's wind turbines. Mr. Gotham stated that by the end of the year, the total capacity of wind turbines on line in Indiana will be 1300 MW. Senator Randolph commented on the current lack of incentives to invest in renewable energy resources. Mr. Gotham agreed that it is a moving target and noted that Indiana does not have a renewable portfolio standard.

Representative Pierce asked whether the cost of coal used in the SUFG's comparisons was the direct cost or if it included externalities; Mr. Gotham replied that it includes the costs associated with regulating emissions under existing rules. Representative Pierce next asked whether electricity costs less in Indiana. Mr. Gotham answered affirmatively but noted that the low average cost is due to the low rates paid by large industrial customers. Representative Pierce also asked about the ability to manage reliability for power generated from renewable energy resources. Mr. Gotham indicated that the availability of wind power can be forecast for the short term but that long term forecasting is problematic. Finally, Representative Pierce asked if the use of renewable energy resources will result in savings by avoiding the costs associated with building new plants. Mr. Gotham answered that there would be long term savings but that the savings themselves, absent restrictions on carbon remissions, would not offset capital costs.

Mr. Gotham next presented the SUFG's 2009 electricity forecast. See Exhibit B. Due to the economic recession, Indiana's electricity consumption decreased in 2008 and 2009 and future growth in demand is predicted to be 1.55%, compared to 2.46% in the 2007 forecast and 2.22% in the 2005 forecast. Mr. Gotham stated that Indiana's future demand

will exceed future existing resources. Real price projections for Indiana electricity based on 2007 dollars are higher than projected in 2007 and 2005.

Representative Moses asked if the reserves maintained by the RTOs are included in SUFG's estimates of available resources. Mr. Gotham replied that the estimates include the reserves less amounts that are obligated for purchase under contract. Mr. Gotham reminded the Committee that SUFG will release its next forecast in the summer of 2011.

IV. Cloud Computing Technology (SEA 384-2010)

Rick Gordon, managing director of Civitas Group, a security strategy consulting group based in Washington, D.C., testified that cloud computing is a growing segment of the information technology (IT) sector, predicted to generate $45 billion in 2013. See Exhibits D and E. Mr. Gordon stated that cloud computing is difficult to define but that it is basically the delivery of myriad technologies via the Internet, resulting in cost savings. According to Mr. Gordon, customers are interested in cloud computing because it reduces costs, provides immediate access to resources, allows increased data flexibility, and lessens the demands on IT personnel. Mr. Gordon further stated that each cloud computing system presents a different trade off between cost and control. Mr. Gordon testified that cloud computing provides perceived security advantages, such as easily repurposed excess capacity, quick access to outside expertise, and timely system patches, as well as perceived security disadvantages, including single points of failure, less transparency and accountability, and a centralized target for hackers.

Representative Pierce asked if the cloud computing industry wants government regulation for security purposes. Mr. Gordon said that he just wants the Committee to be aware of potential risks involved in migrating to cloud computing. In response to Representative Pierce's question about the role of the Committee in the cloud computing debate, Mr. Gordon said he hoped the Committee could provide guidelines for state and local governments to use if and when they migrate to cloud computing.

David Miller, legislative director for the Office of Indiana Attorney General (OAG), distributed to Committee members two publications of the OAG: a pamphlet describing the identity theft unit of the OAG and providing identity theft prevention tips and an overview of agency compliance with the release and protection of individual Social Security numbers. See Exhibits F and G. Mr. Miller told the Committee that Indiana's current IT contracts do not adequately protect security if the data migrates to the cloud.

Jim Jay, president and chief executive officer of TechPoint, addressed two main points in his testimony:

- Cloud computing can leverage the gap between the public and private sectors and provide the government with better security and competitive efficiency.
- Cloud computing is advantageous to small business.

Mr. Jay stated that cloud computing provides greater security because it allows quicker installation of patches in the event of a security breach. He also recommended amending IC 35-34-2-3 to add cloud computing to the definition of computer networks for purposes of computer related crimes. Mr. Jay also noted that many companies already use cloud computing because it is affordable and sophisticated and allows them to remain competitive. Senator Randolph questioned the use of trademarks in cloud computing, and Mr. Jay described it as an opportunity to define who owns what.

V. Adjournment and Other Business

Representative Moses reminded Committee members that the Committee's next meeting is scheduled for Tuesday, September 28, 2010, at 9:30 a.m. in the House Chamber. The meeting was adjourned at 12:30 p.m.

RFSC 9/14/2010
EXHIBIT A

EXECUTIVE SUMMARY

The Indiana Utility Regulatory Commission (Commission or IURC) presents its *Report to the Regulatory Flexibility Committee of the Indiana General Assembly for 2010* (Report or 2010 Report). The 2010 Report highlights key issues faced by the Commission and the Electric, Natural Gas, Communications, and Water/Wastewater utilities in the state of Indiana.

This year's Report provides an overview of recent issues; considers the current industry landscape; and discusses the challenges facing the utility industry as well as the successes. It also contains the results of two new reporting requirements, which include: the Pipeline Vertical Depth Study and the Four-Year Study on Video Service Availability. This Executive Summary emphasizes accomplishments achieved by the Commission and the issues most frequently discussed this past year, while providing context for technical and cross-industry issues that are more fully addressed in the Report. For your convenience, a list of acronyms and a glossary are appended.

COMMISSION ACHIEVEMENTS

With the economic downturn, the Commission's docket rapidly filled with rate cases. From 1990 to 2005, very few major rate cases were filed. However, since 2009, virtually every large jurisdictional utility has filed a rate case with the Commission; has a rate case pending before the Commission; or is preparing a rate filing to be made with the Commission. Rate cases take an enormous amount of staff resources and every division is affected. Based on its current and anticipated caseload for the next two years, the Commission will see demands at a level never before experienced.

In 2009, the Commission successfully handled several high-profile cases, including: an emergency rate case filed by Indianapolis Water Company (IWC), the demand-side management investigation, the review of the Universal Service Program for natural gas utilities, and the ongoing construction of Duke Energy Indiana's Integrated Gasification Combined Cycle Project (IGCC Project) in Edwardsport.

In the IWC case, the Commission moved swiftly and decisively in order to avert potentially disastrous consequences, which resulted in a stable condition conducive to resolution. The base

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EXHIBIT A

rate case is still undergoing review and an order is expected this fall. With regard to demand-side management, the Commission's final decision allowed for targeted development on an integrated program that is designed to be cost-effective and verifiable; this is the first program of its scope in Indiana. Another case that received a considerable amount of attention involved the Universal Service Program. In its final order, the Commission allowed the natural gas utilities to reinstate their respective bill assistance programs until each one provides the Commission with a more complete record that can be comprehensively reviewed in a base rate case. Lastly, the Commission has stayed involved with oversight of the IGCC Project by holding regular hearings and engaging its own engineering firm to assist in oversight.

In order to improve transparency and allow for more executive level input into the budgeting process, the IURC created a finance and budget committee. The committee has oversight responsibility for all of the agency's budgetary and financial matters, including preparation and presentation of monthly expenditures, reports/analysis, and a biennial budget. The Commission also continues to support its financial taskforce that is developing a more formalized and systematic monitoring plan to identify "trip wires" or signals of impending financial issues for Indiana utilities. Developing these two internal groups has allowed the Commission to take a more holistic approach to finance, exploring its impact at an agency, state and national level.

ELECTRIC

In 2009, Indiana's average retail rates were the 15th lowest in the nation, as compared to the 12th lowest for 2008. Consequently, Indiana's electric rates continue to remain attractive, primarily due to its reliance on coal. However, the general trend of increased coal prices observed since 2002 has eroded Indiana's competitive price advantage. Staff analysis shows some Indiana utilities have seen coal prices increase more than 75% since 2002. Neighboring states' average retail rates for 2009 rank as follows: Kentucky 3rd, Ohio 29th, Illinois 30th, and Michigan 34th.[1]

The State Utility Forecasting Group (SUFG) at Purdue University has been tasked by the legislature to identify and forecast future electric needs in Indiana. According to the SUFG's

[1]Energy Information Administration, Average Retail Price of Electricity to Ultimate Customers by End-Use Sector by State, Table 5.6B, historical result archive.

2009 forecast,[2] Indiana will need approximately 1,320 MW of additional resources (all types of generating capacity, demand response, efficiency, and transmission to import power) by 2015 to meet expected load growth. This forecast also projects electricity usage to grow at an annual rate of 1.55% over the twenty-year forecast and for peak demand to grow at an annual rate of 1.61%. Although the utilities are required to meet their individual capacity needs through resource planning, the Commission has also developed policies and rules to help them meet their goals.

For example, the Commission issued a landmark order in 2009 that required jurisdictional electric utilities to achieve an annual energy savings goal of 2% within 10 years with interim savings goals for years one through nine. While the utilities are required to offer certain core programs (residential lighting, home energy audit program, low-income weatherization program, energy efficient schools program, and a commercial and industrial program), they are responsible for designing and implementing the actual programs through a third-party administrator. Another third-party administrator will then oversee the evaluation, measurement and verification of the demand-side management (DSM) programs to ensure their effectiveness, and report those results to the Commission. With regard to energy savings as a percentage of utility sales, Indiana ranks 22nd nationally and 4th among the seven Midwestern states. For the amount spent on energy efficiency initiatives, Indiana ranks 31st and 6th, respectively. During the course of the investigation, three Midwestern states, Illinois, Ohio and Michigan established annual DSM savings targets for electric utilities. Based on the savings goals approved by the Commission, Indiana rivals Illinois and surpasses the other two states.

Generation capacity from renewable resources, including wind and landfill gas, is increasing in Indiana. Renewable resources provide about 1% of the generation capacity serving Indiana customers, and this number continues to increase. In June 2010, the Commission began its informal review of net metering practices in Indiana to determine whether the existing rules within the existing Indiana Administrative Code[3] should be changed, and if so, to what extent. Net metering allows customers to supplement their electric usage and mitigate a portion of their cost. According to the current rule, an eligible net metering customer is one in good standing who owns and operates a solar, wind, or hydroelectric generating facility with a capacity of less

[2] http://www.purdue.edu/discoverypark/energy/pdfs/SUFG/2009SUFGforecast.pdf
[3] *See*, 170 I.A.C. 4-4.2-1

than or equal to 10 kW on their premises. At a minimum, the five investor-owned utilities (IOU) must offer net metering to residential customers and K-12 schools that install a net metering facility. However, the IOUs, or any other electric utility, may still offer net metering to commercial or industrial customers. The Commission has invited legislators, interested stakeholders and the public to comment on the rules and their experiences with them. The Commission continues to review the feedback received by these participants and estimates that it will take further action this fall.

Another investigation pending before the Commission deals specifically with tree-trimming policies and practices, specific provisions in the utilities' tariffs related to tree-trimming practices, and related customer complaints. Respondents to the investigation include all jurisdictional electric utilities. Although tree trimming is necessary in order for the utilities to provide adequate and reliable service without service interruptions, there are no standardized rules or regulations regarding this issue at the state or federal level. Rather, there are certain federal recommendations and standards. Specific considerations by the Commission include, but are not limited to, the following: proper/reasonable notification practices, debris removal after storm events, adoption of industry standards, and uniform clearance standards. The Commission expects that an order will be issued this fall.

Since 2009, the Commission has worked on rate reviews requested by Northern Indiana Public Service Company[4] (NIPSCO) and Southern Indiana Gas and Electric Company (SIGECO),[5] municipal electric operations for Crawfordsville[6] and Columbia City,[7] municipal steam operations for Citizens Thermal Energy[8] and electric cooperatives including Jackson County REMC[9] and Harrison County REMC.[10] Even though each of the utility's needs and situations is unique, federal requirements, aging infrastructure, and new capacity needs influence their ability to recover necessary operating and maintenance expenses. The expenditure of

[4] Cause No. 43526
[5] Cause No. 43839
[6] Cause No. 43773
[7] Cause No. 43832-U
[8] Cause No. 43821
[9] Cause No. 43861
[10] Cause No. 43684

Commission time and resources on regular rate cases ensures changing industry conditions are properly reflected in the retail rates on both a company-wide and customer-class specific basis.

With respect to future issues that may affect the electric industry, the Electric section of this Report focuses on a number of key issues including:

- Regional Transmission Organizations (RTOs) – Because of the importance and pervasiveness of the RTOs' impact for Indiana utilities and their customers, the Commission's involvement with the Federal Energy Regulatory Commission (FERC), as an advocate for Indiana, has increased dramatically.

- Demand-Side Management and Demand Response – This includes energy conservation programs, advanced metering programs, and the "smart grid."

- Regulation of Greenhouse Gases – Potential regulation of carbon emissions continues to be a critical environmental issue and will likely increase in significance for Indiana and the nation depending on the parameters and passage of climate change legislation in Congress.

NATURAL GAS

During the last eighteen months, natural gas prices have decreased, primarily due to an unprecedented new supply of gas from unconventional sources; a decline in industrial demand; a cooler-than-normal summer in 2009; and the worldwide recession. For 2009, initial pricing started relatively low, in comparison to 2008, and moved even lower. NYMEX gas futures hit bottom on September 3, 2009 at $2.51/Dth[11] and peaked on January 6, 2010 at $6.01/Dth, a spread of $3.50. This is in contrast to 2008's volatile market that had a price spread of roughly $10.00. Before these costs are passed along to customers, the Natural Gas Division must review each request by a utility for a gas cost adjustment (GCA) to ensure that the costs are prudent and in the public interest. The Office of Utility Consumer Counselor (OUCC) also reviews the request on behalf of the public. Last year, the Natural Gas Division reviewed 77 GCA petitions.

[11]Natural Gas Futures Prices (NYMEX), http://tonto.eia.doe.gov/dnav/ng/ng_pri_fut_s1_d.htm

In 2009, the Legislature passed the "Call Before You Dig" law, requiring anyone undertaking a digging project to call the Indiana Underground Plant Protection Service Center at the toll-free 8-1-1 number before digging. In response to calls received, a trained representative is dispatched to mark the utility lines free of charge. Once the lines are marked, individuals may begin their digging project; however, they must hand dig within two feet of the buried utility line to prevent damage to the underground facilities. If there is a violation of the law, the Commission's Pipeline Safety Division serves as the investigative unit. If a violation is found, the information is then forwarded to the Governor's Advisory Committee, which was formed in 2010.

Upon receiving a recommendation from the Advisory Committee, and after notice and opportunity for a public hearing, the Commission must uphold or reverse the finding; approve or disapprove the recommendation(s) of the Advisory Committee; and/or collect any civil penalties and deposit the penalties in the underground plant protection account. Since July 1, 2009, Pipeline Safety has registered more than 60 possible violations.

With respect to future issues that may impact the natural gas industry, the Natural Gas section of this Report focuses on a number of key issues including:

- Renewables – Indiana, as well as the nation, has seen an increase in the number of renewable energy sources, including landfill methane gas, renewable natural gas from anaerobic digestion of waste from livestock, and coal bed methane.

- Increased Supply – The emergence of unconventional sources of natural gas supply such as shale gas has dramatically increased the overall supply of natural gas in our country and has contributed to the relatively low prices this past year.

- Distribution Integrity Management Program – As of February 12, 2010, operators must develop and implement written integrity management programs by August 2, 2011. The Commission must then review jurisdictional operators' plans for compliance.

WATER/WASTEWATER

Of all the industries, water/wastewater is the most capital intensive due to high capital costs and relatively low revenues; investing more capital per dollar of revenue earned than any other industry. Costs are increasing for water and wastewater utilities and are driven by the following needs: replacement of aging infrastructure; compliance with U.S. Environmental Protection Agency standards such as water quality and wastewater effluent; growing demand; and the relocation of facilities for city and state road projects. For example, from 1984 to 2008 average water and wastewater treatment cost rose 310% while the consumer price index only rose 207%.[12] A 2003 report[13] issued by the Indiana Advisory Commission on Intergovernmental Relations estimates that statewide wastewater and drinking water infrastructure needs will require $12.4 to $13.9 billion in funding from the year 2000 to 2020.

Many water and wastewater utilities sought rate increases this past year for improvements to existing infrastructure and new projects. One of the most notable rate cases involved IWC, which filed an emergency rate case in early 2009, followed by a standard rate case later that year. The City of Indianapolis, which owns IWC, also announced the potential transfer of its water and wastewater utility to Citizens Energy Group. If approved, the wastewater system would be the first of Indiana's 108 combined sewer systems under Commission jurisdiction. Indiana American Water, the largest investor-owned utility, also sought a rate increase in 2009.

The Commission regulates approximately 116 out of 824 water utilities, and 47 out of 531 wastewater utilities. This is primarily due to an opt out provision in Indiana Code and the fact that the Commission has never had jurisdiction over municipal sewer utilities. When a utility opts out of the Commission's jurisdiction, the IURC no longer oversees its rates and charges or rules and regulations. It also eliminates the agency's ability to provide dispute resolution between utility customers and their utilities. The primary complaint with this arrangement has to do with the difference between inside-city and outside-city customer rates. Many municipalities charge outside-city customers higher rates or a surcharge, with premiums ranging from modest

[12] "Historical Water Price Trends," Steve Maxwell, AWWA Journal, April 2010

[13] "Financial Needs for Wastewater and Water Infrastructure in Indiana," January 2003

amounts to 100% or in some cases, even higher, than rates paid by inside-city customers for the same service.

With respect to future issues that may impact the water and wastewater industries, the Water/Wastewater section of this Report focuses on a number of key issues including:

- Infrastructure – Indiana's water project-funding needs over the next 20 years are $5.9 billion. The greatest need, $4.5 billion, is for underground infrastructure.

- Troubled Utilities – Small, troubled utilities continue to present regulatory challenges for the Commission, which is actively monitoring select small utilities in an effort to educate owners and prevent utilities from becoming troubled.

- Outside-city Rates – Many municipalities charge customers outside their corporate boundaries higher rates than inside-city customers. This raises questions about whether the city rate is cost-justified and non-discriminatory.

COMMUNICATIONS

The year 2010 marked the implementation of the final phase of House Enrolled Act 1279 (HEA 1279), a bill that largely eliminated all regulatory authority over rates and service quality for retail telephone service in Indiana. Per the requirements of the 2006 legislation, the Commission examined its administrative rules and policies and eliminated those that were no longer necessary under the new regulatory framework. The Commission also initiated a rulemaking to modify or repeal sections of the IURC's telecommunications rules located in 170 IAC 7. The Commission then issued a General Administrative Order announcing which sections would no longer be enforced after July 1, 2009. The rulemaking should be complete in the fall of 2010.

While HEA 1279 eliminated many of the Commission's duties, it also added new responsibilities and designated the Commission as the sole video franchise authority in the state as of July 1, 2006. Prior to this date, local franchise authorities, such as counties and municipalities, issued franchises to video service providers. However, this is no longer the case.

Providers had the option to remain under the existing agreements until they expire or seek a state-issued franchise from the Commission.

In order to monitor the availability of video services in the state, HEA 1279 tasked the IURC with collecting data regarding video services offered in Indiana's Metropolitan Statistical Areas (MSAs) from 2006 through 2010. In the Commission's Four-Year Study on Video Service Availability, data shows there has been a steady migration of video service providers in Indiana's MSAs away from local franchise oversight to state-issued franchises. The data also shows the heavy use of technologies such as fiber optic cabling and the use of digital transmission for video signals. There appears to be no correlation between the per capita income in an MSA and number of providers offering service there; however, MSAs with higher population densities have greater numbers of video providers offering service. Most of the infrastructure build-outs undertaken by video service providers from 2006 to 2010 in Indiana MSAs with local franchise agreements occurred without a requirement to do so under the controlling local franchise. The IURC has received no complaints regarding economic redlining under I.C. § 8-1-34-28 by video providers with state-issued franchises.

Another responsibility of the Commission is to monitor and implement area code relief. Two possible remedies are an area code split, which is a geographic split of the existing area code into two or more areas, or an overlay, which would result in 10-digit dialing. According to a recent report by the North American Number Plan Administrator (NANPA), the 812 area code, serving southern Indiana, is projected to exhaust the third quarter of 2013. In order for the Commission to take action, the NANPA must file a petition with the Commission on behalf of the telecommunications industry. The Commission will then hold hearings so that it can receive testimony from the affected stakeholders to determine the best course of action.

With respect to future issues that may impact the communications industry, the Communications section of this Report focuses on a number of key issues including:

- Competition and Investment – With the deregulation of the communications industry, Indiana has seen competition increase and new technology be deployed in certain areas of the state.

- Indiana Universal Service Fund (IUSF) – The IUSF generates funds that are used to subsidize the rates for services offered by companies in high-cost areas in an effort to keep rates reasonable and affordable.

- Mergers – Since 2008, four mergers were announced that directly affect Indiana providers and consumers. Depending on the companies' business models, this could affect the industry landscape.

2010 ELECTRIC REPORT

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I. ELECTRIC OVERVIEW

Industry Structure

The Commission has jurisdiction over the electric service provided to approximately 2.6 million customers in Indiana. In 2009, Indiana's average retail rates were the 15th lowest in the nation.

The Indiana Utility Regulatory Commission (Commission) sets retail rates for electric investor-owned utilities (IOUs), some Rural Electric Membership Cooperatives (REMCs) and municipal electric utilities.[1] Additionally, the Commission reviews and approves the construction of generation facilities for Indiana's electric utilities and long-term financing for IOUs, Indiana Municipal Power Agency (IMPA), and Wabash Valley Power Association (WVPA). The twenty-five retail electric utilities under Commission jurisdiction generated nearly $8 billion in revenue in 2009 and served more than 2.6 million electric customers. The amount of plant in service is approximately $28 billion.[2]

Under certain circumstances, the Commission may review financing arrangements for REMCs and individual municipal electric utilities, but this typically occurs through rate cases. State law allows municipal and cooperative utilities to remove themselves or "opt out" of the Commission's jurisdiction.

Indiana's use of coal contributes to its relatively low-cost electricity.

Indiana's annual ranking for average retail rates from 1998 to 2009 ranged from 10th lowest in 1998, to 4th lowest in 2002, to 15th lowest in 2009. Neighboring states' average retail rates for 2009 rank as follows: Kentucky 3rd, Ohio 29th, Illinois 30th, and Michigan 34th. The variability in ranking is the result of many factors, including the timing of rate cases and rate adjustments due to fuel charges in Indiana as well as the timing of rate proceedings in other states. Indiana's use of coal contributes to its relatively low cost of electricity. However, the general trend of

[1]The cooperative and municipal utilities under IURC rate jurisdiction can be found in Appendix A – Electric Utility Revenues.
[2]2009 Utility Annual Report filings

increased coal prices observed since 2002 has reduced Indiana's relative price advantage. Staff analysis indicates that most Indiana utilities have seen coal prices increase more than 75% since 2002. Consequently, Indiana's ranking over this period slipped from 4th to 15th.

Five major IOUs operate in the state of Indiana in exclusive service territories with other portions of the state similarly assigned to municipal utilities and REMCs. IOUs are for-profit enterprises funded by debt and equity. Indiana's IOUs are vertically integrated, which means they own facilities for generation, transmission, and distribution. These utilities are the most significant in terms of generation and the number of customers served, accounting for more than 90% of the electric power sales made by the state's regulated electric utilities to Indiana retail customers. The IOUs, listed in descending order of 2009 total operating revenue, are:

- Duke Energy Indiana, Inc. (DEI), a subsidiary of Duke Energy Corporation, serves 775,000 customers in areas throughout central and southern Indiana, excluding the metropolitan centers of Indianapolis and Evansville, with headquarters in Plainfield. In 2009, the company's total operating revenue was $2,354,692,352;
- Indiana Michigan Power Company (I&M), a subsidiary of American Electric Power Company, Inc. (AEP), serves 454,000 customers in northeast and north central Indiana with headquarters in Ft. Wayne. In 2009, the company's total operating revenue was $2,085,781,133;
- Northern Indiana Public Service Company (NIPSCO), a subsidiary of NiSource Inc., serves 457,000 customers in northwest and north central Indiana with headquarters in Merrillville. In 2009, the company's total operating revenue was $1,213,923,081;
- Indianapolis Power and Light Company (IPL), a subsidiary of the AES Corporation, serves 469,000 customers in the greater Indianapolis area, where it is headquartered. In 2009, the company's total operating revenue was $1,067,996,891; and
- Southern Indiana Gas & Electric Company (SIGECO), a subsidiary of Vectren Corporation, serves 141,000 customers in southwest Indiana with headquarters in Evansville. In 2009, the company's total operating revenue was $528,673,984.

As of January 2010, 15 of the 72 municipally-owned utilities operating in Indiana remained under Commission jurisdiction for rate regulation. Of these 72 municipally-owned electric

utilities, 51 are members of IMPA, including 10 of the 15 regulated by the Commission. A group of municipalities created IMPA in 1980 to jointly finance and operate generation and transmission facilities. Additionally, IMPA was established to purchase wholesale power and meet members' needs through a combination of member-owned generating facilities, member-dedicated generation, and purchased power. The Commission does not regulate the rates that IMPA charges its members.

As of January 2010, only 4 of the 40 electric distribution cooperatives operating in Indiana remained under Commission jurisdiction for rate regulation. Cooperatives are customer-owned utilities, all of which are members of either Hoosier Energy Rural Electric Cooperative (Hoosier Energy) or WVPA. These two organizations are power generating and transmission cooperatives formed to supply power to distribution cooperatives. The Commission's regulation of Hoosier Energy and WVPA is limited to decisions to purchase, build, or lease generation facilities. In addition, the Commission retains jurisdiction over WVPA's long-term financing.

There are two Regional Transmission Organizations operating in Indiana: the Midwest Independent System Operator and PJM Interconnection, LLC. RTOs dispatch all of the generating facilities in their regions to ensure that the lowest cost combination of resources is used at any given moment.

There are two Regional Transmission Organizations (RTOs) operating in Indiana: the Midwest Independent System Operator (Midwest ISO) and PJM Interconnection, LLC (PJM). These organizations are regulated by the Federal Energy Regulatory Commission (FERC). In addition to being tasked with the reliable and non-discriminatory operation of regional transmission facilities, the Midwest ISO and PJM also direct the operation in real time of all generating facilities in their regions to ensure that the lowest-cost combination of generation resources is being used at any given moment. Additionally, RTOs engage in long-term resource planning in order to achieve greater optimality in the construction of new resources (including peak load reduction and energy efficiency) and act as a market monitor to guard against anticompetitive behavior.

The Midwest ISO operates in fifteen states from Pennsylvania in the east to Montana and the Canadian province of Manitoba in the west and is responsible for the operation of nearly 94,000

miles of interconnected high-voltage power lines that support the transmission of more than 100,000 megawatts (MW) of energy in the Midwest. DEI, NIPSCO, IPL, SIGECO, Hoosier Energy, WVPA, and IMPA are all members of the Midwest ISO. The Midwest ISO is headquartered in Carmel, Indiana. PJM coordinates the movement of wholesale electricity in all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and the District of Columbia. PJM dispatches about 163,500 MW of generating capacity over 56,350 miles of transmission lines. AEP, including its Indiana subsidiary I&M, is a member of PJM. IMPA and WVPA are also members of PJM. PJM is headquartered in Valley Forge, Pennsylvania.

The benefits of RTOs for Indiana's consumers are difficult to quantify, but appear positive.[3] In addition to greater reliability, RTOs encourage lower costs due to more efficient regional planning than is possible by individual utilities acting alone. Because of the vast regional scope of the RTOs, Indiana customers should receive the financial and operational benefits of a more diverse resource mix and additional customer load diversity (e.g., Indiana might experience a peak demand due to hot weather while Montana has much more moderate weather) allowing the RTO to satisfy demand with relatively lower-cost resources. Additionally, because the reliability risk is diversified over the entirety of the RTOs' footprints – from the Rocky Mountains to the Atlantic Ocean – the need for resources is reduced as evidenced by the ability to maintain lower planning and operating reserve margins than were maintained by the Indiana utilities prior to the development of the RTOs.[4] A reserve margin is the amount of extra capacity available to serve load growth and to respond in the event of a system contingency, such as the planned or unplanned outage of a generation plant or a high-capacity transmission line.

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[3]The Midwest ISO states that it "...provides annual benefits of between $555 million and $850 million. These benefits derive from improved reliability, increased efficiencies in the use of generation resources, and improved regional planning. During the next 10 years, this savings is expected to provide net benefits to the region of between $4.6 billion and $6.9 billion." http://www.midwestmarket.org/page/Value%20Proposition
PJM has not conducted a similar analysis of net benefits thus leaving PJM's value to conjecture.

[4]The electric industry has historically maintained planning reserve margins in the 15% to 20% range. With the development of RTOs, reserve margins have fallen to reflect the benefit of more efficient regional coordination. In the Midwest ISO, for example, Indiana utilities have an 11.9% reserve requirement.

To better ensure that Indiana customers and utilities receive the benefits of participating in RTOs, the Commission has devoted staff resources to participate in the RTO processes. Because of the importance and the pervasiveness of the RTOs' impact for Indiana utilities and their customers, the Commission's involvement with the FERC has increased dramatically.

While participation in RTOs provides benefits to Indiana end-use customers, it may be challenging to translate the costs and revenues associated with RTO participation into the traditional cost-of-service model used to set rates in Indiana. To better ensure that Indiana customers and utilities receive the benefits of participating in RTOs, the Commission has devoted staff resources to participate in the RTO processes. Because of the importance and pervasive impact of the RTOs on Indiana utilities and their customers, the Commission's involvement with the FERC has increased dramatically.

Age-Profile

Aging infrastructure is a concern across all utility sectors. For the electric industry, an aging generation fleet is of particular concern due to the potential risk to system reliability and the rising costs associated with new construction. The last coal-fired generation unit in Indiana was completed in 1989.

In recent years, Indiana utilities have generally utilized wholesale purchases from other sources, rather than building capacity, to maintain reserve margins. Because it takes approximately three years to construct new gas-fired peaking generation, five to ten years to construct new coal-fired generation, and still longer to bring new nuclear generation online, long-term planning is critically important.

Table 1 shows the age profile for the coal and natural gas-fired fleet of electric generation owned by Indiana utilities (the columns in the table are cumulative). About 67% of the coal-based fleet is more than thirty years old, and more than 26% of that fleet is more than forty years old. Natural gas-fired generation is much newer, with only 28% of that fleet more than ten years old. Gas-fired combustion turbines generally have higher marginal operating costs than coal-fired units and, as a result, typically only operate during periods of high peak demand.

Table 1

Age Profile of Generating Units Owned by Indiana Utilities

Years Old and Older	Number of Coal Based Units	MW of Generation (Summer Rating)	Percent of Total Coal Based Generation	Peaking (Gas, Oil) Units	MW of Generation (Summer Rating)	Percent of Total Peaking Generation
50	27	1,831	11.1%	10	288	5.7%
40	40	4,321	26.2%	21	489	9.8%
30	57	11,112	67.4%	29	854	17.0%
20	66	16,220	98.5%	30	919	18.3%
10	68	16,475	100.0%	38	1,405	28.0%
0	68	16,475	100.0%	57	5,012	100.0%

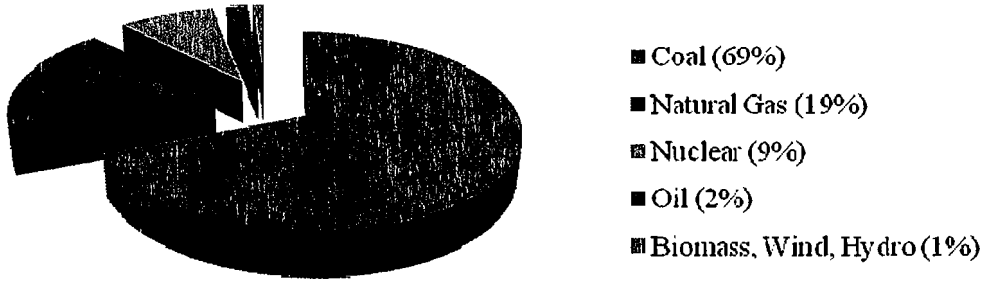
Customers in the northeastern portion of Indiana are served by I&M's Cook Nuclear Generation Station located in Bridgman, Michigan. Cook Units 1 and 2 became operational in 1975 and 1978, respectively. In 2005, the units were relicensed by the Nuclear Regulatory Commission for commercial operation until 2034 for Unit 1 and 2037 for Unit 2.

Existing Generation Portfolio

Generation capacity from renewable resources, including wind and landfill gas, is increasing in Indiana. Renewable resources currently provide about 1% of the generation capacity serving Indiana consumers. Chart 1 shows the fuel mix of generation resources available to meet the electricity needs of Indiana consumers.

Chart 1

Generation Capacity by Fuel Type



Demand

According to the SUFG's 2009 forecast, Indiana will need approximately 1,320 MW of additional resources (all types of generating capacity, demand response, efficiency, and transmission to import power) by 2015 to meet expected load growth and maintain a 16.3% reserve margin.

In order to keep track of Indiana's resource needs, the State Utility Forecasting Group (SUFG) at Purdue University has been tasked by the legislature to identify and forecast future needs. According to the SUFG's 2009 forecast,[5] Indiana will need approximately 1,320 MW of additional resources (all types of generating capacity, demand response, efficiency, and transmission to import power) by 2015 to meet expected load growth and maintain a 16.3% reserve margin. This forecast also projects that electricity usage will grow at an annual rate of 1.55% over the twenty-year forecast and that peak demand will grow at an annual rate of 1.61%. While the current recession may temporarily slow the growth of energy and demand, the expectation is that forecasted rates will resume over the forecast horizon. The SUFG will be updating its most recent forecast by the end of 2011.

Existing Legal and Policy Foundations

Indiana electric utilities operate under a traditional regulatory regime administered by the IURC. Under this regulatory framework, the utility owns and operates generation, transmission, and distribution facilities in order to provide electric retail service to customers in a defined exclusive service territory. Retail customers are billed for service based on the average embedded cost to serve, including an authorized reasonable rate of return on investment. Generation resources owned by utilities are economically dispatched such that generation output meets customer demand.[6] Indiana utilities are responsible for short-term and long-term planning to meet customer demand at the lowest reasonable cost.

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[5] http://www.purdue.edu/discoverypark/energy/pdfs/SUFG/2009SUFGforecast.pdf

[6] Under economic dispatch the lowest cost generation resources are used first with successively more expensive units coming online until total customer demand is met at any given point in time.

II. ELECTRIC LANDSCAPE

Infrastructure

Historically, utilities built generation and transmission resources to meet their customers' forecasted needs for power and to supply sufficient excess generating capacity to address contingencies. Transmission was constructed primarily to connect each utility's generation to its load. Transmission interconnections to neighboring utilities were constructed for reliability reasons, rather than for routine power purchases and sales. The decisions of individual utilities to build generation and transmission rarely took into consideration the resources of other utilities in the state and gave even less consideration to the resource profile of regional utilities. However, because Indiana utilities continue to have an "obligation to serve" customer needs,[7] they must plan and build or purchase the resources necessary to meet those needs in a reliable and cost-effective manner. RTOs now give utilities more options to meet customer needs and provide access to regional wholesale energy markets that allow utilities to more fully utilize generation resources.

Large-Scale Projects and Capital Investment Recovery

Utilities are generally viewed as capital-intensive because of their need for investment in supporting infrastructure. The long-lived nature of utility infrastructure investment is a characteristic that supports the concept of a regulatory compact.[8] Vertically integrated electric utilities have distribution, transmission, and generation infrastructure components, which epitomize this characteristic. The regulatory compact provides a utility's investors the opportunity to earn a fair rate of return over the long life of the infrastructure their investment purchased. This stability serves to reduce risk and, thus the return, required by investors and accordingly reduces the cost to the utility to finance infrastructure used to serve customers. This reduced cost of service is the prime benefit of the regulatory compact.

Large investments that require significant time to construct present risks for investors because utility ratemaking does not include the cost of infrastructure in customer rates until

[7]*See,* I.C. § 8-1-2.3 *et seq.*

[8]The regulatory compact is effectively a non-statutory agreement between the state and the utility provider where in exchange for an obligation to provide service to all customers in a given monopoly service area the utility is provided an opportunity to earn a fair return on the required investment to provide such service.

construction is completed and the project is found to be used and useful through a rate case. This exposes the investment on two fronts. First, conditions may change during the construction period and call the used and useful nature of the project into question. Second, the financing cost cash flow required during construction is not sourced from ratepayers. Indiana and other states have addressed these challenges through a certificate of need process[9] and the allowance of a cash return on financing costs during construction in certain instances.[10]

The certificate of need process provides the Commission and interested parties an opportunity to evaluate the merits of a project before it is undertaken. As such, the preapproved finding of need and prudency reduces risks for the utility, which results in lower financing costs for the project. The allowance of a cash return during construction pays the financing cost when such costs are incurred in lieu of deferring them until construction is complete and then paying both the amount borrowed and the related interest. The improved cash flow during the construction period is also recognized as a significant credit enhancement by credit rating agencies. Consequently, both of these tools serve to reduce the lifetime costs of the investment, a cost paid by a utility's ratepayers.

New Source Review

From 1999 to 2000, the U.S. EPA filed a number of complaints against electric utilities across the country for alleged violations of the New Source Review (NSR) provisions of the Clean Air Act (CAA). The U.S. EPA alleged that maintenance projects performed at various coal-fired generation units were major modifications, as defined in the CAA, and that the utilities violated the CAA when they undertook such projects without obtaining permits and installing the best available emission controls for SO_2, NO_X, and particulate matter. The government seeks to require installation of additional pollution controls on various generating units and unspecified civil penalties in amounts up to $32,500 per day for each violation. Federal action on NSR lawsuits or noticed violations has touched every Indiana electric IOU. A sampling of recent activity follows.

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[9] *See*, I.C. § 8-1-8.5, I.C. § 8-1-8.7, I.C. § 8-1-2-23
[10] *See*, I.C. § 8-1-8.8

In October 2009, IPL received a notice of violation from the U.S. EPA alleging violations at IPL's three coal-fired electric generating facilities dating back to 1986. IPL's recent 10-K filing with the Securities and Exchange Commission (SEC) highlights the impact of these federal environmental actions. IPL statements note that "...settlements and litigated outcomes of similar cases have required companies to pay civil penalties and to install additional pollution control technology projects on coal-fired electric generating units. A similar outcome in this case could have a material impact to our business. We would seek recovery of any operating or capital expenditures related to pollution control technology projects to reduce regulated air emissions..."[11]

DEI also litigated NSR lawsuits that were originally brought by the U.S. EPA in November 1999 for various projects at its Cayuga, Gallagher, Wabash River, and Gibson Stations. A jury verdict was returned on May 22, 2008, which found in favor of Cinergy and DEI on all but three units at Wabash River. Following a new trial awarded by the court due to actions at the original trial, on May 19, 2009, a jury found in favor of DEI on four of the remaining six projects at issue. The two projects in which the jury found violations were undertaken at Units 1 and 3 of the Gallagher Station in Indiana. The parties filed a proposed consent decree with the court on December 22, 2009 for public comment and approval. The substantive terms of the proposed consent decree require: (i) conversion of Gallagher Units 1 and 3 to natural gas combustion by 2013; (ii) installation of additional pollution controls at Gallagher Units 2 and 4 by 2011; and (iii) additional environmental projects, payments and penalties. In its most recent SEC 10-K filing, DEI estimated that actions in the consent decree will cost at least $88 million. The company further stated that "ultimate resolution of these matters relating to NSR, even in settlement, could have a material adverse effect on Duke Energy Indiana's consolidated results of operations, cash flows or financial position. However, Duke Energy Indiana will pursue appropriate regulatory treatment for any costs incurred in connection with such resolution."[12] As of September 30, 2009, Wabash River Units 2, 3, and 5 have been retired.

In July 2008, Hoosier received a request for information from the U.S. EPA under Section 114(a) of the Clean Air Act. Two subsequent requests were received. Hoosier has submitted all

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[11] IPALCO Enterprises Inc. 10-K 12/31/2009
[12] Duke Energy Indiana Inc. 10-K 12/31/2009

information requested to date. In August 2009, the U.S. EPA issued a Notice of Violation under the NSR provisions of the Clean Air Act. Hoosier is currently negotiating consent decree provisions with the U.S. EPA.

Edwardsport IGCC

The Edwardsport IGCC facility will be the first commercial-scale clean coal plant of its kind built in the United States in the last 10 years.

In an Order issued on November 20, 2007, the Commission approved the construction of DEI's Edwardsport IGCC generating facility, which will have a capacity of 618 MW and be designed to use Indiana bituminous coal. Once complete, the Edwardsport IGCC facility will be the first commercial-scale clean coal plant of its kind built in the United States in the last 10 years. The facility is located on approximately 220 acres adjacent to DEI's existing Edwardsport Generating Station in Knox County, Indiana, and has an approved estimated cost of $2.35 billion with an in-service date of 2012. DEI has filed a request with the IURC to update the estimated capital cost of the project to $2.88 billion.[13] DEI expects to receive approximately $450 million in state and federal tax incentives for the project.

Under traditional ratemaking, DEI would have constructed the facility and not been allowed recovery of the costs from ratepayers until the plant was completed (in approximately four years). However, applying Indiana's clean coal technology statutes to the facility, DEI proposed and the Commission approved a pay-as-you-go plan, whereby the costs of the plant (i.e., bricks and mortar) are passed on to ratepayers on a periodic basis as part of an ongoing review process as the plant is under construction. This is otherwise known as construction work in progress or CWIP. As a part of the review process, the Commission established an independent oversight plan to monitor construction and retained the services of consultant Black and Veatch for this purpose. As of July 2010, construction was considered approximately 45% complete.

The IGCC facility will use cleaner technology to reduce traditional air emissions by approximately 50% compared to a state-of-the-art pulverized coal plant.

[13]Cause No. 43114 IGCC4-S1

The IGCC facility will utilize state-of-the-art technology and a gasification process that will convert bituminous coal into a combustible gas called synthesis gas or "syngas" that can then be used to generate electricity. The technology will reduce traditional air emissions by approximately 50% and provide 90% or higher mercury capture at a fraction of the cost of a pulverized coal unit. Carbon capture and sequestration (CCS) is also being explored as an option for this plant. The Commission authorized DEI to spend up to $17 million for a carbon capture study to analyze its feasibility. The choice of capture technology is dependent on the type of coal generation technology used because each capture strategy creates unique conditions that affect the performance of the generation plant and the technology for separating CO_2, making it ready for compression and storage.

With respect to carbon storage or sequestration, significant feasibility and cost issues will need to be resolved before it becomes possible to implement. This includes the cost of permanent geologic storage, insurance, legal liability, property rights, and regulatory issues. For example, the storage potential of known geologic formations is vast, but proper site selection must consider whether the location is economically feasible to reach; has adequate total storage volume, porosity, and permeability to store CO_2; and a cap rock sealant to keep the CO_2 trapped. State and federal entities must also consider legal, physical, and safety issues when developing an appropriate regulatory framework for CO_2 storage. Another issue that must be addressed is identifying the entity responsible for the long-term care of an injection site, in addition to monitoring the integrity of the well, developing remediation plans, and examining the effectiveness of these plans. Effective resolution of these regulatory and institutional issues is critical to the successful widespread use of carbon sequestration and the continued use of coal. As directed by the Commission, DEI has a proposal in Cause No. 43653 to spend between $42 million and $121 million to further evaluate carbon sequestration through site assessment, site characterization, and implementation.

Wind

Although initial wind studies indicated that Indiana was not a prime location for the development of significant amounts of wind generation, improvements in wind turbine energy conversion efficiency as well as wind study methodologies have since demonstrated that there are acceptable locations in Indiana for the installation of wind resources. As such, Indiana has

become the fastest growing state for the development of new wind resources, which are primarily located in Benton and White counties.[14] Table 2 shows the development of wind resources in Indiana.

Table 2

Indiana Wind Farms

Wind Projects	County	Nameplate Capacity (MW)	Estimated Availability at Peak (MW)*	Completion Date
Benton County Wind Farm	Benton	130	10	2008
Fowler Ridge Wind Farm I	Benton	300	24	2009
Fowler Ridge Wind Farm II	Benton	350	28	N/A
Fowler Ridge Wind Farm III	Benton	99	8	2009
Hoosier Wind Farm	Benton	106	8	2009
Meadow Lake Wind Farm I	White	200	16	2009
Meadow Lake Wind Farm II	White	99	8	2010
Meadow Lake Wind Farm III	White	103.5	8	2010
Meadow Lake Wind Farm IV	White	199.5	16	2010
Spartan Wind Farm	Newton	101	8	2011
TOTAL		1,689	135	

*Assumes 8% of nameplate capacity (Midwest ISO wind capacity credit) will be available during summer peak.

The passage of either a state or federal renewable portfolio standard (RPS) or the regulation of greenhouse gas emissions (e.g., carbon emissions regulation) would likely make wind resources desirable. Notwithstanding, wind resources present specific challenges such as its intermittent nature, which does not allow it to be dispatched at the time of peak electricity demand. Due to this challenge, the Midwest ISO recently created a centralized wind forecasting system, which has helped the Midwest ISO better predict available wind resources on an hour-to-hour basis. The development of efficient and economic storage technologies, such as batteries, that store wind energy for later use, would also alleviate this problem. However, utilizing a

[14]American Wind Energy Association Annual Wind Industry Report

battery backup system would also dramatically increase the cost of wind-generated electricity and, potentially, severely impact its economic viability.

In order to plan for the summer 2010 load, Indiana utilities and the Midwest ISO assumed an 8% capacity credit for wind energy resources available for peak demand periods. Table 2 uses this capacity credit. Using the credit, a 100 MW wind farm would typically have an expected output of 8 MW (8% of its nominal capacity) during the summer peak periods. This reflects the weather–driven, variable nature of wind energy production.

Biomass

According to the State Utility Forecast Group's 2009 Indiana Renewable Energy Resources Study, landfill gas is the primary biomass fuel used to generate electricity in Indiana. Total generation capacity from Indiana's landfills is 48.4 MW.[15] On June 10, 2009, the Commission approved a certificate of public convenience (CPCN) for WVPA for the acquisition and construction of an additional 15 MW[16] of landfill gas generation capacity. Another alternative fuel receiving increased attention is woody biomass. Two such companies, Liberty Green Renewables and Bioenergy Power, LLC have recently petitioned the Commission to decline jurisdiction to require each to obtain a CPCN so that they may contribute up to a combined total of approximately 55 MW[17] of net electricity for sale in the wholesale power market.

Nuclear Waste and Spent Fuel

The Nuclear Waste Policy Act (NWPA) was passed in 1982 and required the U.S. Department of Energy (U.S.DOE) to build and operate a permanent repository that was to begin accepting waste from nuclear power plants no later than January 31, 1998. Since 1983, retail customers served by utilities operating nuclear plants have paid into the Nuclear Waste Fund (NWF) in the amount of one-tenth of a cent for every kilowatt-hour produced by a nuclear generator. The NWF now exceeds $33 billion.

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[15]2009 Indiana Renewable Energy Resources Study, September, 2009, State Utility Forecasting Group (SUFG)
[16]Petition of WVPA, (Ind. Util. Reg. Comm'n. Cause No. 43640, Jun 10, 2009)
[17]Petition of Liberty Green Renewables Indiana LLC, (Ind. Util. Reg. Comm'n, Cause No. 43851, Cause pending) and Petition of Bioenergy Power, LLC, (Ind. Util. Reg. Comm'n, Cause No. 43882, Cause pending)

I&M utilizes the Cook Nuclear Generation Station located in Bridgman, Michigan to serve its customers. This facility has two pressurized water reactors: Unit 1, which has a nameplate generation of 1,048 MW and Unit 2, which has 1,107 MW of nameplate generation. The two units became operational in 1975 and 1978, respectively, and, in 2005, the units were re-licensed by the Nuclear Regulatory Commission (NRC) for commercial operation until 2034 for Unit 1 and 2037 for Unit 2. Approximately 65% of the Cook plant costs and power generated is allocated to Indiana retail customers. Through the fourth quarter of 2008, I&M's customers paid to the DOE NWF $275.5 million on a total company basis with Indiana's share approximately $193 million.

Currently, the Cook facility stores spent irradiated fuel on-site in a storage pool. These types of storage pools are only meant to be a temporary solution until the spent fuel can be moved to a permanent storage facility. A permanent storage facility was approved by Congress in 2002 at Yucca Mountain located in Nevada. However, on March 5, 2009, Energy Secretary Steven Chu stated during a Senate hearing that "the Yucca Mountain site was no longer viewed as an option for storing reactor waste."

In July 2009, the U.S. House of Representatives voted 388 to 30 to not completely fund the Yucca Mountain repository in the fiscal year 2010 budget; and, in March 2010, the Yucca Mountain license application with the Nuclear Regulatory Commission was withdrawn. With its existing on-site pool for spent fuel nearing capacity and the Yucca Mountain site on hold, possibly permanently, I&M has devised with an interim solution until a more permanent one can be agreed upon. The solution is to utilize dry cask storage, a method of enclosing high-level radioactive waste in containment cylinders for on-site storage. The company states that industry experts recognize this method as the current preferred solution. The company's program is nearing completion and the initial loading is scheduled to occur in 2011. This places I&M in the position of seeking cost recovery to accommodate the interim solution of constructing and utilizing dry cask storage despite the fact that their ratepayers have already paid into the now defunct NWF, which was to provide a permanent storage solution by 1998.

There are legal options available to utilities that believe DOE has breached its contractual obligations, causing the utilities to incur additional costs to deal with the disposal issue. Recent

Federal Circuit cases suggest that utilities may be successful in recovering damages in federal court.

Transmission

Planning

One of the primary advantages of Indiana utilities' membership in RTOs is the change in planning – from the narrower needs of individual utilities to a broader regional perspective. The RTOs analyze and plan for electricity flows across the entire region thereby permitting greater optimization for the timing, sizing, and location of new transmission facilities. They also allow for more cost-effective planning and construction of transmission facilities. The transmission planning process includes stakeholder participation to ensure a thorough review of the evaluation process and resulting transmission plan.

For example, the 2009 Midwest ISO Transmission Expansion Plan (MTEP) identified 274 projects totaling an estimated $903 million required to maintain the reliability of the system through 2019. Since the regional planning process was established in 2003, $7.2 billion in new construction has been approved, and projects totaling $2.7 billion have been completed. The Midwest ISO estimates that these new transmission facilities will result in the ability to defer new generating capacity with an associated annual savings of $60 million to as much as $111 million. In December 2009, the PJM approved $1.4 billion in electric transmission systems additions and upgrades. With these newest upgrades, PJM's Board has authorized more than $15 billion in total transmission investment through the Regional Transmission Expansion Planning (RTEP) process since 1999. PJM's RTEP includes upgrades and new projects to maintain system reliability and to interconnect new generation. The plan considers the growth and changes in the broad, multi-state region.

Indiana Transmission Projects

In May 2008, SIGECO began the siting process for its first-ever 345 kV transmission line. The Midwest ISO approved the sixty-six mile line that will connect SIGECO's A.B. Brown generating plant with Big Rivers Electric Corp.'s Reid plant, located to the south, and DEI's

Gibson plant, located to the north.[18] The project reflects SIGECO's unique geography in southwestern Indiana and the resulting problems with import capability and heavy line loading. The project has a scheduled in-service date of June 2011 and a cost estimate of $66 million.

In 2008, Duke Energy and AEP formed a joint venture, called Pioneer Transmission, LLC (Pioneer Project), to build and operate a 240-mile, high-voltage 765 kV transmission line from the Rockport generating station in southwestern Indiana to Greentown, which is east of Kokomo. The preliminary estimated cost of the line and associated facilities was $1 billion. The Midwest ISO and PJM jointly studied the proposed project in their planning processes and found that the project failed to pass the required benefit cost test to be included in the RTOs' transmission plans. However, in the future, this project, or a similar one, could be included in plans as the RTOs change the planning criteria for new transmission projects to interconnect low-carbon generation resources.

The Federal Power Act (FPA) and recent amendments give the Federal Energy Regulatory Commission (FERC) increasingly broad powers over the siting, construction, and rates associated with electric transmission and a corresponding diminution of state authorities. However, unlike many other states that have authority over site selection of transmission facilities, the IURC does not have such statutory authority. As a result, the U.S. DOE and the FERC have federal statutory authority to approve the siting of transmission within Indiana. The "Pioneer" proposal, despite the fact that it is proposed to be constructed solely within Indiana, demonstrates that the only legal recourse for Indiana is to be a party – like any other party – in proceedings before the FERC. The ability of Indiana to influence transmission within Indiana and regionally, is severely compromised by the lack of siting authority.

Modernization and Efficiency

Even though the majority of Indiana's electric needs are met through coal-fired generation owned by the utilities, energy efficiency, demand-side management, and demand response programs[19] are also being developed to enhance the value of Indiana's energy services.

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[18]SIGECO's A. B. Brown plant and DEI's Gibson plant are both located in southwest Indiana near Evansville. Big River's Reid plant is located in Henderson, Kentucky.

Indiana jurisdictional electric utilities must achieve an annual energy savings goal of 2.0% within ten years, with interim savings goals for years one through nine.

Year	Annual Electric Savings Goal (% based on weather-normalized average electric sales for prior three years)
2010	0.3%
2011	0.5%
2012	0.7%
2013	0.9%
2014	1.1%
2015	1.3%
2016	1.5%
2017	1.7%
2018	1.9%
2019	2.0%

In December 2009, the Commission completed its investigation into energy conservation and savings and issued an order that instructed the state's jurisdictional electric utilities to create core demand-side management (DSM) programs. Through a reasonable but aggressive timeline, the utilities are expected to achieve an annual energy savings goal of 2 percent within 10 years with interim savings goals for years one through nine.

Due to nonexistent or inconsistent DSM program offerings between jurisdictional utilities, the Commission ordered the utilities to move forward with the following core programs: a home energy audit program; low-income weatherization program; residential lighting program; energy efficiency schools program; and commercial and industrial program.

The Commission also ordered the formation of a DSM Coordination Committee (Committee) that consists of representatives from jurisdictional electric utilities, consumer groups and the Office of Utility Consumer Counselor. The Committee is responsible for developing program designs, coordinating the development and maintenance of a statewide database for all program results, issuing requests for proposals (RFP), and creating periodic joint reports for the Commission on the status of the DSM programs. Since its formation, the Committee has issued two RFPs: one for an independent third party administrator, who will

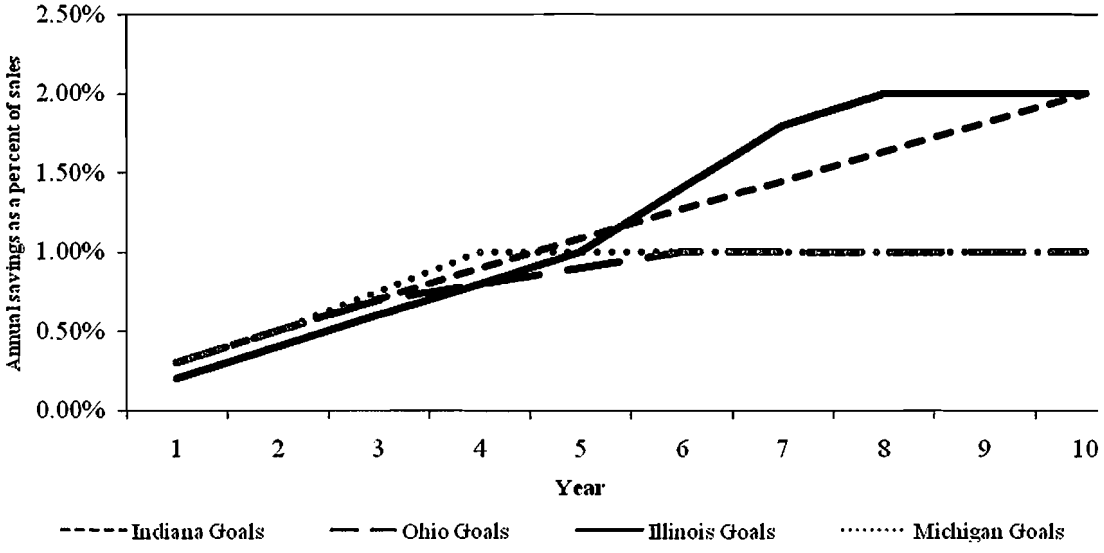
[19]Energy efficiency refers to measures or technologies that reduce the consumption of energy while demand response resources refer to measures, technologies, or incentives and pricing programs that reduce or curtail load during peak periods.

oversee and coordinate the core programs for the utilities, and another for an evaluation administrator, who will undertake the evaluation, measurement and verification of the DSM programs to ensure their effectiveness. The Committee is reviewing bids submitted by interested parties this summer and plans to select the administrators this fall.

With regard to energy savings as a percentage of utility sales, Indiana ranks 22nd nationally and 4th among the seven Midwestern states. For the amount spent on energy efficiency initiatives, Indiana ranks 31st and 6th, respectively. During the course of the investigation, three Midwestern states, Illinois, Ohio and Michigan established annual DSM savings targets for electric utilities. Based on the savings goals approved by the Commission, Indiana rivals Illinois and surpasses the other two states. The graph below depicts how the savings goals differ between the states.

Chart 2

Midwest Electric Efficiency Goals



DSM programs benefit consumers by saving energy, which is the most cost-effective way of meeting future energy supply needs. It also has the corresponding benefit of reducing the need to build additional generation capacity. The initial core programs are to be designed and offered by end of calendar year 2010 for all customer classes – residential, commercial and industrial.

Demand Response Programs

Demand response programs have a long history in the electric industry, and the types of programs available have expanded in recent years. The U.S. DOE defines demand response as "changes in electric usage by end-use customers from their normal consumption patterns in response to changes in the price of electricity over time, or to incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is jeopardized."

Traditionally, Indiana utilities have relied upon interruptible load contracts with large industrial customers to reduce the need for utility-owned generation capacity. Increased use has also been made of appliance load control programs, with emphasis on the control of air conditioners during times of peak load. Indiana utilities have 1,010 MW of interruptible load and 103 MW of air conditioner load control. Demand response programs emphasize the relationship between customer consumption patterns during peak periods in response to high wholesale market prices or when system reliability is at risk. Indiana is among many states working to increase cost-effective customer participation in demand response programs. The Commission continues its investigation, Cause No. 43566, relating to participation by customers in demand response programs offered by the PJM and the Midwest ISO. In response to the Commission's 2010 Summer Reliability Survey, Indiana's utilities reported a potential load reduction of 1,398 MW.

Smart Grid and Advanced Metering

Enhancing and upgrading the nation's electric transmission and distribution systems are key priorities for utilities and the federal government. Generally, "smart grid" refers to a variety of technologies[20] and two-way communications systems, that when added to the grid, help utilities better manage the flow of electricity and the integrity of their system. As communications and information technology advances, the integration of these new systems into substations, transmission, and distribution systems becomes more of a priority. The Commission seeks to

[20]One component of smart grid is the smart meter that allows for real-time or near real-time electric consumption data to be used to reduce load, help localize and minimize outages, and facilitate more accurate pricing. These advanced meters use two-way communication to send the data to the necessary locations and allow for the interaction of advanced features.

evaluate investment proposals for smart grid technologies on a case-by-case basis, while maintaining the expectation to see tangible benefits for Indiana utilities and ratepayers, particularly as it relates to the application of federal funding and customer pricing plans. The following examples detail proposed smart grid projects in Indiana:

1. DEI has proposed a smart grid plan[21] featuring an initial deployment of approximately 40,000 AMI meters, two-way communication devices, and related distribution automation in the area northwest of Indianapolis. Included in its proposal are stationary battery storage and charging infrastructure for plug-in electric vehicles. DEI was selected to receive a cost share grant from the U.S. DOE to help fund smart grid investment in Indiana and Ohio.[22]

2. IPL was also selected by the U.S. DOE to receive stimulus funding for smart grid investments. Funds will be used to offset expenses associated with the deployment of IPL's own advanced technology infrastructure, thereby giving IPL customers' full benefit of such funds. Earlier this year, the Commission approved the deployment of replacement meters for all IPL commercial and industrial customers and up to 22,000 residential and small commercial and industrial customers stating that the company has taken an appropriate step towards modernizing the grid to ensure reasonable adequate energy services and facilities in the future.[23]

3. I&M has been conducting a smart meter pilot program involving approximately 10,000 customers in South Bend. The company's plan calls for utilization of the new technology to pilot certain time-of-day rates and direct load control programs. Earlier this year, the Commission approved I&M's request for an extension of its experimental tariff to be used during the smart meter pilot program. The extension was necessary as the company needed to address technical issues associated with meter installation and to have a full summer season with the experimental tariffs in place.

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[21]Supplemental testimony of Duke Energy Indiana, 4/15/2010, (Ind. Util. Reg. Comm'n. Cause No. 43501, Cause pending)

[22]Terms and conditions of the grant are still pending however the company was one of 6 awardees that were selected for the highest grant amount available.

[23]Order for IPL's Phase II DSM program (Ind. Util. Reg. Comm'n, Cause No. 43623, Feb. 10, 2010)

Regulatory Development

Tree-Trimming Practices

Ongoing maintenance efforts by Indiana's electric utilities that address tree growth near power lines are critical to the provision of safe and reliable electric service for their customers. On April 1, 2009, the Commission opened an investigation, Cause No. 43663, into the tree-trimming policies and practices of Indiana's electric utilities. Respondents to the investigation include all jurisdictional electric utilities. The Commission conducted six field hearings at locations throughout the state to solicit a diverse sample of customer perspectives. Specific issues identified for consideration by the Commission include, but are not limited to, proper/reasonable notification practices, debris removal after storm events, adoption of industry standards, and uniform clearance standards.

Financial Taskforce

In the wake of the financial crisis, the Commission formed a team in late 2008 to closely follow the capital markets and understand their impact on Indiana's regulated utilities. Because utilities are capital-intensive companies, they must be able to raise debt and equity when necessary. This taskforce has met with representatives of Moody's, an agency that assigns financial health ratings to each of a utility's capital obligations, to discuss their evaluation process and its impact on Indiana utilities. The taskforce has also begun semi-annual informal conversations with senior financial officers of the five IOUs to discuss emerging financial issues. Members have also authored relevant articles concerning the confluence of regulatory and financial issues, which have been shared with other IURC personnel.

ARRA Funding

The American Recovery and Reinvestment Act of 2009 (ARRA) will provide billions of dollars of funding over the course of the next few years to support a wide variety of electricity-related programs. Electricity-related ARRA programs include, but are not limited to, the following: energy efficiency, renewable energy, energy storage, smart grid, electric and hybrid vehicles, demand response, coal-fired power plants with carbon capture and storage, and transmission.

In anticipation of an increase in workload, the IURC applied for and received a three-year grant of slightly less than $1 million from the U.S. DOE to enhance its staff resources. The intent is to supplement Commission staff with in-depth skill sets that are traditionally difficult to find and that are not currently at its disposal. The Commission has designated three specific areas of concentration to address areas of high importance:

1. The Commission recently hired an executive manager in the area of long-term Integrated Resource Planning.

2. The Commission intends to hire one specialized analyst in the area of carbon capture and storage (CCS), a technology that is of critical importance to the economic future of Indiana. This position will work specifically with key stakeholders on defined CCS projects to further understanding of how these technologies can be used.

3. The Commission intends to hire one specialized electric analyst in the area of energy efficiency/demand-side management. This position will serve as a lead analyst on a number of DSM programs and initiatives that are likely to come before the Commission. The IURC is currently using ARRA grant funds to support its use of an outside consultant to facilitate implementation of a consistent statewide approach to DSM programs in the state.

Pricing and Economics

Rate Cases

Rate cases should be a regular occurrence to ensure changing industry conditions are properly reflected in the retail rates on both a company-wide and customer class specific basis.

Rate cases allow the Commission and other parties to comprehensively review all costs and revenues incorporated into base rates, potentially identifying decreasing costs that offset increasing costs. They also allow parties to focus on complicated issues such as return on equity, depreciation, and taxes. Additionally, such proceedings provide an opportunity to allocate the total revenue need of the company to the various customer classes based on their cost of service

and to design retail rates to recover that cost of service. Table 3 shows when the base rates for the five IOUs were approved and when the utilities are expected to file their next rate cases.

Table 3

IOU Rate Case Filings

Utility	Last Rate Case	Date of Order	Expected Rate Case Filings in the Future
DEI	Cause No. 42359	May 18, 2004	2011 – 2012 timeframe
NIPSCO	Cause No. 43526	August 25, 2010	No later than September 30, 2012
I&M	Cause No. 43306	March 4, 2009	March 2014
IPL	Cause No. 39938	August 24, 1995	Unknown
SIGECO	Cause No. 43111	August 15, 2007	Pending - Cause No. 43839

Prior to PSI Energy's (now DEI) rate case filing in December 2002, the base rates for Indiana's five investor-owned utilities were last revised in the early- to mid-1990s. Several factors contributed to the way in which the utilities were able to maintain financial stability without increasing base rates during this extended period. First, the utilities' base rates reflected the relatively high cost of capital from the period in which they were set. As the cost of capital declined over time, the utilities were able to utilize the savings in this area to offset expense increases in other areas. Second, the last series of rate cases was, for the most part, driven by the utilities' need to incorporate significant new assets into rate base, specifically new baseload generating facilities and environmental compliance equipment. Third, state legislation allowed the utilities to recover a variety of costs (e.g., environmental compliance and clean coal technology) through tracking mechanisms and thereby avoid the comprehensive review of a rate case.

Since 2009, the Commission has worked on rate reviews requested by the investor-owned electric utilities including NIPSCO[24] and SIGECO[25], municipal electric operations for Crawfordsville[26] and Columbia City,[27] municipal steam operations for Citizens Thermal

[24]Cause No. 43526
[25]Cause No. 43839
[26]Cause No. 43773
[27]Cause No. 43832-U

Energy[28] and electric cooperatives including Jackson County REMC[29] and Harrison County REMC.[30] The NIPSCO rate case was initiated in order to replace rates and rate structures that were set in 1987. The time that had passed since NIPSCO's last rate alignment with its cost of service contributed to a very complex and highly litigated proceeding. The SIGECO proceeding is the company's second rate review in the last four years.[31] As part of that proceeding, it has proposed a rate design that attempts to decouple its non-industrial sales volumes from its fixed cost recovery through an annual rate adjustment mechanism that redistributes those costs over the existing sales volumes.

The recent rate case proceedings for four of the five IOUs served to refresh what in many ways had become a dated picture of their service cost and associated rate design. The regularity of all-in rate reviews was the subject of legislative initiatives in recent sessions, and while no conclusion was reached, the concept of periodic regular rate cases seems reasonable. The pace of industry change, resources of the stakeholders, and the proper use of alternative ratemaking mechanisms should all be inputs to the discussion.

Adjustable Rate Mechanisms

Indiana's regulatory statutes include adjustable rate mechanisms (trackers) as an integral part of regulation. Expenses that are characterized as largely outside the utility's control, variable, and materially significant are the intended goals of such trackers.

Indiana's regulatory statutes include adjustable rate mechanisms (trackers) for expenses and capital investments. Tracking mechanisms provide for a timelier recovery of specifically defined costs than a rate case. An expense tracker allows retail rates to be adjusted outside the context of a base rate case to reflect changes in operating expenses but does not include a return on such expenses. Expenses that are characterized as largely outside the utility's control, variable, and materially significant are the intended goals of such trackers. Examples of expense trackers include the fuel adjustment and RTO charges.

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[28]Cause No. 43821
[29]Cause No. 43861
[30]Cause No. 43684
[31]Cause No. 43111, Final Order 8/15/07

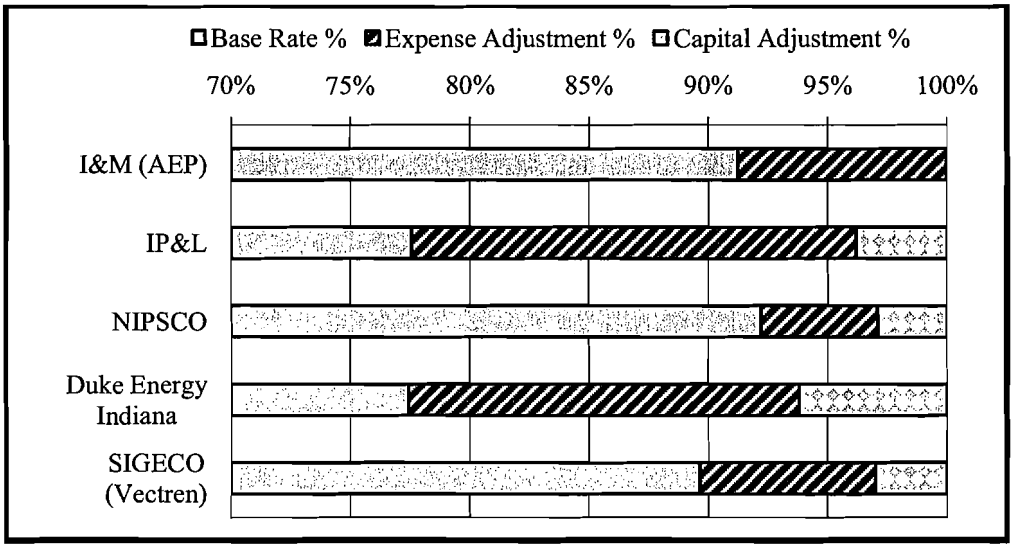
By comparison, a capital investment tracker allows a utility to reflect certain clean coal and energy generation capital costs in its rate base and to reflect the associated return on such investment in retail rates outside of a base rate case. A capital investment tracker reduces the lag time between capital expenditures and cost recovery for the utility and is typically viewed favorably by credit rating agencies. Capital trackers have historically been utilized by utilities to support major investments in upgrading coal generation plants to comply with increasingly stringent environmental regulations.

Table 4 shows a breakdown of how base rates, expense adjustments, and capital adjustments contribute to a residential customer's bill. The relative weighting of these elements varies in part due to the size of the utility, the magnitude of a company's construction program, and how much time has elapsed since the last base rate case.

Table 4

Indiana Investor-Owned Electric Utilities, July 1, 2010 Residential Billing

% of Bill Comparison



The fuel adjustment clause (FAC) has existed in Indiana for more than three decades and tracks a utility's largest variable and unpredictable operating expense: fuel. Other expenses tracked have expanded in recent years to include demand-side management programs, emission allowances, purchased power capacity, clean coal technology operation and maintenance, and Midwest ISO/PJM management expenses. Direct pass-through of expense or revenue reflects

current conditions in retail rates in a more real-time manner than traditional base rate case regulation. The pass-through of unpredictable revenues and expenses to ratepayers reduces volatility in the utility's earnings and may enhance the utility's credit rating.

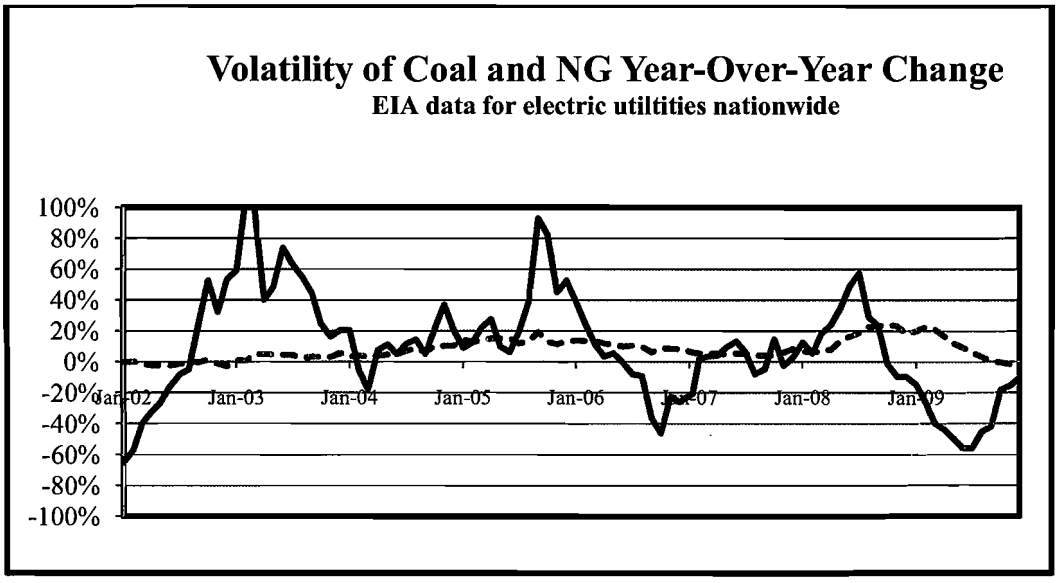
The FAC by statute, and most other adjustable rate mechanisms by design, are expedited summary proceedings in order to provide more timely cost recovery. However, as the number of items, dollar values,[32] and utility decision points being reviewed has increased with no increase in oversight resources or time to review and process the matters at hand, effective regulation is challenged. Recent experience highlights a number of incidents, including over $40 million in refunds to customers required of NIPSCO, that have led the Commission to undertake a review of the FAC oversight process to evaluate whether the process is either appropriate or in the best interest of regulation.

Volatility of Fuel Cost

As previously noted, the cost of fuel is the most significant variable expense for electric generating utilities; and because this expense is tracked, it has a direct impact on customer rates. Chart 3 reflects the volatility of natural gas as well as the less volatile, but nonetheless steady, rise in coal prices. The fuel most often used to generate electricity in Indiana is coal, which is purchased in part under contracts that have durations ranging from 1 to 20 years, with the preponderance of such contracts having an initial term of two to three years. Natural gas use as a fuel for electricity generation by Indiana utilities generally occurs only on the margin and is, therefore, procured on a short-term or spot market basis. This scenario subjects the marginal price of electricity to volatility as reflected in Chart 3.

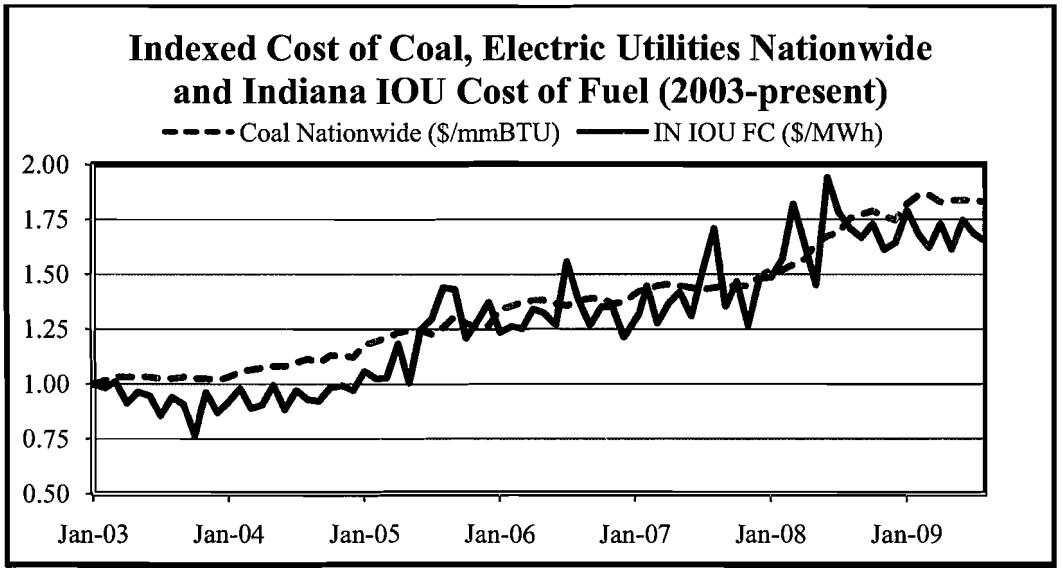
[32]For 2009, the Indiana electric IOUs reported $1.69 billion of jurisdictional fuel costs. The FAC cost recovery mechanism provided for the collection of $698 million of these costs.

Chart 3



As shown in Chart 4, the cost of coal nationwide has steadily increased in recent years. Prudent fuel costs incurred by a utility are passed through an adjustable rate mechanism and are reflected in customer rates dollar for dollar. Chart 4 indicates that the extensive use of coal in Indiana has led to an increase in customer rates over time in a manner that corresponds to the increase in the cost of coal.

Chart 4



III. ELECTRIC GROWTH & INNOVATION

Legislative Initiatives

State

Net Metering

Net metering and feed-in tariffs were two prominent energy issues before the Indiana General Assembly during the 2009 legislative session. Net metering allows customers to satisfy their own electricity needs while retaining the electric utility as a back-up provider. Net metering allows a customer to apply short-term generation amounts in excess of their own needs to future billing periods, but does not provide the customer with the ability to sell or monetize unused generation. This critical feature economically limits the maximum size of the customer system to an amount that meets a customer's needs. The net metering participant avoids the full retail rate of the energy it self-supplies. Because the avoided full retail rate is comprised of both variable (energy) and fixed costs, the participant avoids charges for costs the utility does not avoid. If properly constructed, net metering arrangements limit the risk to the host utility; however, utility cost recovery risk still exists. Absent a mechanism to recover lost fixed costs from other customers, the utility would under-recover the cost of providing service to the net metering customer.

The Commission has determined that it is appropriate to revisit the net metering issue from an administrative perspective and to further engage interested parties to better understand the needs of Hoosiers with regard to this service offering. As such, the Commission is conducting several public hearings across the state to gather feedback on whether to adopt new net metering rules or modify the Commission's existing administrative rules under 170 IAC 4-4.2.

Feed-in Tariffs

Feed-in tariffs are arrangements that compensate energy providers at a pre-set price for a period up to 20 years. In contrast to net metering, the rate or price is set high enough to encourage the development of the specified renewable energy technology (e.g., solar, wind, biomass). Some argue nascent renewable generation resources often require technology-specific subsidies to financially compete with well-developed, utility-scale generation resources.

Additionally, delineation between technologies and unit scale are often included in the set prices. Electricity provided under a feed-in tariff is purchased by the utility and the associated price of that electricity is included in the cost of fuel recovered from the utility's ratepayers. A properly set generation price under a feed-in tariff will balance the desired renewable energy production amount against the rate impact resulting from incenting that amount. The IURC recently approved a three-year pilot feed-in-tariff program for IPL that includes reporting requirements that should enhance the ability of the IURC to monitor developments regarding the degree of subsidy that all ratepayers must fund to achieve this objective.

Federal

Carbon Emissions Legislation

Potential regulation of carbon emissions continues to be a critical environmental issue and will likely increase in significance for Indiana and the nation as recent congressional activity has focused on implementing a cap-and-trade program. Under such a program, the federal government would set annual national limits on the aggregate emission of greenhouse gases, issue emission allowances consistent with the national limits, and enable firms or other entities to buy and sell these allowances. The national limit would be reduced over time and the number of emission allowances issued each year would decline by a corresponding amount.

There are multiple bills pending in both the U.S. Senate and House of Representatives that include provisions regarding CO_2 and other greenhouse gas (GHG) emissions. Several of the bills that have received a significant amount of attention and scrutiny include:

- *H.R. 2454: American Clean Energy and Security (ACES) Act of 2009, sponsored by Representative Waxman (D-CA)*
    - The bill would require the implementation of a cap-and-trade model. It calls for a reduction in U.S. carbon emissions to 97% of 2005 levels by 2012, 83% by 2020, 58% by 2030, and 17% by 2050. The bill passed in the House on June 26, 2009. The bill requires 15% of the annual allowances to be auctioned off.
- *The American Power Act, sponsored by Senators Kerry (D-MA) and Lieberman (I-CN)*
    - Released on May 12, 2010, the bill would create a cap-and-trade system for GHG emissions with the goals of reducing emissions to 95.25% of 2005 levels by 2013,

83% of 2005 levels by 2020, and 17% of 2005 levels by 2050. Introductory floor and ceiling prices would be set at $12/ton and $25/ton respectively, increasing at 5% over inflation annually.

- *S. 2877: Carbon Limits and Energy for America's Renewal, sponsored by Senator Cantwell (D-WA)*
    - The bill requires the President to establish standards to reduce GHGs at the same rate as ACES. Carbon shares would be auctioned with steadily increasing upper and lower price constraints or collars.

The Energy Information Administration (EIA) completed an analysis of the impact of the Waxman-Markey bill through 2030 using a number of different scenarios.[33] The study found that average electricity prices in 2020 were only 3 to 4 percent higher than the reference case. Electricity prices in 2030, however, were projected to be 19 percent above the reference case due to higher emission allowance prices and the phase-out between 2025 and 2030 of the allocation of free emission allowances to utilities that distribute electricity to retail customers. The study also found that receiving free allowances in proportion to output softens the impact of increased energy prices on energy intensive industries and industries that are vulnerable to international trade.

According to data for 2008 provided by the EIA, Indiana-based generation facilities accounted for 2.73% of the nation's nameplate electric capacity; whereas, Indiana accounted for 2.87% of the nation's retail sales of electricity and 5.02% of CO2 emissions from the total U.S. electric power industry. The allowances allocated to Indiana could vary considerably depending on the basis for allocating allowances.

Regions of the country that are more heavily dependent on coal-fired generation, including Indiana, will be much more adversely affected by carbon constraints than other regions. This result was highlighted by a study performed by the SUFG on the proposed carbon legislation in 2007. While the EIA projected the impact on the average price of electricity for the nation to be 10.4% in 2020 and 14.8% in 2025, the SUFG estimated the increase in Indiana electricity prices to be 33.6% in 2020 and 44.6% by 2025.

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[33]Energy Information Administration, Energy Market and Economic Impacts of H.R. 2454, the American Clean Energy and Security Act of 2009, August 2009

On June 15, 2010, the U.S. Environmental Protection Agency (U.S. EPA) released an analysis[34] on the American Clean Power Act which found the bill would add $79 to $146 to the average American household's annual energy cost. The U.S. EPA also predicted that allowance prices under the bill would remain between approximately $13 and $20 each for 2013 to 2020.

If carbon legislation is passed, it is likely that the gap between relatively high-cost states and those that have comparatively lower electric rates will narrow, but the relative position of Indiana to surrounding states may not change significantly. Kentucky (in particular), Ohio, Illinois, and a very large part of the region will see large per capita increases in their cost of service too (in the form of higher power costs) because of the dominance of coal-generated electricity in this region. Illinois and Ohio have considerable amounts of nuclear power; therefore, with regard to carbon dioxide legislation, they will be impaired less than Indiana. However, Illinois and Ohio are facing substantially higher costs due to problems associated with their retail competition efforts. In sum, Indiana's position relative to surrounding states may not change substantially. However, the more dramatic change, with potential major implications for economic development, could stem from the erosion of Indiana's economic advantage due to low cost electricity compared to historically high-cost areas such as California and the upper northeastern U.S.

Carbon Dioxide Regulation

The U.S. EPA is another source of CO_2 emission regulations.

The U.S. EPA is another source of CO_2 emission regulations. On April 2, 2007, the Supreme Court found greenhouse gases (GHGs), including CO_2, to be air pollutants covered by the Clean Air Act.[35] On December 7, 2009, the U.S. EPA finalized its findings under the Clean Air Act that GHGs in the atmosphere endanger both the public health and the environment for current and future generations. The endangerment finding obligates the U.S. EPA, under Section 202(a) of the Clean Air Act, to issue GHG emission standards for motor vehicles, which makes GHG emissions subject to regulation under the Clean Air Act for the first time. Under the Clean Air Act, air pollutants subject to regulation are subject to the Act's "Prevention of Significant

[34] U.S. EPA Analysis of the American Power in the 111th Congress (6/14/10)
[35] *Massachusetts v. EPA, 549 U.S. 497 (2007)*

Deterioration" and operating permit provisions for stationary sources. Consequently, the U.S. EPA intends to require stationary sources of GHGs to obtain permits stating new plants or expansions use the best available technology to cut emissions.

On May 13, 2010, the U.S. EPA issued its final GHG Tailoring Rule to define when permits under the New Source Review (NSR) Prevention of Significant Deterioration (PSD) and Title V Operating Permit programs are required. Some key aspects of the new rule include:

- The U.S. EPA will phase in permit requirements and regulation of GHGs for large stationary sources beginning in 2011. Step 1will take effect on January 2, 2011 and last through the first half of 2011. During Step 1, only those facilities that already must apply for CAA permits as a result of non-GHG emissions (approximately 400 facilities) will need to address their GHG emissions in permit applications. Cases with increases of 75,000 tons per year of total GHG would need to determine Best Available Control Technology (BACT).

- In Step 2, GHG emissions from larger sources will phase in starting in the latter half of 2011, and between then and June 2013, requirements will cover new construction projects that emit at least 100,000 tons per year of GHG and modifications at existing facilities that increase GHG emission by at least 75,000 tons per year. The U.S. EPA estimates about 550 sources will need to obtain Title V permits for the first time due to this Step.

- The U.S. EPA commits to undertake another rulemaking, which is to begin in 2011 and conclude by July 1, 2012, focusing on an additional step for phasing in GHG permitting and to discuss whether smaller sources can be permanently excluded from permitting. Regardless, permitting for sources smaller than 50,000 tons per year will not be required until at least 2016.

- The U.S. EPA plans to develop supporting guidance and other information to assist permitting authorities and will actively work with states on technical information and data needs related to identifying BACT requirements for permits.

Renewable Portfolio Standards

Currently, there is no federal RPS. The Database of State Incentives for Renewables & Efficiency reports that there are 29 states, plus the District of Columbia, that have some type of RPS. Indiana is not one of these states. Several bills have been introduced by Congress that contain national RPS provisions. Some of these bills include:

- *H.R. 2454: American Clean Energy and Security (ACES) Act of 2009, sponsored by Representative Waxman (D-CA)*
    - The bill contains a combined renewable resource and electricity saving standard of 6% in 2012, gradually rising to 20% in 2020. Three quarters of the requirement must be met by renewable energy, except upon receiving a petition from a state governor to lower the renewable portion to 60% of the requirement. Qualifying renewables include: wind, solar, geothermal, biomass, hydropower, marine and hydrokinetic, landfill gas, wastewater treatment gas, coal-mine methane, and qualified waste-to-energy.
- *S.1462 American Clean Energy Leadership Act of 2009, sponsored by Senator Bingham (D-NM)*
    - The bill contains a combined RPS/energy efficiency standard of 3% for 2011-2013, gradually rising to 15% by 2021. Qualifying renewables include: wind, solar, ocean, geothermal, biomass, landfill gas, hydropower, and hydrokinetic.
- *H.R. 890 American Renewable Energy Act, introduced by Representatives Markey (D-MA) and Platts (R-PA)*
    - The bill would establish an RPS of 6% in 2012, steadily growing to 25% by 2025. Qualifying renewables include: wind, solar, geothermal, combustion of biomass or landfill gas, qualified hydropower, or marine and hydrokinetic energy.

Technology

Plug-in Hybrid Electric Vehicles

In the latest push to eliminate the United States' dependence on fossil fuels, Congress has promoted the development of alternative fuel vehicles. In fact, the Energy Independence and

Security Act of 2007 (EISA) contained incentives for the development of hybrid vehicles using a mix of electricity and traditional fuels. The Energy Improvement and Extension Act of 2008 then gave tax breaks to manufacturers of plug-in hybrid electric vehicles. The key to the success of these vehicles is their ability to store the energy they need to operate. This explains why Congress has provided additional incentives through the ARRA. This Act contained solicitations for up to $2 billion in federal funds for the development of the advanced batteries needed to run the electric vehicles as well as the associated advanced technologies.

Typical driving patterns show that many vehicles are used primarily during the day, so they would need to recharge at night. Because electric usage currently peaks during the day and falls off during the night, capacity in the system should be sufficient to support the initial adaptation of hybrid electric vehicles expected in the next few years.

DEI and IPL have been working together along with other members of the Energy Systems Network to develop and facilitate an electric vehicle demonstration project in Central Indiana (also referred to as "Project Plug-IN"). The project continues to evolve, but will likely include vehicles provided or purchased by: the manufacturing partners as part of a loaned fleet; the Project Plug-IN partners for their own use; and DEI and IPL customers who are early adopters of electric vehicles or plug-in hybrid electric vehicles.

As a part of its Smart Grid Pilot, DEI is proposing to install, in five residential homes, a 2.5 kW roof-mounted photovoltaic array and a 5-10 kW lithium ion battery integrated with charging infrastructure for plug-in electric vehicles. DEI wants to test how electric vehicles are charged by consumers when economic incentives are provided through rates to encourage off-peak charging, which minimizes the need for additional resources to meet the demand for electricity.

National Institute of Standards and Technology & Smart Grid

The EISA charged the National Institute of Standards and Technology (NIST) with developing an appropriate framework for achieving interoperability of smart grid devices. The federal agency has defined the smart grid as "a nationwide network that uses information technology to deliver electricity efficiently, reliably and securely."

NIST, a division of the U.S. Commerce Department, released its initial draft of cybersecurity standards in September 2009 and expects to issue its final report by mid-2010. The FERC will then initiate a rulemaking to formally adopt those standards. Uncertainty still remains as to how FERC will enforce those standards at the electricity distribution level, which is regulated by state commissions.

IV. ELECTRIC APPENDIX

Appendix A – Jurisdictional Electric Utility Revenues

Year Ending December 31, 2009

Rank	Utility Name	Operating Revenues	% of Total Revenue
1	Duke Energy Indiana, Inc.	$ 2,354,692,352	30.12%
2	Indiana Michigan Power Co.	2,085,781,133	26.68%
3	Northern Indiana Public Service Co.	1,213,923,081	15.53%
4	Indianapolis Power & Light Co.	1,067,996,891	13.66%
5	So. Indiana Gas & Electric Co. d/b/a Vectren	528,673,984	6.76%
6	Richmond Municipal	83,474,038	1.07%
7	Northeastern REMC	81,437,046	1.04%
8	Anderson Municipal	71,360,839	0.91%
9	Harrison County REMC	47,173,038	0.60%
10	Jackson County REMC	46,858,011	0.60%
11	Mishawaka Municipal	46,262,805	0.59%
12	Logansport Municipal	36,033,782	0.46%
13	Crawfordsville Municipal	30,975,098	0.40%
14	Frankfort Municipal	25,440,123	0.33%
15	Peru Municipal	23,002,949	0.29%
16	Auburn Municipal	21,674,990	0.28%
17	Lebanon Municipal	17,006,294	0.22%
18	Marshall County REMC	12,249,789	0.16%
19	Tipton Municipal	9,663,335	0.12%
20	Columbia City Municipal	9,016,710	0.12%
21	Knightstown Municipal	2,207,173	0.03%
22	Troy Municipal	1,320,266	0.02%
23	Kingsford Heights Municipal	572,707	0.01%
24	Straughn Municipal	137,732	0.00%
25	Greenfield Mills, Inc. Power & Light	35,512	0.00%
	Total	$ 7,816,969,678	100.00%

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I. NATURAL GAS OVERVIEW

Industry Structure

The Indiana Utility Regulatory Commission regulates the rates and charges of intrastate pipelines and local distribution companies, and through its Pipeline Safety Division, the infrastructure that transports natural gas.

The Indiana Utility Regulatory Commission (Commission) regulates the rates and charges of intrastate pipelines and local distribution companies (LDCs), by reviewing and issuing decisions in proceedings on gas cost adjustments, rates and charges, financial arrangements, service territory requests and investigatory proceedings. The Commission also analyzes various forms of alternative regulatory proposals, such as decoupling, trackers, and customer choice initiatives. Through its Pipeline Safety Division (Pipeline Safety), the Commission regulates the infrastructure that transports natural gas throughout the state.

The natural gas industry consists of three systems: producers (the gathering system), interstate and intrastate pipelines (the transmission system), and LDCs (the distribution system). Interstate pipelines, regulated by the Federal Energy Regulatory Commission (FERC), carry natural gas across state boundaries; and intrastate pipelines, regulated by state commissions, carry natural gas within state boundaries. States, including Indiana, that have certified pipeline programs are delegated federal authority by the U.S. Department of Transportation to conduct inspections, investigate accidents, and enforce state and federal safety regulations.

Production Overview

The production of natural gas begins with raw natural gas extracted from the wellhead where initial purification of natural gas occurs before entering the low-pressure, small diameter pipelines of the gathering system. The natural gas is then re-purified at the processing station. Purified natural gas consists of approximately 90 percent methane compared to raw natural gas that is generally 70 percent methane combined with a variety of other compounds. For safety

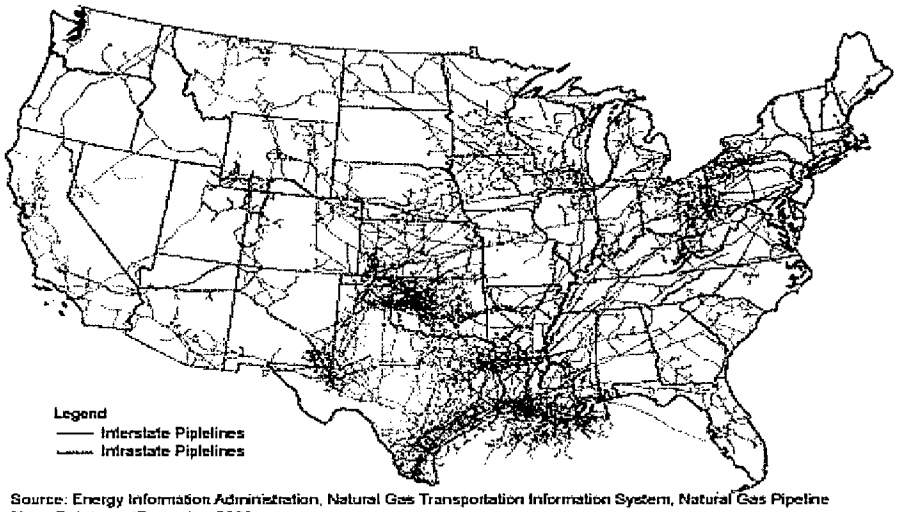
reasons, before allowing natural gas into the pipeline system, it is required to meet certain standards.[1] This pipeline quality natural gas is a commodity.

Transmission System

The vast majority of natural gas consumed in Indiana is from out-of-state production, predominantly the Gulf of Mexico.

The vast majority of natural gas consumed in Indiana is from out-of-state production, predominantly the Gulf of Mexico. In 2008, Indiana consumed approximately 551 million dekatherms (Dth) of natural gas,[2] of which roughly 4.7 million Dth,[3] or less than one percent, was from production within the state. This illustrates Indiana's reliance upon the transmission system to carry natural gas from the gas producing regions of the country into the state.

The national natural gas mainline transmission grid is made up of approximately 217,000 miles of interstate pipelines and 89,000 miles of intrastate pipeline.



Source: Energy Information Administration, Natural Gas Transportation Information System, Natural Gas Pipeline Maps Database (December 2008)

The transmission system includes: interstate and intrastate pipelines that carry gas from producing regions to LDCs, industrial consumers, and power generation customers. The Heartland Pipeline (Heartland) and the Ohio Valley Hub (OVH) pipeline are the two intrastate

[1] http://www.naturalgas.org/naturalgas/processing_ng.asp
[2] http://tonto.eia.doe.gov/dnav/ng/ng_cons_sum_dcu_SIN_a.htm
[3] http://tonto.eia.doe.gov/dnav/ng/ng_prod_sum_dcu_sin_a.htm

pipelines under the Commission's jurisdiction. The Commission governs the pipelines' operations, services and rates.

Heartland is a 25-mile pipeline running west to east connecting the Midwestern Gas Transmission (MGT) interstate pipeline in Sullivan, Indiana to Citizens Energy Group's (Citizens) underground storage facility in Greene County. Heartland supplies firm and interruptible transportation services with a design capacity of 80,000 Dth per day on a firm basis and up to an additional 10,000 Dth per day on an interruptible basis. OVH is a 9.2 mile pipeline located in Knox County. It connects two interstate pipelines (Texas Gas Transmission and MGT) to the Monroe City Gas Storage Field and has a storage capacity of approximately 2.7 million Dth and a firm transmission capacity of 60,000 Dth per day. Firm transportation service takes priority over interruptible service.[4] Consequently, interruptible transportation service customers receive an incentive (slightly lower cost) due to the possibility of interrupted gas supply, especially during peak periods.[5]

Distribution System

The Commission regulates the rates and charges of 21 natural gas distribution utilities in Indiana, with operating revenues totaling $2.1 billion.

Gas passes through the transmission system and enters the distribution system where LDCs take ownership to sell and deliver the gas to retail customers. The Commission regulates the rates and charges of 21 natural gas distribution utilities in Indiana with operating revenues totaling $2.1 billion[6] (Appendix A). These utilities maintain plant in service of approximately $4.4 billion, serving roughly 3.4 million customers.

Of the regulated utilities, one is a not-for-profit, two are municipalities, and eighteen are investor-owned utilities (IOUs). Pursuant to statute, municipal utilities may elect to "opt out" of the Commission's jurisdiction for rates and charges in favor of local control in determining rates;

[4]http://www.aga.org/Kc/aboutnaturalgas/glossary/default.htm?id={6864429D-6294-4BE9-9CB2-64939E9A82FC}
[5]http://www.aga.org/Kc/aboutnaturalgas/glossary/default.htm?id={6EC7604A-70E0-4508-A990-41D3AC4C21B9}
[6]2009 Annual Reports filed with the Commission

however, these utilities still remain under the jurisdiction of the Commission's Pipeline Safety Division.[7] Seventeen gas utilities have elected to "opt out" of the Commission's oversight.

The three largest IOUs providing gas service in Indiana are Northern Indiana Public Service Company (NIPSCO), Indiana Gas Company, Inc. (Indiana Gas), and Southern Indiana Gas & Electric Company, Inc. (SIGECO). NiSource is the parent company of NIPSCO, and Vectren Energy Delivery (Vectren) is the parent company of Indiana Gas and SIGECO. NIPSCO and SIGECO are combination utilities, providing gas and electric service. Citizens, a public charitable trust (treated as a municipal utility for regulatory purposes), serves mainly the Indianapolis metropolitan area. Citizens and the three IOUs mentioned above represent the largest natural gas utilities in Indiana.

Age-Profile

While the majority of the transmission and distribution mains in Indiana are less than 50 years old, almost half of all transmission mains are between 40 and 50 years old.

Indiana's natural gas infrastructure consists of more than 75,920 miles of jurisdictional intrastate pipelines, including more than 39,500 miles of distribution and service mains[8] and approximately 1,950 miles of transmission mains as demonstrated by Table 1.

Table 1

Age Profile of Jurisdictional Transmission and Distribution Mains in Indiana

	Transmission Mains		Distribution Mains	
Years Old and Older	**Number of Miles Mains**	**Percentage of Total Main Miles**	**Number of Miles Mains**	**Percentage of Total Main Miles**
70	0.1	0.01%	674.0	1.70%
60	2.9	0.15%	396.4	1.00%
50	284.6	14.59%	2,740.1	6.93%
40	685.1	35.13%	9,395.9	23.75%
30	246.8	12.66%	4,788.3	12.10%
20	175.2	8.98%	7,105.5	17.96%
10	257.9	13.22%	8,231.2	20.81%
0	179.7	9.21%	5,439.7	13.75%
Other	117.8	6.04%	786.9	1.99%
Total	1,950.1	100.00%	39,558.0	100.00%

[7] *See*, I.C. § 8-1.5-3-9

[8] Service mains are used to transport natural gas from the distribution system to the end user's property for final use.

A majority of the transmission and distribution mains in Indiana are less than 50 years but more than 20 years old. A third of all of the transmission mains were built during the 1960s. While the age of the distribution system is younger than the transmission system, the distribution system requires frequent construction of new mains in order to meet the demand of new customers. In the last 20 years, approximately 35% of the distribution mains were placed in service as compared to roughly 22% of the transmission system. Federal guidelines for integrity management[9] require that operators make every effort to assess threats to their pipelines, age being an obvious threat. The replacement of aging infrastructure will continue to be an ongoing focus as demand for service continues to increase.

Demand

Nationally, the state's annual residential natural gas pricing ranked as the 14th lowest.

LDCs serve three customer classes: residential, commercial, and industrial. The residential customer class consists of single-family homes and small multi-family dwellings. In 2009, Indiana's residential class consumed approximately 140 million Dth of natural gas.[10] Nationally, the state's annual residential natural gas pricing also ranked as the 14th lowest.[11] Most residential customers use the LDC as their natural gas supplier, but residential customers in NIPSCO's service territory have the option of electing an alternative natural gas supplier under NIPSCO's "Choice Program," which was approved by the Commission through an alternative regulatory plan.[12] Those customers (approximately 14% of NIPSCO's total residential customers and 25% of total commercial customers) have elected to contract with an alternative supplier for their natural gas needs, with NIPSCO providing the transportation service.

The commercial customer class typically consists of office, retail, and wholesale facilities in addition to larger residential complexes. Some commercial class customers may choose to

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[9]Integrity management is a risk-based approach to pipeline safety resulting from the Pipeline Safety Act of 2002 and 2006.

[10]http://tonto.eia.doe.gov/dnav/ng/ng_cons_sum_dcu_SIN_a.htm

[11]http://www.eia.gov/dnav/ng/ng_pri_sum_a_EPG0_PRS_DMcf_a.htm

[12]NIPSCO Choice Program was originally approved in Cause No. 40342 as a two-year pilot program that included the approval of affiliate guidelines applicable to NIPSCO and its affiliate companies. The Choice Program was extended in Cause Nos. 41338 and 42097 and most recently approved by the Commission in Cause No. 43837 on March 3, 2010. The Commission's approval extended the Choice Program until March 31, 2012.

receive bundled service or transportation service from the LDC. In 2009, Indiana's commercial class consumed approximately 78.6 million Dth of natural gas.[13]

The industrial customer class typically purchases the highest volume of gas both individually and collectively. This class may receive bundled service or buy gas directly from one or more producers and/or marketers, paying the LDC for transportation costs associated with delivering the gas from the city gate to the industrial customers' facilities. In 2009, Indiana's industrial customers consumed about 242 million Dth, the fourth highest volume in the U.S.[14]

Existing Legal and Policy Foundations

Pipeline Safety Act of 1968 and the State's Pipeline Safety Program

The Pipeline Safety Act of 1968 promotes pipeline safety through exclusive federal authority for regulation of interstate pipeline facilities, and federal delegation to the states for all or part of the responsibility for intrastate pipeline facilities.

The Pipeline Safety Act of 1968 established the federal pipeline safety program. The state's program promotes pipeline safety through exclusive federal authority for the regulation of interstate pipeline facilities and federal delegation to the states for all or part of the responsibility for intrastate pipeline facilities. The federal program authorizes grants-in-aid for up to 80 percent of a state agency's personnel, equipment, and activity costs for its pipeline safety program. However, the federal grant for the year under review is limited to the average of the state's share of costs over the previous three years. Grants are based primarily on the annual evaluation of the state's program. Historically, the annual evaluation of Indiana's program has resulted in high marks (105.5 out of 107 points for the most current evaluation). Furthermore, the federal/state partnership is the cornerstone for ensuring uniform implementation of the pipeline safety program nationwide.

Indiana enforces each federal safety standard through injunctive and monetary sanctions.

[13] http://tonto.eia.doe.gov/dnav/ng/ng_cons_sum_dcu_SIN_a.htm
[14] http://tonto.eia.doe.gov/dnav/ng/ng_cons_sum_a_EPG0_vin_mmcf_a.htm

Indiana participates in the federal pipeline safety grant allocation program through a voluntary certification submission. Under this certification, the Commission, on behalf of the federal government, assumes safety responsibility with respect to intrastate facilities over which it has jurisdiction under state law (submissions for gas and hazardous liquid programs are separate certifications). These laws allow Indiana to enforce each federal safety standard through injunctive and monetary sanctions. The state may also adopt additional or more stringent standards for intrastate pipeline facilities, provided such standards are compatible with federal regulations.

Pipeline Safety administers the Indiana pipeline safety program as established by statute.[15] Annually, the division completes a minimum of one in-depth inspection of each gas pipeline operator and covers 50 percent of each operator's inspection units. These inspections may cover operating procedures, operating records, specialized inspections, follow-up inspections, field inspections, operator training, or any combination of these types of inspections. Upon discovery of a probable violation, an operator receives a written notice and is subject to additional enforcement, as needed. In 2009, Pipeline Safety conducted 895 inspections of 95 operators and 224 associated inspection units, resolving 208 probable violations.

Additionally, Pipeline Safety investigates new operators, determines jurisdictional authority, and incorporates new operators into the program. It also conducts on-site investigations into each pipeline accident reported to the National Reporting Center, unless the incident is determined to be non-jurisdictional. Upon completion of an investigation, Pipeline Safety prepares a written report.

Pipeline Safety is also responsible for the prevention of damage to underground facilities. It also promotes the education of public and emergency officials/responders in recognizing, reporting, and responding to gas-related emergencies and conducts training sessions for pipeline operators in the state. Additionally, Pipeline Safety maintains records for each operator, inspection, and compliance action. Records include, but are not limited to, inspection records, correspondence and compliance actions, incident reports and state and federal annual reports.

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[15] *See*, I.C. § 8-1-22.5

State pipeline safety programs are strongly encouraged to develop data-driven, risk-based inspection plans.

The federal program strongly encourages state pipeline safety programs to develop data-driven, risk-based inspection plans. As operators are now required to develop plans to identify and assess risks to their systems, pipeline safety programs are also under pressure to define elements of risk and determine an operator's overall "risk score." This is done so that riskier operators are more easily identified and given additional scrutiny, resulting in greater safety for the public.

Federal Energy Regulatory Commission Orders

The impact of federal regulation is important to the LDCs, especially since the Federal Energy Regulatory Commission (FERC) oversees the rates, terms and conditions of sales for resale and transportation of natural gas in interstate commerce. The FERC operates as an independent agency in the regulation of interstate pipelines, interstate infrastructure proposals, and liquefied natural gas (LNG) terminals. While the marketplace determines the price of commodity gas, based on supply and demand, the IURC reviews and approves prudent gas purchases along with distribution-related costs. All costs approved by the IURC include FERC-related costs associated with supplying gas to the end-use consumers.

As a result of FERC Orders 636 and 712, pipeline companies changed from being merchants of natural gas to transporters of the commodity. This allowed for open-access transportation services regardless of who owns the gas, thereby increasing competition among sellers. As a result, interstate pipeline companies separated or unbundled transportation and sales services. Pipeline companies began offering a variety of transportation services such as unbundled no-notice, firm transportation, open-access storage, and a capacity release program. The capacity release program led to a secondary market, allowing for the release of surplus firm capacity for transportation and storage. Pipeline companies and LDCs realize benefits from having greater flexibility in managing pipeline contracts and with the value of capacity on interstate pipelines. This capacity value is shared with customers in gas cost filings amongst Indiana's largest utilities, benefiting natural gas customers.

II. NATURAL GAS LANDSCAPE

Infrastructure

Rockies Express Pipeline

The Rockies Express Pipeline (REX) is a major interstate pipeline project that begins in Rio Blanco County, Colorado and ends in Monroe County, Ohio. The portion of the pipeline in Indiana traverses Vermillion, Parke, Putnam, Hendricks, Morgan, Johnson, Shelby, Decatur, and Franklin counties. The joint developers of the project were: Kinder Morgan Energy Partners, L.P.; Sempra Pipelines and Storage, a unit of Sempra Energy; and ConocoPhillips. Construction spanned roughly four years and was completed during the summer of 2009 at a cost of approximately $6.6 billion.

REX is the largest natural gas pipeline in North America.

REX is the largest natural gas pipeline in North America, spanning nearly 1,700 miles with a capacity of 1.8 billion cubic feet per day.[16] REX links natural gas supplies in the Rocky Mountains to major markets in the upper Midwest and Eastern U.S. Historically, a substantial price disparity existed between Rocky Mountain gas and gas supplies in the eastern U.S. The presence of REX in Indiana contributes to the diversification of the state's natural gas sources of supply and contributes to competitive pricing.

Federal inspectors requested assistance from Pipeline Safety to observe and report on the construction of the REX pipeline. Inspectors dedicated more than 238 days and nearly 1,790 man-hours to this endeavor during the time REX crews worked in Indiana. Pipeline Safety also monitored the restoration of the right-of-way for the REX pipeline.

[16] http://pipelineandgasjournal.com/michels%E2%80%99-crews-tackle-construction-three-major-north-american-pipeline-projects

Modernization and Efficiency

Energy Efficiency

The Commission has issued orders fulfilling the requirements of the Energy Independence and Security Act of 2007, approving decoupling and energy efficiency programs.

The federal Energy Independence and Security Act of 2007 (EISA) was signed into law on December 19, 2007. The EISA provisions promote energy independence in the United States by increasing energy efficiency measures and increasing usage requirements for clean renewable fuels. The requirement in Title V, "Energy Savings in Government and Public Institutions," affects the Commission by amending the Public Utility Regulatory Policies Act of 1978. The amendment requires natural gas utilities to adopt policies that establish energy efficiency as a priority in their business operations and planning processes. The amendment also requires regulatory agencies to evaluate rate design modifications and provide for the following:

- Institution of decoupling programs;
- Creation of incentives for utilities to successfully manage energy efficiency programs; and
- Adoption of rate designs promoting energy efficiency in each customer class.

In response to the EISA, the Commission has issued orders approving decoupling mechanisms and energy efficiency programs.[17]

Utility-sponsored energy efficiency programs are included in most of the approved decoupling rate designs that separate a utility's profits from its sales while providing for an allowed rate of return. Although decoupling does not by itself achieve energy efficiency, the two concepts are linked due to the fact that gas utilities may advocate conservation efforts with the assurance of cost recovery.

[17]In Cause Nos. 42943 and 43046, the Commission approved an alternative regulatory plan that included a sales reconciliation decoupling mechanism for SIGECO and Indiana Gas. In Cause No. 43051, the Commission approved an alternative regulatory plan simplifying the residential gas rates as well as an Energy Efficiency Rider for NIPSCO. In Cause No. 42767, the Commission approved an alternative regulatory plan that included a decoupling mechanism and energy efficiency program for Citizens Gas & Coke Utility. In Cause No. 43624, the Commission approved an alternative regulatory plan that included an energy efficiency program for Citizen Gas of Westfield.

The Commission has established independent oversight boards to govern the energy efficiency programs.

The Commission has established independent oversight boards to govern the energy efficiency programs. These oversight boards are comprised of representatives from various energy groups, utilities, state agencies, consumer groups, and educational institutions such as the State Utility Forecasting Group at Purdue University. Each utility selected an independent third-party administrator through a bidding process. The representatives on the oversight boards along with the third-party administrator use a consensus decision-making process to approve a proposed portfolio of programs, as well as the associated costs and measures to determine program effectiveness.

The Commission reviews the programs of each utility through monthly scorecards detailing monthly, year-to-date, and yearly planning goals for therm savings, measures implemented, and budget expenditures. In the near future, the Commission anticipates that various utility programs will be consolidated into a single statewide program to allow for economies of scale and significant market influence not realized by smaller, individual programs. Additionally, customers will benefit from a unified oversight board that will establish consistency in program structure, communications, and education efforts throughout the state.

Shale Gas

The Potential Gas Committee cites an unprecedented increase in U.S. natural gas resources to 515 trillion cubic feet, an increase of 39% from 2006.

The emergence of unconventional sources of natural gas supply such as shale gas has affected the overall supply of natural gas in our country. A recent report by the Potential Gas Committee[18] cites an unprecedented increase in the amount of U.S. natural gas resources of 515 trillion cubic feet, an increase of 39% from 2006, due to newly available drilling techniques of shale gas potential throughout the Appalachian basin, the Mid-Continent, Gulf Coast, and Rocky Mountain areas. Shale gas, during the last few years, has been competitively priced. However,

[18]The Potential Gas Committee is an incorporated, nonprofit organization consisting of experienced volunteers in the natural gas field working independently in association with the Colorado School of Mines.

the price of discovery and the actual production of shale gas varies depending on the location and geological formation.

Recent concerns have raised questions regarding the drilling techniques for shale gas and its impact on the environment. While there is no definitive correlation linking drilling with environmental concerns, many states, where drilling has occurred, have experienced air pollution and contaminated drinking wells due to poorly cased wells and the illegal disposal of fluids. As a result, the federal government launched a review of the commonly used drilling technique known as hydraulic fracturing.[19] These concerns may eventually increase the cost of drilling or temporarily halt drilling until concerns can be addressed. If legislation regarding drilling is passed, the commodity cost of natural gas may increase in the future.

Renewables

Indiana has several opportunities for using renewable energy options.

Indiana has several opportunities for using renewable energy options as an alternative to conventional fuels such as natural gas, fuel oil, and coal. Since landfills are the largest human-generated source of methane emissions in the United States, capturing and using this methane for energy is a growing source of renewable energy. Currently, there are 20[20] operational landfill methane gas (LMG) utilization projects in Indiana, with the potential to develop additional facilities in the future.

Another source of renewable energy is the creation of methane gas or renewable natural gas (RNG) from anaerobic digestion of waste from livestock. In northern Indiana, a project involving two dairy farms is being considered for the farms to become a supplier of pipeline-grade RNG. These farms are capable of producing approximately 900,000 Dth annually. However, in order for the farms to supply RNG, the utility will require upgrades to enable the gas to be transported throughout its system. Therefore, cooperation is necessary between the farms and the utility serving that area. At this early stage, production volumes are low.

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[19]Hydraulic fracturing is a technique used to create fractures that extend from the well bore into rock or coal formations so that the gas may travel more easily from the rock pores to the production well - http://www.earthworksaction.org/FracingDetails.cfm

[20]http://www.epa.gov/lmop

Interest in agricultural, organic, and human-generated waste may lead to additional alternatives to conventional fuels.

Given recent concerns regarding energy efficiency and environmental pollution, interest in agricultural, organic, and human-generated waste may lead to additional alternatives to conventional fuels. Since sustainable sources of natural gas provide economic and environmental benefits, continued success of these types of projects is important to Indiana's energy future. Consequently, the Commission expects to review new proposals for RNG projects in the near future.

Coal bed methane (CBM) is another alternative energy source of natural gas that is extracted from coal beds. Generally, CBM is contained in the un-mined coal seams that lie a few hundred feet below the surface. CBM is recovered by drilling into the coal seam using water and sand at high pressure, thus fracturing the seam. This is similar in nature to shale fracturing. As water levels around the coal seam are lowered, the gas releases up into the well. Currently, CBM accounts for approximately 7% of natural gas production in the United States.[21] There is a CBM project in operation in southern Indiana. Jericho, LLC received a Certificate of Public Convenience and Necessity to own and operate as a public utility with a coal bed methane gathering system. Jericho is producing roughly 1.6 million cubic feet of CBM on a daily basis with forecasts of up to approximately 2.0 million cubic feet in the future. All of the CBM gas produced is purchased by ProLiance Energy[22] and transported via the Heartland Pipeline.[23]

Given Indiana's vast coal reserves, the prospect of using local coal sources for synthetic gas production is another alternative to importing natural gas into our state. The process, which is called "gasification," converts coal into substitute natural gas (SNG). The SNG[24] produced is pipeline quality that may be used for home heating, manufacturing facilities, or in the generation of electricity. In the "Legislation" section of the Report, the gasification process is discussed and a more detailed explanation is provided.

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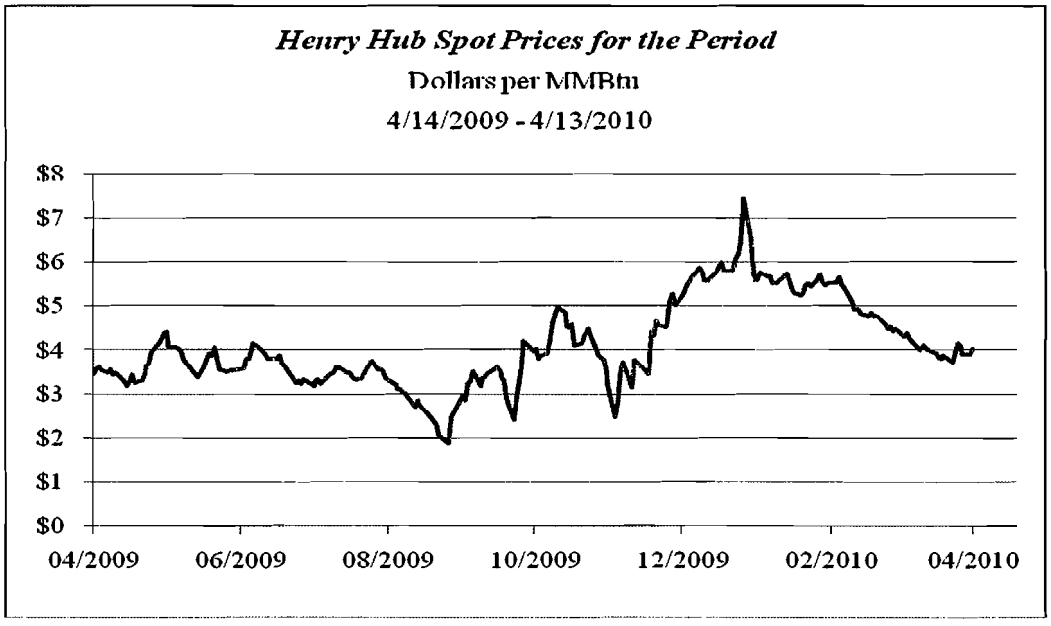
[21]http://waterquality.montana.edu/docs/methane/cbmfaq.shtml#whatiscoalbedmethane
[22]ProLiance Energy is an Indianapolis-based natural gas marketing and supply company.
[23]Order in Cause No. 43500, approved on December 17, 2008
[24]*See*, I.C. § 4-4-11.6 and modified by I.C. § 4-4-1.9-1.2

Pricing and Economics

Pricing

NYMEX gas futures bottomed out on September 3, 2009 at $2.51/Dth and peaked on January 6, 2010 at $6.01/Dth.

Pricing in the natural gas market was less volatile in 2009 than in previous years. For 2009, initial pricing started relatively low in comparison to 2008 and moved even lower. NYMEX gas futures bottomed out on September 3, 2009 at $2.51/Dth[25] and peaked on January 6, 2010 at $6.01/Dth, a spread of $3.50. This contrasts with 2008's volatile market, with a price spread of roughly $10.00. The most prominent impact on pricing is supply and demand. The abundance of supply can be attributed to: an influx of unconventional gas sources (i.e., shale gas); a decline in demand; a cooler-than-normal summer in 2009; and the worldwide recession. The following chart demonstrates the variation in pricing from April of 2009 to April of 2010.



It is important to note that utilities *do not* profit from the gas commodity portion of consumers' bills as it is a dollar-for-dollar pass-through of the gas cost. In order for utilities to recover these costs, the overall weighted cost of gas and a utility's purchasing practices must be

[25]Natural Gas Futures Prices (NYMEX), http://tonto.eia.doe.gov/dnav/ng/ng_pri_fut_s1_d.htm

reviewed by the Commission and the Office of the Utility Consumer Counselor, the state agency that represents ratepayers in proceedings before the Commission. In order for costs to be approved, each utility must demonstrate that its purchases were prudent. The Commission encourages utilities to incorporate a portfolio mix that is diversified (i.e., a balance of purchases such as fixed, hedged, and storage gas) to mitigate price volatility and to have a flexible program to take advantage of market conditions.

One of the chief factors driving natural gas demand is concern for the environment. For instance, many electric utilities use natural gas, a cleaner burning fuel than coal, as a source for electric production. Weather also has a significant impact on the demand for natural gas. As expected, when the weather is colder-than-normal during the heating season, the demand for natural gas increases. Demand also increases if the weather is hotter-than-normal during the non-heating season, as natural gas is used to generate electricity in times of peak demand. Because gas consumption is often lower in the summertime, gas utilities typically use this opportunity to replenish storage with lower-cost gas in preparation for the winter heating season. However, extreme temperature variations can increase the demand for natural gas during summer months, thereby affecting the price of gas as well as the price of electricity. During the summer of 2009, cooler-than-normal temperatures compounded with an abundance of supply, allowed utilities to fill their storage capacity with relatively low-priced gas.

While demand is a significant driver of market volatility, other factors such as supply, storage, weather, and economic conditions contribute as well.

Supply is also a concern, especially when demand for natural gas increases. To keep balance in the market, new sources of supply are needed, especially because some conventional sources of supply produce less natural gas now than in the past and existing wells experience a decline in production as they mature. In addition, higher natural gas prices over the last few years have increased interest in exploration for unconventional sources that were once considered too costly to extract. New technology and lower extraction costs have also led to increased drilling of non-conventional gas supplies (e.g., coal bed methane, shale gas, and tight sands), contributing significantly to the supply of natural gas. As a result, these new sources, along with an increase

in overall working storage of natural gas led to a decline in natural gas prices during the spring of 2010.

Adjustable Rate Mechanisms

On average, the cost of gas reflected in the GCA mechanism accounts for approximately 74 percent of a residential customer's bill.

An adjustable rate mechanism (tracker) allows for the timely recovery of costs that are substantially outside the utility's control (e.g., federal regulations, market volatility). Through an expedited and abbreviated process, the Commission reviews the costs associated with the tracker mechanism. The examples below describe authorized trackers available for consideration:

- Gas Cost Adjustment (GCA) – Pursuant to statute,[26] the GCA mechanism allows a gas utility to recover the commodity cost of gas not recovered through rates established during a rate case.

- Pipeline Safety Adjustment (PSA) – The PSA allows the gas utility to recover prudently incurred, incremental non-capital expenses necessary in order to meet the requirements of the Federal Pipeline Safety Improvement Act of 2002 (PSIA), which imposed many new requirements on pipeline operators.

- Energy Efficiency Funding Component (EEFC) & Sales Reconciliation Component (SRC) – The EEFC funds the promotion of energy efficiency. The SRC allows recovery of expenses from residential and commercial ratepayers that would otherwise be lost due to reductions in revenue caused by energy efficiency programs.

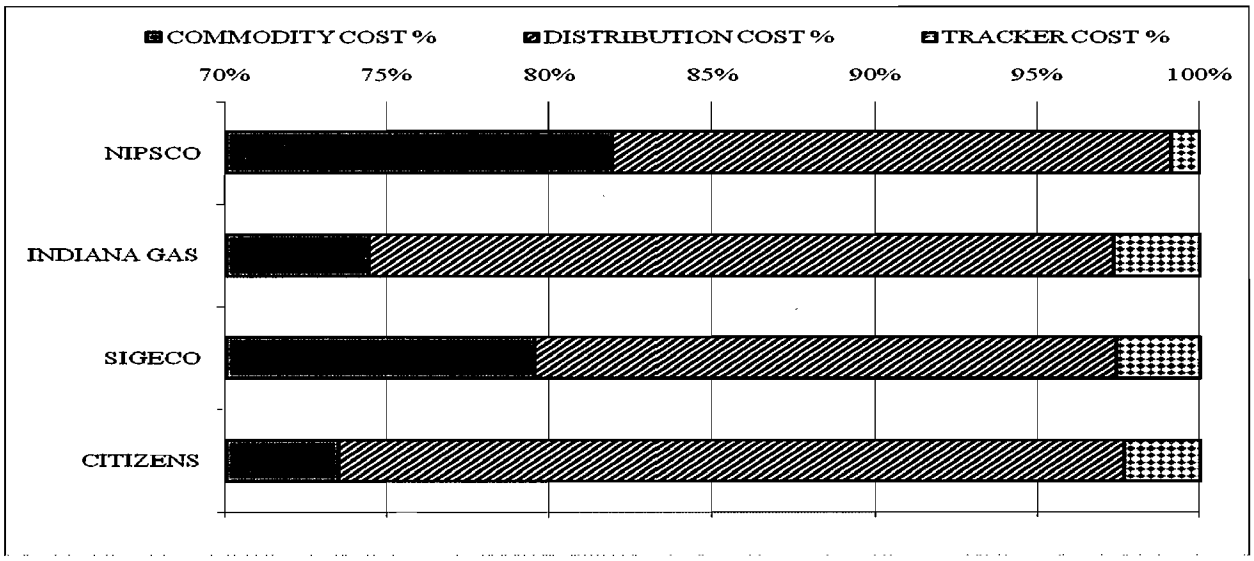
- Normal Temperature Adjustment (NTA) – The NTA reduces the risk of a gas utility not recovering its approved margin due to warmer-than-normal temperatures and mitigates the possibility of over-earning due to colder-than-normal temperatures during the heating season.

[26] *See*, I.C. § 8-1-2-42(g)

Trackers provide an opportunity for utilities to achieve authorized returns between rate cases by recovering certain costs outside of the utility's control. The recovery of costs associated with consumer benefits or the normal operations of the utility improves the financial health of the utility which benefits both the utility and consumers. On average, gas usage (i.e., commodity cost) accounts for approximately 74 percent of a residential customer's bill; whereas, all operating costs account for approximately 24 percent. All other trackers approved by the Commission account for less than 2 percent of a customer's monthly gas bill. The following table demonstrates this cost analysis.

Table 2

Four Largest Indiana Gas Utilities Percentage of Residential Billing Components



Decoupling

Decoupling separates the recovery of a gas utility's fixed costs from the volume of natural gas sold.

Traditional ratemaking allows a utility to recover fixed costs based on an estimated test year volume of natural gas sold. Depending on sales, a utility may over- or under-recover costs. Fixed costs are non-commodity costs such as operational costs that do not vary with the quantity of gas sold. Under traditional ratemaking, a utility captures a portion of its fixed costs through

the volume of natural gas sold. Therefore, a utility can recover fixed costs fully only when customers consume as much or more natural gas as was established in the utility's last rate case. For this reason, the Commission received a number of proposals to modify current rate structures. These alternative rate design proposals are known as "decoupling," in which the recovery of a gas utility's fixed costs is separated from the volume of natural gas sold.

The acceptance of a decoupled rate design by the Commission was premised on its judgment that for that industry it was superior to the prior volumetric rate design in aligning customer interests and regulatory principles. The first usage was closely monitored to gain firsthand experience, and, thus far, the application is meeting expectations.

Regulatory Development

Universal Service Programs

The Commission's order in Cause No. 43669 authorized Citizens, NIPSCO, and Vectren to reinstate their respective bill assistance programs to provide Hoosiers in need with assistance during the winter heating season. The individual utility programs are categorized under the term Universal Service Program (USP). In order for these programs to continue beyond October 31, 2012, each utility must file a base rate case requesting relief that includes the assistance program. This will provide the Commission with an opportunity to further examine the costs and benefits of the programs. Currently, the programs are designed to encourage customers qualifying for USP assistance to also apply for American Recovery and Reinvestment Act weatherization assistance program funds.

Damage Prevention Requirements

States are required under the Pipeline Integrity, Protection, Enforcement, and Safety Act of 2006 (PIPES Act) to create and improve damage prevention programs. The purpose of this effort is to reduce the occurrence of third-party excavation damage to underground natural gas and hazardous liquid pipelines. Indiana has incorporated many, but not all of the required damage prevention elements.

One area in need of improvement is the review of the adequacy of an operator's internal performance measures. Operators now keep records of locate requests and conduct internal

audits to verify the competency of employees and contractors performing these tasks. Pipeline Safety inspectors regularly verify locate ticket information during operator construction inspections and verify procedures during audits. However, a formal process needs to be developed and followed by all jurisdictional operators to provide consistent measures and validation of operators' and the state's damage prevention programs.

Additionally, Indiana does not have a statewide program of standardized training of employees of operators, excavators, and locate companies. Instead, training is conducted by each individual company. It is expected that compliance with internal performance measures and standard training initiatives may be achieved through the Indiana 811 Damage Prevention committee and the Indiana Damage Prevention Council. While the core purpose of Indiana 811 is to provide for safe excavation from initial notification through excavation, this effort must include all stakeholders' involvement from policymaking to implementation in order to succeed.

Distribution Integrity Management Program

The final federal rule establishing integrity management requirements for gas distribution pipeline systems became effective on February 12, 2010. Operators must now develop and implement written programs by August 2, 2011. This significant rulemaking is similar to the integrity management rule for transmission pipelines, but affects distribution operators. The primary focus of this rule is to help ensure pipeline integrity and improve on the safety record of energy transportation by pipelines.

Pipeline Safety is responsible for reviewing jurisdictional operators' plans and verifying compliance with the rule, which requires operators of distribution pipelines to create, implement, and follow a written program designed to reduce risk to their system(s). The written program must include: knowledge of location, materials, and components; identification of system threats; evaluation and ranking of accessible risk; identification and implementation of measures to address each risk; performance measures, including an evaluation of the effectiveness of program; periodic evaluation and improvement; and reporting of results.

III. NATURAL GAS GROWTH & INNOVATION

Legislative Initiatives

Senate Enrolled Act 423 (SEA 423) – Substitute Natural Gas (P.L. 2-2009[31])

Governor Daniels, in keeping with Indiana's homegrown clean energy initiative, signed into law a measure for a proposed gasification facility on March 24, 2009. Coal gasification offers one of the most versatile and the cleanest ways to convert coal into electricity, hydrogen, and other valuable energy products. A gasification facility will convert Indiana coal into pipeline quality gas (i.e., SNG) for use by retail end-use customers. Any proposed facility is required to file a docketed proceeding with the Commission to define its public utility status and the utilities need to seek approval of the contracts.

On March 25, 2010, Governor Daniels signed into law House Enrolled Act 1086[32], which contained provisions allowing for the development of a gasification facility, proposed in SEA 423. These new provisions allow the Indiana Finance Authority to enter into contracts for the sale of SNG with third parties, with proceeds from and costs of those sales being reflected on customers' bills. In addition, SEA 423 also established Commission authority over the allocation of the costs and proceeds from the sale, transportation, and delivery of SNG to retail end-use customers. To date, no filing has been made to the Commission regarding these matters.

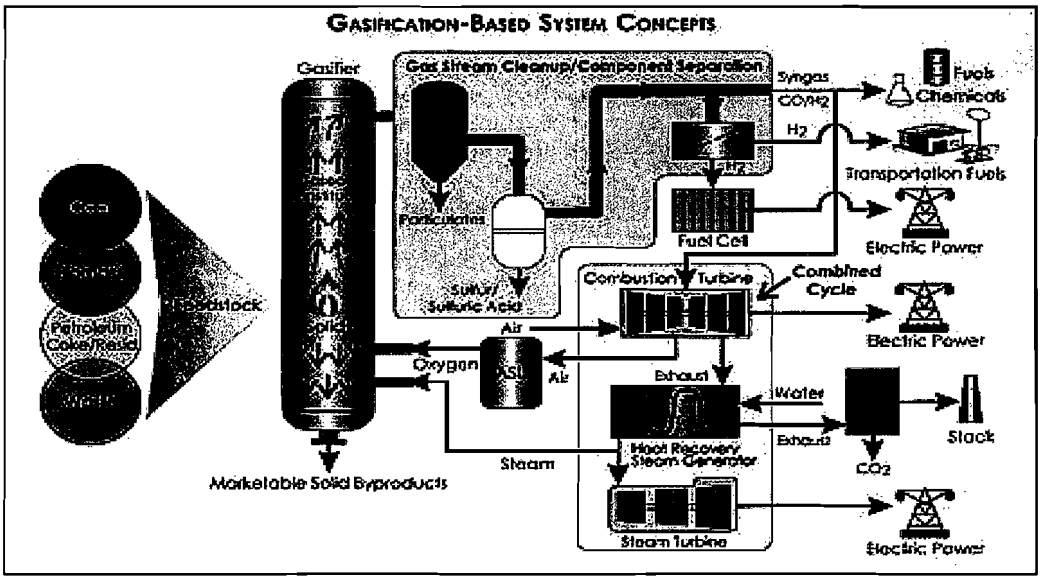
The gasification process is complex but has numerous environmental benefits.

Rather than burning coal directly, gasification (a thermo-chemical process) breaks down coal into its basic chemical constituents. In a gasifier, coal is typically exposed to steam and carefully controlled amounts of air or oxygen under high temperatures and pressures. Under these conditions, molecules in coal break apart initiating chemical reactions that produce a mixture of carbon monoxide, hydrogen, and other gaseous compounds.

The environmental benefits of gasification stem from the ability to achieve extremely low SOx, NOx, and particulate emissions from burning coal-derived gases rather than pulverized

[31]SEA 423 created a new section, I.C. § 4-4-11.6, and modified I.C. § 4-4-1.9-1.2.
[32]P.L. 113-2010

coal. Sulfur in coal, for example, is converted to hydrogen sulfide, which can be captured by processes presently used in the chemical industry. In an Integrated Gasification Combined Cycle (IGCC) plant, the syngas produced is virtually free of fuel-bound nitrogen due to the fact that NOx from the gas turbine is limited to thermal NOx. Diluting the syngas allows for NOx emissions as low as 15 parts per million. The gasification process is detailed in the diagram below[33]



Coal gasification may offer additional environmental advantages by addressing concerns over the atmospheric buildup of greenhouse gases such as carbon dioxide. If oxygen is used in a coal gasifier instead of air, carbon dioxide is emitted as a concentrated gas stream in syngas at high pressure. In this form, it can be captured and sequestered more easily and at lower costs. By contrast, when coal burns reacting in air, of which 79 percent is nitrogen, the resulting carbon dioxide is diluted and more costly to separate.

Senate Enrolled Act 487 (SEA 487) – Underground Plant Protection (P.L. 62-2009)[34]

Indiana 811 was formed by the owners and operators of underground facilities in Indiana as a means of reducing damage to underground facilities. Indiana 811 began operation on October 5, 1981 with seven principal utility members. Membership has since grown to more than 900

[33]http://www.fossil.energy.gov/programs/powersystems/gasification/howgasificationworks.html
[34]SEA 487 modified and created several sections throughout I.C. § 8-1-26 and added I.C. § 8-1-2.6-4(c)(4).

members. In 2003, the General Assembly revised the "Call Before You Dig" law to require all owners and operators of underground facilities to become members of the Indiana 811 by August 31, 2004. This chapter has since been substantially modified, and now includes penalties for certain infractions, effective July 1, 2009.

All owners or operators of underground facilities are required to be members of Indiana 811, and all persons excavating are required to call Indiana 811 at least two full working days, but no more than twenty calendar days, before digging. With the July 1, 2009 modifications, Pipeline Safety serves as the investigative unit for alleged violations of this chapter. If Pipeline Safety finds a violation, the information is forwarded to the Governor's Advisory Committee.

The Advisory Committee consists of seven members appointed by the Governor, with representation from various industry-related services. The Advisory Committee assists the Commission concerning implementation and enforcement. In this capacity, the Advisory Committee may recommend the following penalties upon Pipeline Safety's finding of a violation:

1. Civil penalties up to $10,000;
2. Participation in education or training programs;
3. Warning letters; and/or
4. Development of a plan to avoid future violations of this chapter.

Upon receiving a recommendation from the Advisory Committee, and after giving notice and opportunity for a public hearing, the Commission acts to:

1. Uphold or reverse the finding of a violation by Pipeline Safety;
2. Approve or disapprove the recommendation(s) of the Advisory Committee; and/or
3. Collect any civil penalties and deposit the penalties in the underground plant protection account.

The Commission is in the process of adopting rules to fulfill its responsibilities. Since July 1, 2009, Pipeline Safety has registered more than 60 possible violations.

Rulemaking – Transportation of Gas, Hazardous Liquids, etc. – I70 IAC 5-3

Indiana's pipeline safety rule was revised in March 2010 to bring intrastate hazardous liquid pipeline operators under the jurisdiction of the Commission.

Indiana's pipeline safety rule was revised and received final approval in March 2010, to bring intrastate hazardous liquid pipeline operators (e.g., carbon dioxide and ethanol) under the jurisdiction of the Commission. For all operators, the reportable incident threshold was increased to $50,000 for property damage so that it coincides with the federal rule. Operators are required to file operation and maintenance plans with Pipeline Safety and those plans now must include procedures for handling abnormal operations. Operators must maintain records of their physical plant, including map(s) of in-service facilities, which must be reviewed, updated, and documented once every calendar year. The rule also requires operators to develop and complete a plan to conduct a leak survey of customer-owned, residential service or fuel lines once every five calendar years. The portion of the line to be surveyed is the "...buried...gas carrying steel piping that is between the outlet of the meter and the entry" of the residential building wall.

Master meter operators are now required to include detailed information regarding leak surveys, cathodic protection surveys, and valve inspections conducted for each property in their March 1st annual report. The report is to include the name and contact information of the individual(s) responsible for the gas system.

Depth Study

Ground Penetrating Radar and Electromagnetic instruments are two technologies currently being used most often to vertically locate underground facilities.

Indiana Code 8-1-2.6-4(c)(4) directs that beginning on July 1, 2010, a report concerning best practices for vertical location of underground facilities be included in the Regulatory Flexibility Report. The report is to assess the viability and economic feasibility of technologies used to vertically locate underground facilities. Technologies used in vertical location of facilities change frequently. While the instruments and devices have become more sophisticated, the theory underlying each technology is not new. This report addresses the most widely used processes for this identification.

Ground Penetrating Radar (GPR) and Electromagnetic (EM) instruments are the technologies used most frequently to vertically locate underground facilities. These instruments are expensive. GPR equipment cost ranges from $15,000 to $18,000, while EM equipment cost ranges from $2,000 to $8,000.[35]

GPR is a non-destructive method, using electromagnetic radiation to detect the reflected signals from underground structures. GPR uses an antenna to radiate short pulses of high-frequency radio waves into the ground, which bounce off buried objects or different compositions of soils. The returning waves record the variations, which are reflected in the signal. The depth range is limited by soil conditions because electromagnetic energy is dissipated into heat. Dry and sandy soils are ideal, allowing penetration of up to 15 meters. Challenging soil conditions, such as moist and/or clay-laden soils and/or soils with high electrical conductivity, only allow penetration of a few centimeters.[36]

GPR is primarily used in the determination and location of non-metallic piping, such as Polyvinyl Chloride (PVC), Polyethylene (PE), and other plastic pipes. GPR can work on metallic piping but, due to the electric conductivity of the pipes, is not as accurate. GPR also requires considerable expertise to effectively design, conduct, and interpret GPR surveys. Thus, the equipment is only as good as the operating technician. A GPR technician should have several years experience and knowledge of the scientific theory behind the technology in order to read and interpret results properly.

EM equipment, the most common technology in use today, and is best used for locating and tracing metallic pipes and utility cables. EM has two components: a transmitter and a receiver. The transmitter emits a radio frequency EM field that induces secondary fields in nearby metallic pipes and cables. The receiver detects these fields and traces the pipes, often to distances greater than 200 feet from the transmitter.[37] EM equipment is dependent on soil conditions that affect signal strength, and in crowded environments or where there are multiple facilities underground, frequencies can jump or bleed over to different facilities, giving inaccurate readings. The best

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[35] www.geophysical.com
[36] http://soils.usda.gov/survey/geography/maps/GPR/index.html
[37] www.geovision.com

results are realized when a direct electrical connection can be made to the structure being located, which reduces the chance of the signal straying to another structure.

As with GPR, the EM equipment is dependent on the skill of the operator as this equipment is very sophisticated. The operator must understand electromagnetics and soil compositions to fully comprehend the data, especially interpreting readings. Although GPR and EM are capable of providing estimates of the depth and location of underground facilities, the technology is not 100% accurate even in the hands of the most skilled technicians. Currently, there is not a federal certification program requirement, nor does the state of Indiana require a certificate to operate and interpret GPR and EM locating equipment. ACES Int'l, a not-for-profit certification and testing association, trains and certifies operators of this equipment; however, certified operators in Indiana are a rarity.[38]

A third technology is Global Positioning System or GPS. GPS does not measure depth, as in depth under a street or a yard, or amount of cover. GPS measures elevation from a given baseline. Technically, a GPS unit receives signals from multiple satellites and returns coordinates to define a unique location in space. This unique location never changes, and can be stored and available indefinitely. This may be the most logical method available today. Ideally, the GPS unit must be positioned directly on an exposed underground facility when the reading is taken. This is the only way to provide a true set of coordinates for the structure in that location. Over time, with the accumulation of data, consistent, reliable elevation information on a variety of underground structures can be readily available.

The Common Ground Alliance (CGA) is a member-driven association dedicated to public safety, environmental safety, and prevention of damage to underground facilities. In 1999, the CGA completed a study sponsored by the United States Department of Transportation that identified best practices regarding damage prevention. The CGA recommends hand digging or soft digging within an 18-inch tolerance on each side of the underground facilities. Vacuum digging, the use of high pressure water or air that breaks up the soil accompanied by a powerful vacuum that removes the loosened soil, is an acceptable alternative identified by CGA.[39]

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[38] http://www.acesinternational.org/
[39] www.subtronic.com

GPR and EM equipment provides depth estimates and underground facility locates but no equipment manufacturer guarantees depth readings.

GPR and EM equipment provide depth estimates and underground facility locates but no equipment manufacturer guarantees depth readings. The CGA, equipment manufacturers, and Pipeline Safety all strongly recommend hand-digging or vacuum excavation to expose underground pipe for visual verification. This is the safest means to accurately determine the true depth and location of underground facilities and the only acceptable means an excavator can use to comply with IC 8-1-26. Pipeline Safety recommends that lawmakers consider requiring that all operators of this equipment be certified by an accredited organization in order to better protect underground facilities.

IV. NATURAL GAS APPENDIX

Appendix A – Jurisdictional Gas Utility Revenues

Year Ending December 31, 2009

Utility Name	Revenues*	Percentage of Total Revenues
Northern Indiana Public Service Company	$ 741,280,781	35.33%
Indiana Gas Company, Inc.	664,162,535	31.66%
Citizens Gas & Coke Utility	375,034,956	17.88%
Southern Indiana Gas & Electric Company	111,662,850	5.32%
Northern Indiana Fuel & Light Company, Inc.	46,503,111	2.22%
Kokomo Gas and Fuel Company	41,167,860	1.96%
Ohio Valley Gas Corporation	35,322,575	1.68%
Midwest Natural Gas Corporation	18,888,150	0.90%
Sycamore Gas Company (f/k/a Lawrenceburg Gas Co.)	11,753,072	0.56%
Indiana Natural Gas Corp.	10,300,861	0.49%
Community Natural Gas Co., Inc.	7,863,062	0.37%
Boonville Natural Gas Corporation	6,676,588	0.32%
Indiana Utilities Corporation	6,176,916	0.29%
Ohio Valley Gas, Inc.	5,820,998	0.28%
Citizens Gas of Westfield	4,249,202	0.20%
Fountaintown Gas Co., Inc.	4,096,488	0.20%
Aurora Municipal Gas	3,014,694	0.14%
South Eastern Indiana Natural Gas Company, Inc.	2,304,746	0.11%
Switzerland County Natural Gas Co., Inc.	1,416,156	0.07%
Valley Rural Utility	368,595	0.02%
Snow & Ogden	15,173	0.00%
Total	$ 2,098,079,369	100.00%

Source: 2009 Annual Reports filed with the Commission

2010 WATER/WASTEWATER REPORT

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I. WATER/WASTEWATER OVERVIEW

Industry Structure

There are many types of legal entities that provide water and wastewater service to Hoosiers. These include investor-owned utilities, municipal utilities, not-for-profit utilities, regional water/wastewater districts, water authorities, and conservancy districts. Even though the Commission is the economic regulator of these entities, the Indiana Department of Environmental Management (IDEM) is the water quality regulator.

The legal form of a utility determines whether the utility is subject to the Commission's jurisdiction and the extent of the Commission's regulatory oversight.

The legal form of a utility determines the existence and extent of the Indiana Utility Regulatory Commission's (Commission) regulation. Below are a few examples:

- The rates and terms and conditions of investor-owned water and wastewater utilities are regulated by the Commission.
- The rates of municipal water utilities and water conservancy districts and territory expansions of water conservancy districts are also regulated by the Commission.
- Investor-owned water and wastewater utilities with fewer than 300 customers and municipal water utilities, regardless of the number of customers, are able to remove themselves or "opt out" of the Commission's jurisdiction.[1]
- Rates and terms and conditions for not-for-profit water and wastewater utilities are regulated by the Commission *unless* the utilities have opted out, pursuant to statute.
- The Commission does <u>not</u> regulate municipal wastewater utilities, nor does it regulate regional water/wastewater districts.[2]

Certificates of Territorial Authority (CTAs) authorize utility service in a defined area; however, not all utilities are required to obtain them. For example, investor-owned and not-for-

[1]*See*, I.C. § 8-1-2.7 (not-for-profit, conservancy districts, cooperatives, and investor-owned with 300 or fewer customers) and I.C. § 8-1.5-3-9 (municipalities).

[2]In 2005, a law was passed that provided campgrounds, served by regional sewer districts, the ability to appeal for an informal review of a disputed matter to the Commission's Consumer Affairs Division. *See*, I.C. § 13-26-11-2.1.

profit wastewater utilities are required to obtain CTAs from the Commission, whereas, municipal wastewater utilities, regional wastewater districts, and conservancy districts are not. Likewise, water utilities are not required to obtain CTAs. Consequently, they have no service territory regulation except when the Commission acts to resolve territorial disputes between them, regardless of whether the water utilities are regulated by the Commission.[3]

The Commission regulates approximately 116 out of 824 water utilities and 47 out of 531 wastewater utilities.

Although the Commission only regulates and has partial oversight over a small number of the state's water and wastewater utilities, it should be noted that those regulated utilities serve approximately 90% of Indiana water consumers. According to the Commission's 2008 Annual Reports and data from the IDEM, the Commission regulates approximately 116 out of 824 water utilities and 47 out of 531 wastewater utilities. Table 1 shows the ten largest regulated water utilities. Of the regulated wastewater utilities, only two serve more than 5,000 customers: Hamilton Southeastern Utilities, Inc. with 17,186 customers and Utility Center, Inc. with 11,753 customers.

Table 1

10 Largest Regulated Water Utilities

Ranked by Number of Customers

1	Indianapolis Water	303,757
2	Indiana American Water Co.	282,992
3	South Bend Municipal Water	81,718
4	Fort Wayne Municipal Water	78,608
5	Evansville Municipal Water Works	60,610
6	Mishawaka Municipal Water	30,198
7	Hammond Municipal Water Works	28,271
8	Lafayette Municipal Water Works	26,527
9	Bloomington Municipal Water	22,591
10	Anderson Municipal Water Works	22,427

Source: 2008 Commission Annual Reports

[3]*See*, I.C. § 8-1-2-86.5

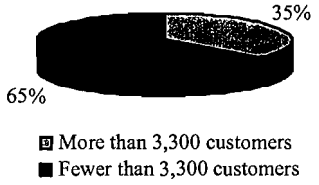
The Commission-regulated water systems have $3.4 billion in utility plant in service, annual revenues of $485 million, and a total rate base of $2.1 billion. The Commission-regulated wastewater utilities have $170.9 million in utility plant in service, annual revenues of $23.7 million, and a total rate base of $71.1 million.[4]

Industry Characteristics

Numerous smaller utility systems serve a relatively small percentage of the population, while a small number of larger utility systems serve the majority of the population. For example, Chart 1 shows that 65% of regulated water utilities serve fewer than 3,300 customers. Chart 2 shows that these utilities only serve 6% of the water utility customer population.

Chart 1

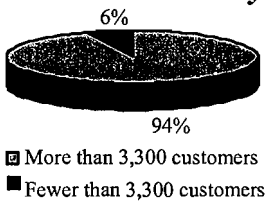
Water Utilities by Size



Source: Commission 2008 Annual Reports

Chart 2

Customers Served by Size



Acquisition and Consolidation

The pace of water/wastewater mergers and acquisitions by investor-owned utilities has slowed recently, but several municipalities have acquired utility property through the condemnation process.

Over the last eight years, the pace of mergers and acquisitions by investor-owned utilities has slowed significantly as the most attractive utilities have been acquired; however, transactions are still taking place. For example, in the 1990s, Indiana-American acquired Indiana's largest investor-owned utilities, including: Indiana Cities, United Water's Indiana properties, Northwest Indiana Water, and several smaller utilities. As a result, Indiana-American is now the state's largest investor-owned water utility, serving approximately 283,000 customers throughout many regions of the state.

[4]2008 Annual Reports filed with the Commission

In February and March of 2010, Indiana-American filed petitions to acquire the municipal water systems of Riley and New Whiteland, respectively. In March 2010, the Commission approved Indiana-American's acquisition of Marion Heights Conservancy District. In March 2009, the IURC approved the merger between Wymberley Sanitary Works, Inc. and Chimney Wood Sewage Works, Inc., the former of which is a wholly-owned subsidiary of Aqua Indiana, Inc.

Several municipalities have acquired private utilities in recent years and all such acquisitions were subject to Commission approval and oversight. In 2006, the town of Winfield acquired Winfield Utilities, Inc., an investor-owned wastewater utility. The city of Fort Wayne completed its acquisition of a large portion of Utility Center, Inc.'s system by initiating a condemnation proceeding in civil court, an action later affirmed by the Indiana Supreme Court. In its decision, the Supreme Court held that under I.C. §§ 8-1-2-92 and 93, an investor-owned utility license, permit, and franchise is conditioned on the ability of municipalities to purchase utility property.

This Supreme Court decision appears to have cleared the way for future acquisitions by condemnation. In April 2008, the town of Cedar Lake filed a condemnation action against Utilities, Inc. The parties reached a settlement that was approved by the Commission in April 2009. Earlier last year, the town of Cedar Lake initiated condemnation action against Robin's Nest Water Company, Inc. Last year, a condemnation action was also initiated by the city of Jeffersonville to obtain utility property operated by Wastewater One, Inc. and owned by the United States Army. In March 2010, all parties reached a settlement whereby Wastewater One, Inc. will turn over operation of its treatment plants at the north and south end of the former Indiana Ammunition Plant to the cities of Jeffersonville and Charlestown, while the city of Jeffersonville will acquire land from the United States Army to build a new treatment plant. In April 2010, the town of Cumberland and Gem Utilities, Inc. filed a joint petition to transfer the water and sewer assets of GEM Utilities, Inc. to the town of Cumberland. Also in April, the town of Ellettsville notified Northern Richland Sewer Corporation that it intends to acquire the utility through purchase or condemnation.

In light of the recent transactions, several issues have been raised. One issue is setting the fair value of the property to effect a change in ownership. Another issue rests with the determination of whether the customers acquired through the condemnation process should be required to pay

more for water than existing customers. Although there is a general lack of consensus on these issues, the Indiana General Assembly remedied one aspect of the condemnation matter. Going forward, when a municipality condemns the property of a public utility, all customers shall bear the costs associated with the condemnation process through their normal rates and charges.[5]

If the transfer between Citizens Energy Group and Indianapolis Department of Waterworks is approved, the wastewater system would be the first of Indiana's 108 combined sewer systems under Commission jurisdiction.

The city of Indianapolis and Citizens Energy Group (Citizens) announced the signing of a Memorandum of Understanding on March 10, 2010, which contemplates the transfer of the water and wastewater systems to Citizens and places both utilities under the Commission's jurisdiction. Before the water utility transfer can take place, the Commission must approve the transaction. If placed under the Commission's jurisdiction as contemplated, the wastewater system would be the first of Indiana's 108 combined sewer systems under Commission jurisdiction. A combined sewer system is a sewer system in which wastewater and storm water flow into a single pipe. The discharge of wastewater and storm water into a body of water is called combined sewer overflow. The large size of the utility, combined with the storm water integration, will present new challenges for the Commission.

Troubled Water/Wastewater Utilities

The Commission continues to actively monitor several utilities that can be described as troubled. However, the Commission's ability to perform this function is forestalled by the ability of investor-owned utilities to withdraw from the Commission's jurisdiction.

In some instances, the Commission classifies water and wastewater utilities as "troubled." The utilities that become "troubled" are typically small utilities (fewer than 300 customers) that were constructed by a developer as part of a housing development. The Commission continues to actively monitor several utilities that can be described as troubled systems. However, the Commission's ability to perform this function is limited by the ability of investor-owned utilities to withdraw from the Commission's jurisdiction. Once withdrawal occurs, the Commission is no

[5]*See,* I.C. § 8-1.5-3-8, eff. July 2009

longer able to proactively monitor the progress and development of those systems that are historically most likely to become troubled.

To determine whether or not a utility is troubled, the Commission may examine several key factors including: technical, financial, and managerial capacity; the physical condition and capacity of the plant; the utility's compliance with state and federal law and/or the Commission's orders; and provision of service to customers. If the utility has continued violations even after the Commission orders it to remedy the deficiencies, the Commission can order the acquisition of the utility by a new owner, or appoint a receiver to operate the utility and work to find a new owner.[6] On a practical basis, neither is a realistic option.

The Commission's primary goal, however, is to prevent utilities from becoming troubled in the first place. Both the Commission and the IDEM have rules regarding the operational abilities of water and wastewater utilities. The IDEM's New Public Water System Capacity Review requires a new public water supply system commencing operation after October 1, 1999 to demonstrate its technical, managerial, and operational abilities to serve.[7] These requirements include, but are not limited to, a demonstration that the proposed public water supply system shall produce drinking water that meets public water supply requirements, an infrastructure replacement plan, a five-year budget plan, a twenty-year financial plan, and a response plan to anticipate and respond to emergency situations. Commission staff members participate in this review process. The Commission has similar requirements for start-up wastewater utilities.[8]

Age-Profile

The water sector remains the most capital intensive of all utilities due to high capital costs and relatively low revenues, investing more capital per dollar of revenue generated than any other industry.

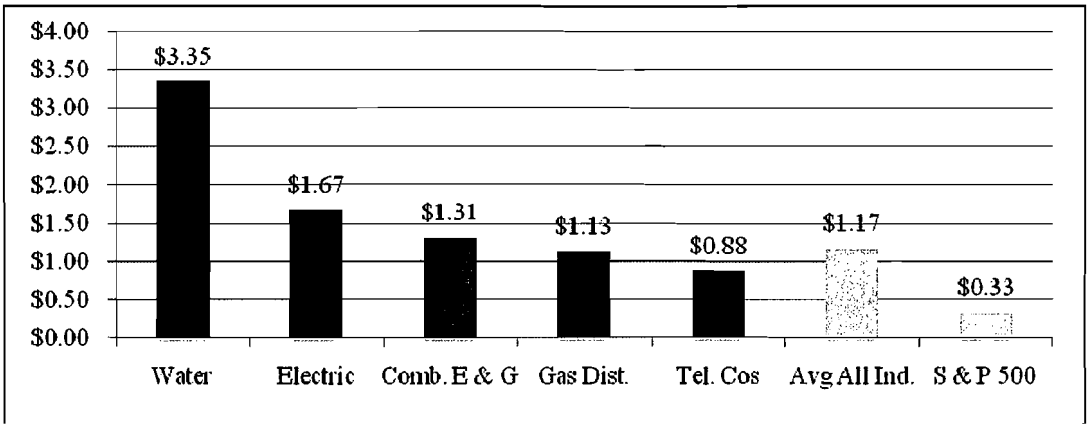
Much of the United States' drinking water and wastewater infrastructure was built following World War II. A significant portion of this infrastructure has aged and will need full-scale replacement over the next few decades. This is problematic because the water sector remains the

[6]*See*, I.C. § 8-1-30, *et seq.*
[7]*See,* 327 I.A.C. 8-3.6, Demonstration of New Public Water Supply System Capacity
[8]*See*, 170 I.A.C. 8.5-3-1, Application for Certificate of Territorial Authority

most capital intensive of all utilities (due to high capital costs and relatively low revenues), investing more capital per dollar of revenue generated than any other industry. Chart 3 shows that in 2008 the water industry invested twice as much capital per dollar of revenue as any other utility sector, close to three times the average of all industries and ten times the ratio of the entire Standard & Poor's 500. Consequently, water utilities are increasing general rates and exploring other ways to increase revenues as discussed later in the report.

Chart 3

Capital Invested per Dollar of Revenue



Source: AUS Utility Reports – 2008

Demand

Total Indiana Water Withdrawals

The demand for water comes from a variety of sources and activities. The generic term for water demand is *withdrawal.*

The demand for water comes from a variety of sources and activities. The generic term for water demand is *withdrawal*, defined as those uses that involve the physical removal of water from a ground or surface source.[9] The state of Indiana divides significant water withdrawal[10] into six categories: Public Supply (water supply utilities, mobile home parks, apartment complexes,

[9]Indiana's Water Shortage Plan, July 2009

[10]Significant water withdrawal is defined as each facility having the capability of withdrawing greater than 100,000 gallons per day.

and schools); Energy Production (power generation, ethanol production, coal preparation, and heating and cooling); Industrial (manufacturing process, and sand and gravel operations); Agriculture (irrigation, golf courses, and field drainage); Rural Use (livestock watering and fish hatcheries); and Miscellaneous (construction dewatering, snow-making, fish and wildlife areas, and lake-level maintenance).

Total withdrawals in Indiana have decreased from 3,419 billion gallons (BG) in 2004 to 3,271 BG in 2008. Most of this decrease was due to a decrease in withdrawals for energy production.

Many factors influence withdrawal, such as annual precipitation, summer temperatures, population growth, and water use efficiency. Table 2 shows public supply increasing from 250,022 million gallons (MG) in 2004 to 259,017 MG in 2008.[11] Furthermore, it shows that the majority of withdrawal is for energy production.

Table 2

Total Indiana Withdrawals from 2004 to 2008

Millions of Gallons

Withdrawal Type	2004	2005	2006	2007	2008
Public Supply	250,022	265,747	255,694	274,541	259,017
Energy	2,279,527	2,224,456	2,239,931	2,212,198	2,146,042
Industry	838,083	784,843	799,533	822,730	797,471
Agriculture	39,228	62,064	37,084	61,686	57,615
Rural	4,182	4,162	3,898	4,230	4,594
Miscellaneous	7,986	7,108	6,267	6,303	6,086
TOTAL	3,419,028	3,348,380	3,342,407	3,381,688	3,270,825

Source: Department of Natural Resources

While Table 2 shows that energy production uses more water than any other category, most of that water is returned to its original source. Withdrawal includes consumptive and non-

[11]According to Commission Annual Reports, total water sold from the top ten utilities in Indiana decreased from 140,093 MG in 2004 to 125,194 MG in 2008.

consumptive uses. According to Indiana's Water Shortage Plan, "consumptive uses are those that, because of evaporation, transfer out of the basin of origin, incorporation into manufactured products or other processes, preclude the return of some or all of the withdrawn water to its source. Non-consumptive uses are those in which the withdrawn water is returned to the supply system undiminished in volume."[12] Table 3 shows that 98% of energy production withdrawal is returned to its original source and that only 2% is for consumptive use.

Table 3

Percentage of Consumptive Use by Sector in Indiana

Public Supply	Self-Supply Domestic	Self-Supply Irrigation	Self-Supply Livestock	Self-Supply Industrial	Self-Supply Fossil Fuel Power Plants
15%	10-15%	90%	80%	6%	2%

Source: Department of Natural Resources

Existing Legal and Policy Foundations

Water and Wastewater Quality

Utilities that provide drinking water and treat wastewater are subject to strict federal regulations to address the issues of safe drinking water and protection of the state's ground and surface water. Water quality regulation falls under the Safe Drinking Water Act (SDWA), passed in 1974 and amended in 1996. The United States Environmental Protection Agency (U.S. EPA) is the primary federal agency to implement the SDWA and is required to set standards for drinking water. The standards, which are enforced by the IDEM, are two-fold: health-related, focusing on inorganic and organic chemicals and microorganisms; and aesthetics, focusing on taste, odor, and appearance. These standards are developed by setting a maximum contaminant level and maximum contaminant level goal, both of which are periodically updated. For example, the IDEM recently instituted a new ground water rule, which requires increased monitoring to detect viral and bacterial contamination in ground water sources of drinking water.

Potable water and wastewater effluent are closely regulated by the U.S. EPA and IDEM.

[12]Indiana's Water Shortage Plan, July 2009

The principal law governing the quality of surface water is the Federal Water Pollution Control Act or Clean Water Act (CWA), most recently amended in 1987. Similar to the SDWA, the U.S. EPA is charged with implementation of the CWA and sets standards for wastewater effluent, while delegating enforcement to the IDEM.[13] Several wastewater utilities under the Commission's jurisdiction have been under consent decrees due to violation of the CWA. In some cases, infrastructure improvements were required to resolve the problems. The cornerstone of water quality is the issuance of a National Pollution Discharge Elimination System (NPDES) permit, which allows utilities to discharge wastewater effluent into waterways. The Commission regularly makes approval of wastewater CTAs contingent on the successful receipt of NPDES permits and requires wastewater utilities to provide proof of issuance of the permit before authorization is granted.

[13]To the extent that wastewater treatment is provided by a septic system or constructed wetland, the Indiana State Department of Health is the jurisdictional agency.

II. WATER/WASTEWATER LANDSCAPE

Infrastructure

Indiana communities and rural areas need safe, reliable and affordable water and wastewater systems to prosper economically. However, a funding shortfall in Indiana exists due to the need to replace aging infrastructure and its attendant high capital requirements. The Indiana Advisory Commission on Intergovernmental Relations report, titled "Financial Needs for Wastewater and Water Infrastructure in Indiana," (January 2003) estimated that the statewide wastewater and drinking water infrastructure needs for the period 2000 to 2020 will require $12.4 to $13.9 billion in funding. Some recommended projects include: correction of combined sewer overflows (CSOs); wastewater conveyance and treatment; remediation of failing septic systems; storm water conveyance and management; drinking water production; and construction or renovation of treatment and distribution facilities. Annual investments made by governmental entities between January 1990 and March 2002 were approximately $253 million, far short of the estimated $658 million investment needed annually to meet the needs identified in this report.

The U.S. EPA projects that Indiana's drinking water infrastructure financing needs from 2007 to 2027 will be $5.9 billion.

The U.S. EPA's Drinking Water Infrastructure Needs Survey and Assessment ("Needs Assessment") supports the findings of the Indiana Advisory Commission on Intergovernmental Relations. Every four years, since 1997, the U.S. EPA provides a Needs Assessment to Congress on the anticipated costs of the investments to install, upgrade, or replace equipment in order to deliver safe drinking water over the next 20 years.[14] The report surveys community water systems and not-for-profit non-community water systems, with the scope limited to those needs eligible for Drinking Water State Revolving Fund assistance.[15]

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[14]For example, the 2009 Report is based on the 2007 Survey and 2005 Report is based on the 2003 Survey.

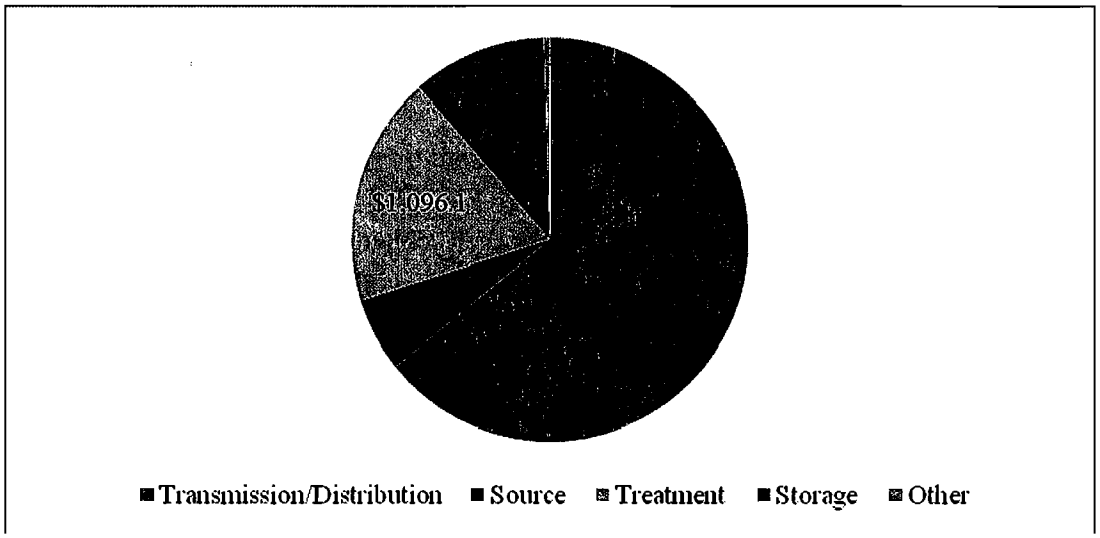
[15]A community water system is a public water system that serves at least 15 connections used by year-round residents or that regularly serves at least 25 residents year-round. Cities, towns, and small communities such as retirement homes are examples of community water systems. A non-community water system is a public water system that is not a community water system and that serves a nonresidential population of at least 25 individuals daily for at least 60 days of the year. Schools and churches are typical examples of non-community water systems.

According to the 2007 Needs Assessment, Indiana's water project needs over the next 20 years were $5.9 billion, which is an increase of 23% from the 2003 Needs Assessment.[16] As shown in Chart 4, the greatest need, $4.5 billion, is underground infrastructure (transmission/distribution and storage).

Chart 4

Indiana Water Utility 20-Year Needs

Millions of 2007 Dollars



Source: 2007 Needs Assessment

Funding Programs

Loans and grants are available for utility infrastructure investment through the State Revolving Fund, Rural Development Loans and Grants, and the Community Focus Fund.

Numerous federal and state funding options are available for infrastructure investment. Grants from the U.S. EPA are leveraged in bond markets to generate State Revolving Loan Fund (SRF) loan proceeds. The Indiana Finance Authority (IFA) administers these funds through low-interest loans at 20-year terms to investor-owned, municipal and not-for-profit utilities. In 2009, the American Recovery and Reinvestment Act of 2009 (ARRA) provided the IFA with an additional $122 million for shovel-ready wastewater and drinking water infrastructure projects.

[16]Data was not broken out between Commission regulated and non-regulated water utilities.

The IFA was able to supplement these funds and make it possible to fund projects worth $250 million. Approximately $74.6 million in drinking water projects funded in the first two rounds of awards was granted to Commission-regulated water utilities.

As part of the ARRA, the Indiana State Revolving Fund has received approximately $122 million to fund water and wastewater projects.

Rural Development Loans and Grants are also available to rural areas and towns serving a population of less than 10,000. Extended 40-year terms are available at market or below-market interest rates, depending on community demographics. As part of this program, Indiana water/wastewater utilities received approximately $94 million for fiscal year 2009 and $34 million as of April 2010 for fiscal year 2010.[17] Both amounts included ARRA funding.

Under the ARRA, a new type of debt instrument called "Build America Bonds" was developed for which the issuer (state or local government) elects to have the interest on the bonds be taxable, in return for a federal interest subsidy. In Indiana, more than $500 million in Build America Bonds have been issued, but none by water utilities under the Commission's jurisdiction.

Grants for planning and up to 75% of project costs are also available. Planning and construction grants are available to non-entitlement cities,[18] towns, or counties through the Community Focus Fund, which is administered through the Indiana Office of Community and Rural Affairs (OCRA).

The benefits of reduced financing costs go directly to utility customers, rather than to the shareholders, owners, or parent companies.

Although the amount of SRF funding to investor-owned and not-for-profit utilities is limited, other options are available. For example, another avenue to obtain low-interest rate loans is Private Activity Bonds (PABs), municipal bonds issued to finance facilities for investor-owned

[17]The fiscal year is from October 1 to September 30.
[18]Non-entitlement cities must go through a state-funding program instead of receiving funds directly from the federal government.

or not-for-profit water utilities.[19] The benefits of reduced financing costs go directly to utility customers, rather than to the shareholders, owners, or parent companies. The federal government sets the overall loan volume cap for each state and then allocates that amount based on a formula.[20] Since 1995, Indiana has used all of the available federal allocation each year, with 9% of the overall dollar amount allocated to the IFA. In addition to water projects, the IFA funds other types of projects, such as manufacturing.

Under the current funding regime, investor-owned and not-for-profit utilities are discriminated against, because they have limited access to low-cost debt.

Under the current federal rules for the funding process, investor-owned and not-for-profit utilities are disadvantaged because they have limited access to low-cost debt. Without access to low-cost debt, costs to serve those customers increase, despite the fact that all customers pay federal income tax to support the funding programs. To gain access to additional SRF funding, several not-for-profit utilities have converted to water authorities to avoid the volume cap for PABs. The National Association of Regulatory Utility Commissioners (NARUC) and the National Association of Water Companies (NAWC) support federal legislation to lift the ban on wastewater utilities and to remove water projects from the volume cap.

Utility Master Plans

The Commission would like to see every utility develop a master plan.

Utilities create master plans to assess current conditions and future needs for service to a specific area. The master plan serves as a "roadmap" to the eventual build-out of the utility's service territory, providing the utility with critical cost, sizing and phasing options. Given the fluid nature of development and economic cycles, the master plan becomes a "living document," requiring frequent updating and re-evaluation.

This process typically begins by analyzing existing and future land use to project demand for a given utility, allowing for some gross-level sizing of piping and key pieces of infrastructure. A

[19]PABs are not available to private wastewater utilities.
[20]*See,* I.C. § 4-4-11.5

conceptual layout is then developed, identifying general routes and projecting the size of the facilities. Cost estimates are developed, which provide valuable financial planning information that can be adjusted as development trends change. The master plan can further be used to coordinate construction projects to take advantage of unrelated work-in-progress, identify opportunities to up-size infrastructure, and avoid expensive conflicts among different utilities (gas, electric, and communications).

The total number of regulated water and wastewater utilities that create and maintain a master plan is relatively small, which may result in duplication of facilities, higher costs to customers, and failure to provide customers with safe and adequate service. Because of their importance, the Commission would like to see every utility develop a master plan.

Modernization and Energy Efficiency

While frequently a topic in the arid Southwest, and even recently in the Southeast, water supply issues have seldom been of concern to the relatively water-rich Midwest. The water supply in Indiana has generally been plentiful, but over the past few years, water rights and access issues have arisen. In fact, Indiana has not always been able to economically access the amount of water needed, and has found that even areas that typically have plenty of water go through periods of drought.

New Sources of Supply/Enhanced Reliability

Maintaining quality ground and surface water is critical because contaminated water cannot be considered a resource. In Indiana, much of the water supply comes from underground aquifers, which utilities tap into by digging wells. To increase the reliability of water from rivers, reservoirs are constructed. Reservoirs play an important role in water treatment since they allow time for particles to settle and provide early-stage natural biological treatment. Although not a natural resource, water tanks also play an important role as a source of backup supply due to their ability to help maintain sufficient water pressure in systems for potable water and fire suppression. Not every water utility in Indiana has its own source of supply. Based on the Commission's Annual Reports, 15% of the Commission-regulated water utilities share source-of-supply infrastructure through wholesale purchase agreements.

Water Efficiency

While statewide water shortages do not exist, water efficiency programs are being developed at the national, statewide, and individual water utility levels.

Water efficiency programs are being developed by individual utilities and at state and national levels in an effort to manage customer usage. In 2009, the Commission approved a water efficiency plan for Indiana-American, the largest investor-owned utility in the state. At the state level, Indiana is developing its own water conservation and efficiency goals and objectives, and implementing either a voluntary or mandatory water conservation and efficiency program by October 2010 as required by the Great Lakes Compact.[21] At the national level, the U.S. EPA has developed the WaterSense® program that labels products, services, and practices as water efficient. This program is similar to the Energy Star program, which identifies energy efficient appliances.

Summer watering costs utilities millions of dollars due to the need to find or build additional water supply, in addition to building water treatment plant capacity to meet peak demands while that capacity sits idle for the remainder of the year.

One issue related to water efficiency planning is summer watering and the shortages that it may cause. Because water shortages can occur with relative frequency, it is important for utilities to address this issue. Summer watering costs utilities millions of dollars due to the need to find or build additional water supply, in addition to building water treatment plant capacity, to meet peak demands while that capacity sits idle for the remainder of the year.

In severe cases of drought, water shortages can lead to low water pressure, which adversely affects fire protection and increases the potential for water contamination. Municipal utilities have recently started taking actions to control water usage during periods of low supply. While some municipalities have passed ordinances that levy fines on customers when they irrigate on restricted days, there are other utility initiatives, mainly outside of Indiana, that modify rate

[21]P.L. 90-419 (90th Congress, S 660) The Great Lakes Compact includes rules and regulations to protect the Great Lakes and the surrounding lands of several states and Canadian provinces, whose direct runoff and watersheds form a large drainage basin that feeds into the lakes. Economic development will be balanced with sustainable water use to ensure Great Lakes waters are managed responsibly.

structures so that water is priced to provide incentives for consumers who conserve water and reduce consumption.

Utilities can reduce the need to develop new sources of supplies by reducing the amount of unaccounted-for-water. Unaccounted-for-water is different from water loss, which is simply water pumped and purchased less water sold; unaccounted-for-water includes water the utility can reasonably track, such as water used for main flushing, maintenance of the treatment plant, and fire suppression. The American Water Works Association (AWWA) developed a guideline of 10% unaccounted-for-water for water utilities, but some of Indiana's utilities exceed this guideline. The Commission now requires utilities to address this issue. If unaccounted-for-water is greater than 10%, the utility must advise the Commission of the actions it is taking to address the problem.

Energy and Water/Wastewater

Water efficiency not only reduces the amount of water consumed, it also saves energy.

Water efficiency not only protects the supply of an important natural resource, but also conserves energy. Energy efficiency campaigns usually include information on how to save water and provide energy efficiency kits containing water saving devices such as low-flow shower heads. According to the U.S. EPA, energy costs for water and wastewater utilities can be a third of a municipality's total energy bill. Furthermore, according to the U.S. EPA, if drinking water and wastewater systems reduce energy use by just 10% through cost-effective investments, collectively they could save approximately $400 million and 5 billion kWh annually.

The federal government and universities are developing programs to educate water and wastewater utilities on ways to conserve and improve upon their existing energy consumption. In January 2008, the U.S. EPA published the *Energy Management Guidebook for Water and Wastewater Utilities,* a step-by-step method based on a "Plan-Do-Check-Act" management system approach. This guidebook aids utilities in identifying, implementing, measuring, and improving energy efficiency and renewable opportunities. Purdue University has even created an Energy Efficiency Services Division within its Technical Assistance Program to further help water and wastewater utilities reduce energy costs.

Some wastewater treatment plants can produce digester or methane gas for use as emergency backup power or renewable energy sources to reduce purchased energy from utilities.

Some wastewater treatment plants can produce digester or methane gas as emergency backup power or a renewable energy source. For example, the city of West Lafayette upgraded its treatment plant and determined it could use the waste byproducts for a co-generation system using micro-turbine technologies. These additions are projected to create $7.2 million in savings over the life of the treatment plant and represent a use of material that would otherwise become part of the waste stream.

Regulatory Development

The Commission is taking steps to correct the misconception that it has no authority over the sale of utility stock or mergers. The Commission must review and approve a utility's actions whenever it seeks to transfer its franchise or control of the utility's works and system to another entity.

Commission Initiatives

Given the large number of utilities, several acquisitions of water and wastewater utilities occur in the state every year. Inevitably, some of these transactions take place through a stock purchase. Over the span of several years, an apparent misconception developed in the utility industry that the Commission no longer has the legal authority to review stock transactions. This misunderstanding has resulted in a number of utility ownership changes taking place without the Commission's knowledge or approval. It is believed that this misunderstanding may have developed from the Indiana Supreme Court's 1999 decision in *Ind. Bell Telephone Co., Inc. v. Ind. Util. Regulatory Comm'n,* 715 N.E.2d 351 (Ind. 1999).[22]

The Commission has taken steps to publicize the Commission's jurisdiction in these matters. Several letters have been sent notifying parties where recent transactions have taken place that were not presented for approval. These letters have resulted in one petition being filed with the

[22]The *Indiana Bell* decision held that the Commission did not have jurisdiction over the transfer of stock between two holding companies. However, the Commission has jurisdiction if a public utility's franchise, works, or system are transferred, resulting in a change of ownership or control. *Indiana Bell,* 715 N.E.2d at 356

Commission to review the stock purchase, and more are expected. In addition to its legal authority, there is a practical aspect to the Commission's review. Because the Commission encourages the consolidation of the widely fragmented water/wastewater industry and the transfer of small, troubled utilities to more responsible owners, oversight is necessary to ensure these goals are accomplished in an orderly manner with qualified owners. The Commission must have confidence that potential owners possess the financial, managerial, and technical capacity to own and operate a water and/or wastewater utility. In some instances, this has not been the case.

The Commission is taking proactive steps to improve the management and operations of small utilities prevalent in the water industry. For example, the Commission is developing a small utility accounting manual to assist utilities with improving their financial books and records.

Other Commission initiatives are taking place to improve the management and operations of small utilities prevalent in the water/wastewater industry. One initiative is a small utility accounting manual to assist utilities with their financial books and records. Financial record keepers for small utilities often have no accounting or financial background. In small municipalities, this responsibility falls on the elected Clerk-Treasurer, a position for which there is no financial education or experience requirement. Similarly, the maintenance of financial records for some developer-owned utilities falls to family members who may have inadequate knowledge or training. Accurate and timely financial records are necessary to provide utility managers with the ability to make informed decisions, provide data to develop accurate rate structures, and lower fees charged by utility consultants.

To maintain oversight of the water/wastewater utilities, the Commission performs an annual comprehensive review of the utilities' annual reports. The review focuses on the managerial, technical, and financial abilities of the utilities. The Commission also believes utility management and operations could be improved through a greater use of master plans, as well as required training for utility board members and city/town council members in the case of municipally-owned utilities.

In an effort to assist the small systems with their rate application filings, the small utility rate application forms are being revised for all types of utilities. The new application is more

automated and is tied to a utility's annual report, which allows Commission staff to provide the utility with test year information already completed in the application.

Completed Rules

In May 2010, administrative rules for the practice of sub-metering and sub-billing of water and wastewater service were completed. Ind. Code § 8-1-2-1.2 provides, in part, that landlords are not utilities by virtue of the provision of certain utility service to tenants. Thus, billing or service issues provided by landlords are not under the Commission's jurisdiction, unless a landlord takes actions in contravention of the Commission rules. The rule sets the time period to maintain records, determines the calculation of the tenant's bill, describes how the bill is rendered, explains how a complaint can be filed and what action the Commission can take with regard to a complaint.

Pricing and Economics

Costs in the water/wastewater industry continue to increase due to replacing infrastructure, U.S. EPA compliance, growing demand, and relocation of facilities.

Industry Costs

Costs are increasing for water and wastewater utilities and are driven by the following needs: replacement of aging infrastructure; compliance with U.S. EPA standards such as water quality and wastewater effluent; growing demand; and the relocation of facilities for local and state road projects. From 1984 to 2008, average water and wastewater treatment cost rose 310% while the consumer price index only rose 207%.[24]

Rate Increases

As the costs for water and wastewater services continue to rise, rates are following suit. Rate cases in Indiana reflect the national trend that shows water and wastewater rates outpacing inflation.[25] In 2009, 13 water utilities were approved for general rate increases averaging 25.91%, and one wastewater utility was approved for a rate increase of 21.52%. The two largest

[24]"Historical Water Price Trends," Steve Maxwell, AWWA Journal, April 2010
[25]Water and Wastewater Financing and Pricing (2005), George Raftelis

water utilities, Indiana-American and the city of Indianapolis, and the largest wastewater utility, Hamilton Southeastern Utilities, Inc., filed rate increase requests in 2009. In June 2009, the Commission granted the city of Indianapolis a 12.27% emergency rate increase and required several compliance filings regarding contract approvals, capital projects, debt issuances and financial reporting. The evidentiary hearing in the case for the establishment of permanent rates was held in April 2010 and a final order is pending. In April 2010, the Commission approved a 19.72% rate increase for Indiana-American. Per Commission rule, the final order in Hamilton Southeastern's rate case will be issued in August 2010. Overall, the number of rate increase requests has been high, with as many as 22 pending at any one time during the past year.

Mechanisms within a Rate Case to Recover Infrastructure Costs

The Commission has several mechanisms within a rate case that allow utilities to recover costs associated with infrastructure projects. Municipal and not-for-profit utilities are allowed to include costs for some types of projects, typically referred to as extensions and replacements, in customer rates. This allows utilities to include future infrastructure projects in rates without relying entirely on debt. In addition, Post-in-Service Allowance for Funds Used During Construction (AFUDC) and Deferred Depreciation, if approved, allow investor-owned utilities to defer the capital costs and depreciation expense of a project to the utility's next rate case. This practice helps to reduce the utility's earnings erosion.

All utilities can use the Minimum Standard Filing Requirements process that allows a utility to update its rate base for capital investments incurred up until the final hearing.[26] This can be an incentive to invest in capital improvements, as the utility does not need to wait until a later rate case to earn a return on capital investments.

Other Sources of Revenue to Finance Infrastructure

In 2000, Indiana was the second state in the nation to approve a capital recovery mechanism called the distribution system improvement charge.

[26]*See*, 170 I.A.C. 1-5

In 2000, Indiana was the second state in the nation to approve a capital recovery mechanism called the distribution system improvement charge (DSIC).[27] The DSIC only applies to water utilities, and the Commission believes that making the DSIC mechanism available to wastewater utilities will encourage investments in necessary infrastructure replacements and upgrades. The DSIC allows water utilities to increase rates to recover the costs of improvements to existing, as opposed to expanding, distribution systems without a rate case. As of May 2010, the Commission has approved close to $104 million in utility distribution plant placed in service through the DSIC.

Another way to finance infrastructure investments and minimize the effect on existing customers is through system development charges (SDCs) or utility fees paid by property owners who connect their properties to the utility's system for the first time. These fees are primarily meant to recover a utility's cost to provide new customers with a source of supply, treatment, and storage facilities; SDCs can be more than $1,400 for water connections and $3,000 for wastewater connections. The use of SDCs supports the notion that "growth should pay for growth" and reduces the likelihood that existing customers will pay for construction of new facilities that do not benefit them.

The Commission plans to study its main extension rules, since it may no longer be appropriate for the Commission to require utilities to share the cost of main extensions with those served.

While SDCs and the DSIC clearly benefit utilities, the Commission's main extension rules may no longer be appropriate. Under the current rules, utilities share the cost of main extensions with developers by providing a three-year revenue allowance.[28] Because utility costs are passed on to ratepayers, this practice requires existing customers to pay for at least a portion of new growth, which conflicts with the notion of SDCs that "growth should pay for growth." The Commission will continue to examine this issue to determine the appropriate policy and cost methodologies regarding SDCs.

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[27] *See*, I.C. § 8-1-31

[28] The three-year revenue allowance is included in the Commission's main extension rules. The revenue allowance is calculated as three times the estimated annual revenues of a new customer. The utility offsets the revenue allowance amount against the customer's cost to connect to the utility system. Since utility costs are passed on to ratepayers, this practice causes existing customers to pay at least a portion of the costs for new growth.

Outside-City Customer Rates

Many municipal utilities provide service to customers outside their corporate boundaries, which can create beneficial economies of scale and rate stability for the municipality.[29] However, some municipalities charge outside-city customers higher rates or a surcharge, with premiums ranging from modest amounts to 100% or in some cases, even higher, than rates paid by inside-city customers for the same service.

Different rates between customers located inside and outside a municipality may raise questions about whether the non-city rate is cost-justified and non-discriminatory.

A corporate boundary is usually not like a natural boundary such as a river or mountain, where crossing to the other side may increase the cost of providing service. With corporate boundaries, the imposition of higher rates or a surcharge may be a device to stimulate support for annexation, represent revenue enhancement, or subsidize in-city customers. It may be difficult to support different dollar amounts for inside-city and outside-city water rates due to the fact that rates approved by the Commission must be cost-justified and non-discriminatory.

When municipal utilities opt out of the Commission's jurisdiction, citizen-customers (i.e., city residents) of that municipality have a voice in how the utility is operated when voting for local leaders. However, non-citizen-customers cannot participate in the local municipal elections and, therefore, have no such voice. One possible remedy might be to provide the Commission with limited jurisdiction over municipal water rates charged to outside-city customers where a surcharge is assessed, even when the municipality has opted out of the Commission's jurisdiction.[30] Alternatively, municipalities could be allowed to assess a surcharge within a

[29]This can also constrain the proliferation of small developer-owned systems that sometimes become troubled.

[30]On February 11, 2010, the Lagrange Circuit Court issued an order in Cause No. 44C01-0912-MI-040, a case involving rates charged to outside-city customers of a municipal wastewater utility. Prior to 2009, the town of Wolcottville charged both inside-city and outside-city customers the same wastewater rate of $20.95. However, the town passed an ordinance in 2009 that maintained the $20.95 rate for inside-city customers but increased the rate for outside-city customers to $46.89. The court found the town abused its discretion by placing the entire burden of the rate increase upon its outside-city customers when that rate was not based on costs associated with furnishing service to outside-city customers, or the number of outside-city versus inside-city customers as required by I.C. § 36-9-23-24(e). Therefore, the court concluded the rates were not just and equitable and declared the 2009 ordinance invalid. While this case dealt with wastewater rates, the same reasoning could apply to municipal water utility rates.

statutorily specified level (i.e., a "safe harbor" provision) and not be subject to Commission oversight.

Fire Protection Surcharge

Prior to the implementation of I.C. § 8-1-2-103(d), many public utilities billed municipalities directly for the cost of fire protection, which, in turn, recovered the costs through taxes. With the passage of I.C. § 8-1-2-103(d), many municipalities have passed ordinances to transfer those fire protection costs to customers through surcharges that appear on customer bills on a revenue-neutral basis to the utility. As municipalities face reduced tax revenues and increasing costs, this trend is likely to continue resulting in higher bills for water utility consumers.

III. WATER/WASTEWATER GROWTH & INNOVATION

Legislative Initiatives

Federal

At the federal level, three bills address infrastructure funding. If enacted, S. 1005 would amend the Federal Water Pollution Control Act and the Safe Drinking Water Act to improve water and wastewater infrastructure in the United States and would make improvements to the existing SRF. One of the improvements would require states to give priority funding to projects that "improve the sustainability" of water systems. Furthermore, utility applicants that implement asset management programs and engage in long-term financial planning would be given higher funding priority. If enacted, S. 3262, the Sustainable Water Infrastructure Investment Act of 2010 would remove state volume caps on PABs for water and wastewater projects. A similar bill was passed in March 2010 by the House of Representatives as part of the Small Business and Infrastructure Tax Act, H.R. 4849. H.R. 2521 would create a national infrastructure bank, funded by the federal government, to encourage investment in public projects such as water or wastewater systems.

Last year, the House passed a bill that would create a new regulatory program for the chemical security of drinking water and wastewater utilities. This bill, H.R. 2868, would put the use of chemicals, such as chlorine, under the U.S. EPA and, because states usually enforce the

rules, the IDEM. One concern with this bill is when a utility is classified as high-risk for chemical security, state officials who might not be familiar with a utility have the final determination in what chemical the utility can use.

State

The Commission recommends the following: 1) preventing investor-owned water/wastewater utilities with less than 300 customers from withdrawing from Commission jurisdiction; 2) expanding the availability of the small utility filing process to utilities with fewer than 10,000 customers; and 3) expanding the DSIC to wastewater utilities.

The Commission offers several recommendations to address specific issues within the industry. One area of concern is the ability of investor-owned water and wastewater utilities with less than 300 customers to withdraw[31] from Commission jurisdiction. Without proper oversight, these customers may pay rates that generate revenues which are greater than the utility's cost. These excess revenues may then be withdrawn by the utility's shareholders providing unjust enrichment. The ability for small investor-owned utilities to withdraw is also problematic because these entities are those most likely to become troubled, and as a class, may be most in need of oversight.

The Commission offers a second proposal for consideration that involves small utility filings.[32] Utilities serving a designated number and type of customer, as determined by the IURC, should be able to take advantage of the small utility filing process. Currently, the statute defines a small utility as one with 5,000 customers or less. Only utilities that primarily serve retail customers and do not extensively serve another utility can use the small utility filing process. By providing the Commission with the requisite flexibility to increase the customer limit and expand the type of customers a utility can serve, more small utilities can take advantage of the small utility rate application process, thus keeping costs to a minimum.

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[31] *See*, I.C. § 8-1-2.7-1.3
[32] *See*, I.C. § 8-1-2-61.5

Finally, the Commission believes that wastewater utilities should be able to utilize the DSIC[33] in the same manner as water utilities. Currently, water utilities use a DSIC in an expedited process to recover distribution system investments incurred between rate cases. The DSIC is a tracking mechanism similar to trackers used by electric and gas utilities to directly pass fuel costs onto customers. Similar to the water distribution system, investments in the collection system of wastewater utilities are critical due to aging infrastructure and increasingly stringent regulations. Aging collection system infrastructure is one of the main causes of inflows and infiltration that may lead to environmental contamination and IDEM violations. A DSIC would provide a financial incentive for wastewater utilities to invest in critical collection system infrastructure by reducing regulatory lag and providing more immediate cash flow without incurring the costs associated with a rate case.

Technology

Replacing Aging Infrastructure or Failing Pipes

Replacing aging or failing water/wastewater pipes using the traditional method of opening the ground and replacing the damaged pipe is expensive. Trenchless methods include Cured-in-Place-Pipe (CIPP) technology, which has existed since the early 1970's, and sliplining, which has been used even longer. In CIPP, a felt bag is inserted into a pipe and after curing, bonds to the existing pipe. Sliplining is completed by installing a smaller pipe into the existing pipe.

These trenchless methods have been predominately focused on wastewater applications. However, within the last few years, technical issues have been resolved and installation costs have decreased to the point where CIPP and sliplining are now offered as a technology for waterworks applications as well. The result is a trenchless way to address aging or failing pipelines that can minimize or avoid many costs associated with traditional open-cut applications, including traffic control, utility conflicts (i.e., communications, gas, or electric) and surface restoration. While this process can still be quite expensive, it can still produce significant cost savings, especially in urban settings.

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[33] *See*, I.C. § 8-1-31

Wastewater Treatment

Wastewater treatment plants are expensive to build, and the location must meet proper siting requirements, while simultaneously being close to an acceptable discharge point. In traditional wastewater treatment plants, effluent is treated via biological processes that require large tank and piping systems. While the technology itself dates back to 1989, the Membrane Bio-Reactor (MBR) process has recently become less expensive and is emerging as a more cost-effective technology. The MBR has the ability to produce high quality effluent that can be discharged to surface waterways or be reclaimed for irrigation purposes. It utilizes the same biological processes as traditional treatment configurations, but is able to operate with a greatly reduced physical footprint due to consolidating several physical elements of a traditional wastewater treatment facility. The advantages of MBRs over conventional wastewater treatment include this small footprint and the ease with which they may be retrofitted within older wastewater treatment facilities. Although the technology is expensive, costs can be offset because expansion or relocation of wastewater facilities is avoided, and/or much larger investments in land and site work are eliminated. In many older systems, tanks can be reused to house the membranes, avoiding many of the traditional structural costs associated with new construction.

IV. WATER/WASTEWATER APPENDICES

Appendix A – Jurisdictional Water Utility Revenues

Year Ending December 31, 2008

Rank	Utility Name	Operating Revenues	% of Total Revenues
1	Indiana-American Water Company, Inc.	$156,057,318	32.18%
2	Indianapolis Water	121,895,524	25.14%
3	Fort Wayne Municipal Water Utility	31,592,716	6.51%
4	South Bend Municipal Water	14,608,556	3.01%
5	Evansville Municipal Water Works Dept.	14,518,567	2.99%
6	Bloomington Municipal Water	10,563,605	2.18%
7	Hammond Municipal Water Works	8,538,305	1.76%
8	Mishawaka Municipal Utilities - Water	7,868,192	1.62%
9	Lafayette Municipal Water Works	7,548,548	1.56%
10	Elkhart Municipal Water Works	7,381,277	1.52%
11	Anderson Municipal Water Works	7,313,143	1.51%
12	Michigan City Municipal Water Works	6,573,810	1.36%
13	Schererville Municipal Water Works	5,238,682	1.08%
14	Utility Center, Inc.	5,002,211	1.03%
15	Columbus Municipal Water Utility	4,814,438	0.99%
16	Marion Municipal Water Works	4,465,637	0.92%
17	Stucker Fork Conservancy District	3,296,283	0.68%
18	Brown County Water Utility, Inc.	2,928,692	0.60%
19	Ramsey Water Company, Inc.	2,923,647	0.60%
20	Chandler Municipal Water Works	2,844,848	0.59%
21	Jackson County Water Utility, Inc.	2,765,703	0.57%
22	New Castle Municipal Water Works	2,385,374	0.49%
23	Silver Creek Water Corporation	2,258,433	0.47%
24	Auburn Municipal Water Utility	2,147,915	0.44%
25	Eastern Heights Utilities, Inc.	2,068,419	0.43%
26	North Lawrence Water Authority	1,963,138	0.40%

27	Edwardsville Water Corporation	1,944,055	0.40%
28	Salem Water Works	1,770,090	0.36%
29	Morgan County Rural Water Corporation	1,767,546	0.36%
30	Martinsville Municipal Water Utility	1,690,839	0.35%
31	Mishawaka-Clay Municipal Utilities - Water	1,641,994	0.34%
32	German Township Water District, Inc.	1,531,000	0.32%
33	Columbia City Municipal Water Utility	1,514,189	0.31%
34	Princeton Municipal Water	1,477,931	0.30%
35	East Lawrence Water Authority	1,398,978	0.29%
36	Peru Municipal Water Dept.	1,364,334	0.28%
37	Boonville Municipal Water Works	1,362,722	0.28%
38	South Harrison Water Corporation	1,340,034	0.28%
39	Watson Rural Water Co., Inc.	1,273,265	0.26%
40	Southwestern Bartholomew Water Corporation	1,251,866	0.26%
41	South Lawrence Utilities, Inc.	1,227,688	0.25%
42	Pike-Gibson Water, Inc.	1,185,219	0.24%
43	Ellettsville Municipal Water Utility	1,164,142	0.24%
44	Corydon Municipal Water Works	1,094,419	0.23%
45	Gibson Water, Inc.	1,050,970	0.22%
46	Twin Lakes Utilities, Inc.	927,924	0.19%
47	Aurora Municipal Water Utility	885,739	0.18%
48	Southern Monroe Water Corporation	881,509	0.18%
49	Floyds Knobs Water Company, Inc.	805,680	0.17%
50	Prince's Lake Municipal Water Dept.	775,117	0.16%
51	Charlestown Municipal Water Dept.	746,865	0.15%
52	North Dearborn Water Corporation	718,350	0.15%
53	Marysville Otisco Nabb Water Corporation	708,655	0.15%
54	Reelsville Water Authority	685,083	0.14%
55	St. Henry Water Corporation	626,946	0.13%
56	Petersburg Municipal Water Works	602,065	0.12%
57	LMS Townships Conservancy District	597,117	0.12%
58	Valley Rural Utility Company	591,352	0.12%
59	Van Buren Water, Inc.	582,116	0.12%

60	Lawrenceburg Municipal Utilities - Water	540,694	0.11%
61	Washington Township Water Corp. of Monroe County	527,385	0.11%
62	Fortville Municipal Water Works	514,898	0.11%
63	B & B Water Project, Inc.	481,265	0.10%
64	Indiana Water Service, Inc.	443,446	0.09%
65	Cataract Lake Water Corporation	442,773	0.09%
66	Clinton Township Water Company	424,933	0.09%
67	Town of Cedar Lake Utilities	362,147	0.07%
68	Riverside Water Company, Inc.	342,696	0.07%
69	Tri-County Conservancy District	338,507	0.07%
70	St. Anthony Water Utilities, Inc.	317,338	0.07%
71	Knightstown Municipal Water Utility	287,365	0.06%
72	Everton Water Corporation	280,102	0.06%
73	Eaton Municipal Water Utility	268,489	0.06%
74	Ogden Dunes Municipal Water	235,179	0.05%
75	Painted Hills Utilities Corporation	225,847	0.05%
76	Consumers Indiana Water Company	224,807	0.05%
77	Kingsford Heights Municipal Water Utility	204,492	0.04%
78	Mapleturn Utilities, Inc.	183,584	0.04%
79	Pioneer Water, LLC	181,340	0.04%
80	South 43 Water Association, Inc.	177,598	0.04%
81	Fairview Park Municipal Water	156,826	0.03%
82	Kingsbury Utility Corporation	127,028	0.03%
83	Oak Park Conservancy District	121,072	0.02%
84	Darlington Waterworks Company	116,552	0.02%
85	Water Service Company of Indiana, Inc.	92,548	0.02%
86	Fillmore Municipal Water	91,425	0.02%
87	Rhorer Harrel & Schacht Roads Water Corp	88,576	0.02%
88	Waldron Conservancy District	86,389	0.02%
89	Wedgewood Park Water Co., Inc.	64,909	0.01%
90	Apple Valley Utilities, Inc.	62,025	0.01%
91	Pleasantview Utilities, Inc.	51,236	0.01%
92	American Suburban Utilities, Inc.	37,655	0.01%

93	J.B. Waterworks, Inc.	30,893	0.01%
94	Sugar Creek Utility Company, Inc.	20,347	0.00%
95	River's Edge Utility, Inc.	17,696	0.00%
96	Wells Homeowners Association, Inc.	13,255	0.00%
97	Shady Side Drive Water Corporation	10,433	0.00%
98	Hessen Utilities, Inc.	7,754	0.00%
99	Pence Water Works	6,728	0.00%
100	Country Acres Property Owners Association	3,978	0.00%
	Total	$484,960,990	100.00%

Source: Data taken from 2008 Annual Reports filed with the Commission

Appendix B – Jurisdictional Wastewater Utility Revenues

Year Ending December 31, 2008

Rank	Utility Name	Operating Revenues	% of Total Revenues
1	Hamilton Southeastern Utilities, Inc.	$8,688,488	36.60%
2	Utility Center, Inc.	4,672,663	19.68%
3	American Suburban Utilities, Inc.	2,372,950	9.99%
4	Twin Lakes Utilities, Inc.	1,543,045	6.50%
5	Eastern Richland Sewer Corporation	1,028,363	4.33%
6	Valley Rural Utility Company	884,305	3.72%
7	L.M.H. Utilities Corporation	625,289	2.63%
8	Driftwood Utilities, Inc.	507,684	2.14%
9	Wymberley Sanitary Works, Inc.	477,847	2.01%
10	Indiana-American Water Company, Inc.	343,808	1.45%
11	Kingsbury Utility Corporation	334,329	1.41%
12	Mapleturn Utilities, Inc.	292,454	1.23%
13	Consumers Indiana Water Company	272,429	1.15%
14	Apple Valley Utilities, Inc.	208,157	0.88%
15	Doe Creek Sewer Utility, Inc.	185,331	0.78%
16	Northern Richland Sewer Corporation	132,825	0.56%
17	Eastern Hendricks County Utility, Inc.	131,264	0.55%
18	Water Service Company of Indiana, Inc.	127,362	0.54%
19	Sani Tech, Inc.	95,726	0.40%
20	Old State Utility Corporation	74,467	0.31%
21	Wildwood Shores Utility Corp., Inc.	69,900	0.29%
22	Howard County Utilities, Inc.	67,005	0.28%
23	Centurian Corporation	64,656	0.27%
24	Galena Wastewater Treatment Plant	64,360	0.27%
25	Southeastern Utilities, Inc.	63,480	0.27%
26	Sugar Creek Utility Company, Inc.	61,042	0.26%
27	Pleasantview Utilities, Inc.	49,704	0.21%

28	South County Utilities, Inc.	45,306	0.19%
29	Heir Industries, Inc.	40,566	0.17%
30	Howard County Utilities, Inc.	39,405	0.17%
31	East Shore Corp.	28,000	0.12%
32	Chimneywood Sewage Works, Inc.	25,448	0.11%
33	Hardin Monroe, Inc.	25,200	0.11%
34	Hillview Estates Subdivision, Inc.	25,187	0.11%
35	JLB Development, Inc.	15,203	0.06%
36	Country Acres Property Owners Association	14,742	0.06%
37	River's Edge Utility, Inc.	12,564	0.05%
38	Brushy Hollow Utilities, Inc.	12,080	0.05%
39	Anderson Lakes Estates Homeowners Assoc., Inc.	6,903	0.03%
40	Harbortown Sanitary Sewage Corporation	5,400	0.02%
41	Hessen Utilities, Inc.	5,308	0.02%
42	Webster Development, LLC	1,355	0.01%
43	Aldrich Environmental, LLC	0	0.00%
44	Sanitrol, Inc.	Not Operational	0.00%
	Total	$23,741,600	100.00%

Source: Data taken from 2008 Annual Reports filed with the Commission

2010 COMMUNICATIONS REPORT

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I. COMMUNICATIONS OVERVIEW

Industry Characteristics and Profile

Commission involvement remains necessary in areas where competition alone may not provide solutions.

The Indiana Utility Regulatory Commission (Commission) handles Indiana-specific issues related to video and telecommunications services, and executes its authority as the sole video franchise authority in Indiana. Commission involvement remains necessary in areas of the communications industry where competition alone may not provide solutions. For example, the Commission resolves carrier-to-carrier disputes, manages policies regarding telephone numbering resources (pursuant to federal law), and works to implement streamlined certification processes that facilitate competition by reducing barriers to entry and eliminating regulatory lag. The Commission also protects consumers from unauthorized changes to their service, ensures that all areas of the state continue to have a provider of last resort for local exchange telecommunications service, and ensures continued access to basic communications services in high-cost areas of the state. As more fully discussed in this report, the Commission has adapted to both changes in its authority and the marketplace.

The communications industry in Indiana continues to transition from the historical model of a regulated market where monopoly carriers provided single segments of communications services to captive customers. In today's market, communications service providers (CSPs) offer multiple services, utilizing different technologies in order to remain competitive with companies that were once in separate and distinct industries. For example, telephone companies provide video service, cable companies provide telephone service, and both provide high-speed access to the Internet.

Consumer behavior is also changing, as customers opt to purchase multiple communications services from one entity in a bundle or package. In response to this preference, most companies offer their services in bundles or packages at a considerable discount over stand-alone pricing. Advances in technologies, coupled with capital investments in communications infrastructure, have made it possible for CSPs to offer multiple products such as voice calling, data, and video

services. Widespread adoption of "triple play" (telephone service, Internet access, and video service) or even "quadruple play" (triple play, plus mobile wireless service) has also resulted in multiple providers offering packages and bundles of services to consumers, leading to increased competition and customer choice. In fact, in 2009, the intrastate operating revenues for Indiana's telecommunications carriers totaled $2.86 billion.[1]

New standards for Certificates of Territorial Authority (CTA) went into effect on July 1, 2009. Prior to this date, the IURC only certificated telecommunications providers. HEA 1279 requires all communications service providers that offer service to Indiana customers to obtain a CTA without regard to the medium or technology used to provide the services. This includes providers of information service, video, broadband and Internet Protocol-enabled services (I.C. 8-1-32.5-3(a)). In order to implement this new section of the statute, the IURC modified its policies to require that all CSPs be similarly certified by the Commission, thereby allowing competitors to receive similar "light regulatory" treatment.[2]

Prior to the July 1, 2009 requirement, there were 624 communications companies that had CTAs and were, therefore, grandfathered in as CSPs under HEA 1279. Since May 20, 2009, 73 new applications have been filed. Of these new applications, 65 have been granted; 7 are pending; and 1 was denied. Commission staff members continue to follow up with companies that have not yet complied with this statutory requirement.

Existing Legal and Policy Foundations

IURC authority has changed and evolved but has not been eliminated.

The regulatory landscape in Indiana changed for CSPs and their customers when the final phase of HEA 1279 became effective in July 2009. Deregulation of basic telecommunications service (BTS) led to the elimination of many regulations that were no longer necessary. However, the statute also added mandates to implement new programs and certify new types of communications providers. The new regulatory framework seeks parity for all types of CSPs,

[1] 2009 Annual IURC Fee Billing Report
[2] Pursuant to HEA 1279, P.L. 27-2006

using competition rather than rate or service quality regulation, to promote a high level of service quality at an affordable price.

170 I.A.C. 7 of the Indiana Administrative Code details the IURC's regulations and procedures for telecommunications carriers. The Commission and its staff reviewed the IURC's telephone rules to determine which rules should be eliminated, modified or preserved in order to align the Commission's administrative rules with current statutory provisions. Commission staff also sought input from industry representatives and the Office of Utility Consumer Counselor prior to approval of the Proposed Rule on March 3, 2010. In the Proposed Rule, 47% of the telephone rules were eliminated due to HEA 1279. The revised rules fit into the following categories:

- *Slamming and Cramming Rules* – I.C. § 8-1-2.6-13(d)(4) retained the Commission's jurisdiction to enforce anti-slamming and cramming rules; therefore, these rules are largely unchanged with the exception of updates to comply with federal regulations.

- *Obligations of Eligible Telecommunications Carriers (ETCs) and Communications Service Providers (CSPs)* – The proposed rule greatly reduces the previous service quality section and eliminates performance metrics and automatic customer bill credits for noncompliance (i.e., maximum time to respond to out-of-service complaints, maximum waiting times for calls to repair centers, etc.). The rule also sets forth the remaining Indiana-specific obligations for ETCs and CSPs.

- *Customer Rights and Responsibilities* – The proposed rules significantly reduced the previous Customer Rights and Responsibilities section, (e.g., standards for evaluating creditworthiness of customers, deposit requirements and disconnection notice requirements) but retain billing standards for utility service necessary to enforce anti-slamming and cramming rules and procedures for customers to report problems and complaints to the IURC.

- *Carrier-to-Carrier Disconnections* – The Commission retains its jurisdiction to mediate the disconnection of one carrier by another carrier pursuant to Section 251 of the

Telecommunications Act of 1996 (TA-96) (I.C. § 8-1-2.6-2). This is important to protect end-user customers from losing their service with no advance notice.

- *Carrier-to-Carrier Interconnection Disputes* – The Commission retains its jurisdiction and responsibility to arbitrate and resolve disputes between telecommunications carriers pursuant to Section 252 of the Telecommunications Act (I.C. § 8-1-2.6-1.5(b)).

HEA 1279 also contained legislative mandates concerning video franchising and low-income assistance. With the passage of HEA 1279, the IURC became the sole video franchising authority in Indiana effective July 1, 2006, with the exception of those that had agreements with providers that chose to remain under local franchise agreements until expiration of the then-current agreement. The IURC has worked diligently to implement the video sections of the statute over the last four years. Data summarizing the growth in deployment and activity in Indiana's video industry is detailed in the Four-Year Study of Video Availability Report (Appendix D).[3]

HEA 1279 also mandated the development and implementation of the Indiana Lifeline Assistance Program (ILAP) which will help low-income Hoosiers benefit more from the funds that all Indiana telecommunications customers pay through the federal universal service fee on their monthly bills. Having a state program allows Indiana to receive matching dollars from the federal government, which means low-income Hoosiers will receive an additional discount. This program is discussed in greater detail later in this report.

II. COMMUNICATIONS LANDSCAPE

Infrastructure

Investments in communications infrastructure are making both urban and rural communities more economically competitive.

[3] Required in Section 64 of HEA 1279 (P.L. 27-2006).

Company Funded Infrastructure Investment

Beyond its role as the foundation for voice, data, video, and access to the Internet, communications infrastructure is critical to industries such as banking and financial services, healthcare, education, government, and the energy industry and other utilities, through so-called "smart grids." Consequently, investments in communications infrastructure are helping to satisfy customer needs. They are also making both urban and rural communities more economically competitive since they help rural communities attract new businesses and jobs, while retaining current businesses that might have otherwise relocated due to a lack of adequate Internet service. Examples of recent infrastructure upgrades include:

1) Rochester Telephone Company (RTC), located in north central Indiana, is nearing the end of a fiber-to-the-home (FTTH) build-out project that began in 2003.[4] RTC currently serves about 90% of its subscriber base with fiber and offers triple play service bundles to those customers. RTC has already invested in excess of $9 million and expects to invest an additional $2.5 million through the end of 2010. Rochester estimates an additional $600,000 in annual expenditures for the next eight years to fully convert its customers, all of whom are located in Fulton County, to fiber connectivity.

2) Mulberry Cooperative Telephone Co., Inc., located in central Indiana, invested in both FTTH and fiber-to-the-node (FTTN) technologies, as well as in major hardware, switching, and software upgrades over the last few years, including more than $1 million in 2009 alone. Mulberry serves customers in western Clinton County and eastern Tippecanoe County.

These examples show that Indiana companies are investing in their infrastructure to provide customers with access to the services they need and want.

Industry Development

The new regulatory framework in Indiana seeks parity for all types of communications service providers, using competition rather than economic or service quality regulation.

[4] RTC received federal universal service support but no federal stimulus funding.

New Standards for Certificates of Territorial Authority

As referenced earlier, in 2009, many entities, including providers of WiFi, Internet services, and VoIP that were not accustomed to interacting with the Commission were required to obtain CTAs for the first time.[5] The new CTA framework provides a uniform application and certification process for all types of carriers, regardless of whether they are a reseller of long-distance services or a facilities-based provider of local exchange service. The Commission continues to keep records on the types of services offered by CSPs because federal law and other areas of Indiana law have differing obligations and benefits, depending upon the type of service provided. For example, local exchange providers, as well as wireless carriers, are required to provide access to 911 and dual-party relay service to hearing and speech impaired individuals, while long-distance providers do not have this obligation.[6]

Telephone Penetration in Indiana/Federal and State Lifeline Programs

Lifeline/Link-up is a federally-funded program that reimburses ETCs for discounts provided to low-income households on basic telephone service. All ETCs are required to offer Lifeline/Link-up. Many states, including Indiana, have trouble raising awareness to eligible low-income households regarding the availability of this program. The IURC has taken several steps over the years to boost participation in the Lifeline program, including working with social service agencies and communications providers to increase awareness. Unfortunately, these efforts have only produced temporary results.

The Indiana General Assembly directed the IURC to establish a state Lifeline Program.

The Indiana General Assembly recognized the need to address telephone affordability and directed the IURC to implement rules for the establishment of a state Lifeline Assistance Program (ILAP). Lifeline customers in states that implement a State Lifeline Program receive an additional discount from the federal Lifeline Fund. When implemented, the ILAP will reimburse ETCs for providing discounted telephone service to eligible low-income customers.

[5] *See*, I.C. § 8-1-32.5
[6] *See*, I.C. § 36-8-16 and I.C. § 8-1-2.8

Customers are eligible for the discount if they participate in any of seven social service programs or have a household income at or below 150% of the federal poverty guidelines. The program was to be functional no later than July 1, 2009.[7] The IURC approved an Order establishing the funding mechanism in November 2007 and rules for the program in May 2008 as required by the statute; however, the State Budget Agency withheld approval. Therefore, the program could not be implemented in 2009. The IURC approved a new funding mechanism on June 30, 2010[8] and hopes that the approved mechanism and the new administrative rule will become effective after state approval later this year.

Only 9% of eligible Indiana residents participated in the federal Lifeline program in 2009.

The IURC continues to recognize the ILAP and the Federal Lifeline Program as important tools for increasing telephone penetration rates in Indiana. The FCC's telephone subscribership report estimates that 93.1% of Indiana residents had a telephone in their household in 2009.[9] Indiana lags in penetration rates when compared to other states. (See Appendix A)

Lifeline/Linkup could be a tool for increasing penetration rates. However, an estimate prepared by the Universal Service Administrative Company for Indiana, showed that only 9% of eligible Lifeline customers in Indiana participated in the federal Lifeline program in 2009. This means 511,298 eligible households in Indiana are not participating in the program which translates into approximately $43 million federal dollars lost to Indiana's economy annually. In addition, Indiana telephone customers contribute more into the Federal Universal Service Fund, which funds the Lifeline/Link-up Program, than Indiana companies receive.[10] Implementation of the ILAP program mandated by I.C. 8-1-36 will further this goal by providing an Indiana specific program with additional emphasis on outreach.

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[7] *See*, I.C. § 8-1-36
[8] Cause No. 43082
[9] Telephone Subscribership in the United States, Federal Communications Commission, (rel. February 2010).
[10] In 2008, Indiana received $32.9 million less than it contributed to the federal USF according the Universal Service Monitoring Report, (rel. December 2009).

Without universal service support, residents of some rural areas of the state would pay significantly more for telephone services than those living in other areas.

Through HEA 1279, the Legislature retained the Commission's authority to "fulfill its obligations under TA-96 and I.C. 20-20-16 concerning universal service and access to telecommunications service and equipment including the designation of eligible telecommunications carriers..."[12] The Federal Universal Service Fund supports telecommunications companies that provide service in high cost areas and to low income consumers, schools, libraries and rural health care services, all of which have a significant impact on Indiana's current and future economy. The Commission is diligent in fulfilling those responsibilities and closely monitors proposed changes to the federal universal service law that could affect Indiana companies and consumers.

Due to Federal Universal Service changes that had a detrimental impact on Indiana's rural companies, the IURC implemented a state universal service fund for Indiana (IUSF) in 2007. The purpose of the IUSF is to provide cost recovery so that companies in high-cost areas[13] may continue to offer services at rates that are "just, reasonable and affordable." Without universal service support, residents in some rural areas of the state would pay significantly more for telephone services than those living in other areas. This could result in a reduction in telephone penetration in high cost rural areas. Telecommunications companies that serve these areas could also decide they cannot afford to modernize their networks or provide services of the same quality as is available in urban areas. Indiana is one of 16 states that have a state universal service fund.[14]

The IUSF is funded by a percentage surcharge upon total intrastate retail telecommunications services. Indiana telecommunications customers saw a reduction of this surcharge from 0.54% to

[12] *See*, I.C. § 8-1-2.6-13(d)(5)

[13] High-cost service areas are designated by the federal government due to the high fixed costs of building and maintaining a telecom network in rural areas with low population densities or rugged terrain; 47 USC 254(b)(3) requires the availability of comparable service at a comparable price.

[14] Making the High Cost Decision: How to Assess Your State's Needs, National Regulatory Research Institute, 2010.

0.40% on their intrastate telephone bills on March 1, 2010.[15] The order establishing the IUSF required the Commission to set the initial surcharge and allowed for modification of the surcharge by the administrator upon approval by the Commission. Modifications are allowed up to twice per calendar year as necessary to maintain sufficient funds required for disbursements.

The Commission uses a third-party administrator to manage the IUSF. The administrator, Solix, administers state universal funds for 14 of the 16 states throughout the country that offer such programs.[16] Solix serves Indiana by collecting funds from contributing carriers and disbursing the funds to small rural carriers that meet certain criteria and demonstrate a need for the support.[17] Solix works very closely with the Commission and provides quarterly and annual status reports on the IUSF operations.

Area Code Relief

When assignable telephone numbers are exhausted in a particular area code, the IURC must implement area code relief.

The IURC continues to monitor the state's area code exhaust projections. Three-digit area codes and seven-digit telephone numbers are finite resources that are in heavy demand. When assignable telephone numbers are exhausted in a particular area code, the IURC must implement area code relief consisting of either a geographic split of the existing area code into two or more areas, or an overlay of a new area code in the same geographic area as the existing area code. Neither option is popular with consumers because they involve either changes of phone numbers or ten-digit dialing to place a local call. The increase in telecommunications providers, growth in wireless customers, and Internet-based phone systems, place pressure on numbering resources.

Forecasting reports from the North American Numbering Plan Administrator (NANPA) indicate that area code 812, serving southern Indiana, has the shortest remaining life of the Indiana area codes with a current exhaust projection of 2013. Although exhaust projections for

[15] Cause No. 42144-S3, Docket Entry, December 29, 2009

[16] www.solixinc.com/internet/current-programs.aspx

[17] In order to qualify for support from the IUSF, companies must meet certain standards, maintain service quality and demonstrate need as enumerated in the Final Order in Cause No. 42144. In this Cause, the Commission approved a settlement agreement between small rural carriers, large ILECs, wireless carriers and competitive local exchange carriers.

812 have been extended several times, a petition for area code relief may be filed by NANPA in the near future. Once the petition is received, the IURC will determine the appropriate form of area code relief. The current status of numbering resources for Indiana's six area codes is reflected in the following table:

Table 3

Area Code Life Projections

Area Code	Year & Quarter of Projected Number Exhaust Date
812	2013 3Q
317	2017 4Q
765	2018 2Q
219	2031 3Q
260	2034 4Q
574	2036 1Q

Source: North American Number Plan Administration, 2010-1 NRUF and NPA Exhaust Analysis, Released April 2010.

Mergers

Since 2008, three mergers and one spin-off were announced that directly affect Indiana providers and consumers.

Several mergers and spin-offs have taken place during the past few years among U.S. telecommunications providers. Carriers are joining forces in order to enhance revenues and achieve economies of scale to better position themselves in the market, which now includes strong, new competitors from the cable TV and wireless companies. Since 2008, four mergers were announced that directly affect Indiana providers and consumers.

The merger transactions involve: CenturyTel, Inc.'s (CenturyTel) merger with Embarq Corporation (Embarq); the transfer of control of the licenses, authorizations, and spectrum leasing arrangements held by Centennial Communications Corp. to AT&T, Inc; CenturyLink's proposed all-stock merger with Qwest; and Frontier Communications Corp.'s (Frontier) acquisition of Verizon Communications, Inc.'s (Verizon) wireline properties in 14 states. All four transactions have focused on delivery of services to predominantly rural areas. See Appendix B for details of the transactions.

Pricing and Economics

Effects of Competition and Technological Change on Universal Service and Pricing

This section of the report focuses primarily on BTS, which the Indiana General Assembly has defined as "stand-alone telephone exchange service (as defined in 47 U.S.C. 153(47))" provided to residential customers over the customer's primary line. It must be the sole service purchased by the customer and cannot be part of any promotion, package, bundle, or contract; it also cannot include a "functionally equivalent service" that is provided through "Internet Protocol enabled retail services."[18]

The Commission's jurisdiction over BTS expired on June 30, 2009, which marked the end of the legislative "rate transition period."[19] From March 26, 2006, through June 30, 2009, a provider offering BTS could only increase its monthly flat rates for BTS by a maximum of $1.00 per year and $3.00 total, calculated in reference to the rate in effect on March 26, 2006.[20] Providers electing to implement such rate increases did not need prior approval from the Commission; however, the statute required that broadband be offered to at least 50% of the households located in the local exchange area,[21] at average speeds of at least 384 Kbps upstream and at least 1.5 Mbps downstream,[22] not later than eighteen calendar months after the provider's first rate increase in the local exchange area. Specifically, providers were required to demonstrate compliance in the context of docketed proceedings before the IURC[23] in order to maintain the rate increase.

The Commission does not have statutory authority to either prohibit local rate increases or to cap the size of any increases that companies might elect to make.

Verizon and Embarq each raised their respective BTS rates once during the rate transition period. Embarq successfully demonstrated compliance with the statutory broadband build out

[18] *See*, I.C. § 8-1-2.6-0.1
[19] *See*, I.C. § 8-1-2.6-1.3(b)
[20] *See*, I.C. § 8-1-2.6-1.3(c)
[21] *See*, I.C. § 8-1-2.6-1.3(e)
[22] *See*, I.C. § 8-1-2.6-1.3(a), *also*, I.C. § 8-1-2.6-1.3(e)
[23] *See*, I.C. § 8-1-2.6-1.3(e)

requirements in at least 50% of the local exchange areas subject to the rate increase.[24] Verizon met the 50% deployment requirement in all affected exchanges except the Corydon exchange. As a result, the Commission ordered Verizon to refund $15 plus interest at an annual rate of two-tenths of one percent (0.20%) to all affected customers in Corydon.

AT&T Indiana raised its BTS rates to $13.00 in August 2009 in each of its four rate groups after the expiration of the rate transition period; the increases were all more than $1.00.[25] AT&T also raised its non-BTS rates three times during the transition period, ending up with a non-BTS rate of $13.00 for all of its rate groups. The Commission is unaware of any other ILECs that raised their BTS rates during the rate transition period or since last year's report. However, it should be emphasized that as of July 1, 2009, ILECs are no longer required to file BTS tariffs with the Commission. The Commission does not have statutory authority to either prohibit local rate increases or to cap the size of any increases that companies might elect to make.

III. COMMUNICATIONS GROWTH & INNOVATION

Future and Pending Legislation

State

During the 2010 legislative session, House Enrolled Act 1086[27] (HEA 1086) passed and included a significant addition to the wireless 911 section of the statute.[28] Formerly, this statute required all wireless carriers to contribute to the Wireless 911 Board and treated all wireless carriers the same. However, TracFone, a prominent prepaid wireless provider, stated that they could not collect the 911 fee when their phones and services are sold by third party retailers. This issue also arose in a complaint before the IURC[29], which was later dismissed because the IURC was not the appointed authority to hear disputes regarding 911 fees, among other reasons. HEA 1086 provides that retail sellers of prepaid wireless service shall collect a fee at the point of sale in the amount of 50% of the current wireless 911 fee assessments. Currently, the monthly

[24] Cause Nos. 43772 (Verizon) and 43763 (Embarq)

[25] Because the transition period was over at that time, AT&T was not bound by the statutory requirements; therefore, the increases of more than $1.00 were not legislatively prohibited. Likewise, AT&T did not have to demonstrate compliance with the specific statutory requirements regarding the 50% broadband build out.

[27] P.L. 113-2010

[28] *See*, I.C. § 36-8-16.6

[29] Complaint of the Indiana Enhanced 9-1-1 Advisory Board against TracFone Wireless, Inc., Cause No. 43524

wireless user fee for traditional bill-for-service wireless providers is $.50, so the initial pre-paid wireless 911 user fee is $.25 per month. HEA 1086 also requires the seller to remit the funds to the Indiana Department of Revenue for distribution to the Wireless 911 Board for deposit and county distribution. This legislation clarifies that prepaid wireless providers must also contribute to the Enhanced Emergency Telephone System Fund even though they do not have traditional billing or service distribution methods.

Federal

On March 16, 2010, the FCC released the National Broadband Plan (the Plan). The Plan addresses the nation's digital divide between rural and urban areas; low-income and at-risk populations; and the lack of affordable access, connectivity, and features for commercial and anchor institutions. It is considered to be a roadmap and contains numerous goals and recommendations for the FCC, Congress and other federal and state agencies.

Action taken on the Plan will affect state regulatory proceedings, though to what extent is not yet known. The possible effects of the Plan will emerge through an extended series of rulemakings and Congressional hearings. As of this summer, the FCC has issued a Notice of Inquiry (NOI) and a Notice of Proposed Rulemaking (NPRM) on Universal Service Reform; a NPRM on Pole Attachments; a NOI regarding Classifications of Service; and a Referral to the Federal-State Joint Board on Universal Service for recommendations on expanding Universal Service Programs currently used to assist low-income consumers (Lifeline and Linkup) in obtaining and maintaining telephone service, to include broadband service.

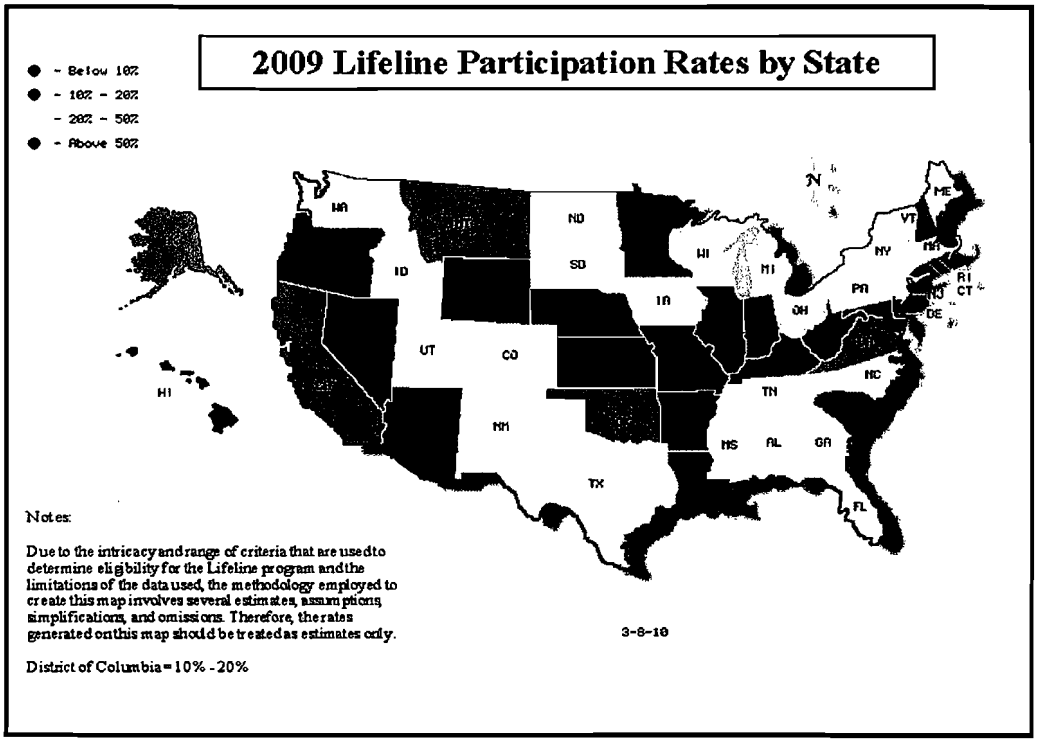
In its NPRM on Universal Service Reform, the FCC made several proposals that could have an adverse impact on Indiana rural local exchange carriers (RLECs) and mid-size ILECs. Based on recommendations in its National Broadband Plan, the FCC proposed to cap and ultimately eliminate existing federal high-cost (universal service) funding for traditional voice service and shift support to capital expenditures for broadband networks that will carry both voice and other applications that ride on the Internet. The FCC has also proposed to phase out and then eliminate access charge payments (payments made by long distance providers and others primarily to ILECs for originating, terminating, switching, and/or transporting certain types of long-distance traffic).

This is important to Indiana because, on average, an Indiana rural company receives more than 50% of its operating revenues from access charges and universal service support. It is important to note that many Indiana rural telephone companies are already offering both voice and broadband today, even though federal support is only designed for voice service. Because the small and mid-size companies are so dependent on access charges and high-cost support, parties are concerned that if the FCC eliminates or sharply reduces these revenue streams some Indiana companies may consider relinquishing their Provider of Last Resort (POLR) status and discontinuing both voice and broadband service in some of their service territories. If a company relinquishes its POLR status or discontinues service, the Commission is charged with finding a successor provider or replacement so that consumers in the affected area have access to communications services.[30] By affecting the viability of the existing providers, FCC action could result in a reduction in the universe of providers available for designation in rural areas by the Commission. Fewer providers would make the Commission's charge of finding a successor provider much more difficult. The IURC filed comments outlining its concerns with the FCC and will continue to monitor these proceedings and assess the potential impact of FCC decisions on Indiana companies and consumers. Additional rulemakings and other actions are expected to occur through the end of 2011. For a complete list, see Appendix C.

[30]This is allowed under I.C. § 8-1-32.4.

IV. COMMUNICATIONS APPENDICES

Appendix A – 2009 Lifeline Participation Rates by State



Source: Universal Service Administrative Company

Appendix B – Details on Communications Mergers

CenturyTel/Embarq

CenturyTel's merger with Embarq was completed on July 1, 2009, after receiving approval from the FCC and the U.S. Department of Justice (DOJ). Executives from both CenturyTel and Embarq stated that the newly merged entity will be a stronger, more competitive company, particularly in rural areas.[31] The resulting company will be the fourth largest local exchange company in the U.S., serving close to 7.3 million access lines, 2.1 million broadband customers, and approximately 470,000 video subscribers, spread out over 33 states.[32] As of December 31, 2009, the combined company, doing business as CenturyLink, served approximately 185,600 Indiana local access lines, predominantly in northern and southeastern Indiana.

Centennial Communications Corp./AT&T Inc.

Centennial Communications Corp.'s acquisition by AT&T Inc. was completed on November 6, 2009, after receiving approval from the FCC and the DOJ.[33] AT&T's acquisition of Centennial increased AT&T's cell phone holdings in Indiana. Centennial had a major presence in the Fort Wayne area, including the U.S. headquarters and a large call center. AT&T plans to implement a 3G upgrade in at least 75 of the Indiana cell sites it acquired from Centennial in 2010.[34]

CenturyLink/Qwest

On April 22, 2010, CenturyLink announced a proposed all-stock merger with Qwest. CenturyLink would also assume $11.8 billion of Qwest's debt. Qwest, formerly known as U.S. West, is a Regional Bell Operating Company whose ILEC territory is in the western United States. The combined company will have 360 employees and approximately 185,600 access lines in Indiana.[35] The companies hope to complete the merger by the end of the 2nd quarter of 2011.

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[31] http://www.fiercetelecom.com/story/centurytel-acquire-embarq/2008-10-27

[32] http://www.centurytelembarqmerger.com/aboutmerger/index.html (viewed on April 15, 2010)

[33] AT&T was required to divest itself of seven of Centennial's wireless operations in Louisiana and Mississippi, but none in Indiana.

[34] "Former Centennial Sites to Get 3G Upgrade," by Doug LeDuc, Greater Fort Wayne Business Weekly, April 1, 2010.

[35] Qwest currently has no access lines in Indiana.

Verizon/Frontier

Verizon's spin-off and merger of its wireline operations in 14 states (including Indiana) to Frontier was completed on June 30, 2010 after receiving approval from the FCC, the DOJ, and nine state commissions having jurisdiction over such transactions. Upon completion of the transaction, Frontier became the parent company of the Verizon spin-off, acquiring all of Verizon's local wireline telephone and FiOS operations in Indiana. The combined company will serve approximately 718,000 access lines in Indiana. As a result, Indiana will be the second largest state served by Frontier based on the number of access lines; Frontier will be the second largest provider in Indiana; and Fort Wayne will be the second largest city served by the new Frontier.

Appendix C – FCC Broadband Action Items Agenda

Proposed 2010 Key Broadband Action Agenda Items*

	Q2 2010 (CY)	Q3 2010 (CY)	Q4 2010 (CY)
Promote World-Leading Mobile Broadband Infrastructure and Innovation	Mobile Roaming Order and FNPRM (WTB)	AWS Bands Analysis (WTB, OET)	AWS Potential Order (WTB, OET)
	D Block Order/NPRM (WTB, PSHSB) [Also in Public Safety]		Secondary Markets Internal Review (WTB)
	Launch Strategic Spectrum Plan and Triennial Assessment (WTB, OET, OSP)	Spectrum Sharing/Wireless Backhaul NPRM/NOI (WTB, OET)	Spectrum Dashboard 2.0 (WTB, OET, PSHSB, MB, IB)
		Oppor. Use of Spectrum NPRM (OET, WTB, IB, MB, PSHSB)	Recommendation re: Contiguous Unlicensed Spectrum Proceeding (OET, WTB)
	2.3 GHz WCS/SDARS Order (OET, WTB, IB)	TV White Spaces Opinion & Order (OET, MB, WTB)	
		MSS NPRM (OET, IB, WTB)	Experimental Licensing NPRM (OET)
		Broadcast TV Spectrum Innovation NPRM (OET, MB, WTB)	
Accelerate Universal Broadband Access and Adoption	USF Reform NPRM and NOI (WCB, WTB)	Mobility Fund NPRM (WTB, WCB)	
	Lifeline/Low-Income Joint Board Referral Order (WCB, WTB)	Hearing Aid Compat. Second Report & Order/FNPRM (WTB, OET, CGB)	Spectrum on Tribal Lands NPRM (WTB, CGB)
	E-Rate FY2011 NPRM (WCB)	E-Rate FY2011 Order (WCB)	
	USF Merger Commitments Order (WCB, WTB)	Rural Health Care Reform NPRM (WCB)	USF Transformation NPRM (WCB, WTB)
	Lifeline Pilot Roundtable (WCB, WTB)	Lifeline Flexibility NPRM (WCB, WTB)	Intercarrier Compensation NPRM (WCB, WTB)
	FCC/FDA Workshop and PN on Converged Devices (OET)	Establish Accessibility and Innovation Forum (CGB, WCB, WTB)	USF Contributions NPRM (WCB, WTB)
	Launch FCC Office of Native American Affairs (CGB)	Real-Time Text NOI (CGB, WCB, WTB, OET)	Real-Time Text NPRM (CGB, WCB, WTB, OET)
	FCC-Native Nations Broadband Task Force (CGB)		Internet Video and Device Accessibility NOI (CGB, WCB, WTB, MB)
Foster Competition and Maximize Consumer Benefits Across the Broadband Ecosystem	Mobile Wireless Competition Report (WTB, OSP)	Interconnection Clarification Order (WCB)	
	Pole Attachments Order and FNPRM (WCB)	Rights-of-Way Task Force (CGB, WCB)	Small Business Broadband & Wholesale Comp. NOI (WCB)
	Small Business Broadband & Wholesale Comp. PN (WCB)		
	Special Access Workshop (WCB, WTB, OSP)	Special Access NPRM (WCB, WTB, OSP)	
	CableCARD NPRM (MB, OET)		
	Smart Video Devices NOI (MB, OET)		Smart Video Devices NPRM (MB, OET)
	Launch Tech. Adv. Grp. on Speed & Perf. (CGB, OET, WCB)	Transparency & Disclosure NPRM (CGB, WCB, WTB, OET)	
	Launch Speed and Performance Measurement Program (CGB, WTB, WCB, OET)		Broadband Data NPRM (WCB, WTB, OSP)
Advance Robust and Secure Public Safety Communi-cations Networks	Public Safety Roaming & Priority Access NPRM (WTB, PSHSB)		NG 911 NOI (PSHSB, OET, WCB, WTB)
	D Block Order/NPRM (WTB, PSHSB) [Also in Mobile]		Back-Up Power NOI (PSHSB, OET, WTB)
	700 MHz Waiver Petitions (PSHSB, WTB, OET)		Serv. Outage & Homeland Security NPRM (PSHSB, OET, WCB, WTB, IB)
	ERIC Public Safety Interoperability Order (PSHSB)	700 MHz Public Safety Order/FNPRM (PSHSB, WTB, OET)	
	Cybersecurity Certification NOI (PSHSB, WTB, OET, WCB)	Location Accuracy FNPRM (PSHSB, OET, WTB)	
	Survivability NOI (PSHSB, OET, WTB, WCB)		
	Serv. Outage & Homeland Security Workshop (PSHSB, OET, WCB, WTB, IB)		

Wireless Telecommunications Bureau (WTB) | Wireline Competition Bureau (WCB) | Office of Engineering and Technology (OET) | Media Bureau (MB) | Consumer & Governmental Affairs Bureau (CGB) | Public Safety & Homeland Security Bureau (PSHSB)

* This document reflects only proposed FCC actions, not those of other government agencies, and is not exhaustive of all 2010 FCC actions. The location and timing of actions in this document represents a series of targets that may be adjusted to respond to changing conditions as appropriate; items that span quarters are expected to occur late in the earlier quarter, or early in the later quarter. Does not include initiatives discussed in Agenda from Q1 2010 and earlier (E-rate Community Use Order, Rural Health Care Pilot Program Extension Order, Spectrum Dashboard Beta, and Tower Siting Declaratory Ruling).

Appendix D – IURC Report on Video Deployment in Indiana 2006-2009

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I. INTRODUCTION

HEA 1279

Before July 1, 2006, video services in Indiana were provided by firms that had negotiated local franchise agreements (LFAs) with local governmental units (units). These LFAs covered defined and discrete geographic areas that typically had high population densities (e.g., cities and towns). Indiana customers predominately only had one land-based video service provider (VSP) available to them, meaning that limited head-to-head and/or direct competition in the video service market existed.

The Video Section of HEA 1279,[1] which became effective on July 1, 2006, made the Indiana Utility Regulatory Commission (Commission) the sole issuer of new video service franchises. The statute permitted video service providers to convert existing local franchises into state-issued franchises within a limited time period or keep the local franchises in place until they expire. Some video service providers continue to provide service under locally-issued franchises and will do so until those franchises expire. Conditions of local franchises vary because the agreements were negotiated by different communities, with different video providers, at different times. In contrast, conditions for obtaining a state-issued franchise are standardized in a manner consistent with the requirements outlined in state law. The obligations for a state-issued franchise include reporting requirements on: areas served; changes to programming content; provision of Public, Educational and Governmental (PEG) channels; and payment of franchise fees to the local governmental units.

The state video franchising statute was created in part to increase the availability of video services throughout the state and increase competition among video providers as well as to provide consumers with choices in video service. The Federal Communications Commission (FCC) estimated that cable rates had risen 7.5 percent annually between 1998 and 2004.[2] In an

[1] *See,* I.C. § 8-1-34.

[2] Federal Communications Commission, *Report on Cable Industry Prices*, MM Docket No. 92-266, released February 4, 2005, Attachment 4. The commission's authority to regulate cable service tier prices, which began in 1992, ended on March 31, 1999, as provided in the Telecommunications Act of 1996. Local franchising authorities (e.g., municipalities) regulate the price of the basic tier of cable service, which includes only broadcast stations and public, educational, and government access channels. Federal Communications Commission, *Fact sheet – Cable television*, June 2000, 3, 5. http://www.fcc.gov/mb/facts/csgen.html

effort to mitigate increases in rates and encourage competition, Indiana legislators passed state franchising legislation in 2006. The statute represented the second state video franchise law in the country and provided the first comprehensive approach to video reform.

In 2006, when the law was enacted, all 92 counties in Indiana had at least one video provider that covered at least a portion of the county; however, only seven counties had county-wide video coverage.[3] This coverage, however, does not include satellite providers, which serve approximately 30% of the video service subscribers in the state. Because I.C. § 8-1-34(14) defines video service as "the transmission to subscribers of video programming and other programming service through facilities located at least in part in a public right-of-way", other competitive alternatives that do not meet that definition, including satellite, are not included in this analysis.

Statutory Requirements for the Four-Year Report

Section 64 of HEA 1279[4] required the Commission to conduct an analysis of the deployment of video service in Indiana's Metropolitan Statistical Areas (MSAs).[5] It specifically required the Commission to include the results of its analysis in its 2010 Report to the Regulatory Flexibility Committee. The statute lists specific data that the Commission was to collect for each MSA in Indiana, for each year during the four-year period from July 1, 2006 to July 1, 2010. The Commission collected the required data listed below and has included it as Appendix B:

- The median per capita income;
- Whether the MSA is a part of, or includes an underserved area;
- Identification of each provider offering video service and whether it provides service under a local or state-issued franchise;
- The type of technology used by each provider;
- Any infrastructure build-out initiated or completed during the data collection period; and
- Compliance with I.C. § 8-1-34-28 (Information regarding redlining complaints).

[3]Jay, Henry, Howard, Lake, Marion, Porter and Vermillion counties are the only counties in Indiana with county-wide video service coverage.
[4]*See,* I.C. § 8-1-1-2 Compilers Notes
[5]Metropolitan Statistical Areas do not cover the entire state.

Data Collection

The Commission collected data as required by statute in order to provide relevant information to the General Assembly regarding the growth of competition from year to year in Indiana's video market and the shift from local franchises to state franchises.

Sources of Data

The Commission developed multiple mediums to gather the data needed to monitor changes in Indiana's video market and the individual providers that make up that market. Information is gathered through applications for and notices of changes to state issued video franchise authority, quarterly reports from holders of state-issued franchises, the Annual IURC Communications Survey, FCC data on cable providers, and additional surveys to obtain specific information needed for reporting to the Regulatory Flexibility Committee.

State-Issued Franchise Application

In the application form for a state-issued franchise, created by the Commission pursuant to I.C. § 8-1-34, companies are required to provide detailed information regarding the designated service area in which they are seeking authority. Additionally, the Commission requires quarterly reports from the companies providing data at census block level indicating where the company is actually offering service. This detailed information allows the Commission to track the areas in Indiana where more than one video provider is offering service. It also enables the Commission to look for evidence of redlining because the data is available at a very granular level.

Annual Communications Survey

The Commission also collects data annually from video service providers in its Annual Communications Survey. The Survey gathers data at the zip code level regarding the number of subscribers purchasing analog versus digital packages, the technology used to provide the service and a description and price for the company's basic service offering. This data may be used to show the movement from analog to digital as well as pricing changes associated with that shift.

FCC Cable Providers List

The Commission also uses data gleaned from FCC cable provider lists in order to obtain information regarding cable companies providing service under existing local franchises. Staff has included in each Report to the Regulatory Flexibility Committee since the passage of HEA 1279, county level information regarding the areas served by those locally franchised companies that were not required, under HEA 1279, to make themselves known to the Commission until July 1, 2009.[6]

IURC MSA Level Video Survey

Additionally, in February 2010 the Commission sent a Survey to all video providers that it could identify to gather specific information at the MSA level to ensure the data provided to the General Assembly to satisfy the Reporting requirements in Section 64 of HEA 1279 was accurate and complete.

Storage and Analysis of Collected Data

The data collected from these various sources was entered into IURC databases that allowed the Commission to analyze the data and identify trends. The Commission created a Geographical Information System (GIS) to enable the creation of maps and the ability to distinguish between areas where companies provide service in different parts of the same county or zip code and areas where companies are actually engaged in head-to-head competition.

II. TRANSITION OF THE MARKET BY MSA 2006 – 2009

What is an MSA?

A Metropolitan Statistical Area or MSA is a core area containing a substantial population nucleus, together with adjacent counties having a high degree of economic and social integration with that core area. The 2000 standards provide that an MSA must have at least one urbanized area of 50,000 or more inhabitants.[7]

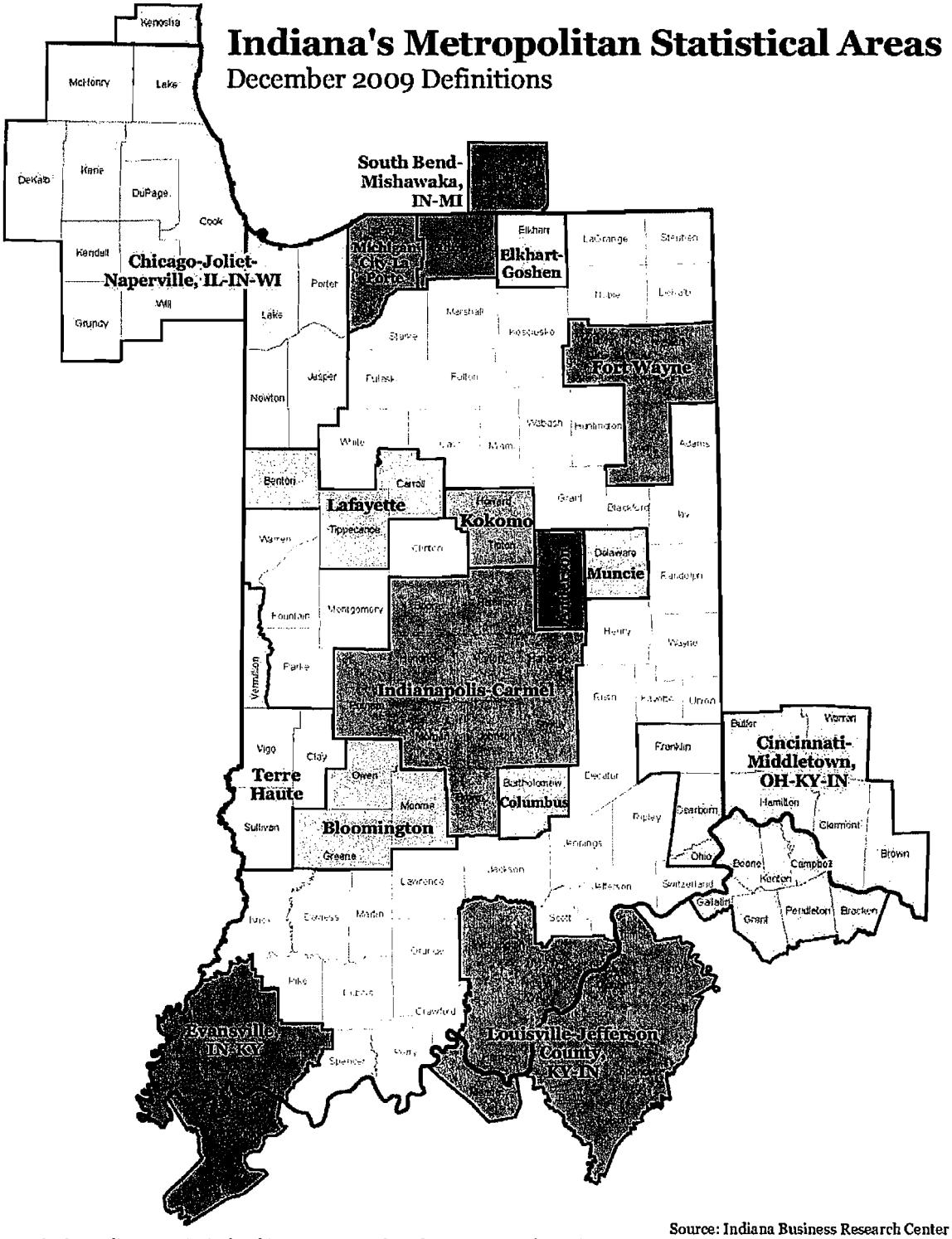
[6]Effective July 1, 2009 video providers doing business in Indiana were required to obtain a CTA as a Communications Service Provider. *See,* I.C. § 8-1-32.5

[7] www.census.gov/population/www/metroareas/metroarea.html

A MSA's geographic delineation is referred to as its "definition." MSAs are defined by the U.S. Office of Management and Budget (OMB) and are the result of the application of published standards to Census Bureau data. The standards for defining the areas are reviewed and revised once every ten years. Between censuses, the definitions are updated annually to reflect the most recent Census Bureau population estimates. Areas based on the 2000 standards and Census 2000 data were defined in June of 2003. The current definitions are as of November 2008.[8] A map showing the boundaries of Indiana's MSAs is included on the following page as Map 1.

[8] Ibid

Map 1



Note: The four Indiana counties in the Chicago metro area form the Gary Metropolitan Division

Source: Indiana Business Research Center
www.stats.indiana.edu

As the map shows, there are many counties in the state that are not part of an MSA due to their distance from a metropolitan area that meets the definitions explained above. For that reason, the analysis done at the MSA level fails to show a complete picture of video competition in Indiana.

Analysis of Data Collected to Comply with Section 64 of HEA 1279

Data regarding video service deployment over the last four years in the state's various MSAs is summarized in a table attached at the end of this report. It is important to note that MSAs are not uniform in size and, in many instances, cover large geographic areas (i.e., multiple counties), which makes meaningful analysis of the data difficult. Specific difficulties are discussed in greater detail later in this report. Nonetheless, the Commission offers the following analysis regarding information found in the MSA-level data.

State vs. Local Franchises

Analysis of the data collected by the Commission for the period from 2006 to 2009 shows there has been a steady migration of video service providers in Indiana's MSAs away from local franchise oversight to state-issued franchises. Increases in state-issued franchises can be attributed to the entrance of new providers in the market. Additionally, incumbent video providers had the option in HEA 1279 to convert local franchises into state-issued franchises. However, there does not appear to be any correlation between particular MSAs and the conversion of local franchises to state-issued franchises. Instead, conversion of franchise type is dependent on incumbent video providers' individualized decisions to convert their franchises. As large incumbent cable providers, like Comcast, Insight, and Charter Communications, opted to terminate their local franchise agreements, large portions of the state (inside and outside MSAs) instantly became serviced by state-issued franchises. Other large incumbent providers, like Mediacom and Brighthouse, chose not to terminate existing local agreements but instead converted parts of their service areas to state-issued franchises as the local franchise agreements expired.

Video Service Technologies

Since the passage of HEA 1279, there are three major types of technologies used in the state's MSAs to provide video service. Incumbent video providers use either coaxial cabling to provide analog video service or a combination of fiber optic cable and coaxial cable to provide both analog and digital programming. Incumbent video providers also have modified their networks to convert from coaxial only to the hybrid fiber-coaxial technology. New entrants, like AT&T, provide video service using a combination of newly installed fiber optic cabling and copper cable that is already deployed in their network to provide digital programming content.

Per Capita Income

Section 64 requires the Commission to report on the per capita income of each MSA; however, there does not appear to be any correlation between the per capita income in an MSA and the number of providers offering service. The same observation is true for infrastructure deployments by providers. Instead, data indicates that MSAs with higher population densities generally seem to draw the early deployment of video service facilities by new entrants and a greater number of video providers generally. This is to be expected given the greater number of potential customers and lower per customer capital expenditures present in more densely populated MSAs.

Infrastructure Build-outs

As reflected in the attached table summarizing the statutorily required data, new video service entrants have deployed significant infrastructure in MSAs across the state. Incumbent video providers have also undertaken infrastructure improvements to their existing systems. Most of the infrastructure build-outs undertaken from 2006 to 2009 in Indiana MSAs by video service providers with local franchises occurred without a requirement to do so under the controlling local franchise.

Redlining Complaints

Unlike local franchises that required video service providers to eventually offer service throughout the entirety of the area (e.g., city, town or unincorporated county), holders of state-issued franchises have no obligation to serve all areas where they hold a franchise. However, I.C.

§ 8-1-34-28 prohibits video providers with state-issued franchises from discriminating, based on the economic characteristics of a particular area, in the offering of service. This is known as redlining. To date the Commission has received no redlining complaints regarding carriers authorized to provide service in the state's MSAs.

Growth in the Number of Providers and Move to State-issued Franchises

In 2006, the IURC approved state-issued video service franchises for five companies that were either new service providers or existing service providers expanding into new areas. In 2007, four more companies obtained state-issued franchises; in 2008 there were two, and in 2009 there was one. In all, 12 companies received approval for state-issued video franchises in areas where they had not previously provided service.

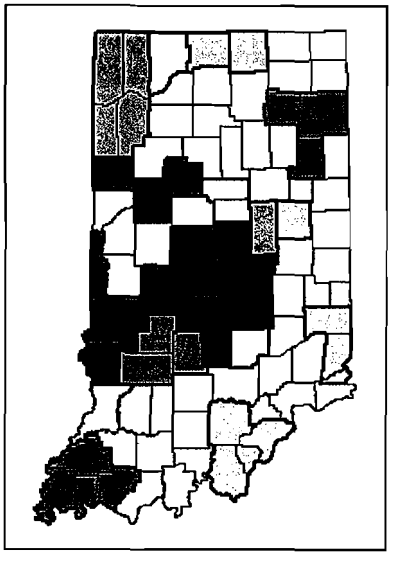
In 2006, five existing cable companies terminated their local franchises and acquired state-issued franchises. In 2007, four more existing cable providers obtained a state-issued franchise in some or all of their service territories, either terminating the previous local franchise or upon the expiration of those local franchises. In 2008, there were four; and in 2009, there were two more existing providers that sought state-issued franchises upon the expiration of some or all of their local franchises. In all, since the effective date of the state franchise statute, 15 existing companies sought and obtained state-issued video franchises.

Appendix A indentifies the companies that continue to hold state-issued franchises in all or part of their service areas. Some companies have been acquired and some have merged; whereas, others have not yet begun to provide service or have discontinued service.

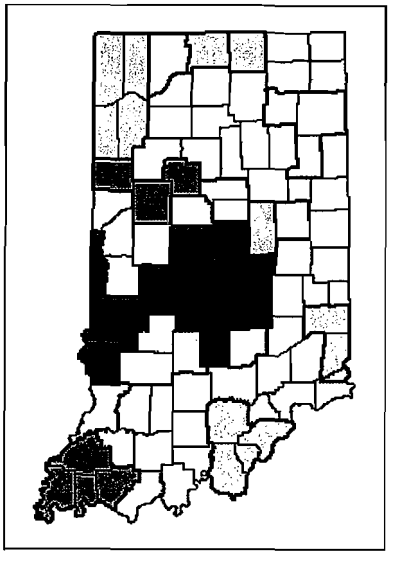
Maps 2 and 3 show the number of video service providers in each MSA that hold local franchises versus state franchises, respectively.

Map 2

Number of VSPs with Local Franchises By MSA



2006



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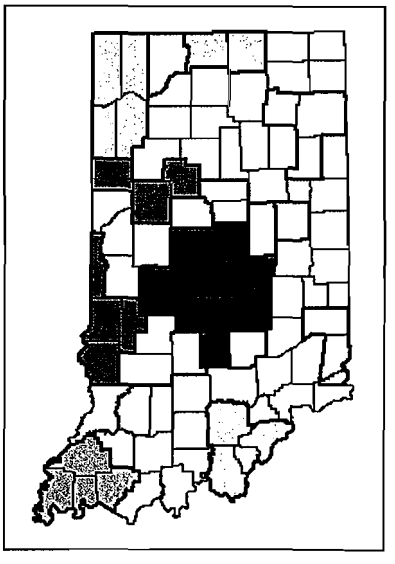

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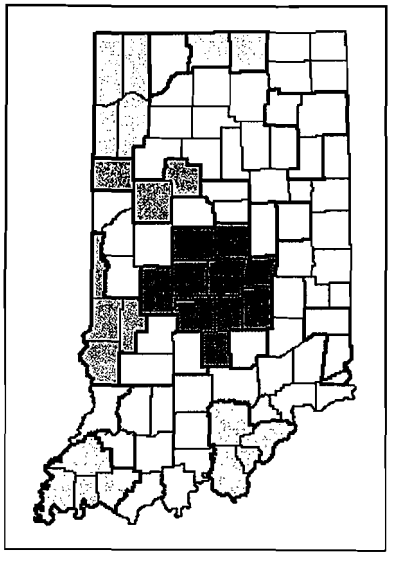

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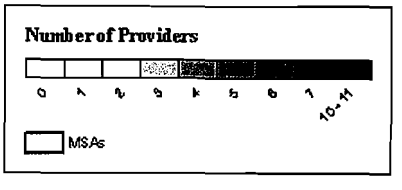
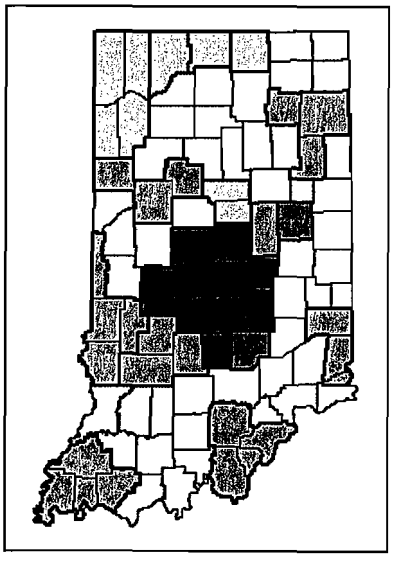


Map 3

Number of VSPs with State-Issued Franchises By MSA



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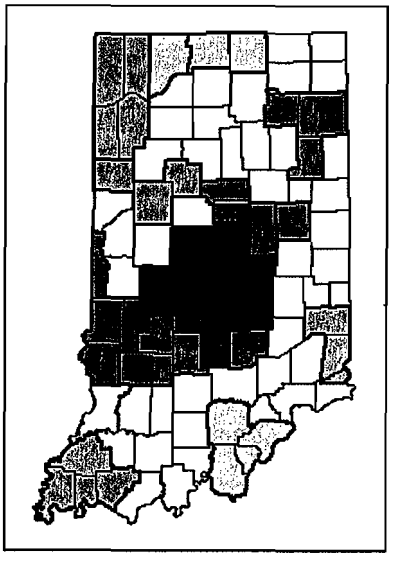

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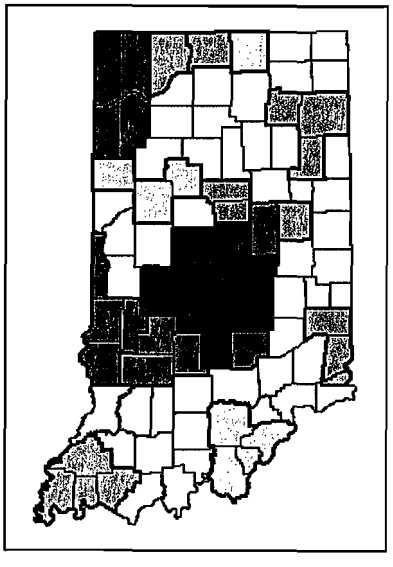

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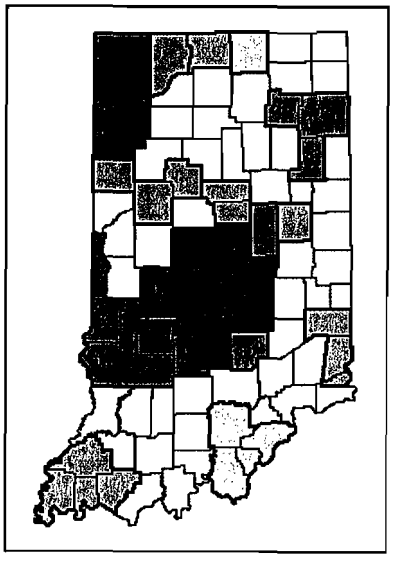

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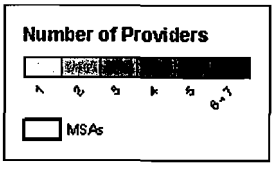


Limitations with Using MSA Level Data

Analysis of video competition expansion at the MSA level has limited value for many reasons. First of all, MSAs are very large, non-uniform geographic areas, in most cases encompassing multiple counties. Reporting at this level can obscure not only the scope of service provision by different providers, but also the growth in video service competition within the MSA. Second, reporting at this level ignores any competitive activity in the more rural areas of the state due to the fact that MSAs are made up of areas surrounding major metropolitan locations. These limitations are further explained by taking a closer look at the following areas: scope, growth, and urban vs. rural issues.

Scope

By simply reporting that a video provider is providing service in an MSA, it is impossible to identify the scope of the service offering. If the report shows that two providers are offering service in a given MSA, the two companies appear to be offering service to a similar area. However, the fact might be that one of the providers is offering service in the entire MSA while the other is offering service in only one small portion of one county within the MSA.

Growth

Reporting the data at this level obscures any expansion that a provider may implement over time. Once the provider is shown as offering service in any part of the MSA, only withdrawal from the MSA will show any change in the area served within the MSA. This is problematic if a company that is offering service in a small portion of an MSA also provides video service in an area that is not included in an MSA due to its rural characteristics. Hence, MSA-level data would not provide an accurate picture of the area served by that provider.

Urban vs. Rural

The definition of an MSA specifically excludes a large portion of the state from the analysis required under Section 64 of HEA 1279. Though some areas that are considered rural may be included in an MSA due to the county's proximity to a metropolitan area, many rural areas of Indiana are not accounted for in the analysis. However, it is true that the areas of the state that fall within an MSA have a much higher population density than those that do not. Because of

this, it is likely that competitors will be drawn to enter the market in those areas, which is why the Commission has undertaken additional analysis using data collected through the various video reporting requirements to show more comprehensive information at a more granular level than MSA.

III. BROADER ANALYSIS AT A MORE GRANULAR LEVEL

HEA 1279 provided the means for increased competition and, as a result, new competitors have emerged across Indiana. There may have been an expectation that competition in the video market would explode with the passage of state franchising legislation. The reality is, however, that new entrants have approached the deployment of video service from a business perspective. New video service deployment is happening where there is a business case for it. While the spread of competition may be slower than some expected, there is competition, and while the number of new competitors is small, there are new competitors in the market. The Phoenix Center addressed the issue of competition and build-out in a policy paper issued in 2006. In describing the level of facilities-based competition that should be expected in local communications markets the paper makes the point that:

> "...scale economies and sunk costs limit the number of firms that can profitably serve a market- and local communications networks are notoriously riddled with scale economies and sunk costs. Any policymaker interested in local communications markets should, therefore, start from the assumption that there will, at best, be only a "few" facilities-based firms. The notion that the local market can sustain five to seven local terrestrial networks all offering highly substitutable services is both naïve and unrealistic."[9]

According to this analysis, it is unreasonable to expect multiple competitors to enter the same markets and expect to make a profit. Therefore, the number of providers may be less than expected.

[9] http://www.phoenix-center.org/FCLJCompetitionAfterUnbundling.pdf

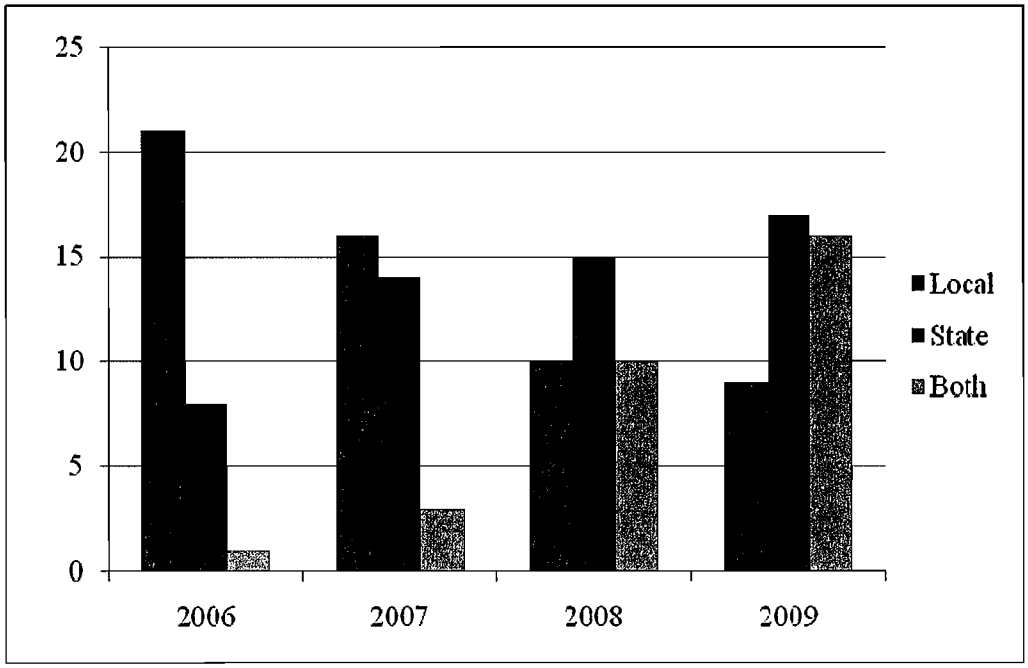
Moving from Local to State-issued Franchises

State vs. Local Franchises

Increasingly, video service is being offered by providers under state-issued franchises. As of December 31, 2009, 27 of the 38 video service providers (VSPs) providing service in Indiana held state-issued video service franchises, while the other nine continued to provide service under local franchises. According to information provided to the Commission by video service providers, video service was available from providers with state-issued franchises in about 52% of Indiana's census blocks, which contain approximately 79% of the state's population.[10]

Table 1

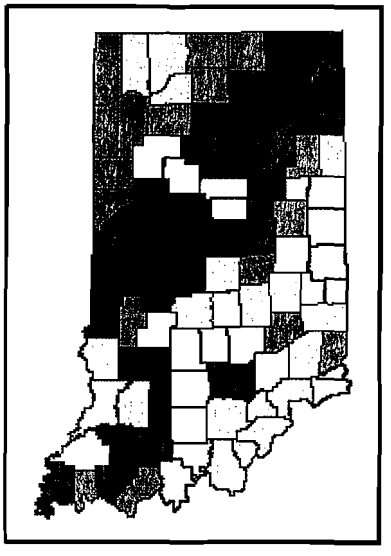
Number of Franchises by Year



[10]According to TIGER 2000 census block data from the Census Bureau, Indiana has a total of 201,321 census blocks.

Map 4

Number of VSPs with Local Franchises By County



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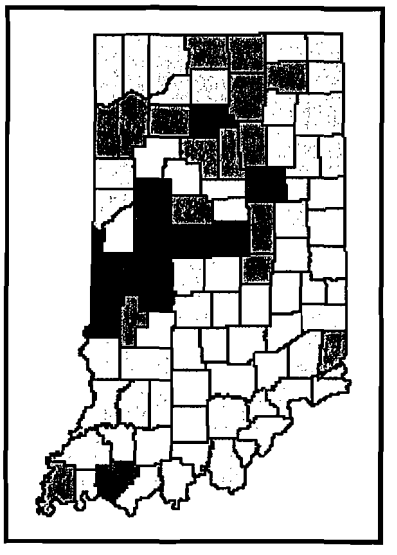

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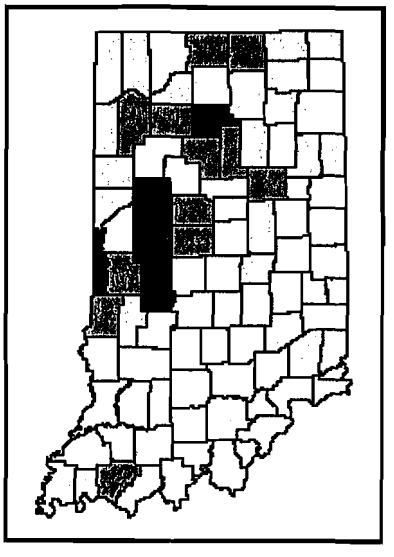

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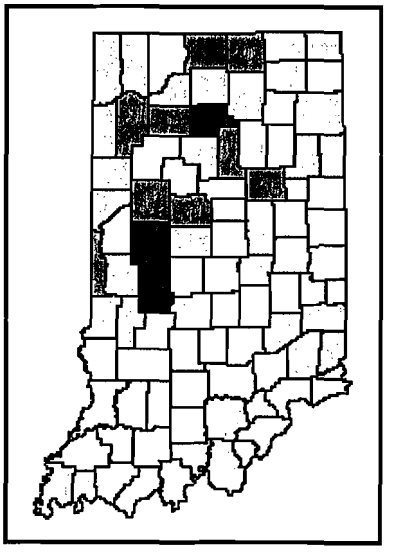

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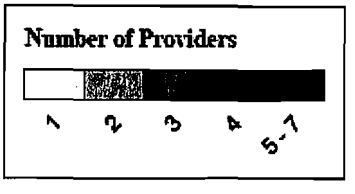
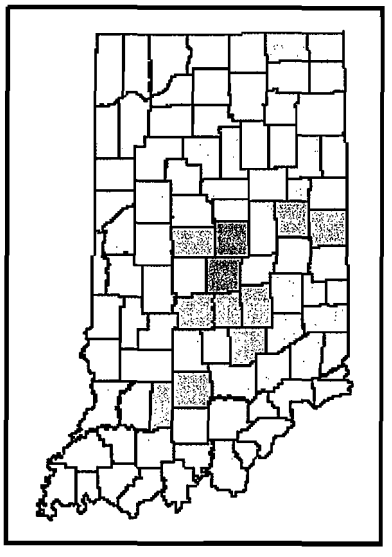


Map 5

Number of VSPs with State-Issued Franchises By County



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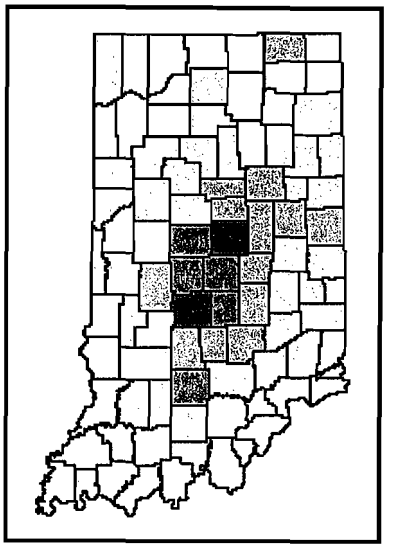

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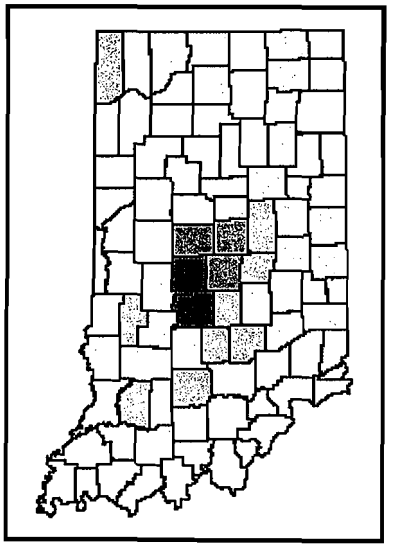

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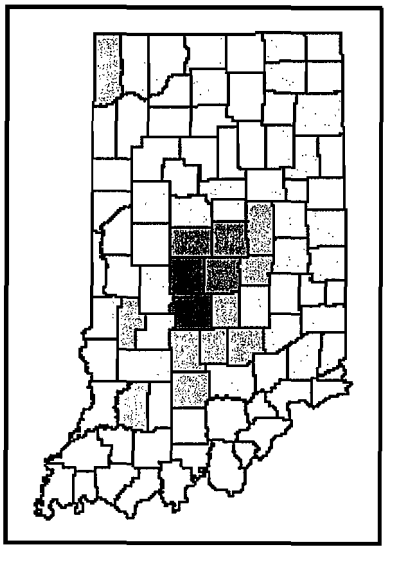

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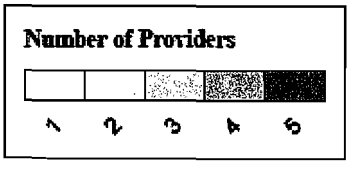


Affects of State Franchise Law on Business Practices

PEG Issues

Public, Educational and Governmental (PEG) programming is an area that changed dramatically when companies terminated their local franchises and obtained state-issued franchises. The IURC has received many inquiries regarding companies' obligations with regard to PEG channels. Some of the concerns raised dealt with financial support payments and the provision of facilities that were included in the local franchise but ceased after the companies switched to the state-issued franchise. An example of this was when Comcast notified producers in South Bend, Hammond, Merrillville, Mishawaka, Plymouth, Goshen, and Portage that it would be closing production studios and playback facilities for public access TV.[11] A few other communities have also approached Commission staff about the provision of PEG channels by new entrants, specifically that new entrants were not fulfilling the PEG obligations required of them in the statute. When contacted, Commission staff has consistently explained that governmental units have the option of filing a formal petition with the IURC to request resolution of the issue. To date, no governmental unit has filed a formal complaint with the Commission regarding the provision of PEG channels.

Consumer Complaints

Prior to the passage of HEA 1279, most local governmental units, in their role as the franchise authority, took complaints from cable customers and worked with the companies to reach a resolution. However, post-HEA 1279, those entities no longer have the authority to resolve complaints with cable companies under state-issued franchises; and the IURC, as the new franchise authority, encouraged the units to forward those complaints to the Commission's Consumer Affairs Division. Though HEA 1279 did not give the Commission authority over video service quality issues or specific authority to take and resolve customer complaints, the FCC delegates enforcement of the customer service standards set out in the Federal Cable Act[12] to franchise authorities. Through GAO 2007-2, effective March 19, 2008, the IURC, as the Indiana franchising authority, began enforcing the FCC customer service standards.

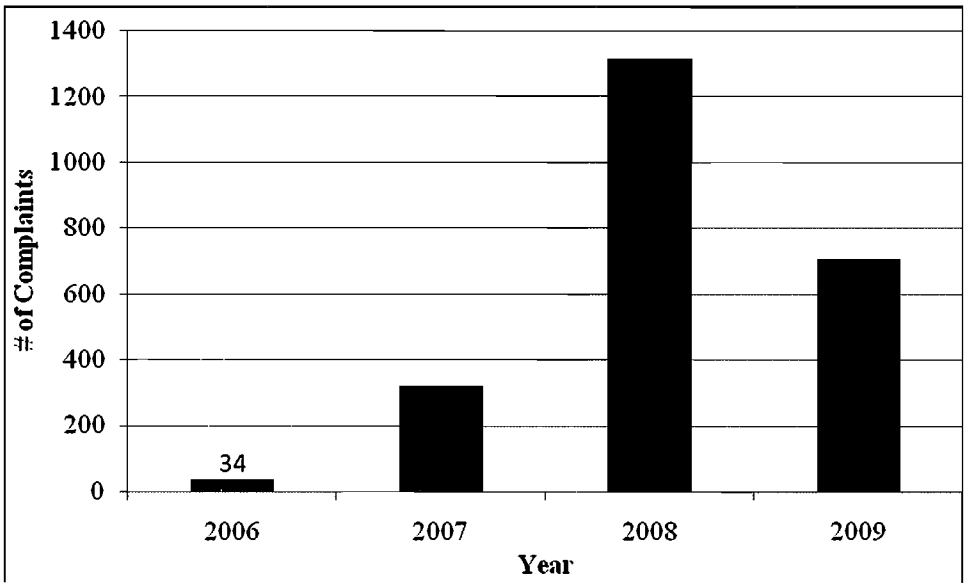
[11] http://www.ourchannelsindiana.org/index.php?option=com_content&task=view&id=68&Itemid=1
[12] 47 C.F.R § 76.309; Federal Communications Commission customer service standards

Enforcing the FCC standards allows the Commission to accept and resolve video customer service complaints from Indiana consumers. Consequently, the IURC's Consumer Affairs Division began to immediately record customer video service complaints.. Complaints that fit under the FCC standards are thoroughly investigated and resolved under the regular Consumer Affairs Division complaint process. Complaints that don't fit under the FCC standards are forwarded to the video provider for resolution under that company's process. Regardless of the type, video complaints are recorded and tallied to allow the Commission to accurately gauge the level of problems consumers are experiencing in Indiana's video market. Table 3 shows the numbers of complaints each year since the inception of state franchising.

For example, in 2006 the Commission received a very low number of complaints. This was likely due to the fact that the year reflected only six months worth of data and the fact that most of the companies that obtained a state franchise in 2006 did not do so until the fourth quarter. However, in 2007, there was an increase in the number of complaints that came in to the Commission. This was likely due to the fact that the IURC began reaching out to local units, encouraging them to cease taking complaints and begin directing the customers to call the IURC. The high number of complaints in 2008 can be at least partially attributed to the service quality issues that surrounded the transition of 320,000 Indiana Insight customers to Comcast as part of the dissolution of a joint venture between the two companies. More than a third of the total 2008 complaints received by the IURC were from Comcast customers between January and mid-April of that year.

Table 2

Total Video Complaints Received
By the IURC Consumer Affairs Division



Franchise Fees

Though there was much misinformation about franchise fees following the passage of HEA 1279, franchise fees continue to go directly to the local units. The state is in no way involved with the process. The only involvement by the IURC that can occur under the statute is when there is disagreement between the local unit and the video provider regarding the amount of revenues upon which the franchise fee is calculated. HEA 1279 provided the IURC with the authority to resolve disputes between video providers and local governmental units regarding the calculation of franchise fees. The City of Indianapolis and the City of Westfield filed complaints with the Commission requesting assistance in determining the amount the video providers in question should pay in franchise fees to the cities. The case involving the City of Indianapolis vs. Bright House Networks was withdrawn after the parties reached agreement. The complaint of the City of Westfield vs. AT&T, Bright House Networks, Comcast, and First Mile is still pending in Cause Number 43877.

Build-out Requirements vs. Redlining

As previously discussed, video service offered under local franchises typically included obligations for the provider that entered into the agreement. The requirements often included providing service throughout the entirety of the local unit (e.g., city, town, or unincorporated portions of a county), which is also known as a build-out requirement. State-issued video service franchises have no such build-out requirements. Instead, video providers under state-issued franchises are prohibited from discriminating in the offering of their service based on the economic makeup of an area, which is known as redlining. In particular, IC 8-1-34-28 prohibits a video provider under a state-issued franchise from denying access to any group of potential residential subscribers based on the income level of the residents in the local area in which the group resides. The Commission has an important role to play in resolving any such allegation of redlining. First, the Commission collects detailed data at a census block level on a quarterly basis related to where exactly a video provider with a state-issued franchise offers service. This data is housed by the GIS database. The electronic storage of this data facilitates access by parties interested in examining state-issued franchise service providers' respective service areas, which may be helpful to parties who suspect that redlining has occurred. The electronic format of the video providers' service areas, along with available census information on income, greatly facilitates analysis of potential redlining in the service territories.

In addition, the Commission also has a formal role to play in determining the validity of redlining allegations. Specifically, the Commission would be the recipient of any petition that alleges redlining by a video provider with a state-issued franchise. After holding a hearing on the matter, the Commission is empowered to determine that either no violation of the redlining statute has occurred or, if a violation has occurred, the date by which video service must be offered to those to whom access had been previously denied.

New Entrants vs. Existing Companies with State Franchises

Existing Video Providers

Before the passage of HEA 1279, video service was provided by incumbent cable companies that obtained local franchises from each city, town or unincorporated portions of counties in the state. Since the passage of HEA 1279, some cable companies have expanded the area they serve

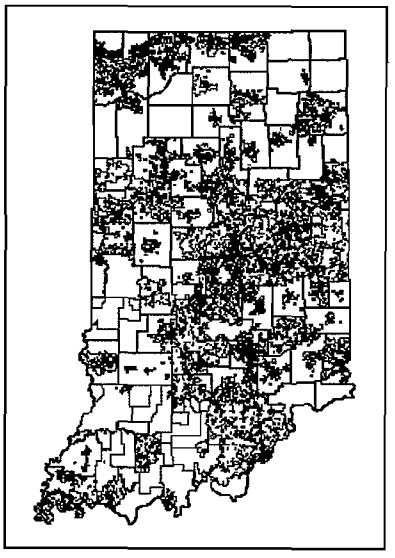
by a very small amount; however, the service territories of the incumbent providers have largely remained the same from 2006 through 2009 as they were prior to passage of the legislation.

The Commission has census block level data on the incumbent cable service territories that have been converted to state-issued franchises. The service territories served at the end of 2009 by incumbent video providers under state-issued franchises is displayed in Map 6. While this map does not indicate the areas served by incumbent providers under LFAs, it does show the extent to which the state has been and continues to be served by incumbent video providers. In addition, some incumbent video providers have ceased operation since the passage of HEA 1279. This conclusion is drawn from the fact that from year to year some companies' names have dropped off the FCC's list of registered communities and the providers that serve them. Because the Commission does not have direct jurisdiction over local franchise providers, the information surrounding local providers who have ceased operation is limited.

Nonetheless, there are anecdotal indications that many of these individual cable systems that ceased operation had a relatively small number of customers and faced increased fees to carry channels, like ESPN™, that may have contributed to their inability to continue providing video service. There have also been consolidations of incumbent cable companies which reduced the total number of companies providing service in some areas. For example, many cable systems formerly owned by Charter Communications were acquired by Avenue Broadband in late 2007 and many cable systems formerly owned by Insight were acquired by Comcast in early 2008.

Map 6

Incumbent VSPs with State-Issued Franchises (2006-2009)



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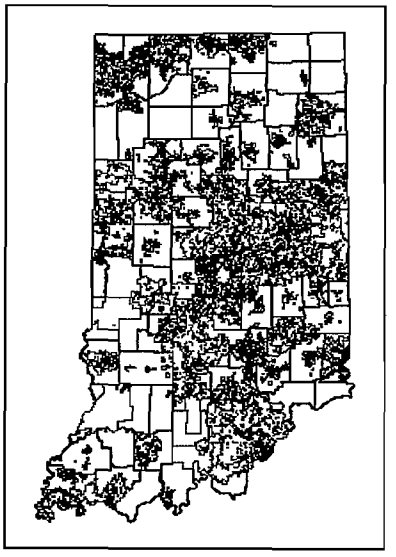

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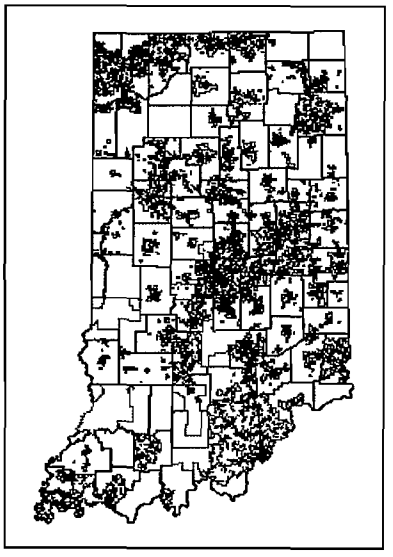

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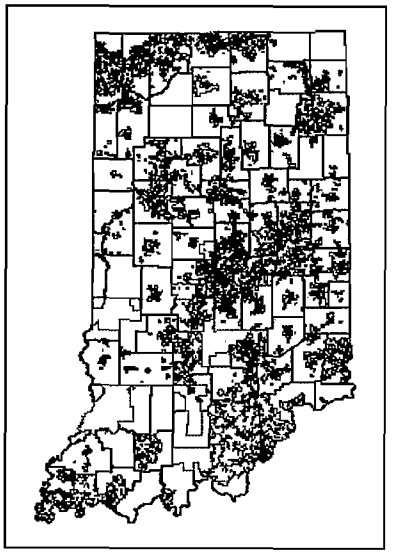


2009

Note: These maps do not indicate the service areas of any VSPs providing service under a local franchise.

New Entrants

According to information provided to the Commission by video service providers, 9 of the 12 new entrants with state-issued franchises were actively competing for customers in Indiana as of December 31, 2009. These entities were offering service in 35,861 census blocks in which they had not offered video service prior to the passage of HEA 1279. This is more than a tenfold increase in the number of census blocks that had competition since the end of 2006.

Table 3

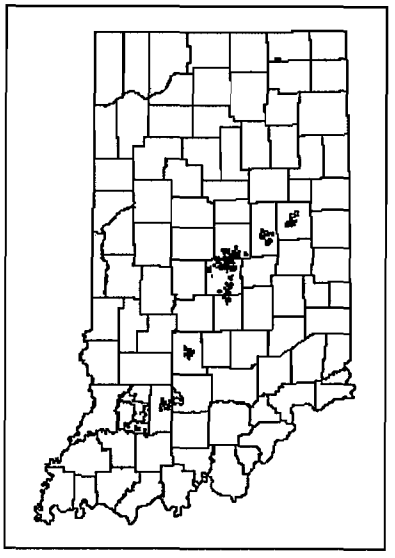
New Video Providers Actively Competing in Indiana

	2006	**2007**	**2008**	**2009**
# New Providers	3	6	7	9
# Census Blocks	3,064	18,911	31,962	35,861

New entrants in the video service market since the passage of HEA 1279 can be broadly classified in one of two categories: 1) large telephone providers, such as AT&T and Verizon; and 2) smaller telephone providers such as Smithville Telecom, Endeavor Communications, and ACME Communications. A complete list of new entrants in the video service market and the date each began offering service is included in Table 2. Over the last four years, both the number of new entrants and the territory they serve has expanded as illustrated by Map 7.

Map 7

New Entrant VSPs with State-Issued Franchises By Census Block



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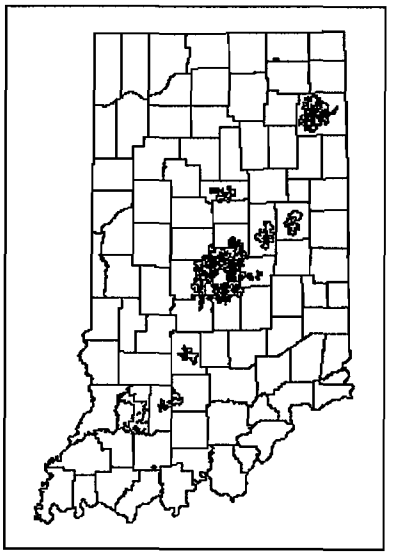

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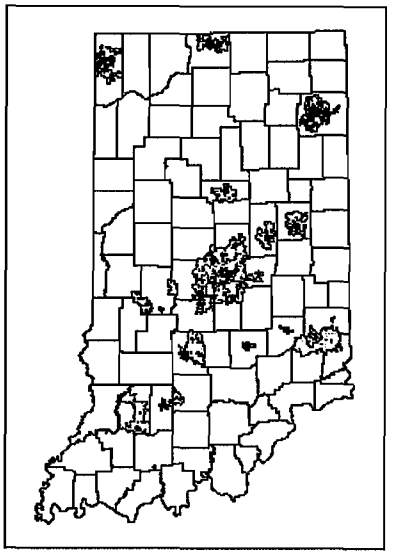

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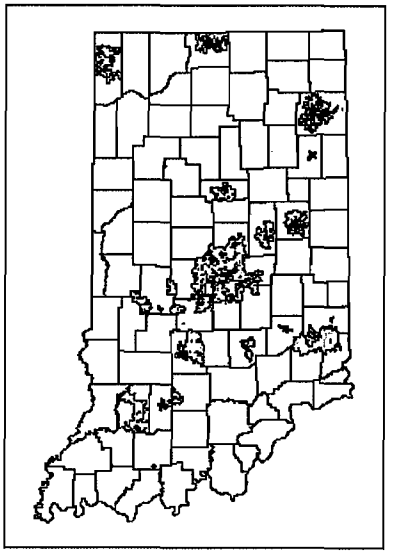

2009

Note: Data for each map is for the end of the year indicated. However, due to the confidentiality of more recent AT&T data, the 2009 map reflects AT&T's service territory as of June 30, 2009. Also, these maps do not indicate the service areas of any VSPs providing service under a local franchise.

IV. DISCUSSION OF ADDITIONAL MARKET COMPONENTS

Infrastructure Investments

While specific information related to the growth of video competition and the movement from local to state franchises provides an overview of the effects of state franchising legislation in Indiana, the level of investment by providers and potential providers of video service is also important to consider. Below are examples of investments companies have made to compete in Indiana's video market:

- From 2006 to 2008, AT&T deployed its AT&T U-verse™ services, including U-verse TV, U-verse High Speed Internet and U-verse Voice, in parts of several communities that included: Anderson, Bloomington, Columbus, Indianapolis, Muncie, Kokomo, South Bend, and areas across Lake County.[13] In 2009, AT&T continued the rollout of its U-verse™ service to more Indiana customers. Communities that received U-verse™ in 2009 included: Alexandria, Bedford, Charlestown, Chesterfield, Clarksville, Crawfordsville, Daleville, Jeffersonville, New Albany, Oolitic and Sellersburg.

- Verizon invested in fiber optic technology during the period from 2007 to 2010 to support its FiOS offerings in Allen County, which is in the Fort Wayne MSA.

- Comcast has undertaken a digital network enhancement that "converts analog channels to digital to create capacity for more advanced products and services." The company has invested more than $500 million, in Indiana, in network facilities and equipment since 2007. Comcast's regional headquarters is in Fishers, Indiana, and it has a customer base of more than 700,000 households statewide.[14]

- In 2009, Smithville Telecom, LLC, d/b/a Smithville TV, began a five-to-seven year multi-project fiber overbuild effort in Monroe County. As individual projects are completed, the company will begin offering IPTV to its customers over the fiber installed in that project. Smithville Telecom has a state-issued franchise in Monroe County, which is in the Bloomington MSA.

- Between 2008 and 2010, Central Indiana Communications, Inc., d/b/a HTV, invested in DSL and FTTH infrastructure in Hancock, Hamilton, Marion, Shelby, and Madison counties. These investments, which included both new construction and overbuilding existing copper facilities, are being used to provide Internet Protocol Television (IPTV) services in the Indianapolis and Anderson MSAs. HTV has a local franchise in Hancock County and a state-issued franchise in Hamilton, Marion, Shelby, and Madison counties.

[13] www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=26697
[14] Letter to IURC Commissioner Larry Landis from Scott Tenney, Sr. VP, Comcast Indpls. Region, July 29, 2010

- In 2006 and 2007, Indiana Fones, Inc., which merged into Central Indiana Communications, Inc., effective January 1, 2008, invested in DSL and FTTH infrastructure in Hamilton and Hancock counties. During this time period, Indiana Fones constructed facilities in new developments and overbuilt existing copper facilities with FTTH infrastructure deployments.

- Between 2007 and 2010, Clay County Rural Telephone Cooperative, Inc., d/b/a Endeavor Communications, invested in FTTH infrastructure in Hendricks, Putnam, Clay, and Morgan counties. These investments are being used to provide video services in the Indianapolis-Carmel and Terre Haute MSAs. Endeavor has a local franchise in portions of Morgan and Putnam counties and a state-issued franchise in Hendricks and Clay counties, as well as in other portions of Putnam and Morgan counties.

- Similarly, Miles Communications Corp., d/b/a Enhanced Telecommunications Corp. (Enhanced) invested in Fiber-to-the-Premises (FTTP) infrastructure and equipment in Franklin County between 2006 and 2010. This investment has allowed Enhanced to provide video services in the Cincinnati MSA. Enhanced has a local franchise in Franklin County.

- Rochester Telephone Company (RTC), located in north central Indiana, is nearing the end of a FTTH build-out project that began in 2003.[15] RTC serves about 90% of its subscriber base with fiber and offers triple play service bundles to those customers. RTC has invested in excess of $9 million and expects to invest an additional $2.5 million through the end of 2010. Rochester estimates an additional $600,000 in annual expenditures for the next eight years to fully convert its customers, all of whom are located in Fulton County, to fiber connectivity.

- From 2000 to 2010, Washington County Rural Telephone Cooperative, Inc. (Washington), invested in DSL infrastructure build-outs in Clark, Floyd, Scott, and Washington counties, which are in the Louisville MSA. Washington included the following note on its video survey response: "Infrastructure build-outs were initiated in the outer-most areas of the telephone exchange service territory, expanding inward towards the wire center (town of Pekin) of the entire telephone exchange. This order of implementation was necessary to reinforce the facilities for telephone, broadband and video services from the most needed to the least needed areas."

- From 2006 to 2010, Indiana Datapipe began investing in fiber and IPTV infrastructure in Tippecanoe County, located in the Lafayette MSA. Although the infrastructure build out is not complete, the company stated, in response to the Commission's 2006 – 2010 "Survey of Video Services in Indiana," that it expects "this network will eventually be used to deliver video services using IPTV (Internet Protocol Television)."

[15]RTC received federal universal service support but no federal stimulus funding.

- Mulberry Cooperative Telephone Co., Inc., located in central Indiana, invested in both FTTH and fiber-to-the-node (FTTN) technologies, as well as major hardware, switching, and software upgrades over the last few years. Mulberry invested more than $1 million in 2009 alone, and Mulberry serves 1,600 DSL/Internet customers and 1,075 video customers in western Clinton County and eastern Tippecanoe County.

Additionally, several CSPs have made investments and deployed technologies that could be used to provide both broadband and video services. In some cases, the desire to provide video services may have been an incentive for companies to invest in infrastructure that could be used to provide both. Furthermore, adding video to the set of services traveling over a particular optical fiber would create an additional revenue stream that might make the investment more profitable.

IV. APPENDICES

Appendix A – Companies with State-Issued Certificates of Franchise Authority

As of 12/31/09

Company Name	1st Franchise Granted	New or Existing Provider	Date in-service/ Notes on Some Existing Systems
AT&T Indiana[16]	8/30/2006	New	12/28/06
Daviess-Martin County Rural Telephone Corporation	9/13/2006	New	10/1/06
Comcast[17]	11/30/2006	Existing	
LIG TV	11/30/2006	New in requested service area	Discontinued Service 1/3/2008
Time Warner Cable[18]	12/06/2006	Existing	
Insight Communications Midwest, LLC	12/06/2006	Existing	
Perry-Spencer Communications	12/13/2006	New in requested service area	12/1/07
FirstMile Technologies	12/20/2006	Existing	
Verizon North Inc.	12/23/2006	New	7/17/07
Wow! Internet, Cable and Phone[19]	1/24/2007	Existing	
Adams Wells TV	2/07/2007	New	6/1/2009
Bright House Networks, LLC	2/28/2007	Existing	
Endeavor Communications[20]	3/14/2007	New	3/14/07
ACME Communications	6/06/2007	New	Not yet providing service
Citizen's Telephone Corporation	7/25/2007	Existing	
Avenue Broadband	10/24/2007	Existing	Purchased Charter Properties
New Paris Telephone Co.	10/30/2007	New	1/28/2008
Cequel III Communications	1/4/2008	Existing	
Smithville Telecom, LLC	7/9/2008	New	11/16/2009
Cinergy MetroNet Inc.	9/10/2008	Existing	
Enhanced Telecommunications Corp.	9/17/2008	New in requested service area	10/15/2008
Central Indiana Communications	10/1/2008	Existing	
Mediacom Indiana, LLC	10/8/2008	Existing	
Windjammer Communications	12/4/2008	Existing	Purchased Some Time Warner Properties
Indiana Datapipe, LLC	8/26/2009	New	Not yet providing service
TV Cable of Rensselaer	9/3/2009	Existing	
Mulberry Co-op Telephone Co. Inc.	9/23/2009	Existing	

[16]AT&T Indiana has two state-issued franchises.
[17]Consists of 14 affiliated Comcast companies with separate franchises.
[18]Consists of three affiliated Time Warner Cable companies with separate franchises, latest of which was issued 11/12/2009.
[19]Consists of two affiliated Wow! Internet, Cable and Phone companies with separate franchises.
[20]An affiliated Endeavor Communications company was also granted franchise on 6/1/2009.

Appendix B – Analysis of Deployment of Video Service in Indiana[21]

[21] See the following spreadsheets for data related to the analysis of deployment of video service in Indiana.

Analysis of Deployment of Video Service in Indiana
CY 2006
(Pursuant to HEA 1279 Section 64)

Providers Offering Video Service in Indiana MSAs (2006)	Per Capita Income	MSA Includes an Underserved Area[1]	Franchise Type	Video Service Offered in 2006	Technology Used	Infrastructure Buildout Initiated or Completed	Buildout Required by LFA?	Redlining Complaints
Indiana	**$32,842**							
Anderson, IN	**$29,225**	Not Available						
AT&T Indiana			State	Yes	IPTV-FTTN	Yes	N/A	None
Bright House Networks, LLC			Local	Yes	Hybrid-Fiber Coax	No	No	N/A
Comcast			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Longview Cable and Data, LLC[2]								
Bloomington, IN	**$27,225**	Not Available						
AT&T Indiana			State	Yes	IPTV-FTTN	Yes	N/A	None
Cequel III Communications II, LLC, d/b/a Suddenlink			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
Insight Communications Midwest, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Chicago-Naperville-Joliet, IL-IN-WI	**$41,654**	Not Available						
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
Mediacom Indiana, LLC			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
TV Cable of Rensselaer, Inc.			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
Wow! Internet, Cable and Phone			Local	Yes	Co-axial Cable	No	N/A	N/A
Cincinnati-Middletown, OH-KY-IN	**$36,299**	Not Available						
Comcast			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Insight Communications Midwest, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	N/A

Analysis of Deployment Video Service in Indiana
CY 2006
(Pursuant to HEA 1279 Section 64)

Providers Offering Video Service in Indiana MSAs (2006)	Per Capita Income	MSA Includes an Underserved Area[1]	Franchise Type	Video Service Offered in 2006	Technology Used	Infrastructure Buildout Initiated or Completed	Buildout Required by LFA?	Redlining Complaints
Miles Communications Corp.			Local	Yes	FTTP	Yes	No	N/A
Sunman Cablevision Company			Local	Yes	Co-axial Cable	Yes	No	N/A
Time Warner Cable			Local	Yes	Hybrid-Fiber Coax	No	No	N/A
Columbus, IN	**$35,326**	Not Available						
Comcast			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Charter Communications			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Insight Communications Midwest, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Elkhart-Goshen, IN	**$32,382**	Not Available						
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
Mediacom Indiana, LLC			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
New Paris Telephone's Quality Cablevision, Inc.			Local	Yes	Co-axial Cable	No	N/A	N/A
Evansville,IN-KY	**$33,849**	Not Available						
Cequel III Communications II, LLC			Local	Yes	Hybrid-Fiber Coax	No	No	N/A
Charter Communications			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Insight Communications Midwest, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Perry-Spencer Communications, Inc.			Local	Yes	ADSL 2+	No	N/A	N/A
Sigecom, LLC			Local	Yes	Hybrid-Fiber Coax	Yes	No	N/A
Time Warner NY Cable, LLC			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A

Analysis of Deployment of Video Service in Indiana
CY 2006
(Pursuant to HEA 1279 Section 64)

Providers Offering Video Service in Indiana MSAs (2006)	Per Capita Income	MSA Includes an Underserved Area[1]	Franchise Type	Video Service Offered in 2006	Technology Used	Infrastructure Buildout Initiated or Completed	Buildout Required by LFA?	Redlining Complaints
Fort Wayne, IN	**$32,018**	Not Available						
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
Craigville Telephone Company			State	No	FTTH	Yes	N/A	None
Longview Cable and Data LLC[2]								
Mediacom Indiana, LLC			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
Verizon North, Inc.			State	No	FTTH	Yes	N/A	None
Warren Cable[2]								
Indianapolis-Carmel, IN	**$37,345**	Not Available						
AT&T Indiana			State	Yes	IPTV-FTTN	Yes	N/A	None
Bright House Networks, LLC			Local	Yes	Hybrid Fiber Coax	No	N/A	N/A
Cequel III Communications II, LLC d/b/a Suddenlink			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
Charter Communications			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Cinergy MetroNet, Inc.			Local	Yes	FTTH	Yes	No	N/A
Clay County Rural Telephone Coop.			Local	Yes	FTTH	No	No	N/A
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
E.com			State	Yes	Hybrid Fiber Coax	No	N/A	None
Full Choice Communications, Inc.			Local	Yes	Coaxial Cable	No	N/A	N/A
Glass Antenna Systems, Inc[2]								

Analysis of Deployment Video Service in Indiana
CY 2006
(Pursuant to HEA 1279 Section 64)

Providers Offering Video Service in Indiana MSAs (2006)	Per Capita Income	MSA Includes an Underserved Area[1]	Franchise Type	Video Service Offered in 2006	Technology Used	Infrastructure Buildout Initiated or Completed	Buildout Required by LFA?	Redlining Complaints
Indiana Fones, Inc.			Local	Yes	IPTV via FTTH and DSL	Yes	No	N/A
Insight Communications Midwest, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Longview Cable and Data, LLC[2]								
Rapid Communications, LLC[2]								
Kokomo, IN	**$31,218**	Not Available						
Insight Communications Midwest, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Lafayette, IN	**$27,774**	Not Available						
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
Indiana Datapipe, LLC			Local	No	Fiber/IPTV	Yes	No	N/A
Insight Communications Midwest, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Mulberry Cooperative Telephone Company			Local	Yes	FTTN/ADSL2+/C	Yes	No	N/A
Longview Cable and Data, LLC[2]								
Rapid Communications Corp.[2]								
Tri-County Communications Corp.			Local	Yes	Analog 450 MHz	No	N/A	N/A
Louisville-Jefferson County, KY-IN	**$35,871**	Not Available						
Century Cablevision Holdings, LLC, Debtor-in-Possession/Time Warner Cable[2]								
Charter Communications			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Insight Communications Midwest, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Washington County Rural Telephone Cooperative, Inc. d/b/a TeleMedia Solutions			Local	Yes	DSL	Yes	No	N/A

Analysis of Deployment of Video Service in Indiana
CY 2006
(Pursuant to HEA 1279 Section 64)

Providers Offering Video Service in Indiana MSAs (2006)	Per Capita Income	MSA Includes an Underserved Area[1]	Franchise Type	Video Service Offered in 2006	Technology Used	Infrastructure Buildout Initiated or Completed	Buildout Required by LFA?	Redlining Complaints
Michigan City-La Porte, IN	**$27,924**	Not Available						
Acme Communications, Inc.				No	FTTH	Yes	N/A	N/A
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
Mediacom Indiana, LLC			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
Muncie, IN	**$26,782**	Not Available						
AT&T Indiana			State	Yes	IPTV-FTTN	Yes	N/A	None
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
Insight Communications Midwest, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Longview Cable and Data, LLC[2]								
South Bend-Mishawaka, IN-MI	**$33,218**	Not Available						
Comcast			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Mediacom Indiana, LLC			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
TW Fanch-One Company			Local	Yes	Coaxial Cable	No	N/A	N/A

Analysis of Deployment Video Service in Indiana
CY 2006
(Pursuant to HEA 1279 Section 64)

Providers Offering Video Service in Indiana MSAs (2006)	Per Capita Income	MSA Includes an Underserved Area[1]	Franchise Type	Video Service Offered in 2006	Technology Used	Infrastructure Buildout Initiated or Completed	Buildout Required by LFA?	Redlining Complaints
Terre Haute, IN	**$26,208**	Not Available						
Cequel III Communications II, LLC d/b/a Suddenlink			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
Charter Communications			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Insight Communications Midwest, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Longview Cable and Data, LLC[2]								
Rapid Communications, LLC[2]								
Time Warner Cable			Local	Yes	Hybrid-Fiber Coax	Yes	No	N/A

[1]The data compiled by the Indiana Office of Technology defines an underserved area as a census block, where broadband service at advertised speeds of at least 768 kilobits per second (kbps) downstream and at least 200 kbps upstream to end users, is not available to at least one household. This data had not yet been compiled in 2006.

[2]This entity was identified in FCC records as providing video service. The entity does not hold a state-issued video franchise, and staff was unable to collect data regarding a local franchise.

Analysis of Deployment of Video Service in Indiana
CY 2007
(Pursuant to HEA 1279 Section 64)

Providers Offering Video Service in Indiana MSAs (2007)	Per Capita Income	MSA Includes an Underserved Area[1]	Franchise Type	Video Service Offered in 2007	Technology Used	Infrastructure Buildout Initiated or Completed	Buildout Required by LFA?	Redlining Complaints
Indiana	**$33,702**							
Anderson, IN	**$29,929**	Not Available						
AT&T			State	Yes	IPTV	Yes	N/A	None
Bright House Networks, LLC			Local	Yes	Hybrid-Fiber Coax	No	No	N/A
Comcast			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Insight Communications Midwest, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Bloomington, IN	**$28,595**	Not Available						
AT&T			State	Yes	IPTV	Yes	N/A	None
Cequel III Communications II, LLC, d/b/a Suddenlink			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
Full Choice Communications, Inc.			Local	Yes	Coaxial Cable	No	N/A	N/A
Insight Communications Midwest, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Chicago-Naperville-Joliet, IL-IN-WI	**$44,346**	Not Available						
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
Mediacom Indiana, LLC			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
TV Cable of Rensselaer, Inc.			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
WOW! Internet, Cable and Phone			Both	Yes	Hybrid-Fiber Coax	No	N/A	None

Analysis of Deployment Video Service in Indiana
CY 2007
(Pursuant to HEA 1279 Section 64)

Providers Offering Video Service in Indiana MSAs (2007)	Per Capita Income	MSA Includes an Underserved Area[1]	Franchise Type	Video Service Offered in 2007	Technology Used	Infrastructure Buildout Initiated or Completed	Buildout Required by LFA?	Redlining Complaints
Cincinnati-Middletown, OH-KY-IN	**$37,782**	Not Available						
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
Insight Communications Midwest, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Miles Communications Corp.			Local	Yes	FTTP	Yes	No	N/A
Sunman Telecommunications Corp.			Local	Yes	Coaxial Cable	Yes	No	N/A
Time Warner Entertainment Company, LP			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
Columbus, IN	**$36,957**	Not Available						
Avenue Broadband Communications			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
Insight Communications Midwest, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Elkhart-Goshen, IN	**$33,369**	Not Available						
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
Mediacom Indiana, LLC			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
New Paris Telephone's Quality Cablevision, Inc.			Local	Yes	Coaxial Cable	No	N/A	N/A
Evansville,IN-KY	**$34,832**	Not Available						
Avenue Broadband Communications			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Cequel III Communications			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
Insight Communications Midwest, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	None
P.C. One Cable[2]								
Perry-Spencer Communications, Inc.			Local	Yes	ADSL 2+	No	N/A	N/A

Analysis of Deployment of Video Service in Indiana
CY 2007
(Pursuant to HEA 1279 Section 64)

Providers Offering Video Service in Indiana MSAs (2007)	Per Capita Income	MSA Includes an Underserved Area[1]	Franchise Type	Video Service Offered in 2007	Technology Used	Infrastructure Buildout Initiated or Completed	Buildout Required by LFA?	Redlining Complaints
Sigecom, LLC			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
Telecommunications Management, LLC dba NewWave			Local	Yes	Coaxial Cable	No	N/A	N/A
Time Warner Entertainment, LP			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
Time Warner NY Cable, LLC			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
TW Fanch-One Company[2]								
WOW! Internet, Cable and Phone			State	Yes	Hybrid-Fiber Coax	N/A	N/A	None
Fort Wayne, IN	**$33,173**	Not Available						
Comcast			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Craigville Telephone Company			State	No	FTTH	No	N/A	None
Insight Communications Midwest			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Mediacom Indiana, LLC			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
Verizon North, Inc.			State	Yes	FTTH	Yes	N/A	None
Indianapolis-Carmel, IN	**$38,455**	Not Available						
AT&T			State	Yes	IPTV-FTTN	Yes	N/A	None
Avenue Broadband Communications			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Bright House Networks, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Cinergy MetroNet, Inc.			Local	Yes	FTTH	Yes	No	N/A
Clay County Rural Telephone Coop.			Both	Yes	FTTH	Yes	No	None
Comcast			State	Yes	Hybrid-Fiber Coax	No	N/A	None
E.com			State	Yes	Hybrid Fiber Coax	Yes	N/A	None
Full Choice Communications, Inc.			Local	Yes	Coaxial Cable	No	N/A	N/A

Analysis of Deployment Video Service in Indiana
CY 2007
(Pursuant to HEA 1279 Section 64)

Providers Offering Video Service in Indiana MSAs (2007)	Per Capita Income	MSA Includes an Underserved Area[1]	Franchise Type	Video Service Offered in 2007	Technology Used	Infrastructure Buildout Initiated or Completed	Buildout Required by LFA?	Redlining Complaints
Galaxy American Communications[2]								
Glass Antenna Systems, Inc d/b/a Globalcom, Inc.[2]								
Indiana Fones, Inc.			Local	Yes	IPTV via FTTH and DSL	Yes	No	N/A
Insight Communications Midwest			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Longview Cable and Data, LLC[2]								
Kokomo, IN	**$32,581**	Not Available						
AT&T			State	Yes	IPTV-FTTN	Initiated	N/A	None
Insight Communications Midwest, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Lafayette, IN	**$28,979**	Not Available						
Comcast			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Full Choice Communications, Inc.			Local	Yes	Coaxial Cable	No	N/A	N/A
Indiana Datapipe, LLC			State	No	Fiber/IPTV	Yes	No	None
Insight Communications Midwest, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Mulberry Cooperative Telephone Company			Local	Yes	FTTN/ADSL2+/C	Yes	No	N/A
Tri-County Communications Corp.			Local	Yes	Analog 450 MHz	No	N/A	N/A
Louisville-Jefferson County, KY-IN	**$37,473**	Not Available						
Insight Communications Midwest, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Time Warner Cable[2]								

Analysis of Deployment of Video Service in Indiana
CY 2007
(Pursuant to HEA 1279 Section 64)

Providers Offering Video Service in Indiana MSAs (2007)	Per Capita Income	MSA Includes an Underserved Area[1]	Franchise Type	Video Service Offered in 2007	Technology Used	Infrastructure Buildout Initiated or Completed	Buildout Required by LFA?	Redlining Complaints
Washington County Rural Telephone Cooperative, Inc. d/b/a TeleMedia Solutions			Local	Yes	DSL	Yes	No	N/A
Michigan City-La Porte, IN	**$28,945**	Not Available						
Acme			State	No	FTTH	Yes	N/A	None
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
Mediacom Indiana, LLC			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
Muncie, IN	**$27,611**	Not Available						
AT&T			State	Yes	IPTV-FTTN	Yes	N/A	None
Comcast			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Longview Cable and Data, LLC								
South Bend-Mishawaka, IN-MI	**$34,638**	Not Available						
Comcast			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Mediacom Indiana, LLC			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
TW Fanch-One Company			Local	Yes	Coaxial Cable	No	N/A	N/A
Terre Haute, IN	**$27,404**	Not Available						
Avenue Broadband Communications			Both	Yes	Coaxial Cable	No	No	None
Cequel III Communications II, LLC d/b/a Suddenlink			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
Insight Communications Midwest, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Full Choice Communications, Inc.			Local	Yes	Coaxial Cable	No	N/A	N/A

Analysis of Deployment Video Service in Indiana
CY 2007
(Pursuant to HEA 1279 Section 64)

Providers Offering Video Service in Indiana MSAs (2007)	Per Capita Income	MSA Includes an Underserved Area[1]	Franchise Type	Video Service Offered in 2007	Technology Used	Infrastructure Buildout Initiated or Completed	Buildout Required by LFA?	Redlining Complaints
Glass Antenna Systems[2]								
P.C. One Cable[2]								
Time Warner Entertainment Company, LP			Local	Yes	Hybrid-Fiber Coax	Yes	No	N/A

[1]The data compiled by the Indiana Office of Technology defines an underserved area as a census block, where broadband service at advertised speeds of at least 768 kilobits per second (kbps) downstream and at least 200 kbps upstream to end users, is not available to at least one household. This data had not yet been compiled in 2007.

[2]This entity was identified in FCC records as providing video service. The entity does not hold a state-issued video franchise, and staff was unable to collect data regarding a local franchise.

Analysis of Deployment of Video Service in Indiana
CY 2008
(Pursuant to HEA 1279 Section 64)

Providers Offering Video Service in Indiana MSAs (2008)	Per Capita Income	MSA Includes an Underserved Area[1]	Franchise Type	Video Service Offered	Technology Used	Infrastructure Buildout Initiated or Completed	Buildout Required by LFA?	Redlining Complaints
Indiana	**$34,543**							
Anderson, IN	**$30,674**	Not Available						
AT&T			State	Yes	IPTV-FTTN	Yes	N/A	None
Bright House Networks, LLC			Local	Yes	Hybrid-Fiber Coax	No	No	N/A
Central Indiana Communications, Inc.			State	Yes	IPTV via FTTH and DSL	Yes	No	None
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
Bloomington, IN	**$30,231**	Not Available						
AT&T			State	Yes	IPTV-FTTN	Yes	N/A	None
Cequel III Communications II, LLC, d/b/a Suddenlink			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
Full Choice Communications, Inc.			Local	Yes	Coaxial Cable	No	N/A	N/A
Smithville Telecom, LLC			State	Yes	IPTV-FTTN	Yes	N/A	None
Chicago-Naperville-Joliet, IL-IN-WI	**$45,377**	Not Available						
AT&T			State	Yes	IPTV-FTTN	Yes	N/A	None
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
Mediacom Indiana, LLC			Both	Yes	Hybrid-Fiber Coax	No	N/A	None
TV Cable of Rensselaer, Inc.			Both	Yes	Hybrid-Fiber Coax	No	N/A	None
Wow! Internet, Cable and Phone			Both	Yes	Coaxial	No	N/A	None
Cincinnati-Middletown, OH-KY-IN	**$39,066**	Not Available						
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
Miles Communications Corp.			Local	Yes	FTTP	Yes	No	N/A

Analysis of Deployment of Video Service in Indiana
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Providers Offering Video Service in Indiana MSAs (2008)	Per Capita Income	MSA Includes an Underserved Area[1]	Franchise Type	Video Service Offered	Technology Used	Infrastructure Buildout Initiated or Completed	Buildout Required by LFA?	Redlining Complaints
Sunman Telecommunications Corp.			Both	Yes	Co-axial Cable	Yes	No	None
Time Warner Entertainment Company, LP			Local	Yes	Hybrid-Fiber Coax	No	No	N/A
Columbus, IN	**$38,068**	Not Available						
AT&T			State	No	IPTV-FTTN	Yes	N/A	None
Avenue Broadband Communications			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Comcast			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Elkhart-Goshen, IN	**$32,263**	Not Available						
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
Mediacom Indiana, LLC			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
New Paris Telephone's Quality Cablevision, Inc.			Local	Yes	Coaxial Cable	No	N/A	N/A
Evansville,IN-KY	**$36,329**	Not Available						
Avenue Broadband Communications			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Cequel III Communications			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
Insight Communications Midwest, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Perry-Spencer Communications, Inc.			Local	Yes	ADSL 2+	No	N/A	N/A
Sigecom, LLC			State	Yes	Hybrid-Fiber Coax	N/A	N/A	None
Telecommunications Management, LLC d/b/a NewWave			Local	Yes	Co-axial Cable	No	N/A	N/A
Time Warner NY Cable, LLC			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
Fort Wayne, IN	**$34,176**	Not Available						
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None

Analysis of Deployment of Video Service in Indiana
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Providers Offering Video Service in Indiana MSAs (2008)	Per Capita Income	MSA Includes an Underserved Area[1]	Franchise Type	Video Service Offered	Technology Used	Infrastructure Buildout Initiated or Completed	Buildout Required by LFA?	Redlining Complaints
Craigville Telephone Company			State	No	FTTH	Yes	N/A	None
Mediacom Indiana, LLC			Local	Yes	Hybrid-Fiber Coax	Yes	N/A	N/A
Verizon North, Inc.			State	Yes	FTTH	Yes	N/A	None
Indianapolis-Carmel, IN	**$39,297**	Not Available						
AT&T			State	Yes	IPTV-FTTN	Yes	N/A	None
Avenue Broadband Communications			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Bright House Networks, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Central Indiana Communications, Inc.			Both	Yes	IPTV via FTTH and DSL	Yes	No	None
Cinergy MetroNet, Inc.			Both	Local Only	FTTH	Yes	No	None
Clay County Rural Telephone Coop.			Both	Yes	FTTH	Yes	No	None
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
E.com			State	Yes	Hybrid Fiber Coax	No	N/A	None
Full Choice Communications, Inc.			Local	Yes	Coaxial Cable	No	N/A	N/A
Kokomo, IN	**$32,752**	Not Available						
AT&T			State	Yes	IPTV-FTTN	Yes	N/A	None
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
Lafayette, IN	**$30,921**	Not Available						
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
Full Choice Communications, Inc.			Local	Yes	Coaxial Cable	No	N/A	N/A
Indiana Datapipe, LLC			State	No	Fiber/IPTV	Yes	No	None
Mulberry Cooperative Telephone Company			Local	Yes	FTTN/ADSL2+/C	Yes	No	N/A

Analysis of Deployment Video Service in Indiana
CY 2008
(Pursuant to HEA 1279 Section 64)

Providers Offering Video Service in Indiana MSAs (2008)	Per Capita Income	MSA Includes an Underserved Area[1]	Franchise Type	Video Service Offered	Technology Used	Infrastructure Buildout Initiated or Completed	Buildout Required by LFA?	Redlining Complaints
Tri-County Communications Corp.			Local	Yes	Analog 450 MHz	No	N/A	N/A
Louisville-Jefferson County, KY-IN	**$37,995**	Not Available						
Insight Communications Midwest, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Windjammer Communications, LLC			Local	Yes	Coaxial Cable	No	N/A	N/A
Washington County Rural Telephone Cooperative, Inc. d/b/a TeleMedia Solutions			Local	Yes	DSL	Yes	No	N/A
Michigan City-La Porte, IN	**$30,689**	Not Available						
Acme Communications, Inc.			State	No	FTTH	Yes	N/A	None
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
Mediacom Indiana, LLC			Both	Yes	Hybrid-Fiber Coax	No	N/A	None
Muncie, IN	**$29,349**	Not Available						
AT&T			State	Yes	IPTV-FTTN	Yes	N/A	None
Comcast			State	Yes	Hybrid-Fiber Coax	No	N/A	None
South Bend-Mishawaka, IN-MI	**$34,986**	Not Available						
AT&T			State	Yes	IPTV-FTTN	Yes	N/A	None
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
Mediacom Indiana, LLC			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
Windjammer Communications, LLC			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
Terre Haute, IN	**$29,652**	Not Available						

Analysis of Deployment of Video Service in Indiana
CY 2008
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Providers Offering Video Service in Indiana MSAs (2008)	Per Capita Income	MSA Includes an Underserved Area[1]	Franchise Type	Video Service Offered	Technology Used	Infrastructure Buildout Initiated or Completed	Buildout Required by LFA?	Redlining Complaints
Avenue Broadband Communications			Both	Yes	Coaxial Cable	No	N/A	None
Cequel III Communications II, LLC d/b/a Suddenlink			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Clay County Rural Telephone Coop.			State	Yes	FTTH	Yes	N/A	None
Comcast			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Full Choice Communications, Inc.			Local	Yes	Coaxial Cable	No	N/A	N/A
Glass Antenna Systems[2]								
Time Warner Entertainment Company, LP			Local	Yes	Hybrid-Fiber Coax	Yes	No	N/A

[1]The data compiled by the Indiana Office of Technology defines an underserved area as a census block, where broadband service at advertised speeds of at least 768 kilobits per second (kbps) downstream and at least 200 kbps upstream to end users, is not available to at least one household. This data had not yet been compiled in 2008.

[2]This entity was identified in FCC records as providing video service. The entity does not hold a state-issued video franchise, and staff was unable to collect data regarding a local franchise.

Analysis of Deployment Video Service in Indiana
CY 2009
(Pursuant to HEA 1279 Section 64)

Providers Offering Video Service in Indiana MSAs (2009)	Per Capita Income[3]	MSA Includes an Underserved Area[1]	Franchise Type	Video Service Offered	Technology Used	Infrastructure Buildout Initiated or Completed	Buildout Required by LFA?	Redlining Complaints
Indiana								
Anderson, IN	Not Available	No						
AT&T			State	Yes	IPTV-FTTN	Yes	N/A	None
Central Indiana Communications, Inc.			State	Yes	IPTV via FTTH and DSL	Yes	No	None
Bright House Networks, LLC			Local	Yes	Hybrid-Fiber Coax	No	No	N/A
Comcast			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Longview Communications[2]								
Bloomington, IN	Not Available	Yes						
AT&T			State	Yes	IPTV-FTTN	Yes	N/A	None
Cequel III Communications II, LLC, d/b/a Suddenlink			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
Full Choice Communications, Inc.			Local	Yes	Coaxial Cable	No	N/A	N/A
Smithville Telecom, LLC			State	Yes	IPTV-FTTH	Yes	N/A	None
Chicago-Naperville-Joliet, IL-IN-WI	Not Available	No						
AT&T			State	Yes	IPTV-FTTN	Yes	N/A	None
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
Mediacom Indiana, LLC			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
TV Cable of Rensselaer, Inc.			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
Wow! Internet, Cable and Phone			Both	Yes	Coaxial	No	N/A	None

Analysis of Deployment of Video Service in Indiana
CY 2009
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Providers Offering Video Service in Indiana MSAs (2009)	Per Capita Income[3]	MSA Includes an Underserved Area[1]	Franchise Type	Video Service Offered	Technology Used	Infrastructure Buildout Initiated or Completed	Buildout Required by LFA?	Redlining Complaints
Cincinnati-Middletown, OH-KY-IN	Not Available	Yes						
Comcast			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Insight Communications Midwest, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Miles Communications Corp.			Local	Yes	FTTP	Yes	No	N/A
Sunman Telecommunications Corp.			Both	Yes	Coaxial Cable	Yes	No	None
Time Warner Entertainment Company, LP			Local	Yes	Hybrid-Fiber Coax	No	No	N/A
Columbus, IN	Not Available	Yes						
AT&T			State	Yes	IPTV-FTTN	Yes	N/A	None
Avenue Broadband Communications			Both	Yes	Coaxial Cable	No	No	None
Comcast			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Elkhart-Goshen, IN	Not Available	Yes						
Comcast			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Mediacom Indiana, LLC			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
New Paris Telephone's Quality Cablevision, Inc.			Both	Yes	Coaxial Cable	No	N/A	None
Evansville,IN-KY	Not Available	Yes						
Avenue Broadband Communications			Both	Yes	Coaxial Cable	No	No	None
Cequel III Communications			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Insight Communications Midwest, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	None

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Providers Offering Video Service in Indiana MSAs (2009)	Per Capita Income[3]	MSA Includes an Underserved Area[1]	Franchise Type	Video Service Offered	Technology Used	Infrastructure Buildout Initiated or Completed	Buildout Required by LFA?	Redlining Complaints
Perry-Spencer Communications, Inc.			Local	Yes	ADSL 2+	No	N/A	N/A
Sigecom, LLC			State	Yes	Hybrid-Fiber Coax	N/A	N/A	None
Telecommunications Management, LLC dba NewWave			Local	Yes	Coaxial Cable	No	N/A	N/A
Time Warner NY Cable, LLC			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
Fort Wayne, IN	Not Available	Yes						
Comcast			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Craigville Telephone Company			State	Yes	FTTH	Yes	N/A	None
Mediacom Indiana, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Verizon North, Inc.			State	Yes	FTTH	Yes	N/A	None
Indianapolis-Carmel, IN	Not Available	Yes						
AT&T			State	Yes	IPTV-FTTN	Yes	N/A	None
Avenue Broadband Communications			Both	Yes	Coaxial Cable	No	No	None
Bright House Networks, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Central Indiana Communications, Inc.			Both	Yes	IPTV via FTTH and DSL	Yes	No	None
Cinergy MetroNet, Inc.			Both	Local Only	FTTH	Yes	No	None
Clay County Rural Telephone Coop.			Both	Yes	FTTH	Yes	No	None
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
E.com			State	Yes	Hybrid Fiber Coax	Yes	N/A	None
Full Choice Communications, Inc.			Local	Yes	Coaxial Cable	No	N/A	N/A
Longview Communications[2]								

Analysis of Deployment of Video Service in Indiana
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Providers Offering Video Service in Indiana MSAs (2009)	Per Capita Income[3]	MSA Includes an Underserved Area[1]	Franchise Type	Video Service Offered	Technology Used	Infrastructure Buildout Initiated or Completed	Buildout Required by LFA?	Redlining Complaints
Kokomo, IN	Not Available	No						
AT&T			State	Yes	IPTV-FTTN	Yes	N/A	None
Comcast			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Lafayette, IN	Not Available	Yes						
Comcast			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Full Choice Communications, Inc.			Local	Yes	Coaxial Cable	No	N/A	N/A
Indiana Datapipe, LLC			State	No	Fiber/IPTV	Yes	No	None
Mulberry Cooperative Telephone Company			Both	Yes	FTTN/ADSL2+/C	Yes	No	None
Tri-County Communications Corp.			Local	Yes	Analog 450 MHz	No	N/A	N/A
Louisville-Jefferson County, KY-IN	Not Available	Yes						
Insight Communications Midwest, LLC			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Windjammer Communications, LLC			State	Yes	Coaxial Cable	No	N/A	None
Washington County Rural Telephone Cooperative, Inc. d/b/a TeleMedia Solutions			Local	Yes	DSL	Yes	No	N/A
Michigan City-La Porte, IN	Not Available	No						
Acme Communications, Inc.			State	No	FTTH	Yes	N/A	N/A
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
Mediacom Indiana, LLC			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A

Analysis of Deployment | Video Service in Indiana
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Providers Offering Video Service in Indiana MSAs (2009)	Per Capita Income[3]	MSA Includes an Underserved Area[1]	Franchise Type	Video Service Offered	Technology Used	Infrastructure Buildout Initiated or Completed	Buildout Required by LFA?	Redlining Complaints
Muncie, IN	Not Available	Yes						
AT&T			State	Yes	IPTV-FTTN	Yes	N/A	None
Comcast			State	Yes	Hybrid-Fiber Coax	No	N/A	None
South Bend-Mishawaka, IN-MI		Yes						
AT&T			State	Yes	IPTV-FTTN	Yes	N/A	None
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
Mediacom Indiana, LLC			Local	Yes	Hybrid-Fiber Coax	No	N/A	N/A
Windjammer Communications, LLC			State	Yes	Coaxial Cable	No	N/A	None
Terre Haute, IN	Not Available	Yes						
Avenue Broadband Communications			Both	Yes	Coaxial Cable	No	No	None
Cequel III Communications II, LLC d/b/a Suddenlink			State	Yes	Hybrid-Fiber Coax	No	N/A	None
Clay County Rural Telephone Coop.			State	Yes	FTTH	Yes	N/A	None
Comcast			State	Yes	Hybrid-Fiber Coax	Yes	N/A	None
Full Choice Communications, Inc.			Local	Yes	Coaxial Cable	No	N/A	N/A
Glass Antenna Systems[2]								
Time Warner Entertainment Company, LP			Local	Yes	Hybrid-Fiber Coax	Yes	No	N/A

[1]The data compiled by the Indiana Office of Technology defines an underserved area as a census block, where broadband service at advertised speeds of at least 768 kilobits per second (kbps) downstream and at least 200 kbps upstream to end users, is not available to at least one household.

[2]This entity was identified in FCC records as providing video service. The entity does not hold a state-issued video franchise, and staff was unable to collect data regarding a local franchise.

[3]2009 Income Data not yet available from Bureau of Economic Analysis-U.S. Departement of Commerce.

ACRONYMS

A

ADSL – Asynchronous Digital Subscriber Line

AEP – American Electric Power

AFUDC – Allowance for Funds Used During Construction

AGA – American Gas Association

AOS – Alternative Operator Service

ARP – Alternative Regulatory Plan

AWWA – American Water Works Association

B

Bcf – Billion cubic feet

BPL – Broadband over Power Lines

BTS – Basic Telecommunications Service

Btu – British thermal unit

C

CAIR – Clean Air Interstate Rule

CalWaRN – California Water/Wastewater Agency Response Network

CAMR – Clean Air Mercury Rule

CCT – Clean Coal Technology

CETCs - Competitive Eligible Telecommunications Carriers

CGA – Common Ground Alliance

CLEC – Competitive Local Exchange Carrier

CPCN – Certificate of Public Convenience and Necessity

CT – Combustion Turbine

CTA – Certificate of Territorial Authority

CWA – Communications Workers of America

D

DIMP – Distribution Integrity Management Program

DNR – Indiana Department of Natural Resources

DSA – Designated Service Area

DSIC – Distribution System Improvement Charge

DSL – Digital Subscriber Line

DVR – Digital Video Recorder

E

EEFC – Energy Efficiency Funding Component

EIA – Energy Information Administration

EPA – U.S. Environmental Protection Agency

EPAct – Energy Policy Act of 2005

ERO – Electric Reliability Organization

ETC – Eligible Telecommunications Carrier

F

FAC – Fuel Adjustment Clause

FCC – Federal Communications Commission

FERC- Federal Energy Regulatory Commission

FT – Firm Transportation

FTR – Financial Transmission Rights

FTTH – Fiber-to-the-Home

H

HEA – House Enrolled Act

I

ICTA – Indiana Cable Telecommunications Association

IDEM – Indiana Department of Environmental Management

IEDC – Indiana Economic Development Corporation

IGCC – Integrated Gasification Combined Cycle

ILAP – Indiana Lifeline Assistance Program

ILEC – Incumbent Local Exchange Carrier

I&M – Indiana Michigan Power Company, subsidiary of AEP

IMP – Integrity Management Program

IMPA – Indiana Municipal Power Agency

INWARN – Indiana Water/Wastewater Agency Response Network

IOU – Investor-owned utility, financed by the sale of securities

IPTV – Internet Protocol Television

IPL – Indianapolis Power and Light

ISDH – Indiana State Department of Health

ISO – Independent System Operator

ISP – Internet Service Provider

IT – Interruptible Transportation

ITU – International Telecommunication Union

IUPPS – Indiana Underground Plant Protection Service

IURC – Indiana Utility Regulatory Commission

IUSF – Indiana Universal Service Fund

L

LDC – Local Distribution Company

LFA – Local Franchise Authority

LMG – Landfill Methane Gas

LMOP – Landfill Methane Outreach Program

LNG – Liquefied Natural Gas

M

Mcf – Million cubic feet

MGT – Midwestern Gas Transmission

Midwest ISO – Midwest Independent Transmission System Operator

MMBtu – One million British Thermal Units. Generally accepted as a rough equivalent of an Mcf.

MMcf – One million cubic feet

MMTCE – Million metric tons of carbon equivalent

MS4 – Municipal Separate Storm Sewer System

MSW – Municipal Solid Waste

MTEP – Midwest ISO Transmission Expansion Plan

MVPD – Multichannel Video Programming Distributor

MW – Megawatts

MWH – Megawatt Hour

N

NANPA – North American Numbering Plan Administrator

NAPSR – National Association of Pipeline Safety Representatives

NARUC – National Association of Regulatory Utility Commissioners

NCTA – National Cable and Telecommunications Association

NERC – North American Electric Reliability Council

NIPSCO – Northern Indiana Public Service Company

NO_x – Nitrogen Oxides

NOAA – National Oceanic and Atmospheric Administration

NOPR – Notice of Proposed Rulemaking

NPDES – National Pollutant Discharge Elimination System

NPMS – National Pipeline Mapping System

NRRI – National Regulatory Research Institute

NTA – Normal Temperature Adjustment

O

OECD – Organization for Economic Cooperation and Development

OMS – Organization of Midwest ISO States

OPS – Office of Pipeline Safety

OQ – Operator Qualification

OUCC – Office of Utility Consumer Counselor

P

PHMSA - Pipeline Hazardous Materials Safety Administration

PIPES – Pipeline Integrity, Protection, Enforcement, and Safety

PJM – The PJM Interconnection

POLR – Provider of Last Resort

PPA – Purchase Power Agreement

PPTT – Purchased Power and Transmission Tracker

PSA – Pipeline Safety Adjustment

PSAPs – Public Safety Answering Points

PSI – PSI Energy

PSTN – Public Switched Telephone Network

PUHCA – Public Utility Holding Company Act of 1935

PUHCA 2005 – Public Utility Holding Company Act of 2005

PURPA – Public Utility Regulatory Policies Act of 1978

R

RFP – Request for proposals

RLECs – Rural Incumbent Local Exchange Carriers

RSD – Regional Sewer District

RSG – Revenue Sufficiency Guarantee

RTO – Regional Transmission Organization

S

SDC – System Development Charge

SIGECO – Southern Indiana Gas & Electric Company

SNG – Synthetic Natural Gas

SO2 - Sulfur Dioxide

SOHO – Small Office Home Office

SRC – Sales Reconciliation Component

SUFG – State Utility Forecasting Group

T

TA-96 –Telecommunications Act of 1996

U

UGS – Underground storage

UNEs – Unbundled Network Elements

USAC – Universal Service Administrative Company

USF – Universal Service Fund

V

VoIP – Voice over Internet Protocol

W

Wi-Fi – Wireless Fidelity

Wi-Max – Worldwide Interoperability for Microwave Access

GLOSSARY

A

Access Charges: Charges designed to compensate local exchange carriers for the maintenance and operation of the local exchange network after the break up AT&T in 1984 in the Modified Final Judgment. Access charges take two forms: 1) an end user access charge, also known as Subscriber Line Charge that appears on the customer's bill as a separate line item; 2) carrier access charges paid by interexchange carriers to local exchange carriers when they connect to their local networks. Such charges are determined by tariffs subject to state or federal approval depending upon the intrastate or interstate nature of the call.

Alternative Fuels: Any non-traditional energy source.

Alternate Ratemaking for Pipelines: In a series of orders in February 1996, the Federal Energy Regulatory Commission opened the door to non-cost-based rates for pipeline services, including transmission and storage, provided that a pipeline could show: 1) it did not have market power or that the power was mitigated; and (2) cost-based recourse rates were available for customers who might be disadvantaged under the new system. Pipelines are also required to show the quality of service was maintained and that market-based, incentive or negotiated rates did not shift costs to captive customers.

American Gas Association (AGA): Trade group representing natural gas distributors and pipelines. The AGA also operates a laboratory for appliance certification.

Aquifer: Water bearing permeable rock formation that is capable of storing natural gas.

Area Code Overlay: A method used to relieve area code exhaust. A new three-digit area code is associated with the same geographic boundaries of an existing area code. Because the same seven-digit telephone numbers could then be assigned out of each area code, local calls are required to be dialed with 10-digits.

Area Code Split: A method used to relieve area code exhaust. The geographic area that uses the area code is split in two and a different area code is assigned to part of the geographic area while the other area keeps the existing area code.

Asynchronous Digital Subscriber Line (ADSL): A DSL designed to deliver more bandwidth downstream (from the central office to the customer's site) than upstream. Downstream rates range from 1.5 to 9 million bits per second. See also Digital Subscriber Line.

B

Base Gas: Gas required in a storage pool to maintain sufficient pressure to keep the working gas recoverable. Also called "cushion" gas.

Basic Telecommunications Service (BTS): A term used in House Enrolled Act 1279 to distinguish between telecommunication services regulated until June 30, 2009 and services that were unregulated on or before March 27, 2006. BTS is defined as standalone telephone exchange service that is provided to a

residential customer through the customer's primary line; is the sole service purchased by the customer; is not a part of a package, promotion, or contract; and, not otherwise offered at a discounted price.

British Thermal Unit (Btu): The quantity of heat required to raise one pound of water (about one pint) one degree Fahrenheit at or near its point of maximum density. A common unit of measurement for gas prices. 1,034 Btus = 1 cubic foot.

Broadband: Advanced communications systems capable of providing high-speed transmission of services such as data, voice, and video over the Internet and other networks. Transmission is provided by a wide range of technologies, including digital subscriber line and fiber optic cable, coaxial cable, wireless technology, and satellite. Broadband platforms make possible the convergence of voice, video and data services onto a single network.

Bundled Resale of Local Exchange: Competitive local exchange carriers can compete by reselling the services of the incumbent local exchange carrier (ILEC) in this form. They purchase the services of the ILEC at wholesale rates hoping to resell them to retail customers at a profit. Each of Indiana's three large ILECs offer wholesale discounts to competitive carriers.

Bundled Service: Gas utility that operates as both the supplier and distributor of natural gas.

C

Capacity: The size of a plant (not its output). Electric utilities measure size in kilowatts or megawatts and gas utilities measure size in cubic feet of delivery capability.

Carbon Capture: The process of capturing carbon dioxide produced in the combustion of fuel to facilitate its disposal.

Carbon Sequestration: The storage of carbon dioxide in geological formations to prevent its release into the atmosphere.

Certificate of Public Convenience and Necessity (CPCN): A special permit commonly issued by a state commission that authorizes a utility to engage in business, construct facilities or perform some other service. Also a permit issued by the Federal Energy Regulatory Commission to engage in the transportation or sale for resale of natural gas in interstate commerce, or to construct or acquire and operate any facilities necessary.

City Gate: The physical location where gas is delivered by a pipeline to a local distribution company.

Coal Gasification: The controlled process of placing coal, steam, and oxygen under pressure to produce a low Btu gas.

Coal Bed Methane: Any gas produced from a coal seam.

Commodity Charge: The charge that covers the pipeline's variable costs in a Straight Fixed Variable rate design. Also referred to as a "usage charge."

Communications Service Provider: A term used in House Enrolled Act 1279 that means a person or entity offering communications services to customers in Indiana, without regard to the technology or medium used by the person or entity to provide the communications service.

Condemnation Action: A legal proceeding whereby a municipality exercises its power of eminent domain and condemns utility property that results in the transfer of utility property to the municipality.

Conditional Congestion Area: As designated by the U.S. Department of Energy, as areas where electric utilities have planned generation, and while some transmission congestion is present, significant congestion would result if transmission is not built in conjunction with the new generation resources.

Cooperative: A business entity similar to a corporation, except that ownership is vested in members rather than stockholders and benefits are in the form of products or services rather than profits.

Cost-of-Service Rates: Rates based on prudently incurred costs of doing business, plus a reasonable rate of return on investment in plant and equipment, and throughput projections. This is the rate development methodology commonly used by state or federal regulators.

Cramming: A practice in which customers are billed for unexpected and unauthorized telephone charges or services. Refers to the fact that the charges are crammed into the telephone bill in an inconspicuous place so the charges go unnoticed by the customer.

Customer Charge: A fixed amount to be paid periodically by a customer without regard to demand or energy actually used. The customer charge recovers the cost of meters and other administrative costs of billing.

D

Decoupling: Alternative rate design theory that separates the recovery of a utility's fixed costs from the volume of natural gas sold.

Dekatherm (Dth): A unit of heating value equal to 10 therms or one million Btus (1MMBtu). Roughly, 1 Mcf = 1, MMBtu = 1 Dth

Demand Response: Reducing the use of electricity to meet local or regional power system needs rather than increasing the output of electricity.

Digital Subscriber Line (DSL): A generic term for digital lines provided by incumbent or competitive local exchange carriers that allows the customer to use the same subscriber line for voice and data simultaneously without subscribing to a second line for Internet access.

Distribution: The component of a gas, electric or water system that delivers gas, electricity, or water from the transmission component of the system to the end-user. Usually the commodity has been altered from a high pressure or voltage level at the transmission level to a level that is usable by the consumer. Distribution is also used to describe the facilities used in this process.

Distribution System Improvement Charge: A mechanism available to water utilities to pass the costs of infrastructure replacement onto their customers between rate cases on a more expedited basis.

E

Effluent: The water that is discharged after being treated at a sewage plant.

Eligible Telecommunications Carrier (ETC): A common carrier eligible to receive universal service support. An ETC is required to offer services that are supported by the federal universal support mechanisms either using their own facilities or a combination of its own facilities and resale of another carrier's services. State commissions are responsible for the designation of ETCs.

End Use: The final use to which gas or electricity is put by the ultimate consumer.

Energy Information Administration: Statistical information collection and analysis branch of the Department of Energy.

Energy Independence & Security Act of 2007: A comprehensive energy law that focuses on improved efficiency standards, and the research and development of energy technologies and infrastructure.

Energy Policy Act of 1992: This act authorized the Federal Energy Regulatory Commission to order wholesale wheeling of electricity while explicitly restraining its power to order retail wheeling. The Act also created a new legal category of electricity generating and sales companies, referred to as "Exempt Wholesale Generators," that are free from the Public Utility Holding Company Act of 1935 restrictions.

Energy Policy Act of 2005: Major provisions regarding the electricity industry included the creation of the Public Utility Holding Company Act of 2005, clean coal, nuclear, wind, and alternative energy initiatives, establishment of an Electric Reliability Organization, incentive rates for transmission investment, transmission siting, smart metering, net metering, utility interconnection with distributed generation, increased efficiency of fossil-fuel power plants, and the increased diversity of fuel sources to generate electricity.

Environmental Protection Agency: A federal agency created in 1970 to execute federal research, monitoring, standard setting and enforcement actions related to protecting the environment.

F

Facilities-based Interexchange: A carrier that offers facilities-based interexchange deploys their own tandems and/or trunks as opposed to purchasing blocks of time from other interexchange carriers and reselling the services to retail customers.

Facilities-based Local Exchange: A carrier that offers facilities-based local exchange may construct and deploy its own networks or it may rely on unbundled network elements from incumbent local exchange carriers or a combination of the two.

Federal Energy Regulatory Commission (FERC): The U.S. federal agency with jurisdiction over interstate electricity sales, wholesale electric rates, hydroelectric licensing, natural gas pricing, and oil pipeline rates. The FERC also authorizes liquefied natural gas terminals, interstate natural gas pipelines and non-federal hydropower projects.

FiOS: Verizon's broadband initiative featuring fiber to the premise that is being deployed in several areas throughout the U.S.

Firm Service: The highest quality sales or transmission service that is offered to customers under a filed rate schedule that anticipates no planned interruption.

Fixed Costs: All costs included in the cost of service that do not fluctuate with the volume of the commodity passing through the system (e.g., labor, maintenance, and taxes).

G

Gigabit: A unit of measurement for the amount of data that is transferred in a second between two telecommunication points. One gigabit per second (Gbps) equals one billion bps.

Gasification: 1) The conversion of carbonaceous material into gas or the extraction of gas from another fuel. 2) The process during which liquefied natural gas is returned to its vapor or gaseous state through an increase in temperature and a decrease in pressure.

Gathering System: Pipelines and other equipment installed to collect, process, and deliver natural gas from the field, where it is produced, to the trunk or main transmission lines of pipeline systems.

Generation: The process of producing electricity. Also refers to the assets used to produce electricity for transmission and distribution.

H

Heartland: Heartland Gas Pipeline, LLC

Hedging: A method by which a purchaser or producer of natural gas or electricity uses a derivative position to protect against adverse price movements in the cash market by "locking in" a price for future delivery.

Holding Company: A corporate structure where one company holds the stock (ownership) of one or more other companies but does not directly engage in the operation of any of its business.

I

Indiana Lifeline Assistance Program (ILAP): A state program required by House Enrolled Act 1279 for the purpose of offering reduced charges for basic telecommunications services to eligible customers (customers with income that falls within 150 percent of the Federal Poverty Guidelines or participates in certain assistance programs, such as Medicaid, food stamps, etc).

Independence Hub: A large natural gas production platform in the Gulf of Mexico.

Independent System Operator (ISO): An independent organization or institution that controls the electric transmission system in a particular region.

Indiana Utility Regulatory Commission: An independent fact-finding body that hears evidence in cases filed before it and makes decisions based on the evidence presented in those cases. An advocate of neither the public nor the utilities, the Commission is required by state statute to make decisions that balance the interests of all parties to ensure the utilities provide adequate and reliable service at reasonable prices.

Integrated Gasification Combined Cycle (IGCC) Facility: A power plant using synthetic gas as a source of clean fuel. Syngas is produced from coal (or other fuels) in a gasification unit. Steam generated by waste heat boilers of the gasification process is utilized to help power steam turbines.

Integrity Management: Specifies how pipeline operators must identify, prioritize, assess, evaluate, repair and validate - through comprehensive analyses - the integrity of gas pipelines that, in the event of a leak or failure, could affect High Consequence Areas.

Internet Protocol Television (IPTV): A system where a digital television service is delivered by using Internet Protocol over a network infrastructure that may include delivery by a broadband connection.

Interruptible Transportation Service: Conditional gas service interrupted at the option of the pipeline. Also, referred to as "best efforts." Tariffs for interruptible service are cheaper than firm service. Electric providers may offer a similar service.

Interstate Gas: Gas transported through interstate pipelines to be sold and consumed in states other than the one in which it was produced. Also, refers to gas produced in the federal domain of the Outer Continental Shelf.

Intrastate Gas: Gas sold and consumed in the state in which it was produced and not transported in interstate pipelines.

Investor-owned Utility: A utility financed by the sale of securities.

J

Joint Board: Also known as the Federal-State Joint Board, instituted by the Federal Communications Commission to recommend changes of any of its regulations in order to implement section 214(e) of the Telecommunications Act of 1996, including the definition of services that are supported by the Federal universal service support mechanisms.

K

Kilobit: A unit of measurement for the amount of data that is transferred in a second between two telecommunication points. One kilobit per second (Kbps) equals 1000 bit per second (bps).

Kilowatt (kW): A basic unit of measurement; 1kW = 1,000 watts.

Kilowatt-Hour (kWh): One kilowatt of power supplied to or taken from an electric circuit steadily for one hour.

L

Landfill Gas: Gas produced by aerobic and anaerobic decomposition of a landfill generally composed of approximately 55% methane and 45% carbon dioxide, sometimes refined with membrane methods to eliminate the carbon dioxide.

Liquefied Natural Gas (LNG): Natural gas converted to a liquid state by pressure and severe cooling, and then returned to a gaseous state to be used as a fuel. It is stored by many distributors for peak season use.

M

Mandatory Number Pooling: Requires carriers to share a pool of numbers with the same exchange. Without number pooling each competitive local exchange carrier is assigned an entire exchange or 10,000 block of phone numbers, which may not all be needed. With number pooling, exchanges can be broken down into blocks of 1,000, as known as "thousand block number pooling."

Megabit: A unit of measurement for the amount of data that is transferred in a second between two telecommunication points. One megabit per second (Mbps) equals one million bps.

Megawatt (MW): One thousand kilowatts or one million watts.

Megawatt-Hour (MWh): One megawatt of power supplied to or taken from an electric circuit steadily for one hour.

Merchant Plant: A power plant that is funded by investors and sells electricity in the competitive wholesale market.

Methane: The main component of natural gas.

Midwest ISO: The Midwest ISO was formed by transmission owners in 1996, and is based in Carmel, Indiana. The Midwest ISO's main responsibility is to ensure the safe and reliable transfer of electricity in the Midwest and ensure fair access to the transmission system.

Multi-Association Group Order (MAG Order): A Federal Communications Commission Report and Order adopted October, 2001 which prescribed access charge reform measures that affected small, rural incumbent local exchange carriers.

Municipalization: When a municipally-owned utility acquires an investor-owned utility serving a city or town.

Municipal Utility: A utility that is owned and operated by a municipal government. These utilities are organized as nonprofit local government agencies and pay no taxes or dividends; they raise capital through the issuance of tax-free bonds.

N

National Interest Electric Transmission Corridor: As established in the Energy Policy Act of 2005, any geographic area experiencing electric energy transmission capacity constraints or congestion that adversely affects consumers.

Normal Temperature Adjustment (NTA): A decoupling mechanism that reduces the risk of the gas utility not recovering margin due to warmer-than-normal (vice versa) during the heating season.

Not-for-profit Utility: A utility that does not distribute its surplus funds to owners or shareholders but uses them to pursue its goals.

NPDES Permits: Permits that allow utilities to discharge wastewater effluent into waterways.

O

Order 436: A Federal Energy Regulatory Commission rule promulgated in October 1985, establishing a voluntary, open-access system of natural gas transportation.

Order 500: An interim natural gas rule on open-access transportation, replacing Order 436. Order 500 embodied all the elements of Order 436 with three additions: forcing producers to credit transportation volumes against accruing take-or-pay (cross-crediting); allowing pipelines to direct bill customers for part of past take-or-pay charges; and allowing pipelines to fashion gas inventory charges (or supply reservation fees) to take care of future take-or-pay.

Order 636: Commonly known as the "Restructuring Rule," Order 636 provides for pipeline companies to change from being merchants of natural gas to being transporters of natural gas and allows open-access transportation services regardless of who owns the gas.

Order 712: Revised regulations governing interstate natural gas pipelines to reflect changes in the market for short-term transportation services on pipelines and to improve the efficiency of the capacity release program.

Organization of Midwest ISO States (OMS): A group of state utility commissions in the Midwest ISO footprint that acts as an adviser on some Midwest ISO functions.

P

Peak Shaving: Supply of fuel gas for distribution systems from an auxiliary source of limited supply and higher cost (e.g., propane, liquefied natural gas) during periods of maximum demand when the primary source is not adequate. Electricity providers may also use peak shaving to reduce demand at peak periods. Service interruptions and customer-owned generation are methods electricity providers use for peak shaving.

PJM Interconnection: The PJM Interconnection is the regional transmission organization (RTO) responsible for the operation and control of the bulk power system throughout all or portions of Delaware,

Indiana, Illinois, Kentucky, Maryland, Michigan, New Jersey, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and the District of Columbia. PJM became the first fully functioning RTO in 1997.

Point-to-Point Transmission: The reservation and/or transmission of electricity on either a firm basis and/or a non-firm basis from point(s) of receipt to points(s) of delivery, under a tariff, including any ancillary services that are provided by the transmission provider.

Private Activity Bonds: Municipal bonds that are issued to finance facilities for investor-owned or not-for-profit water utilities.

Privatization: When an investor-owned utility acquires a municipally-owned utility.

Public Utility Holding Company Act of 1935 (PUHCA): A federal law to facilitate the regulation of electric utilities, by either limiting their operations to a single state, and thus subjecting them to effective state regulation, or forcing divestitures so that each became a single integrated system servicing a limited geographic area. Another purpose of the PUHCA was to keep utility holding companies engaged in regulated businesses from engaging in unregulated businesses. The PUHCA required Securities and Exchange Commission approval prior to a holding company engaging in a non-utility business and that such businesses be kept separate from the regulated business. The PUHCA was repealed by the Energy Policy Act of 2005, and replaced by what is known as the Public Utility Holding Company Act of 2005.

Public Utility Regulatory Policies Act (PURPA): A federal law passed in 1978 as part of the National Energy Act. It was meant to promote greater use of renewable energy. Implementation of the act was left to the states. The PURPA was amended in 2005 by the Energy Policy Act of 2005 sections 1251 through 1254.

Pulverized Coal: Coal that is ground into dust using a powdered coal mill and used as the fuel in a power plant to generate electricity.

Purchasing Cooperative: A type of cooperative arrangement, often among businesses, to agree to aggregate demand to get lower prices from selected suppliers.

Q

Quadruple Play: A service bundle that includes high-speed data, telephony, television and wireless communications services.

R

Rate Base: The investment value established by a regulatory authority upon which a utility is permitted to earn a specified rate of return.

Rate Design: The method of classifying fixed and variable costs between demand and commodity components.

Rate of Return: The percentage that a company earns on its investment.

Raw Natural Gas: Natural gas brought from underground up to the wellhead. Natural gas found at the wellhead is not as pure as processed or pipeline quality natural gas used by consumers. Raw natural gas comes from three types of wells: oil wells, gas wells, and condensate wells.

Reclaimed Water: Wastewater that has been treated to remove solids and certain impurities, and used for irrigation or recharging aquifers.

Reliability: A term used in both the electric and gas industry to describe the utility's ability to provide uninterrupted service of gas or electricity. Reliability of service can be compromised at any level of service: generation or production, transmission or distribution.

Renewable Portfolio Standard: A requirement that a specified portion of a utility's electricity be supplied by energy sources defined as renewable.

S

Service Territory: Under the current regulatory environment, an electric utility is granted a franchise to provide energy to a specified geographical territory, designated as a service territory.

Slamming: The practice of switching a telephone customer's long distance or local service provider without obtaining permission from the customer.

Smart Grid: An electricity delivery system that encompasses devices and technologies designed to improve the efficiency of energy use and the transfer of energy across it.

Small Utility Filing: A process where a utility, which serves under 5,000 customers, primarily residential, and does not serve extensively another utility, can increase its rates without a formal public hearing.

Spot Market: A market characterized by short-term, typically interruptible, or best efforts contracts for specified volumes. The bulk of natural gas spot market trades on a monthly basis, while power marketers sell spot supplies on an hourly basis.

Storage: Facilities used to store natural gas that is transferred from its original location. Usually consists of natural geological reservoirs like depleted oil or gas fields, waterbearing sands sealed on top by impermeable cap rock, underground salt domes, bedded salt formations, or in rare cases, abandoned mines.

Straight-Fixed Variable Rate Design: Rate design methodology that allocates all fixed costs to the demand component and allocates all variable costs to the commodity, or volumetric, component. Also called "Fixed Variable."

Supply Side Management: The systematic development of a gas supply plan or an electric resource plan.

Synthetic Natural Gas: Energy-rich vapors manufactured from coal.

System Development Charge: A one-time charge assessed by water and wastewater utilities to new customers to finance development of utility systems necessary to serve those new customers. The purpose is to impose a portion of the cost of capital improvements upon those developments that create the need for, or increase demand for capital improvements.

Sub-metering/Sub-billing: The practice where a consumer of utility service, usually an apartment complex or a mobile home park, passes along the cost of water or electric service to the tenants of the complex or park through a separate utility bill.

T

Take-and-Pay: Clause that requires a minimum quantity of natural gas to be physically taken and paid for, usually in association with oil, or wells, that will be damaged by failure to produce.

Tariff: Compilation of all effective rate schedules for a company, along with general terms and conditions of service.

Therm: Unit of heating value equivalent to 100,000 Btus.

Transmission: The process of transferring energy (either gas or electricity) or water from the production or generation source to the point of distribution. Also refers to the facilities used for this process.

Triple Play: A service bundle that includes telephone, high-speed Internet access and television.

U

Unaccounted for Gas: The difference between the total gas available from all sources and the total gas accounted for as sales, net interchange, and company use. This difference includes leakage or other actual losses, discrepancies due to meter inaccuracies, variations of temperature and/or pressure, and other variants, particularly billing lag.

Unbundled Network Elements: The Telecommunications Act of 1996 required that independent local exchange carriers unbundled their network elements to make them available to competitive local exchange carriers on the basis of incremental costs.

Universal Service: A policy to keep local rates low and encourage every household to have a telephone.

Unserved Energy: Electricity demand that the utility is unable to supply. In the electric utility planning process, unserved energy helps identify when and what type of new resources may be needed in the future.

V

Volatility: The market's price and movement within that range. The direction of the price move, whether up or down, is not relevant. Historic volatility indicates how much prices have changed in the past and is derived by using daily settlement prices for futures. Implied volatility measures how much the market thinks prices will change in the future, obtained from daily settlement prices for options.

Voltage: The rate at which energy is drawn from a source that produces a flow of electricity in a circuit; expressed in volts.

Voice over Internet Protocol (VoIP): Technology used to transmit voice conversations over a data network using the Internet Protocol. Such data network may be the Internet or a corporate Intranet.

W

Weatherization: Any change made to a home or building that is designed to conserve energy.

Well: A well that produces at surface conditions the contents of a gas reservoir.

Wellhead: The assembly of fittings, valves, and controls located at the surface and connected to the flow lines, tubing, and casing of the well as to control the flow from the reservoir.

Wireless Fidelity (Wi-Fi): Wi-Fi was originally a brand licensed by the Wi-Fi Alliance to describe the embedded technology of wireless local area networks (WLAN) based on the IEEE 802.11 standard. As of 2007, common use of the term Wi-Fi has broadened to describe the generic wireless interface of mobile computing devices, such as laptops in local area networks.

Withdrawal: Those uses of water that involve the physical removal of water from the ground or surface source.

Worldwide Interoperability for Microwave Access (Wi-Max): Wi-Max is a telecommunications technology aimed at providing wireless data over long distances in a variety of ways, from point-to-point links to full mobile cellular type access. Wi-MAX allows a user, for example, to browse the Internet on a laptop computer without physically connecting the laptop to a wall jack.

Discovery Park

PURDUE UNIVERSITY

2010 Indiana Renewables Study & 2009 Forecast

RFSC 9/14/2010

EXHIBIT B

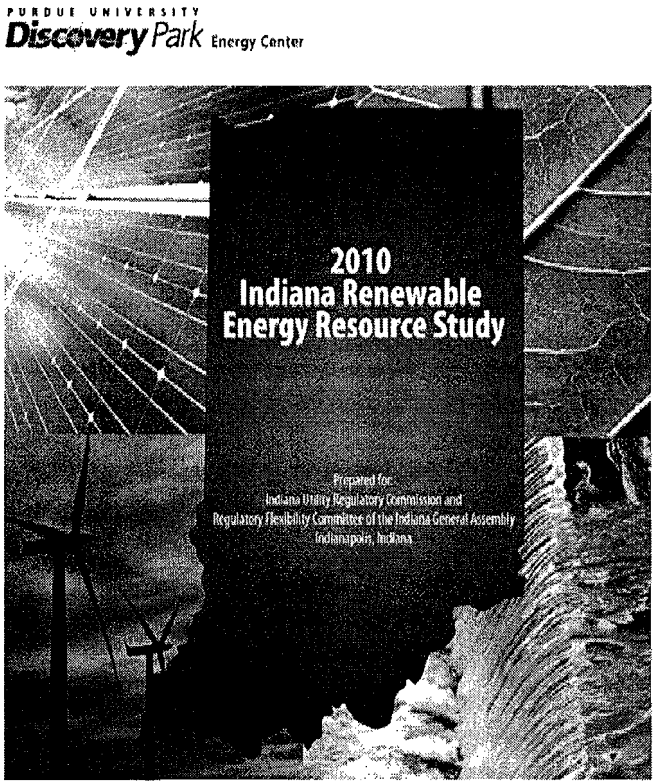
Presented by:
Douglas J. Gotham, Director
State Utility Forecasting Group
Purdue University

Presented to:
Regulatory Flexibility Committee
Indiana General Assembly

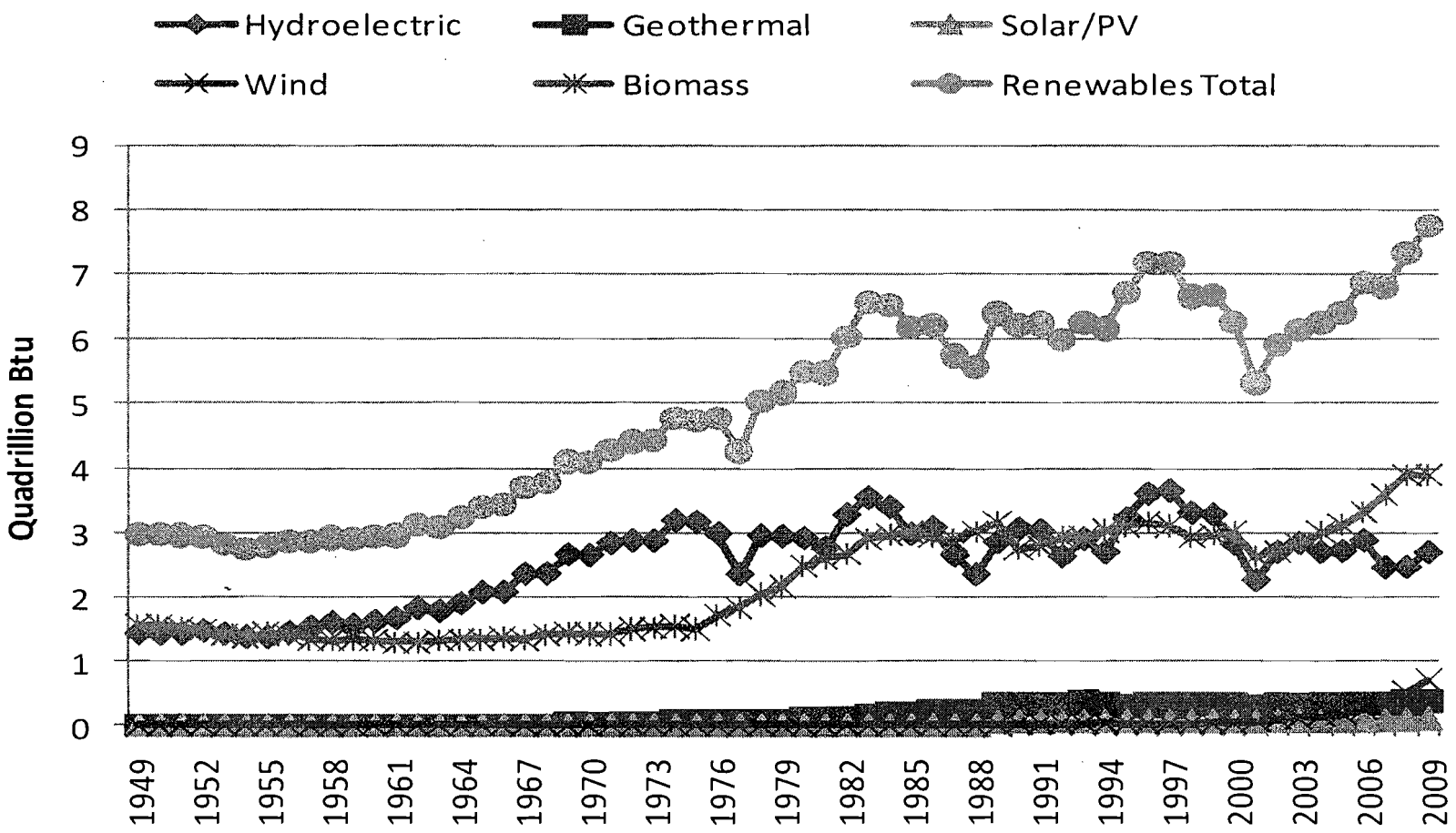
September 14, 2010

2010 Renewable Resources Study

- Renewable energy trends
- Barriers and incentives
- Individual renewable resources
  - Wind
  - Energy crops
  - Organic waste
  - Solar/photovoltaics
  - Fuel cells
  - Hydropower
  - Algae
- In-depth look at woody biomass

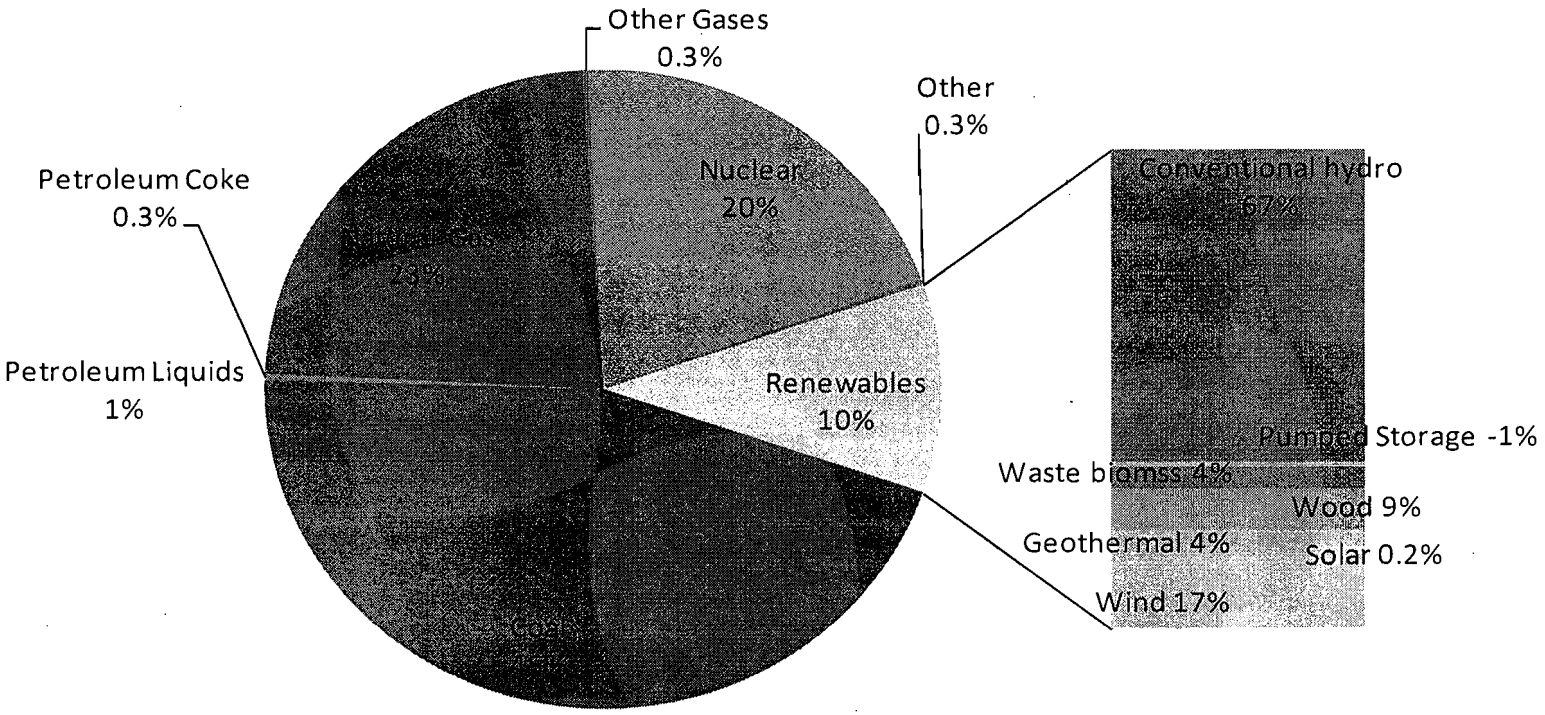


Historical Renewable Energy in the U.S.



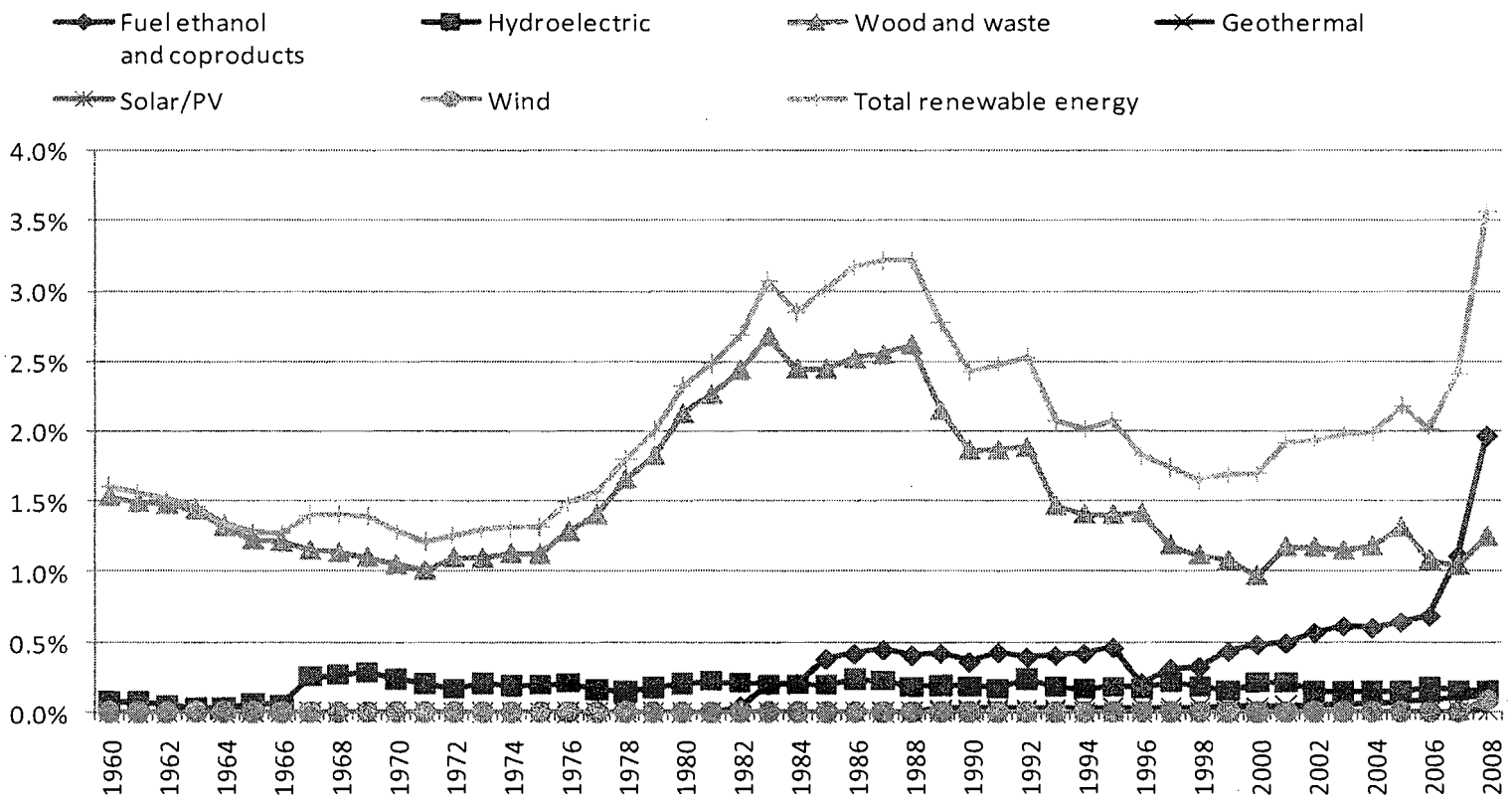
Source: EIA

2009 U.S. Electricity Generation by Energy Source



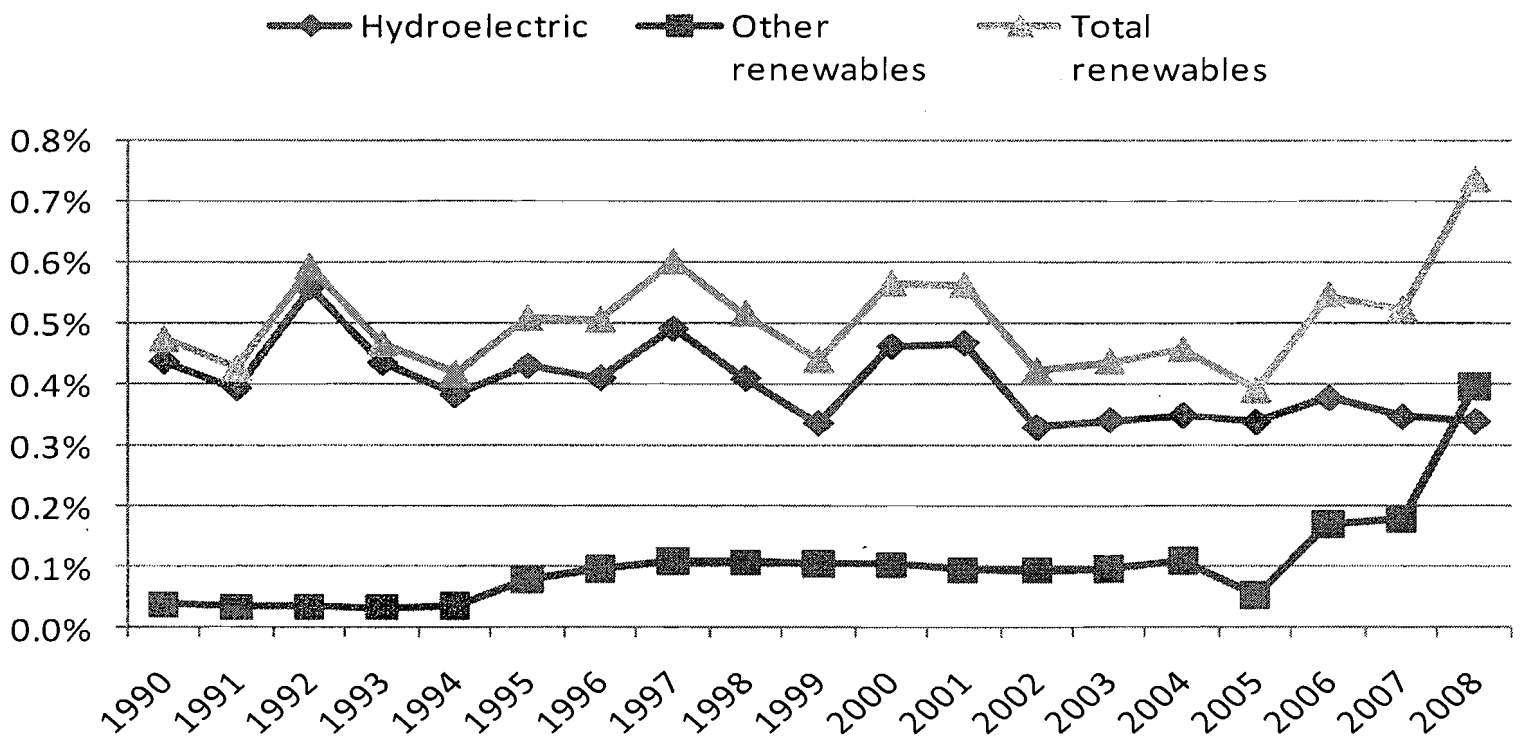
Source: EIA

Renewables Share of Indiana Total Energy Consumption



Source: EIA

Renewables Share of Indiana Electricity Generation



Source: EIA

Barriers to Renewables

- Major barrier is cost
  - Most renewable technologies have high capital costs
  - Indiana had the 11th lowest electricity rates in the country in 2008, according to the Energy Information Administration (7.09 cents/kWh vs. national average 9.74 cents/kWh)
- Limited availability for some resources
  - Solar/photovoltaics, hydropower
- Intermittency for some resources
  - Solar/photovoltaics, wind

Wind Developments

- First wind farm in Indiana completed in May 2008 (131 MW)
- Another 908 MW of capacity brought on-line in 2009
- In 2010, 99 MW of new capacity has come on-line with another 203 MW expected to be completed next month
- Over 400 MW of projects have been proposed for the future

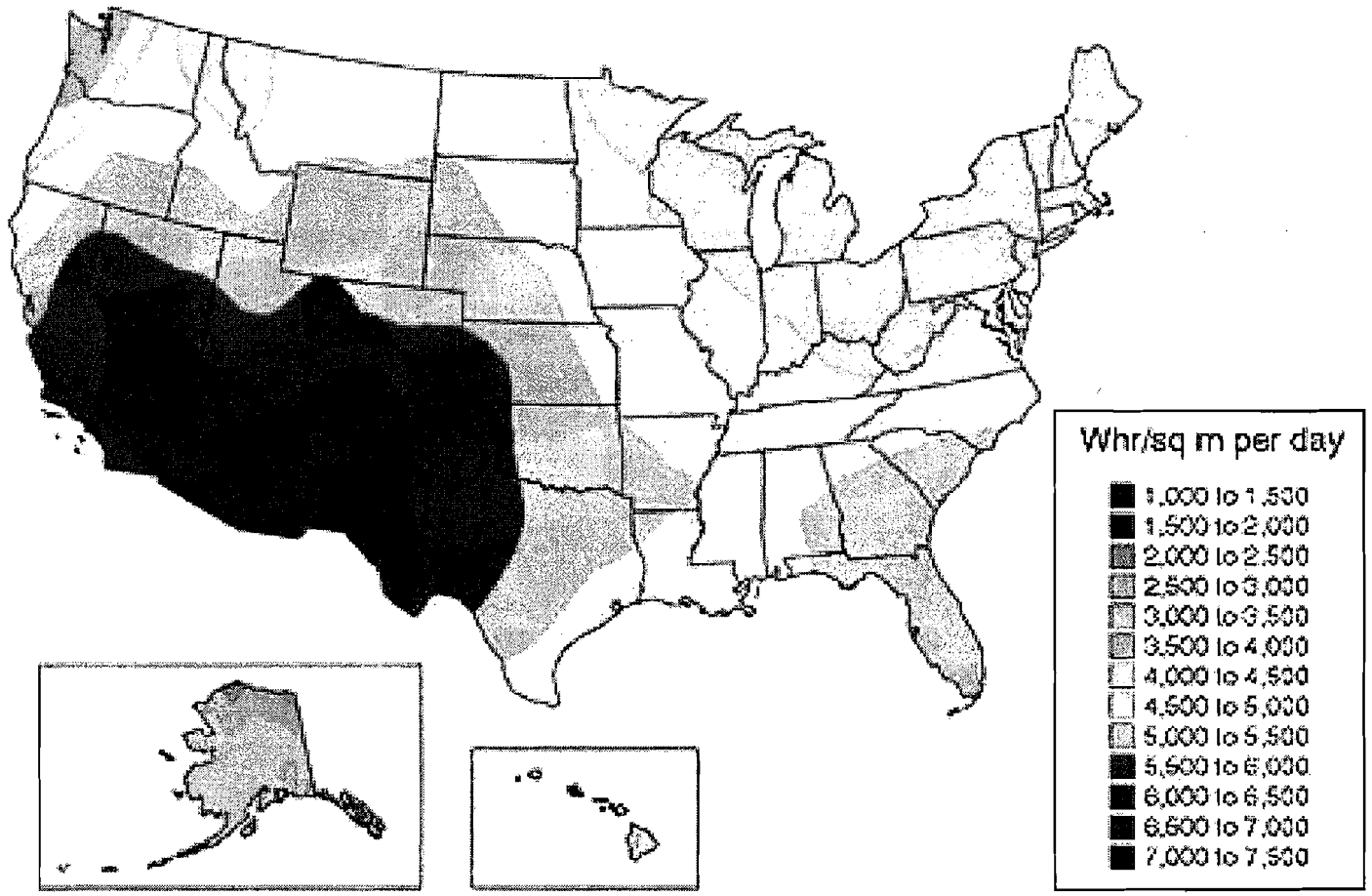
Energy Crops

- Transportation fuels
  - Ethanol
  - Biodiesel
- Other possibilities
  - Fast growing hardwood trees (hybrid poplar/willow)
  - Grasses (switchgrass)
- Barriers to be overcome
  - Other high-value uses for the land
  - Harvesting and transportation costs
  - Price of competing fossil fuels

Organic Waste Biomass

- Until the recent increase in ethanol production, this resource was the largest source of renewable energy in Indiana
  - Primarily due to the use of wood waste
- It is the 3rd largest source of renewable electricity generation in the state
  - Landfill gas
  - Municipal solid waste
  - Animal waste biogas
  - Wastewater treatment

Solar Energy / Photovoltaics



Solar resource for a flat-plate collector

Source: DOE

Fuel Cells

- Currently available fuel cells cost about $2500/kW
- According to DOE, the price needs to fall to the $400/kW to $750/kW to be commercially viable
- There is a large amount of research being performed to solve some of the problems
  - Cost
  - Efficiency
  - Hydrogen production
  - Hydrogen storage

Hydroelectric Power

- Indiana has about 60 MW of hydroelectric generating capacity.
  - Mostly run-of-the-river (no dam)
  - Largest source of renewable electricity
- The U.S. Department of Energy identified another 66 MW of potential hydropower at existing dams
  - Only about 42 MW was considered viable (spread out over 27 sites)

Energy from Algae

- Rapid growth and efficient conversion of sunlight
- Much higher oil content than other biomass
- Not a food crop
- Can be grown in water and on land that is not usable for other agriculture
- Potential for recycling of CO2 from fossil fueled power plants
- Production of both biofuels and valuable co-products
- But cost of harvesting and processing is high

Woody Biomass Appendix

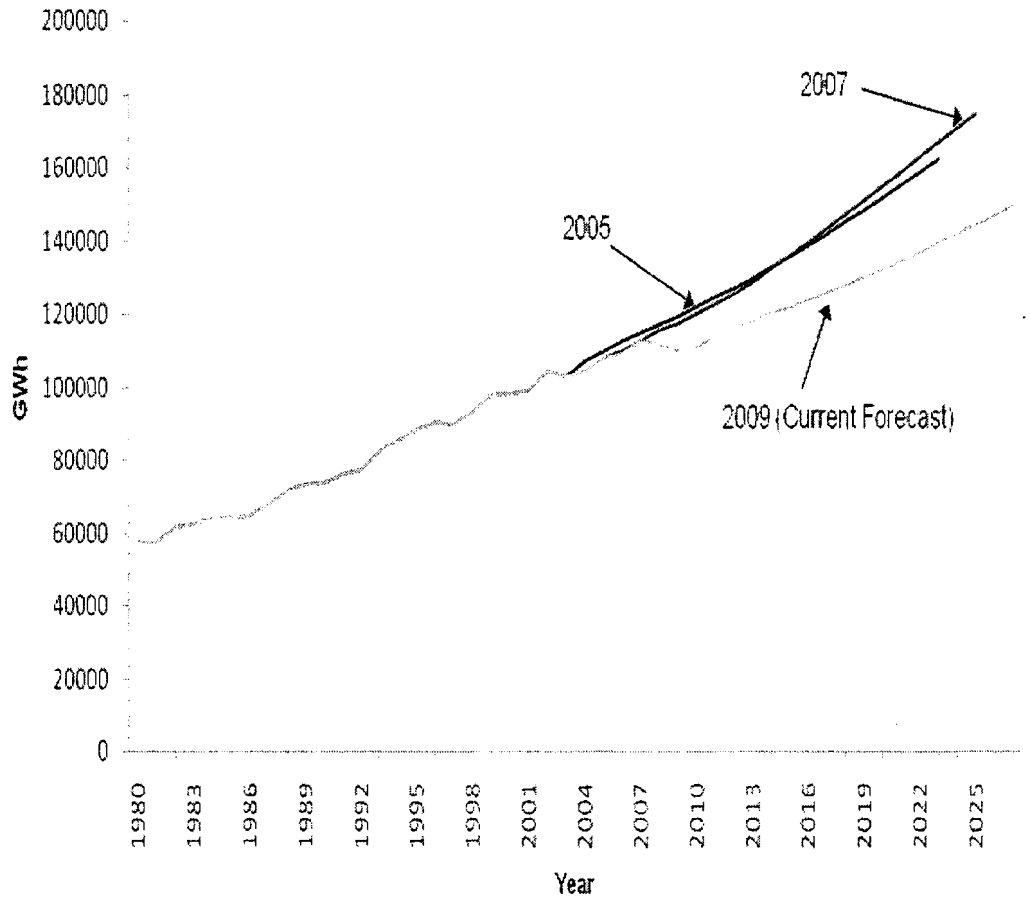
- Three main sources of residues
  - Harvesting residues
  - Standing dead trees
  - Residues from wood products industry
- Primary industries (saw milling, building materials, paper/pulp) produce most residues
  - Only about 1% is currently unused
- In order to produce a significant additional contribution to Indiana's energy supply, live trees would have to be harvested

Indiana Electricity Projections: The 2009 Forecast

- The economic recession has had a significant short-term impact on electricity consumption
  - Demand fell in 2008 and 2009
- There is also a longer-term effect
  - Growth in demand in the future is expected to be somewhat lower than what we have seen historically

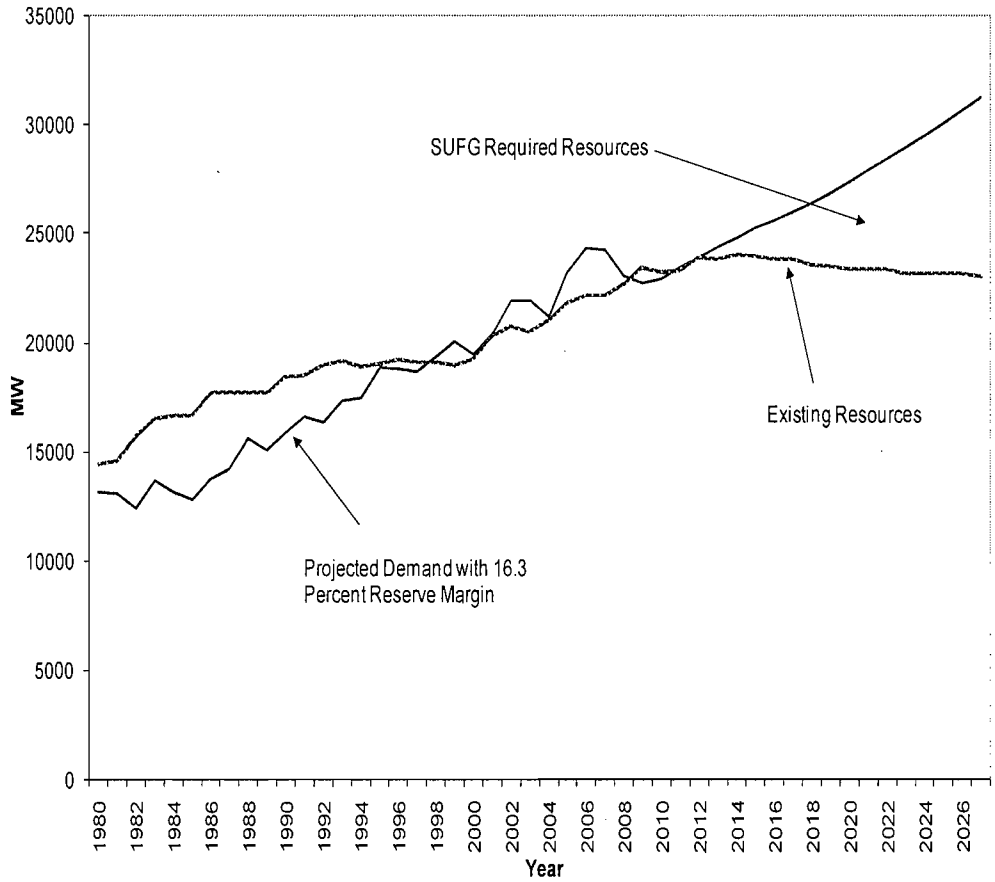
Indiana Electricity Requirements

- Retail sales by investor owned and not-for-profit utilities
- Includes estimated transmission and distribution losses
- Growth rates
  - 2009 forecast: 1.55%
  - 2007 forecast: 2.46%
  - 2005 forecast: 2.22%



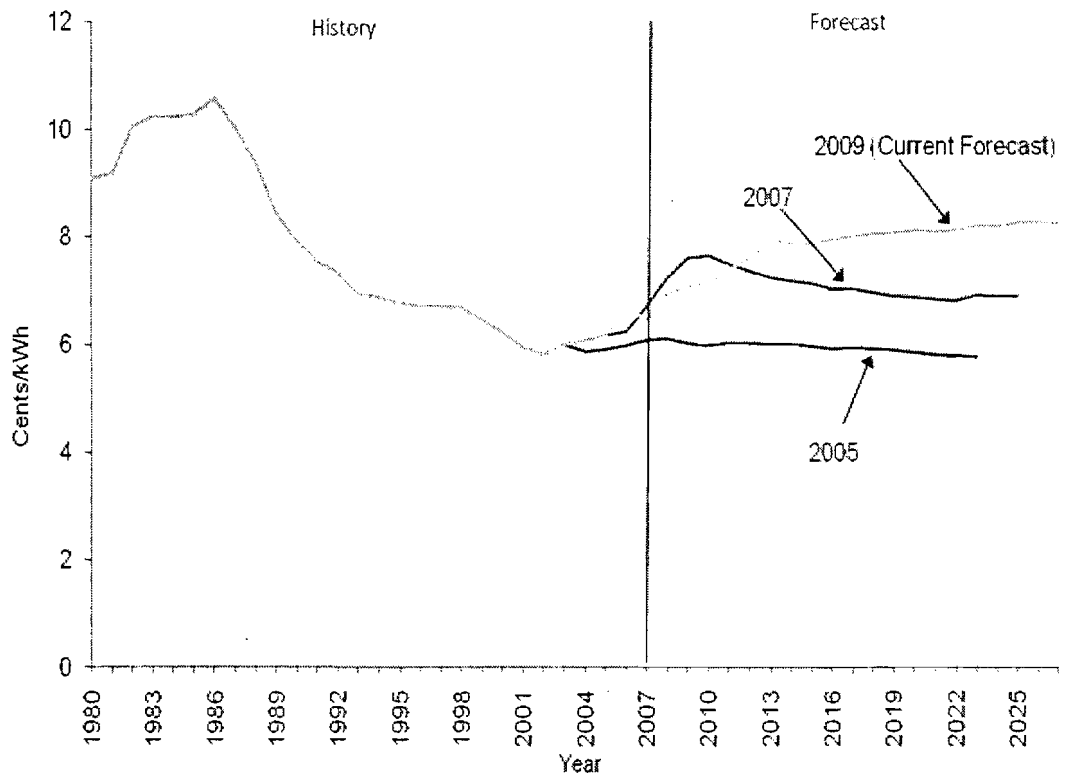
Indiana Resource Requirements

- Resources may be provided by conservation measures, contractual purchases, purchases of existing assets, or new construction
- Existing resources are adjusted into the future for retirements, contract expirations, and IURC approved new resources



Indiana Real Price Projections (2007 $)

- Effect of inflation removed
- Includes the cost of meeting CAIR
- Includes the cost of new resources
- Does not include CO2 restrictions or RPS



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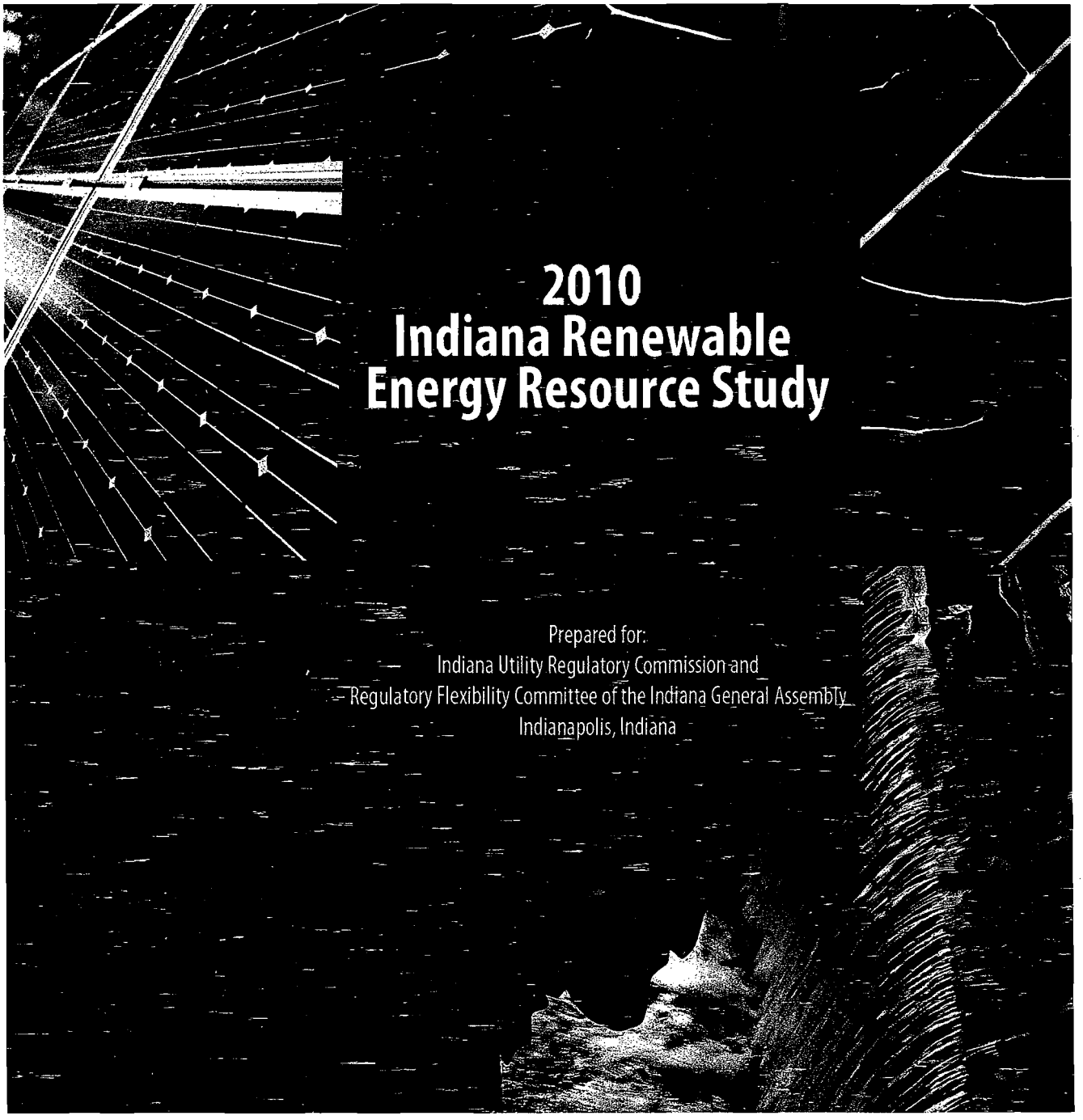

2010 Indiana Renewable Energy Resource Study

Prepared for:
Indiana Utility Regulatory Commission and
Regulatory Flexibility Committee of the Indiana General Assembly
Indianapolis, Indiana

State Utility Forecasting Group | Energy Center at Discovery Park | Purdue University | West Lafayette, Indiana

RFSC 9/14/2010

EXHIBIT C

2010 INDIANA RENEWABLE ENERGY RESOURCES STUDY

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September 2010

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Acronyms and Abbreviations

AFC	Alkaline Fuel Cell
AFOSR	Department of Defense Air Force Office of Scientific Research
ASD	Agricultural Statistical District
ASP	U.S. Department of Energy's Aquatic Species Program
APS	Arizona Public Service
AWEA	American Wind Energy Association
BIPV	Building Integrated Photovoltaics
BTC	Breakeven Turnkey Cost
Btu	British Thermal Unit
CAIR	Clean Air Interstate Rule
CHP	Combined heat and power
CPV	Concentrating photovoltaic
CREB	Clean Renewable Energy Bonds
CRP	Conservation Reserve Program
CSP	Concentrating Solar Power
DARPA	Department of Defense Advanced Research Projects Agency
DMFC	Direct methanol fuel cell
DOE	U.S. Department of Energy
DNR	Indiana Department of Natural Resources
DSIRE	Database of State Incentives for Renewables and Efficiency
EERE	Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy
EIA	Energy Information Administration, U.S. Department of Energy
EPA	U.S. Environmental Protection Agency

EPRI	Electric Power Research Institute
ERS	U.S. Department of Agriculture Economic Research Service
GHG	Green house gases
GWh	Gigawatthour
H_2	Hydrogen
IEA	International Energy Agency
IEC	Israel Electric Company
IPL	Indianapolis Power and Light Company
INEL	Idaho National Engineering and Environmental Laboratory, U.S. Department of Energy
IREC	Interstate Renewable Energy Council
ITC	Business energy investment tax credit
kW	Kilowatt
kWh	Kilowatthour
LEED	Leadership in Energy and Environmental Design, U.S. Green Building Council
LMOP	Landfill Methane Outreach Program, Energy Information Administration, U.S. Department of Energy
m/s	Meters per second
MACRS	Modified Accelerated Cost-Recovery System
MACT	Maximum Achievable Control Technology
MCFC	Molten Carbonate Fuel Cell
MGY	Million gallons per year
mph	Miles per hour
MSW	Municipal solid waste
MTBE	Methyl tertiary butyl ether – a gasoline oxygenating additive
MW	Megawatt
MWh	Megawatthour

NBT	Nature Beta Technologies Corporation
NIPSCO	Northern Indiana Public Service Company
NMSU	New Mexico State University
NO_x	Nitrogen oxide
NRCS	Natural Resources Conservation Service, U.S. Department of Agriculture
NREL	National Renewable Energy Laboratory, U.S. Department of Energy
O&M	Operation and maintenance
OED	Indiana Office of Energy Development
ORNL	Oak Ridge National Laboratory, U.S. Department of Energy
PAFC	Phosphoric Acid Fuel Cell
PBR	Photobioreactor (an enclosed algae growing reactor)
PEM	Polymer electrolyte membrane
PEMFC	Polymer Electrolyte Membrane Fuel Cells
POLYSYS	Policy Analysis System
PTC	Production tax credit
PV	Photovoltaic
REAP	Rural Energy for America Program, U.S. Department of Agriculture
REP	Renewable energy production – Indianapolis Power & Light feed-in tariff for renewable energy
REPI	Renewable Energy Production Incentive
QECB	Qualified Energy Conservation Bonds
RFA	Renewable Fuels Association
RFC	Regenerative Fuel Cell
RFS	Renewable fuel standard
SAI	Solar America Initiative
SEGS	Solar Electric Generation System, California

SEDS	State Energy Data System, Energy Information Administration, U.S. Department of Energy
SOFC	Solid Oxide Fuel Cell
SUFG	State Utility Forecasting Group
TAGS	Triacylglycerols (algae oil)
USDA	U.S. Department of Agriculture
VEETC	Volumetric ethanol tax credit
W/m^2	Watts Per Meter Squared
WVPA	Wabash Valley Power Association
WWT	Waste water treatment

Foreword

This report represents the eighth annual study of renewable resources in Indiana performed by the State Utility Forecasting Group. It was prepared to fulfill SUFG's obligation under Indiana Code 8-1-8.8 (added in 2002) to "conduct an annual study on the use, availability, and economics of using renewable energy resources in Indiana." The code was further amended in 2009, directing SUFG to "evaluate potential renewable energy generation opportunities from biomass and algae production systems."

The report consists of nine sections. Section one provides an overview of the renewable energy industry in the United States and in Indiana. It includes a discussion of trends in penetration of renewable energy into the energy supply, both nationally and in Indiana. The other eight sections are each devoted to a specific renewable resource: energy from wind, dedicated crops grown for energy production, organic biomass waste, solar energy, photovoltaic cells, fuel cells, hydropower from existing dams, and energy from algae. They are arranged to maintain the format in the previous reports as follows:

- Introduction: This section gives an overview of the technology and briefly explains how the technology works.
- Economics of the renewable resource technology: This section covers the capital and operating costs of the technology.
- State of the renewable resource technology nationally: This section reviews the general level of usage of the technology throughout the country and the potential for increased usage.
- Renewable resource technology in Indiana: This section examines the existing and potential future usage for the technology in Indiana in terms of economics and availability of the resource.
- Incentives for the renewable resource technology: This section contains incentives currently in place to promote the development of the technology and recommendations that have been made in regards to how to encourage the use of the renewable resource.
- References: This section contains references that can be used for a more detailed examination of the particular renewable resource.

In-depth coverage of the use of woody biomass is included in this report as an appendix. Energy from wood and wood waste constitutes a significant portion of the total renewable energy produced in Indiana. The appendix examines the availability of additional energy from woody biomass, some of the limitations to accessing and using additional woody biomass, and issues associated with the carbon dioxide emissions of wood-based energy relative to fossil fuels.

This report was prepared by the State Utility Forecasting Group. The information contained in it should not be construed as advocating or reflecting any other organization's views or policy position. For further information, contact SUFG at:

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1. Overview

This first section of the 2010 Indiana Renewable Energy Resources Report presents an overview of the trends in renewable energy consumption in the U.S. and in Indiana.

1.1 Trends in renewable energy consumption in the United States

Figures 1-1 and 1-2 show the historical trend in renewable energy consumption in the U.S. As can be seen in Figure 1-1, biomass and hydroelectricity have been the two primary sources of renewable energy. From about 1980 until the mid 2000s, biomass and hydroelectricity have contributed nearly equal amounts of energy, except for the annual variations associated with varying levels of precipitation in the hydroelectric basins. In more recent years, corn-based ethanol has risen sharply, causing the share from biomass to be consistently higher than from hydroelectricity. Initially corn-ethanol's sharp production increase was due to its use as replacement for the gasoline oxygenating additive MTBE which began to be phased out in 2000. Production continued to increase rapidly due to the federal Renewable Fuel Standard first authorized in the 2005 Energy Policy Act.

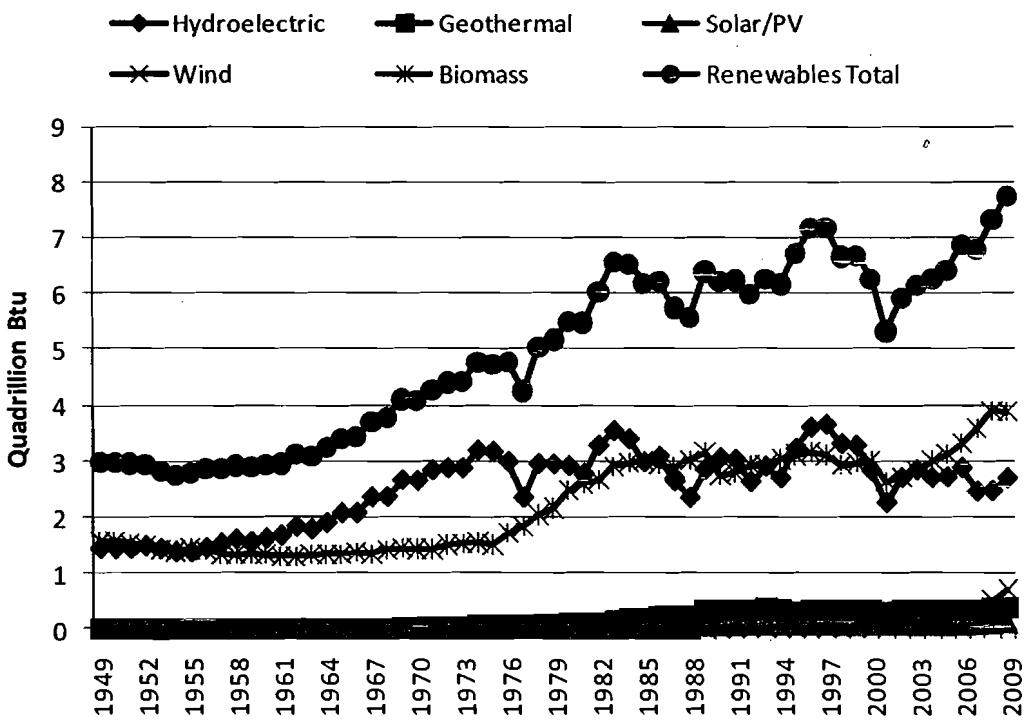

Figure 1-1: Renewable energy consumption in the U.S. (1949-2009) (Source: EIA [1, 2])

As can be seen in Figure 1-2 renewable energy's share has remained modest at less than 10 percent of the total energy consumed. In 2009 renewables contributed 8 percent of the nation's 94 quadrillion Btu of energy consumed and about 10 percent of the electricity generated.

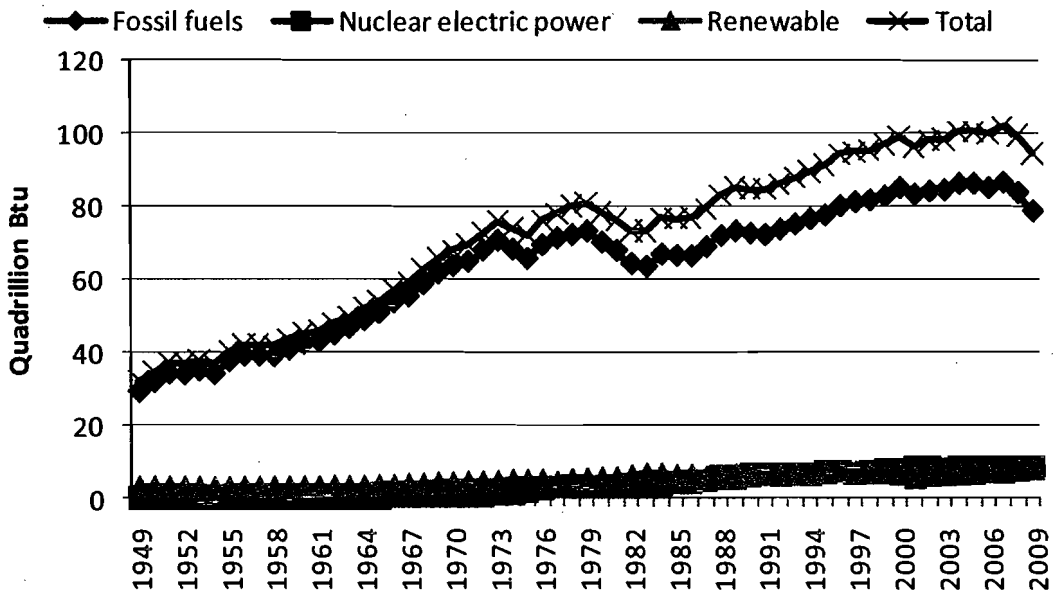

Figure 1-2: U.S. energy consumption by source (1949-2009) (Data source: EIA [1, 2])

Figure 1-3 shows the contribution of the various energy sources to the total energy consumed in the U.S. in 2009. Petroleum continues to be the dominant energy source supplying 37 percent, followed by natural gas at 25 percent and coal at 21 percent. Among the renewable resources, biomass supplied 50 percent of the renewable energy consumed, followed by hydroelectricity at 35 percent. Wind contribution increased to 9 percent from 7 percent in 2008 and geothermal maintained its 5 percent share and solar stayed at 1 percent.

When one considers renewable resources in electricity generation (Figure 1-4), hydroelectricity plays a dominant role, exceeding all the other renewable resources combined. Hydroelectricity makes up 67 percent of the renewable electricity generated. Wind energy takes second place at 17 percent and biomass drops to third place at 13 percent. Geothermal share drops to 4 percent and solar maintains a modest 0.2 percent of renewable electricity generated. As expected pumped hydroelectricity's net energy contribution was negative[1].

[1] Pumped hydroelectric facilities use electricity from the grid during periods of low demand so as to be available to generate electricity during high demand periods. Due to evaporation and inefficiencies in the pumping and generating processes, less energy is generated than is used. The value of the lost energy is more than compensated because low cost, off-peak electricity is converted to high cost, on-peak electricity.

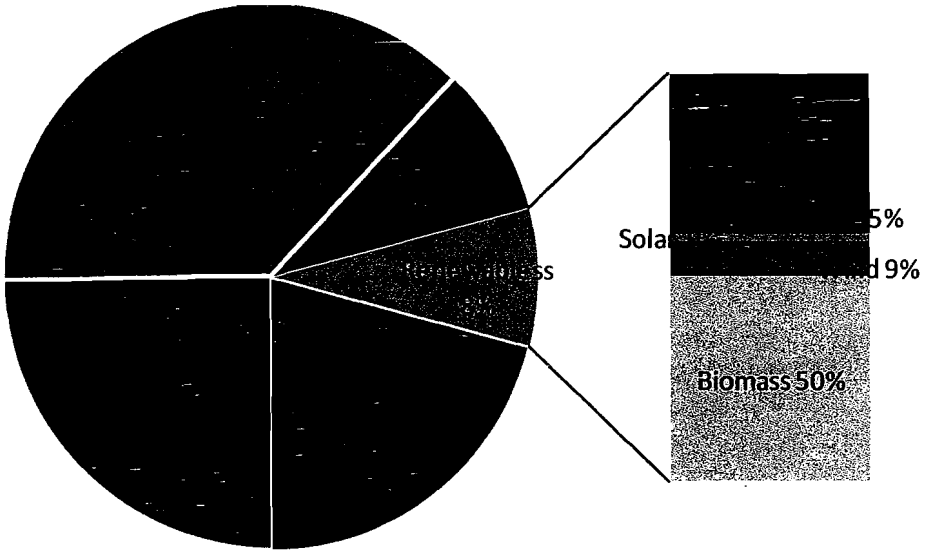

Figure 1-3: U.S. total energy consumption by energy source in 2009 (Source: EIA [2])

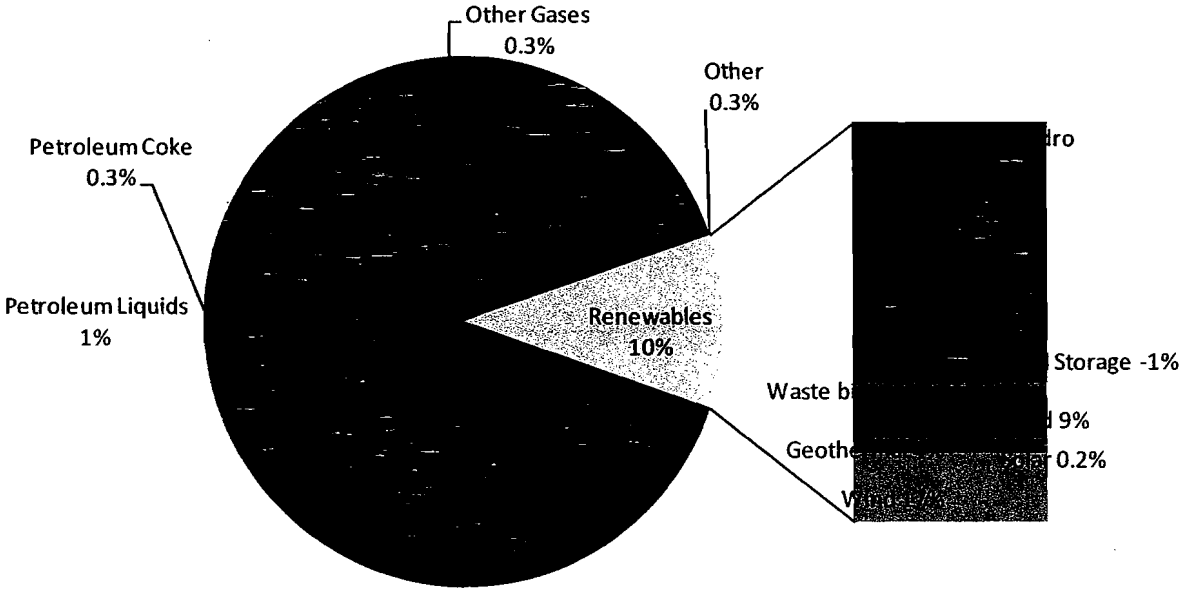

Figure 1-4: Net U.S. electricity generation by energy source in 2009 (Data source: EIA [3, 4])

1.2 Trends in renewable energy consumption in Indiana

Figure 1-5 shows renewable energy consumption in Indiana from 1960 to 2008. At the peak in the 1980s, renewable resources contributed over 3 percent of total energy consumed in Indiana. In the 1990s the share fell to below 2 percent, before the recent increase in ethanol increased it to over 3.5 percent. Woody biomass had been the main source of renewable energy in Indiana, contributing over 80 percent of the total renewable energy until the rise of corn-based ethanol.

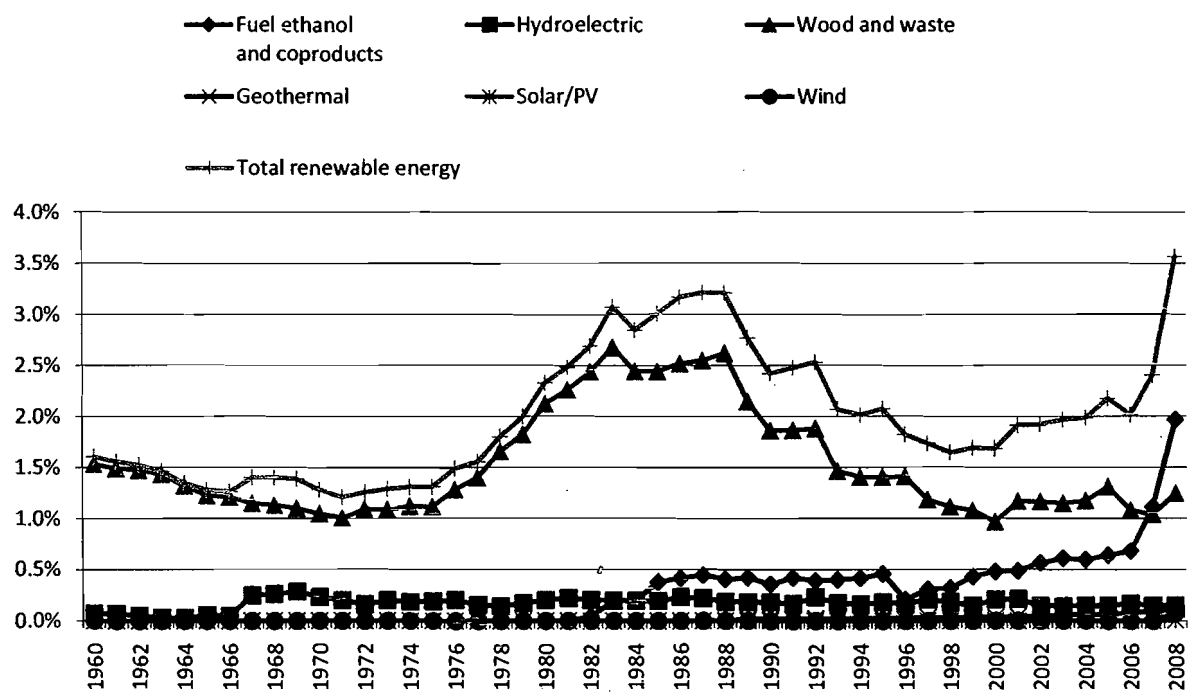

Figure 1-5: Renewables share of Indiana total energy consumption (1960-2008) (Data source: EIA [5])

When one considers only the renewable resources in electricity generation in Indiana, the role of biomass is diminished and hydroelectricity plays the dominant role. Figure 1-6 shows Indiana electricity generation from renewable resources from 1990 to 2008. While renewable resources have contributed about 2 percent of Indiana's total energy consumption through 2007, they have contributed less than 0.6 percent of electric energy. The dramatic rise in other renewables from 2007 to 2008 is due to the development of the first commercial wind farm in Indiana, which came on line in May of that year. While 2009 data is not yet available, an even greater increase is expected due to a full year of production from that facility along with production from additional wind generators that became operational during 2009.

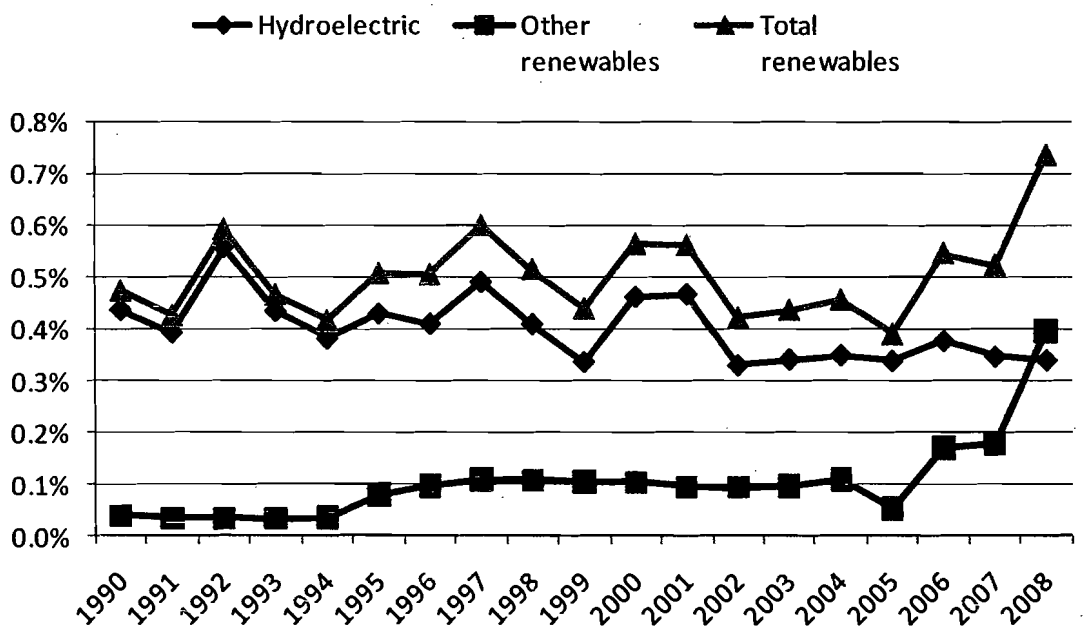

Figure 1-6: Renewables share of Indiana net electricity generation (1990-2008) (Data source: EIA [6])

There are two main reasons that renewable energy resources play a much smaller role in Indiana compared to the rest of the nation: Indiana has relatively modest hydroelectric resources, and the cost of electricity is relatively low. Table 1-1 shows average retail electricity prices for Indiana and the U.S. by sector and for all sectors combined for 2008. It also shows Indiana's ranking among states with respect to electricity cost.

	Indiana (cents/kWh)	*U.S. (cents/kWh)*	*Indiana Rank*
Residential	8.87	11.26	12
Commercial	7.82	10.36	17
Industrial	5.46	6.83	14
All Sectors	7.09	9.74	11

Table 1-1: Indiana's 2008 retail prices comparison and ranking (Data source: EIA [7])

Indiana wind capacity has increased rapidly in the last three years from a mere 20 kW in 2007 to 1039 MW at the end of 2009, with an additional 203 MW expected to be commissioned before the end of 2010. The heaviest construction was in 2009 when a total of 908 MW were brought on line. The first phase of the Fowler Ridge wind farm with a capacity of 400 MW was

commissioned in March 2009 and the second phase with a capacity of 200 MW was completed in December. The first phase of the Meadow Lake wind farm with a name plate capacity of 200 MW was commissioned in October 2009 and the 106 MW Hoosier Wind project was commissioned in November. In addition a two-turbine 2 MW project in Union City, owned jointly by the city and the Randolph Eastern school district was completed the same year. In the first half of 2010 Horizon Energy commissioned the 99 MW second phase of the Meadow Lake wind farm. The third and fourth phases of the Meadow Lake project with a combined capacity of 203 MW, are expected to be completed and commissioned by October 2010. Table 2-3 shows the status of the various Indiana wind farm projects.

Project Name	County	Capacity (MW)	Developer	Date Completed	Power Purchaser
Benton County Wind Farm	Benton	131	Orion Energy	May 2008	Duke (101 MW) Vectren (30 MW)
Fowler Ridge Wind Farm 1	Benton	400	BP Alternative Energy & Dominion	March 2009	I&M (100 MW), Appalachian (100 MW) Dominion (2001 MW)
Fowler Ridge Wind Farm 2	Benton	200	BP Alternative Energy	December 2009	AEP (50x3 MW), Vectren (50 MW)
Hoosier Wind Project	Benton	106	enXco	November 2009	IPL (106 MW)
Union City/Randolph Eastern School Corporation	Randolph	2	Operated by Performance Services Corporation	2009	
Meadow Lake Phase 1	White	200	Horizon (EDP)	October 2009	Wholesale market
Meadow Lake Phase 2	White	99	Horizon (EDP)	Summer 2010	I&M (50 MW)
Under construction					
Meadow Lake Phase 3	White	104	Horizon (EDP)	October 2010	Wholesale market
Meadow Lake Phase 4	White	99	Horizon (EDP)	October 2010	Wholesale market
Proposed Projects					
Fowler Ridge 3	Benton	150	BP Alternative Energy		
Meadow Lake Phase 5	White	100	Horizon (EDP)		
Spartan Wind Farm	Newton	101	Duke Generation Services		

Table 1-2: Status of wind generation projects in Indiana

Indiana utilities have signed power purchase agreements to purchase electricity from these wind farms and from wind farms outside Indiana as shown in Table 1-3.

Utility	Project	State	Power Purchase Agreement (MW)
Duke	Benton County Wind Farm	Indiana	100
Vectren	Benton County Wind Farm	Indiana	30
Vectren	Fowler Ridge Wind Farm 2	Indiana	50
Indiana Michigan	Fowler Ridge Wind Farm 1	Indiana	100
Indiana Michigan	Meadow Lake Wind Farm 2	Indiana	50
NIPSCO	Buffalo Ridge	South Dakota	50
NIPSCO	Barton Windpower	Iowa	50
IPL	Hoosier Wind	Indiana	106
IPL	Lakefield Wind	Minnesota	201
WVPA	AgriWind	Illinois	8
Hoosier Energy	Story Counter Wind Energy Center	Iowa	25
IMPA	Crystal Lake Wind	Iowa	50

Table 1-3: Wind energy purchase agreements by Indiana utilities (Source: IURC)

1.3 References

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2. Energy from Wind

2.1 Introduction

Wind turbines convert the kinetic energy in wind into mechanical energy and then into electricity by turning a generator. There are two main types of wind turbines, vertical and horizontal axis. The horizontal axis turbine with three blades facing into the wind is the most common configuration in modern wind turbines. Figure 2-1 shows the basic parts of a modern wind turbine used for electricity generation.

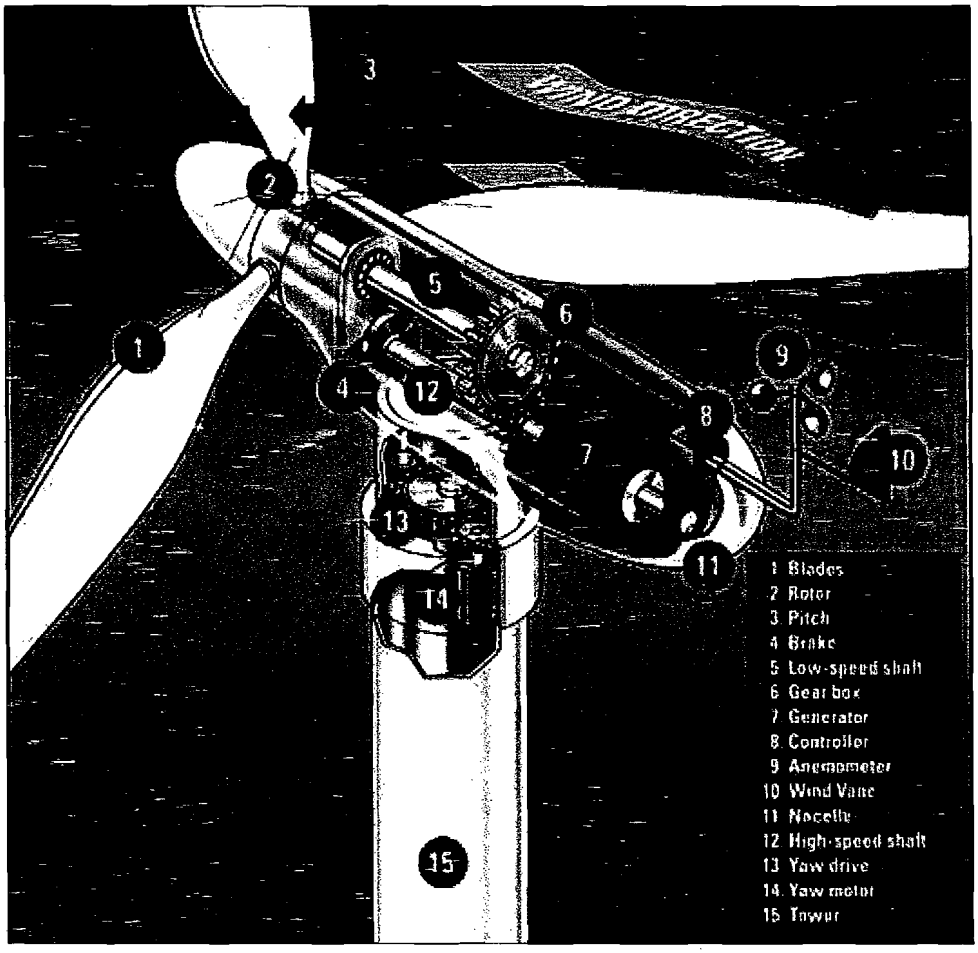


Figure 2-1: Horizontal wind turbine configuration (Source: Euro Avia Corporation [1])

Utility scale wind farms in the U.S. began in California in the 1980s, with individual wind turbines on the order of 50 – 100 kilowatt (kW) of rated capacity. This has grown steadily to the point where the 1.5 megawatt (MW) wind turbine is common in modern day wind farms [2]. Despite this dramatic increase in size and capacity, a wind farm's generating capacity is still

small compared to coal and nuclear power plants. The largest wind farm in the U.S. is the Horse Hollow Wind Farm in Texas with a name plate capacity of 736 MW [3], while the largest coal power plant in Indiana is composed of five 600 MW units adding up to a plant capacity of 3,000 MW. Furthermore the capacity factor of a wind farm is typically far less than that of a baseload power plant.[2] A baseload coal or nuclear power plant in the U.S. will typically have an annual capacity factor of over 80 percent while the capacity factors of wind farms are estimated to range between 25 and 40 percent, depending on the average annual wind speeds at their location [4].

Wind speeds are important in determining a turbine's performance. Generally, annual average wind speeds of greater than 3 meters per second (m/s), or 7 miles per hour (mph), are required for small electric wind turbines not connected to the grid, whereas utility-scale wind plants require a minimum wind speed of 5 m/s (11 mph) [5]. The power available to drive wind turbines is proportional to the cube of the speed of the wind. This implies that a doubling in wind speed leads to an eight-fold increase in power output. A measurement called the wind power density measured in watts per meter squared (W/m^2), calculated from annual observed wind speeds and the density of air, is used to classify sites into "wind power classes" [5]. Table 2-1 lists the class distinctions currently used.

	10 m (33 ft) Elevation		**50 m (164 ft) Elevation**	
Wind Power Class	Wind Power Density (W/m^2)	Speed m/s (mph)	Wind Power Density (W/m^2)	Speed m/s (mph)
1	< 100	< 4.4 (9.8)	< 200	< 5.6 (12.5)
2	100 – 150	4.4 – 5.1 (9.8 – 11.5)	200 – 300	5.6 – 6.4 (12.5 – 14.3)
3	150 – 200	5.1 – 5.6 (11.5 – 12.5)	300 – 400	6.4 – 7.0 (14.3 – 15.7)
4	200 – 250	5.6 – 6.0 (12.5 – 13.4)	400 – 500	7.0 – 7.5 (15.7 – 16.8)
5	250 – 300	6.0 – 6.4 (13.4 – 14.3)	500 – 600	7.5 – 8.0 (16.8 – 17.9)
6	300 – 400	6.4 – 7.0 (14.3 – 15.7)	600 – 800	8.0 – 8.8 (17.9 – 19.7)
7	> 400	> 7.0 (15.7)	> 800	> 8.8 (19.7)

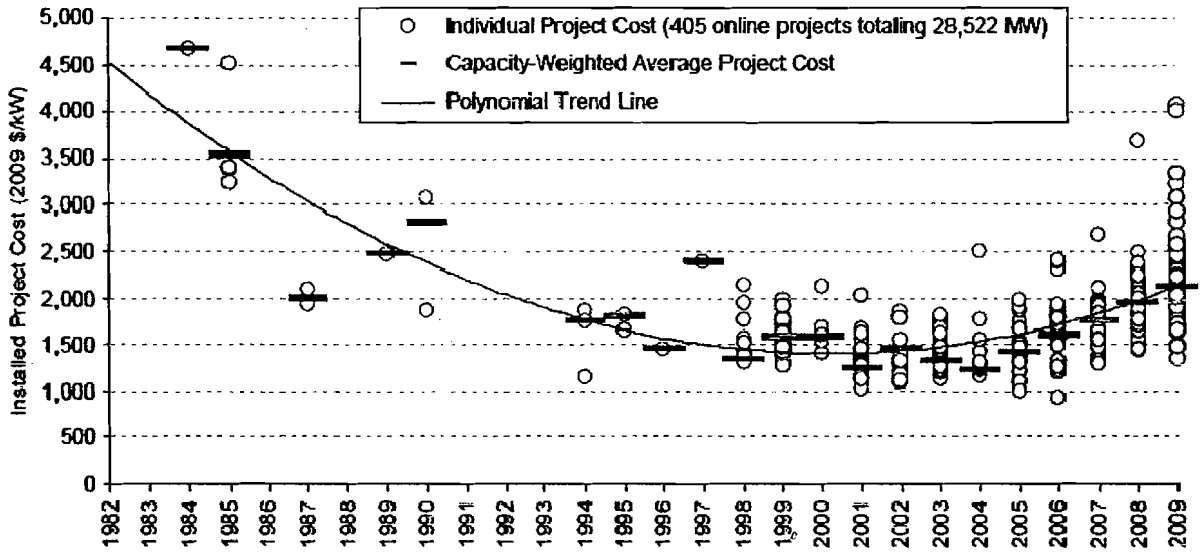
Table 2-1: Wind resource classification (Source: AWEA [5])

In addition to its being a virtually inexhaustible renewable resource, wind energy has the advantage of being modular, that is a wind farm's size can be adjusted by simply adjusting the number of turbines on the farm. Wind technology's main disadvantage when compared to traditional fossil fuel generation is the fact that the amount of energy coming out of the turbine is solely dependent on the wind and the electric system operator cannot dispatch it to match the varying demand as is done with traditional generation.

[2] $$\text{Annual capacity factor} = \frac{\text{Actual amount of energy produced in a year}}{\text{Energy that would have been produced if plant operated at full rated capacity all year}}$$

2.2 Economics of wind energy

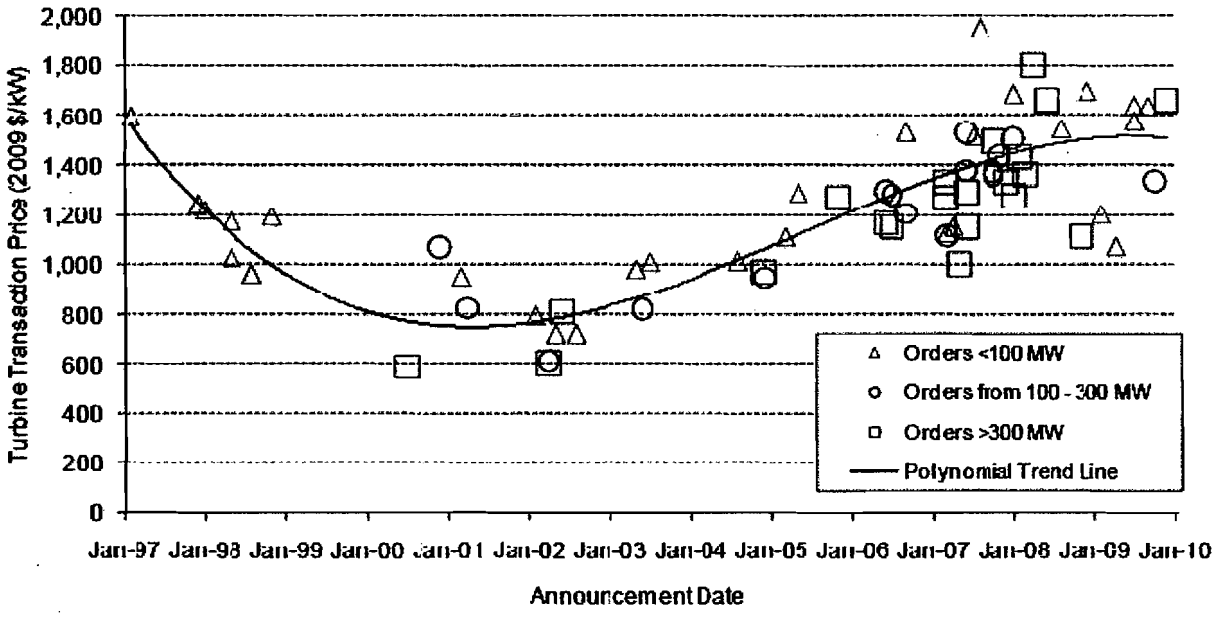
Through 2009, the installed cost of wind energy projects continued to follow an upward trend that started in the early 2000s. The 2,120 $/kW capacity-weighted average costs of projects completed in 2009 was 9 percent higher than the cost of the projects completed in 2008 and 63 percent higher than the cost of the projects completed in 2001. Figure 2-2 shows the trends in the installed projects costs from 1982 to 2009. It is expected that project costs will decline in the near future as recent decreases in the price of steel and other materials work their way through the wind industry's supply chain [6].



Source: Berkeley Lab (some data points suppressed to protect confidentiality)

Figure 2-2: Installed wind project costs over time (Source: EERE [6])

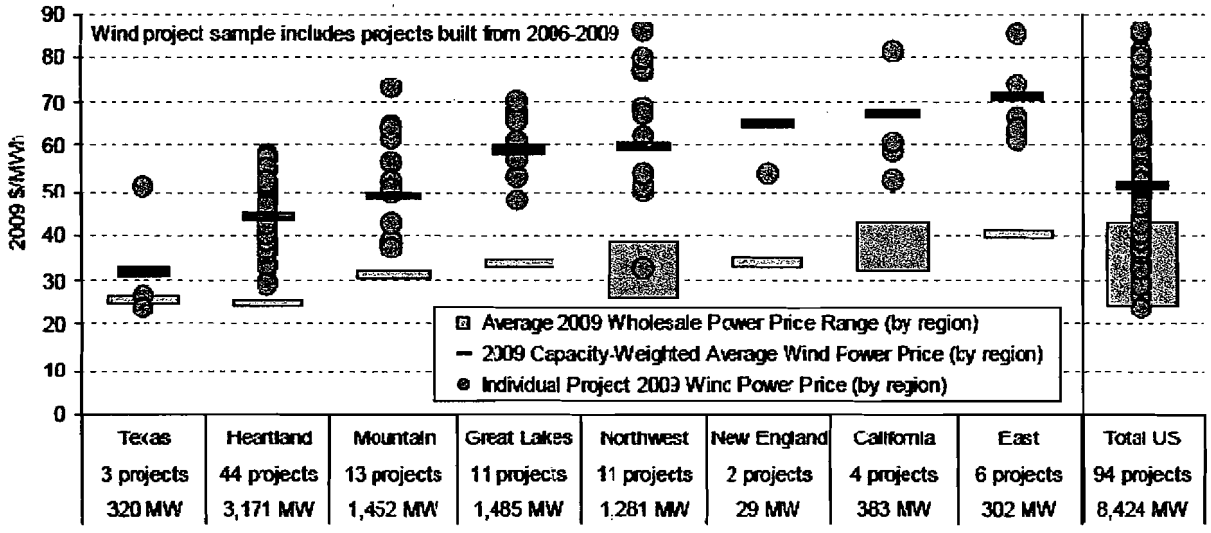
The expected decline in wind farm project costs is already being reflected by a reduction in prices of turbines in the beginning months of 2010. Figure 2-3 shows wind turbine costs over time as calculated for the projects included in the Lawrence Berkeley National Laboratory dataset used in the *2009 Wind Technologies Market Report* [6]. As illustrated in the diagram, turbine prices were in a steady increase, increasing by more than 100 percent between 2000 and 2009.



Source: Berkeley Lab

Figure 2-3: Reported U.S. wind turbine prices over time (Source: EERE [6])

Figure 2-4 shows the prices received by the wind projects in the Berkeley National Lab sample that were built between 2006 and 2009. Unlike in previous years, wind energy prices were not as competitive in 2009, with the prices received by the projects built between 2006 and 2009 being at the higher end of the wholesale electricity price range across the U.S. The drop in wholesale prices that caused this shift in wind energy's competitiveness in 2009 was primarily due to two factors: the drop in electricity demand and prices due to the economic recession and the reduced natural gas prices due to the development of substantial shale gas deposits.



Source: Berkeley Lab, Ventyx, ICF

Figure 2-4: Average cumulative wind and wholesale power prices by region (Source: EERE [6])

2.3 State of wind energy nationally

As can be seen in Figure 2-5, wind energy capacity additions increased in 2009 with over 9,994 MW of name-plate capacity installed in the year. This continued a trend of steady growth since 2005 and record breaking growth since 2007. Prior to 2005 (1999 to 2004) the industry had been characterized by boom-bust cycles attributed primarily to the recurring discontinuities in the renewal of the federal production tax credit since it was first put in place 1992. According to the DOE *2009 Wind Market Technologies Report* [6] the growth in 2009 can be attributed to the following factors.

1. The extension of the production tax credit that was set to expire at the end of 2008 caused projects that had been rushing to beat the deadline to be carried over to 2009. The tax credit has now been extended to 2012.
2. The *American Recovery and Reinvestment Act of 2009* (Stimulus Act) included a provision where wind developers could opt to take a 30 percent cash grant from the U.S. Treasury in lieu of the production tax credit.
3. Projects brought to completion in 2009 to beat the December 2009 expiration date of the first-year bonus depreciation associated with the Modified Accelerated Cost Recovery System.

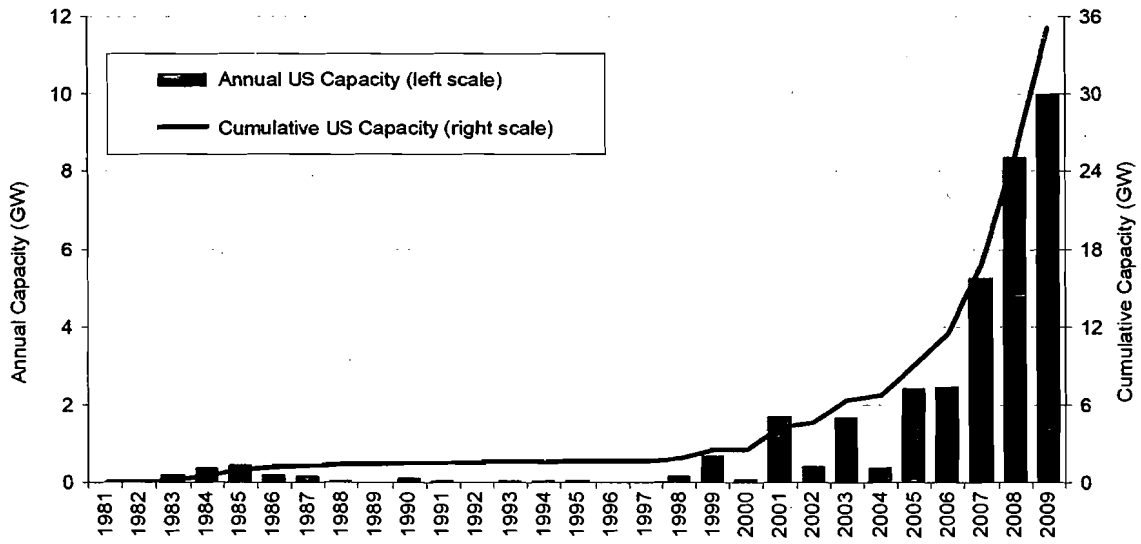


Figure 2-5: Annual capacity additions and cumulative capacity in the U.S. (Source: EERE [6])

The other drivers behind the growth in the wind and renewable energy industry in general also played a role in keeping the wind industry active. These include the renewable portfolio standards enacted and goals set by a large number of states and the uncertainty surrounding the fossil fuel industry due to concerns about future climate change legislation. Figure 2-6 is a map showing the states that have enacted some form of renewable portfolio standard or set a non-

binding goal [7].

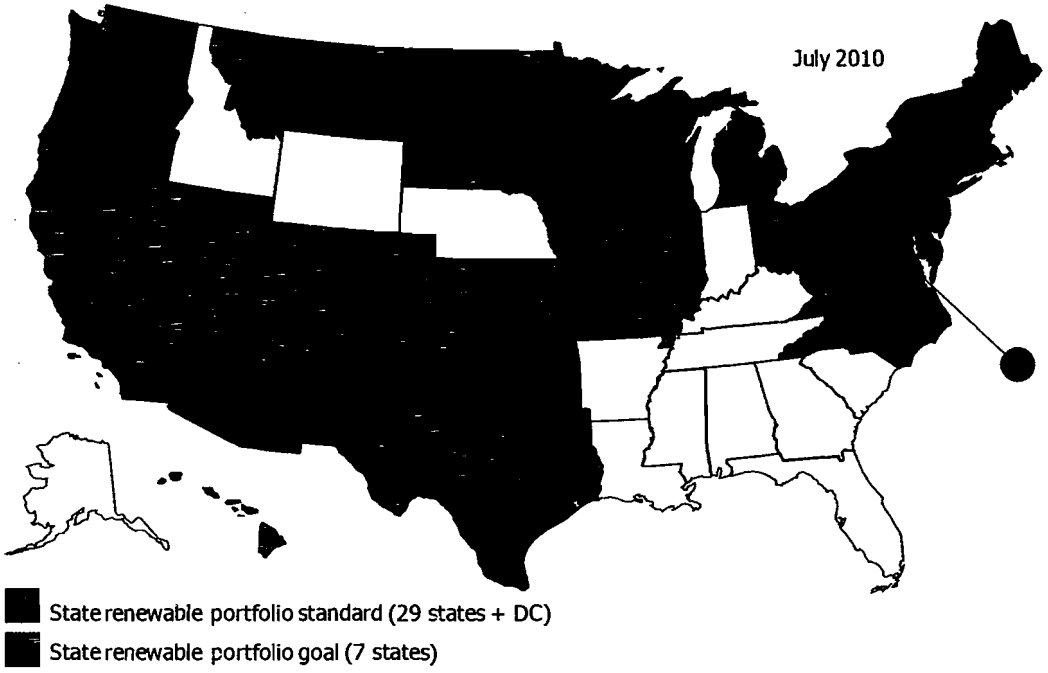
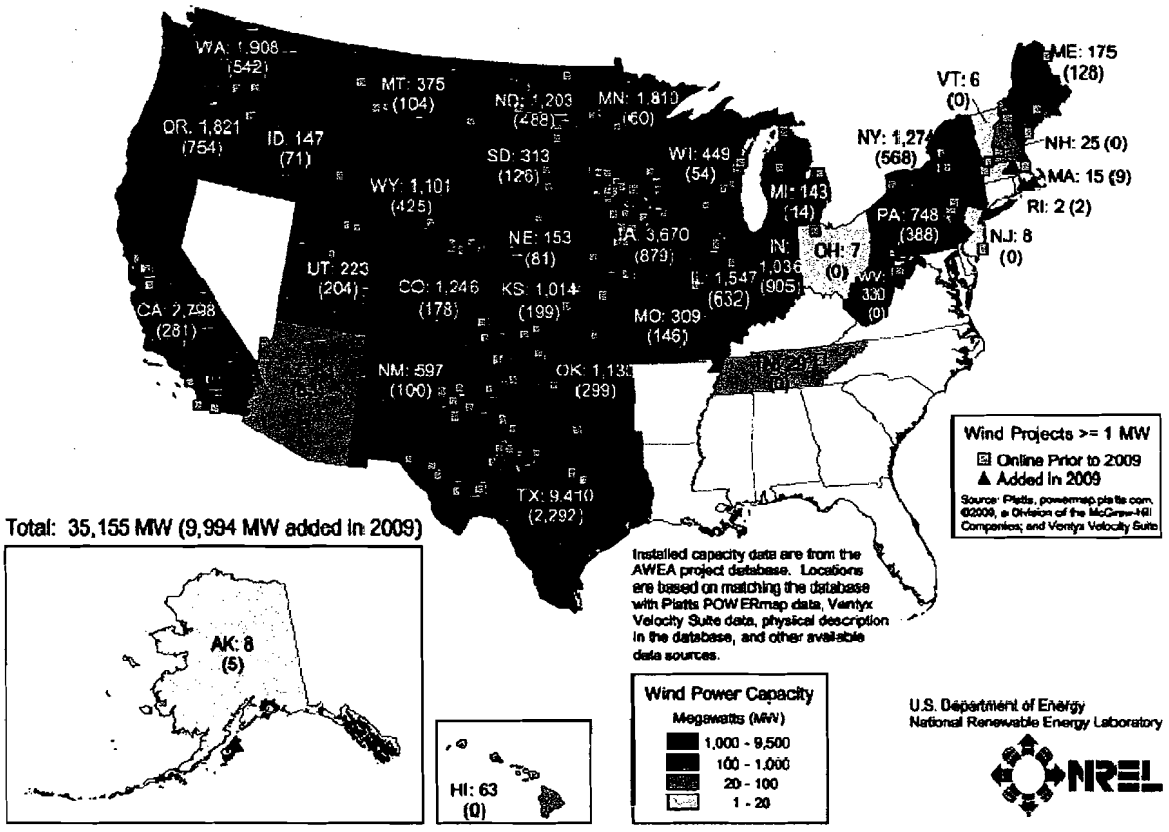


Figure 2-6: Renewable portfolio standards across the U.S. (Source: DSIRE [7])

Figure 2-7 shows the capacity of wind energy installed in states as of May 2009. Texas continued to lead with a total capacity of 9,410 MW installed followed by Iowa with 3,670 MW. The other states in the top five were California – 2,798; Washington – 1,908; Oregon-1,821. Indiana's place as a wind energy state has changed dramatically, from having no utility-scale wind project in 2007 to being ranked 13th nationally with an installed capacity of 1,036 MW at the end of 2009.



Note: Numbers within states represent cumulative installed wind capacity and, in parentheses, annual additions in 2009.

Figure 2-7: Wind power capacity by state at the end of 2009 (Source: EERE [2])

When one considers the penetration of wind energy as a percent of the total electricity generated in 2009, Texas drops to ninth place behind Wyoming whose total installed capacity at the end of 2009 was only 1,101 MW compared to Texas' 9,410 MW. The leading five states in wind energy penetration in 2009 are Iowa –18.8 percent, South Dakota – 13.6 percent, North Dakota – 11.5 percent, Minnesota – 10 percent and Oregon – 8.7 percent. Table 2-2 shows the top twenty states in capacity added in 2009, total cumulative capacity and estimated wind energy as a percentage of total electricity generated in 2009. Indiana's wind penetration ranks 17th nationally at estimated 2.7 percent of total in-state electricity generation, which is slightly above the U.S. average of 2.4 percent.

Annual Capacity (2009, MW)		Cumulative Capacity (end of 2009, MW)		Estimated Percentage of In-State Generation	
Texas	2,292	Texas	9,410	Iowa	18.8%
Indiana	905	Iowa	3,670	South Dakota	13.6%
Iowa	879	California	2,798	North Dakota	11.5%
Oregon	754	Washington	1,908	Minnesota	10.0%
Illinois	632	Oregon	1,821	Oregon	8.7%
New York	568	Minnesota	1,810	Kansas	7.2%
Washington	542	Illinois	1,547	Colorado	7.0%
North Dakota	488	New York	1,274	Wyoming	6.9%
Wyoming	425	Colorado	1,246	Texas	6.3%
Pennsylvania	388	North Dakota	1,203	Oklahoma	5.0%
Oklahoma	299	Oklahoma	1,130	Montana	4.8%
California	281	Wyoming	1,101	Washington	4.5%
Utah	204	Indiana	1,036	New Mexico	4.4%
Kansas	199	Kansas	1,014	California	3.1%
Colorado	178	Pennsylvania	748	Maine	3.1%
Missouri	146	New Mexico	597	Idaho	2.9%
Maine	128	Wisconsin	449	Indiana	2.7%
South Dakota	126	Montana	375	Hawaii	2.2%
Montana	104	West Virginia	330	Illinois	2.1%
New Mexico	100	South Dakota	313	New York	2.0%
Rest of U.S.	358	*Rest of U.S.*	1,376	*Rest of U.S.*	0.25%
TOTAL	**9,994**	**TOTAL**	**35,155**	**TOTAL**	**2.4%**

Source: AWEA project database, EIA, Berkeley Lab estimates

Table 2-2: U.S. wind power rankings: Top 20 states (Data source: EERE [2])

Transmission continued to be a major issue in wind energy development since the most abundant wind energy resource is in the Great Plains (Figure 2-8) and distant from the major population centers along the coasts. Although Figure 2-6 does not show it, the wind resources off the coasts are typically better than onshore winds, with higher wind speeds that are steadier and with less ground level interference. According to the *2009 Wind Market Technologies Report*, almost 2,500 MW of offshore wind projects have made significant advances in the permitting and development process. This includes the highly contested Cape Wind project off the coast of Cape Cod that received its federal permit from the U.S. Department of the Interior in April 2010.

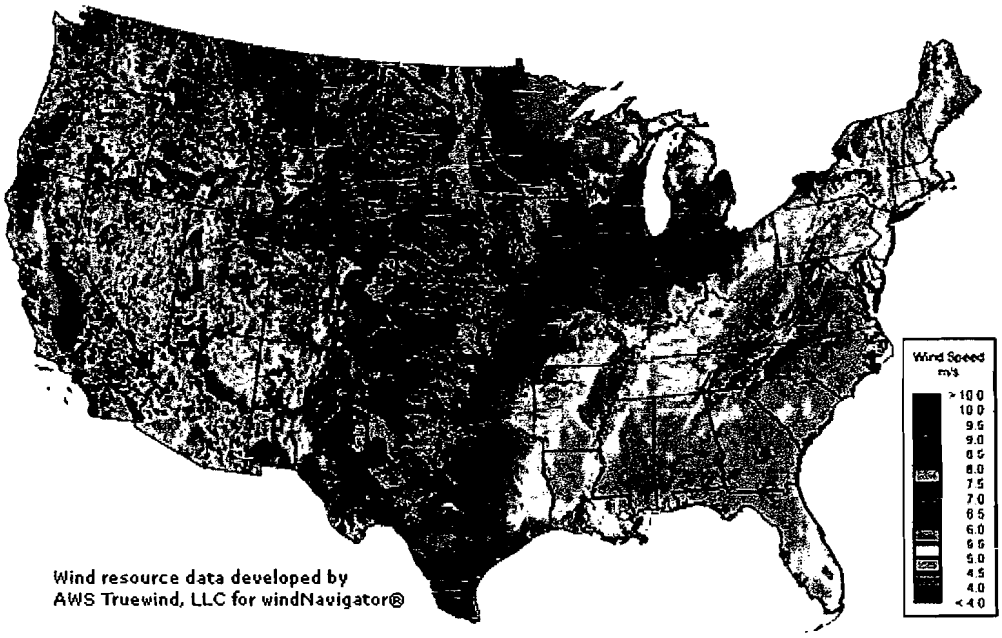


Figure 2-8: 80-meter onshore wind resource map (Source: EERE [8]

2.4 Wind energy in Indiana

Indiana has roughly two wind regions, with the northern half having class 2 winds (12.5 – 14.3 mph at a height of 50 meters) and the southern half having class 1 winds (0 – 12.5 mph). Figures 2-9 through 2-11 show the wind energy distribution in Indiana at 50, 70 and 100 meters, respectively [9]. The higher altitude wind maps indicate that wind speeds are significantly higher farther up. For instance, much of northern Indiana experiences class 4 or better winds at 100 meters.

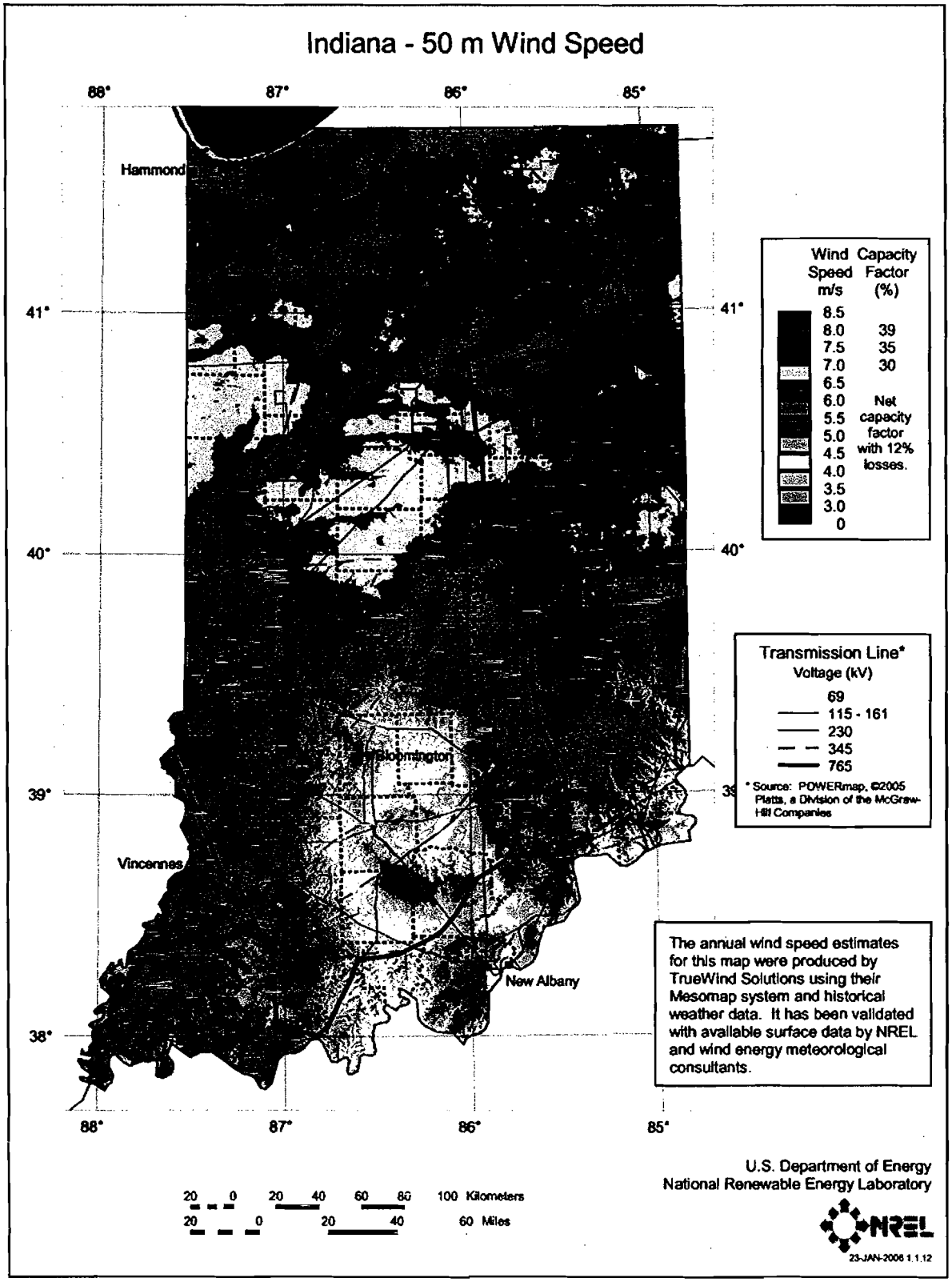


Figure 2-9: Indiana wind speed at 50 meters height (Source: OED/NREL [9])

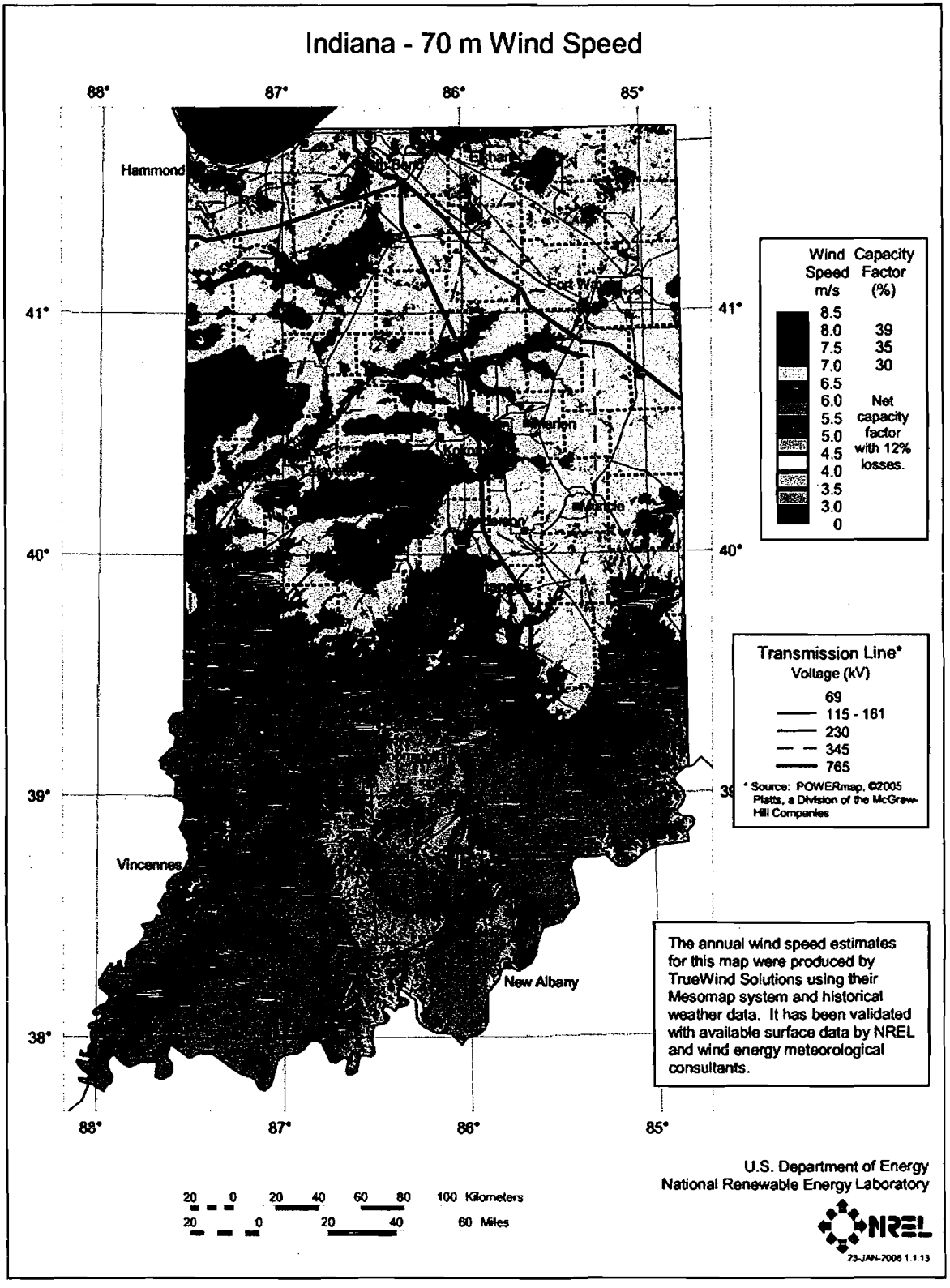


Figure 2-10: Indiana wind speed at 70 meters height (Source: OED/NREL [9])

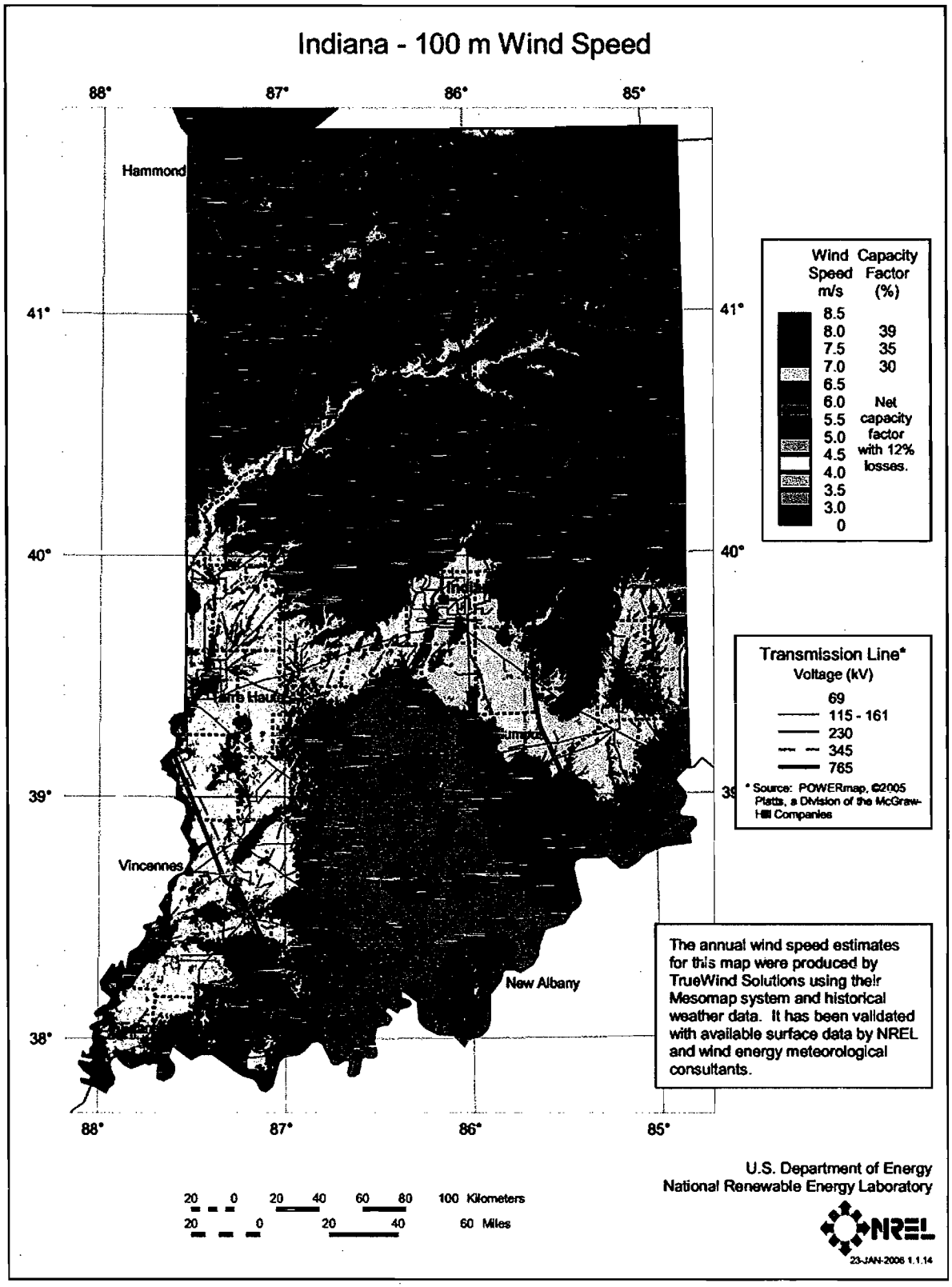


Figure 2-11: Indiana wind speed at 100 meters height (Source: OED/NREL [9])

Indiana wind capacity has increased rapidly in the last three years from a mere 20 kW in 2007 to 1039 MW at the end of 2009, with an additional 203 MW expected to be commissioned before the end of 2010. The heaviest construction was in 2009 when a total of 908 MW were brought online. The first phase of the Fowler Ridge wind farm with a capacity of 400 MW was commissioned in March 2009 and the second phase with a capacity of 200 MW was completed in December. The first phase of the Meadow Lake wind farm with a name plate capacity of 200 MW was commissioned in October 2009 and the 106 MW Hoosier Wind project in November. In addition, a two turbine 2 MW project in Union City, owned jointly by the city and the Randolph Eastern school district was completed the same year. In the first half of 2010 Horizon Energy commissioned the 99 MW second phase of the Meadow Lake wind farm. The third and fourth phases of the Meadow Lake project, with combined capacity of 203 MW, are expected to be completed and commissioned by October 2010. Table 2-3 shows the status of the various Indiana wind farm projects.

Project Name	County	Capacity (MW)	Developer	Date Completed	Power Purchaser
Benton County Wind Farm	Benton	131	Orion Energy	May 2008	Duke (101 MW) Vectren (30 MW)
Fowler Ridge Wind Farm 1	Benton	400	BP Alternative Energy & Dominion	March 2009	I&M (100 MW), Appalachian (100 MW) Dominion (2001 MW)
Fowler Ridge Wind Farm 2	Benton	200	BP Alternative Energy	December 2009	AEP (50x3 MW), Vectren (50 MW)
Hoosier Wind Project	Benton	106	enXco	November 2009	IPL (106 MW)
Union City/Randolph Eastern School Corporation	Randolph	2	Operated by Performance Services Corporation	2009	
Meadow Lake Phase 1	White	200	Horizon (EDP)	October 2009	Wholesale market
Meadow Lake Phase 2	White	99	Horizon (EDP)	Summer 2010	I&M (50 MW)
Under construction					
Meadow Lake Phase 3	White	104	Horizon (EDP)	October 2010	Wholesale market
Meadow Lake Phase 4	White	99	Horizon (EDP)	October 2010	Wholesale market
Proposed Projects					
Fowler Ridge 3	Benton	150	BP Alternative Energy		
Meadow Lake Phase 5	White	100	Horizon (EDP)		
Spartan Wind Farm	Newton	101	Duke Generation Services		

Table 2-3: Status of wind generation projects in Indiana

Indiana utilities have signed power purchase agreements to purchase electricity from these wind farms and from wind farms outside Indiana as shown in Table 2-4.

Utility	Project	State	Power Purchase Agreement (MW)
Duke	Benton County Wind Farm	Indiana	100
Vectren	Benton County Wind Farm	Indiana	30
Vectren	Fowler Ridge Wind Farm 2	Indiana	50
Indiana Michigan	Fowler Ridge Wind Farm 1	Indiana	100
Indiana Michigan	Meadow Lake Wind Farm 2	Indiana	50
NIPSCO	Buffalo Ridge	South Dakota	50
NIPSCO	Barton Windpower	Iowa	50
IPL	Hoosier Wind	Indiana	106
IPL	Lakefield Wind	Minnesota	201
WVPA	AgriWind	Illinois	8
IMPA	Crystal Lake Wind	Iowa	50

Table 2-4: Wind energy purchase agreements by Indiana utilities (Source: IURC)

2.5 Incentives for wind energy

The following federal and state incentives are available for wind energy projects [7].

Federal Incentives

- Renewable Electricity Production Tax Credit (PTC) credits wind energy producers with 2.2 cents/kWh during the first ten years of operation. The PTC was modified in the February 2009 Stimulus Act to allow producers who would qualify for the PTC to opt to take the federal business energy investment tax credit (ITC) or equivalent cash grant from the U.S. Department of Treasury [7].

- Business Energy Investment Tax Credit (ITC) credits up to 30 percent of expenditures on qualifying wind energy installations.
- Renewable Energy Production Incentive (REPI) provides financial incentives similar to the Production Tax Credit to wind generators owned by not-for-profit groups, public-owned utilities and other such organizations. REPI payments are subject to availability of annual appropriations by congress [7].
- Qualifying Advanced Energy Project Investment Tax Credit encourages the development of a U.S.-based renewable energy manufacturing sector. The tax credit is equal to 30 percent of the qualified investment required for an advanced energy project that establishes, re-equips or expands a manufacturing facility that produces equipment and/or technologies used to produce energy qualifying renewable resources [7].
- Residential Renewable Energy Tax Credit allows taxpayers to claim 30 percent of their qualifying expenditures on installation of small wind-energy systems for the dwelling in which they reside [7].
- Modified Accelerated Cost-Recovery System (MACRS): This program allows businesses to recover investments in solar, wind and geothermal property through depreciation deductions.
- Clean Renewable Energy Bonds (CREBs): This program, authorized by the Energy Policy Act of 2005, makes available a total of $1.2 billion in 0 percent interest bonds for non-profit organizations, public utilities, and state and local governments to pursue renewable energy projects. The Energy Improvement and Extension Act of 2008 allocated $800 million for new CREBs. In February 2009, the American Recovery and Reinvestment Act of 2009 allocated an additional $1.6 billion for new CREBs, for a total new CREB allocation of $2.4 billion [7].
- Qualified Energy Conservation Bonds (QECBs) are similar to Clean Renewable Energy Bonds except that they are not subject to the U.S. Department of Treasury application process and instead are allocated to each state based upon their state's percentage of the U.S. population. The states are then required to allocate a certain percentage to "large local governments."[7]
- Energy Efficiency Mortgage can be used by homeowners to finance a variety of energy efficiency measures, including renewable energy technologies, in a new or existing home. The federal government supports these loans by insuring them through FHA or VA programs. This allows borrowers who might otherwise be denied loans to pursue energy efficient improvements [7].
- Rural Energy for America Program promotes energy efficiency and renewable energy for agricultural producers and rural small businesses through the use of (1) grants and loan guarantees for energy efficiency improvements and renewable energy systems, and (2) grants for energy audits and renewable energy development assistance. The program covers up to 25 percent of costs. Congress has allocated funding for the new program in the following amounts: $60 million for FY 2010, $70 million for FY 2011, and $70

million for FY 2012 [7].

- High Energy Cost Grant Program administered by the U.S. Department of Agriculture (USDA) is aimed at improving the electricity supply infrastructure in rural areas having home energy costs exceeding 275 percent of the national average. Eligible infrastructure includes renewable resources generation. The USDA has allocated a total of $15.5 million for the 2010 funding cycle. The individual grants range from $75,000 to $5 million [10]

Indiana Incentives

- Net metering rule: Solar, wind and hydroelectric facilities with a maximum capacity of 10 kW are qualified for net metering. The net excess generation is credited to the customer in the next billing cycle.
- Renewable Energy Systems Property Tax Exemption provides property tax exemptions for the entire renewable energy device and affiliated equipment [7].
- Emissions Credits: Electricity generators that do not emit nitrogen oxides (NO_x) and that displace utility generation are eligible to receive NO_x emissions credits under the Indiana Clean Energy Credit Program [11].
- Indianapolis Power & Light Co. – Rate REP Renewable Energy Production: IPL is offering a "feed-in tariff" to facilities that produce renewable energy. IPL can purchase renewable energy and contract the production for up to 10 years. Compensation for small wind facilities is $0.14/kWh and for large wind facilities is $0.075/kWh [7]

2.6 References

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3. Dedicated Energy Crops

3.1 Introduction

Dedicated energy crops represent one of three types of biomass or organic matter that can be converted into energy. The other two types are dual-use food crops, such as corn and soybeans, and organic waste such as forest residues, agricultural residues, livestock manure and municipal solid waste. The use of organic waste biomass as a source of energy is the subject of the next section (Section 4) of this report.

Dedicated energy crops can be divided into two broad categories: herbaceous grasses such as switchgrass, sorghum, and energy cane, and short rotation woody crops such as hybrid poplars and hybrid willows. Unlike dual use food crops and organic waste biomass, the dedicated energy crop industry is still in its infancy. According to a report by Marie Walsh of Oak Ridge National Laboratory (ORNL), as of 2000 there was no commercial production of dedicated energy crops anywhere in the U.S. [1].

One advantage of biomass over other renewable resources is that, as a source of energy, biomass is not intermittent like wind and solar. Another unique feature about biomass among other renewable resources is that it can be readily converted into liquid fuels for the transportation industry [2].

Energy is extracted from biomass on a large scale either by directly burning the material or by converting the material to a substance that has efficiency or end-use benefits. Two methods are used for burning the material: direct firing and co-firing. In direct firing the biomass material is simply burned and the heat is used to create steam which can be used to create electricity. In co-firing, the biomass material is used as a supplement to coal. One advantage to using the co-firing method over using only coal is that lower net emissions of carbon dioxide and sulfates per unit of heat are obtained from the biomass material. Also, co-firing results in a smaller volume of ash than direct firing biomass [3]. One disadvantage of using biomass in coal reactors is that fouling of the reactor sides can occur due to the high amounts of alkaline impurities introduced to the reaction mix.

Apart from direct combustion of the material, biomass can be altered using thermochemical or biochemical processes. Gasification is a thermochemical process where the fuel is converted into a gaseous fuel using high temperatures. Pyrolysis is another process where the biomass material is converted into smaller compounds using heat. This technology can increase the energy transfer efficiencies [3, 4].

Other ways of handling biomass are to convert the material to a fuel using a biochemical process. The main methods of this transformation are anaerobic digestion and fermentation [3]. In digestion, enzymes are added to break down the material in order to produce biogas which is a mixture of methane and carbon dioxide. In fermentation, ethanol is produced from the material [3].

Bioenergy constituted 4.2 percent of the total energy consumed, and 51 percent of the total renewable energy consumed, in the U.S. in 2009 [5]. Of the 3.596 quadrillion British thermal units (quads) of energy supplied by biomass in 2007, 56 percent was consumed in the industrial sector, 12 percent was consumed in the electricity sector, and 12 percent was consumed in the residential sector [6]. Another 17 percent was consumed in the transportation sector in the form of ethanol and biodiesel. The majority of biomass consumption in the industrial sector comes from the use of wood wastes at pulp and paper plants. Here the wood residues from the manufacturing process are combusted to produce steam and electricity [7]. Residential consumption occurs primarily in the form of wood burning fireplaces and stoves. The primary sources of biomass for electricity generation are landfill gas and municipal solid waste, which account for approximately 90 percent of biomass electricity generation[3] [6].

Analogous to a refinery for petroleum, biorefineries are facilities that use biomass to create fuels, power, and chemicals. They are able to process the high volume of raw biomass into a more easily handled product such as transportation fuel. Research occurring at NREL takes two approaches for developing biorefineries. The biochemical approach focuses on the fermentation of sugars to produce fuels and other useful products for energy generation. The thermochemical approach uses gasification technologies to obtain these products [8].

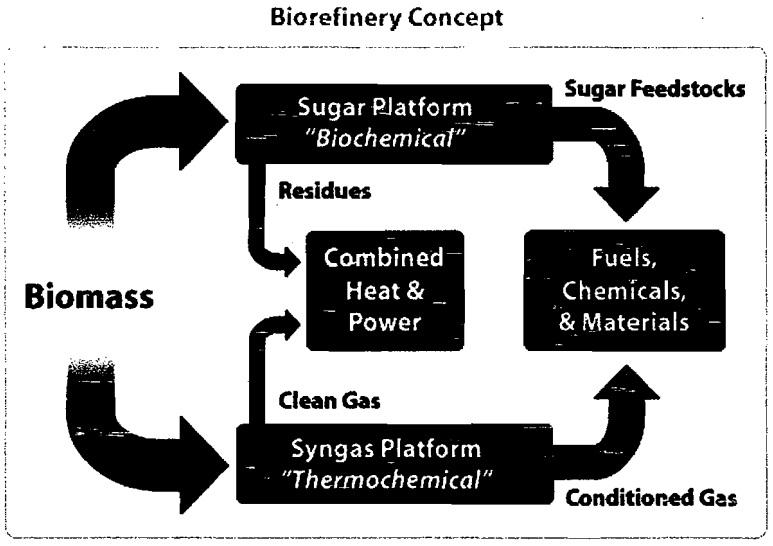

Figure 3-1: Biorefinery platforms (Source: NREL [8])

[3] A complete overview of organic waste biomass is presented in Section 4 of this report.

The advantage of a biorefinery lies in maximizing the value derived from the different biomass stocks. The NREL Biomass Program is currently working on six major biorefinery projects [8]. On May 5, 2009, U. S. Secretary of Energy Steven Chu announced that the American Reinvestment and Recovery Act would allocate nearly $800 million to aid in biofuels research and commercialization, which includes additional funding for commercial-scale biorefinery demonstration projects [9]. On May 6, 2010, the U.S. Departments of Energy and Agriculture announced an additional $33 million for funding research to develop technologies and processes that produce biofuels, bioenergy, and high-value biobased products [10].

Energy crops have long-term advantages, such as erosion mitigation, that other sources of biomass do not have [11]. Willow and switchgrass energy crops are not being commercially grown in the U.S. at present, although demonstration projects have been funded by DOE in Iowa and New York [7]. The Bioenergy Feedstock Development Program at ORNL has identified hybrid poplars, hybrid willows, and switchgrass as having the "greatest potential as dedicated energy crops over a wide geographic range" [11]. Canola, a specialized oilseed, is also a potential energy crop that is being grown in the Northern Plains region of the United States [12]. As a relatively new crop, adoption of canola is limited by farmer confidence and the large amount of land required for profitable initial production.

Switchgrass falls under the category of herbaceous energy crops. These energy crops are perennials that are harvested annually after taking an initial two to three years to reach full productivity. A 2005 study by McLaughlin and Kszos reported a current average annual yield of switchgrass clones of 4.2 - 10.2 dry tons/acre in the U.S. [13]. The hybrid poplar and hybrid willow are short rotation, fast growing hardwood trees. They are harvested within five to eight years after planting. The comparative chemical characteristics between relevant energy crops and conventional fossil fuels are shown in Table 3-1 [14].

Fuel Source	Heating Value (gigajoule/ton)	Ash (%)	Sulfur (%)
Switchgrass	18.3	4.5-5.8	0.12
Hybrid Poplar/Willow	19	0.5-1.5	0.03
Coal (Low Rank)	15-19	5-20	1-3
Coal (High Rank)	27-30	1-10	0.5-1.5
Oil	42-45	0.5-1.5	0.2-1.2

Table 3-1: Comparative chemical characteristics of energy crops and fossil fuels (Source: ORNL [14])

Converting a traditional coal-fired power plant to a co-firing plant costs $150-$300 per kilowatt of biomass generation in pulverized coal boilers [15].

3.2 Economics of energy crops

According to ORNL [1], there was no dedicated energy crop production in the U.S. as of the year 2000. This is because the low price of fossil fuels meant that the price of energy crops would be too low for farmers to profitably grow them in place of current traditional food crops, such as corn and soybeans. Furthermore, the proposed revision to the *Clean Air Interstate Rule* (CAIR) would reclassify biomass boilers making them subject to the *Maximum Achievable Control Technology* (MACT) to restrict emissions will likely worsen the economic viability of biomass combustion for energy. The proposed rule was issued by the U.S. Environmental Protection Agency in April 2010 and the public comment period closed in August [16].

In a report titled *Biomass for Energy Generation* by Zia Haq at the Energy Information Administration (EIA) [7], biomass supply for energy production was predicted to grow dramatically given higher prices for biomass. Dr. Haq utilized an agricultural sector model called POLYSYS (Policy Analysis System), which was developed by ORNL to estimate possible future supplies of agricultural crops. Traditionally this software has been used for estimating commodity crops' supply; thus, to evaluate the economic potential of energy crops, several modifications to the POLYSYS model were made [17]. The estimated national supply curve for biomass and energy crops produced by POLYSYS for the year 2020 is shown in Figure 3-2.

Figure 3-2 indicates that energy crops will be supplied to the market when the average price (in 2000 dollars) paid for biomass exceeds $2.10/million Btu. In comparison, the average price of coal to electric utilities in 2007 was $1.48/million Btu (in 2000 dollars) [18]. Therefore, the use of energy crops is not yet economical. Tighter emission standards (SO_2, NO_x, mercury, carbon etc) may significantly alter the price spread over which biomass becomes viable.

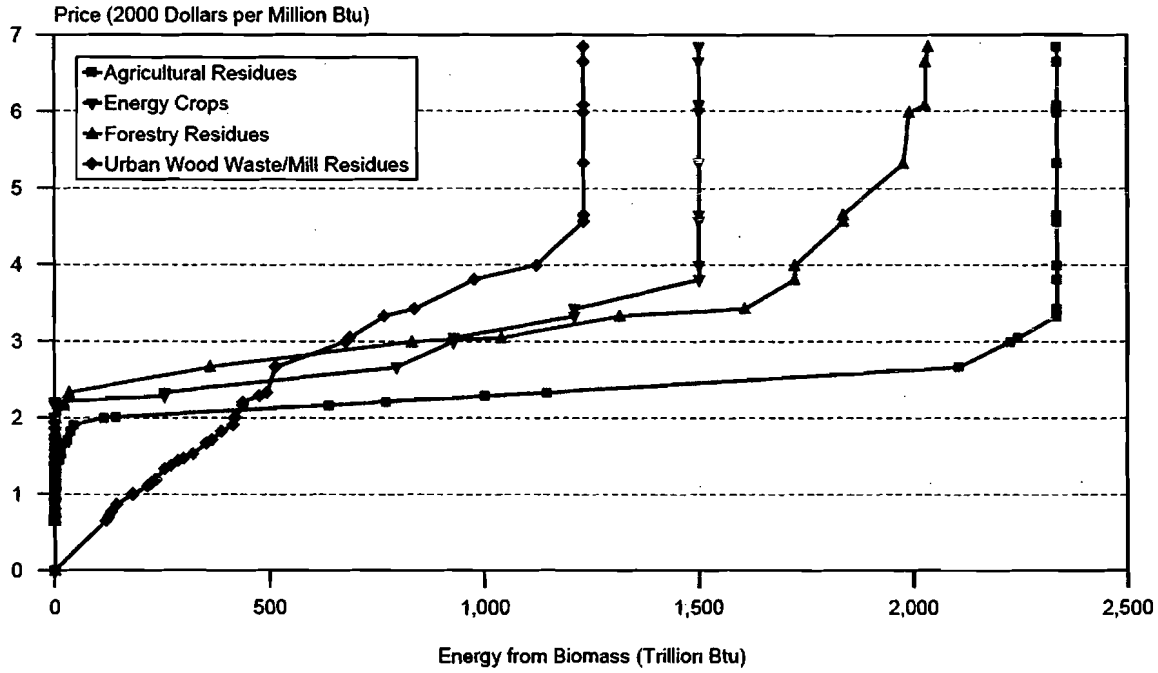

Figure 3-2: POLYSYS estimated biomass supply curve for year 2020 (Source: EIA)

Corn and soybean use for biofuel production

Although corn and soybeans do not meet the strict definition of a dedicated energy crop, their rapid rise as feedstocks for ethanol and biodiesel plants has had a significant effect on the renewable energy industry and agriculture in Indiana. Unlike most other renewable fuels in this report, the main use of ethanol and biodiesel is in the transportation sector. Before the construction boom in the mid 2000s Indiana's ethanol production capacity consisted of one facility, with a 102 million gallons per year (MGY) production capacity and not a single biodiesel plant. The corn-based ethanol production capacity was increased to 938 MGY by the addition of eleven ethanol plants, and biodiesel capacity increased to 118 MGY across five plants. Tables 3-2 and 3-3 show the location and capacities of the ethanol and biodiesel plants in Indiana [19]. The following factors account for the rapid increase in biofuel production.

- Substitution of ethanol as a gasoline oxygenating additive in place of the chemical additive MTBE, which has been associated with ground water pollution. The shift from MTBE to ethanol was driven by states and the 2005 Energy Policy Act [20].
- The renewable fuel standard (RFS) included in the 2005 Energy Policy Act. The RFS mandates the increasing use of renewable fuels by expanding to 7.5 billion gallons by 2012 [21].
- The streamlining of the volumetric ethanol excise tax credit (VEETC) process and the raising of the cutoff level for the small producer's tax credit from 30 million gallons per year to 60 million gallons per year. The streamlined VEETC allows for a 45 cents/gallon

tax credit to be given to the individual who produces the mixture of gasoline and ethanol [22]. This tax credit is due to expire December 31, 2010, but legislation to extend the tax credit until 2015 has been submitted in the Senate and the House of Representatives [23].

Company	Location	Current Capacity (MGY*)
New Energy Corp	South Bend	100
Central Indiana Ethanol	Marion	40
Iroquois Bio-Energy Co.	Rensselaer	40
POET Energy	Portland	65
POET Energy	Alexandria	60
POET Energy	North Manchester	65
The Andersons Clymers	Clymers	110
Valero Energy	Linden	100
AltraBiofuels Indiana	Cloverdale	60
Cardinal Ethanol	Union City	100
Indiana Bio-Energy	Bluffton	110
Abengoa Bioenergy Corp.	Mt. Vernon	88

*MGY is million gallons per year.

Table 3-2: Ethanol plants in Indiana (Source: ISDA [19])

Biodiesel plant Name	Year	Town/County	Estimated Capacity (MGY)
E-biofuels	2007	Middletowm/Henry	10
Evergreen Renewables	2006	Hammond/Lake	5
Integrity Biofuels	2006	Morristown/Shelby	5
Louis Dreyfus	2007	Claypool/Kosciusko	88
Xenerga	2008	Kingsbury/LaPorte	10

Table 3-3: Biodiesel plants in Indiana (Source: ISDA [19])

3.3 State of energy crops nationally

Energy crops can be grown on most of the land classified as cropland in the U.S. [11]. Overall, the nation's cropland acreage remains around 400 million acres with changes from year to year of harvested crop land at less than 13 percent [24, 25]. Figure 3-3 shows estimated biomass production potential nationally [26]. A subset of these lands is defined as prime farmland – those lands with the best combination of physical and chemical characteristics for growing crops. However, while traditional crops may be best grown on prime farmland, energy crops can also be grown on erosive lands or lands that are otherwise marginal for conventional crop production.

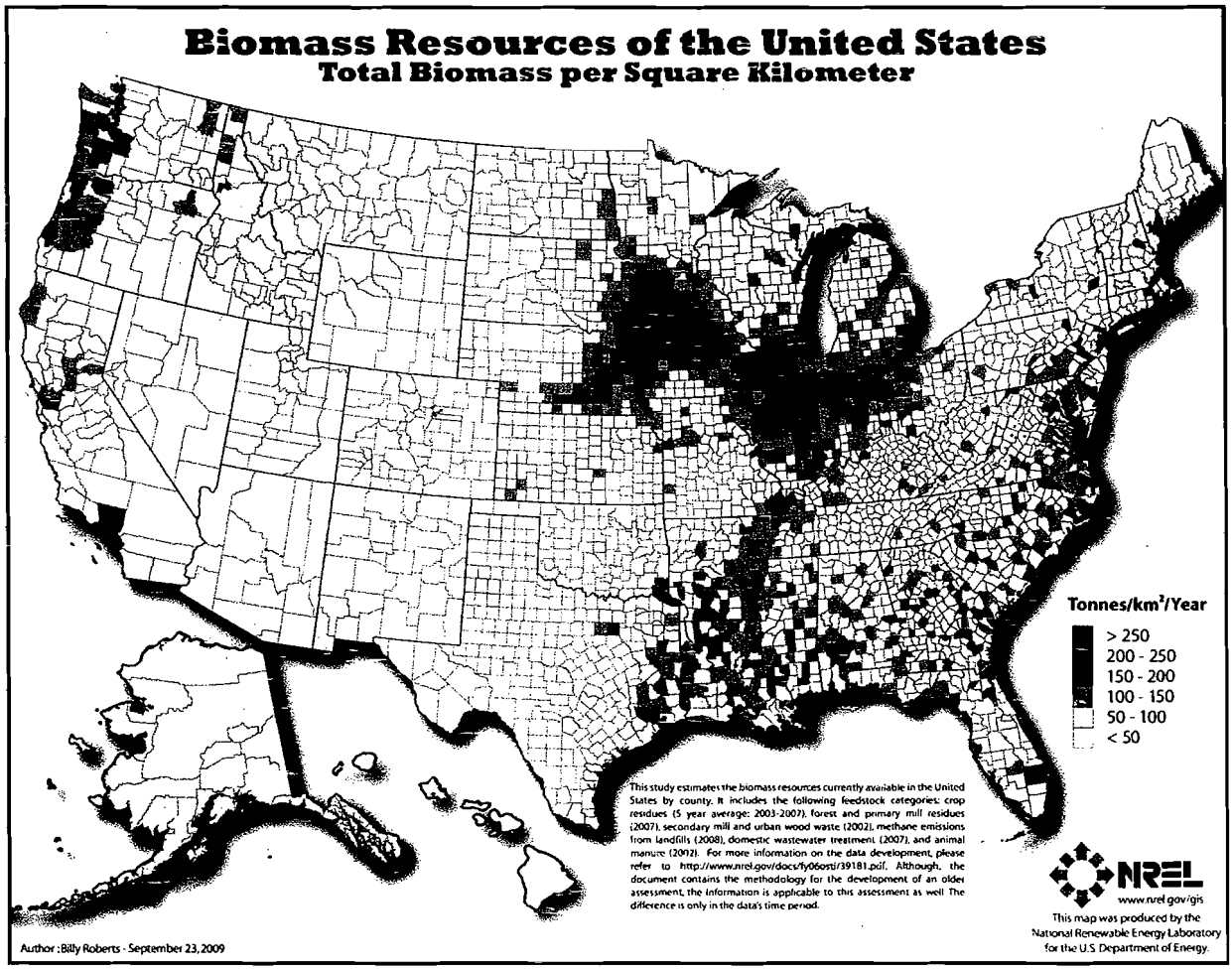

Figure 3-3: Biomass resources available in the U.S. (Source: NREL [26])

ORNL, which houses the national Biomass Feedstock Development Program, uses the POLYSYS modeling system referred to in Section 3.2 to estimate the quantities of energy crops that could be produced at various prices in the future. The POLYSYS model assumes that irrigation of energy crops would be economically and environmentally unfeasible, and thus excludes the Western Plains due to the natural rain gradient in the U.S. Also, the Rocky Mountain region is excluded as it is assumed to be an unsuitable climate in which to produce energy crops. The assumed yields of energy crops were lowest in the Northern Plains and highest in the heart of the Corn Belt, including Indiana [7, 27]. Hybrid poplar production was assumed to occur in the Pacific Northwest, Southern and Northern regions, while willow production was centered on the northern Great Lakes and the Northeast. The production assumptions used by ORNL are shown in Figure 3-4. The final panel in Figure 3-4 shows the acreage in the Conservation Reserve Program (CRP) that may be available for bioenergy crop production. These and further assumptions that ORNL used with the POLYSYS model are discussed in *The Economic Impacts of Bioenergy Crop Production on U.S. Agriculture* [17].

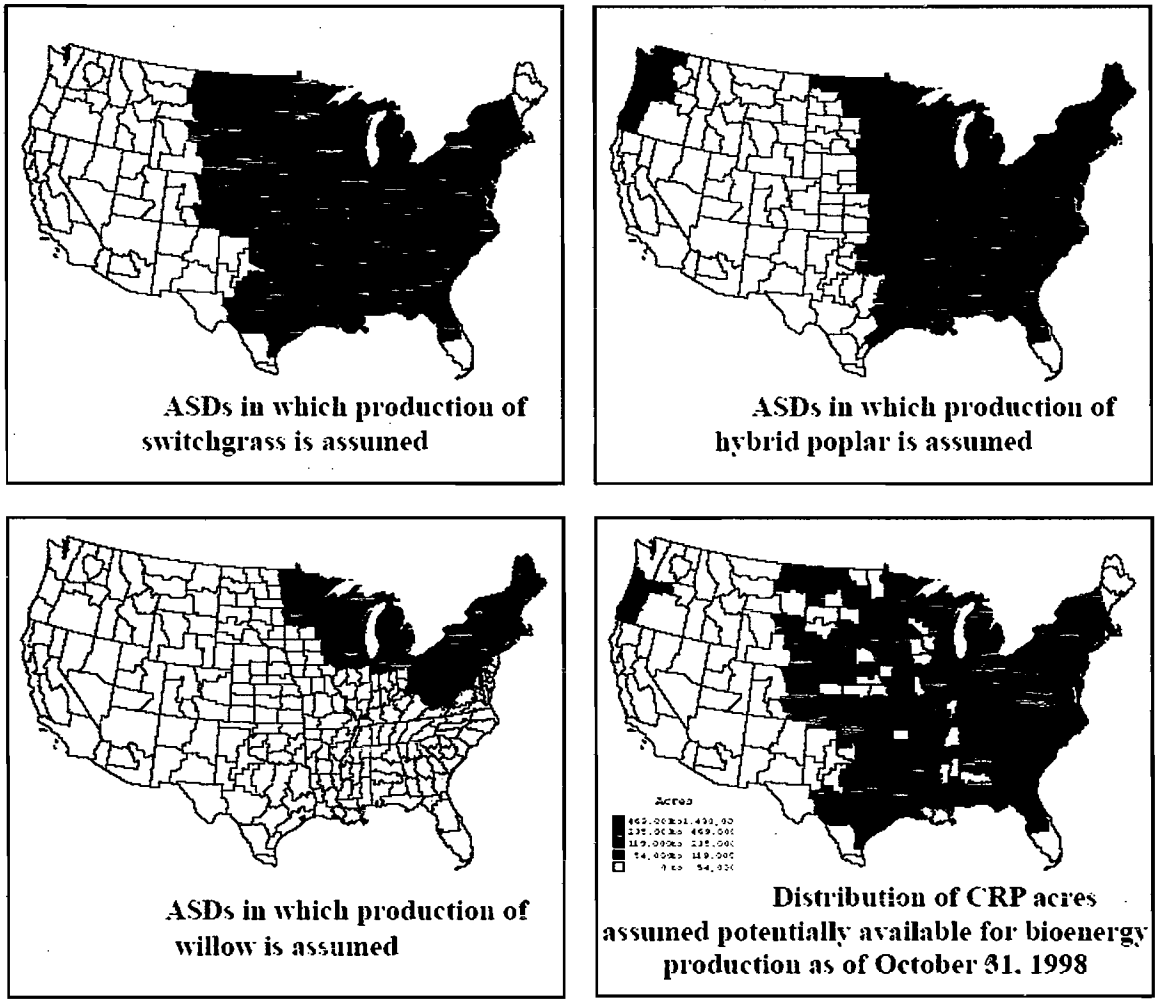

Figure 3-4: POLYSYS assumed Agricultural Statistical Districts (ASDs) for energy crop production (Source: University of Tennessee [17])

The energy crop yield assumptions that have been used for the POLYSYS model are displayed in Table 3-4. According to Haq's *Biomass for Electricity Generation* [7], the variation in yields for energy crops is due to differing soil conditions and weather patterns across the country. Also, different varieties of the energy crops are suited for different parts of the country, and these have variable growth rates. Haq's projections indicate that the lower costs and higher yields of switchgrass would make switchgrass the preferred energy crop of farmers. Also, for end users, switchgrass is advantageous because it has much lower moisture content than wood chips from hybrid poplars or willows. Another advantage of switchgrass is that the same plant will produce new stalks every year indefinitely. Thus, there is very low cost of maintenance—once a farmer plants switchgrass, it can be harvested for years to come. Haq indicates that the yield and quality of switchgrass will continually improve through genetic modification and breeding. Thus, farmers may plow under their fields and plant new varieties of switchgrass periodically, perhaps every 10 years.

Energy Crop	Currently Cultivated Lands	Idle and Pasture Land
Switchgrass	2.0 to 6.7	1.7 to 5.7
Hybrid poplar	3.25 to 6.0	2.8 to 5.1
Willow	3.15 to 5.8	2.7 to 4.9

Table 3-4: Energy crop yield assumptions for the POLYSYS model (dry tons/acre/year) (Source: EIA [7])

Hybrid poplars would be planted at 545 trees/acre. Based on geographic location, the trees would be harvested every 6-10 years of growth. The trees would be distributed to customers as wood chips. Willows would be grown in a short rotation woodland management system and would be replanted every 22 years. Willows can be planted at 6,200 trees/acre, and would be harvested a total of 7 times over a 22 year time frame. The willow trees would also be distributed as wood chips.

The USDA and DOE conducted another study in 2000 using the POLYSYS model,to determine the potential of producing biomass energy crops [1]. The results indicated that an estimated 188 million dry tons (2.9 quads) of biomass could be available annually at prices of less than $2.88/million Btu by the year 2008. The cost is still too high, however, to compete with other sources of energy like coal. The analysis includes all cropland suitable for the production of energy crops that is currently planted with traditional crops, idled, in pasture, or in the CRP. It is estimated that 42 million acres of cropland (about 10 percent of all cropland acres) could be converted to energy crop production, including 16.9 million CRP acres.

The study indicates that CRP acres could become a significant source of biomass crops, decreasing the impact of competition with traditional crops [17]. Harvest of CRP acres will require a significant change in the current laws, however, and likely need to be structured in a way that maintains the environmental benefits of the program.

Energy crop yields will increase over time, as will yields for traditional crops. The interplay of demand for food, feed, and fiber; yields of traditional crops; and crop production costs will determine the number of acres allocated to traditional crop production. International demand for food, feed, and fiber is expected to increase in coming years.

Biotechnology is expected to substantially increase crop yields in the future, although studies (such as those by the Office of Technology Assessment and by the Resource Conservation Act assessments) indicate that the largest increases in yields will likely occur after 2020. Potential quantities of energy crops could increase in the near future, but increases may be due more to increasing yields per acre than to an increasing number of acres under cultivation.

3.4 Energy crops in Indiana

A 2002 study conducted at Ball State University estimated that there was potential to produce 90 million tons per year of switchgrass in Indiana if all the crop land was converted to the production of this energy crop. These 90 million tons of switchgrass would produce 450,000 GWh of energy, which is approximately four times Indiana's annual electrical energy consumption.

According to the Ball State study, switchgrass is viable as an energy crop in Indiana because of the following factors.

- Switchgrass is native to most of the Midwest;
- It does not require much input after planting, resulting in less soil disturbance and erosion;
- Harvest usually occurs from September to October, prior to the harvest of corn and soybeans; and
- The machinery required for harvesting switchgrass is similar to that used for hay or silage [3].

Figure 3-5 shows the levels of energy crops that would be produced in Indiana at three different biomass price levels used in a 1998/1999 USDA/USDOE study using the POLYSYS model. As the figure shows energy crops do not begin to be competitive with traditional food crops until the biomass price approaches $40 per dry ton. At $50 per ton, the biomass production jumps to 5 million tons [1, 28]. The biomass price levels needed to achieve the production levels shown in Figure 3-5 will be higher today given that food crop price levels are much higher than they were in 1999.

The estimates of switchgrass and poplar production potential in a 2006 ORNL [29] study are shown in Figure 3-6. The study used the same agricultural sector model (POYSYS) referred to previously. As can be seen in Figure 3-6, central Indiana has the highest potential for switchgrass production while the northeast and southeast regions of Indiana have the highest potential for hybrid poplar production.

Figure 3-5: Estimated annual cumulative energy crop quantities (dry tons) by delivered price (1997 dollars) for Indiana (Data source: ORNL [1])

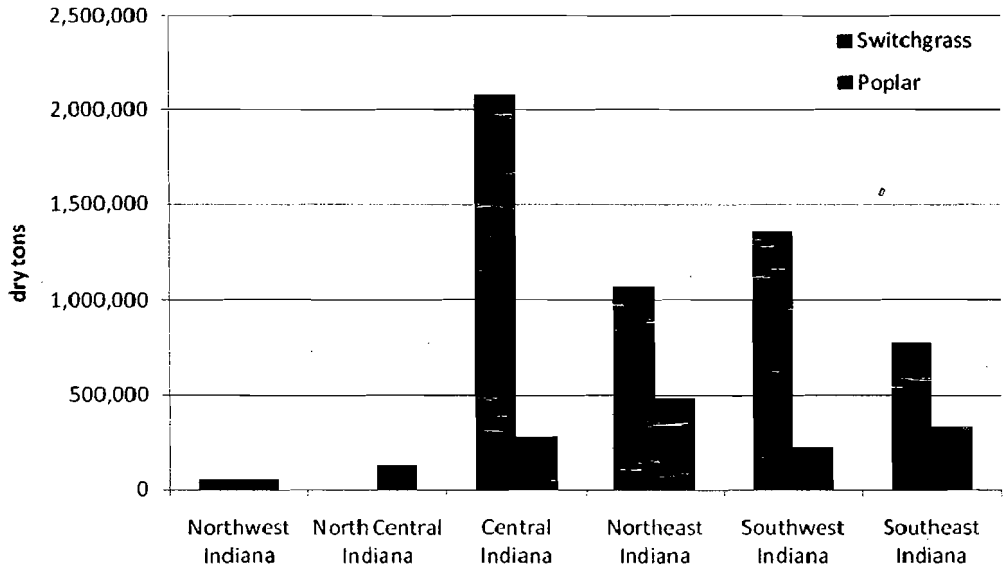

Figure 3-6: Estimated annual potential production of switchgrass and hybrid poplar (dry tons) for Indiana, USDA baseline 2001 (Source: ORNL [29])

In an April 2008 working paper, Brechbill and Tyner of Purdue's Agricultural Economics Department did an extensive study of the cost of producing switchgrass and harvesting corn stover for the energy industry. Table 3-5 shows the average cost of producing switchgrass given in this study [30]. The table includes the farmer's choice to either purchase and own the harvesting equipment or to hire the services of a specialized custom operator.

	500 acre farm	1,000 acre farm	1,500 Acre farm	2,000 acre farm
Custom hired equipment	$53.23	$53.23	$53.23	$53.23
Owned equipment	$54.54	$52.43	$51.73	$51.38

Table 3-5: Average cost ($/ton) for producing switchgrass in Indiana (Source: Brechbill & Tyner [30])

3.5 Incentives for energy crops

The following incentives have been available to assist in the use of energy crops.

Federal Incentives

- Renewable Electricity Production Tax Credit (PTC) provides a 2.2 cents/kWh tax credit for wind, geothermal and closed-loop biomass and 1.1 cents/kWh for open-loop biomass, landfill gas municipal solid waste, small hydroelectric and marine energy technologies. As part of the February 2009 Stimulus Act the PTC was modified to provide the option for qualified producers to take the federal business energy investment tax credit (ITC) or an equivalent cash grant from the U.S. Department of Treasury. Dedicated energy crops fall under the closed loop biomass category [31].
- Business Energy Investment Tax Credit (ITC) credits up to 30 percent of expenditures on qualifying renewable energy systems [31].
- Renewable Energy Production Incentive (REPI) provides financial incentive payments for electricity produced and sold by new qualifying renewable energy generation facilities. Qualifying facilities are eligible for annual incentive payments of 1.5 cents/kWh for the first ten years of production, subject to the availability of annual appropriations in each federal fiscal year of operation. The Energy Policy Act of 2005 expanded the list of eligible technologies and facilities owners, and reauthorized the payment for fiscal years 2006 through 2026 [31].
- Rural Energy for America Program promotes energy efficiency and renewable energy for agricultural producers and rural small businesses through the use of (1) grants and loan guarantees for energy efficiency improvements and renewable energy systems, and (2) grants for energy audits and renewable energy development assistance. The program covers up to 25 percent of costs [31].
- Qualified Energy Conservation Bonds (QECBs) are qualified tax credit bonds and are allocated to each state based upon their state's percentage of the U.S. population. The

states are then required to allocate a certain percentage to "large local governments". In February 2009, these funds were expanded to $3.2 billion [31].

- Value-Added Producer Grant Program: Grants are available to independent producers, agricultural producer groups, farmer or rancher cooperatives, and majority-controlled producer-based business ventures seeking funding. Previously awarded grants supported energy generated on-farm through the use of agricultural commodities, wind power, water power, or solar power. The maximum award per grant was $300,000 [32].
- High Energy Cost Grant Program administered by the U.S. Department of Agriculture (USDA) is aimed at improving the electricity supply infrastructure in rural areas having home energy costs exceeding 275 percent of the national average. Eligible infrastructure includes renewable resources generation. The USDA has allocated a total of $15.5 million for the 2010 funding cycle. The individual grants range from $75,000 to $5 million [33]

Indiana Incentives

- Emissions Credits: Electricity generators that do not emit NO_x and that displace utility generation are eligible to receive NO_x emissions credits under the Indiana Clean Energy Credit Program [34]. These credits can be sold on the national market.
- Indianapolis Power & Light Co. – Rate REP Renewable Energy Production: IPL is offering a "feed-in tariff" to facilities that produce renewable energy. IPL can purchase renewable energy and contract the production for up to 10 years. Biomass compensation is $6.18/kW per month plus $0.085/kWh [31, 35].

Government aid could also assist in offsetting the renovation costs in converting conventional fossil-fueled generating stations to co-firing stations. Converting a coal-fired station to co-fire with biomass can result in an incremental cost of approximately 1 to 2 cents/kWh, and conversion to gasification can result in an incremental cost of 7 cents/kWh [36]. Further biotechnology developments in energy crops and improvements in energy conversion technology would also assist in the development of energy crops within Indiana and the use of biomass in electricity generation. Overall, farmers could earn up to $8 billion more per year if biomass were more widely utilized in the U.S. [36].

3.6 References

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4. Organic Waste Biomass

4.1 Introduction

Organic waste biomass with potential to be used as a source of energy includes:

- Residues from the forestry products industry:
  - Forest residues - Includes material left after the logging or harvesting of trees or as a result of thinning during forest management activities
  - Paper and pulping industry residues - leftover lignin and pulping liquor from paper-making processes. Many paper mills use leftover lignin to produce energy for their own processes.
- Municipal solid waste (MSW): Residential, commercial, and institutional post-consumer wastes contain a significant proportion of plant-derived organic material. They include such things as waste paper, cardboard, wood waste and yard cuttings.
- Residues from food and other biomass processing industries: Processing of biomass yields byproducts and waste streams that have significant energy potential.
- Animal wastes: Farms and animal processing operations create animal wastes that constitute a complex source of organic materials convertible into energy.
- Agriculture crop residues: Stalks, leaves and other material not harvested and typically not removed from the field during harvest have significant energy potential.

Biomass is one of the largest sources of renewable energy in the U.S. Historically it has ranked second to hydroelectric power, but has recently become the leading source of renewable energy. In 2009 renewable energy constituted 8.1 percent of the total energy consumed in the U.S. [1]. Of that, 50 percent was from biomass, making biomass the single largest source of renewable energy (Figure 4-1). More than 70 percent of biomass in 2007 was black liquor, a byproduct of papermaking and residue wood from the forest products industry [2]. The primary sources of biomass for non-cogeneration electricity are landfill gas and municipal solid waste [2]. Together, they accounted for over 54 percent of biomass electricity generation in the U.S. in 2007. During 2009, biomass accounted for approximately 10 percent of renewably generated electricity, 99 percent of industrial renewable energy use, 76 percent of residential renewable energy use, and 86 percent of commercial renewable energy use [1].

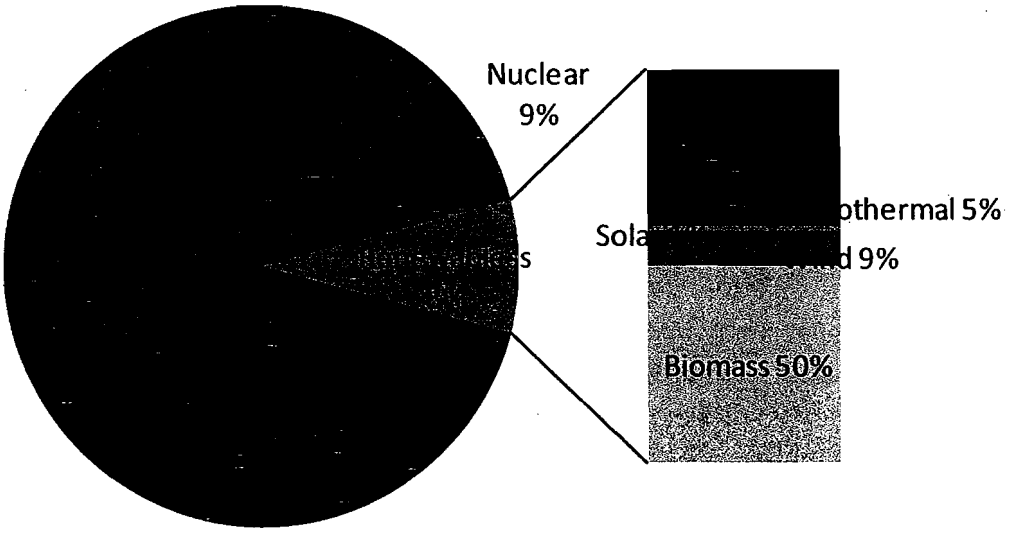

Figure 4-1: Summary of U.S. energy consumption in 2009 (Data source: EIA [1])

Figure 4-2 shows the projected growth in non-hydro renewable electricity generation in the 2010 EIA *Annual Energy Outlook* reference case [3]. Biomass and wind are forecast to remain the main suppliers of non-hydro renewable electricity with biomass growing from its current 1.4 percent share to 5.5 percent in 2035 and wind growing from its current 1.9 percent to 4.1 percent in 2035.

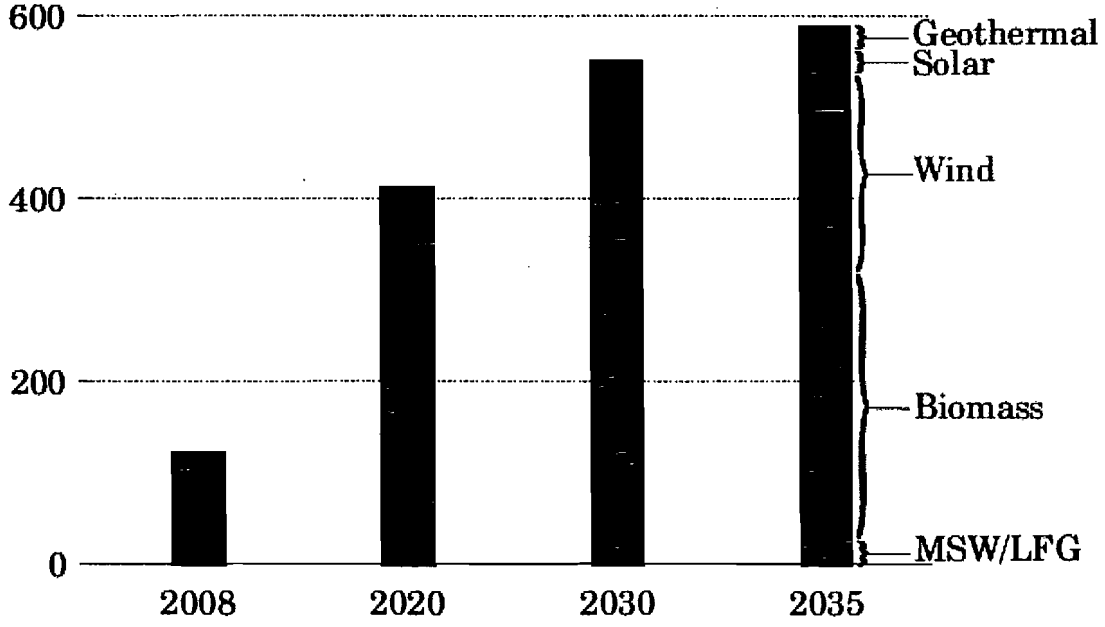

Figure 4-2: Non-hydroelectric renewable electricity generation by energy source 2008-2035 (billion kWh) (Source: EIA [3])

Biomass can be converted into energy in one of the following ways[4]: direct combustion, co-firing in conventional coal power plants, chemical conversion, and gasification. Direct combustion and co-firing are the two most common methods used in converting biomass into energy. In direct combustion the biomass material is burned to produce heat. This heat can either be used directly or can be used to produce steam which is then passed through a turbine to produce electrical energy. According to the March 2003 report by NREL, *Biopower Technical Assessment: State of the Industry and Technology*, direct combustion to make steam was in use in all 7,000 MW of biomass-driven electricity generation plants existing in the U.S. at that time. A big hindrance to the co-firing of biomass in coal power plants is the presence of alkali metals such as sodium, potassium and calcium. The combustion products of these metals have a tendency to corrode or form deposits on heat transfer surfaces that would tend to reduce overall plant efficiency and increase the plant's maintenance costs [4].

Gasification is the technology that holds the greatest promise for future use in the conversion of biomass into energy because it is able to achieve much higher recovery efficiencies than other energy conversion methods. Combustion efficiencies range from 17-25 percent. However with cogeneration, where both steam and heat are utilized, much greater efficiencies are obtained at around 85 percent. Producer gas from gasification contains up to 70-80 percent of the original energy contained in the feedstock [5]. Although gasification technologies have been

[4] These terms are explained fully in Section 3.

successfully tested in demonstration projects, they still have some technical barriers before they can be widely deployed at a commercial scale [6].

The energy content in various organic waste biomass fuels vary, as shown in Table 4-1.

Fuel Type	*Heat Content*	
Agricultural Byproducts	8.248	Million Btu/Short Ton
Biodiesel	5.359	Million Btu/Barrel
Black Liquor	11.758	Million Btu/Short Ton
Digester Gas	0.619	Million Btu/Thousand Cubic Feet
Ethanol	3.539	Million Btu/Barrel
Landfill Gas	0.490	Million Btu/Thousand Cubic Feet
MSW Biogenic	9.696	Million Btu/Short Ton
Methane	0.841	Million Btu/Thousand Cubic Feet
Paper Pellets	13.029	Million Btu/Short Ton
Peat	8.000	Million Btu/Short Ton
Railroad Ties	12.618	Million Btu/Short Ton
Sludge Waste	7.512	Million Btu/Short Ton
Sludge Wood	10.071	Million Btu/Short Ton
Solid Byproducts	25.830	Million Btu/Short Ton
Spent Sulfite Liquor	12.720	Million Btu/Short Ton
Utility Poles	12.500	Million Btu/Short Ton
Waste Alcohol	3.800	Million Btu/Barrel

Table 4-1: Average heat content of selected biomass materials (Source: EIA [2])

4.2 Economics of organic waste biomass

Co-firing with biomass fuels utilizes existing power plant infrastructure to minimize costs while maximizing environmental and economic benefits [7]. Up to 20 percent of the input fuel mix can be biomass in typical co-firing applications. To allow for co-firing, some low-cost conversion of the existing fuel supply system in the plant is required. The payback period for this capital investment is between one and eight years [8].

The economics of biomass energy production are driven in a large part by geography. If the biomass source is within a close radius—a feasible distance is roughly 100 miles—then the use of biomass may make economic sense. Most of Indiana would fall in this category. Transporting biomass a greater distance, however, would increase costs. Certain industries, such as papermaking and forestry products, produce much organic waste. New, small-scale generators are now becoming available that allow on-site electricity generation from biomass for these industries [9]. The economic viability of burning biomass for energy will likely be

negatively impacted by the proposed revision of the *Clean Air Interstate Rule* (CAIR) that has been proposed by the Environmental Protection Agency (EPA). The proposed rule would reclassify biomass fired boilers in such a manner that they would now be subject to the *Maximum Achievable Control Technology* (MACT) to restrict the emission of mercury, carbon monoxide and other non-mercury metals. The MACT proposal was published in April 2010 with a public comment period that ended in August [10].

Biomass gasification is a technology that is still under development and has not been fully deployed on a large commercial scale. According to the DOE Biomass Program, biomass gasification technology has the following technical barriers to be overcome before wide-scale commercial deployment [6]:

- A reliable feed system to supply uniform characteristic (size, moisture, etc.) feed to the gasifier has not been developed. Since biomass comes in such a wide variety of sizes and other physical characteristics, designing a system that will function across the whole range of characteristics presents a challenge.
- Gasifier systems suitable for integration with fuels synthesis technologies are not yet commercially available.
- Available gas cleanup and conditioning systems are neither cheap nor effective enough for commercial deployment.
- The process control systems needed to maintain gasifier plant performance and emission targets are not yet commercially available.
- Process integration at a large enough scale to make gasification commercially viable is not yet available.
- The reactions in black liquor gasifiers are difficult to contain and the necessary approaches are yet to be developed.

4.3 State of organic waste biomass nationally

In 2008, the total biomass-based electricity generation capacity in the U.S. was 11,050 MW [11]. Of this installed capacity, 6,864 MW was dedicated to generation from wood and wood derived fuels, 4,186 MW was attributed to generation capacity from all other biomass including municipal solid waste (MSW) and landfill gas supplies.

The United States has a tremendous capacity for biomass. Figure 4-3 shows the current biomass availability in the U.S. According to a 1999 analysis by the ORNL, at the price of $50/ton, there would be over 500 million dry tons of biomass available in the U.S., which would provide over 8 quads (10^{15} Btus) of energy [12]. About 7.2 percent of this biomass could come from urban wood wastes, while the wood, paper, and forestry industries could provide about 18 percent. Forest residues could contribute another 9 percent, while agricultural residues would add 29 percent. According to the *Billion Ton* report [13], the amount of biomass in the U.S. could be

increased to 1 billion tons a year through new technologies, different industrial and farming methods, and government incentives.

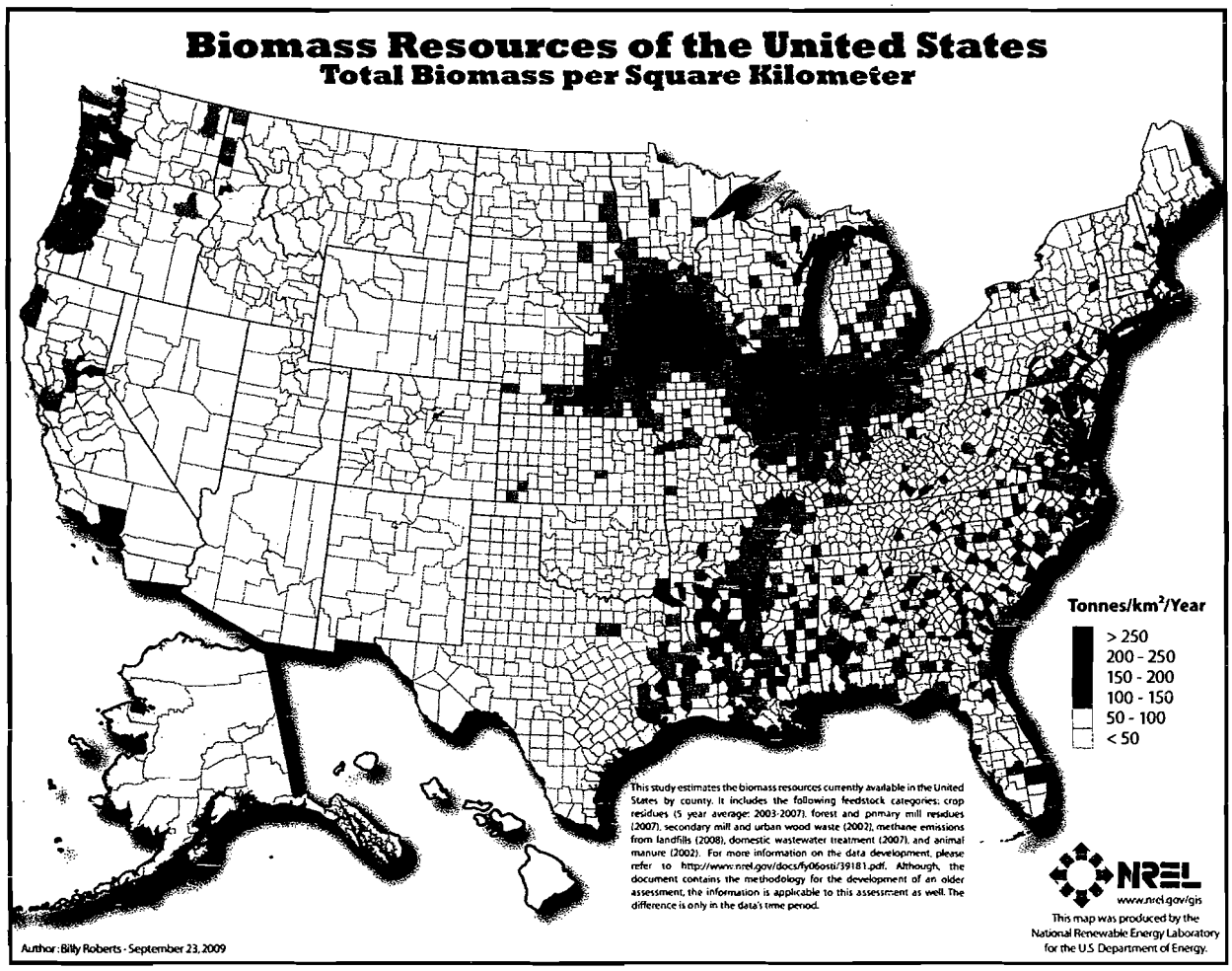

Figure 4-3: Biomass resources available in the U.S. (Source: NREL [14])

NREL is conducting research into biomass from many different angles. Research into biochemical conversion technologies focuses on improving the conversion of sugars into readily usable fuels. This includes improving the efficiency of producing ethanol, and researching ethanol production from sources other than corn. New biocatalysts are also being developed to improve the conversion of lignin and hemicellulose in plant fibers into fuel [15].

Research into thermochemical conversion technologies focuses on biomass gasification and the subsequent production of syngas which is a mixture of carbon monoxide and hydrogen [16]. Using syngas instead of direct biomass results in environmental benefits, and reducing the cost and improving the efficiency of syngas production is important. Research in gasification is geared towards addressing the technological shortcomings laid out in Section 4.2. An important area of research concerning gasification is in manufacturing small modular gasifiers. These

gasifiers are being researched by the Carbona Corp. and the Community Power Corp. in association with NREL. This technology is especially appropriate for remote communities that do not have access to electricity, but have supplies of biomass available. Electricity for these areas can be produced using small modular gasifiers [9].

There are many commercially operated stations throughout the U.S. that co-fire biomass with traditional fossil fuels to generate electricity. In 2005, according to IEA Bioenergy, there were 40 co-firing stations in the U.S. [17]. Most of the co-firing operations use an input mix of less than 10 percent biomass, though some use up to 40 percent biomass. The Bay Front station in Ashland, WI, can generate electricity using coal, wood, rubber and natural gas [18]. The station found that co-firing causes excessive ash and slag formation, and therefore it is better to operate exclusively on coal during heavy loads and on biomass during light loads. Up to 40 percent of the output of the Bay Front station is from biomass. The Tacoma Steam Plant in Tacoma, WA, can co-fire wood, refuse-derived fuel, and coal [18].

There is interest in improving biomass gasification technology in the future, especially by combining gasification systems with fuel cell systems. These systems will have reduced air emissions and may become more competitive economically as technology improvements cause costs to drop [19].

4.4 Organic waste biomass in Indiana

In 2008 biomass contributed 0.2 percent of the 129,510 GWh of total electrical energy generated in Indiana while all renewable resources combined contributed a total of 0.7 percent [20]. Wood is the most commonly used biomass fuel for heat and power, while landfill gas is the most common biomass fuel for electricity generation. The estimated supplies of urban and mill residues available for energy use in Indiana are respectively 470,000 and 28,000 dry tons per year [21].

Indiana has a large agricultural residue biomass potential, as shown in Figures 4-4 and 4-5. Over 16 million dry tons of agricultural residues, mainly from corn stover, are available each year in Indiana [21, 22].

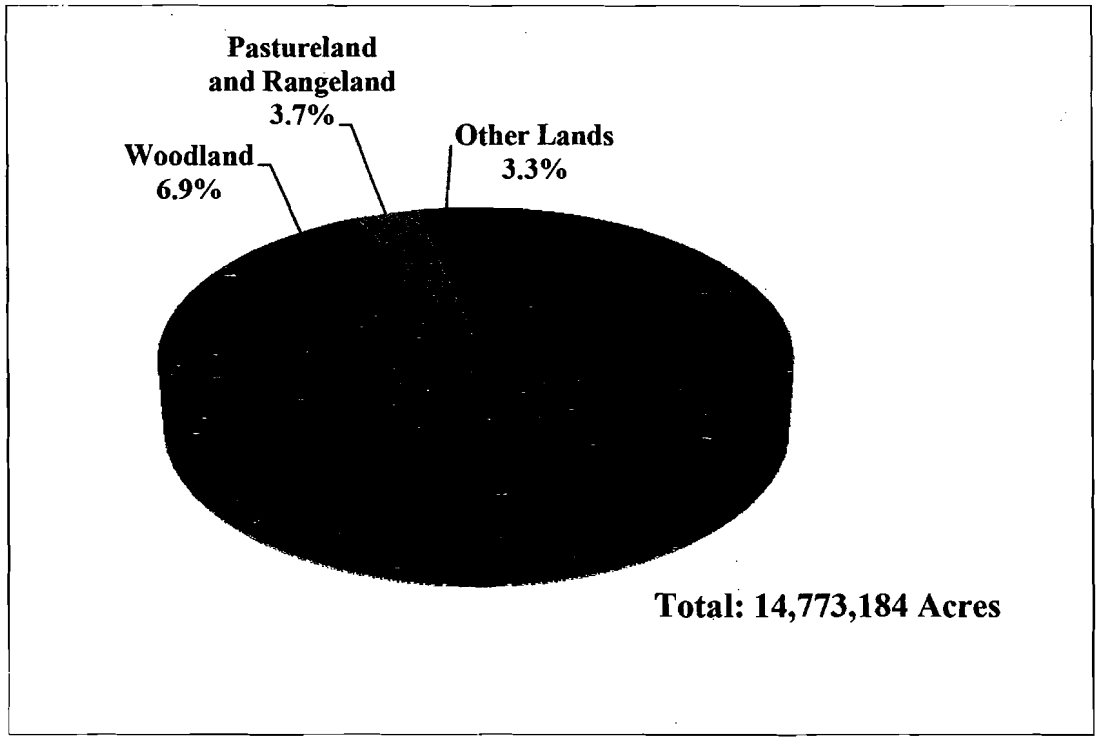

Figure 4-4: Indiana land use in 2007 (Data source: USDA [22])

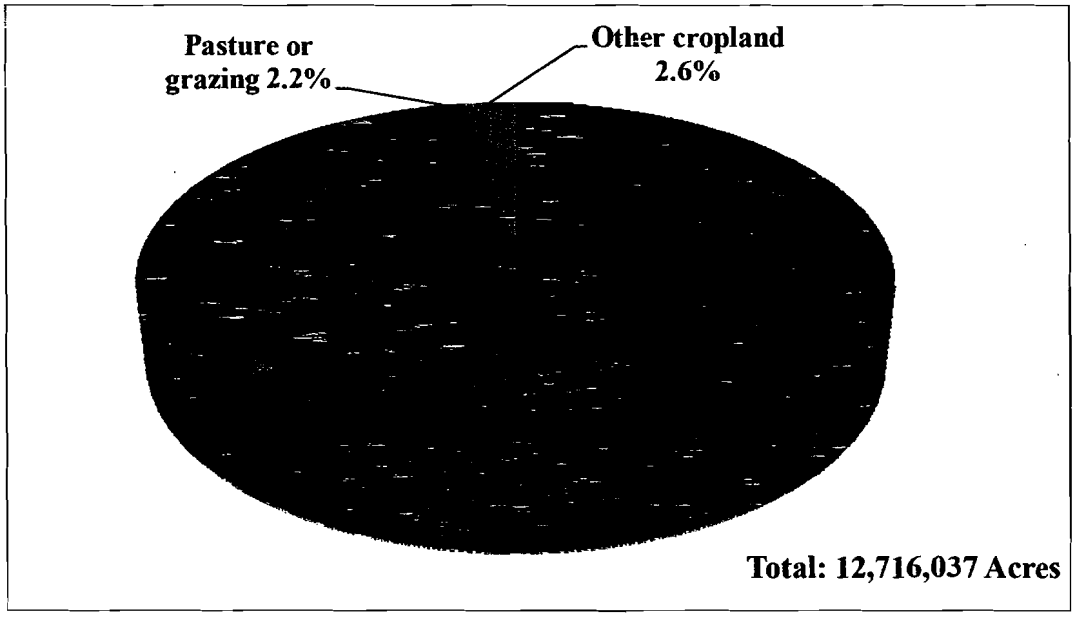

Figure 4-5: Indiana cropland use in 2007 (Data source: USDA [22])

The annual potential of biomass in Indiana is shown in Figure 4-6. Estimates of crop residues were made based on two types of planting systems; conventional tillage and no till which is a

form of conservation tillage designed to preserve soil resources. Biomass production potential is much greater when no till farming is practiced. Central Indiana has the highest potential for producing biomass within the state. The northwest, north central and northeast regions also produce significant amounts of crop residues accounting for 18 percent, 14 percent and 13 percent, respectively [21].

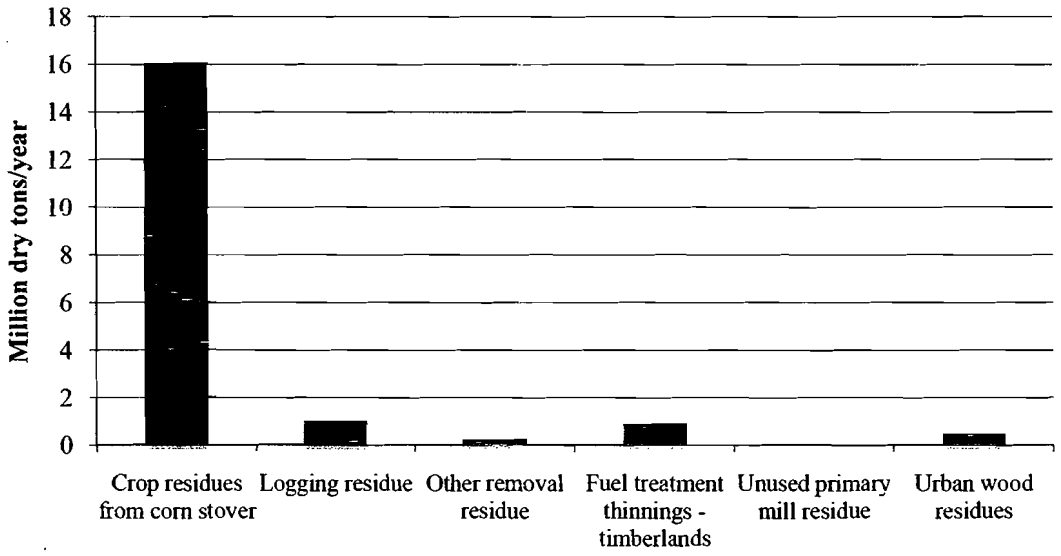

Figure 4-6: Estimated biomass production potential in Indiana (Source: ORNL [21])

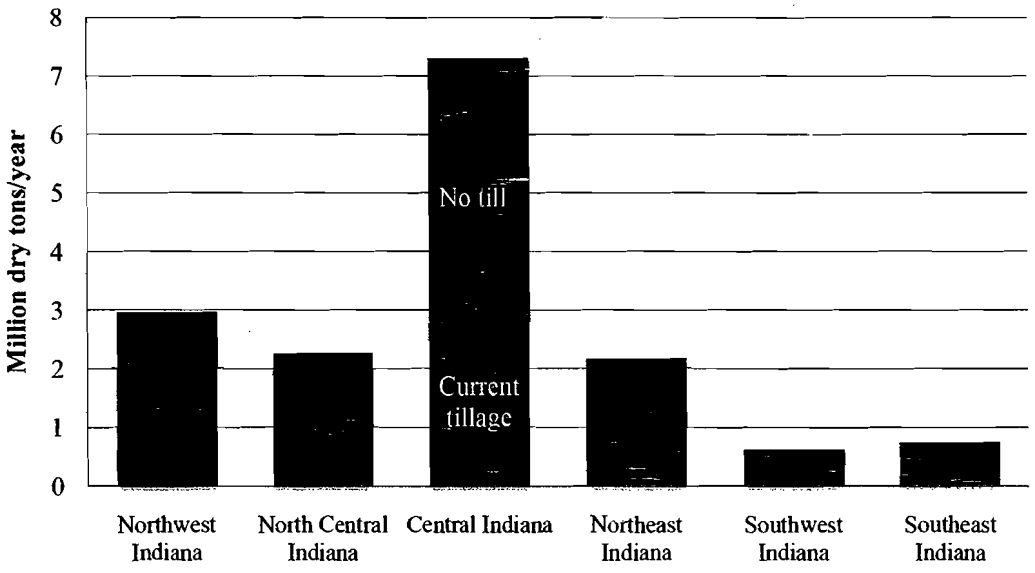

Figure 4-7: Estimated production potential of crop residues from corn stover in Indiana (Source: ORNL [21])

Figure 4-8 shows the estimate of the cost of harvesting and collecting corn stover in Indiana presented in a working paper by Brechbill and Tyner [23].

The cost of the stover is dependent on various farm level characteristics. One of these is the choice to either purchase the harvest equipment or to hire a specialized custom operator. The choices are marked as "owned" or "custom" in Figure 4-8. The other farm level characteristics affecting the cost of harvesting and collecting the stover are grouped into three scenarios as follows.

Scenario 1 – The farmer decides to only bale the stover, i.e., the corn is harvested and residue collected in a windrow behind the combine. This results in removing 38 percent of the stover and requires only one additional pass by the baler after the corn harvesting pass.

Scenario 2 – The farmer decides to rake and bale the stover. This results in removing 52.5 percent of the available stover, and requires two additional passes after the corn harvesting pass.

Scenario 3 – The farmer decides to shred, rake and bale the stover. This results in removing 70 percent of the residue, and requires three additional passes after the corn harvesting pass.

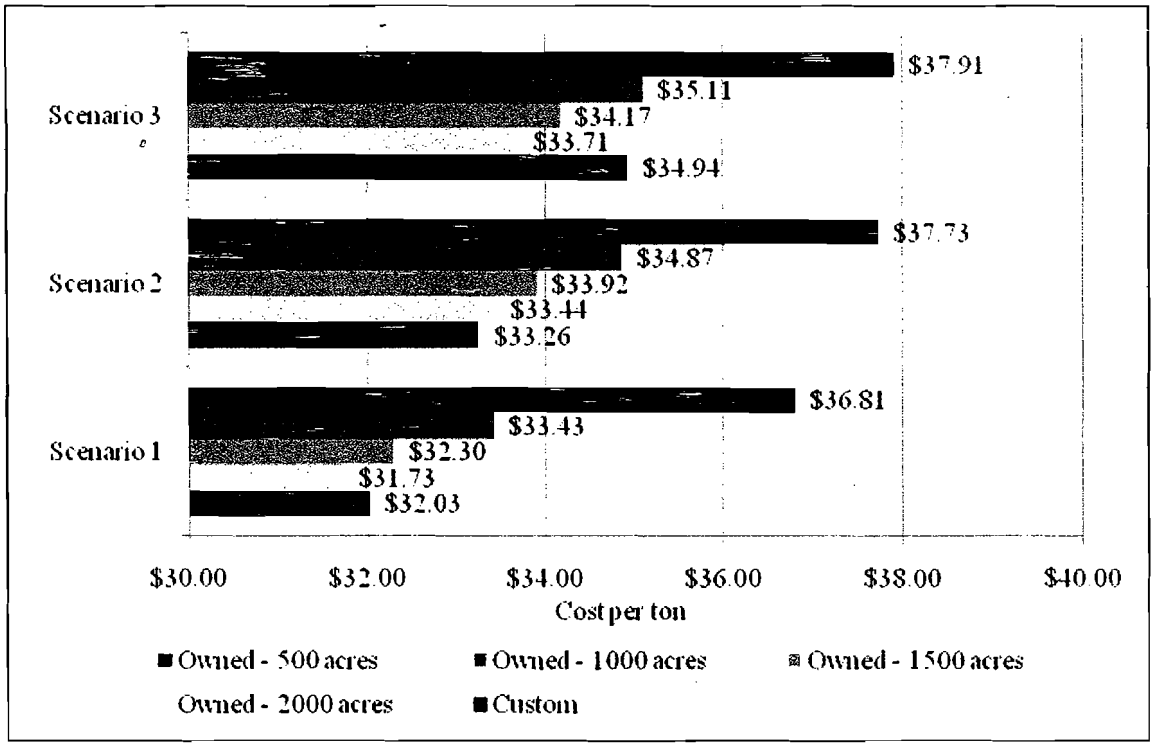

Figure 4-8: Corn stover product only costs (Source: Brechbill and Tyner [21])

According to the Electric Power Research Institute *Biomass Interest Group Technical Report for 2002* [24] Northern Indiana Public Service Company (NIPSCO) conducted biomass co-firing tests at two of its coal-fired power plants at its Michigan City Station (425 MW) in Michigan City and Bailly Station (480 MW) in Chesterton under a DOE Biomass Program. The tests were conducted with a biomass input fuel mix at 5 percent. At both plants, the tests resulted in reductions of nitrogen oxides, sulfur dioxide and carbon dioxide emissions.

As mentioned previously, landfill gas is the main biomass fuel used for electricity generation in Indiana. The most active user of this organic waste biomass for electricity generation is the Wabash Valley Power Association with a total of 25.6 MW of landfill gas generation capacity [25]. The total generating capacity from Indiana's landfills is 45.9 MW [26].

Another biomass fuel use for electricity in Indiana comes from the anaerobic digesters installed at three dairy farms in Northwest Indiana. The three dairies are the Boss Dairy No. 4, the Fair Oaks Dairy, and the Herrema Dairy. Each of these dairies has over 600 kW of generating capacity [27].

In addition SUFG is aware of a total of 195 kW of electricity generating capacity in wastewater treatment facilities in the cities of Jasper and West Lafayette, 65 kW in Jasper and 130 kW in West Lafayette.

Covanta Energy Corporation's Indianapolis facility uses municipal solid waste to generate steam which is in turn used for district heating in downtown Indianapolis. The plant has capacity to process 2,175 tons of solid waste per day to produce at least 4,500 tons of steam per ton of solid waste [28].

4.5 Incentives for organic waste biomass

Federal Incentives

- Renewable Electricity Production Tax Credit (PTC) provides a 2.2 cents/kWh tax credit for wind, geothermal and closed-loop biomass and 1.1 cents/kWh for open-loop biomass, landfill gas municipal solid waste, small hydroelectric and marine energy technologies. Organic waste biomass falls under the open-loop category. As part of the February 2009 Stimulus Act the PTC was modified to provide the option for qualified producers to take the federal business energy investment credit (ITC) or an equivalent cash grant from the U.S. Department of Treasury [29].
- Business Energy Investment Tax Credit (ITC) credits up to 30 percent of expenditures on qualifying renewable energy systems [29].
- Renewable Energy Production Incentive (REPI) provides financial incentive payments for electricity produced and sold by new qualifying renewable energy generation facilities. Qualifying facilities are eligible for annual incentive payments of 1.5

cents/kWh for the first ten years of production, subject to the availability of annual appropriations in each federal fiscal year of operation. The Energy Policy Act of 2005 expanded the list of eligible technologies and facilities owners, and reauthorized the payment for fiscal years 2006 through 2026 [29].

- Rural Energy for America Program (REAP): Eligible renewable energy projects include wind, solar, biomass and geothermal; and hydrogen derived from biomass or water using wind, solar or geothermal energy sources. REAP incentives are generally available to state government entities, local governments, tribal governments, land-grant colleges and universities, rural electric cooperatives and public power entities, and other entities, as determined by USDA. The program covers up to 25 percent of costs [29].
- Qualified Energy Conservation Bonds (QECBs) are qualified tax credit bonds and are allocated to each state based upon their state's percentage of the U.S. population. The states are then required to allocate a certain percentage to "large local governments". In February 2009, these funds were expanded to $3.2 billion [29].
- High Energy Cost Grant Program administered by the U.S. Department of Agriculture (USDA) is aimed at improving the electricity supply infrastructure in rural areas having home energy costs exceeding 275 percent of the national average. Eligible infrastructure includes renewable resources generation. The USDA has allocated a total of $15.5 million for the 2010 funding cycle. The individual grants range from $75,000 to $5 million [30]

Indiana Incentives

- Emissions Credits: Electricity generators that do not emit NO_x and that displace utility generation are eligible to receive NO_x emissions credits under the Indiana Clean Energy Credit Program [31]. These credits can be sold on the national market.

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5. Solar Energy

5.1 Introduction

Solar energy entails using energy from the sun to generate electricity; provide hot water; and to heat, cool, and light buildings. Solar energy can be converted either directly or indirectly into other forms of energy, such as heat or electricity. In this section, the indirect conversion of solar energy using solar thermal technology is discussed. The direct conversion of solar energy into electricity by photovoltaic cells is discussed in the following section (Section 6).

Solar thermal energy is captured using a solar-energy collector. There are two main types of collectors: concentrating and non-concentrating. Concentrating collectors are used to harness a large quantity of solar energy and are usually deployed to generate electricity [1]. Non-concentrating collectors are used for small-scale projects that require relatively low temperatures, such as solar water heating for pools and homes [2].

There are several major types of non-concentrating collectors. The most commonly used non-concentrating collectors are flat-plate designs. Of the various flat-plate design types, all consist of (1) a flat-plate absorber, which intercepts and absorbs the solar energy, (2) a transparent cover (glazing) that allows solar energy to pass through but reduces heat loss from the absorber, (3) a heat-transport fluid (air or water) flowing through tubes to remove heat from the absorber, and (4) a heat insulating backing. Flat-plate collectors often look like skylights when installed on residential roofs. Figure 5-1 shows the basic components of a flat-plate collector. Other non-concentrating collectors include evacuated-tube collectors and integral collector-storage systems [3].

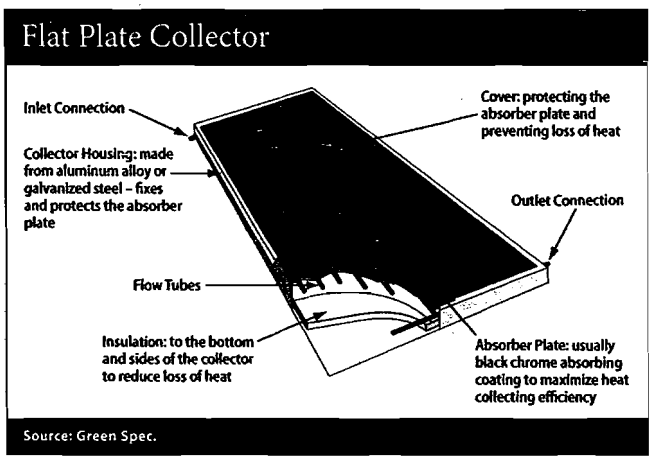


Figure 5-1: General layout of a flat-plate collector (Source: Texas Energy Report [2])

There are three main types of thermal concentrating solar power (CSP) systems in use or under development. These are the parabolic trough, solar power tower, and solar dish [4], and are illustrated in Figure 5-2.

- The trough system has trough shaped collectors with a parabolic cross section and a receiver tube located at the focal line of the trough. A working fluid is then used to transport the heat from the receiver systems to heat exchangers. Trough systems can be hybridized with conventional generators or coupled with thermal storage to enable them to be dispatched to meet utility demand. Current systems range from small-scale to a large-scale 354 MW system in California [5]. While the trough system is a well-developed technology, there are major disadvantages. For example, herbicides must be used to prevent grass and weed growth between troughs. Also, the trough design cannot produce as high of temperatures as the power tower design discussed below, resulting in lower efficiency of power production. Both the trough system and the power tower design have relatively high cooling water requirements, which may cause problems in the desert of the Southwest where the solar resource is especially good [4].
- The dish/engine system utilizes a parabolic shaped dish that focuses the sun's rays to a receiver at the focal point of the dish. An engine/generator located at the focal point of the dish converts the absorbed heat into electricity. Individual dish/engine units currently range from 3-25 kW [6]. Many of these dish systems would have to be combined to make a utility-scale power plant. The dish/engine design results in the highest efficiency of the thermal designs; an array of dishes can produce 60 percent more electricity per acre than a trough system [4]. The dish/engine system does not use any cooling water, and these systems can be installed near residential areas.
- The power tower system utilizes thousands of flat sun-tracking heliostats (mirrors) that concentrate the solar energy on a tower-mounted heat exchanger (receiver). This system avoids the heat loss during transportation of the working fluid to the central heat exchanger. They are typically equipped with molten salt energy storage tanks at the base of the towers that enable them to store energy for several hours [5]. This system provides higher efficiency than the trough system because all sunlight is concentrated on a single point, which can then reach a very high temperature [4].

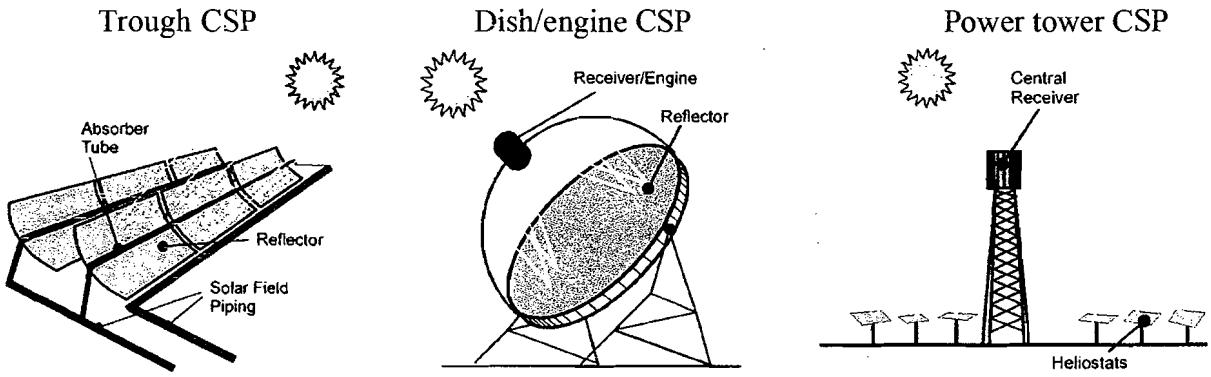


Figure 5-2: Types of concentrating solar power (CSP) collectors (Source: NREL [4])

Table 5-1 illustrates further differences between the three types of solar thermal technologies [7].

		Parabolic Trough	**Power Tower**	**Dish/Engine**
Size#		30 – 320 MW	10 – 200 MW	5 – 25 kW
Operating Temperature (°C/°F)		390 / 734	565 / 1,049	750 / 1,382
Annual Capacity Factor#		23 – 50 percent	20 – 77 percent	25 percent
Net Annual Efficiency#		11 – 16 percent	7 – 20 percent	12 – 25 percent
Commercial Status		Available	Scale-up Demonstration	Prototype Demonstration
Technology Development Risk		Low	Medium	High
Storage Available		Limited	Yes	Battery
Hybrid Designs		Yes	Yes	Yes
Cost#	$/m^2	630 - 275	475 – 200	3,100 – 320
	$/kW	4,000 – 2,700	4,400 – 2,500	12,600 – 1,300
	$/kW$_p$+	4,000 – 1,300	2,400 - 900	12,600 – 1,100

Values indicate changes over the 1997 – 2030 time frame.

+ $/kW$_p$ removes the effect of thermal storage (or hybridization for dish/engine).

Table 5-1: Characteristics of solar thermal electric power systems (Source: EERE [7])

Researchers are working with utilities on experimental hybrid power towers that run on solar energy and natural gas. A similar solar/fossil fuel hybrid is being developed for dish/engine systems. The advantage offered by hybrid systems is that they could run continuously independent of the weather conditions.

Like all other renewable technologies, solar thermal energy has distinct advantages and disadvantages. The major advantages include:

- It is a free and inexhaustible resource;
- It is a source of clean, quiet, non-polluting energy; and
- It is a modular and scalable technology.

However, there are some disadvantages of solar thermal energy, namely:

- Solar is an intermittent source of energy,
- It has high equipment costs when compared to traditional technologies, and
- The collectors occupy a substantial amount of land area

5.2 Economics of solar technologies

Researchers today are working to reduce the cost of parabolic trough power plants to $2,000/kW. Present estimates for the cost of a large-scale facility (above 50 MW) are around $3,000/kW. New developments made in materials for high temperature performance may lead to an increase in efficiency. Estimated costs of large scale (above 50 MW) dish/engine facility are approximately $2,500/kW. According the Department of Energy's *Solar Energy Utilization Report* future research and development could potentially reduce the cost for both trough and dish systems by more than $500/kW [4].

The cost of electricity produced by current large-scale (above 10 MW) concentrating solar power technologies are in the range of 9 – 12 cents/kWh. The hybrid systems which utilize solar technology together with conventional fuels have a cost of around 8 cents/kWh. It is forecast that within the next few decades, the advancements in technology would reduce the cost of large-scale solar power to around 5 cents/kWh [8]. Table 5-2 shows the forecast costs of energy from the solar thermal technologies in areas with high solar resources [9].

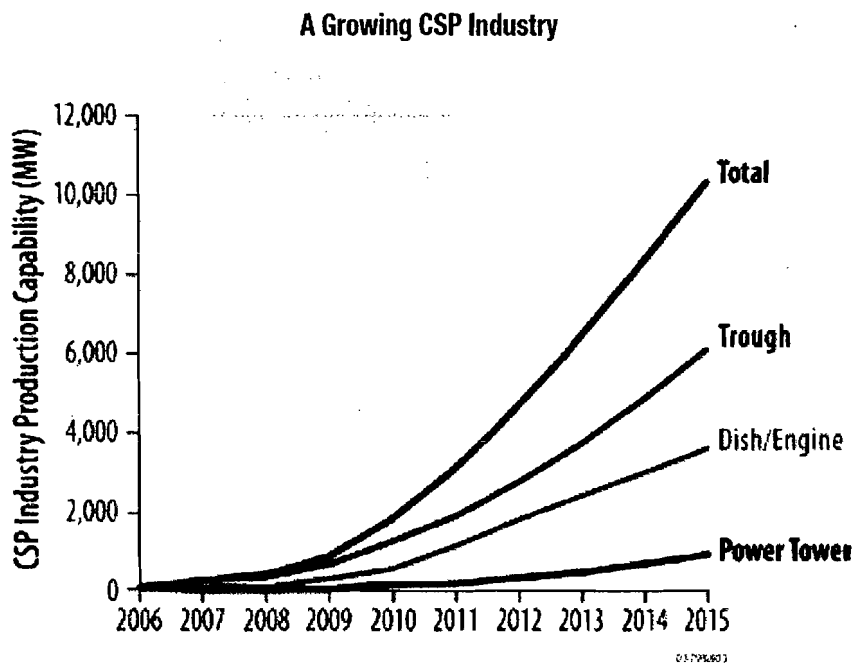
		Levelized COE *(constant 1997 cents/kWh)*				
Technology	**Configuration**	*1997*	*2000*	*2010*	*2020*	*2030*
Dispatchable Technologies						
Solar Thermal	Parabolic Trough	17.3	11.8	7.6	7.2	6.8
	Power Tower	--	13.6	5.2	4.2	4.2
	Dish Engine—Hybrid	--	17.9	6.1	5.5	5.2
Intermittent Technologies						
Solar Thermal	Dish Engine—solar only	134.3	26.8	7.2	6.4	5.9

Table 5-2: Comparative costs of different solar thermal technologies (Source: Sandia [8])

5.3 State of solar energy nationally

Energy from solar resources accounted for about 1 percent of the total renewable energy produced in the U.S. in 2007, and 0.08 percent of all energy produced in the country [10]. The CSP industry has shown to be a potentially viable source of renewable energy in the U.S. The industry is constituted by companies who design, sell, own, and/or operate energy systems and power plants based on the concentration of solar energy. Figure 5-3 shows that strong growth in installed capacity is expected over the next 10 years [5].

The total domestic shipments of solar thermal collectors were 17.0 million square feet in 2008 [11]. This represents an increase from 15.1 million square feet in the previous year. The majority of shipments were low-temperature type collectors (83 percent) while medium and high-temperature collectors represented 17 percent of total shipments [12]. Nearly all low-temperature solar thermal collectors were used for the heating of swimming pools. Medium-temperature collectors were used primarily for water heating applications, while high-temperature collectors were installed solely for electricity generation [13]. Florida and California were the top destinations of solar thermal collectors, accounting for more than half of all domestic shipments [14]. Figure 5-4 illustrates the top states for domestic shipments of solar thermal collectors in 2007.



The production capability of the CSP industry is estimated to grow significantly through 2015. This estimate represents a cumulative 10.3 gigawatts (GW) of additional peak capacity.[4]

Figure 5-3: Expected growth in electricity generation capacity by concentrating solar power (Source: EERE [5])

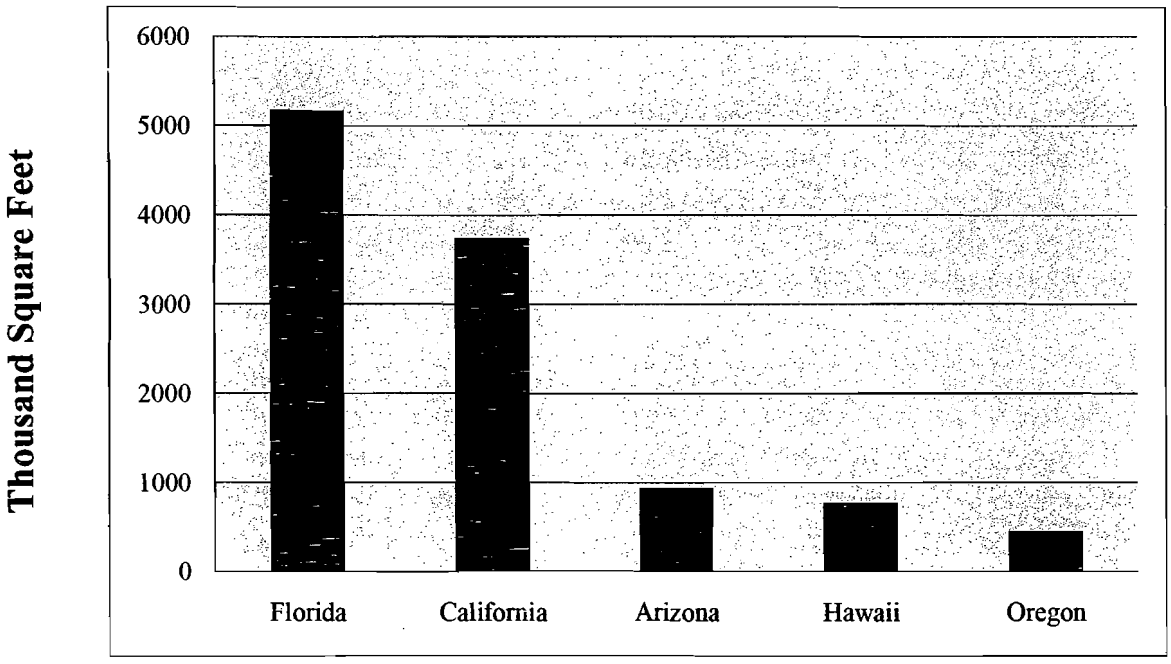


Figure 5-4: Top domestic destinations for solar thermal collectors in 2007 (Source: EIA [14])

Figure 5-5 shows annual average solar radiation with a fixed, flat-plate, collector orientation fixed at its latitude [15]. The flat-plate collector's ability to use indirect or diffuse light allows it to outperform the concentrating collectors in areas where there is less direct sunlight. Conversely, concentrating collectors work better in regions with more intense sunlight. Figure 5-6 illustrates the solar radiation available to concentrators which move to track the sun, such as a dish/engine [15].

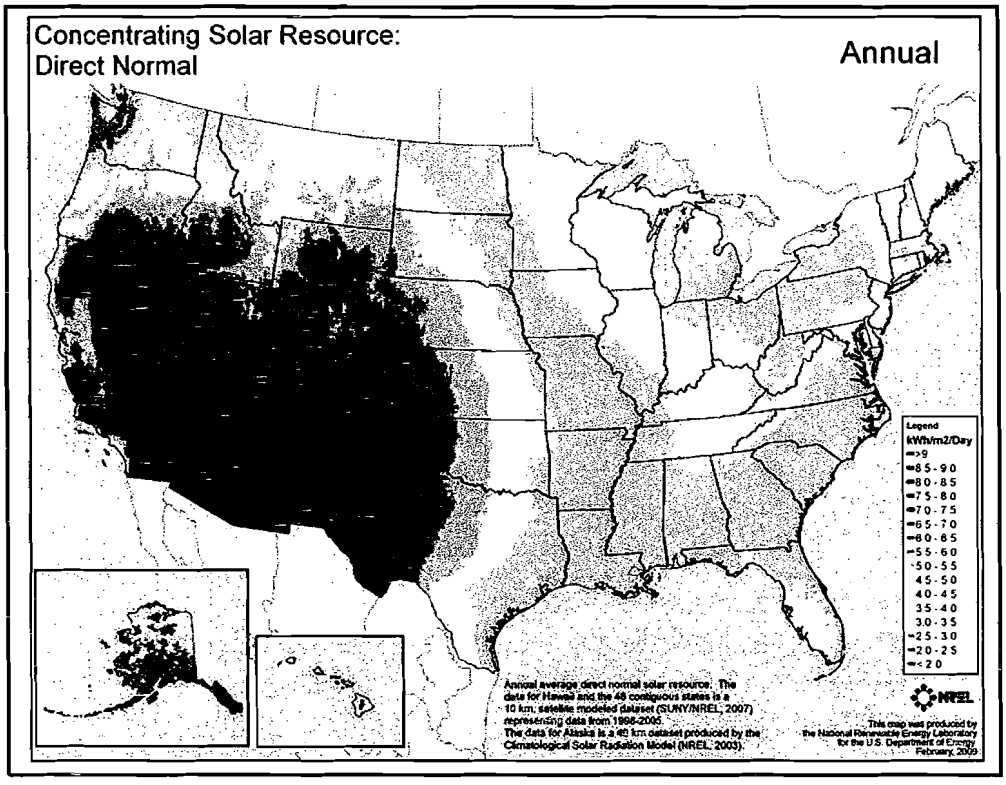


Figure 5-5: Annual average solar radiation for a flat-plate collector (Source: NREL [15])

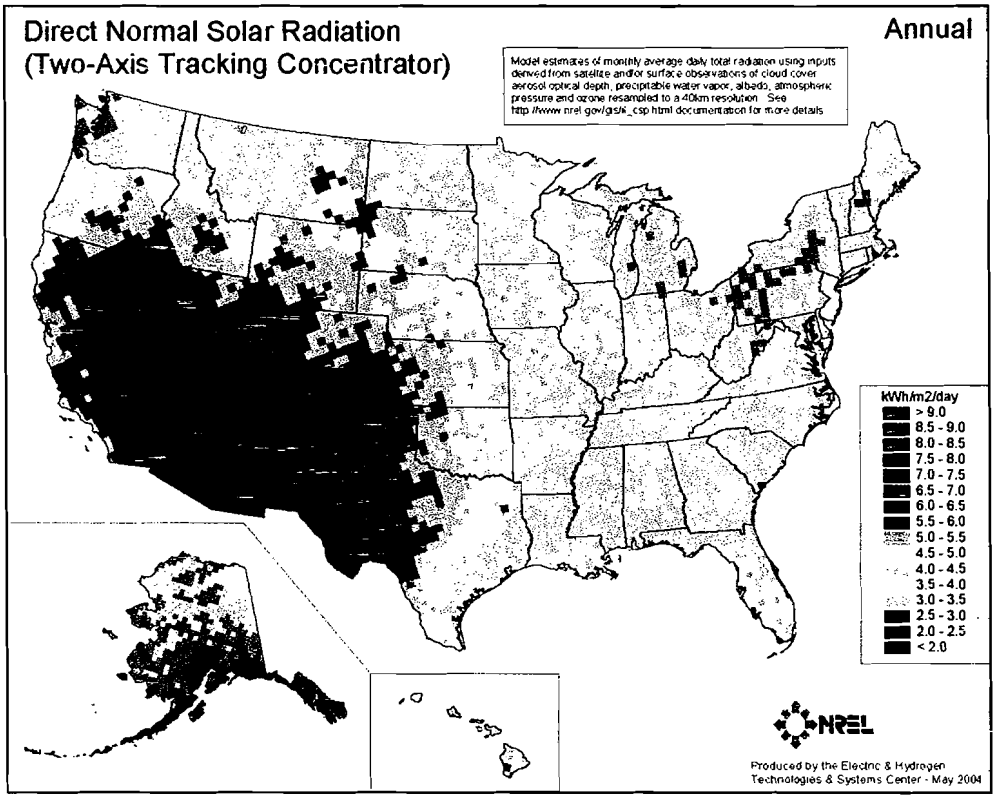


Figure 5-6: Direct normal solar radiation (two-axis solar concentrator) (Source: NREL [15])

These maps clearly illustrate the potential for solar power in the southwestern parts of the U.S. It is in this part of the U.S. that solar thermal power plants have been built. The largest grid connected solar project in the U.S., the 354-MW Solar Electric Generation System (SEGS), is located in the Mojave desert in California [4]. SEGS consists of nine parabolic trough collectors and associated power plants built in the late 1980s and early 1990s. SEGS accounts for over 95 percent of the total solar power electricity generation capacity in the U.S. The SEGS power plants are hybrid stations, in that they can use natural gas during periods of low levels of solar energy. The plants are used as peaking stations, as the system peak in the area is largely driven by air conditioning loads that coincide with the maximum output of the facility. In addition to the California plants, a 64 MW parabolic trough power plant came online in Boulder City, Nevada, in June, 2007. This plant, called the Nevada Solar One, has a capacity to produce electricity for 40,000 homes at a cost of 9 – 13 cents/kWh [19].

Two power tower facilities, Solar One and Solar Two, were built in Barstow, California, in the 1980s and 1990s as demonstrations for the feasibility of the technology. The Solar One facility used oil as the transfer fluid, whereas the Solar Two facility used molten salt. The facility consisted of 1,818 heliostats and a total generating capacity of 10 MW. This project was jointly funded by DOE and the utility with the objective of validating the use of molten salt for thermal energy transport and storage in a CSP plant and to also validate the technology's viability as a source for dispatchable power [16]. The Solar Two project was discontinued in 1999. In 2009, Sierra SunTower was built in Lancaster, California. This is the only power tower plant in the United States. It has a capacity of 5 MW and can power 4,000 homes [17].

There are currently many projects in the Southwest investigating the long term use of dish/engine systems for power production [18]. While most of these projects are relatively small-scale, plans were announced in 2005 to construct a 4,500 acre dish/engine plant in southern California. This plant would have a 500 – 850 MW capacity and would be constructed using 20,000 dishes, making it the first large-scale dish/engine power plant in the world. Current projections are that this California dish power plant will sell electricity at 6 cents/kWh [19].

Current government initiatives in the solar industry include [20]:

- USA Trough Initiative: Through the USA Trough Initiative, NREL is supporting the DOE's efforts to expand U.S. industry involvement and competitiveness in worldwide parabolic-trough development activities. This includes helping to advance the state of parabolic-trough technology from a U.S. knowledge base.
- Parabolic-Trough Solar Field Technology: NREL is working to develop less costly and more efficient parabolic-trough solar field technology. This involves improving the structure of parabolic-trough concentrators, receivers and mirrors, and increasing the

manufacturing of these components. NREL is focused on optimizing the structure of the current steel/thick-glass concentrators and increasing the concentrator size.

- Advanced Optical Materials for Concentrating Solar Power: NREL is working to develop durable, low-cost optical materials for concentrating solar power systems. These optical materials—which reflect, absorb, and transmit solar energy—play a fundamental role in the overall cost and efficiency of all concentrating solar power systems. To reduce the costs of solar collectors, NREL focuses on improving the stability of selective coatings at higher temperatures for use on optical materials.
- Parabolic-Trough Systems Integration: NREL is developing system integration software tools for evaluating parabolic-trough technologies and assessing concentrating solar power program activities. This includes models for evaluating:
    - Collector optics and thermal performance;
    - Plant process design and integration tools;
    - Annual performance and economic assessment; and
    - Capital and operation and maintenance (O&M) costs.
- Parabolic-Trough Solar Power Plant Technology: NREL continues to evaluate and develop opportunities for improving the cost effectiveness of parabolic-trough concentrating solar power plants. They are primarily working to integrate parabolic-trough technology into the power plants Their work also encompasses projects to reduce power plant and solar-field O&M costs by:
    - Scaling up plant size;
    - Increasing capacity factor;
    - Improving receiver and mirror reliability, and mirror-washing techniques;
    - Developing improved automation and control systems; and
    - Developing O&M data integration and tracking systems.
- Parabolic-Trough Thermal Energy Storage Technology: Parabolic-trough technology currently has one thermal energy storage option—a two-tank, indirect, molten-salt system. The system uses different heat transfer fluids for the solar field and for storage. Therefore, it requires a heat exchanger and has a unit cost of $30-$40/kW. NREL is working to develop efficient and lower cost thermal energy storage technologies for parabolic-trough concentrating solar power systems. Improved thermal energy storage is needed to:
    - Increase solar plant capacity factors above 25 percent;
    - Increase dispatchability of solar power; and
    - Help reduce the cost of solar electricity.

The DOE shut down the Million Solar Roofs program in 2006 in order to concentrate on the Solar America Initiative (SAI). Through the Million Solar roofs program, over 200 MW of solar heating capacity was built in the U.S. SAI is aimed towards reducing the cost and improving the

technology of photovoltaic systems and concentrating solar systems; the goal is to achieve cost-parity for these technologies by 2015 [21].

Through the Solar America Cities partnership, DOE has awarded financial and technical assistance to 25 cities pursuing city-wide solar energy initiatives. The 25 Solar America Cities are partnering with more than 180 organizations and have committed $11.9 million in funding to match $11.2 million in DOE assistance, for a combined investment of $23.1 million. Each of the Solar America Cities aims to integrate solar technology into city energy planning, streamline city-level regulations and practices, promote solar technology among residents and local businesses, and serve as a model for other cities interested in promoting the use of solar energy technologies. The two requirements for being named a Solar America City are that the population must be over 100,000, and there must be a sincere commitment to spreading the usage of solar power throughout the city [22].

On May 27, 2009, President Obama announced that over $467 million from the American Reinvestment and Recovery Act would go towards expanding and accelerating the development, deployment, and use of geothermal and solar energy throughout the United States. $117.6 million of those dollars will be allocated for solar energy with $51.5 million going towards photovoltaic technology development, $40.5 million going towards solar energy deployment, and $25.6 million going towards concentrating solar power research and development [23].

5.4 Solar energy in Indiana

Indiana has relatively little potential for grid-connected solar projects like those in California because of the lack of annual solar radiation, as shown in Figures 5-5 and 5-6 [15]. There is, however, some potential (more so in the southern part of the state) for water and building heating using flat-plate collectors. The actual viability of installing solar energy water heating within Indiana depends on the microclimate of the area of concern. The typical initial cost of a solar water heating system is about $2,000 to $4,500 [24].

5.5 Incentives for solar energy

The following available incentives could help increase use of solar energy within Indiana:

Federal Incentives

- Business Energy Investment Tax Credit (ITC) credits up to 30 percent of expenditures on solar systems [25].
- Energy Efficiency Mortgage: These mortgages can be used by homeowners to finance a variety of energy efficiency measures, including renewable energy technologies, in a new or existing home. The federal government supports these loans by insuring them through FHA or VA programs. This allows borrowers who might otherwise be denied loans to

pursue energy efficient improvements, and it secures lenders against loan default and provides them with confidence in lending to customers who would usually denied [25].

- Modified Accelerated Cost-Recovery System (MACRS): Under this program, businesses can recover investments in solar, wind and geothermal property through depreciation deductions. The MACRS establishes a set of class lives for various types of property, ranging from three to fifty years, over which the property may be depreciated. For solar, wind and geothermal property placed in service after 1986, the current MACRS property class life is five years [25].
- Qualified Energy Conservation Bonds (QECBs) are qualified tax credit bonds and are allocated to each state based upon their state's percentage of the U.S. population. The states are then required to allocate a certain percentage to "large local governments". In February 2009, these funds were expanded to $3.2 billion [25].
- Renewable Energy Production Incentive (REPI) provides financial incentive payments for electricity produced and sold by renewable energy generation facilities owned by non-profit groups, public utilities, or state governments [25].
- Residential Energy Conservation Subsidy Exclusion: According to Section 136 of the IRS Code, energy conservation subsidies provided by public utilities, either directly or indirectly, are nontaxable: "Gross income shall not include the value of any subsidy provided (directly or indirectly) by a public utility to a customer for the purchase or installation of any energy conservation measure" [25].
- Rural Energy for America Program (REAP): The Food, Conservation, and Energy Act of 2008 converted the USDA Renewable Energy Systems and Energy Efficiency Improvements Program into the Rural Energy for America Program (REAP). Solar facilities are eligible for grants for up to 25 percent of the cost of the system and loans for another 50 percent of the cost [25].
- Value-Added Producer Grant Program: Grants are available to independent producers, agricultural producer groups, farmer or rancher cooperatives, and majority-controlled producer-based business ventures seeking funding. Previously awarded grants supported energy generated on-farm through the use of agricultural commodities, wind power, water power, or solar power. The maximum award per grant was $300,000 [26].
- High Energy Cost Grant Program administered by the U.S. Department of Agriculture (USDA) is aimed at improving the electricity supply infrastructure in rural areas having home energy costs exceeding 275 percent of the national average. Eligible infrastructure includes renewable resources generation. The USDA has allocated a total of $15.5 million for the 2010 funding cycle. The individual grants range from $75,000 to $5 million [27]

Indiana Incentives

- Emissions Credits: Electricity generators that do not emit NO_x and that displace utility generation are eligible to receive NO_x emissions credits under the Indiana Clean Energy Credit Program. These credits can be sold on the national market [28].
- Net Metering Rule: Solar, wind and hydroelectric facilities with a maximum capacity of 10 kW are qualified for net metering in Indiana. The net excess generation is credited to the customer in the next billing cycle [29].
- Renewable Energy Property Tax Exemption: provides property tax exemptions for active solar equipment used for heating and cooling. Photovoltaic systems are not included in this exemption [29].
- Solar Access Laws: Indiana state law includes both covenant restrictions and solar-easement provisions. The state's covenant restrictions prevent planning and zoning authorities from prohibiting or unreasonably restricting the use of solar energy. Indiana's solar-easement provisions do not create an automatic right to sunlight, though they allow parties to voluntarily enter into solar-easement contracts which are enforceable by law [29].
- Indiana Solar Thermal Grant Program: provides up to $150,000 for entities in Indiana's public, non-profit, and business sectors to offset the cost of purchasing solar water heating systems. Applicants must use more than 100,000 gallons of hot water annually and can receive up to $25,000. The deadline for the applications was September 1, 2010 [30, 31].

5.6 References

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6. Photovoltaic Cells

6.1 Introduction

Unlike solar thermal systems, photovoltaic (PV) cells allow for the direct conversion of sunlight into electricity. The photovoltaic cell is a non-mechanical device constructed from semiconductor materials (see Figure 6-1). When the photons in sunlight strike the surface of a photovoltaic cell, some of them are absorbed. The absorbed photons cause free electrons to migrate in the cell, thus causing "holes." The resulting imbalance of charge between the cell's front and back surfaces creates a voltage potential like the negative and positive terminals of a battery. When these two surfaces are connected through an external load, electricity flows [1].

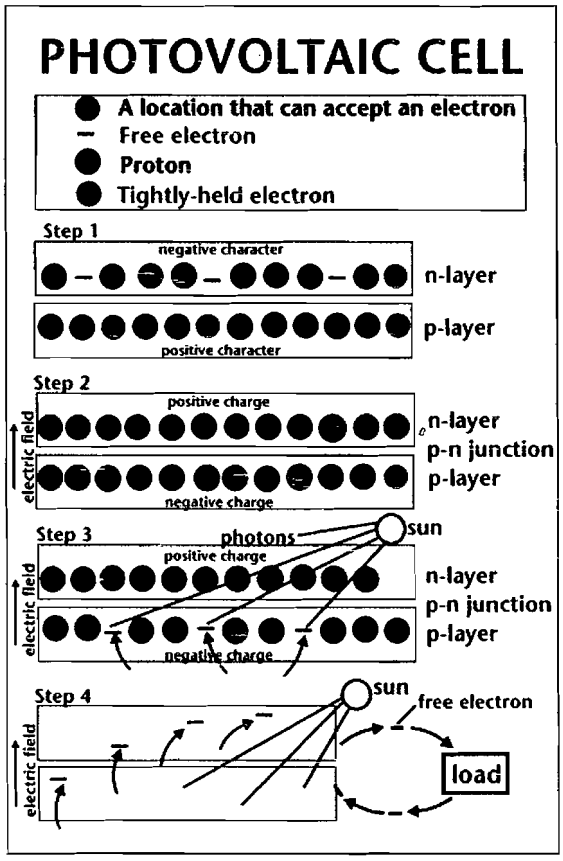

Figure 6-1: Photovoltaic cell operation (Source: EIA [1])

The photovoltaic cell is the basic building block of a PV system. The individual cells range in size from 0.5 to 4 inches across with a power output of 1 to 2 watts. To increase the power output of the PV unit, the cells are usually electrically connected into a packaged weather-tight module. About 40 cells make up a module, providing enough power for a typical incandescent light bulb. These modules could further be connected into arrays to increase the power output.

Hundreds of arrays could be connected together for larger power applications. The performance of PV units depends upon sunlight, with more sunlight leading to higher power output. Figure 6-2 illustrates how cells can combine to make a module, and how modules are combined to make an array [3].

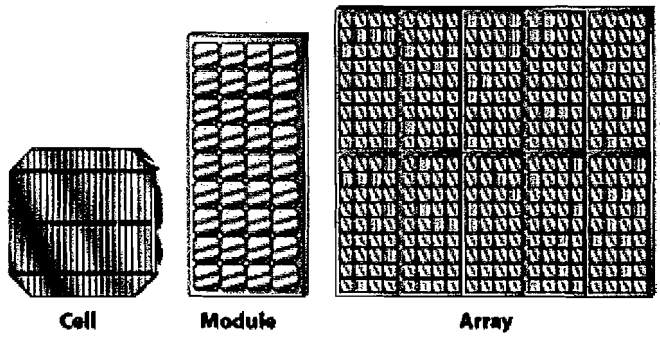

Figure 6-2: Illustration of a cell, module and array of a PV system (Source: EERE [3])

Simple PV systems are used to power calculators and wrist watches, whereas more complicated systems are used to provide electricity to pump water, power communication equipment, and even provide electricity to houses and buildings.

There are currently three major types of PV cells: crystalline silicon-based, thin film-based, and concentrator-based. A new experimental type of cell, the spheral cell, aims to reduce the amount of silicon used to construct solar cells; spheral cells remain mostly in the research phase. Silicon PV cells, the most common type, typically cost more than thin film cells but are more efficient [4]. Efficiency ranges of 13 to 17 percent are normal, though Sanyo announced in 2007 that they had built a silicon-based cell that achieves 22 percent efficiency [5]. Thin-film cells have a normal efficiency of 10 percent. Concentrator cells and modules utilize a lens to gather and converge sunlight onto the cell or module surface [4].

PV cells can be arranged into two different types of arrays: flat-plate PV arrays and concentrating PV arrays. Flat-plate PV arrays can be mounted at a fixed-angle facing south, or they can be mounted on a tracking device that follows the sun throughout the day. Concentrating PV (CPV) arrays use a lens to focus sunlight onto cells. CPV arrays cannot use diffuse sunlight and as such are generally installed on tracking devices. The advantage of CPV arrays is that they use less semiconductor material than flat-plate arrays to produce the same output. A disadvantage, though, is that because they are unable to make use of indirect sunlight, CPV arrays can only be used in the sunniest parts of the country, unlike the broad geographical range of flat-plate PV arrays [2].

NREL is actively researching CPV technology, especially as an alternative to the dish/engine solar thermal system discussed in Chapter 5. CPV systems have no moving parts (besides the

tracking device) and no heat transfer, making them potentially more reliable than dish/engine systems. Also, CPV systems result in efficiencies greater than 40 percent and a reduction in the use of expensive semiconductor materials, lowering the effective total cost compared to flat-plate PV systems. The cost of CPVs is similar to that of solar thermal technologies, and CPVs may eventually be used at the utility-scale. NREL is currently focusing on the development of multi-cell packages (dense arrays) to improve overall performance and reliability [6].

Figure 6-3 illustrates the historical progress of solar cell efficiencies until 2009. As shown in the graph, experimental multi-junction concentrator-based PV cells reported the highest efficiency levels, approximately 40 percent [7].

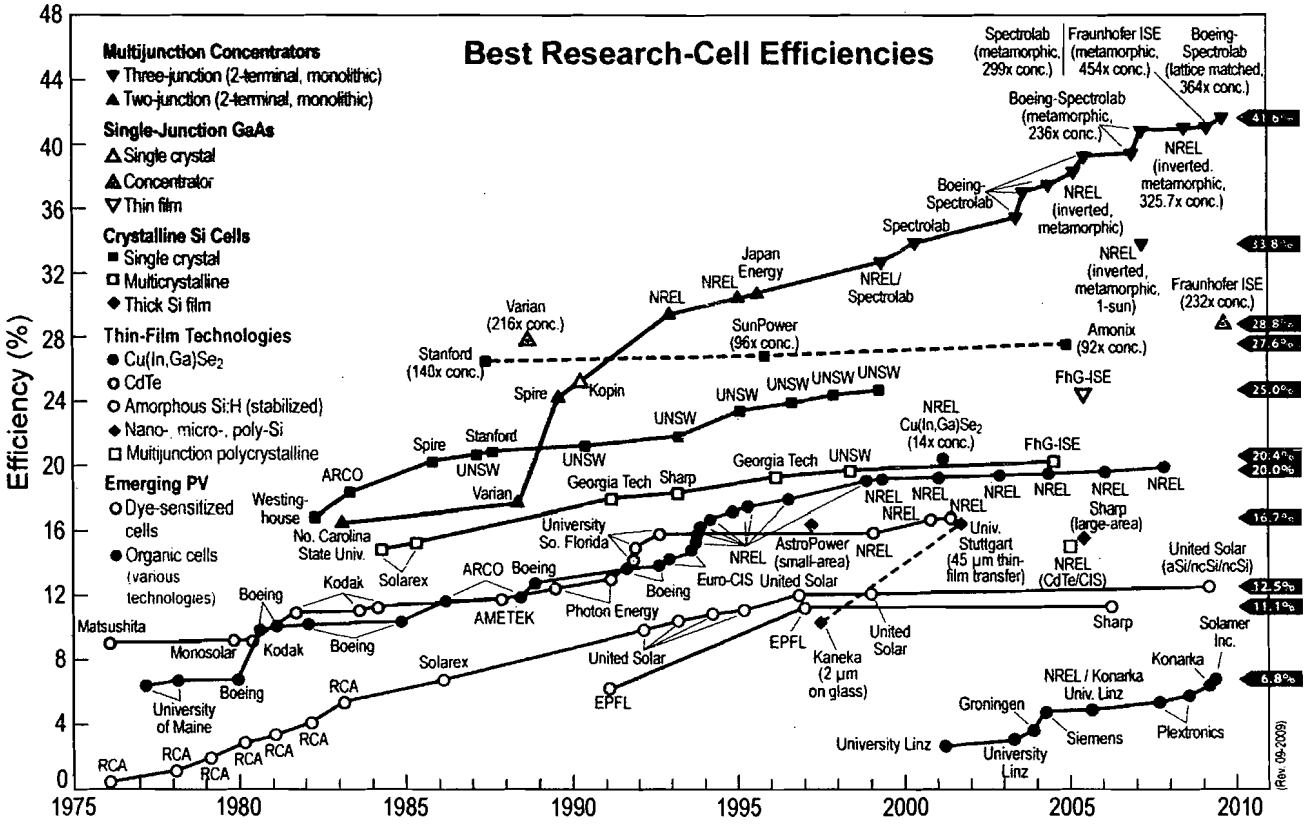

Figure 6-3: Improvements in solar cell efficiency, by system, from 1976 to 2009 (Source: NREL [8])

In addition to multi-junction CPV cells, other advanced approaches to solar cells are under investigation. For example, dye-sensitized solar cells use a dye-impregnated layer of titanium dioxide to generate a voltage as opposed to the semiconducting materials used in most solar cells currently in the industry. Because titanium dioxide is fairly inexpensive, it offers the potential to significantly reduce the cost of solar cells. Other advanced approaches include polymer (or plastic) solar cells and photoelectrochemical cells, which produce hydrogen directly from water in the presence of sunlight [7].

Flat-plate PV arrays, CPVs, and other types of solar PV technology are used in many different ways across America. In 1998, a study was carried out by EIA to determine trends in the U.S. photovoltaic industry. The report divided the national PV market into several niche markets that were labeled and described as follows [9]:

- Building Integrated Photovoltaics (BIPV): These are PV arrays mounted on building roofs or facades. For residential buildings, BIPV capacities may reach up to 4 kW per residence. Systems may consist of conventional PV modules or PV shingles. This market segment includes hybrid power systems, combining diesel generator, battery, and photovoltaic generation capacity for off-grid remote cabins.
- Non-BIPV Electricity Generation (grid interactive and remote): This includes distributed generation (e.g., stand-alone PV systems or hybrid systems including diesel generators, battery storage, and other renewable technologies), and water pumping power for irrigation systems. The U.S. Coast Guard has installed over 20,000 PV-powered navigational aids (e.g., warning buoys and shore markers) since 1984.
- Communications: PV systems provide power for remote telecommunications repeaters, fiber-optic amplifiers, rural telephones, and highway call boxes. Photovoltaic modules provide power for remote data acquisition for both land-based and offshore operations in the oil and gas industries.
- Transportation: Examples include power on boats, in cars, in recreational vehicles, and for transportation support systems such as message boards or warning signals on streets and highways.
- Consumer Electronics: A few examples are calculators; watches; portable and landscaping lights; portable, lightweight PV modules for recreational use; and battery chargers.

The main advantages to using PV systems are:

- The conversion from sunlight to electricity is direct so no mechanical generator systems are required, leading to high system reliability [1];
- Sunlight is a free and inexhaustible resource;
- There are no emissions (by-products) from PV systems;
- Most PV systems consume no water, unlike many other power systems;
- A diversified power supply from thousands of solar units can increase the reliability of the grid and reduce the need for larger transmission capacity [10];
- The lack of moving parts[5] results in lower maintenance costs; and
- The modular nature of PV systems (PV arrays) allow for variable output power configurations.

The main disadvantages to using PV systems are:

[5] There are no moving parts for fixed-orientation PV units and minimal slow-moving parts for tracking PV units.

- The sun is an intermittent source of energy (i.e., a cloudy day can reduce output); and
- They have high costs relative to traditional technologies.

Despite the intermittent nature of sunlight, PV has the added potential as a supplier of electricity during periods of peak demand, since it produces more electricity on sunny days when air conditioning loads are the greatest [10].

6.2 Economics of PV systems

The cost of a PV installation depends on the installation size and the degree to which it utilizes standard off-the-shelf components [11]. The capital costs range from $5/W for bulk orders of standardized systems to around $11/W for small, one-of-a-kind grid connected PV systems [2, 11].

The recent trend in PV module prices is shown in Figure 6-4 [12]. Overall photovoltaic prices have declined on average 4 percent per year over the past 15 years [13].

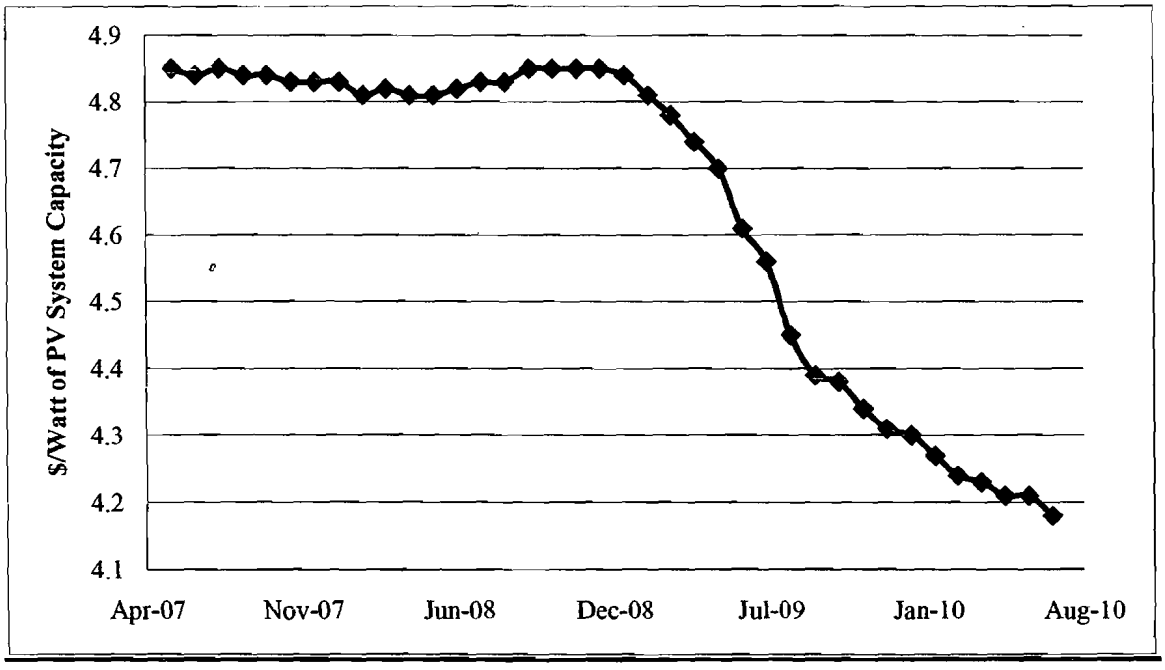

Figure 6-4: Historical PV module prices (Source: Solarbuzz [12])

Levelized PV energy costs of around 30 cents/kWh [11] are common, assuming a 25-year lifespan of the PV system. At these prices, PV may be cost effective for residential customers located further than a quarter of a mile from the nearest distribution line because of the relatively high costs of distribution line construction [11].

Distributors have identified markets where photovoltaic power is cost-effective now, without subsidies. Examples include: (1) rural telephones and highway call boxes, (2) remote data acquisition for both land-based and offshore operations in the oil and gas industries, (3) message boards or warning signals on streets and highways, and (4) off-grid remote cabins, as part of a hybrid power system including batteries.

When state and utility subsidies are taken into account, however, there are parts of the country where PV panels are cost-effective currently without subsidies. Figure 6-5 shows the breakeven turnkey costs (BTC) for commercial PV installations by state. The BTC represents the highest price of PV that will still breakeven over the lifespan of the system. States with the highest BTC values will have the most PV installations. Four states—California, Massachusetts, New York, and North Carolina—have BTC values above $10/W for PV systems, meaning that PV systems are economically viable in those areas [14].

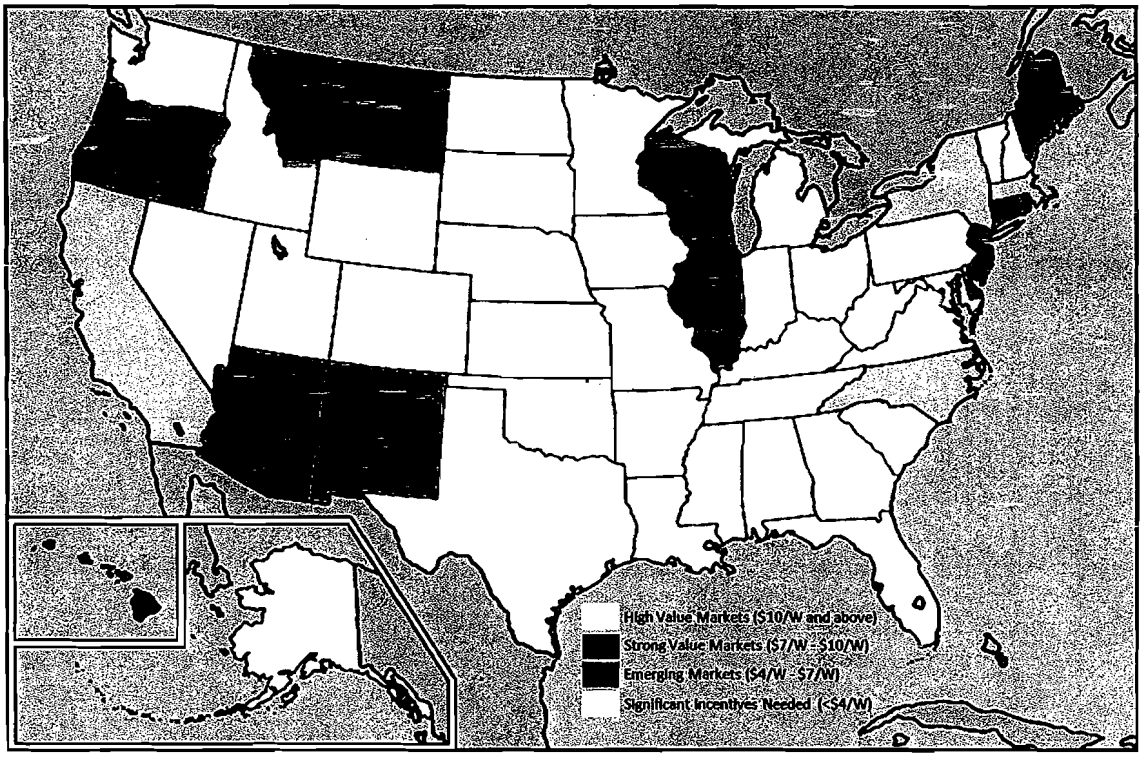

Figure 6-5: Breakeven turnkey costs by state (Source: DSIRE [14])

Figure 6-6 shows the so-called 80 percent learning curve: for every doubling of the total cumulative production of PV modules worldwide, the price has dropped by approximately 20 percent. DOE's projected learning curve beyond 2003 is between 70 and 90 percent.

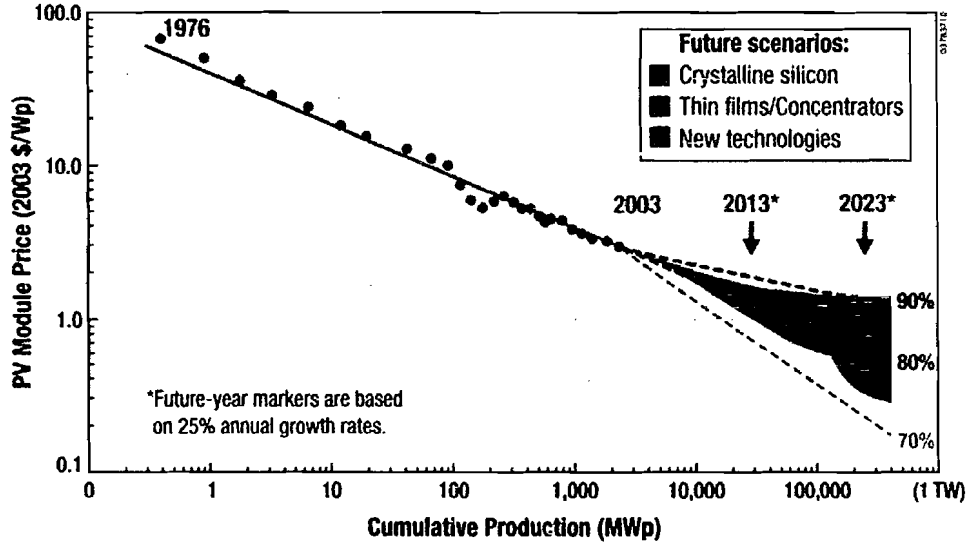

Figure 6-6: Learning curve for PV production (Source: DOE [7])

A key goal of researchers is to make PV technologies cost-competitive by increasing the conversion efficiency of PV systems. Higher efficiency directly impacts the overall electricity costs, since higher efficiency cells will produce more electrical energy per unit of cell area. Another important factor that will contribute to a reduction in capital cost is the utilization of less expensive materials when manufacturing PV systems [7].

6.3 State of PV systems nationally

According to the International Energy Agency (IEA), the U.S. is at the forefront of PV technology and is the world leader in thin-film PV manufacturing. The country accounted for 9 percent of worldwide PV production and 6 percent of PV installations. In 2009, there were 90,000 solar electric systems installed in the United States [15].

Figure 6-7 shows the solar radiation available to a flat plate collector with a fixed orientation while Figure 6-8 shows the radiation available to a concentrating collector that tracks the sun throughout the day [16]. The southwestern region of the U.S. has the highest solar resources in the country for both the flat-plate and the concentrating PV systems, while the eastern Great Lakes states have the worst solar resources.

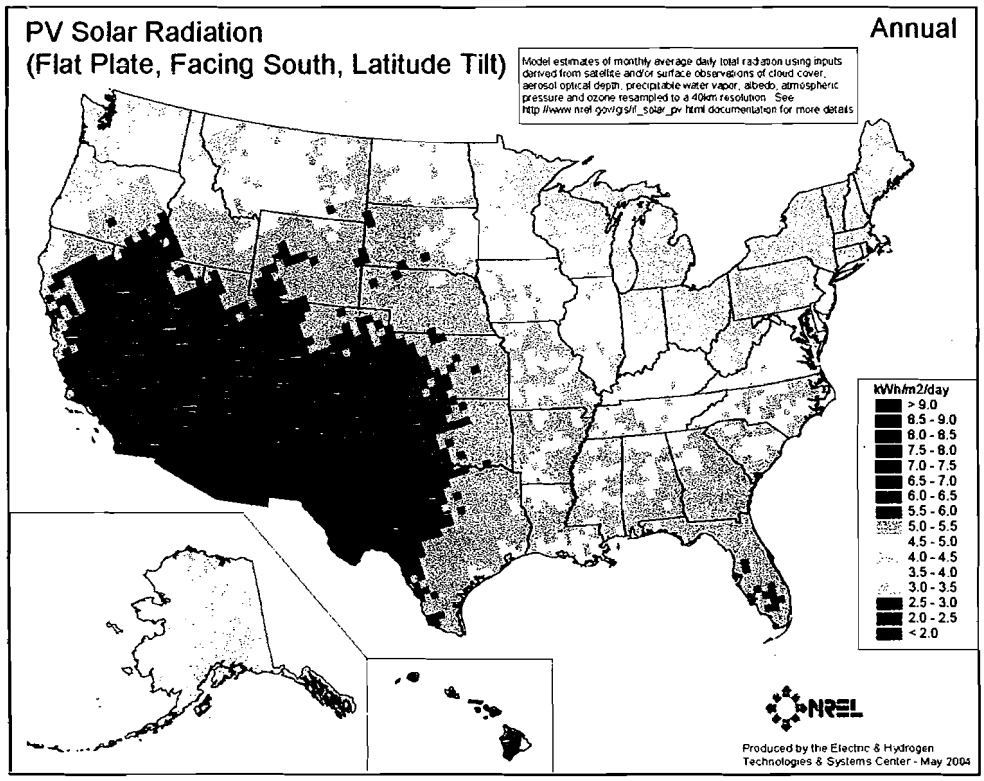

Figure 6-7: Annual average solar radiation for a flat-plate collector (Source: NREL [16])

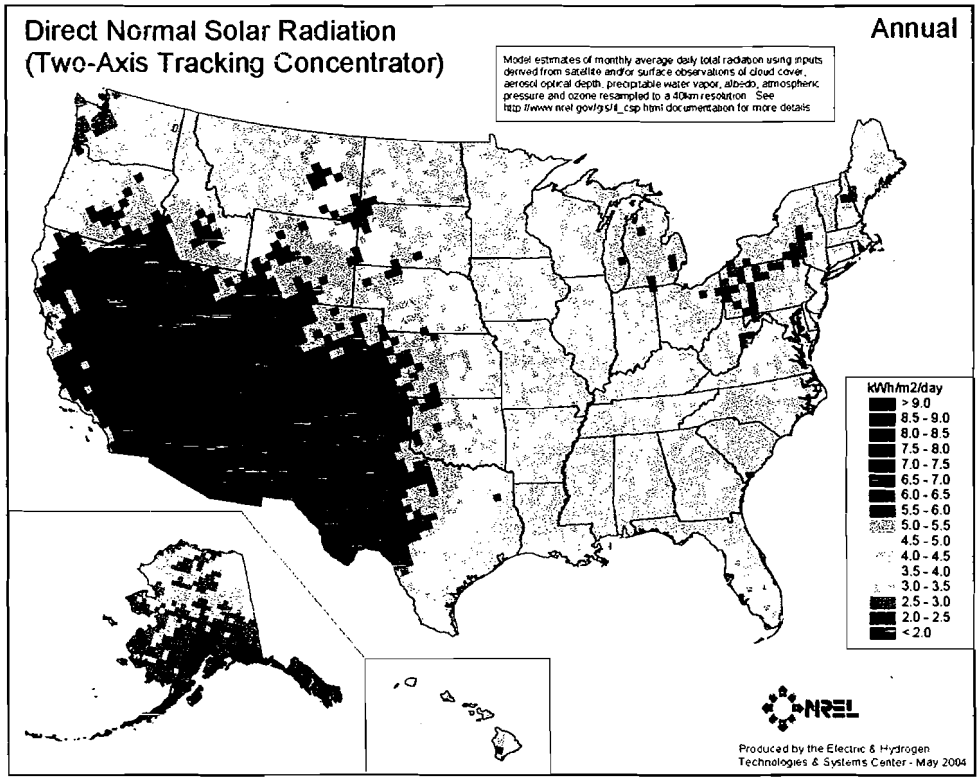

Figure 6-8: Direct normal solar radiation (two-axis solar concentrator) (Source: NREL [16])

The EIA currently tracks the shipments[6] of PV systems within the nation [17]. These domestic shipments provide an indication of the status of the PV market. Table 6-1 shows the total annual shipments, imports and exports of PV cells in the U.S.

Year	Total photovoltaic cells and modules shipment (kW)	Imported photovoltaic cells and modules (kW)	Exported photovoltaic cells and modules (kW)
1997	46,354	1,853	33,793
1998	50,562	1,931	35,493
1999	76,787	4,784	55,562
2000	88,221	8,821	68,382
2001	97,666	10,204	61,356
2002	112,090	7,297	66,778
2003	109,357	9,731	60,693
2004	181,116	47,703	102,770
2005	226,916	90,981	95,451
2006	337,268	173,977	130,757
2007	517,684	238,018	237,209
Total	1,844,021	595,300	945,244

Table 6-1: Total annual shipments, imports and exports of PV cells and modules in the U.S. (Source: EIA [17])

As shown in Table 6-2, the total use of PV systems is increasing in the U.S. During 2006, domestic demand for PV systems increased significantly, by 54 percent compared to 2005, which itself had a 71 percent increase from the previous year. Imports also increased significantly from 47,703 kW in 2004 to 90,981 kW in 2005 to 173,977 kW in 2006. Electricity generation is currently the largest end-use application of PV systems (grid interactive and remote) with communications and transportation coming in second and third respectively. However, an important fraction of U.S. shipments of PV cells and modules are exported – about 40 percent of the total shipments in 2006 [17]. This may be because of strong demand in countries like Germany, which offer heavy rebates for solar power.

Figure 6-9 shows the growth of installed PV installations in the U.S. over the 12 year period from 1995 to 2006 segregated by market sector as defined by the International Energy Agency (IEA). The U.S. PV installations have increased an approximate 30 percent annual growth rate since 2003, increasing from 275 MW in 2003 to 624 MW in 2006. The fastest growing market sector was the grid-connected distributed sector. The grid connected distributed sector includes those PV systems installed to provide to a grid connected customer or directly to a number of customers at the distribution level [18].

[6] The reason for keeping track of shipments rather that energy produced could be because of the large number of off-grid and small-scale PV applications.

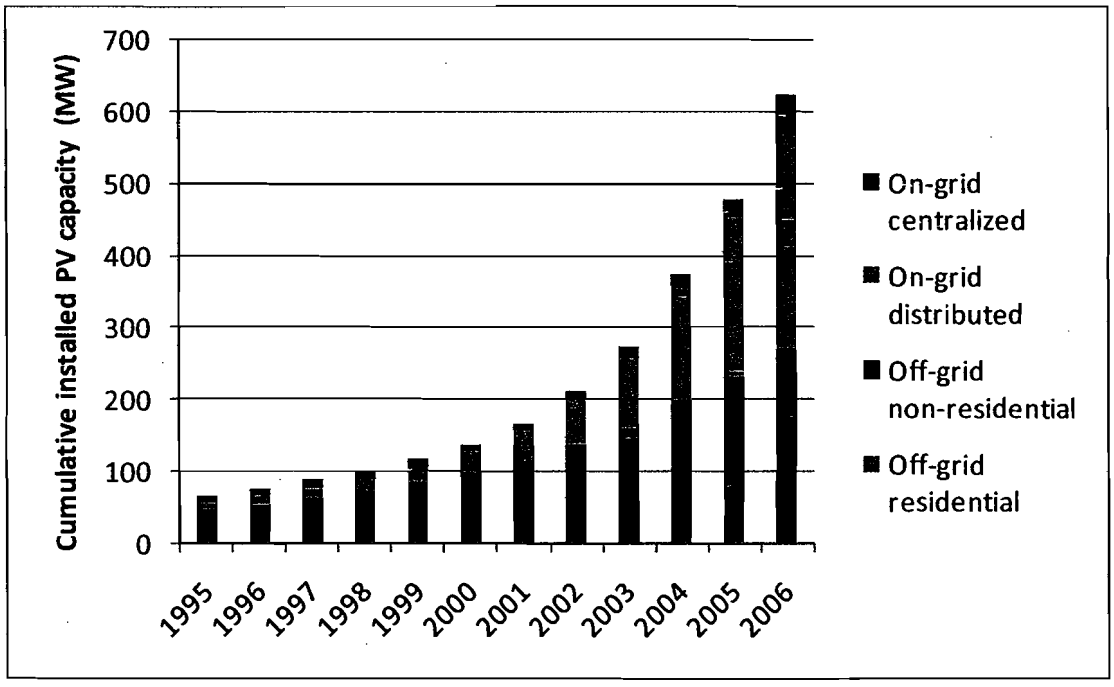

Figure 6-9: Cumulative installed PV capacity in the U.S. by sub-market (Data source: IEA [18])

In 2008, PV installations for residential, non-residential and utility uses were growing strongly, as shown in Figure 6-10 [19].

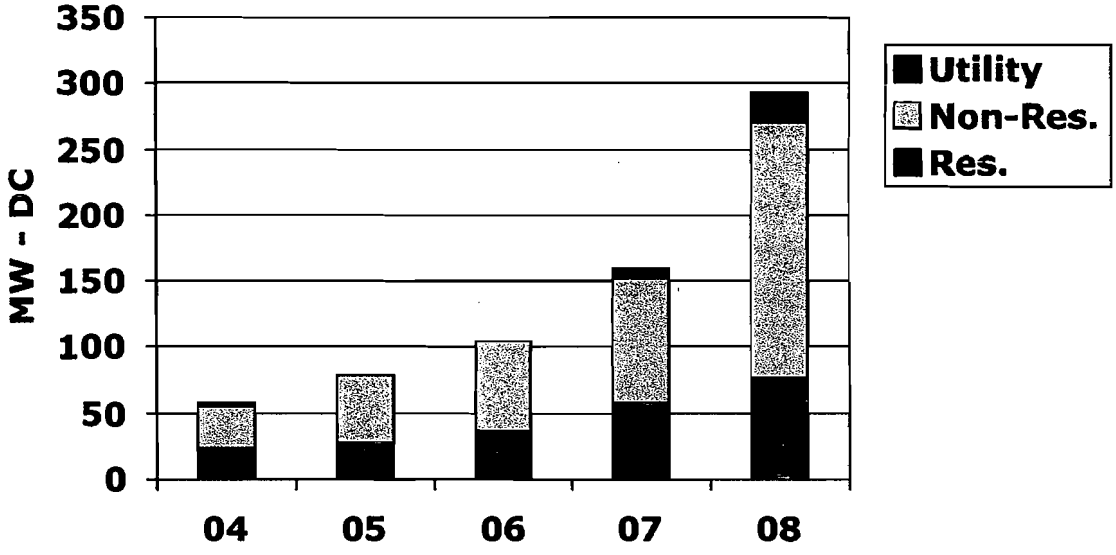

Figure 6-10: Residential, non-residential and utility PV installation in the U.S. (Source: IREC [19])

In 2006, President Bush proposed a new program to reduce the cost and increase the deployment of solar power across the U.S. This program, the Solar America Initiative (SAI), was part of the Advanced Energy Initiative that President Bush unveiled in his 2006 State of the Union address.

Although the SAI was concluded in 2009, it had a budget nearly 80 percent larger than previous solar programs in the Department of Energy. It was responsible for accelerating the development of advanced solar electric technologies, including PV and CPV systems. Its goal was to make solar energy cost competitive with other sources of renewable electricity by 2015. Most of the programs that were created under the SAI were absorbed into the current Solar Energy Technologies Program [20].

Along with the launch of the SAI, the DOE decided to shut down the Million Solar Roofs program in 2006, four years ahead of schedule. The goal of the program was to prompt the installation of one million PV and solar water heating systems in the country by 2010. By 2006, the program had led to 377,000 new solar roof installations and 200 MW in PV capacity [21].

One such program that the SAI launched was Solar America Cities, a program in which the DOE partners with 25 cities across the country to increase the deployment of solar technology. The DOE seeks to help cities develop comprehensive approaches to solar technology that facilitate mainstream adoption of solar power. The selected cities receive funding and technical support to develop a city-wide, solar implementation plan to [22]:

- Integrate solar technology into city energy planning and facilities;
- Streamline city-level regulations and practices that affect solar adoption by residents and local businesses (e.g., permitting, inspections, local codes); and
- Promote solar technology among residents and local businesses (e.g., outreach, curriculum development and implementation, incentive programs, etc.).

6.4 PV systems in Indiana

While Indiana does not have ideal solar resources, there is some potential for fixed, flat-plate PV systems such as those shown in Table 6-2. In addition, through 2007, Duke Energy Indiana has installed PV arrays on 10 schools in the state. Together, these arrays should produce 2,000 kWh of electricity annually. These schools have also received computerized performance monitoring stations so students can monitor the amount of electricity as it is generated as well as weather conditions affecting power production. The ten schools currently participating in the program are [23]:

- Batesville Middle School – Batesville
- Carmel High School – Carmel
- Clay City Junior/Senior High School – Clay City
- Doe Middle School – New Palestine
- Greenwood Middle School – Greenwood
- New Albany High School – New Albany
- North Manchester High School – Manchester

- Rushville High School – Rushville
- Wabash High School – Wabash
- West Lafayette High School – West Lafayette

Owner/Developer	Rated Capacity (kW)	Location
Hoosier Energy	3	Greensburg, Decatur County
Hoosier Energy	3	Franklin, Johnson County
Hoosier Energy	3	Meron, Sullivan County
Hoosier Energy	3	Victory, Dubois County
Duke	1.92	Kokomo
Duke	8	Bloomington Solar Panel
Duke	24	Bloomington EverGreen Village Project
IPL PV program in four Indianapolis area schools	2 In each school	Lutheran High School Brebeuf Jesuit Prep School Emmerich Manual High School Crispus Attucks Medical Magnet Middle School
Schmidt Associates (in partnership with IPL)	3	Indianapolis
The Caldwell Eco Center	0.5	Residential
The Usrey Farm	1.17	Residential
Dick Stumpner	1.765	Residential
Randolph Eastern School Corporation	1	Union City Community High School

Table 6-2: Grid-connected PV systems in Indiana

In Indianapolis in 2001, BP Amoco opened the first of its BP Connect stores in the U.S. The store incorporates thin film PV collectors in the canopy over the fuel islands to produce

electricity for use on site [24]. In addition, Duke Energy has installed an 8 kW system at its Bloomington office and a 2 kW system at its Kokomo office [25].

The remote locations of farming residences in the state of Indiana make PV energy more attractive. The high installation costs are offset by little or no operating costs, since there is no fuel required[7] and there are no moving parts. Levelized energy costs from PV systems are around 30 cents/kWh [2]. Although this is high for grid connected consumers, it may be acceptable for remote consumers and applications where grid connection is too expensive and where diesel generators are too expensive or unreliable.

The relatively low solar resource (Figures 6-7 and 6-8) in Indiana combined with the availability of low cost energy from coal-fired power plants results in a very low breakeven cost of PV technology (see Figure 6-5). An NREL study indicates that Indiana is ranked 21st in the nation in terms of breakeven cost, and the breakeven cost in the state is currently too low to be economically viable for most situations [14]. Another NREL study done in 2009 observed that factors such as cost of electricity, rate structure and availability of financing have a greater influence on the breakeven cost in an electric service territory than resource availability [26].

The average cost of PV systems was $4.18 per watt in July 2010 [12], but this is still above the breakeven cost of entry of PV systems within Indiana which is less than $4 per watt. For small residential installments in Indiana the current price is $8.09 per watt [27].

A 3.5 MW PV system has been proposed the ERMCO Green Energy Corporation for installation at Fort Benjamin Harrison in Indianapolis. According to the developer, the project is financed using the 2009 Stimulus Act funds and when completed will be the largest roof-mounted PV system in the U.S. [28]. The financial viability of the project is also enhanced by the feed-in-tariff offered by Indianapolis and Light (IPL) as part of their Renewable Energy Production rate (REP). The REP rate buys electricity generated by PV systems of the size of this project at $0.2/kWh [29]. More details about IPL's incentive rates for electricity generated from renewable resources is given in Section 6.5 below.

6.5 Incentives for PV systems

Federal Incentives

- Business Energy Investment Tax Credit (ITC) credits up to 30 percent of expenditures on solar systems [30].
- Energy Efficiency Mortgage: These mortgages can be used by homeowners to finance a variety of energy efficiency measures, including renewable energy technologies, in a new or existing home. The federal government supports these loans by insuring them through

[7] Besides the energy from the sun.

FHA or VA programs. This allows borrowers who might otherwise be denied loans to pursue energy efficient improvements, and it secures lenders against loan default and provides them with confidence in lending to customers whom they would usually deny [30].

- Modified Accelerated Cost-Recovery System (MACRS): Under this program, businesses can recover investments in solar, wind and geothermal property through depreciation deductions. The MACRS establishes a set of class lives for various types of property, ranging from three to fifty years, over which the property may be depreciated. For solar, wind and geothermal property placed in service after 1986, the current MACRS property class life is five years [30].
- Qualified Energy Conservation Bonds (QECBs) are qualified tax credit bonds and are allocated to each state based upon their state's percentage of the U.S. population. The states are then required to allocate a certain percentage to "large local governments". In February 2009, these funds were expanded to $3.2 billion [30].
- Renewable Energy Production Incentive (REPI) provides financial incentive payments for electricity produced and sold by renewable energy generation facilities owned by non-profit groups, public utilities, or state governments [30].
- Residential Energy Conservation Subsidy Exclusion: According to Section 136 of the IRS Code, energy conservation subsidies provided by public utilities, either directly or indirectly, are nontaxable: "Gross income shall not include the value of any subsidy provided (directly or indirectly) by a public utility to a customer for the purchase or installation of any energy conservation measure" [30].
- Rural Energy for America Program (REAP): The Food, Conservation, and Energy Act of 2008 converted the USDA Renewable Energy Systems and Energy Efficiency Improvements Program into the Rural Energy for America Program (REAP). Solar facilities are eligible for grants for up to 25 percent of the cost of the system and loans for another 50 percent of the cost [30].
- Value-Added Producer Grant Program: Grants are available to independent producers, agricultural producer groups, farmer or rancher cooperatives, and majority-controlled producer-based business ventures seeking funding. Previously awarded grants supported energy generated on-farm through the use of agricultural commodities, wind power, water power, or solar power. The maximum award per grant was $300,000 [31].
- High Energy Cost Grant Program administered by the U.S. Department of Agriculture (USDA) is aimed at improving the electricity supply infrastructure in rural areas having home energy costs exceeding 275 percent of the national average. Eligible infrastructure includes renewable resources generation. The USDA has allocated a total of $15.5 million for the 2010 funding cycle. The individual grants range from $75,000 to $5 million [32]

Indiana Incentives

- Emissions Credits: Electricity generators that do not emit NO_x and that displace utility generation are eligible to receive NO_x emissions credits under the Indiana Clean Energy Credit Program. These credits can be sold on the national market [33].
- Net Metering Rule: Solar, wind and hydroelectric facilities with a maximum capacity of 10 kW are qualified for net metering in Indiana. The net excess generation is credited to the customer in the next billing cycle [30].
- Solar Access Laws: Indiana state law includes both covenant restrictions and solar-easement provisions. The state's covenant restrictions prevent planning and zoning authorities from prohibiting or unreasonably restricting the use of solar energy. Indiana's solar-easement provisions do not create an automatic right to sunlight, though they allow parties to voluntarily enter into solar-easement contracts which are enforceable by law [30].
- Indianapolis Power & Light Co. – Rate REP Renewable Energy Production: IPL is offering a "feed-in tariff" to facilities that produce renewable energy. IPL can purchase renewable energy and contract the production for up to 10 years. Solar compensation is $0.24/kWh for systems between 20 and 100 kW and $0.20/kWh for systems greater than 100kW up to 10MW [29, 30].
- Indianapolis Power & Light Co. – Small Scale Renewable Energy Incentives Program: IPL is offering compensation for new photovoltaic installments for its customers. The compensation is $2 per watt up to $4,000. Participants in the REP program are not eligible [30, 34].

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7. Fuel Cells

7.1 Introduction

A fuel cell is an electrochemical device that produces direct current electrical power without combustion. A fuel cell functions like a battery that does not run down but that keeps producing electricity as long as fuel is supplied. The basic fuel cell consists of two electrodes encompassing an electrolyte. Figure 7-1 shows the basic structure of a polymer electrolyte membrane (PEM) fuel cell.

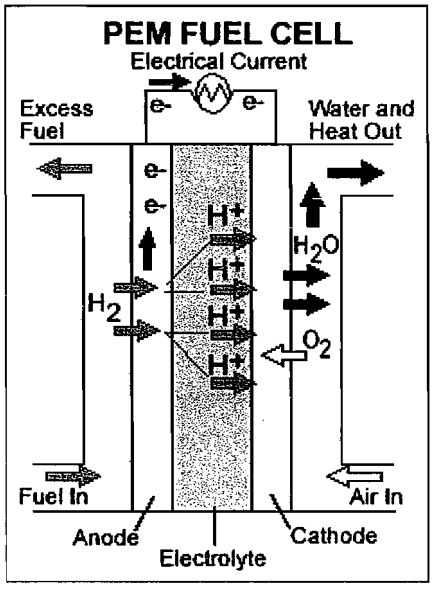


Figure 7-1: Schematic of basic fuel cell operation (Source: EERE [1])

Hydrogen (H_2) is fed into the anode, and oxygen (air) enters the fuel cell through the cathode. At the anode, the hydrogen molecule splits into separate atoms, and each atom releases an electron (e^-) with the aid of a catalyst. The remaining protons (H^+) pass through the electrolyte towards the cathode, whereas the electron flows through an external electric circuit (thereby producing electric current). The protons, electrons, and oxygen are rejoined at the cathode to produce water as the exhaust [2].

Fuel cells are classified primarily by the kind of electrolyte they employ. This in turn determines the chemical reactions that take place in the cell, the catalysts required for the chemical reaction, the temperature range in which the cell will operate, the type of hydrogen input fuel required, and a variety of other factors. Taken together, these characteristics affect the applications for which these cells are most suitable. Several types of fuel cells currently under development, each with its own advantages, limitations, and potential applications are listed [1].

- Polymer Electrolyte Membrane Fuel Cells (PEM): These fuel cells (also known as proton exchange membrane fuel cells) deliver high power density and offer advantages of low weight and volume, compared to most other fuel cells. However, the costs associated with the catalyst required by PEMFCs, as well as the space required for hydrogen storage, prevent the use of these fuel cells in vehicles.
- Direct Methanol Fuel Cells (DMFC): These fuels cells are a subset of PEM typically used for small portable power applications, with a size range of less than one watt to about 100W and operating at 60 - 90° C [3]. These cells are powered by pure methanol (CH_3OH), which is mixed with steam and fed to the fuel cell anode. Direct methanol fuel cells do not have the fuel storage problems that are prevalent in most hydrogen-based fuel cells because methanol has a higher energy density than hydrogen. Moreover, methanol is liquid at room temperature, obviating the need for the special storage technology required for hydrogen. However, this technology is relatively new and research is still being conducted on its efficacy and economic viability. DMFCs may be used to power consumer electronics, such as cell phones and laptops.
- Alkaline Fuel Cells (AFC): These fuel cells use a solution of potassium hydroxide in water as the electrolyte. Conventional high-temperature AFCs operate between 100°C and 250°C. However, newer designs operate between 23°C to 70°C. AFCs have demonstrated efficiencies of approximately 60 percent in space applications. AFC stacks have been proven to maintain stable operation for more than 8,000 operating hours.
- Phosphoric Acid Fuel Cells (PAFC): These fuel cells use liquid phosphoric acid as the electrolyte, porous carbon as electrodes, and a platinum catalyst. PAFCs are among the most mature cell types and were the first to be used commercially, with over 200 units currently in use. This type of fuel cell is typically used for stationary power generation, but some PAFCs have been used to power large vehicles such as city buses.
- Molten Carbonate Fuel Cells (MCFC): These fuel cells are being developed for natural gas and coal-based power plants for electric utility, industrial, and military applications. MCFCs utilize an electrolyte composed of a molten carbonate salt mixture and operate at temperatures of 650°C. The primary disadvantage of MCFC technology is durability. The high temperatures at which these cells operate, and the corrosive electrolyte used, reduce cell life.
- Solid Oxide Fuel Cells (SOFC): SOFCs use a hard ceramic compound as the electrolyte. SOFCs operate at temperatures of approximately 1,000°C, which can result in slow startups and requires increased thermal shielding to retain heat and protect personnel.
- Regenerative Fuel Cells (RFC): RFCs produce electricity from hydrogen and oxygen and generate heat and water as byproducts. However, RFC systems are capable of utilizing energy from solar power or other sources to divide the excess water into oxygen and hydrogen fuel (electrolysis). This technology is still being developed by NASA and others.

The characteristics of the five basic fuel cell types that are currently being pursued by manufacturers are shown in Table 7-1.

	Polymer Electrolyte Membrane	**Alkaline**	**Phosphoric Acid**	**Molten Carbonate**	**Solid Oxide**
Acronyms	PEM/PEFC/PEMFC	AFC	PAFC	MCFC	SOFC
Electrolyte	Solid organic polymer polyperfluoro-sulfonic acid	Aqueous solution of potassium hydroxide soaked in a matrix	Liquid phosphoric acid soaked in a matrix	Liquid solution of lithium, sodium, and/or potassium carbonates, soaked in a matrix	Yttria stablized zirconia
Operating Temperature	50 - 100°C	90 - 100°C	150 - 200°C	600 - 700°C	650 - 1000°C
System Output	1 – 250 kW	10 – 100 kW	50 kW – 1 MW	1 kW – 1 MW	5 kW – 3 MW
Efficiency	Transportation: 53 – 58% Stationary: 25 – 35%	60%	32 - 38%	45 – 47%	35 – 43%
Applications	Backup power, portable power, small distributed generation, transportation	Military, space	Distributed generation	Electric utility, large distributed generation	Auxiliary power, electric utility, large distributed generation
Advantages	Solid electrolyte reduces corrosion and management problems, low temperature, and quick startup	Cathode reaction faster in alkaline electrolyte so high performance	High efficiency in cogeneration of electricity and heat, can use impure H_2 as fuel	High efficiency, fuel flexibility, can use a variety of catalysts, suitable for cogeneration	High efficiency, fuel flexibility, can use a variety of catalysts, solid electrolyte reduces corrosion and management problems, suitable for cogeneration, hybrid/GT cycle
Disadvantages	Low temperature requires expensive catalysts, high sensitivity to fuel impurities, not suitable for cogeneration	Expensive removal of CO_2 from fuel and air streams required	Requires expensive platinum catalyst, low current and power, large size/weight	High temperature enhances corrosion and breakdown of cell components, complex electrolyte management, slow startup	High temperature enhances corrosion and breakdown of cell components, slow startup, brittleness of ceramic electrolyte with thermal cycling

Table 7-1: Comparison of fuel cell technologies (Source: EERE [3])

The attractive features of fuel cell technology include

- High energy conversion efficiencies exceeding 80 percent in combined heat and power applications;
- Virtual elimination of most energy-related air pollutants;

- Modularity that enables fuel cells to be used in a wider variety of applications of differing energy requirements [4].

Disadvantages and challenges facing the full deployment of fuel cell technology include

- Cost: Fuel cell systems are still more expensive than conventional energy conversion technologies. Section 7.2 discusses the economics of fuel cell systems;
- Durability and reliability: The durability of fuel cell systems has not yet been established. For example fuel cells intended for automotive use will need to reach the same levels equivalent to the current automotive engine's 5,000 hour lifespan and be able to function over the vehicle operating conditions of 40 °C to 80 °C similar to current automobile engines.
- Size: The fuel cell system (fuel cell, fuel processor, compressor/expander and sensors) are still larger than ideal, especially for the transportation industry.
- Air, Thermal, and Water Management: According to the DOE fuel cell technologies program none of the compression technology available today is appropriate for use in a fuel cell intended for automobiles. Also because the sensitivity of fuel cells to operating and ambient temperatures, large heat exchangers are needed to manage the heat and water in a fuel cell.
- Hydrogen Storage: The necessary infrastructure to produce, store and transport hydrogen is not yet in place.

Although fuel cells run on hydrogen, the most plentiful gas in the universe, hydrogen is never found alone in nature. Therefore, efficient methods of extracting hydrogen in large quantities are required. There are several methods being currently pursued by DOE to produce hydrogen at an economically competitive price [5].

- Natural Gas Reforming: Hydrogen can be produced from methane (natural gas) using high-temperature steam. This process, called steam methane reforming, accounts for about 95 percent of the hydrogen used today in the U.S.
- Electrolysis: Electrolysis uses an electric current to split water into hydrogen and oxygen. The electricity required can be generated using renewable sources.
- Gasification: Gasification is a process in which coal or biomass is converted into gaseous components by applying heat under pressure and in the presence of steam. A subsequent series of chemical reactions produces a synthesis gas, which is reacted with steam to produce hydrogen that then can be separated and purified. Producing hydrogen directly from coal by gasification and reforming is much more efficient than burning coal to make electricity that is then used to make hydrogen. Moreover, because biomass resources consume CO_2 in the atmosphere as part of their natural growth process, producing hydrogen through biomass gasification releases near-zero net greenhouse gases.
- Renewable Liquid Reforming: Biomass can be processed to make renewable liquid fuels, such as ethanol or bio-oil that are relatively convenient to transport. These renewable

liquid fuels can be reacted with high-temperature steam to produce hydrogen at or near the point of end-use.

- High-Temperature Thermochemical Water Splitting: This method uses high temperatures generated by solar concentrators or nuclear reactors to drive a series of chemical reactions that split water. All of the chemicals used are recycled within the process.
- Photobiological and Photoelectrochemical: When certain microbes, such as green algae and cyanobacteria, consume water in the presence of sunlight, they produce hydrogen as a byproduct of their natural metabolic processes. Similarly, photoelectrochemical systems produce hydrogen from water using special semiconductors and energy from sunlight.

Using fossil fuels is seen as a commercial short-term solution, whereas the electrolysis of water using solar or wind energy is seen as the ideal hydrogen production method to achieve the full environmental potential of the hydrogen economy.

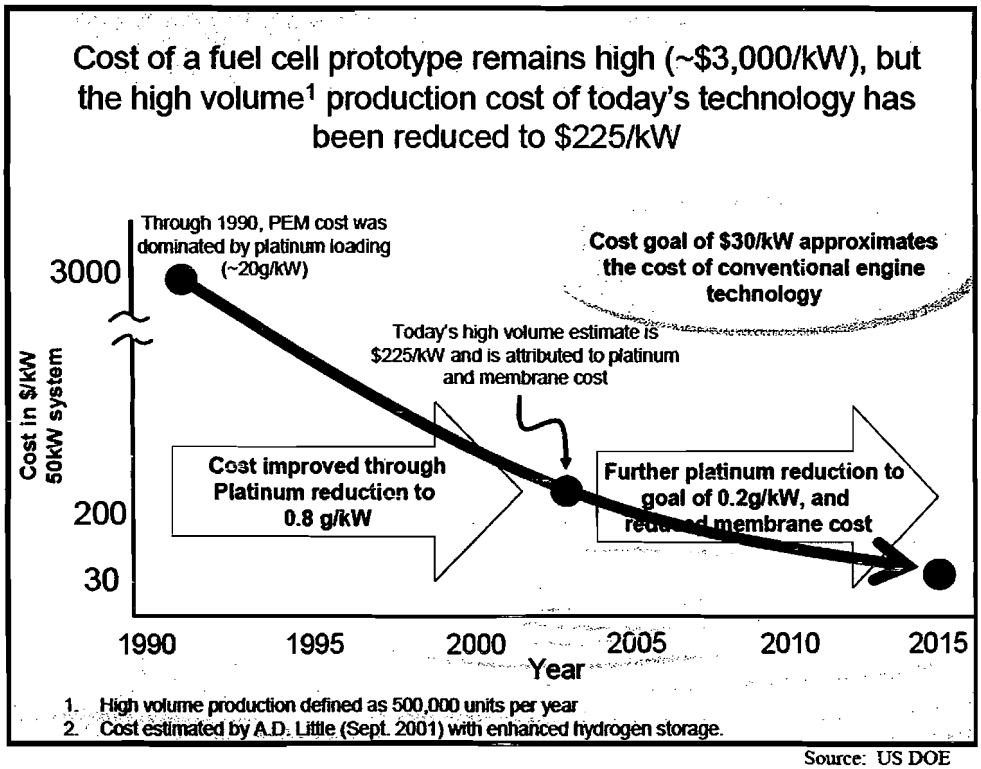
Applications for the fuel cell technology fall into two broad categories: stationary uses and fuel cell systems for the transportation industry. Stationary fuel cell uses includes such applications as grid-connected units for electricity generation and other grid support services; combined heat and power units for buildings; emergency back-up units, off-grid units powering such installations as communication towers, and electricity generation units gas from landfills and wastewater treatment plants. The fuelcell.org database lists 460 stationary fuel cell installations in the U.S., including four in Indiana. Uses in the transportation industry include fuel cell engines for cars and buses and material handling units (forklifts) and auxiliary power units for heavy duty trucks [6].

7.2 Economics of fuel cells

Currently available stationary PAFC units cost around $2,500/kW, as calculated for United Technology's PureCell Model 400 fuel cell. These units are only produced in 400 kW sizes that are suitable for larger power applications. The long-term cost of electricity produced from natural gas by the Model 400 fuel cell is roughly 12 cents/kWh. Because fuel cells use natural gas more efficiently than conventional combustion generators, UTC Power's fuel cells produce only half the carbon dioxide of traditional natural gas generation [7]. According to DOE, the price of stationary fuel cells needs to fall to the $400/kW to $750/kW range in order to be commercially viable [8].

Unlike stationary fuel cells, which are economically viable in certain situations, the cost of fuel cells for transportation purposes remains prohibitively high. The cost of today's hand-built prototypes is still well above the level necessary for commercialization. Prototype fuel cell engines for automotive transportation in operation today are on the order of $3,000/kW,

considerably higher than the approximately $30/kW cost of conventional internal combustion engines in use today. DOE estimates that the mass-production cost of a fuel cell engine is approximately $225/kW. Figure 7-2 shows the technology progression since 1990 and into the future [9]. The cost of the Clarity, Honda Motor Corporation's fuel cell powered automobile, is estimated at $300,000. Six of these automobiles have been leased to drivers in Southern California at a Honda subsidized price of $600 per month [10].



Source: US DOE

Figure 7-2: Cost of fuel cell vehicle engine (Source: *FuelCells2000* [9])

7.3 State of fuel cells nationally

Fuel cells are currently in service at over 150 landfills and wastewater treatment plants in the U.S. A few of these projects include [11]:

- Groton Landfill (Connecticut) installed a fuel cell in 1996. This plant produces about 600,000 kWh of electricity per year.
- Yonkers Wastewater Treatment Plant (New York) installed a fuel cell in 1997 and produces over 1.6 million kWh/year.
- City of Portland (Oregon) installed a fuel cell that utilizes anaerobic digester gas from a wastewater facility. It generates 1.5 million kWh/year and reduces the electricity bill of the treatment plant by $102,000/year.

Stationary fuel cell systems deployed in the U.S. include [12]:

- U.S. Postal Service (Anchorage, Alaska) installed a 1 MW (5x200 kW) fuel cell system at the U.S. Postal Service's Anchorage mail handling facility. The system runs on natural gas and provides primary power for the facility. The system was the largest commercial fuel cell system in the nation when constructed in 2000 and was the first time a fuel cell system was part of an electric utility's grid.
- South Windsor High School (Connecticut) installed a natural gas powered 200 kW fuel cell system in 2002. A comprehensive fuel-cell curriculum has been developed for high school students, providing learning opportunities for students in programs that include earth sciences, chemistry/physics, and general studies.
- Freedom Tower (New York City): The design of the new Freedom Tower, to be built in New York City over the next few years, calls for the use of fuel cells. Twelve 400-kW fuel cell systems have been ordered, which will produce 4.8MW of electricity from natural gas and will also cogenerate hot water. The cost of the 12 fuel cell systems is estimated at $10.6 million.

Other projects at various levels of development include [13]:

- Adaptive Materials Provides SOFC System to AeroVironment Unmanned Aerial Vehicle: Adaptive Materials's solid oxide fuel cell (SOFC) systems recently powered AeroVironment's PUMA unmanned aerial vehicle on a test flight. Adaptive Materials's fuel cell system provided enough power for a test flight lasting more than seven hours as well as for two surveillance cameras on the unmanned aerial vehicle.
- Delphi and Peterbilt Successfully Demonstrate SOFC Auxiliary Power Unit: Delphi Corporation and Peterbilt Motors Company successfully demonstrated a Delphi solid oxide fuel cell (SOFC) auxiliary power unit powering a Peterbilt Model 386 truck's "hotel" loads. The Delphi SOFC provided power for the Model 386's electrical system and air conditioning and maintained the truck's batteries—all while the Model 386's diesel engine was turned off.
- PolyFuel Develops Notebook Prototype: PolyFuel has developed the first functional version of its prototype power supply for notebook computers that can provide continuous performance with the simple replacement of small cartridges of methanol fuel. The consumer-friendly design has been fully integrated with a representative notebook, the Lenovo T40 ThinkPad.

Commercial use of stationary fuel cells is currently limited to larger power applications. Smaller residential-type fuel cells are being researched, and commercial production of these units is expected soon [4]. In 2004, NREL conducted a demonstration study to understand the economics of residential fuel supply systems. The report found that fuel cells are feasible as primary or backup power supply, especially for homes that are located more than a mile from utility lines.

In 2008, the National Research Council released a report, *Transition to Alternative Transportation Technologies: A Focus on Hydrogen*, which catalogued research conducted by the National Academies regarding the future of hydrogen and fuel cells for transportation. The report indicated that the best case scenario would be to have 2 million vehicles (out of 280 million vehicles) powered by fuel cells by 2020. Not until 2023 would fuel cell cars be made and sold profitably by automakers, and only if the government were to invest a total of $55 billion in research and other incentives for automakers over 15 years. By 2030, 25 million vehicles would be powered by fuel cells, and nearly all cars would have fuel cells by 2050 [14].

Currently the 15 states shown in Figure 7-4 and Washington D.C allow for the use of hydrogen/fuel cells in meeting their renewable portfolio standards. The states of Washington, Oregon, California, Idaho, New Mexico, Iowa, Michigan, New York, Maryland, Massachusetts, Delaware, and Montana provide tax incentives or rebates for power generation from stationary fuel cells [15].

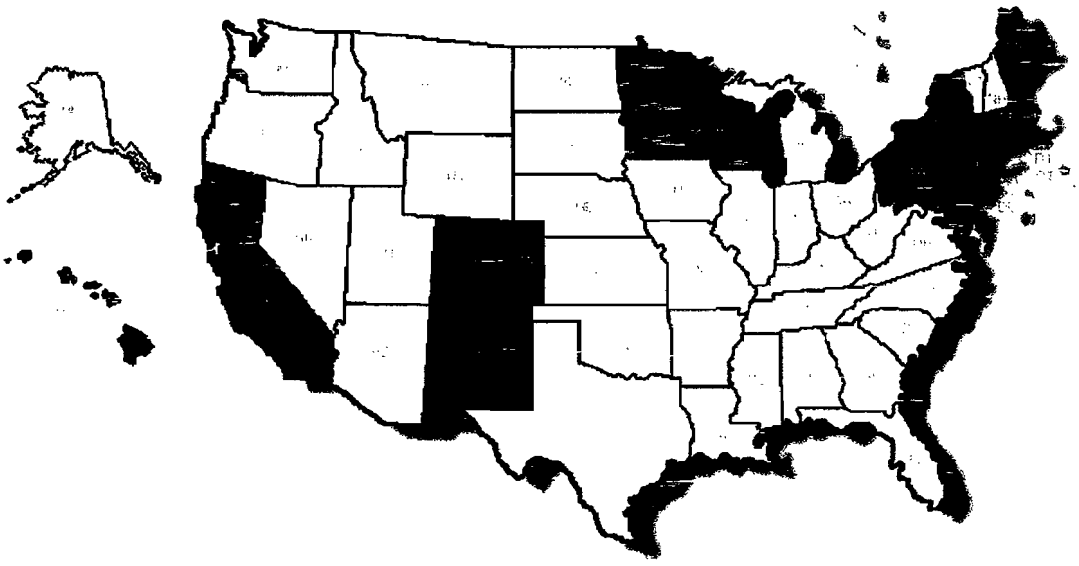


Figure 7-3: Renewable portfolio standards that include fuel cells (Source: *FuelCells2000* [2])

7.4 Fuel cells in Indiana

Table 7-2 shows the four fuel cell installations listed for Indiana in the *FuelCells2000* database [12]. According to this database the first fuel cell to be installed in Indiana was the Ballard Power 250 kW stationary generator at the Crane Naval Surface Warfare Center in the 1990s. This was the first 250 kW PEM fuel cell generator in the world to enter field testing and provided valuable information concerning the viability of fuel cells during its two-year evaluation period. In March 2004, the U.S. Navy installed a PEM-powered refueler at Crane. The second system to be installed in 2000 was a 3 KW unit in a residence in Chesterton in a

project developed in a partnership involving NiSource, Gas Technology Institute and Ishikawajima-Harima Heavy Industries.

Site	Year	Manufacturer	City	Capacity
Crane Naval Surface Warfare Center	1990s	Ballard Power Systems	Crane	250 kW
Wabash River Energy facility	2003	FuelCell Energy	Terre Haute	2 MW
U.S. Navy Naval Surface Warfare Center-Crane Division	2004	Hydrogenics Corp.	Crane	Not listed
Residential unit in a new housing development	2000	MOSAIC Energy	Chesterton	3 kW

Table 7-2: Fuel cell installations in Indiana (Source: *FuelCells2000* [12])

The third and largest plant, installed in 2003, is the 2 MW fuel cell set at the Wabash River coal gasification site near Terre Haute. This installation was designed to run on gasified coal, or syngas, from the nearby gasification facility. Partial funding was provided by the DOE as part of the federal Clean Coal Technology Program. According to fuelcell.org this was the first fuel cell plant to use a combination natural gas and coal-derived synthetic gas.

7.5 Incentives for fuel cells

Federal Incentives

- Business Energy Investment Tax Credit (ITC) credits up to 30 percent of expenditures on qualifying renewable energy systems [16].
- Conservation Security Program: The Food, Conservation, and Energy Act of 2008 reincorporated the program as the "Conservation Stewardship Program" in 2009 and increased funding in the program by $1.1 billion [17].
- Modified Accelerated Cost-Recovery System (MACRS): Under this program, businesses can recover investments in alternative energy systems through depreciation deductions. The MACRS establishes a set of class lives for various types of property, ranging from three to fifty years, over which the property may be depreciated [16].
- Qualified Green Building and Sustainable Design Project Bonds: The American Jobs Creation Act of 2004 authorized $2 billion in tax-exempt bond financing for green buildings, brownfield redevelopment, and sustainable design projects. These bonds are

only issued for projects that are certified at the 75 percent level in the *Leadership in Energy and Environmental Design* (LEED) certification system, receive at least $5 million in funding from state or local government, and include one million square feet of construction. Tax-exempt financing allows a project developer to borrow money at a lower interest rate because the buyers of the bonds will not have to pay federal income taxes on interest earned [18].

- Rural Energy for America Program (REAP): The Food, Conservation, and Energy Act of 2008 converted the USDA Renewable Energy Systems and Energy Efficiency Improvements Program into the Rural Energy for America Program (REAP). Fuel cell systems that run on renewably-produced hydrogen are eligible for grants for up to 25 percent of the cost of the system and loans for another 50 percent of the cost [16].
- High Energy Cost Grant Program administered by the U.S. Department of Agriculture (USDA) is aimed at improving the electricity supply infrastructure in rural areas having home energy costs exceeding 275 percent of the national average. Eligible infrastructure includes renewable resources generation. The USDA has allocated a total of $15.5 million for the 2010 funding cycle. The individual grants range from $75,000 to $5 million [19]

Indiana Incentives

- Emissions Credits: Electricity generators that do not emit NO_x and that displace utility generation are eligible to receive NO_x emissions credits under the Indiana Clean Energy Credit Program. These credits can be sold on the national market [20].

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8. Hydropower from Existing Dams

8.1 Introduction

Hydroelectric energy is produced by converting the kinetic energy of falling water into electrical energy [1]. The moving water rotates a turbine, which in turn spins an electric generator to produce electricity. There are several different types of hydropower facilities, including [2]:

- Impoundment hydropower: This facility uses a dam to store water. Water is then released through the turbines to meet electricity demand or to maintain a desired reservoir level. Figure 8-1 from the Idaho National Engineering and Environmental Laboratory shows a schematic of this type of facility.
- Pumped storage: When electricity demand is low, excess electricity is used to pump water from a lower reservoir to an upper reservoir. The water is released through the turbines to generate electricity when electricity demand is higher.
- Diversion projects: This facility channels some of the water through a canal or penstock. It may require a dam but is less obtrusive than that required for impoundment facilities.
- Run-of-river projects: This facility utilizes the flow of water of the river and requires little to no impoundment. Run-of-river plants can be designed for large flow rates with low head[8] or small flow rates with high head.
- Microhydro projects: These facilities are small in size (about 100 kW or less) and can utilize both low and high heads. These would typically be used in remote locations to satisfy a single home or business.

In addition, there are a variety of turbine technologies that are utilized for hydropower production. The type of turbine is chosen based on its particular application and the height of standing water. The turning part of the turbine is called the runner, and the most common types of turbines are listed below [3]:

- Pelton Turbines: The Pelton turbine has multiple jets of water impinging on the buckets of a runner that looks like a water wheel. These turbines are used for high-head sites (50 feet to 6,000 feet) and can be as large as 200 MW.
- Francis Turbines: These turbines have a runner with a number of fixed vanes (usually nine). The water enters the turbine in a radial direction with respect to the shaft, and is discharged in an axial direction. Francis turbines usually operate from 10 feet to 2,000 feet of head and can be as large as 800 MW.
- Propeller Turbines: These turbines have a runner with three to six fixed blades, much like a boat propeller. The water passes through the runner and provides a force that drives the blades. These turbines can operate from 10 feet to 300 feet of head and can be as large as 100 MW.

[8] Head is the elevation difference between the water level above the turbine and the turbine itself.

years will be the 4.3 GW of "incremental" capacity available at existing facilities. Improvements in turbine design to minimize environmental impacts and federal and state government incentives could help further develop potential hydropower projects at existing dams.

Currently, DOE is researching technologies that will enable existing hydropower projects to generate more electricity with less environmental impact. The main objectives are to develop new turbine systems with improved overall performance, develop new methods to optimize hydropower operations, and to conduct research to improve the effectiveness of the environmental mitigation practices required at hydropower projects. Together, these advances in hydropower technology should reduce the cost of implementation and help smooth the hydropower integration process [18].

8.4 Hydropower from existing dams in Indiana

Until the commissioning of the first wind farm in Indiana in 2008, hydroelectricity has been the main source of renewable electricity in Indiana as shown in Figure 8-6.

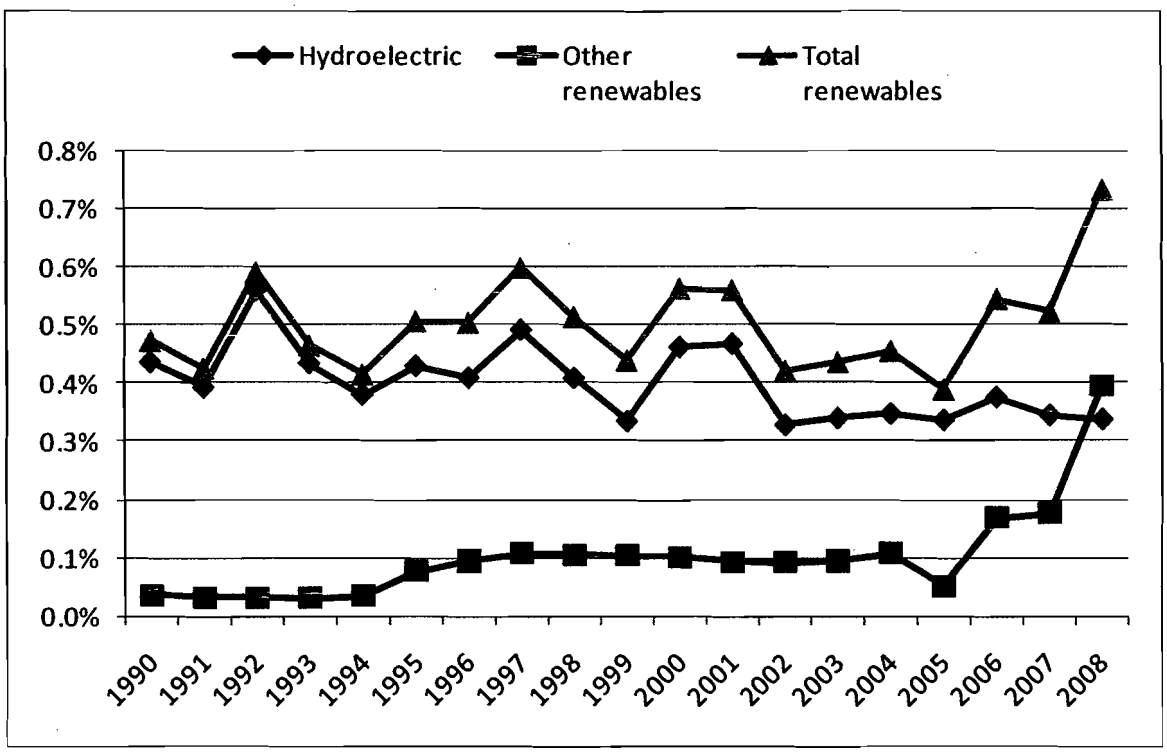

Figure 8-6: Renewables share of Indiana net electricity generation (1990-2008) (Data source: EIA [19])

However, when one considers total Indiana energy consumption, wood and more recently ethanol take the more dominant role as sources of renewable energy consumed in Indiana as

shown in Figure 8-7. Hydroelectricity comes in third contributing less 0.2 percent of the total energy consumed in Indiana.

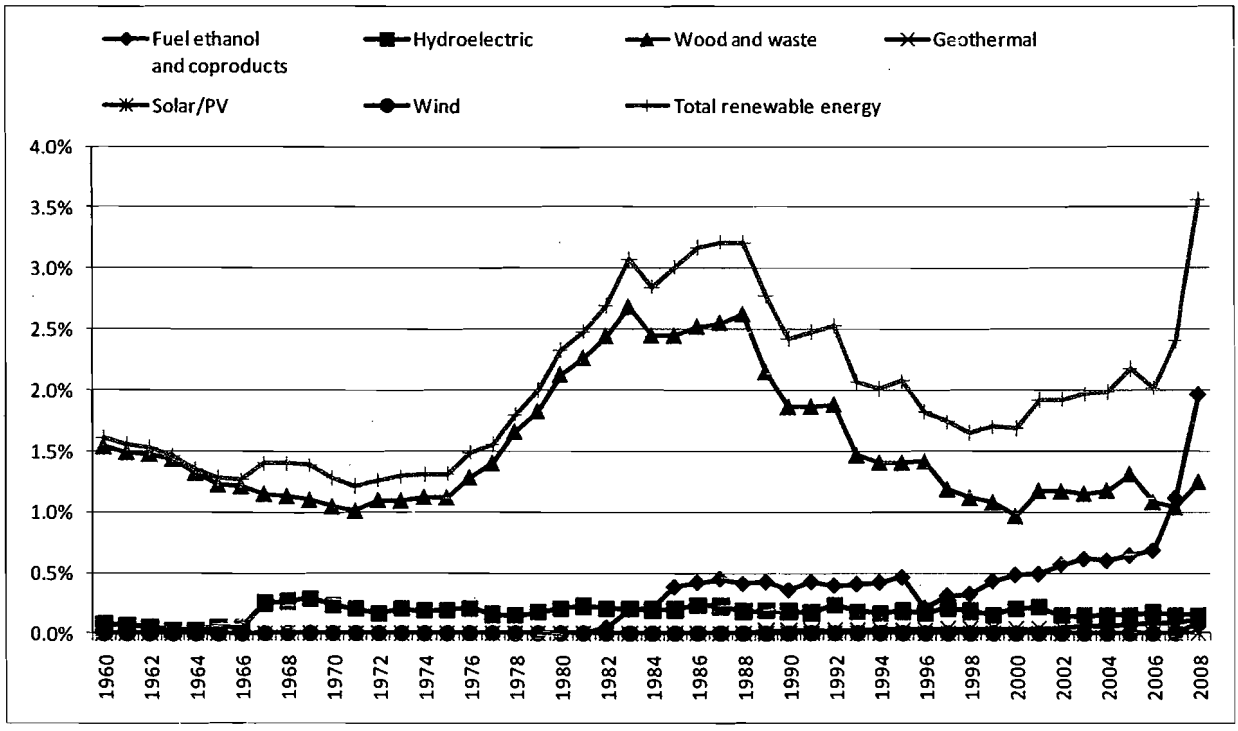

Figure 8-7: Renewables share of Indiana total energy consumption (1960 – 2008) (Data source: EIA [20])

A 1995 national hydro-potential study conducted by DOE estimated Indiana to have the potential for approximately 43 MW of exploitable capacity on 5 of Indiana's river basins as shown in Table 8-2 [21].

	Exploitable hydro potential (MW)	Number of sites	Number of sites with existing power generation	Number of sites without existing power generation	Number of un-developed sites
Wabash river basin	22.73	12	0	11	1
St. Joseph river basin	10.32	12	3	9	0
Ohio main stream	9.23	3	0	2	0
Maumee river basin	1.08	2	0	2	0
Cumberland River basin	0.0045	1	0	0	1
Total	**43.4**	**30**	**3**	**24**	**2**

Table 8-2: Hydropower potential in Indiana (Source: INEL [21])

The 43 MW shown in Table 8-2 is the net capacity that can exploited after screening out capacity deemed unsuitable for development due to environmental factors. The gross total capacity before the screening was assessed at 84 MW.

American Municipal Power is in the process of developing five new run-of-the-river hydroelectric projects on existing dams along the Ohio River whose combined capacity will be more than 350 MW. Four of these projects, including the one near Cannelton, Indiana, are at an advanced stage with the contract for the manufacture of the turbines having been signed. The other three are located at the Smithland, Meldahl and Willow Island Locks and Dams in the Illinois, Ohio and Pennsylvania sections of the Ohio River [22].

8.5 Incentives for hydropower

Federal Incentives

- Renewable Electricity Production Tax Credit (PTC): provides a 2.1 cents/kWh tax credit for wind, geothermal and closed-loop biomass and 1.1 cents/kWh for open-loop biomass, landfill gas, municipal solid waste, small hydroelectric and marine energy technologies. As part of the February 2009 Stimulus Act the PTC was modified to provide the option for qualified producers to take the federal business energy investment credit (ITC) or an equivalent cash grant from the U.S. Department of Treasury [23].
- Clean Renewable Energy Bonds (CREBs): This program, authorized by the Energy Policy Act of 2005, makes available a total of $1.2 billion in 0 percent interest bonds for non-profit organizations, public utilities, and state and local governments to pursue renewable energy projects. The Energy Improvement and Extension Act of 2008 allocated $800 million for new CREBs. In February 2009, the American Recovery and Reinvestment Act of 2009 allocated an additional $1.6 billion for new CREBs, for a total new CREB allocation of $2.4 billion. [23].
- Conservation Security Program: The Conservation Security Program offers a $200 payment for each renewable energy generation system installed on an eligible farm [24, 25]. The Food, Conservation, and Energy Act of 2008 re-incorporates the program as the "Conservation Stewardship Program" in 2009 and increases funding in the program by $1.1 billion [26].
- Rural Energy for America Program (REAP): The Food, Conservation, and Energy Act of 2008 converted the USDA Renewable Energy Systems and Energy Efficiency Improvements Program into the Rural Energy for America Program (REAP). Hydroelectric facilities are eligible for grants for up to 25 percent of the cost of the system, and loans for another 50 percent of the cost [23].
- High Energy Cost Grant Program administered by the U.S. Department of Agriculture (USDA) is aimed at improving the electricity supply infrastructure in rural areas having home energy costs exceeding 275 percent of the national average. Eligible infrastructure includes renewable resources generation. The USDA has allocated a total of $15.5

million for the 2010 funding cycle. The individual grants range from $75,000 to $5 million [27]

Indiana Incentives

- Emissions Credits: Electricity generators that do not emit NO_x and that displace utility generation are eligible to receive NO_x emissions credits under the Indiana Clean Energy Credit Program. These credits can be sold on the national market [28].
- Alternative Power and Energy Grant Program: This program offers grants of up to $100,000 to Indiana public, non-profit, and business sectors for the purchase of alternative energy systems, including micro-hydro electricity systems [29].
- Net Metering Rule: Solar, wind, and hydroelectric facilities with a maximum capacity of 10 kW are qualified for net metering in Indiana. The net excess generation is credited to the customer in the next billing cycle [30].

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9. Energy from Algae

9.1 Introduction

Algae, like other plants, utilize energy from the sun through the process of photosynthesis to convert carbon dioxide from the air into biomass usable for energy production. Algae range from seaweeds growing to over 100 feet long to microscopic microalgae, and they are found both in saltwater and freshwater environments. According to the DOE Aquatic Species Program (ASP) final close-out report, microalgae are the most primitive form of plants and are generally more efficient converters of solar energy because of their simple cellular structure. Most of the algae energy research has focused on microalgae due to their generally higher content of the natural oils (lipids) needed for biofuels such as biodiesel [1]. The ASP program identified four major groupings of microalgae. They are

- Diatoms are found mainly in oceans, but also inland in fresh and saltwater environments. These store carbon mainly as oils or as a carbohydrate.
- Green algae are the most commonly seen occurring in such places as swimming pools. They store carbon mainly as starch.
- Blue-green algae are closer to bacteria in structure and play an important role in fixing nitrogen in the atmosphere. Blue-green algae store carbon mainly as lipids.
- Golden algae can appear as yellow, brown or orange in color and occur primarily in freshwater environments. They store carbon as oils and carbohydrates.

Research on the use of microalgae as a source of renewable energy started in the U.S. as early as the 1950s. At that time the focus of the research was on growing algae in wastewater treatment facilities for the production of methane gas. Between 1978 and 1996 the U.S. Department of Energy conducted the most comprehensive algae to energy research to date under the Aquatic Species Program based at the National Renewable Energy Laboratory. According to the DOE algae research draft roadmap document, while the ASP program and other subsequent research had clearly illustrated the potential for algae as a source for renewable energy, no scalable, sustainable and commercially viable algae to energy system had emerged [2]. The algae research at NREL was revived in 2009 [3].

Algae have several advantages over other biomass as a source of energy and especially in the production of biodiesel. These advantages include [1], [2]:

- Algae grows more rapidly and has higher photosynthetic efficiency than other biomass;
- It has a much higher oil content than other biomass (Table 9-1 shows estimated algae oil content compared to traditional oilseed crops);

- It is not a food crop;
- It can be grown in water with very high salt concentration that is not usable for other agriculture;
- It can be grown in otherwise non-arable land such as deserts;
- It has the potential for recycling of CO2 from fossil fueled power plants; and
- Both biofuels and valuable co-products can be produced from algae.

Crop	Oil Yield (Gallons/Acre/Year)
Soybean	48
Camelina	62
Sunflower	102
Jatropha	202
Oil palm	635
Algae	1,000-4,000

Table 9-1: Microalgae oil yield compared to oil seed crops (Data source: EERE [2])

Algae can be grown in either open ponds combined to make an algae farm or in enclosed bioreactors. An algae farm consists of shallow algae ponds combined to make a large scale farm. Algae and nutrients are circulated around a "racetrack" using paddle wheels with water, nutrients and carbon dioxide being fed continuously to the pond. The ponds are shallow to provide adequate sunlight for all the algae. The algae containing water is removed for the harvesting and processing of algae. Figure 9-1 shows the basic design of an algae pond.

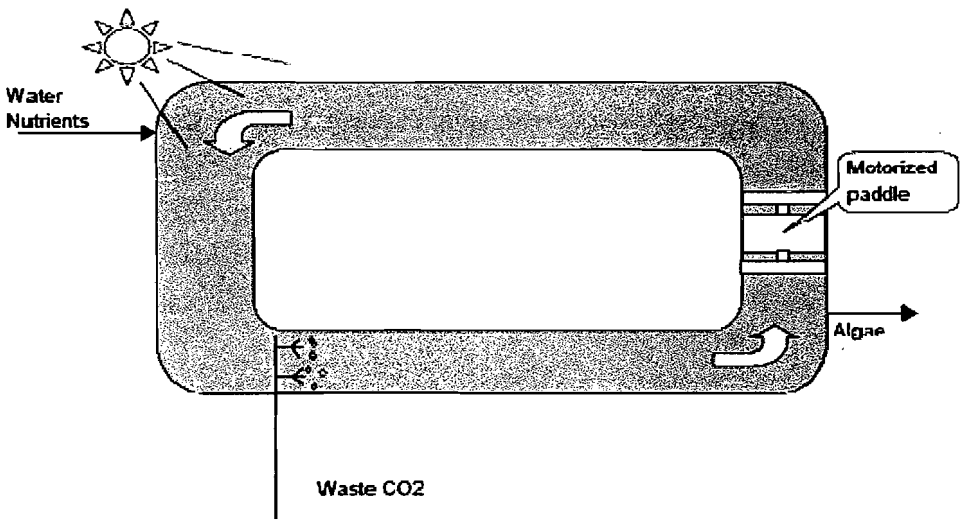

Figure 9-1: Algae pond (Source: NREL [1])

Although open pond algae farms are much more cost competitive, they are vulnerable to setbacks such as contamination of the algae in the pond by faster growing native algae, water loss through evaporation and exposure to extreme weather variations.

Enclosed bioreactors, also referred to as photobioreactors, have the algae culture entirely enclosed in greenhouses, plastic tubes, plastic bags or other transparent enclosures. They are much more expensive, but provide for better control of the algae environmental conditions and protection from biological contamination. They also provide for higher algae concentrations, thus reducing liquid handling costs [1].

One particularly elegant application for the use of algae is to couple bioreactors with coal power plants and allow the flue gas to pass through the reactors. This decreases the amount of CO_2 emissions from the plant and increases the uptake of CO_2 by the algae [1]. This is a popular concept in attempts at commercialization of the technology. Figure 9-2 shows an algae bioreactor at the Arizona Public Service Red Hawk power plant where an experiment was conducted in 2006 and 2007 to locate an algae farm next to a power plant [4, 6]. GreenFuel was the company that the Arizona Public Service used to develop the project. However, during Phase II of the project, in 2009, GreenFuel was forced to sell its assets due to financial reasons [5]. Arizona Public Service has continued the Red Hawk project. There are other successful algae ventures, such as PetroAlgae, that are attempting to commercialize the technology.

Figure 9-2: Algae bioreactors at an Arizona Public Service power plant (Source: APS: [4])

9.2 Economics of algae-based energy

Figure 9-3 gives the estimated cost of algal oils, technically known as triacylglycerols (TAGS) from various research projects presented at the December 2008 *DOE Algal Biofuels Technology Roadmap Workshop*. These costs are preliminary costs and better projections will not be available until a commercial scale algae oil production system is in place [7]. As stated in Figure 9-3 the average production cost from projects included is $109/gallon with very wide variability as represented by a standard deviation of $301/gallon.

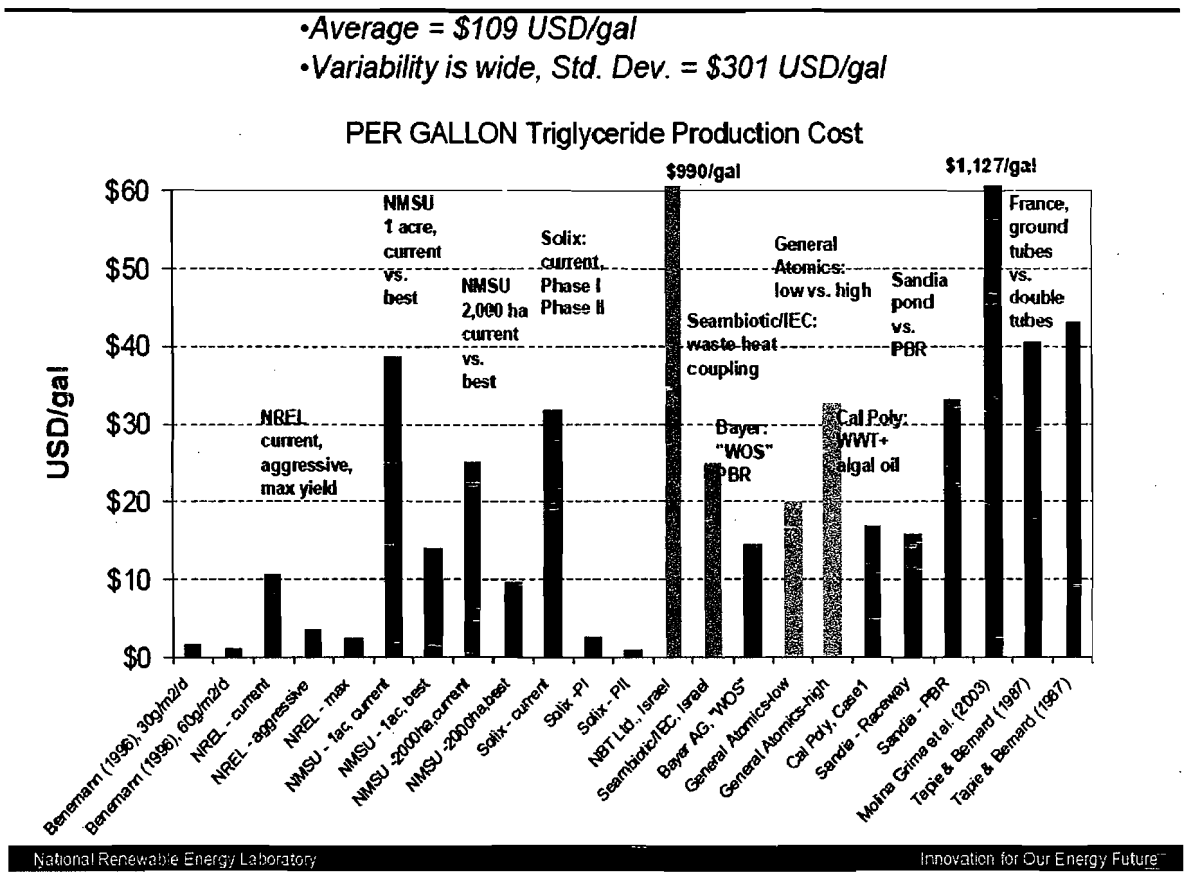

Figure 9-3: Cost comparison of various algae research projects (Source: NREL: [7])

The acronyms in Table 9-2 represent the following

- NREL – Various algae research projects at the National Renewable Energy Laboratory
- NMSU – an algae research project at the New Mexico State University in Artesia, New Mexico
- Solix – closed bioreactor based algae research at the Solix Biofuels Corporation of Fort Collins, Colorado
- NBT Ltd. – algae research at the Nature Beta Technologies Corporation of Israel

- Seambiotic/IEC Israel – a joint project between the Seambiotic Corporation of Israel and the Israel Electric Company (IEC) to grow algae using CO_2 from a coal power plant
- Bayer AG, "WOS" PBR – a photobioreactor (PBR) based algae research project by Bayer Corporation in Germany and El Paso, Texas
- Cal Poly WWT + algal oil – California Polytechnic State University microalgae research project that uses algae for the dual role of wastewater treatment and algal oil production.

The objective of the ongoing DOE algae biofuels research roadmapping effort is to "*identify the critical barriers currently preventing the development of a domestic, commercial-scale algal biofuels industry*" [2].

9.3 State of algae-based energy nationally

According to DOE, while the ASP program and other subsequent research had clearly illustrated the potential for algae as a source for renewable energy, scalable, sustainable and commercially viable algae to energy system had not emerged [2].

In the last few years the use of algae as a source of biofuels has again begun to receive attention. This movement is driven by factors such as the expected continued upward trend in the price of petroleum, the increased concern for energy security and the increased concern about the effect of carbon dioxide on global climate change [8]. Some recent Federal efforts in algae biofuel research include:

- Department of Defense Advanced Research Projects Agency (DARPA) jet fuel project. This project first initiated in 2006 has as an objective the development and commercialization of "*a highly efficient system for low-cost algal oil production and optimizing its conversion to JP-8 jet fuel*" [8].

- Department of Defense Air Force Office of Scientific Research (AFOSR) algal jet fuel project. A workshop to initiate this project was held in February 2008 to "develop a basic science research "roadmap" from which recommendations can be made for future scientific funding opportunities within AFOSR." This project is being done in partnership with the National Renewable Energy Laboratory [8].

- U.S. Air Force funded project carried out in 2006 by a partnership of Arizona Public Service and National Energy Technology Laboratory to conduct field assessments of an algae farming technique to fix carbon dioxide and a conversion process to produce various liquid fuels [8].

- Starting in 2004 the DOE Small Business Innovative Research Grants program has provided awards to various algae production, harvesting and processing applied research projects [8].

DOE has recently launched an effort to consolidate the national algae research effort. As part of this effort DOE hosted a national *Algal Biofuels Technology Roadmap Workshop* at the University of Maryland on December 9 and 10, 2008, attended by researchers and other stakeholders in the industry. A national roadmap document was issued after this workshop [2].

9.4 Algae-based energy in Indiana

The following algae developers are operating in Indiana

- Algaewheel Corporation of Indianapolis. Algaewheel has carried out pilot projects in Seymour, Whitestown and at Purdue University's swine research facility. The primary application of Algaewheel technology is in wastewater treatment facilities [9, 10]. A demonstration project using Algaewheel technology to manage nitrogen content in water is taking place in Hopewell, Virginia [11].

- Biotown USA. Nicknamed Biotown USA in 2005, Reynolds, Indiana has become a prominent figure for biomass renewable energy resources. At the start of 2010, a $2.7 million wastewater treatment plant became operational, using a 6,500 square-foot greenhouse installed by Algaewheel Technologies. After passing through filters, the wastewater flows through wheels containing algae. The algae feed on nutrients in the water while using energy from the sun. After passing through more filters and a disinfection system, the treated wastewater exits the plant. The plant is able to process 90,000 gallons of wastewater per day [12, 13].

- Stellarwind Bio Energy LLC. Stellarwind opened a small scale production facility and corporate headquarters in Indianapolis in March 2009 [14 - 16].

9.5 Incentives for algae-based energy

Recent federal government actions have re-energized algae biofuel research, including:

- The 2007 Renewable Fuel Standard (RFS). The mandate for renewable fuels, first signed into law in 2005, was increased substantially and extended to 2022. It is mandated that 21 billion gallons out of the 36 billion gallon total required biofuel be from biomass other than corn ethanol in 2022. It is expected that this 21 billion gallon mandate gallon creates an opportuity for algae and other new generation biofuels [2].

- Biomass research funds made available in the 2009 American Recovery and Renewal Act, also known as the Stimulus Act. $800 million in this Act was allocated to fund biofuel research, including algae biofuel, under the Biomass Program of the Department of Energy [2].

Other Federal Incentives

- Renewable Electricity Production Tax Credit (PTC) provides a 2.2 cents/kWh tax credit for wind, geothermal and closed-loop biomass and 1.1 cents/kWh for open-loop biomass, landfill gas municipal solid waste small hydroelectric and marine energy technologies. As part of the February 2009 Stimulus Act the PTC was modified to provide the option for qualified producers to take the federal business energy investment credit (ITC) or an equivalent cash grant from the U.S. Department of Treasury [17].
- Business Energy Investment Tax Credit (ITC) credits up to 30 percent of expenditures on qualifying renewable energy systems [17].
- Renewable Energy Production Incentive (REPI) provides financial incentive payments for electricity produced and sold by renewable energy generation facilities owned by non-profit groups, public utilities, or state governments [17].
- Qualified Energy Conservation Bonds (QECBs) are qualified tax credit bonds and are allocated to each state based upon their state's percentage of the U.S. population. The states are then required to allocate a certain percentage to "large local governments". In February 2009, these funds were expanded to $3.2 billion [17].
- Value-Added Producer Grant Program: Grants are available to independent producers, agricultural producer groups, farmer or rancher cooperatives, and majority-controlled producer-based business ventures seeking funding. Previously awarded grants supported energy generated on-farm through the use of agricultural commodities, wind power, water power, or solar power. The maximum award per grant was $300,000 [18].
- High Energy Cost Grant Program administered by the U.S. Department of Agriculture (USDA) is aimed at improving the electricity supply infrastructure in rural areas having home energy costs exceeding 275 percent of the national average. Eligible infrastructure includes renewable resources generation. The USDA has allocated a total of $15.5 million for the 2010 funding cycle. The individual grants range from $75,000 to $5 million [19]

Indiana Incentives

- Emissions Credits: Electricity generators that do not emit NO_x and that displace utility generation are eligible to receive NO_x emissions credits under the Indiana Clean Energy Credit Program. These credits can be sold on the national market [20].
- Indianapolis Power & Light Co. – Rate REP Renewable Energy Production: IPL is offering a "feed-in tariff" to facilities that produce renewable energy. IPL can purchase

renewable energy and contract the production for up to 10 years. Biomass compensation is $6.18/kW per month plus $0.085/kWh [17, 21].

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Appendix: Energy from Woody Biomass

A.1 Introduction

Woody biomass has historically been one of the main sources of renewable energy in the U.S. and in Indiana. In 2008, biomass, mostly woody biomass, supplied over 3 percent of total energy consumed in the U.S. and 1.2 percent of Indiana's total energy consumption. At its peak in the 1980s wood and wood waste supplied as much as 2.5 percent of Indiana's total energy. In more recent years (starting in 2007) corn-based fuel ethanol has overtaken wood as the main source of renewable energy in Indiana. The drivers behind this rapid rise in corn-based ethanol production are discussed in Section 1 of this report. Figure A-1 shows the historical contribution of renewable resources in Indiana's total energy consumption.

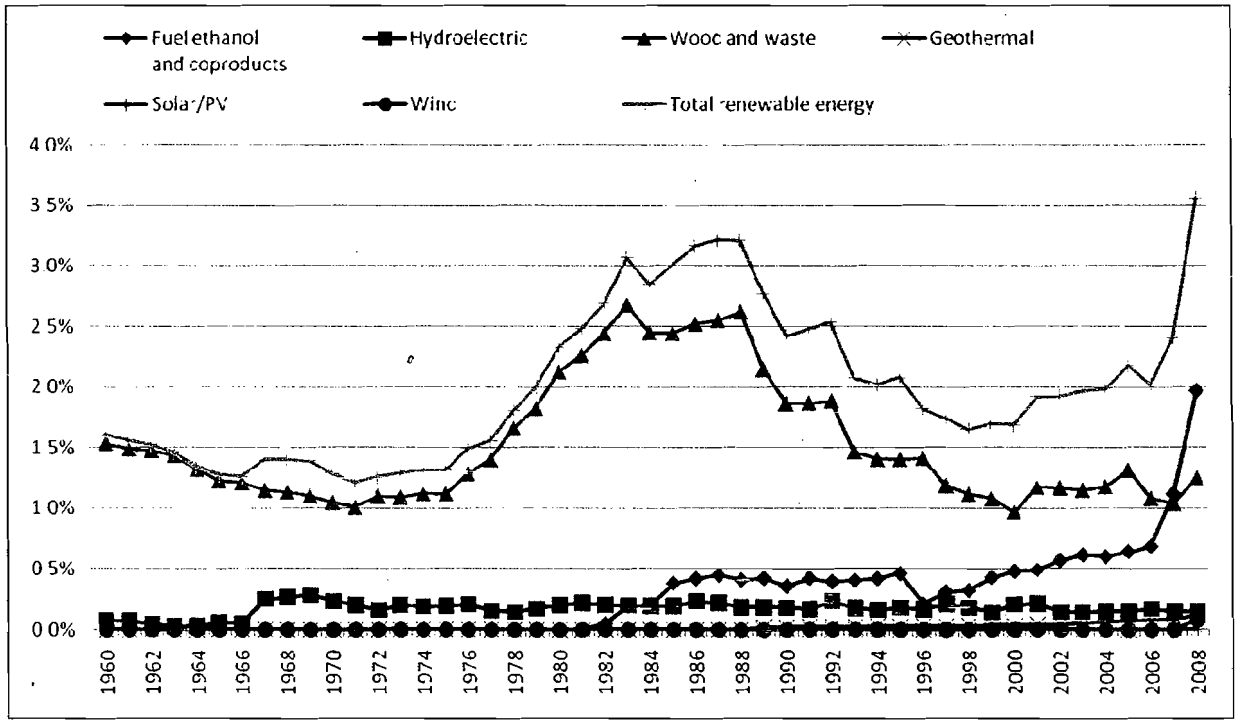

Figure A-1: Renewables share of Indiana total energy consumption (1960 – 2008) (Data source: EIA [1])

A.2 Energy from woody biomass nationally

In 2005 the U.S. Department of Agriculture (USDA) and the U.S. Department of Energy (DOE) issued a joint report from a study done to investigate the viability of using energy from biomass to replace 30 percent of U.S. petroleum consumption by the year 2030. According to this report, *Biomass Feedstock for a Bioenergy and Bioproducts Industry: the Technical Feasibility of a*

Billion-Ton Annual Supply [2], approximately 1.3 billion tons of biomass could be sustainability produced in the U.S. by the mid-21st century. That amount is more than sufficient to meet the 30 percent petroleum replacement target. Of this 1.3 billion tons of biomass available annually, 368 million tons would be from the forest (wood) industry. The sources of forest biomass would include residues generated from traditional logging and other forest and timberland management activities; residues recoverable from forest fire management activities, the current use of wood as heating fuel and for electric generation; wood products industry residues, and a projected growth resulting from increasing demand of wood industry products; and an improvement in the forest biomass equipment enabling recovery of material that is currently inaccessible. Figure A-2 shows the quantities of forest biomass potentially available as feedstock for the bioenergy industry according to the billion-ton biomass vision.

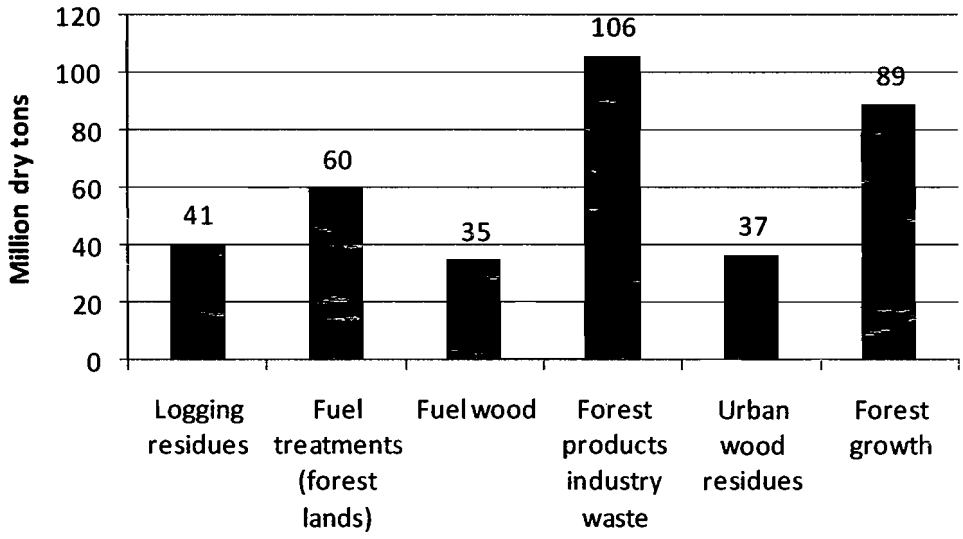

Figure A-2: Estimate of annual sustainably recoverable forest biomass in the U.S. (Data source: USDA, DOE [2])

A.3 Availability of woody biomass in Indiana

According to the Indiana Department of Natural Resources (DNR) [3] there are three main sources of residue woody biomass in Indiana: harvesting residues, standing dead trees and residues from the wood products industry. Further, the wood industry can be divided into primary and secondary wood manufacturing industries. The primary manufacturing industry includes industries such as saw milling, building materials, and paper/pulp industries. This primary wood industry is currently the main source of the woody biomass residue. DNR estimates that 1.3 million green tons of residues are produced annually from the primary wood industry. However, most of this residue is already being used for other purposes, and only about one percent (17,700 tons in 2005) is unused and therefore potentially available for production of more woody biomass-based energy. The current usage includes the 20 percent that is currently

being used for energy as shown in Figure A-3. No data on the amount of residue available from secondary mills or from municipal solid waste could be found.

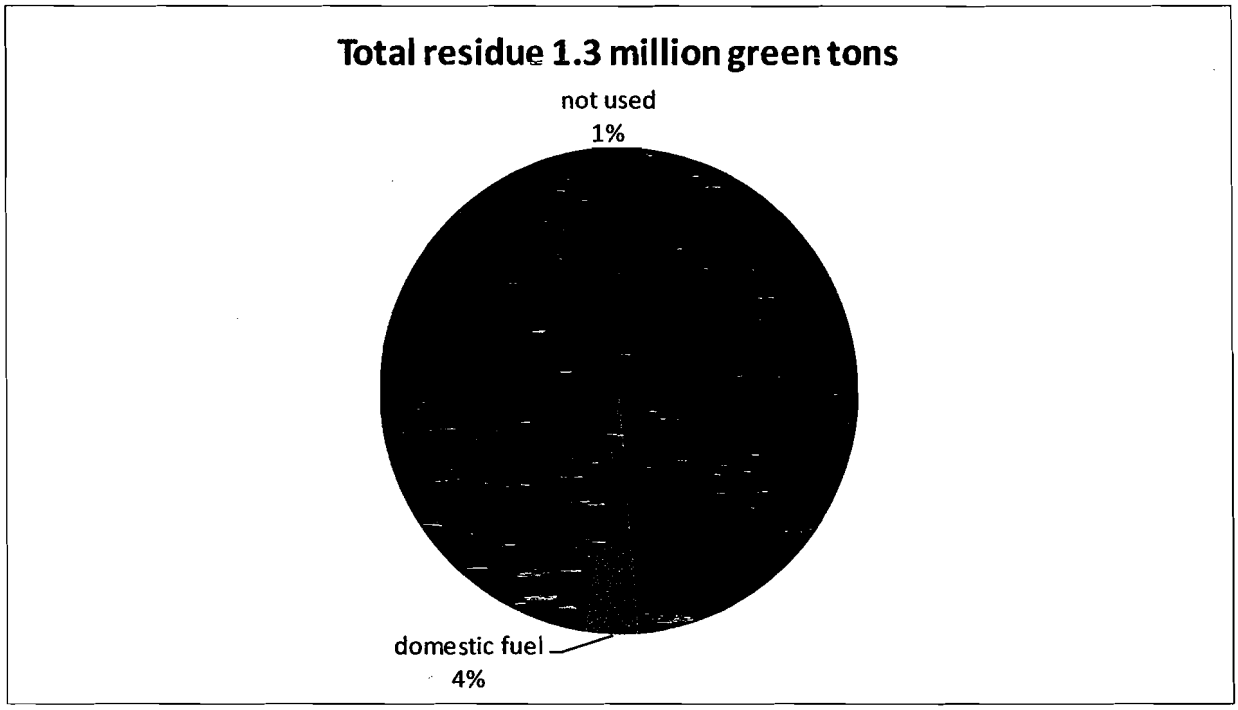

Figure A-3: Uses of primary mill residue in Indiana in 2005 (Data source: DNR [3])

Table A-1 shows the approximate amount of additional energy over and above the amount currently being produced that can be extracted from wood industry residue. The heat values are estimated from the USDA Forest Service fuel value calculator [4], assuming a 20 per cent moisture content for primary mill residue and 0 percent moisture content for construction/demolition residue. If all of Indiana's residue from Table A-1 is burned in a combined heat and power plant operating at 70 percent efficiency, the 132 billion Btu extracted would amount to approximately 0.005 percent of Indiana's 2,900 trillion Btu of total energy consumed in Indiana in 2008. If, on the other hand, the residue was used to generate electricity in an electricity generating plant operating at a heat rate of 16,000 Btu/kWh, the resulting 12 GWh of electricity would amount to 0.011 percent of Indiana's 110,000 GWh annual electricity consumption.

	Unused residue (tons)	Net heating value (Btu/ton)	Net heat available (mmBtu)	Energy from CHP plant* (mmBtu)	Energy from thermal plant* (mmBtu)	Electricity* (MWh)
Primary mill residue	17,700	10,560,000	186,912	130,838	112,147	11,504
Secondary mill residue	NA	NA	NA	NA	NA	NA
Municipal solid waste	NA	NA	NA	NA	NA	NA
Construction & demolition residue	162	13,800,000	2,236	1,565	1,341	138
Total			103,048	72,134	61,829	6,342

*Assumed efficiencies: combined heat and power plant (CHP) 70%; thermal plant 60%; electricity-only generating plant 16,000 Btu/kWh

Table A-1: Energy available from wood industry residue (Data source: DNR [3], USDA [4])

Table A-2 shows the energy potential if logging residues and standing dead trees were used. Logging residues and standing dead trees are currently not harvested for the most part. Therefore they present a potential source of biomass for substantially increasing the current levels of bioenergy production. The 4.8 trillion Btu obtained if all logging residues were passed through a combined heat and power plant (CHP) operating at 70 percent efficiency is approximately 0.2 percent of Indiana's total energy consumption in 2008. The 400 GWh obtained if the logging residue was passed through an electricity generating plant operating at a 16,000 Btu/kWh heat rate would be enough to meet 0.4 percent of Indiana's annual electricity consumption. The standing dead trees have the potential to supply 0.8 percent of Indiana's total annual energy demand or 1.9 percent, or approximately one week's worth, of Indiana's annual electricity consumption.

	Harvesting/logging residue	Standing dead trees
Available residue (cubic feet)		398,000,000
Available (tons)	1,200,000	3,719,626
Net heating value* (Btu/ton)	5,740,000	8,950,000
Total energy available (mmBtu)	6,888,000	33,290,654
Energy from CHP plant (mmBtu)	4,821,600	23,303,458
Energy from thermal plant (mmBtu)	4,132,800	19,974,393
Electricity (Mwh) (~16000 Btu/kWh)	423,939	2,048,956

*Assumed moisture content: Harvesting residue 50%; standing dead trees 30%.

Table A-2: Energy available from forest residue (Data sources DNR: [3], USDA [4])

A.4 Limitations to the access and utilization of woody biomass

As can be seen in Table A-2 if woody biomass is to play a much greater role in the energy mix in Indiana than its current 1 percent, use will have to be made of material that is currently left in forests such as logging residue and standing dead trees. Due to the low value of wood residue currently, there has been no financial incentive to invest in the infrastructure needed to collect and deliver these materials. According to the DNR report on the use of woody biomass for bioenergy, this infrastructure will require substantial capital investments which are currently not economical [3]. This observation is corroborated by other studies, including the USDA/DOE billion-ton vision report referred to in Section A.2 [2]. The USDA/DOE report observed that challenges related to access and transport of the forest biomass would greatly limit the amount of the total forest biomass identified in the billion-ton study that could be economically put to use. Further, a proposed boiler emissions rule revision by the Environmental Protection Agency (EPA) will likely further negatively impact the competitiveness of biomass energy. The proposed rule would reclassify biomass fired boilers in such a manner that they would now be subject to the *Maximum Achievable Control Technology* (MACT) to restrict the emission of mercury, carbon monoxide and other non-mercury metals. The proposal was issued in April 2010 with a public comment period that ended in August [5].

A.5 Carbon neutrality of energy from woody biomass

The discussion about the desirability of harvesting forest biomass as a feedstock for energy production has been brought into focus by the June 2010 publication of the *Biomass Sustainability and Carbon Policy Study* conducted for the Massachusetts Department of Energy Resources by the Manomet Center for Conservation Sciences [6]. The study came to the conclusion that using forest biomass as a substitute for fossil fuels would result in more emissions in the short run than would have been emitted using traditional fossil fuels. This is

due to the fact that biomass generally emits more green house gases (GHG) than fossil fuels per unit of energy produced. Table A-3 shows Manomet's estimate of the total GHG emissions per unit of energy produced by biomass and fossil fuels in the three scenarios considered in the study.

Scenario	Forest Biomass	Coal	Fuel oil (#6)	Fuel oil (#2)	Natural gas
Utility-Scale Electric	**Kilograms/MWh**				
Fuel Production & Transport	7	9			34
Fuel Combustion	399	270			102
Total	406	279			136
Thermal	**Kilograms/mmBtu**				
Fuel Production & Transport	1		6	6	6
Fuel Combustion	35		27	25	17
Total	36		33	31	23
Combined Heat and Power	**Kilograms/mmBtu**				
Fuel Production & Transport	1		6	6	6
Fuel Combustion	35		29	27	18
Total	36		35	33	24

Table A-3: Green house gas emissions in carbon-equivalent kilograms per unit of energy (Source: Manomet [6])

The estimates in Table A-3 include the direct and indirect emissions of carbon and other green house gases in the production, processing and transportation of the feedstock in equivalent kilograms of carbon per unit of energy. For example, burning forest biomass in an electricity-only generating plant releases a total 406 kilograms of carbon-equivalent GHG per Megawatthour (MWh) of electricity produced while coal releases 279 kg/MWh.

Table A-4 shows the excess GHG emissions when biomass is used to replace fossil fuels to produce electricity, heat or in a combined heat and power plant. The excess GHG emissions is expressed as percentage of the emissions from a biomass power plant. For example, forest biomass burned to produce electricity releases 31 percent more GHG than coal when expressed as a percent of total biomass emissions, that is (406-279)÷406).

	Coal	Fuel oil (#6)	Fuel oil (#2)	Natural gas
Electric	31%			66%
Thermal		8%	15%	37%
Combined heat & power		2%	9%	33%

Table A-4: Initial excess green house gas emissions when forest biomass is used to replace fossil fuel (Source: Manomet [6])

As the forest grows to replace the harvested material the excess carbon shown in Tables A-3 and A-4, referred to in the Manomet study as the 'carbon debt', is absorbed and in the long term the re-growth results in a continuing 'carbon dividend'. However the time it takes to pay off the initial carbon debt and hence achieve carbon neutrality relative to burning fossil fuels can be long – as long as 20 years when biomass replaces coal for electricity-only generation and greater than 90 years when forest biomass is used to replace natural gas in electricity-only generating plants. Table A-5 shows the carbon debt payback periods for various energy settings in Massachusetts.

Fossil Fuel Technology	Carbon Debt Payback (years)
Oil (#6), Thermal/CHP	5
Coal, Electric	21
Gas, Thermal	24
Gas, Electric	>90

Table A-5: Length of time to pay back the initial carbon debt (Data source: Manomet [6])

In applying the results from their study, Manomet cautions readers to take into account that the results are very site specific, being affected by such factors as: the characteristics of the fuel system being replaced, the efficiency of converting biomass to energy, the volume of material harvested from the site, the forest ecosystem productivity and such dynamics as forest fires, dead wood production and deadwood decay rates. In addition, the study compares the harvesting of live forest biomass and not the use of residues that are already being removed from forests for current wood industry and forest management purposes. They also point out that the use of woody biomass planted as a dedicated energy crop as discussed in Section 3 of this report would not incur the carbon debt as the harvesting of forest biomass does as long as no plants were cleared to make way for the plantation. The carbon neutrality of the dedicated energy crop forest is enhanced by the fact that the standing trees in the plantation represent stored carbon that would not have been there otherwise.

As can be seen in Table A-3 the excess carbon emissions in biomass relative to fossil fuels occurs in the combustion phase rather the production and transportation phases. The emissions

from combustion in the electricity-only generating plants in the Manomet study are 339 kg/MWh for biomass, 270 kg/MWh for coal, and 102 kg/MWh for natural gas. This higher carbon emission level is a reflection of the fact that biomass power plants operate at a much lower efficiency that fossil fuel fired power plants. The efficiencies of the power plants used in the Manomet study were as follows: 48 percent for natural gas fired; 32 percent for coal fired; and 20-25 percent for biomass fired power plants. Inefficiencies in the combustion of biomass are due to such factors as the low energy density per unit mass, higher moisture content and high alkali levels that cause slag and corrosion in the boiler [7].

A.6 Incentives for woody biomass

Federal Incentives

- Renewable Electricity Production Tax Credit (PTC) provides a 2.2 cents/kWh tax credit for wind, geothermal and for trees planted for energy use (closed-loop biomass) and 1.1 cents/kWh for open-loop biomass. Wood waste falls under the open-loop biomass category. As part of the February 2009 Stimulus Act the PTC was modified to provide the option for qualified producers to take the federal business energy investment credit (ITC) or an equivalent cash grant from the U.S. Department of Treasury [8, 9].
- Grants for Forest Biomass Utilization: Sections 209, 210, and 944 of the 2005 Energy Policy Act enable grant programs for rural or remote communities. One program is for communities that improve the commercial value of woody biomass for increased efficiency or use, and the other is for small business bioproduct marketing and certification. USDA is authorized to issue grants to improve the commercial value of forest biomass for such uses as electric power and heat. Eligible communities can get up to $500,000 total or up to $20 per ton of green forest biomass for utilization in generating electricity and heat. DOE may issue grants for rural and remote community electrification, with grants up to $20 million per year available for increased efficiency or use of renewable energy sources including woody biomass [8].
- Rural Energy for America Program (REAP): Eligible renewable energy projects include wind, solar, biomass and geothermal; and hydrogen derived from biomass or water using wind, solar or geothermal energy sources. REAP incentives are generally available to state government entities, local governments, tribal governments, land-grant colleges and universities, rural electric cooperatives and public power entities, and other entities, as determined by USDA. The program covers up to 25 percent of costs [8, 9].
- High Energy Cost Grant Program administered by the U.S. Department of Agriculture (USDA) is aimed at improving the electricity supply infrastructure in rural areas having home energy costs exceeding 275 percent of the national average. Eligible infrastructure includes renewable resources generation. The USDA has allocated a total of $15.5 million for the 2010 funding cycle. The individual grants range from $75,000 to $5 million [10]

A.7 References

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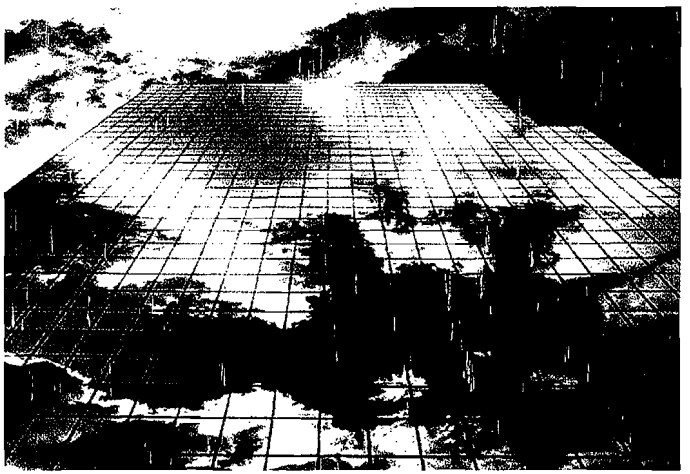
Moving to the Cloud: Risks and Opportunities

Indiana Interim Regulatory Flexibility Committee



RFSC 9/14/2010
EXHIBIT D

Presented by:

Rick Gordon, Managing Director

September 14, 2010

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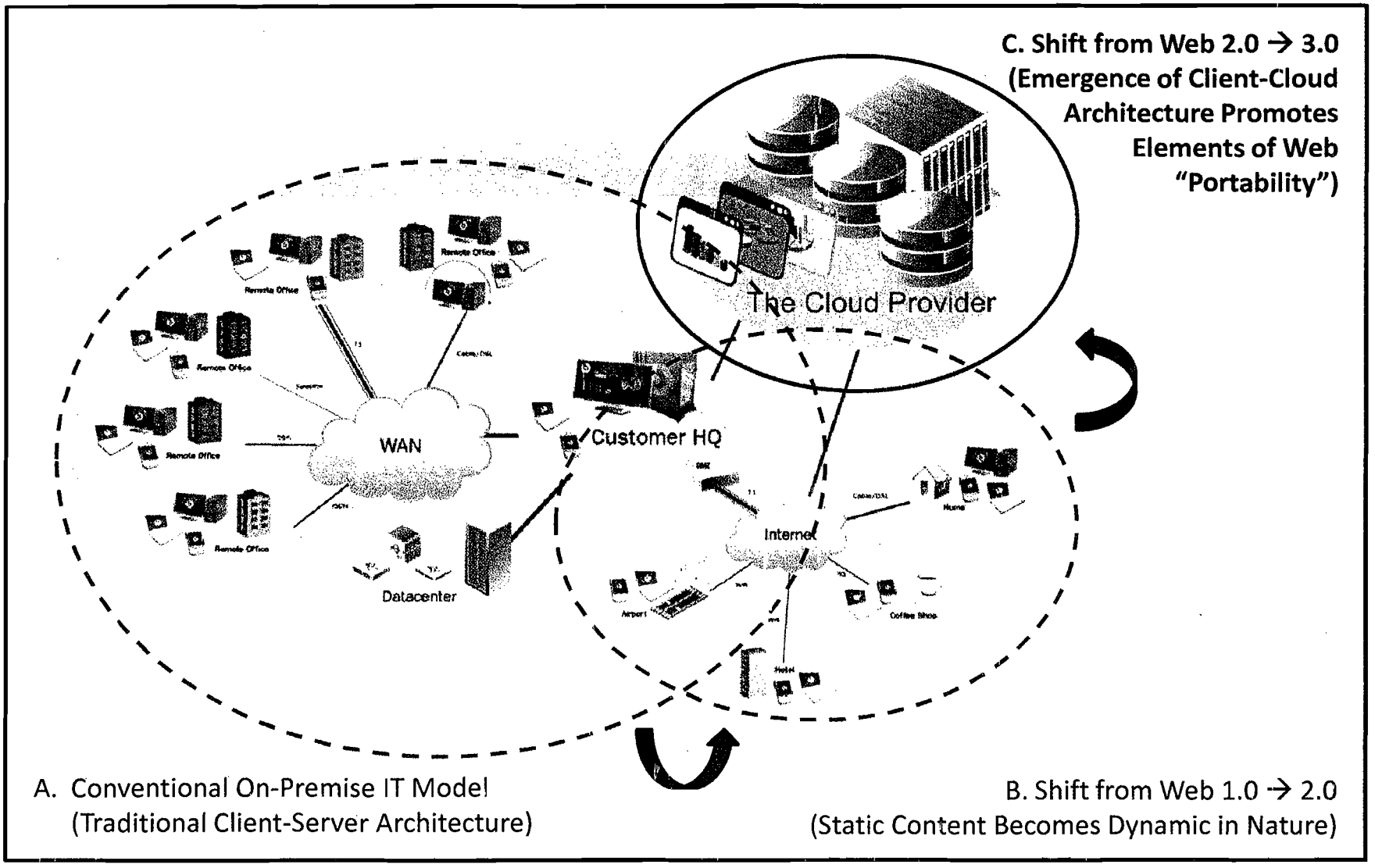
A Brief Introduction to Cloud Computing



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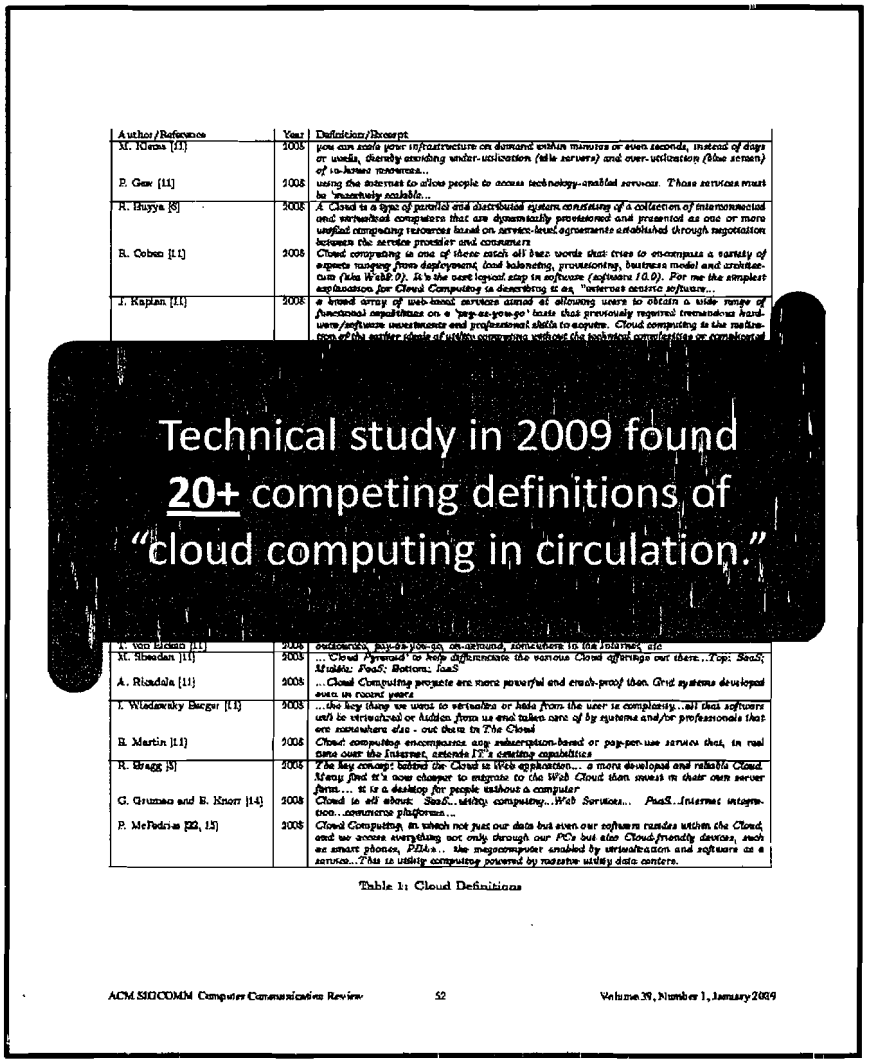
The Definitional Problem with the Cloud

A Good Example of a Solid *Technical* Definition

"Clouds are large pools of easily usable and accessible virtualized resources. These resources can be dynamically reconfigured to adjust to a variable load, allowing also for an optimum resource utilization. This pool of resources is typically exploited by a pay-per-use model in which guarantees are offered by the Infrastructure Provider by means of a customized Service Level Agreement."



Author/Reference	Year	Definition/Excerpt
M. Klems [11]	2008	you can scale your infrastructure on demand within minutes or even seconds, instead of days or weeks, thereby avoiding under-utilization (idle servers) and over-utilization (blue screen) of in-house resources...
P. Gaw [11]	2008	using the internet to allow people to access technology-enabled services. Those services must be 'massively scalable'...
R. Buyya [8]	2008	A Cloud is a type of parallel and distributed system consisting of a collection of interconnected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resources based on service-level agreements established through negotiation between the service provider and consumers
R. Cohen [11]	2008	Cloud computing is one of those catch all buzz words that tries to encompass a variety of aspects ranging from deployment, load balancing, provisioning, business model and architecture (like Web 0). It's the next logical step in software (software 10.0). For me the simplest explanation for Cloud Computing is describing it as "internet centric software"...
J. Kaplan [11]	2008	a broad array of web-based services aimed at allowing users to obtain a wide range of functional capabilities on a 'pay-as-you-go' basis that previously required tremendous hardware/software investments and professional skills to acquire. Cloud computing is the realization of the earlier vision of utility computing without the technical complexities or commitment of
A. Van Eckhoff [11]	2008	outsourced, pay-as-you-go, on-demand, somewhere in the Internet, etc
M. Sheedan [11]	2008	...'Cloud Pyramid' to help differentiate the various Cloud offerings out there...Top: SaaS; Middle: PaaS; Bottom: IaaS
A. Rizzolo [11]	2008	...Cloud Computing projects are more powerful and crash-proof than Grid systems developed even in recent years
I. Wladawsky Berger [11]	2008	...the key thing we want to virtualize or hide from the user is complexity...all that software will be virtualized or hidden from us end users and taken care of by systems and/or professionals that are somewhere else - out there in The Cloud
B. Martin [11]	2008	Cloud computing encompasses any subscription-based or pay-per-use service that, in real time over the Internet, extends IT's existing capabilities
R. Gragg [8]	2008	The key concept behind the Cloud is Web application... a more developed and reliable Cloud. Many find it's now cheaper to migrate to the Web Cloud than invest in their own server farms.... it is a desktop for people without a computer
G. Gruman and E. Knorr [14]	2008	Cloud is all about: SaaS... utility computing...Web Services... PaaS...Internet integration...commerce platforms...
P. McFedries [22, 15]	2008	Cloud Computing, in which not just our data but even our software resides within the Cloud, and we access everything not only through our PCs but also Cloud-friendly devices, such as smart phones, PDAs... the megacomputer enabled by virtualization and software as a service...This is utility computing powered by massive utility data centers.

Table 1: Cloud Definitions

ACM SIGCOMM Computer Communications Review 52 Volume 39, Number 1, January 2009

Technical study in 2009 found **20+** competing definitions of "cloud computing in circulation."

Source: Vaquero, Roderno-Merino, Caceres, & Lindner, "A Break in the Clouds: Towards a Cloud Definition," in *ACM SIGCOMM Computer Communications Review*, 2009.

The layman's typical response:

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A Better Starting Point for the Rest of Us

A Good Example of a Solid *Layman's* Definition

"Cloud Computing is associated with a new paradigm for the provision of computing infrastructure. This paradigm shifts the location of this infrastructure to the network in order to reduce the costs associated with the local management of hardware and software and resources."

For Consensus Technical Definition, Please Refer to Additional References: Peter Mell & Tim Grance, *Definition of Cloud Computing,* National Institute of Standards and Technology, Computer Security Division, Version 15, October 2009.

Why are customers interested in moving to the cloud?

- **COST REDUCTION**: Limit upfront investment in servers or software licensing (CAPEX → OPEX)
- **ON-DEMAND SERVICE**: near-immediate provisioning of and access to additional computing resources
- **FLEXIBILTY / SCALABILITY**: Adjust data center capacity (e.g., in response to unexpected demand or peak loads)
- **LESSEN BURDEN ON DEDICATED IT PERSONNEL**: Reassign staff tasked with cumbersome duties like configuration and patch management

Different Cloud Deployments Introduce a Fundamental Trade-Off

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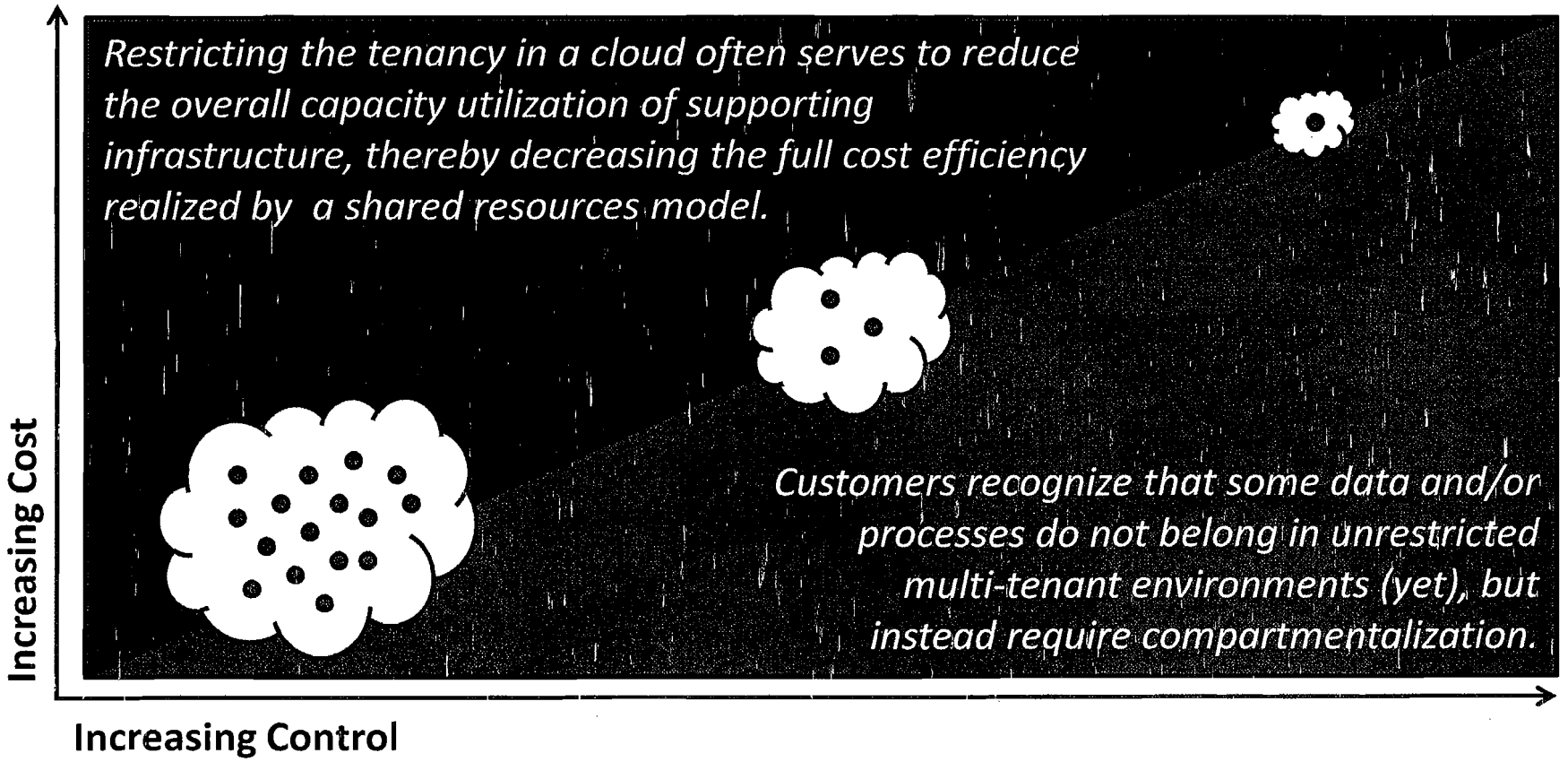
Public	Community	Private
Infrastructure is owned by an organization selling cloud services to the general public or a large industry group.	Infrastructure is shared by several organizations and supports a specific community that has shared concerns.	Infrastructure is owned or leased by a single organization and is operated solely for that organization.



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Spotlight on Cloud Security

Industry Surveys

- ***December 2009*** – IDC updates second "Cloud Services Survey" to reveal top challenges to adoption (security, availability, and performance) remain unchanged
- ***October 2009*** – Penn, Schoen, & Berland (PSB) released the results of their "Online Exposure, Offline Uncertainty" Survey, indicating 75% of senior business leaders cite safety, security, and privacy as the top potential risks posed by cloud computing

Subject Matter Experts

- ***November 2009*** – The European Network & Information Security Agency (ENISA) releases one of the first "Cloud Computing Risk Assessments," identifying eight risks deemed both high-impact and high-probability of occurring
- ***March 2010*** – The Cloud Security Alliance (CSA) clarifies the "Top Threats to Cloud Computing" in a profile of seven new and distinct risks that impact this new technical paradigm

"The ability of cloud computing services to collect and centrally store increasing amounts of consumer data, combined with the ease with which such centrally stored data may be shared with others, creates a risk that larger amounts of data may be used by entities in ways not originally intended or understood by consumers."

– **David Vladeck**
Director of Bureau of Consumer Protection, FTC

"We in state government must be extremely vigilant about the security of Indiana's electronic records – particularly the personal identifying information of Hoosiers that could subject them to identity theft if it fell into the wrong hands."

– **Greg Zoeller**
Indiana Attorney General

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How Do We Gauge Risk in a (Public) Cloud?

Perceived Security Advantages	Perceived Security Disadvantages
A. Excess capacity can be repurposed for defensive purposes	A. Centralization of data from multiple clients increases attractiveness of target
B. Quick access to specialized expertise of an outsourced agent	B. Reliance on external agents can degrade sense of accountability and/or transparency
C. Timely patch and system change management	C. Acknowledged single points of failure

At its current stage of maturity, the cloud introduces significant differences in terms of:

A. **SCALE:** sheer scale of the underlying systems

B. **EXTERNAL SERVICE PROVIDER:** ambiguity around workable checks and balances to ensure data custodian accountability and transparency

C. **HOMOGENEITY OF SYSTEMS:** unknown potential for loss of data control and/or catastrophic single points of failure resulting from increased homogeneity of systems

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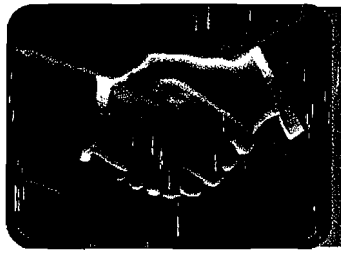
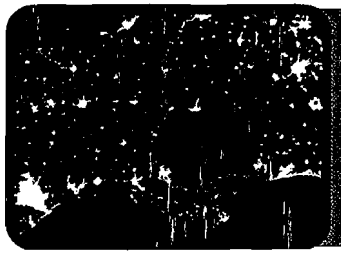
Associated Security Themes and Questions

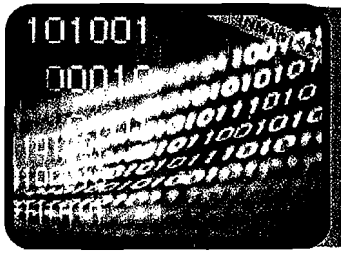
1. Audit-ability (of security controls)



2. Trust (in authentication of users)



3. Reliability (of continuous service)



4. Integrity (of software development)

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Conclusion: "Good" vs. "Bad" Cloud Traits

Dirty Cloud		Clean Cloud
Limited SAS-70 audits of a handful of critical controls	**1. Audit-ability**	*Robust, internationally recognized standards*
Perpetuation of weak ID systems; static "one-size-fits-all" technical architecture	**2. Trust**	*Support for strong authentication mechanisms; options for dedicated service*
Reliance on "click-thru" SLA; service outage = work outage	**3. Reliability**	*Financially-backed penalties; dual reliance on local assets*
Buggy applications operating in multi-tenant environments	**4. Integrity**	*Active employ of trusted software assurance methodologies*

Examples of Cloud Activity at the State & Local Level

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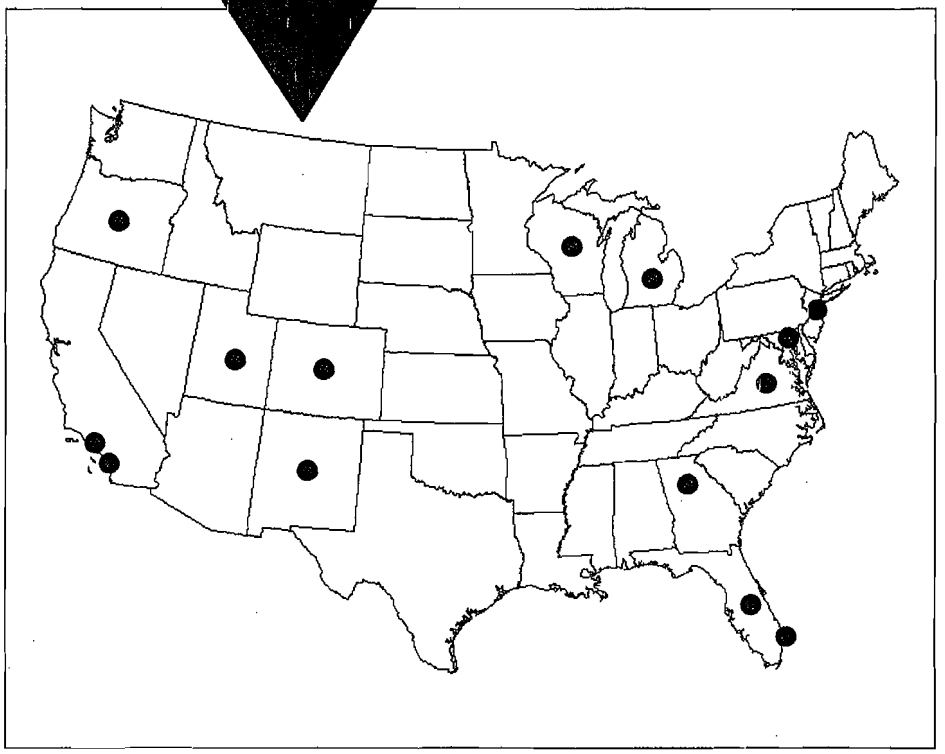
State	City	Solution	Vendor
CA	City of Carlsbad	Communication / Collaboration	Microsoft
CA	City of Los Angeles	E-Mail / Productivity	Google
FL	City of Orlando	E-mail / Productivity	Google
GA	City of Canton	E-mail / Productivity	Google
MD	Prince George's County School District	E-mail / Productivity	Google
NM	Office of the Attorney General	E-mail / Productivity	Google
NJ	Transit Authority	CRM	Salesforce
OR	Klamath County	E-mail / Productivity	Microsoft
WI	Department of Natural Resources	Communication / Collaboration	Microsoft
FL	City of Miami	Platform (311 Service)	Microsoft
VA	Information Technologies Agency	Platform (App Development)	Amazon
CO	Office of Information Technology	Hybrid (Shared Services)	Google
UT	Department of Technology Services	Hybrid (Shared Services)	Salesforce; Google
MI	Department of Technology	Infrastructure Pilot	Unknown

Recently, the Federal CIO Council profiled 14 IT projects in 12 states – each providing a model for what to do right (and what to do wrong) as state and local governments approach the cloud…



Source: Vivek Kundra & Federal CIO Council, "State of Public Sector Cloud Computing," May 2010.

Expanded Definition

SUPPLEMENTAL MATERIALS

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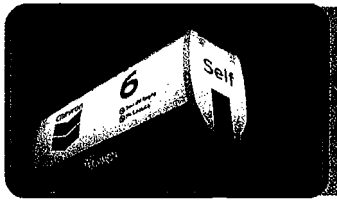
The Cloud Shares 5 Basic Characteristics

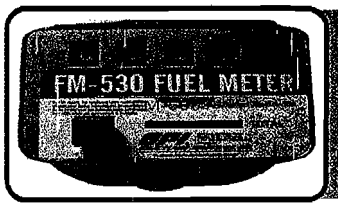


1. On-Demand Self-Service

2. Broad Network Access

3. Resource Pooling

4. Rapid Elasticity



5. Measured Service

Source: Peter Mell & Tim Grance, *Definition of Cloud Computing,* National Institute of Standards and Technology, Computer Security Division, Version 15, October 2009.

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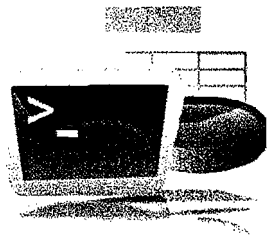
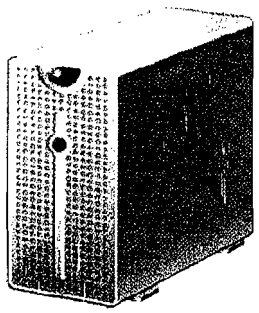
The Cloud Encompasses 3 Distinct Services

Service Model	Description	Prime Examples
 **Software (SaaS)**	Customers rent software (e.g., email, collaboration, and productivity suites) hosted by the vendor and run over the web	• Microsoft "Live Services / BPOS" • Google "Apps" • Salesforce.com "App-Exchange" • NetSuite "OneWorld"
Platform (PaaS)	Customers rent infrastructure and programming tools hosted by the vendor to create and deploy their own applications in the cloud	• Microsoft "Windows Azure" • Google "App Engine" • Salesforce.com "Force.com" • Boomi "AtomSphere"
 **Infrastructure (IaaS)**	Customers rent raw processing, storage, networking, and other fundamental computing resources for all purposes	• Amazon Web Services "EC2 / VPC" • IBM "Cloudburst" • Terremark "Enterprise Cloud" • AT&T "Synaptic"

Building Confidence in the Cloud

Indiana Interim Regulatory Flexibility Committee

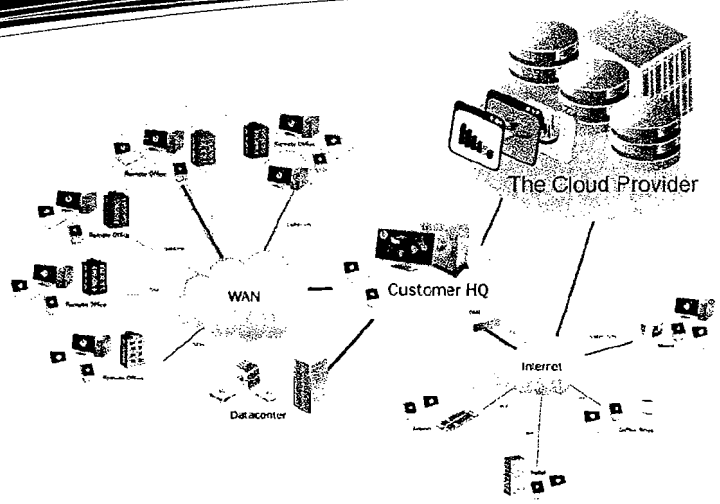
September 14, 2010

Technical Definition P.1

Economic Benefits P.2

Security & Privacy Risks P.3

Recommendations P.4



NIST Definition

In October 2009, Peter Mell and Tim Grance from the National Institute of Standards and Technology (NIST) published one of the most comprehensive and timely definitions of "cloud computing." This working definition has been widely adopted by many technical groups focused on the cloud.

According to NIST, cloud computing is "*a model for enabling convenient, on-demand network access to a shared pool of resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.*"

Most importantly, a true cloud model reflects five essential characteristics:

1) On-demand self service
2) Broad network access
3) Resource pooling
4) Rapid elasticity
5) Measured service

What is Cloud Computing?

In January 2009, author Nicolas Carr helped highlight an ongoing shift within the technology industry in his seminal book *The Big Switch*. Carr argued that we were entering a new phase of the information age. Specifically, by hooking into the Internet's global computing grid, massive information-processing plants have begun pumping data and software code into our homes and businesses – effectively turning computing into a shared utility. Phrased in this way, a maturing phenomenon – commonly known as "cloud computing" – began to permeate the public imagination.

Almost overnight, the phrase became an umbrella term for several related concepts (e.g., grid computing, cluster computing, virtualization, web services, service-oriented architecture, etc.). In fact, in some early analytical work on the subject, McKinsey & Company identified 22 competing definitions of cloud computing. Fortunately, over the course of the next year, several industry groups and standards organizations intervened and provided a consensus definition of "the cloud" (see sidebar) designed to alleviate some of the continuing confusion over competing terminology.

Unfortunately, this consensus definition remains somewhat technical. **In the simplest terms**, cloud computing represents a transformational model for providing and accessing information technology. Instead of buying more software, more processing power, and more networking equipment that is all managed on-premises, cloud computing lets you rent these fundamental computing resources from a third-party service provider (e.g., Amazon, Google, Microsoft, Salesforce.com, etc.). This model proves highly flexible, scalable, cost-efficient, and takes full advantage of our newfound interconnectedness.

Currently, cloud computing encompasses three distinct service (or "delivery") models:

1) ***Software-as-a-Service***: Customers rent basic email or productivity apps hosted by the vendor.
2) ***Platform-as-a-Service***: Developers access a set of programming tools that help them build and distribute applications designed to run in the cloud.
3) ***Infrastructure-as-a-Service***: IT managers rent and configure raw processing, storage, and networking components maintained by an outside cloud vendor.

EXHIBIT E

RFSC 9/14/2010

Recent Research from Brookings

Historically, there has been a wide range of cost savings estimates provided by various analytical sources, which have each examined the impact of shifting an isolated organization's computing resources from on-premises to the cloud.

Most recently, the President and Director of Governance Studies at the Brookings Institute set-out to examine a broader set of seven recent case studies involving public sector customers who had shifted select operations to the cloud.

In his own words:

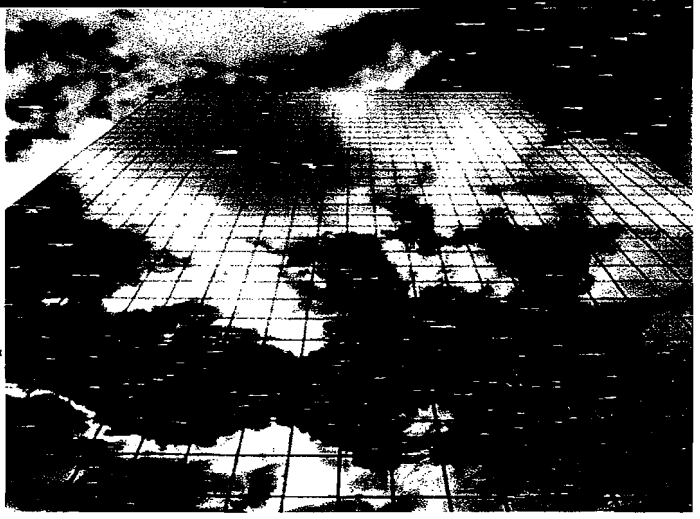
"To summarize, based on these case studies, there is significant cost savings associated with various cloud computing migrations. Depending on the scope and timing of the migration, reliance on public versus private clouds, the need for privacy and security, the number of file servers before and after migration, the extent of labor savings, and file server storage utilization rates, ***savings generally average between 25 and 50 percent.****"*

Darrel M. West

Saving Money through Cloud Computing, Page 9

Published April 2010

What are the **economic benefits** driving adoption of cloud computing?

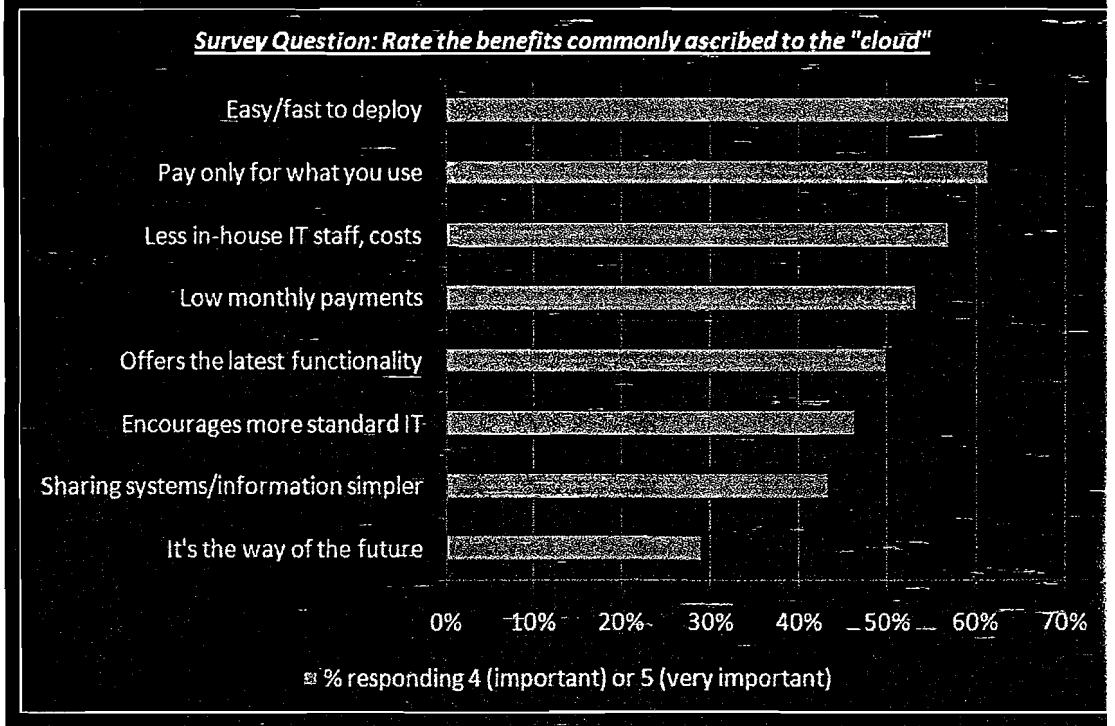


Several technology pundits, including Amazon's CTO Werner Vogels, have argued that cloud computing can be summarized in one word – "agility." In the legacy IT model, drawn-out procurement processes and provisioning cycles could delay an IT deployment by weeks, if not months. In the cloud, users have the ability to obtain resources rapidly – sometimes within minutes of a request, thus saving considerable time and energy.

Furthermore, in addition to this primary value proposition, the cloud also represents a fundamental advantage in terms of cost-savings. In most cloud deployments, infrastructure is shared between a distinct set of unrelated customers. Before the advent of the cloud, each of these customers would be required to invest in their own independent infrastructure – often including costly excess capacity.

In the cloud, shared resources car be reconfigured on-demand, thereby optimizing collective capacity Individual customers effectively benefit from the massive economies of scale achieved by the wide community. During the onset of the current economic crisis, customers found this aspect of the cloud appealing because it allowed them to convert fixed capital expenditures into flexible operational expenditures

IDC Survey of IT Executives on Cloud Benefits

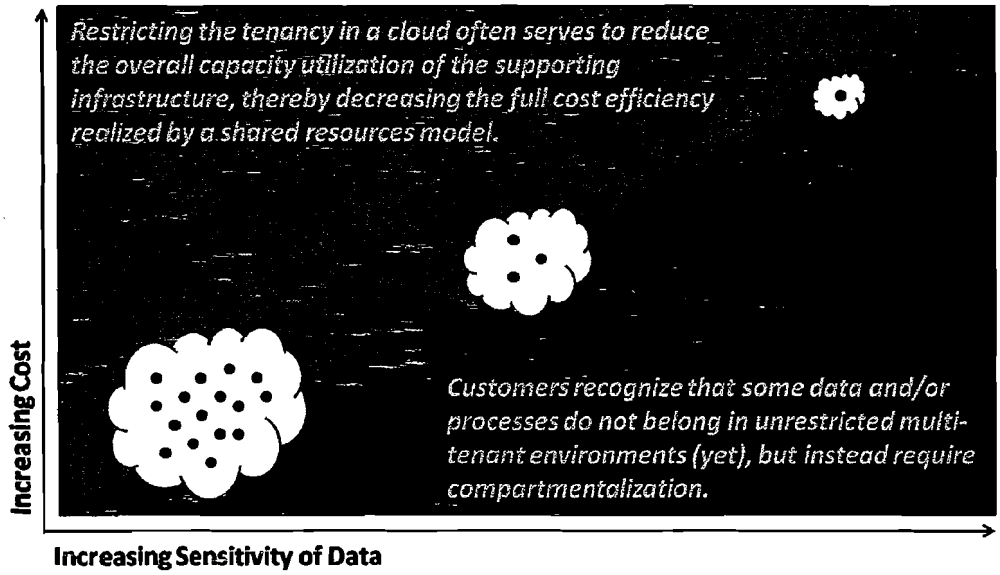


What are the **security & privacy risks** associated with cloud computing?

The cost-savings described in the previous section are primarily a function of economies of scale that can best be achieved in clouds subject to unrestricted multi-tenancy – also known as "public" clouds. While "public" clouds may represent the most efficient form of common resource pooling from an economic perspective, they also embody several essential traits that could prove problematic from a security and privacy perspective.

Public clouds are built on a massive scale – representing the aggregation of data from several thousand individual customers. This makes them an attractive target for the next wave of cybercrime. Consequently, service providers who maintain public clouds do not openly document many of the security controls built into the supporting infrastructure. While this helps prevent malicious actors from taking advantage of such information, it can also present a compliance obstacle for prospective cloud customers. Lastly, to achieve scalability and flexibility, clouds are built using homogenous system components. This provokes fears that weaknesses found in one component affecting one customer might potentially represent a system-wide vulnerability. Due to these perceived risks, many customers feel they face an underlying trade-off depending on what type of cloud environment they choose to employ.

Public →	→ Community →	→ Private
Infrastructure is owned by an organization selling cloud services to the general public or a large industry group.	Infrastructure is shared by several organizations and supports a specific community that has shared concerns.	Infrastructure is owned or leased by a single organization and is operated solely for that organization.



Ongoing Research from Cloud Security Alliance

Part of the responsibility of the wider security community is to develop technical guidance, best practices, and new standards that adequately protect customers against risks that are viewed as new and distinct to the cloud.

Over the last few years, several non-profit groups have organized or adapted their primary research to focus on the cloud. Among these, the Cloud Security Alliance (CSA) is recognized as a significant contributor to relevant research in this area.

In March, CSA published an initial guide to the "Top Threats of Cloud Computing." They identified seven distinct threats, including: (1) abuse and nefarious use of cloud computing; (2) insecure application programming interfaces (API); (3) malicious insiders; (4) shared technology issues; (5) data loss or leakage; (6) account or service hijacking; and (7) unknown risk profile.

This study – and others like it – helps provide a guide for prospective customers looking to establish what steps select cloud vendors are taking to guard against these specific risks (see recommendations).

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GROUP

About Civitas

The Civitas Group provides strategy advisory services to clients operating within the homeland and national security markets. This work extends to engagements with government agencies, commercial firms, and investment partners.

A dominant feature of the collective intellectual property developed by Civitas is centered on the topic of cyber security. In that capacity, senior representatives from Civitas have participated in security and privacy discussions at major industry events in both the United States and Europe.

These include: GFIRST in Atlanta, BlackHat and CES in Las Vegas, and InfoProtect in Brussels. Civitas has also participated in smaller workshops in Washington DC hosted by the law firms of both Hunton & Williams LLP and Covington & Burling LLP.

Recommended Elements of Proposed Cloud Study (SEA 384)

1) **AUDIT-ABILITY**: ***How can you [the vendor] demonstrate that the information security policy (ISP) you have in place is sufficient for my organization's needs? In other words, aside from individual provisions negotiated into the contract, how do I know my data is safe?***

As a necessary first step, vendors should submit to an independent, third-party audit against a recognized industry-standard for information security, such as ISO-27001/02. The results of this audit can be made available for review in a confidential setting to assure conformity with the policies and procedures set by the customer.

2) **TRUST**: ***How do I know precisely where and how my data is stored, accessed, processed, and backed-up at all times? How do I know that the systems I rely on are never shared or accessed by an unauthorized user?***

The cloud is designed for agility and redundancy, which means that basic elements of the supporting infrastructure are both shared and highly automated. However, if needed, vendors should be able to provide customers with the option of employing dedicated architecture, which ensures that the portion of the cloud where customer data resides is fixed and/or reserved for a unique entity. Furthermore, regardless of whether the customer ultimately chooses a shared service or a dedicated service, vendors should be able to demonstrate support for emerging models of identity management and authentication systems that safeguard against the risk of improper user and/or administrative access (e.g., claimed-based identity, one-time password tokens, secure federation, etc.).

3) **RELIABILITY**: ***I have a minimum set of criteria for service availability and reliability (i.e., "uptime") – how do I know you can consistently match that performance specification over time?***

Vendors increasingly guarantee 99.99% uptime, which equates to approximately 10 minutes of unplanned downtime per month. If a vendor fails to achieve this set of criteria in a given month, it should waive part of its customer service fee – not simply extend the term of service. This provides a clear incentive for vendors to do everything possible to achieve and maintain a consistent track record of reliable, uninterrupted cloud service. Furthermore, uptime should be calculated in a simple, cumulative fashion – vendors should not discount or disregard brief outages (<5 min).

4) **INTEGRITY**: ***How do I know the cloud applications and services I rely on are safe, secure, and trusted?***

Development of applications in cloud environments tends to be accelerated and the update schedule tends to be more irregular than seen with legacy packaged projects. In order to avoid the release of buggy code into shared, multitenant environments, vendors should be able to demonstrate to customers how they have adapted trusted software assurance methodologies for rapid application development (i.e., "agile").

Identity Theft Prevention

Tips to Protect Yourself from America's Fastest Growing Crime

1. Consider placing a security freeze to block thieves from using your credit. There is no charge to place or lift a freeze for Indiana residents.

2. Don't share your personal information over the phone, through mail or online unless you know who you are dealing with.

3. Beware of missing bills or unexpected mail such as credit cards or account statements.

4. Promptly remove mail once it has been delivered.

5. Don't carry your Social Security Card in your wallet or write your SSN on a check.

6. Shop with cash when visiting fairs, festivals, luncheons, or sporting events.

7. Mark out all but the last four digits of any receipts containing your credit card numbers.

8. Prescription bottles contain vital information and should be disposed of without labels.

9. Review financial documents and billing statements regularly and shred before discarding them.

10. As soon as you become aware that your personal information has been stolen or used by someone else, report it to the Attorney General's ID Theft Unit and your local police department.

RFSC 9/14/2010
EXHIBIT F

Greg
Zoeller
Indiana Attorney General

Identity Theft Unit

[illegible] protecting identities through an online tool kit. Additionally, the Office offers an expert speaker to deliver ID theft prevention presentations free of charge for non-profit and civic organizations in the State of Indiana.

Understanding Your Rights

A 'security freeze' is a consumer right provided by Indiana law and is one of the most effective ways to protect yourself from ID theft. Placing a security freeze, also known as a credit freeze, on your credit reports can block an identity thief from opening a new account or obtaining credit in your name. It also keeps new creditors from accessing your credit report without your authorization.

How to Place a Security Freeze

Any Indiana resident can place a security freeze on their credit reports free of charge. There is no fee to place, temporarily lift, remove or request a new password or PIN. To place a freeze, either use each credit agency's online process or send a letter by certified mail to each of the three credit agencies.

Office of the Indiana Attorney General
Consumer Protection Division

302 West Washington Street, 5th Floor
Indianapolis, IN 46204
1.800.382.5516
www.IndianaConsumer.com

Overview of Agency Compliance with the Release/Protection of Individual Social Security Numbers

August 31, 2006
Indiana Government Center South
Auditorium

RECEIVED
JAN 22 2009
ATTORNEY GENERAL OF INDIANA
CONSUMER PROTECTION

Presented by: The Office of the Attorney General

RFSC 9/14/2010
EXHIBIT G

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Agenda 3

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House and Senate Roll Call for Senate Enrolled Act 503 6

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IC 4-1-11: Notice of Security Breach 10

10 IAC 5: Release of Social Security Numbers by State Agencies 12

State Contracts 14

Notes:

AGENDA

REGISTRATION AND SIGN-IN — **12:30 P.M.**

JASON THOMPSON, DEPUTY ATTORNEY GENERAL — **1:00 P.M.**

- Overview and Purpose of Legislation Regarding the Release/Protection of Individual Social Security Numbers
- Statutory Authority for Rules
- Purpose of 10 IAC 5, Release of Social Security Numbers by State Agencies

BRENT EMBREY, CHIEF COUNSEL — **1:25 P.M.**

- Enforcement of:
  - Release of Individual Social Security Numbers
  - Notification of Security Breaches

DEANNA BRUNNER, DEPUTY ATTORNEY GENERAL — **1:40 P.M.**

- Contracting Protocol

MARTIN DURAND, INFORMATION TECHNOLOGY DIRECTOR — **1:50 P.M.**

- Security Protocol
  - Steps the Office of the Attorney General Has Taken
  - Steps the State Has Taken Through Other Information Technology Sources

ALL PANEL — **2:05 P.M.**

- Question and Answer Session

DISMISSAL — **2:30 P.M.**

LETTER OF WELCOME AND INTRODUCTION

Thank you for your interest in the topic of Identity Theft and the implementation of HB 1101. I regret that I am not there to join you in person, but appreciate the opportunity to share some thoughts with you.

Issues surrounding identity theft and security breach notification have seen an increasing amount of interest at the federal and state level. It represents a growing recognition of the power of technology to manipulate data in positive, and unfortunately, negative ways that the framers of our Constitution never contemplated and that our government processes and legal remedies have been slow to address.

From commercial breaches like Choicepoint to the potential loss of government data as recently witnessed by the theft of a Veterans Administration computer containing personal data on hundreds of thousands of citizens, people are becoming keenly aware that the power of technology has the ability to manipulate and disseminate potentially damaging personal information with the click of a key.

The issue was first brought to my attention as what appeared to be a relatively small and isolated problem. Veterans were often encouraged to submit their DD214's, or separation from military service documents, to their local county recorders. The belief was that doing so created a safe and durable document repository if the veteran lost the paperwork and needed it to access government benefits later in life. The document contains personal identifying information, including social security numbers.

Although it created a publicly accessible document, the risk was minimized, as few people would make the effort to search through public documents in a local courthouse for such data. Until now...

Enter the data broker. Using computer technology to vacuum up large amounts of data, assembling it, repackaging it and selling it to a variety of users worldwide, public data became the Holy Grail of consumer research. While the vast majority of the data was used for legal purposes, a growing problem has emerged of the data being used for fraudulent purposes.

In examining ways to secure the data, we ran into a number of problems with existing law and business practices. The media staunchly defended the need to keep documents as open as possible. Business interests defended the need to do consumer research for a vast array of purposes. A need for accountability in the handling of data was revealed, and a lack of any meaningful punishment for those who recklessly endangered citizens' private information was uncovered.

The goal of this bill, and prior legislation was to create a reasonable standard of care by government offices in the handling of citizens' data, a limitation of the purposes for which that data could be used, meaningful penalties for those who mishandle data through negligence or willful misconduct, and a mechanism for informing consumers of the need to safeguard their accounts when such data has been released. We have also strengthened the tools which prosecutors may use in pursuing ID Theft perpetrators, and have funded a technical solution to removing Social Security numbers from publicly available documents. As technology evolves, our laws must be prepared to answer the new challenges that are created. HB1101 represents a strong first step towards protecting Hoosiers, but it is not the last step. As experienced professionals in public service, your insights and opinions are important to me, and I welcome your feedback on how we can best protect our constituents in the face of this growing threat. Thank you.

Senator Brandt Hershman

LEGISLATIVE ACTION LIST FOR SENATE ENROLLED ACT 503

Action List: Senate Bill 0503

ARCHIVE (2005)

Authors: Hershman, Craycraft, Jr.

Date	Chamber	Action
01/18/2005	S	Authored by Senator Hershman
01/18/2005	S	First reading: referred to Committee on Homeland Security, Utilities, and Public Policy
02/24/2005	S	Committee report: amend do pass, adopted
02/28/2005	S	Senator Craycraft added as coauthor
02/28/2005	S	Second reading: amended, ordered engrossed
02/28/2005	S	Amendment 1 (Hershman), prevailed; Voice Vote
03/01/2005	S	Third reading: passed; Roll Call 259: Yeas 48 and Nays 0
03/01/2005	S	Referred to the House
03/01/2005	S	House sponsor: Rep. Koch
03/01/2005	S	Cosponsor: Rep. Heim
03/10/2005	H	First reading: referred to Committee on Public Safety and Homeland Security
03/21/2005	H	Representatives Woodruff and J. Smith added as cosponsors
03/29/2005	H	Committee report: amend do pass, adopted
04/04/2005	H	Second reading: amended, ordered engrossed
04/04/2005	H	Amendment 1 (Koch), prevailed; Voice Vote
04/06/2005	H	Third reading: passed; Roll Call 449: Yeas 81, Nays 12
04/06/2005	H	Returned to the Senate with amendments
04/13/2005	S	Senate concurred in House amendments; Roll Call 430: Yeas 47, Nays 0
04/19/2005	H	Signed by the Speaker
04/19/2005	S	Signed by the President Pro Tempore
04/19/2005	S	Signed by the President of the Senate
04/26/2005	S	Signed by the Governor
05/23/2005	H	Public Law 91
05/25/2005	H	Section 4 effective 04/26/2005
05/25/2005	H	Sections 1 through 3 effective 07/01/2005

See http://www.in.gov/apps/lsa/session/billwatch/billinfo?year=2005&request=getActions&doctype=SB&docno=0503

HOUSE AND SENATE ROLL CALL FOR SENATE ENROLLED ACT 503

Indiana State Senate
Roll Call Number: 259 Date: 03/01/2005
Time: 7:03:47 PM
SB 503
Hershman
3rd Reading
Release of Social Security numbers.
Presiding: President
YEAS - 48 NAYS - 0 EXCUSED - 2
PASSED
YEAS - 48

Alting	Garton	Long	Server
Antich-Carr	Harrison	Lubbers	Sipes
Bowser	Heinold	Lutz	Skinner
Bray	Hershman	Meeks, R.	Smith
Breaux	Howard	Merritt	Steele
Broden	Hume	Miller	Waltz
Clark	Jackman	Mishler	Waterman
Craycraft	Kruse	Mrvan	Weatherwax
Dillon	Lanane	Nugent	Wyss
Drozda	Landske	Paul	Young, M
Ford	Lawson	Riegsecker	Young, R.
Gard	Lewis	Rogers	Zakas

NAYS - 0
EXCUSED - 2
Kenley Simpson

Indiana House of Representatives
114th General Assembly
First Regular Session
MEETING DAY 40 04-06-05
Roll Call 449: PASSED
SB 503 Koch
Release of Social Security numbers.
Yeas: 81 Nays: 12
Excused: 4
3rd Reading N/Voting: 3
VOTING YEA: 81

Aguilera	Davis	Lehe	Ruppel
Austin	Dobis	Leonard	Saunders
Avery	Dodge	Lutz	Smith, J
Ayres	Duncan	Mays	Stevenson
Becker	Espich	McClain	Stilwell
Behning	Foley	Messer	Thomas
Bischoff	Friend	Micon	Thompson
Borders	Frizzell	Murphy	Tincher
Borror	GiaQuinta	Neese	Torr
Bottorff	Goodin	Noe	Turner
Bright	Grubb	Orentlicher	Ulmer
Brown,T	Gutwein	Oxley	VanHaaften
Buck	Harris, T	Pelath	Walorski
Budak	Heim	Pflum	Welch
Buell	Hinkle	Pierce	Whetstone
Burton	Hoy	Pond	Wolkins
Cheney	Kersey	Porter	Woodruff
Cherry	Klinker	Reske	Yount
Cochran	Koch	Richardson	
Crawford	Kuzman	Ripley	
Crooks	Lawson	Robertson	

VOTING NAY: 12

Alderman	Dickinson	Harris, E	Smith,V
Brown,C	Dvorak	Kromkowski	Stutzman
Day	Fry	Moses	Summers

EXCUSED FROM VOTING: 4
Adams Bauer Denbo Hoffman
NOT VOTING: 3
Bardon Mahern Mr. Speaker

See: http://www.in.gov/legislative/bills/2005/PDF/Hrollcal/0449.PDF.pdf
http://www.in.gov/legislative/bills/2005/PDF/Srollcal/0259.PDF.pdf

Concurrence Roll Call for Senate Enrolled Act 503

INDIANA STATE SENATE
Roll Call Number: 430 Date: 04/13/2005
Time: 2:10:23 PM
SB 503

Hershman
Concurrences Eligible for Action
Release of Social Security numbers.

Presiding: Landske

YEAS - 47 NAYS - 0 NOT VOTING - 1 EXCUSED - 2
PREVAILED
YEAS - 47

Alting	Heinold	Lubbers	Simpson
Antich-Carr	Hershman	Lutz	Sipes
Bowser	Howard	Meeks, R.	Smith
Bray	Hume	Merritt	Steele
Breaux	Jackman	Miller	Waltz
Craycraft	Kenley	Mishler	Waterman
Dillon	Kruse	Mrvan	Weatherwax
Drozda	Lanane	Nugent	Wyss
Ford	Landske	Paul	Young, M
Gard	Lawson	Riegsecker	Young, R.
Garton	Lewis	Rogers	Zakas
Harrison	Long	Server	

NAYS - 0
NOT VOTING - 1
Clark
EXCUSED - 2
Broden Skinner

See: http://www.in.gov/legislative/bills/2005/PDF/Srollcal/0430.pdf.pdf

IC 4-1-11: Notice of Security Breach

IC 4-1-11-1, Applicability
This chapter applies after June 30, 2006.

IC 4-1-11-2, "Breach of the security of the system"

(a) As used in this chapter, "breach of the security of the system" means unauthorized acquisition of computerized data that compromises the security, confidentiality, or integrity of personal information maintained by a state or local agency.

(b) The term does not include the following:
  (1) Good faith acquisition of personal information by an agency or employee of the agency for purposes of the agency, if the personal information is not used or subject to further unauthorized disclosure.
  (2) Unauthorized acquisition of a portable electronic device on which personal information is stored if access to the device is protected by a password that has not been disclosed.

IC 4-1-11-3, "Personal information"

(a) As used in this chapter, "personal information" means:
  (1) an individual's:
    (A) first name and last name; or
    (B) first initial and last name; and
  (2) at least one (1) of the following data elements:
    (A) Social Security number.
    (B) Driver's license number or identification card number.
    (C) Account number, credit card number, debit card number, security code, access code, or password of an individual's financial account.

(b) The term does not include the following:
  (1) The last four (4) digits of an individual's Social Security number.
  (2) Publicly available information that is lawfully made available to the public from records of a federal agency or local agency.

IC 4-1-11-4, "State agency"
As used in this section "state agency" has the meaning set forth in IC 4-1-10-2.

IC 4-1-11-5, Disclosures of security breach

(a) Any state agency that owns or licenses computerized data that includes personal information shall disclose a breach of the security of the system following discovery or notification of the breach to any state resident whose unencrypted personal information was or is reasonably believed to have been acquired by an unauthorized person.

(b) The disclosure of a breach of the security of the system shall be made:
  (1) without unreasonable delay; and
  (2) consistent with:
    (A) the legitimate needs of law enforcement, as described in section 7 of this chapter; and
    (B) any measures necessary to:
      (i) determine the scope of the breach; and
      (ii) restore the reasonable integrity of the data system.

IC 4-1-11-6, Notification to third party owner of security breach

(a) This section applies to a state agency that maintains computerized data that includes personal information that the state agency does not own.

(b) If personal information was or is reasonably believed to have been acquired by an unauthorized person, the state agency shall notify the owner or licensee of the information of a breach of the security of the system immediately following discovery. The agency shall provide the notice to state residents as required under section 5 of this chapter.

IC 4-1-11-7, Time requirement for notification

The notification required by this chapter:

(1) may be delayed if a law enforcement agency determines that the notification will impede a criminal investigation; and

(2) shall be made after the law enforcement agency determines that it will not compromise the investigation.

IC 4-1-11-8, Form of notification

Except as provided in section 9 of this chapter, a state agency may provide the notice required under this chapter:

(1) in writing; or

(2) by electronic mail, if the individual has provided the state agency with the individual's electronic mail address.

IC 4-1-11-9, Alternate form of notification

(a) This section applies if a state agency demonstrates that:

(1) the cost of providing the notice required under this chapter is at least two hundred fifty thousand dollars ($250,000);

(2) the number of persons to be notified is at least five hundred thousand (500,000); or

(3) the agency does not have sufficient contact information;
the state agency may use an alternate form of notice set forth in subsection (b).

(b) A state agency may provide the following alternate forms of notice if authorized by subsection (a):

(1) Conspicuous posting of the notice on the state agency's web site if the state agency maintains a web site.

(2) Notification to major statewide media.

IC 4-1-11-10, Notification to consumer reporting agencies

If a state agency is required to provide notice under this section to more than one thousand (1,000) individuals, the state agency shall notify without unreasonable delay all consumer reporting agencies (as defined in 15 U.S.C. 1681a) of the distribution and content of the notice.

See http://www.ai.org/legislative/ic/code/title4/ar1/ch11.html

10 IAC 5: Release of Social Security Numbers by State Agencies

Rule 1. Authority and Applicability

10 IAC 5-1-1 Authority
Authority: IC 4-1-10-13
Affected: IC 4-1-10

This article is adopted under the authority granted to the attorney general by the release ofSocial Security number act (IC 4-1-10-13).

(Office of Attorney General for the State; 10 IAC 5-1-1; filed Jun 16, 2006, 2:50 p.m.:20060712-IR-010050319FRA)

10 IAC 5-1-2 Applicability
Authority: IC 4-1-10-13
Affected: IC 4-1-10

The definitions in IC 4-1-10 and 10 IAC 5-2 apply throughout this article.

(Office of Attorney General for the State; 10 IAC 5-1-2; filed Jun 16, 2006, 2:50 p.m.:20060712-IR-010050319FRA)

10 IAC 5-1-3 Effective date
Authority: IC 4-1-10-13
Affected: IC 4-1-10-1

The effective date of this article is July 1, 2006.

(Office of Attorney General for the State; 10 IAC 5-1-3; filed Jun 16, 2006, 2:50 p.m.:20060712-IR-010050319FRA)

Rule 2. Definitions

10 IAC 5-2-1 "Express consent" defined
Authority: IC 4-1-10-13
Affected: IC 4-1-10-5

"Express consent" means a specific grant of authority made by an individual allowing a state agency to disclose that individual's Social Security number. The grant of authority shall:

(1) not be given:
  (A) pursuant to or as a condition of a state agency's services that would otherwise be available to the individual; or
  (B) by any person other than the individual to whom the Social Security number has been assigned by the Social Security Administration; and
(2) be:
  (A) given in writing;
  (B) signed by the individual; and
  (C) dated in a legible form as determined by the state agency.

(Office of Attorney General for the State; 10 IAC 5-2-1; filed Jun 16, 2006, 2:50 p.m.:20060712-IR-010050319FRA)

10 IAC 5-2-2 "State law enforcement agency" defined
Authority: IC 4-1-10-13
Affected: IC 4-1-10-4

"State law enforcement agency" includes the following entities or persons:

(1) The state police department.
(2) The office of attorney general for the state.
(3) The office of the inspector general.
(4) Prosecutors and their deputies.

(5) Other state agencies or entities that conduct investigations relating to the enforcement of state law.

(Office of Attorney General for the State; 10 IAC 5-2-2; filed Jun 16, 2006, 2:50 p.m.:20060712-IR-010050319FRA)

Rule 3. Attorney General's Discretion

10 IAC 5-3-1 Mitigating factors
Authority: IC 4-1-10-13
Affected: IC 4-1-10; IC 4-1-11

The attorney general may, in his or her discretion, determine that the release of Social Security numbers was a negligent act and not a knowing, intentional, or reckless act if a state agency or employee establishes that the following provisions, singly or in combination, have been met:

(1) The release of the Social Security numbers is immediately stopped.
(2) Any individuals whose Social Security numbers are disclosed are immediately notified in a timely manner.
(3) The release of the Social Security numbers was as follows:
  (A) Unintended.
  (B) De minimis and nonsystematic.
(4) The handling of the Social Security numbers was conducted pursuant to a contractual relationship, and the contract contained a clause requiring the state agency and the contractor to comply with the following:
  (A) The release of Social Security number provisions set forth in IC 4-1-10.
  (B) The notice of security breach provisions set forth in IC 4-1-11.
(5) The state agency had established reasonable policies and procedures designed to prevent the unauthorized disclosure of individual Social Security numbers.
(6) Corrective measures are initiated to prevent future disclosures under similar circumstances.
(7) Other relevant circumstances as determined by the attorney general.

(Office of Attorney General for the State; 10 IAC 5-3-1; filed Jun 16, 2006, 2:50 p.m.:20060712-IR-010050319FRA)

Rule 4. Notice Requirements

10 IAC 5-4-1 Notification to the attorney general
Authority: IC 4-1-10-13
Affected: IC 4-1-10

When a state agency becomes aware of a release of Social Security or other personal identifying information, the state agency or employee shall, within two (2) business days of the disclosure, notify the office of attorney general for the state in writing of the following:

(1) The nature of any release of Social Security or other personal identifying information.
(2) The steps taken by the agency or employee to do the following:
  (A) Stop the current release.
  (B) Notify the individuals affected.
  (C) Prevent future releases.

(Office of Attorney General for the State; 10 IAC 5-4-1; filed Jun 16, 2006, 2:50 p.m.:20060712-IR-010050319FRA)

See http://www.in.gov/legislative/register/20060712-IR-010050319FRA.xml.pdf

Contracts

IC 4-1-10-6

A state agency complies with [the section on nondisclosure] if the agency:

(1)removes; or

(2)completely and permanently obscures;

a Social Security number on a public record before disclosing the public record.

Why Contract is Rejected (Outright Disclosure)

- SSN is Fully Disclosed:
  - EDS Sheet
  - Contract
  - Attachment
  - Underlying EDS, Contract, Attachment

Why Contract is Rejected (Outright Disclosure)

- SSN only Partially Removed
  - White-out
  - Black marker
  - Ink pen

Contract Rejection Process (Outright Disclosure)

- Sealed Envelope
- Only Agency Contact Can Pick Up
- Only Released with Photo ID

Contract Approval

There is no boilerplate content or special formula that guarantees approval. Contracts are reviewed case by case.

Even if a contract is approved as legal *on its face*, that does not guarantee it will be legal in application.

The **AGENCY** is responsible for due diligence.

Agency Law Cases - contracting

"It cannot be disputed that a party competent to contract may so authorize others to act in his behalf."

Andonov v. Christoff, 348 N.E.2d 84, 85 (Ind. Ct. App. 1976) (citing *Caley v. Morgan*, 114 Ind. 350, 16 N.E. 790 (1888).

Agency Law Cases – formation of agency

"[A]n agency relationship arises out of a contractual agreement between the principal and the agent."

Jones v. City of Logansport, 436 N.E.2d 1138, 1145 (Ind. Ct. App. 1982) (citing *Lewis v. Davis*, 410 N.E.2d 1363, 1366 (Ind. Ct. App. 1980).

Agency Law Cases – duty of contractor

"An agent may be an independent contractor, not subject to control in the manner in which he performs his duties, but he is an agent nevertheless, and from this agency relation flow certain legal consequences.

Agency Law Cases – duty of contractor

"The fact of the relation implies a promise to use care and skill and imposes fiduciary obligations of loyalty and obedience not normally present in other bilateral agreements."

Andonov v. Christoff, 348 N.E.2d at 85 (referencing *Commonwealth v. Minds Coal Mining Corp.*, 60 A.2d 14 (Pa. 1948).

Good to Include

- Vendor's internal privacy/confidential information policy
- State boilerplate language on confidentiality
- (if created by DOA) State boilerplate language on IC 4-1-10 and 4-1-11
- Additions to boilerplate where necessary
- requiring notification to and permission by the State prior to disclosure to third party

Good to Include

- Due Diligence
  - What if it was your SSN?
  - What if you knew the Indy Star was watching?
  - What if you knew it was a D Felony?

What to Avoid

- Removing State boilerplate confidentiality language or (if applicable) compliance with IC 4-1-10 or 4-1-11 language
- Referencing but not attaching Vendor's internal privacy/confidential information policy
- Permitting a Vendor to disclose confidential information to a third party without permission from the State