INDIANA OFFICE OF ENERGY AND DEFENSE DEVELOPMENT

# Indiana Residential Geothermal Heat Pump Rebate

## Program Review

**Paul Cummings**

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http://www.in.gov/energy/programs/current.html#Geothermal

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# Introduction

The Indiana Office of Energy & Defense Development (OED) developed the Hoosier Homegrown Energy Plan in 2006. The plan focuses on using more of Indiana's indigenous resources to meet its energy needs. Geothermal heat pumps fit nicely into this plan because they reduce the amount of energy used to heat and cool homes, which reduces the amount of energy production needed. Geothermal heat pumps (GHP) are able to be so efficient because they can concentrate and move solar energy stored in the soil outside the home to the inside of the home to provide heating in winter. In summer the heat inside of the home can be moved and dumped into the soil to provide cooling.

OED receives funding from the US Department of Energy (DOE) through the State Energy Program (SEP). OED must create a plan for what programs will be offered to the public using the federal SEP dollars, which the US DOE must approve. Within the past few years the US DOE has been focusing on market transformative programs. The goal is to transform a market sector to use a more energy efficient product to accomplish the same task. The Indiana Residential Geothermal Heat Pump Rebate program was designed to transform the market for replacement geothermal systems in the residential market.

Geothermal systems reduce energy usage by 25-75% over conventional heating and cooling, making them the most efficient system on the market. (EERE Publication) While GHPs are the most efficient heating systems, they are also the most costly system to install. In new home construction, the increased cost of the geothermal can easily be added to the mortgage and the cost spread over 30 years. This results in a good cash flow for the homeowner since utility bills will be reduced by more than the mortgage will be increased. The retrofit market is not as easy to penetrate due to shorter and less desirable financing terms. The monthly payment is much greater in retrofit situations, so the economics are not as attractive as in new construction. To facilitate a greater penetration into this market OED decided to offer the rebate program.

# Program Description

The program was unveiled on October 1, 2007 with a budget of $500,000 to last until May 31, 2008 or until fully subscribed. Rebates were calculated at $400 per ton of capacity installed with a maximum rebate of $2,000. Most homes need between three and five tons to provide adequate heating and cooling. 326 Hoosier homeowners received a rebate using this program.

## Program Eligibility Requirements

The following is a list of basic eligibility requirements for the program:

- The system must be installed in a single family home located within the State of Indiana.
- The installed system must be listed on the Energy Star website as an energy star certified geothermal heat pump system.
- The system must be a replacement for an existing heating system (i.e. not for new construction).
- The system must be a closed loop system.
- All equipment must be new.

# Program Report

This report contains statistics and analysis of the program and of the systems installed. Subjects that will be covered include size, cost, and location of systems as well as information on what types of heating fuels were replaced. This report will use the data from the 326 rebate applications that were approved by the end of the program for fiscal year 2008. The funds have not all been distributed at the time of writing. There may be some rebates that were approved that do not get reimbursed due to homeowners changing their minds and not installing the system. This number should be very low.

# Descriptive Statistics

## Geothermal System Sizes

Geothermal systems are classified using a unit of measurement called *tons*, which is equal to 12,000 btu/hr. This unit is based on the amount of energy that a ton of ice will absorb in order to melt, and is the industry standard unit for air conditioning. The units most commonly sold for residential applications range in size from two to six tons. The vast majority of units (92%) that received a rebate were in the three -5 ton range. This range includes three, three an a half, four and five ton units. The most common size installed was four tons (40%) followed by three tons (29%). (Table 1)

**Table 1 Number of systems by size**

| Size | Number | % of Total |
|---|---|---|
| 2 tons | 5 | 2% |
| 2.5 tons | 6 | 2% |
| 3 tons | 95 | 29% |
| 3.5 tons | 19 | 6% |
| 4 tons | 129 | 40% |
| 5 tons | 56 | 17% |
| 6 tons | 16 | 5% |
| Total | 326 | 100% |

The average home size in the program is 2,731 $ft^2$. Unit size seems to increase with increases in home size. The average home size is1620 $ft^2$ for two ton units, 2,079 $ft^2$ for three ton units, 2,826 $ft^2$ for four ton units, and 3,755 $ft^2$ for five ton units. This relationship does not apply to the half units as these homes average nearly the same size as the preceding whole unit. There are only 25 (8%) of these half sizes in the program. There seems to be a trend away from them in the market as multiple speed units become more popular, allowing a wider range of capacity out of a single unit. (Table 2)

**Table 2 Geothermal system and average home sizes**

| size | Home size ( sq. ft.) |
|---|---|
| 2 tons | 1620 |
| 2.5 tons | 1621 |
| 3 tons | 2079 |
| 3.5 tons | 2147 |
| 4 tons | 2826 |
| 5 tons | 3755 |
| 6 tons | 3777 |
| Total | 2731 |

## Installation Costs

Installation costs vary to a degree with system size, where larger systems cost more. There are two main types of installations that are important to separate to accurately describe costs; systems that require a new loop to be constructed versus those that do not. The systems that do not need a new loop are existing geothermal users that need to update their heat pump equipment to newer, more efficient models. These systems account for 25% of rebates. These systems cost on average $4,300 less than systems needing a loop. The average price for this "heat pump only" rebate is $9,500-$10,000 for three – four ton units and $11, 188 for five ton units. There is very little difference in the cost of three and four ton units, with four ton units costing $300 more. The three .5 ton units actually cost more than three or four ton units.

The average cost of a full system rebate was $14,278. The average cost of a three ton unit is $13,719 and $13,969 for a four ton unit, which is only $250 different. The five ton costs about $3,000 more than the three -4 ton units. There is no statistically significant trend or difference in cost between two and a half to four ton units. The two ton unit seems to be less expensive, but there are only five rebates issued to two ton units, which would not yield a statistically significant difference. The three and four ton units are the most popular on the market accounting for nearly 70% of the installs and are very similar in price. (Table 3)

**Table 3 Cost by system type**

| Tons | Total Systems | Heat Pump only |
|---|---|---|
| 2 | $12,285 | $8,400 |
| 2.5 | $13,483 | $7,922 |
| 3 | $13,719 | $9,465 |
| 3.5 | $13,297 | $9,959 |
| 4 | $13,969 | $9,765 |
| 5 | $16,865 | $11,188 |
| Total | $14,278 | $9,990 |

## Analysis and Recommendations

The rebates were calculated using $400/ton of capacity with a cap of $2,000. There was much deliberation as to structure the rebate the way we did or to have a flat rebate. The graduated rebate favors four and five ton systems accounting for 11-12 % of the cost of the systems respectively. Three ton systems receive $400 less for a rebate, but cost the nearly the same as four ton units. This causes a two point disparity in percent of cost incented. The two ton unit gets the worst deal with a four percentage point loss versus the four ton system. The $1,500 flat rebate would make every rebate class four tons and less within 1 percentage point and would even out the rebate for three and four ton units (69% of the market). There would be a penalty for systems five tons and greater, but it would only be a two point loss. The recommendation is for a $1,500 flat rebate for full systems, if the program is continued.

**Table 4 Rebates for full systems**

| Tons | Total | Rebate | % of Cost | $1500 rebate % |
|---|---|---|---|---|
| 2 | $12,285 | $800 | 7% | 12% |
| 2.5 | $13,483 | $1,000 | 7% | 11% |
| 3 | $13,719 | $1,200 | 9% | 11% |
| 3.5 | $13,297 | $1,400 | 11% | 11% |
| 4 | $13,969 | $1,600 | 11% | 11% |
| 5 | $16,865 | $2,000 | 12% | 9% |

Twenty five percent of all the rebates went to homeowners that were only replacing the heat pump. This type of installation is on average $4,300 cheaper than rebates for people switching to geothermal from another heating system. We were aware that this would occur and that it was a good idea to encourage the continued use of geothermal. The pattern for this type of rebate follows the same pattern as for full systems, only at a higher percentage. A four ton heat pump only rebate gets nearly six percentage points more than the equivalent full system. The argument could be made that these installations need less incentive due to the sunken capital cost of the existing loop. The recommendation is for a flat rebate of $1,000 for heat pump only applications if the program is continued.

**Table 5 Rebates for heat pump only systems**

| Tons | Cost | Rebate | % of cost | $1000 rebate % |
|---|---|---|---|---|
| 2 | $8,400 | $800 | 10% | 12% |
| 2.5 | $7,922 | $1,000 | 13% | 13% |
| 3 | $9,465 | $1,200 | 13% | 11% |
| 3.5 | $9,959 | $1,400 | 14% | 10% |
| 4 | $9,765 | $1,600 | 16% | 10% |
| 5 | $11,188 | $2,000 | 18% | 9% |

## Heating Fuel Replacement

The analysis of heating fuels replaced is a little tricky since existing geothermal units use electricity the same as an electric furnace. For that reason, geothermal heat pump replacements are treated as a separate category. Electricity was the most popular fuel (39%) when geothermal was not isolated. Table 6 illustrates that propane is the most popular fuel to replace followed by geothermal heat pumps and then natural gas. These three types of installations account for three quarters of the installs. The remainder is made of miscellaneous electric heating types, heating oil furnaces, and other heating sources such as wood.

**Table 6 Heating fuels replaced**

| Fuel | Total | % |
|---|---|---|
| Geothermal Heat Pump | 84 | 26% |
| Other Electricity | 41 | 13% |
| Heating Oil | 33 | 10% |
| Natural Gas | 66 | 20% |
| Other | 5 | 2% |
| Propane | 97 | 30% |
| Total | 326 | |

Propane is an obvious candidate for the top spot as it is relatively expensive and is used in more rural areas where lot sizes are generally large enough to accommodate installing the ground loop. The 30% representation of propane is three times higher than the 9% market penetration in the state. (Table 7) Geothermal heat pumps are the second most popular because the rebate is very lucrative if you already have a ground loop. The only factor limiting this type of replacement is the number of units installed 15 -30 years ago that needed to be replaced this year. Natural gas is the most popular heating fuel in Indiana (65% Table 7), but is usually associated with urban areas where lot sizes are not conducive to geothermal loops. It is also the most inexpensive of the major fuels, which keeps the number of replacements lower than the other two fuels.

**Table 7 2000 Overall Indiana Heating fuels**

| Fuel | % of homes |
|---|---|
| Natural Gas | 65% |
| Fuel Oil | 3% |
| Electricity | 22% |
| Propane | 9% |
| Other/None | 1% |

Source: EIA

The remaining 25 percent of installations replaced primarily heating oil and other electric heating. Heating oil is a very expensive heating fuel and exceedingly rare in Indiana (3% table 7). The fact that 10% of the rebates used heating oil may attest to the higher cost of this heat source.

Table 8 illustrates the breakdown of electric heating types and the number of systems replaced by geothermal. Nearly half of the systems replaced were air source heat pumps. Air source heat pumps are the second most efficient heating method after geothermal. Their downfall is that they work best in temperatures down to 30 or 40 degrees. Below that temperature a backup heat source is required. This is often an electric resistance heater. This is basically an electric furnace, which one of the least economical systems to use. It is surprising that only eight electric furnaces have been switched over using the program.

Baseboard electric heating is not a popular replacement for a couple of reasons. These systems are usually in small homes, with small heating loads. Baseboard heating is the lowest cost equipment to purchase and only moderately expensive to operate since there is no fan or distribution losses normally associated with furnaces. The rest of the heating types are likely resistive in nature and are going to be moderately expensive to very expensive to operate.

**Table 8 Electric heating types**

| Electric heating types | # | % |
|---|---|---|
| Air Source Heat Pump | 20 | 49% |
| Electric other | 10 | 24% |
| Furnace | 8 | 20% |
| Baseboard electric | 3 | 7% |
| Total | 41 | 100% |

## Economics and energy savings

The following tables outline fuel costs, fuel use efficiency and heating costs based on fuel use efficiency. These are estimates and actual costs vary due to differences in efficiency of individual units and seasonal variations in fuel costs. These three tables will help illustrate the economics of these systems in Indiana.

### Home Heating Costs

**Table 9 Fuel cost estimates 2008**

| Fuel Type | Unit | Price Per Unit (dollars) | Heat Content Per Unit (Btu) | Price Per Million Btu (dollars) |
|---|---|---|---|---|
| Fuel Oil (No. 2) | Gallon | $3.00 | 138,690 | $21.63 |
| Electricity | KiloWatt-hour (kWh) | $0.080 | 3,412 | $23.45 |
| Natural Gas * | Therm ** | $1.20 | 100,000 | $12.00 |
| Propane | Gallon | $2.40 | 91,333 | $26.28 |

Source: EIA spreadsheet

**Table 10 Heating equipment and fuel use efficiency**

| Heating System Type | Type of Efficiency Rating | Approximate Efficiency (%) |
|---|---|---|
| Oil Furnace or Boiler | AFUE | 78% |
| Electric Furnace/Baseboard/Space Heater | Est. | 99% |
| Electric Air-Source Heat Pump | HSPF | 199% |
| Electric Geothermal Heat Pump | COP | 350% |
| Natural Gas Furnace or Boiler | AFUE | 78% |
| Propane Furnace or Boiler | AFUE | 78% |

Source: EIA spreadsheet

**Table 11 Fuel costs per MMBTU of heating required**

| Fuel and Heating System Type | Cost Per MMBtu |
|---|---|
| Oil - Furnace or Boiler | $27.73 |
| Electric - Furnace/Baseboard/Space Heater | $23.68 |
| Electric - Air-Source Heat Pump | $11.76 |
| Electric - Geothermal Heat Pump | $6.70 |
| Natural Gas - Furnace or Boiler | $15.38 |
| Propane - Furnace or Boiler | $33.68 |

Source: EIA spreadsheet

## Home Energy Savings

Table 12 was constructed using REM/Rate, a home energy modeling software. A 2731 $ft^2$ ranch with 8 foot walls on crawl space was used as the model. The home had R-13 wall insulation and R-38 ceiling insulation with .53 natural air changes per hour. All of the replaced heating equipment was modeled at the efficiencies specified in Table 10. Cooling was modeled using a 10 SEER electric AC except for the existing geothermal and air source heat pumps. The Existing geo had a COP of 3 and an EER of 20. Hot water equipment was electric for all heating systems except for natural gas and propane which used the same heating fuel for water and home heating. The new system used a 4.7 COP and 25.1 EER 4 ton unit that was the most common used in the program. Replacement hot water was modeled using a standard efficiency electric water heater taking advantage of the desuperheater on the geothermal unit.

**All homeowners should take measures to reduce heating and cooling loads. A certified energy rater can perform a whole house analysis and provide an improvement analysis that would include upgrade costs and savings.**

**Table 12 Estimated energy savings by heating fuel**

| Existing Heat | orig heat ($/yr) | geo heat ($/yr) | orig cool ($/yr) | geo cool ($/yr) | orig dhw ($/yr) | geo dhw ($/yr) | **Total Savings** ($/yr) |
|---|---|---|---|---|---|---|---|
| Oil Furnace | $2,777 | $480 | $172 | $66 | $328 | $259 | $2,472 |
| Electric Furnace | $2,596 | $480 | $172 | $66 | $328 | $259 | $2,291 |
| Air Source Heat Pump | $1,550 | $480 | $112 | $66 | $328 | $259 | $1,192 |
| Geothermal Heat Pump | $695 | $480 | $85 | $66 | $328 | $259 | $303 |
| Natural Gas Furnace | $1,567 | $480 | $172 | $66 | $266 | $259 | $1,200 |
| Propane Furnace | $3,356 | $480 | $172 | $66 | $583 | $259 | $3,306 |

Based on the price assumptions made above, people switching from propane will save the most money on energy expenses, $3,306 per year on average. The switch from fuel oil is the second most lucrative saving $2,472 per year. The switch from electric resistive heating is next followed by natural gas, air source heat pumps and geothermal heat pumps respectively. The savings for geothermal heat pumps is due to an increase in efficiency of today's units and efficiency loss due to wear and tear. Total energy savings are presented in Table 13. The total estimated savings are $573,917.

**Table 13 Total Estimated Savings by Program in Year 1**

| Existing Heat | Savings/yr*rebate | # | Total savings |
|---|---|---|---|
| Oil Furnace | $2,472 | 31 | $76,632 |
| Electric Furnace/other electric | $2,291 | 21 | $48,111 |
| Air Source Heat Pump | $1,192 | 20 | $23,840 |
| Geothermal Heat Pump | $303 | 84 | $25,452 |
| Natural Gas Furnace | $1,200 | 66 | $79,200 |
| Propane Furnace | $3,306 | 97 | $320,682 |
| | **Total** | | **$573,917** |

## Economic Analysis

The program was designed specifically to target the emergency and planned replacement market. The homeowner that decided to take advantage of the rebate was faced with replacing existing equipment anyway. The average cost of a geothermal installation was $14,278 for a total system. Subtracting the rebate and other incentives leaves about $12,500. Conventional HVAC equipment varies widely in cost so two cases are presented for economic returns. The first case presented in table 14a illustrates an $8,000 replacement cost. The savings are based on the difference between a geothermal system and 94% efficient combustion equipment and a 14 SEER air conditioner. This provides an apples to apples analysis of what the homeowner was faced with. Table 14b shows a higher incremental cost due to the choice to use lower cost 80% efficiency equipment and a 13 SEER air conditioner. The incremental cost is higher for this application, but the energy savings are larger. Existing geothermal systems were not analyzed as their choice is to switch away from geothermal. The energy savings are small since they were using geo to begin with, but the incremental cost is also about $4,000 less. A complete switch from geothermal to another fuel would essentially use the savings numbers below versus the reduced incremental cost.

**Table 14a Economics of Geothermal with incremental cost of $4500**

| Existing Heat | Savings/yr ($) | incremental cost ($) | payback (yrs) | ROI % |
|---|---|---|---|---|
| Oil Furnace | $1,956 | $4,500 | 2.30 | 43% |
| Electric Furnace | $2,247 | $4,500 | 2.00 | 50% |
| Air Source Heat Pump | $1,192 | $4,500 | 3.78 | 26% |
| Natural Gas Furnace | $890 | $4,500 | 5.06 | 20% |
| Propane Furnace | $2,691 | $4,500 | 1.67 | 60% |

*assumes 94% efficient combustion furnaces and 14 SEER ac would have been installed*

**Table 14b Economics of Geothermal with incremental cost of $7000**

| Existing Heat | Savings/yr ($) | incremental cost ($) | payback (yrs) | ROI |
|---|---|---|---|---|
| Oil Furnace | $2,403 | $7,000 | 2.91 | 34% |
| Electric Furnace | $2,291 | $7,000 | 3.06 | 33% |
| Air Source Heat Pump | $1,192 | $7,000 | 5.87 | 17% |
| Natural Gas Furnace | $1,161 | $7,000 | 6.03 | 17% |
| Propane Furnace | $3,222 | $7,000 | 2.17 | 46% |

*assumes 80% efficient combustion furnaces and 14 SEER ac would have been installed*

In all situations the payback on the incremental cost is 6.03 years or less. The return on investment ranges from 17-60%. This makes geothermal one of the most economical forms of renewable energy available today.

The prior assumes that the money is spent up front with no financing. Many systems will be financed over a term of 5 -20 years. Financing $4500 over five years at 7% interest would yield payments of $1,070 per year. This is less than the energy savings for all systems except the natural gas system. After five years the entire savings per year would be realized. Extending the loan term to 20 years reduces the yearly payment to around $500 and creates a positive cash flow in every instance.

## Rebate Distribution

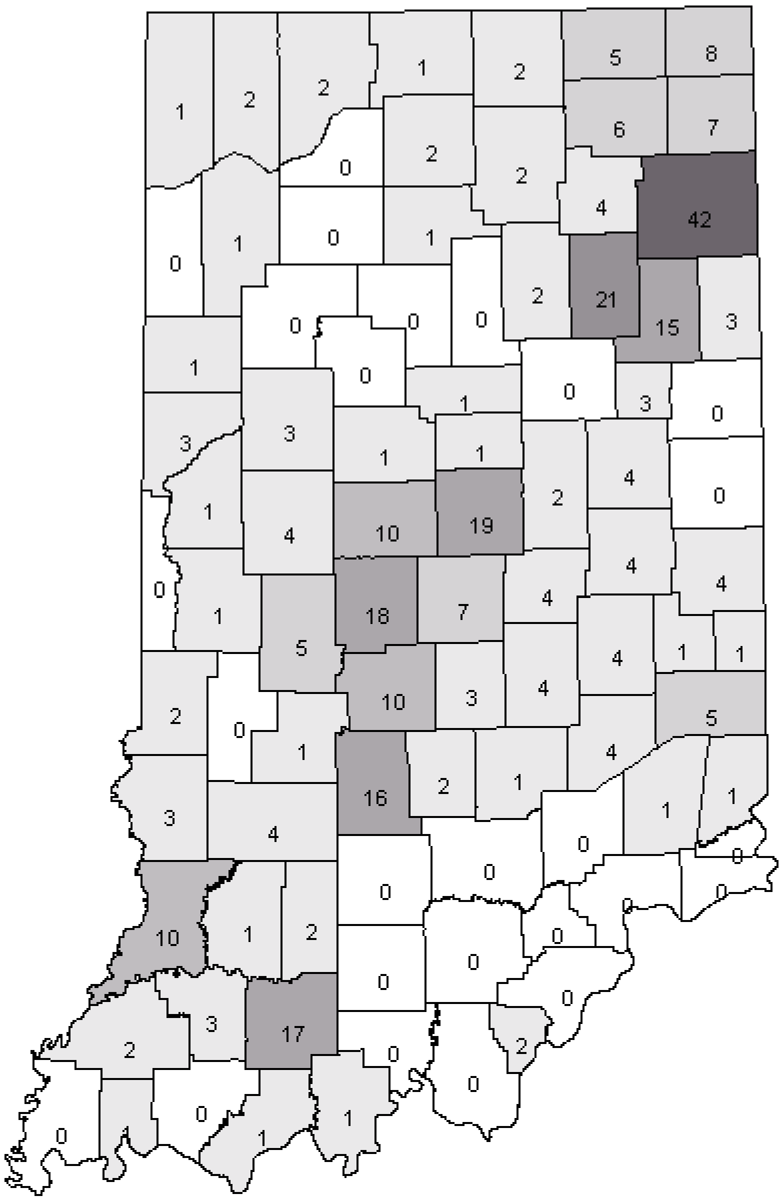
### Statewide distribution

Rebates were claimed in 72% (66) of all 92 counties. The distribution is widespread across the state. (Figure 1) There are three areas of greater concentration. The highest density is near Ft. Wayne. There were 111 (34%) rebates in the northeastern nine counties. Allen and Huntington counties made up 19% of all rebates, garnering 63 between the two. The next highest density was in central Indiana. Marion, Hamilton, Morgan, Hendricks, and Monroe all had six or more installations. Hendricks and Hamilton each had 18 and 19 respectively and Monroe County had 16. The third area of density was in the southwest where Dubois County had 17 rebates.

There were virtually no rebates in any of the counties southeast of Bloomington. There were only six rebates in any county touching the Ohio River. This lack of installations is due in part to geology, economics, climate and HVAC conventions. This part of the state was not glaciated, so there is often bedrock near the surface, which can necessitate vertical boring. This type of installation is more expensive than ground loops. The climate of the south is much milder than the rest of the state. Evansville has an average of 4400 heating degree days per year, where Fort Wayne has an average of 6200 heating degree days per year. The winter average temperature in Evansville is 45 degrees versus 37 in Fort Wayne. In this climate the return on investment of geothermal is much less than in the north. A positive return is still likely, but maybe not perceived to be high enough to justify the capital investment. There are advantages to air source heat pumps in that they are cheaper and do not require land disturbance. The disadvantage of air source heat pumps is that they are less effective below 30 – 40 degrees and often times use resistance electric heating as backup. These temperatures are less frequent in this region, and it is less costly to use air source heat pumps than in the north. Anecdotally, the convention in the Ohio River Valley is to use air to air heat pumps for people desiring high efficiency heating.

Two other areas of particularly low concentration are the fringes of central Indiana and the northwest. There are several counties on the Illinois and Ohio Border in central Indiana that have one or no rebates. The northwest quarter of the state has no county with more than three rebates. All of the hypotheses for why the south had few installations do not apply for these two areas. The central counties have similar soils and climate to the Indianapolis region. The northwest has a climate and geology similar to the northeast. The best argument is that there is a lack of geothermal salespeople in these areas. These areas present the best opportunities for expansion of the geothermal market in the state. Appendix 1 illustrates the number of rebates and the amount of rebate money in each county.

**Figure 1 Rebates by County**



## Electric Utility Distribution

Table 15 illustrates the distribution of rebates by the type of electric utility that serves them. The data for investor owned utilities (IOUs) is further broken down into the five utilities of this type in the state. There was one rebate in a municipal utility. These are city utilities where lot sizes are smaller. There are also no known incentives offered by municipal utilities for geothermal in the state. Rural electric management cooperatives (REMCs) accounted for 60% of all rebates. REMCs serve rural areas where people tend to have larger yards that can easily accommodate geothermal heat pumps. They are also areas where natural gas is unavailable; so many people are forced to use more expensive fuels. They also tend to offer generous rebates for geothermal heat pumps. Of the forty REMCs, thirty one offer rebates ranging from $100 - $1200, with most in the $200 - $500 range. See Appendix 2 for the entire list.

**Table 15 Rebates by utility type**

| Utility Type | Electric utility | Total | % |
|---|---|---|---|
| Investor Owned | | 129 | **39.7%** |
| | Duke Energy | 64 | 19.7% |
| | AEP | 43 | 13.2% |
| | Nipsco | 12 | 3.7% |
| | IPL | 8 | 2.5% |
| | Vectren | 2 | 0.6% |
| Municipal | | 2 | **0.6%** |
| REMC | | 194 | **59.7%** |
| Total Count* | | 325 | 100.0% |

*one rebate was missing this data

IOUs account for forty percent of all installations. Duke Energy has the most rebates within its service territory of all IOUs with 46. Duke offers a rebate of $200 the largest of all the IOUs. IPL is the only other IOU to offer a rebate ($100). AEP had the second most rebates within its service territory with 34. AEP happens to serve the Ft. Wayne area which is a hotbed for geothermal due to strong salespeople in the area. The rest of the IOUs had relatively few rebates. IPL primarily serves Indianapolis, which has a large population and only had six rebates. This is due to the availability of natural gas and the lack of lot space to install the geothermal. Nipsco and Vectren's lack of rebates are explained above as Nipsco serves the northwest part of the state and Vectren the extreme southwest.

# Economic Development

The program had a budget of $500,000 which leveraged an additional $4,000,000 of private investment. Assuming the $4,500 incremental cost for a geothermal system versus a conventional high efficiency system, nearly $1,500,000 of economic activity happened that would not have without the program.

Almost all of this money stays within the state in wages and profits. The installers and distributors are almost exclusively residents of Indiana. Table 15 illustrates the manufacturers of the systems installed in the state. Waterfurnace is the most prevalent with about 75% of all installations using their equipment. The Waterfurnace factory is in Fort Wayne and provides around 200 well paying jobs to Hoosiers. These factories as well as the installers pay income taxes which add to the state coffers. The sales tax alone on the incremental revenue of $1,500,000 is around $100,000. It is difficult to assess the increased revenue to the state, but this program nearly pays for itself in increased corporate income, private income, and sales taxes.

**Table 16 Rebates by manufacturer**

| Manufacturer | Number | Percent |
|---|---|---|
| Waterfurnace | 240 | 73.6% |
| Climatemaster | 29 | 8.9% |
| Bryant | 6 | 1.8% |
| Geoexcel | 20 | 6.1% |
| FHP | 7 | 2.1% |
| Carrier | 11 | 3.4% |
| Geocomfort | 11 | 3.4% |
| ECR | 2 | 0.6% |
| Total | 326 | 100% |

## Summary and Recommendations

The following is a list of key points about the program:

- The average home size was 2731 $ft^2$.
- The most common system sizes were three and four ton units.
- The average full system cost was $14,278 and heat pump only replacement cost was $9,990.
- People with expensive heating fuels and people replacing heat pumps only were disproportionately represented in the rebate.
- The program will save rebate recipients more money in reduced energy bills in the first year than the program spent.

The rebate is currently calculated at $400/ton of capacity. The average rebate was around $1,500. The recommendation is that all rebates for complete systems be $1,500. This makes the percentage of cost even for three and four ton systems, where the four ton systems are currently getting a higher percentage. Roughly a quarter of all rebates were for existing geothermal systems. These people already have a loop, so they are getting a rebate that is an even greater fraction of their costs. The recommendation is that this type of replacement be given a $1,000 rebate. This rebate puts them on par with the full systems getting a $1,500 rebate. This would make the average rebate 10-11% of system costs for three and four ton units in both rebate types.

**Appendix 1 Rebate Number and Dollar Amount by County**

| County | Rebates | $ amount |
|---|---|---|
| Allen | 42 | $69,000 |
| Huntington | 21 | $31,800 |
| Hamilton | 19 | $28,600 |
| Hendricks | 18 | $27,000 |
| Monroe | 16 | $25,400 |
| Dubois | 17 | $24,800 |
| Wells | 15 | $24,400 |
| Knox | 10 | $17,600 |
| Morgan | 10 | $16,200 |
| Boone | 10 | $15,400 |
| Steuben | 8 | $12,800 |
| Dekalb | 7 | $11,400 |
| Marion | 7 | $9,000 |
| Noble | 6 | $9,000 |
| Lagrange | 5 | $7,600 |
| Franklin | 5 | $7,400 |
| Putnam | 5 | $7,400 |
| Shelby | 4 | $6,400 |
| Wayne | 4 | $6,400 |
| Decatur | 4 | $6,000 |
| Montgomery | 4 | $6,000 |
| Rush | 4 | $6,000 |
| Greene | 4 | $5,800 |
| Henry | 4 | $5,800 |
| Delaware | 4 | $5,600 |
| Whitley | 4 | $5,600 |
| Hancock | 4 | $5,400 |
| Blackford | 3 | $5,200 |
| Warren | 3 | $5,200 |
| Pike | 3 | $4,800 |
| Johnson | 3 | $4,600 |
| Adams | 3 | $4,200 |
| Sullivan | 3 | $4,200 |
| Tippecanoe | 3 | $4,000 |
| Floyd | 2 | $3,600 |
| Elkhart | 2 | $3,200 |
| Vigo | 2 | $3,200 |
| Wabash | 2 | $3,200 |
| Kosciusko | 2 | $2,800 |
| Madison | 2 | $2,800 |
| Brown | 2 | $2,400 |
| Gibson | 2 | $2,400 |
| LaPorte | 2 | $2,400 |
| Marshall | 2 | $2,400 |
| Martin | 2 | $2,400 |
| Porter | 2 | $2,400 |

| County | Rebates | $ amount |
|---|---|---|
| Daviess | 1 | $2,000 |
| Jasper | 1 | $2,000 |
| Lake | 1 | $2,000 |
| Owen | 1 | $2,000 |
| Vanderburgh | 1 | $2,000 |
| Bartholomew | 1 | $1,600 |
| Clinton | 1 | $1,600 |
| Fountain | 1 | $1,600 |
| Howard | 1 | $1,600 |
| Parke | 1 | $1,600 |
| Perry | 1 | $1,600 |
| Ripley | 1 | $1,600 |
| St Joseph | 1 | $1,600 |
| Fulton | 1 | $1,400 |
| Benton | 1 | $1,200 |
| Dearborn | 1 | $1,200 |
| Fayette | 1 | $1,200 |
| Spencer | 1 | $1,200 |
| Tipton | 1 | $1,200 |
| Union | 1 | $1,200 |
| Carroll | 0 | $0 |
| Cass | 0 | $0 |
| Clark | 0 | $0 |
| Clay | 0 | $0 |
| Crawford | 0 | $0 |
| Grant | 0 | $0 |
| Harrison | 0 | $0 |
| Jackson | 0 | $0 |
| Jay | 0 | $0 |
| Jefferson | 0 | $0 |
| Jennings | 0 | $0 |
| Lawrence | 0 | $0 |
| Miami | 0 | $0 |
| Newton | 0 | $0 |
| Ohio | 0 | $0 |
| Orange | 0 | $0 |
| Posey | 0 | $0 |
| Pulaski | 0 | $0 |
| Randolph | 0 | $0 |
| Scott | 0 | $0 |
| Starke | 0 | $0 |
| Switzerland | 0 | $0 |
| Vermillion | 0 | $0 |
| Warrick | 0 | $0 |
| Washington | 0 | $0 |
| White | 0 | $0 |

**Appendix 2 Other Rebates**

| Indiana Utility Geothermal Heat Pump Rebates | | | | |
|---|---|---|---|---|
| | Utility | Rebate Amt | Phone | Email |
| Hoosier Energy | Bartholomew County REMC | $200/ton up to 4 tons | (812) 372-2546 | questions@bcremc.com |
| | Clark County REMC | $250 | (800) 462-6988 | ccremc@theremc.com |
| | Daviess-Martin County REMC | $150 | (800) 762-7362 | mbelcher@dmremc.com |
| | Decatur County REMC | $200/ton up to 4 tons | (812) 663-3391 | dcremc@dcremc.com |
| | Dubois REC, Inc. | $250 | (812) 482-5454 | |
| | Harrison REMC | $200 | (812) 738-4115 | customerquestion@harrisonremc.com |
| | Henry County REMC | $250 | (765) 529-1212 | hcremc@hrtc.net |
| | Jackson County REMC | $225 | (800) 288-4458 | info@jacksonremc.com |
| | Johnson County REMC | $200 | (317) 736-6174 | waltersi@jcremc.com |
| | Orange County REMC | $250 | (812) 865-2229 | ocremc@myremc.coop |
| | RushShelby Energy | $250 | (765) 932-4121 | rse@rse.coop |
| | South Central Indiana REMC | $250 | (765) 342-3344 | paulas@sciremc.com |
| | Southeastern Indiana REMC | $300 | (800) 737-4111 | barryl@seiremc.com |
| | Southern Indiana REC, Inc. | $100 | (812) 547-2316 | sirec@sirec.com |
| | Utilities District of Western Indiana REMC | $500 | (800) 489-7362 | |
| | WIN Energy REMC | $250 | (812) 882-5140 | info@winenergyremc.com |
| | Whitewater Valley REMC | $0 | (800) 529-5557 | gsayne@wwvremc.com |
| Wabash Power | Boone REMC | $0 | (765) 482-2390 | memberservices@bremc.com |
| | Carroll County REMC | $0 | (765) 564-2057 | pminnicus@remconline.net |
| | Central Indiana Power | $750 | (317) 477-2219 | info@cipower.com |
| | Fulton County REMC | $750 | (574) 223-3156 | |
| | Hendricks Power Cooperative | $0 | (317) 745-5473 | |
| | Jasper County REMC | $500 | (219) 866-4601 | jasperremc@jasperremc.com |
| | Jay County REMC | $250 | (260) 726-7121 | |
| | Kankakee Valley REMC | $250 | (219) 733-2511 | aleek@kvremc.com |
| | Kosciusko REMC | $200 | (574) 267-6331 | mail@kremc.com |
| | LaGrange County REMC | $500 | (260) 463-7165 | dlevitz@lagrangeremc.com |
| | Marshall County REMC | $300 | (574) 936-3161 | mbatman@marshallremc.coop |
| | Miami-Cass REMC | $500 | (765) 473-6668 | kimb@mcremc.coop |
| | Newton County REMC | $0 | (219) 474-6224 | |
| | Noble REMC | $0 | (260) 636-2113 | rshisler@nobleremc.com |
| | Northeastern REMC | $500 or $100/ton | (260) 625-3700 | m_defreeuw@nremc.com. |
| | Parke County REMC | $0 | (765) 569-3133 | info@pcremc.com |
| | Paulding-Putnam EC | $1200* | (800) 686-2357 | webmaster@ppec.coop |
| | Steuben County REMC | $0 | (260) 665-3563 | cburgi@remcsteuben.com |
| | Tipmont REMC | $100/ton max $500 | (800) 726-3953 | |
| | United REMC | $0 | (260) 758-3155 | mail@unitedremc.com |
| | Wabash County REMC | $600 | (260) 563-2146 | mail@wabashremc.com |
| | Warren County REMC | $500 | (765) 762-6114 | toddw@wcremc.com |
| | White County REMC | $500 | (574) 583-7161 | |
| Investor Owned | Duke | $200 | 800-521-2232 | |
| | AEP – Indiana Michigan Power | $0 | 800-311-4634 | |
| | IPL | $100 | 317-261-8222 | CustomerServices@aes.com |
| | NIPSCO | $0 | 800-464-7726 | nipscoquestions@nisource.com |
| | Vectren | $0 | 812-464-4750 | |

*Subject to change at any time without warning.*

## Appendix 3 Simple Heat Load Calculation

**Heating Degree Days of selected cities**

Evansville=4355 HDD/yr
Indianapolis=5700 HDD/yr
South Bend=6499 HDD/yr
Fort Wayne=6205 HDD/yr

**Simple Heat Load Calculation Formula**

MMBTU/yr = (HHI * A * HDD)/1,000,000

Where:
HHI = Home Heating Index (btu/ $ft^2$*yr)

> *8 is an average value. The more airtight and well insulated a home the lower the HHI and less energy used.*

A = Average home size ($ft^2$), 2731 $ft^2$ is the average from the data
HDD=Heating Degree Days/year

Using 8 for HHI and the HDD for Indianapolis, we get ~125 MMBTU/yr heat load. This compares favorably to what was modeled using the software. Using other climate data will affect the heat load.