



PURDUE
UNIVERSITY®

Manufacturing Extension Partnership

A white recycling symbol (three chasing arrows forming a triangle) positioned over a blue gear.

qcells

Sustainability Trends

MEET YOUR PRESENTER

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AGENDA



✓ *Welcome and Introductions*

Defining Sustainability

Trends in Sustainability

Purdue Sustainability



**DEFINING
SUSTAINABILITY**

SUSTAINABILITY

➤ *“Meeting the needs of the present without compromising the ability of future generations to meet their own needs.”*

– UN General Assembly, Report of the World Commission on Environment and Development

➤ *“Able to last or continue for a long time”* – *Merriam Webster*

➤ *“In every deliberation, we must consider the impact on the seventh generation.”* – *The Constitution of the Iroquois Nations*



SUSTAINABILITY “TRIPLE BOTTOM LINE”

Profit (Economic)

- Improves efficiency & lowers costs
- Reduces regulatory compliance costs
- Creates revenue enhancement opportunities

Planet (Environmental)

- Reduces demand for resources and energy *from nature*
- Reduces waste *to nature*

People (Social)

- More resources & energy become available for others
- Closing the loop generates new jobs



PRODUCTIVITY IMPROVEMENTS

How can more sustainable workplaces impact the company?

- Workers with a view?
 - Performed 10% to **25% better** on tests of mental function and memory recall
- More rigorous environmental standards?
 - **16% higher** labor productivity



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WORKFORCE

Sustainability matters more than ever before

- **70%** of U.S. workers said that a firm's environmental record is important to them and is a consideration when deciding whether to take a job with a company.
- **25%** referred to corporate environmental records as a "**major factor**" in their decision to take a job. — *2021 Gallup Poll*



HR COSTS

- Labor is typically the 1st or 2nd largest cost for companies.
- Companies with sustainability goals have
 - Higher employee retention
 - Better recruitment
 - Reduced turnover



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**TRENDS IN
SUSTAINABILITY**

THIRD PARTY REPORTING



ISO / TS 14067

Greenhouse gases -- Carbon footprint of products -- Requirements and guidelines for quantification and communication



the BIFMA sustainability standard

SUPPLIER SUSTAINABILITY SURVEYS

21 Sustainability Criteria

 ENVIRONMENT	 LABOR & HUMAN RIGHTS	 ETHICS	 SUSTAINABLE PROCUREMENT
<p>Operations</p> <ul style="list-style-type: none"> • Energy Consumption & GHGs • Water • Biodiversity • Local & Accidental Pollution • Materials, Chemicals & Waste <p>Products</p> <ul style="list-style-type: none"> • Product Use • Product End-of-Life • Customer Health & Safety • Environmental Services & Advocacy 	<p>Human Resources</p> <ul style="list-style-type: none"> • Employee Health & Safety • Working Conditions • Social Dialogue • Career Management & Training <p>Human Rights</p> <ul style="list-style-type: none"> • Child Labor, Forced Labor & Human Trafficking • Diversity, Discrimination & Harassment • External Stakeholder Human Rights 	<ul style="list-style-type: none"> • Corruption • Anticompetitive Practices • Responsible Information Management 	<ul style="list-style-type: none"> • Supplier Environmental Practices • Supplier Social Practices

GLOBAL RESPONSE

SUSTAINABLE DEVELOPMENT GOALS



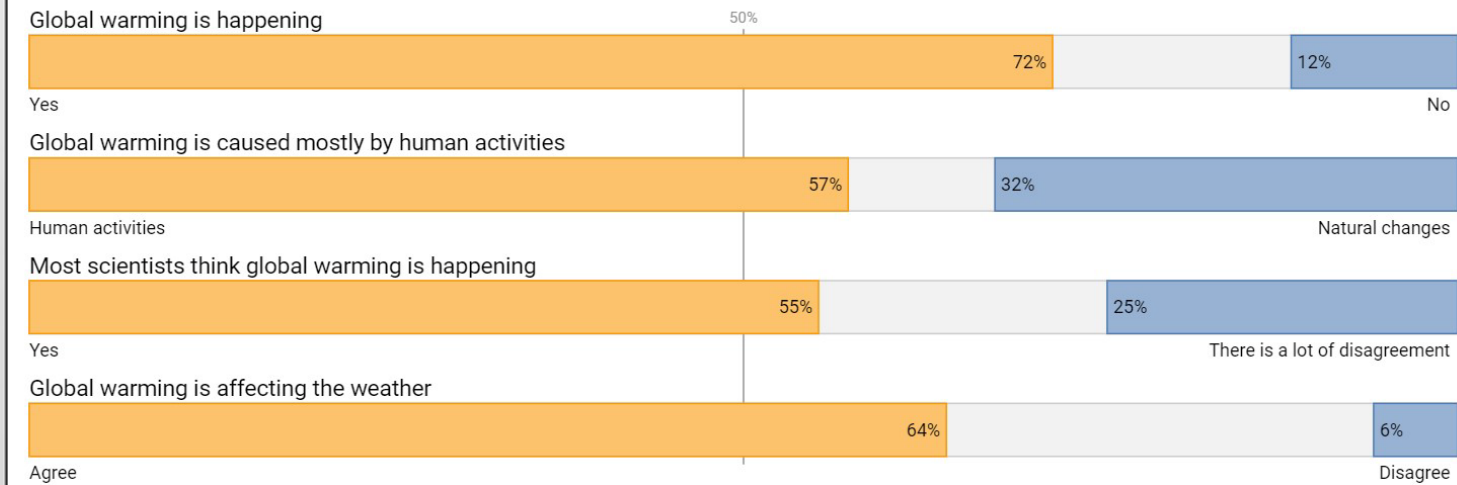
Source: United Nations <https://sdgs.un.org/goals>

Climate Change 2020

Source: Yale Study 2020

Public Opinion Estimates, United States, 2020

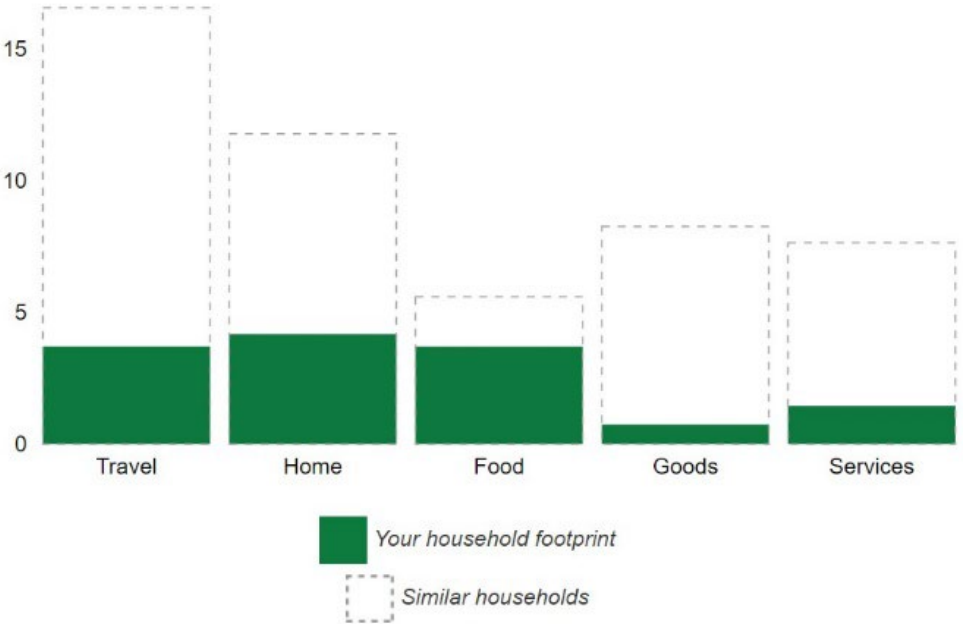
BELIEFS



CARBON FOOTPRINT CALCULATORS

13 TONS CO₂/ YR

Household tons CO₂/year



A screenshot of a carbon footprint calculator interface. At the top, there is a navigation bar with icons and labels for 'Get Started', 'Travel', 'Home', 'Food', 'Shopping', 'Your Footprint', and 'Take Action'. The 'Your Footprint' section is active, showing a footprint icon and the text 'Your Footprint'. Below this is a button that says 'See how you compare'. The main display shows '13 tons CO₂/year Total Footprint' and a small bar chart with five bars of decreasing height. To the right, it states '73% Better than Average'.

<https://www.nature.org/en-us/get-involved/how-to-help/carbon-footprint-calculator/>

CARBON ACTIVITIES


What contributes to our carbon emissions?


 Auto miles


 Air miles

 Electricity used

 Raw material extraction/ refining/ processing/ shipping

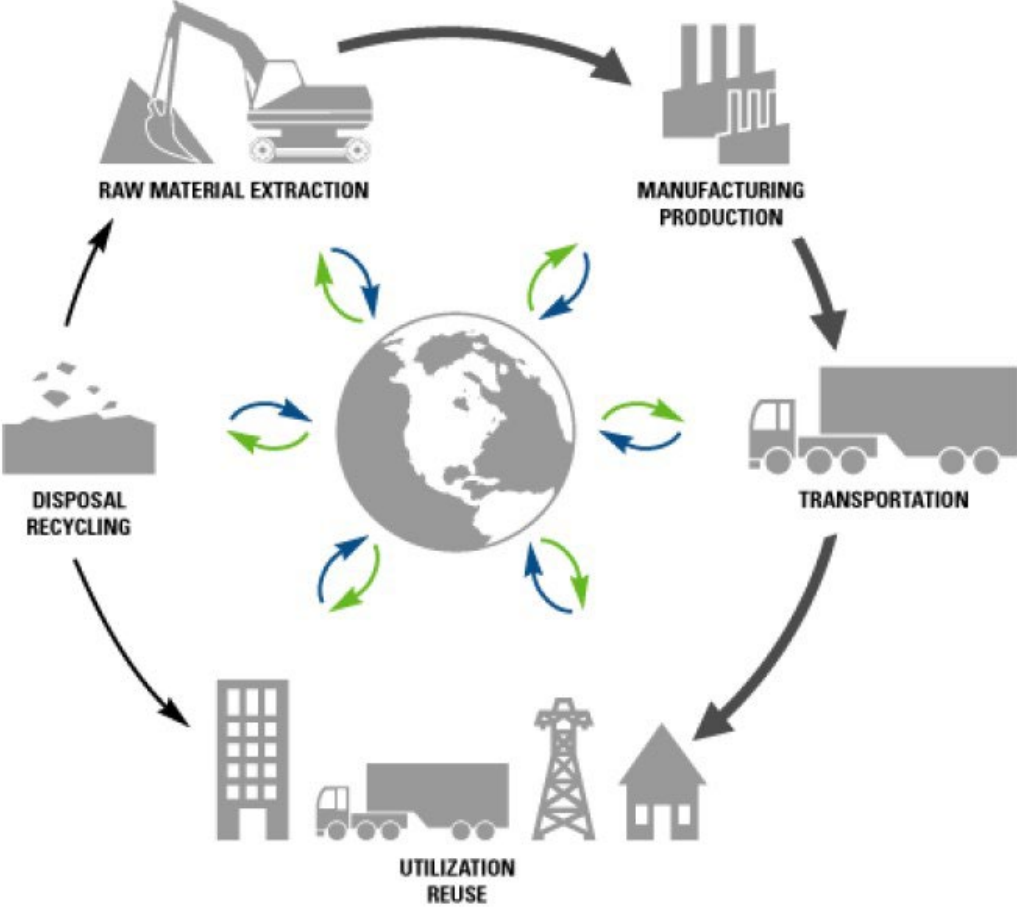
 Final product production/ shipping

 Waste recycling/ shipping

 Food production/ shipping

PRODUCT CARBON FOOTPRINT

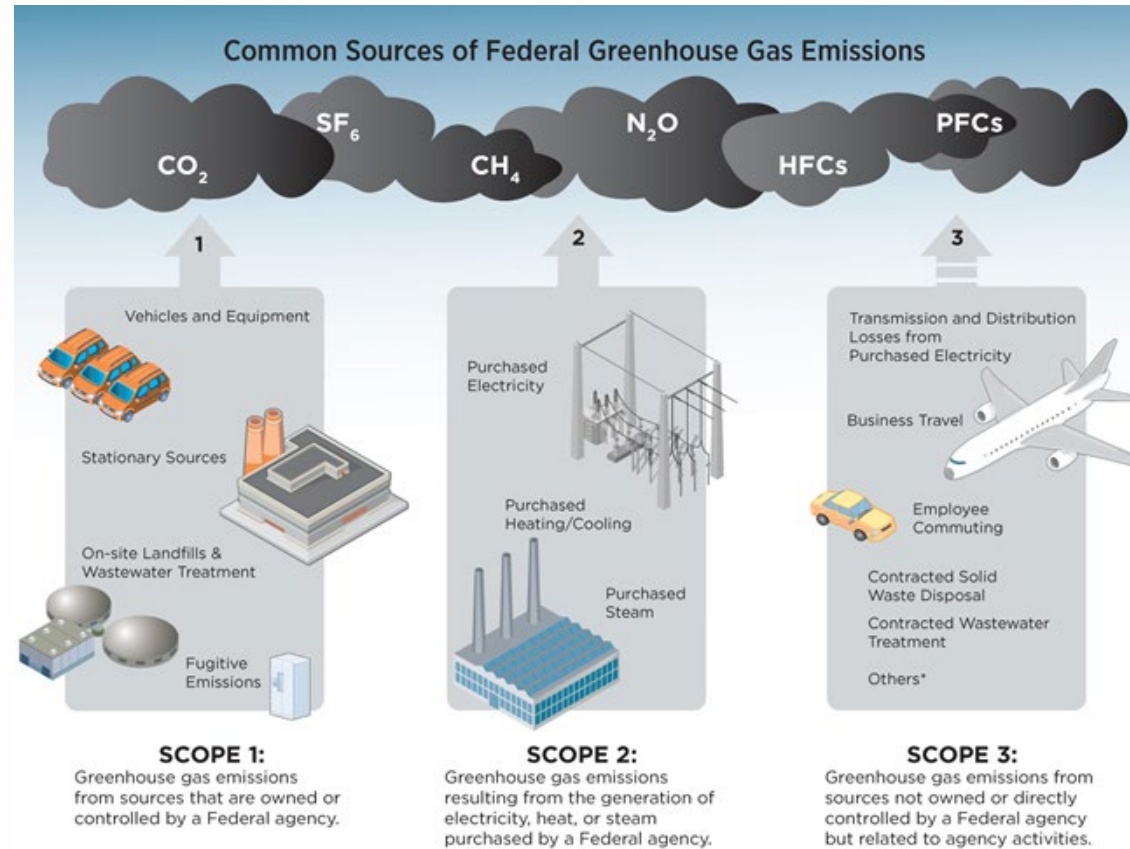
Where does Carbon Come From?



EMISSION SCOPES

Mapping Your Company's Carbon Footprint

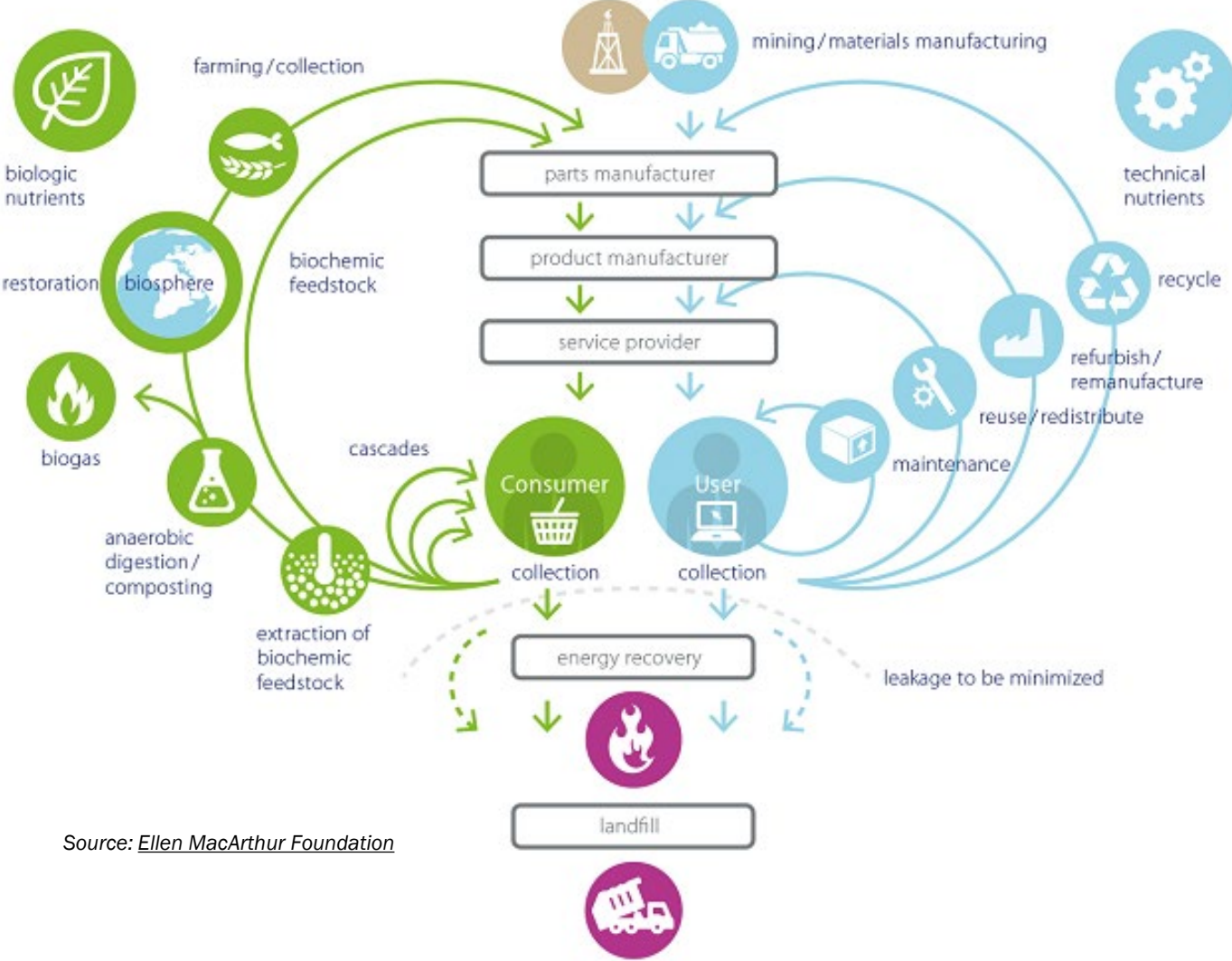
- Scope 1
- Scope 2
- Scope 3



*Additional, significant Scope 3 emission sources exist beyond the examples provided.

Source: EPA 2014

CIRCULAR ECONOMY: CRADLE TO CRADLE



Source: *Ellen MacArthur Foundation*

CARBON QUIZ

- How much Carbon is produced by leaving on one 100-watt bulb for a single year?
 - 1,100 lbs. CO₂e
- An LED bulb?
 - 198 lbs. CO₂e



CARBON QUIZ

➤ Drying Your Hands?

➤ Standard Electric Dryer

➤ 20 grams Co₂e

➤ One Paper Towel

➤ 10 grams CO₂e

➤ Four Paper Towels

➤ 40 grams CO₂e

➤ Hi-Efficiency Dryer

➤ 3 grams CO₂e

CARBON QUIZ



- Photovoltaic Panels-
- 1,800 kWh/yr

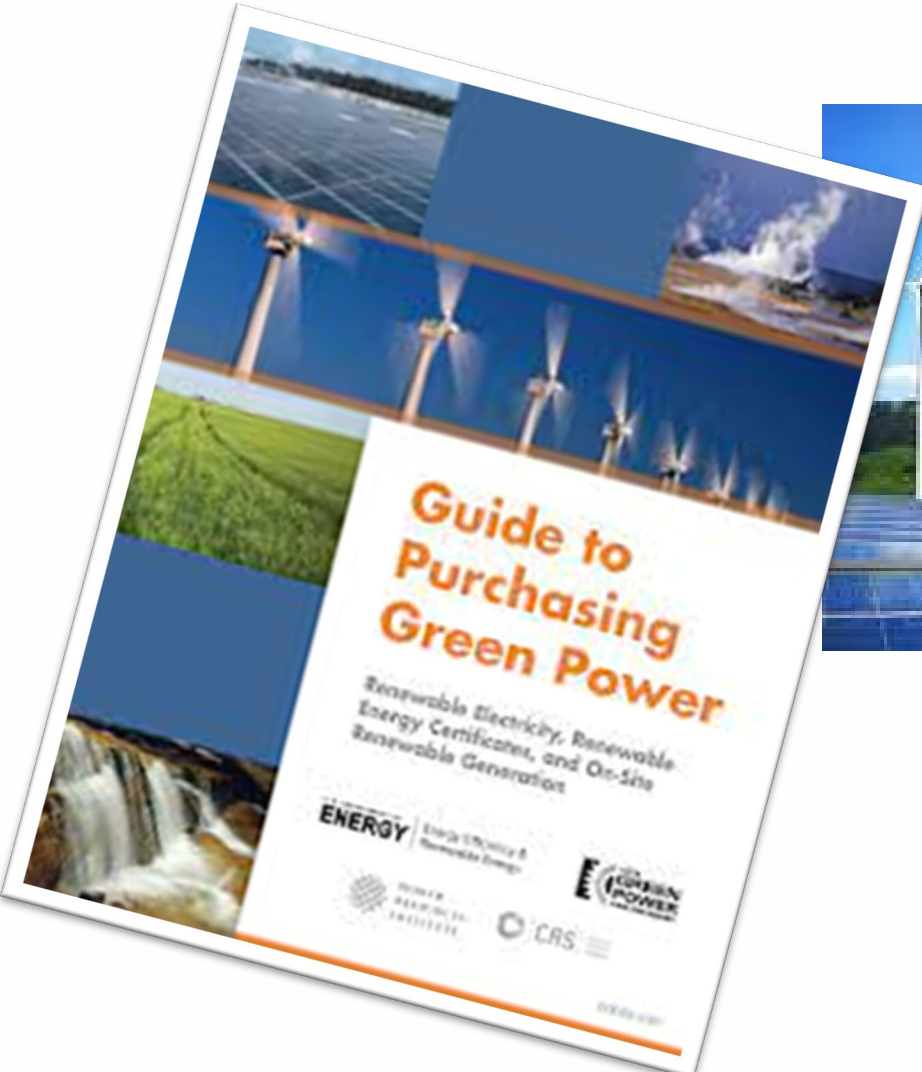
➤ Embodied Carbon in Manufacturing?

➤ 3.5 Tons CO₂e






➤ Carbon Reduction Through Lifetime?

➤ 50 Tons CO₂e

PURCHASING AGREEMENTS



COMPANY TRAVEL

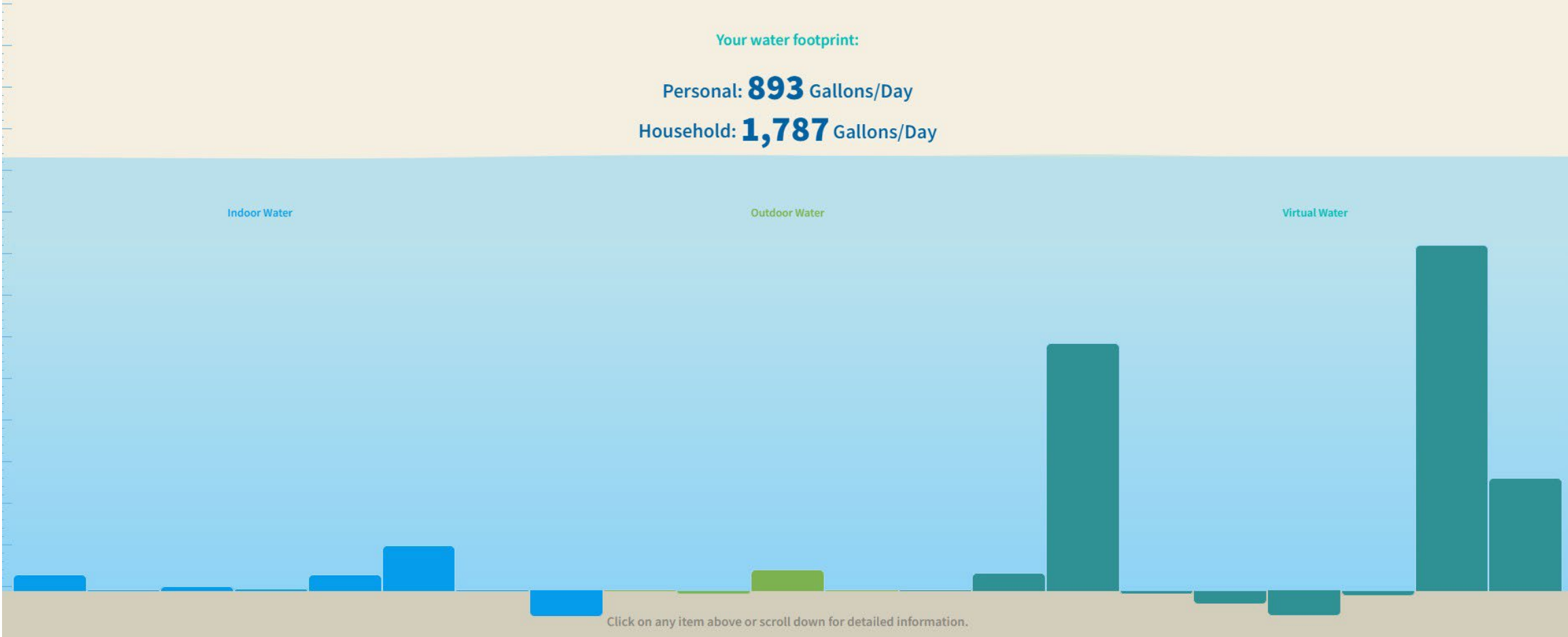
	6:30 PM – 8:50 PM Delta · Operated by Endeavor Air DBA Delta Conne...	2 hr 20 min IND–JFK	Nonstop	183 kg CO ₂ Avg emissions ⓘ	\$353 round trip	∨
	4:45 PM – 7:00 PM American · Operated by Republic Airways as Ame...	2 hr 15 min IND–JFK	Nonstop	170 kg CO ₂ -7% emissions ⓘ	\$353 round trip	∨
	12:42 PM – 2:45 PM American · Operated by Republic Airways as Ame...	2 hr 3 min IND–LGA	Nonstop	195 kg CO ₂ +6% emissions ⓘ	\$368 round trip	∨
	3:17 PM – 7:37 PM American · Operated by PSA Airlines as American ...	4 hr 20 min IND–LGA	1 stop 1 hr 30 min DCA	222 kg CO ₂ +21% emissions ⓘ	\$377 round trip	∨
	2:00 PM – 7:36 AM⁺¹ United · Operated by Republic Airways DBA United...	17 hr 36 min IND–EWR	1 stop ▲ 14 hr 26 min IAD	243 kg CO ₂ +33% emissions ⓘ	\$378 round trip	∨

WATER FOOTPRINT

Your water footprint:

Personal: **893** Gallons/Day

Household: **1,787** Gallons/Day

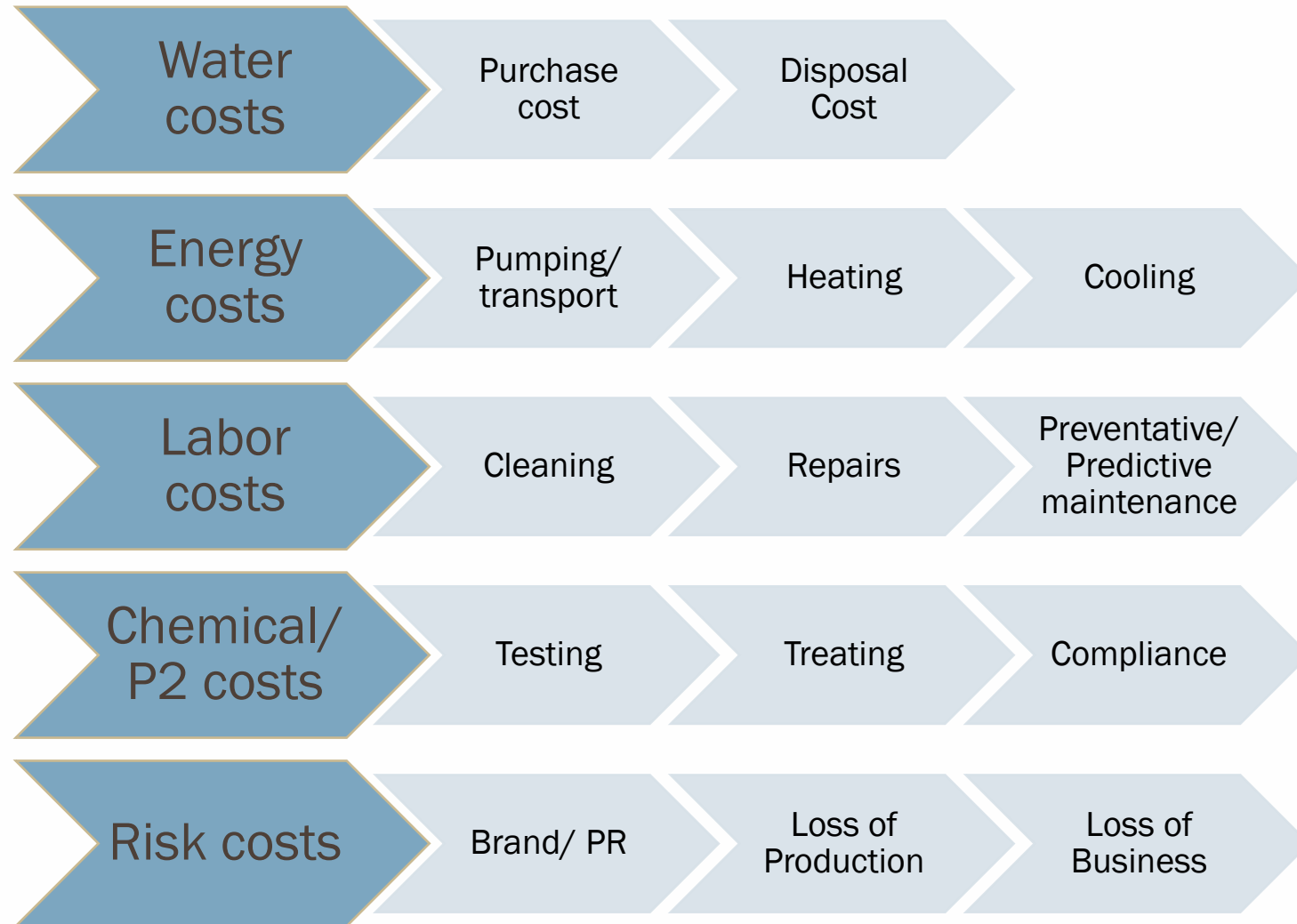


WATER RISK: QUANTITY

- *Monticello,
Indiana*
- *2020
Drought*



EMBODIED COSTS



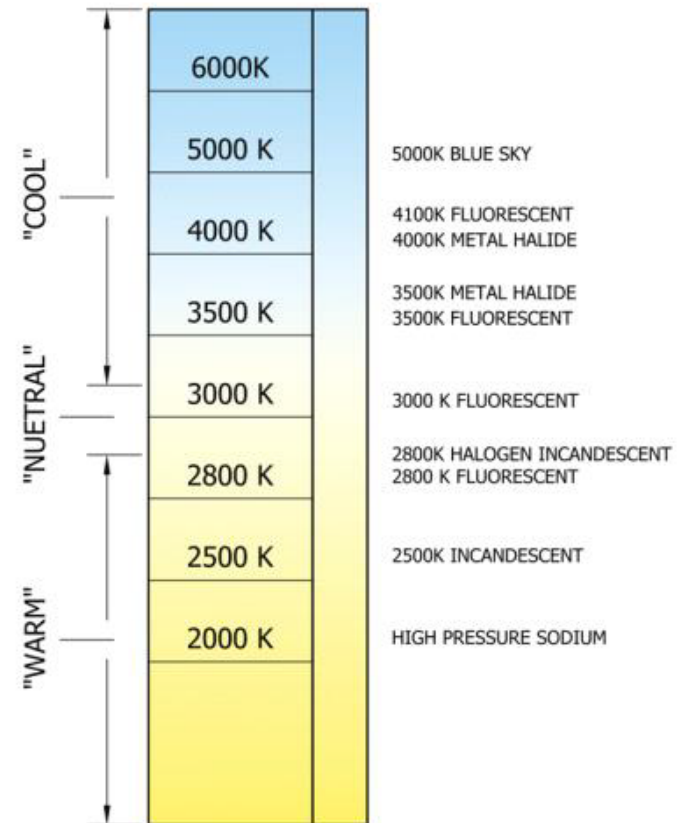
A graphic of a clipboard with a tan background and a white rectangular area in the center. Two black rectangular shapes are positioned at the top and bottom center of the clipboard, representing clips. The text "TECHNOLOGIC AL ADVANCES" is centered within the white area.

TECHNOLOGIC AL ADVANCES

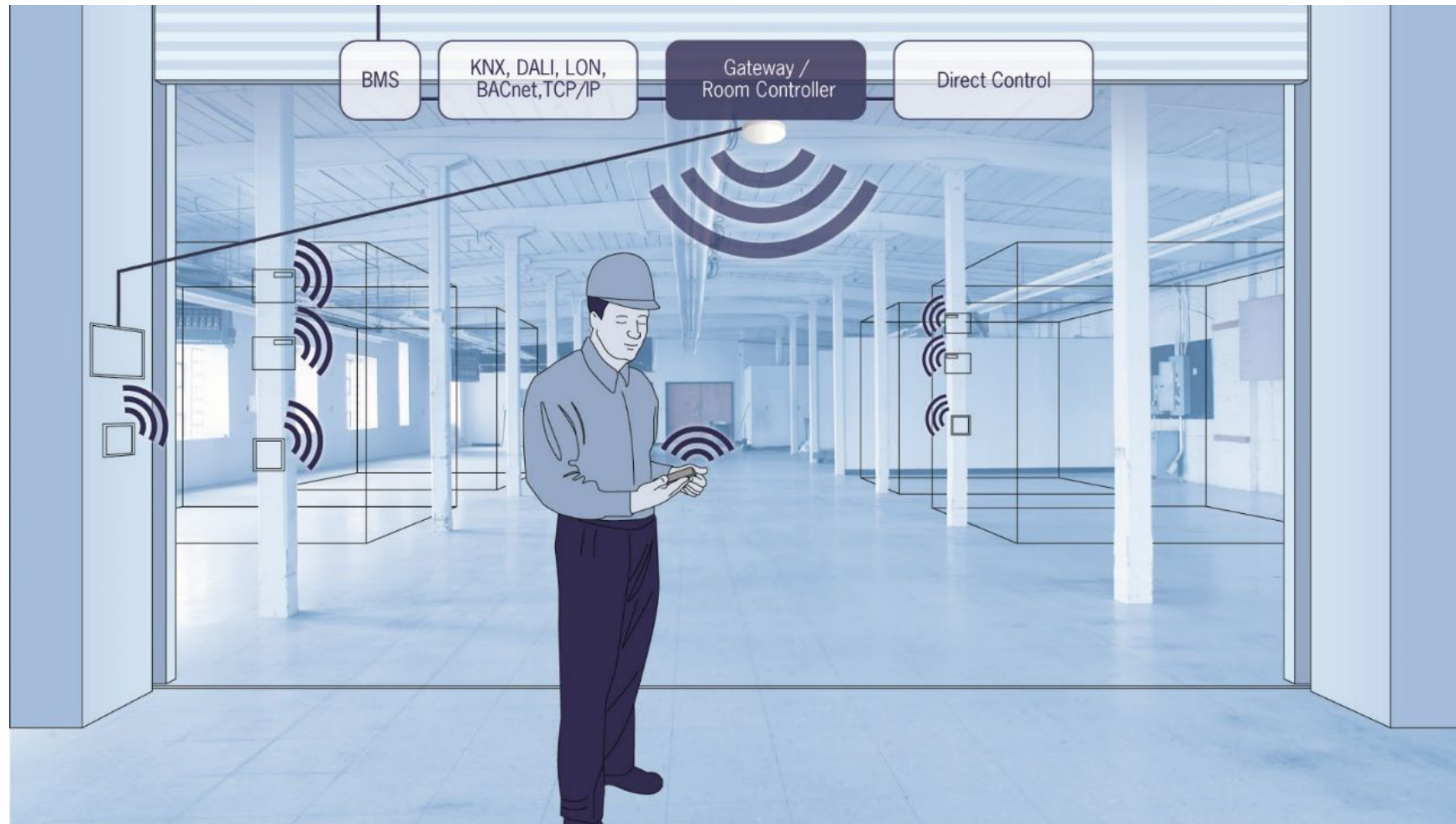
LIGHTING



CORRELATED COLOR TEMPERATURES (CCT)
OF COMMON LIGHT SOURCES



WIRELESS CONTROL SYSTEMS



LED 'SKYLIGHTS'

Transforming Dark Spaces

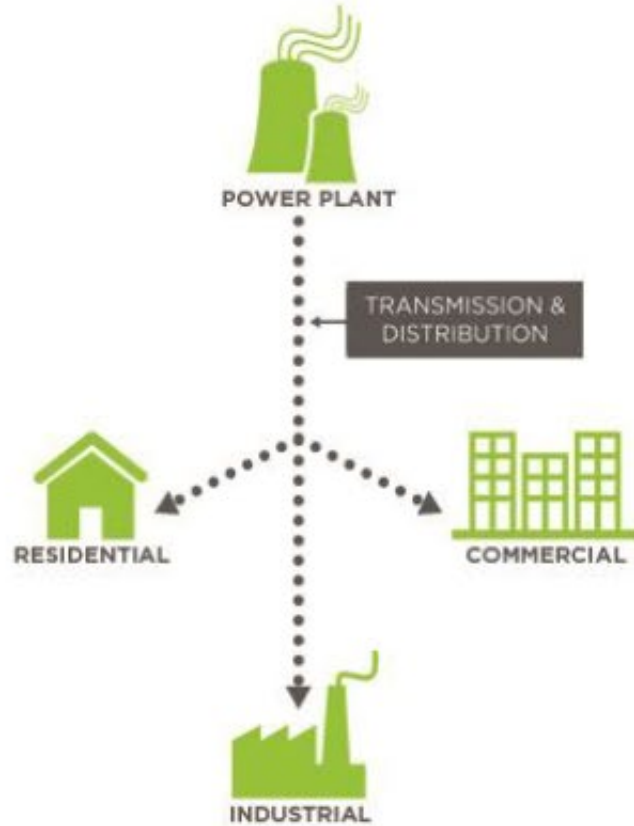


THE MODERN ENERGY GRID

The way of the future

TODAY: ONE-WAY POWER SYSTEM

Central, One-Way Power Systems



EMERGING: THE ENERGY CLOUD

Distributed, Two-Way Power Flows

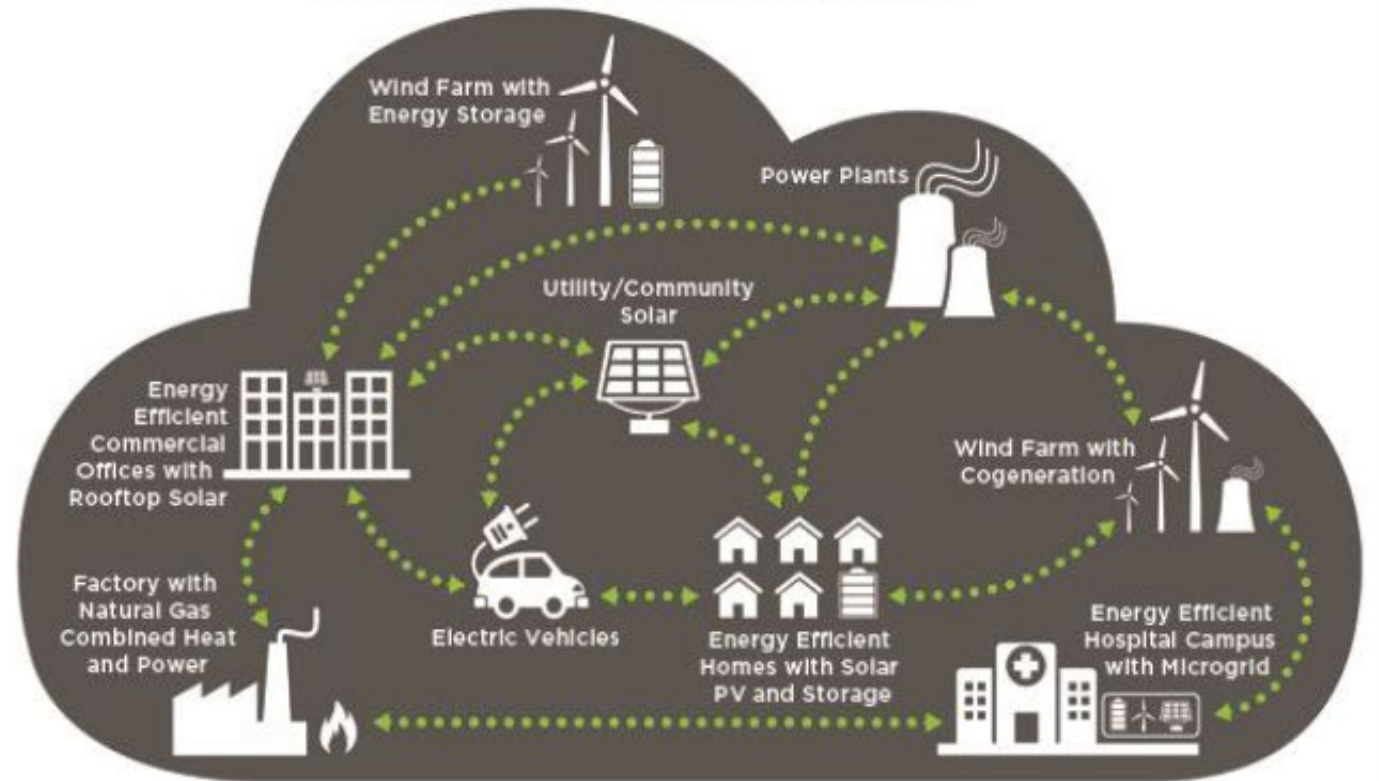


Image Source: DOE Grid Interactive Buildings/Navigant

SMART BUILDING TECHNOLOGIES

They have arrived!



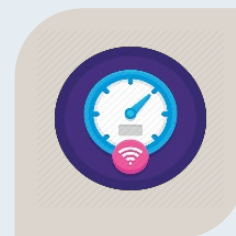
IOT ENABLED SMART
LIGHTING SYSTEMS



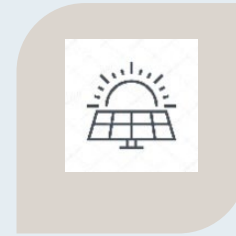
SMART HVAC
SYSTEMS



SMART PLUG
CONTROL

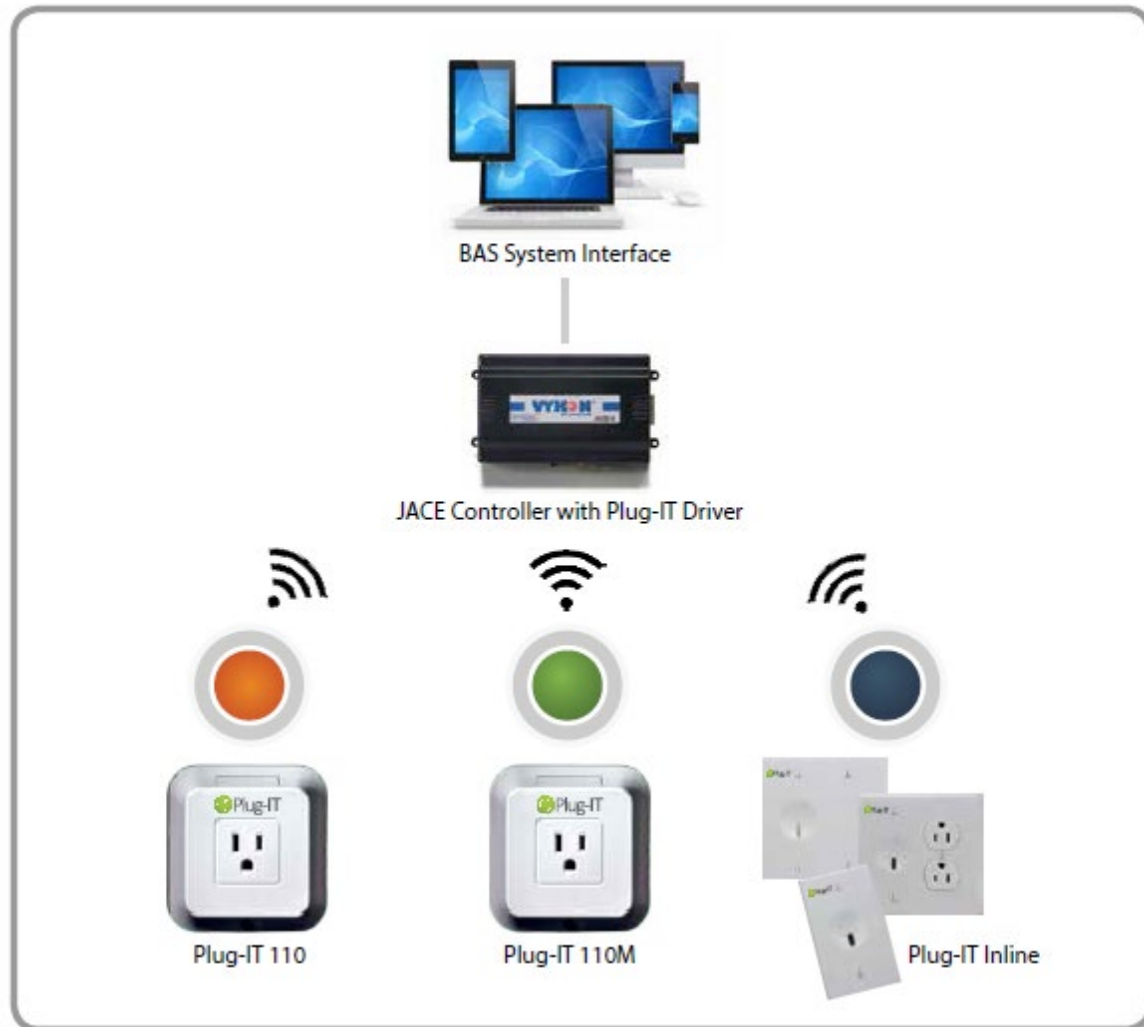


SMART METERS



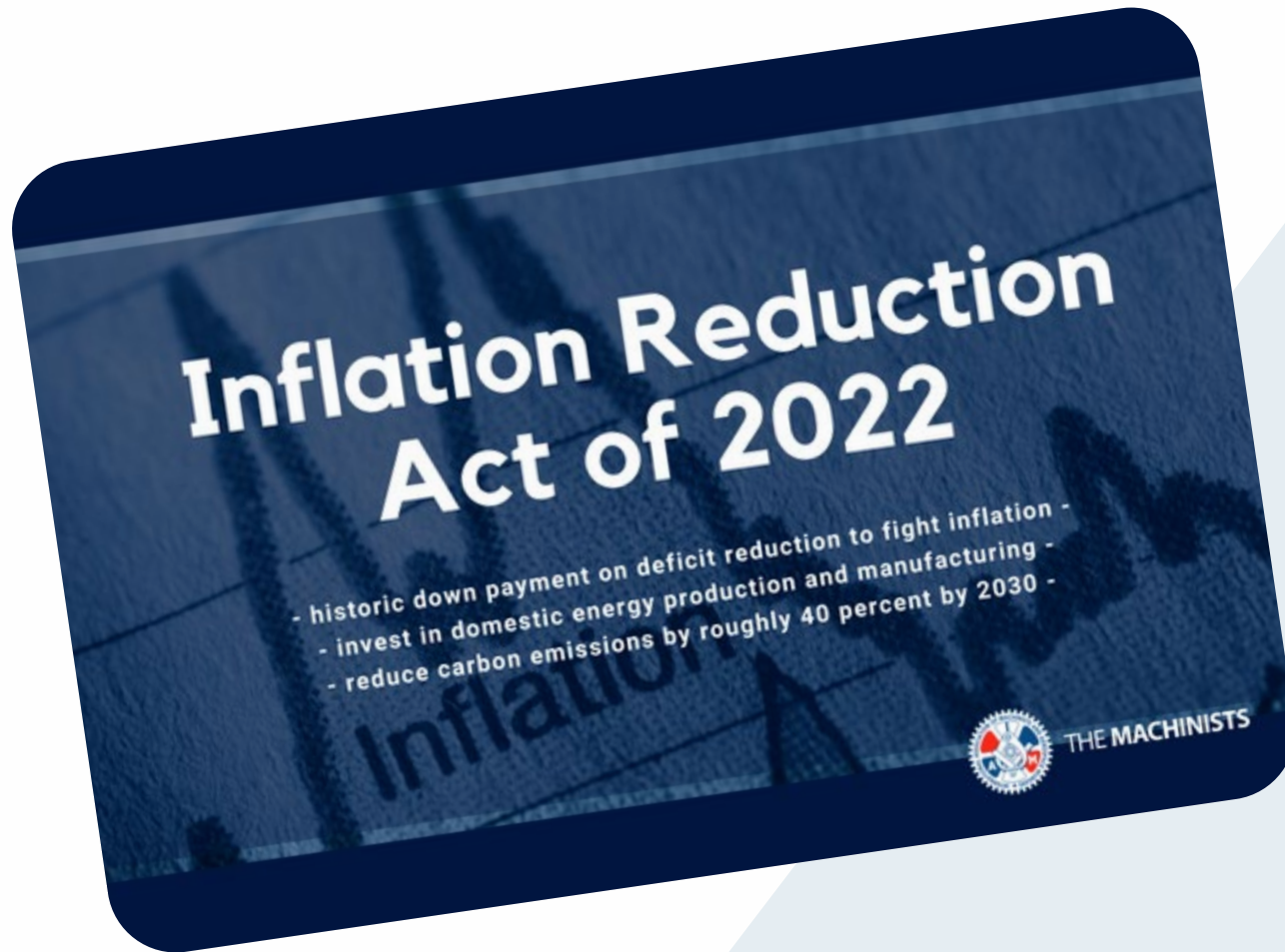
GRID INTERACTIVE
BUILDINGS AND
DISTRIBUTED
ENERGY RESOURCES

SMART PLUG TECHNOLOGY



- Wireless
- Addressable
- Power metering
- Scheduler
- Group control
- Integration with building lighting or HVAC system
- Report and Analysis
- Dashboard

INCENTIVES



Range of incentives and tax credits

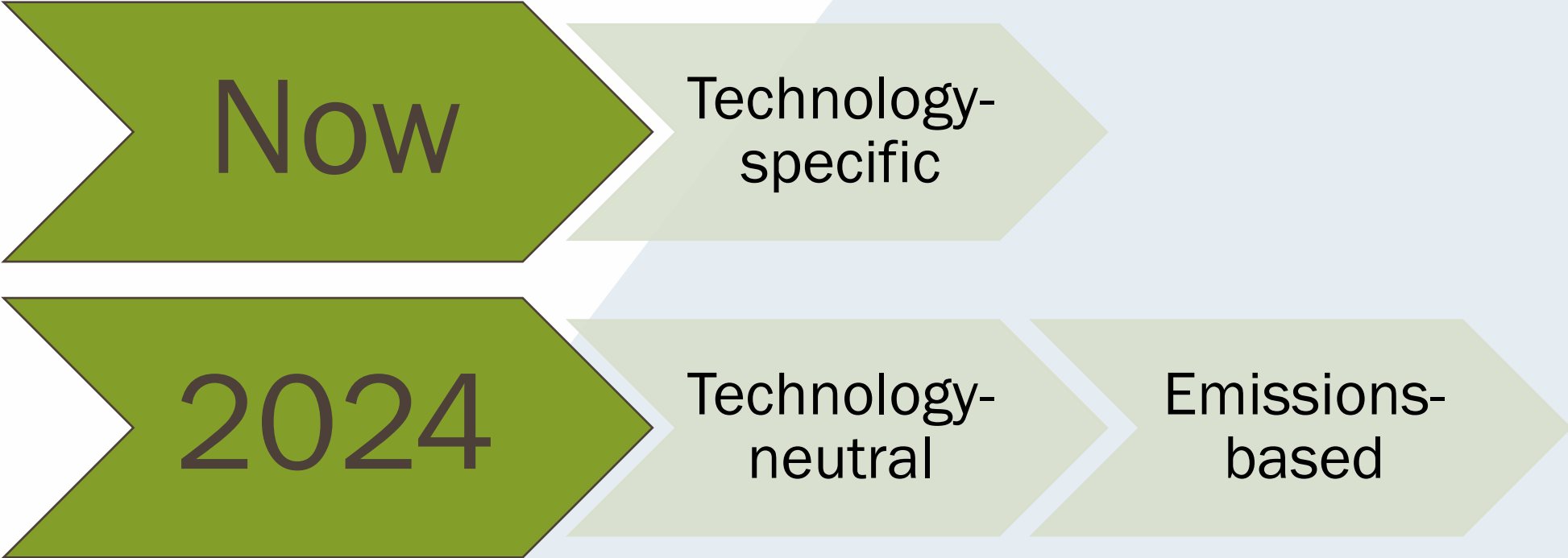
- Emissions-free energy
- Electric vehicles
- Nuclear power
- Clean hydrogen
- Electrification of buildings

RENEWABLE ENERGY GROWTH



- 10-year tax credit policy will provide the solar and energy storage sectors with needed certainty
- Returns tax incentive to **30%**
 - *Was slated to drop to 22% in 2023*
- Batteries now eligible

RENEWABLE ENERGY PRODUCTION TAX CREDITS



EVACUATED TUBES



- Indirect system
- Round tubes = always perpendicular to the sun's rays
- Much higher efficiency & holds temperature longer than a conventional single flat plate collector installed system

INCENTIVES

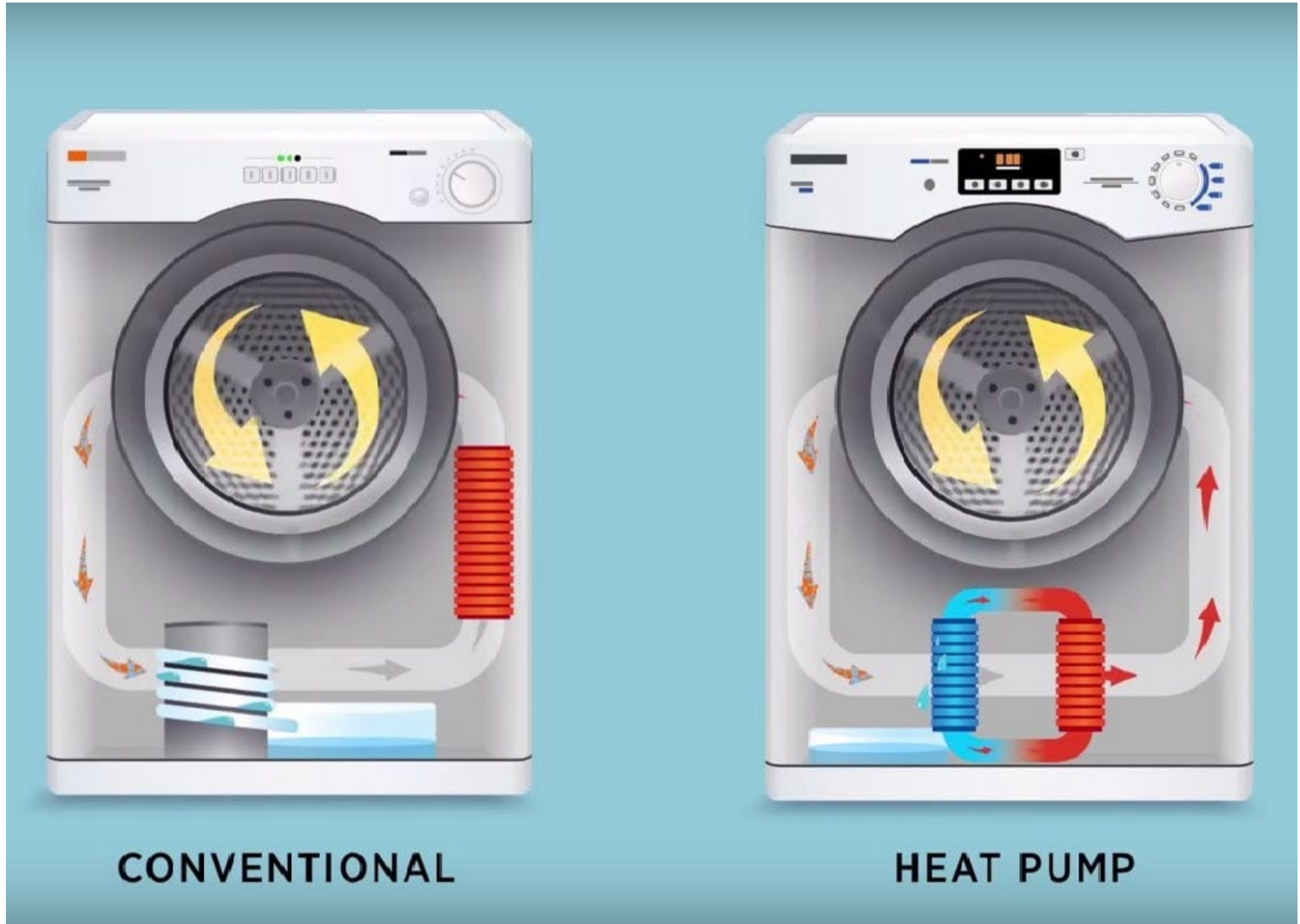
- ✓ Up to \$14,000 in rebates to switch over to electric appliances
 - ✓ \$8,000 heat pump, which serves as an air conditioner in the summer and heater in the winter
 - ✓ Up to \$9,100 for enabling improvements to the electric panel, wiring, and home insulation
- ✓ Alternative rebate option- 50% of whole-home energy efficiency retrofit or 80% for low- or moderate-income households

ENERGY STAR APPLIANCES

Dryers

Newer technologies

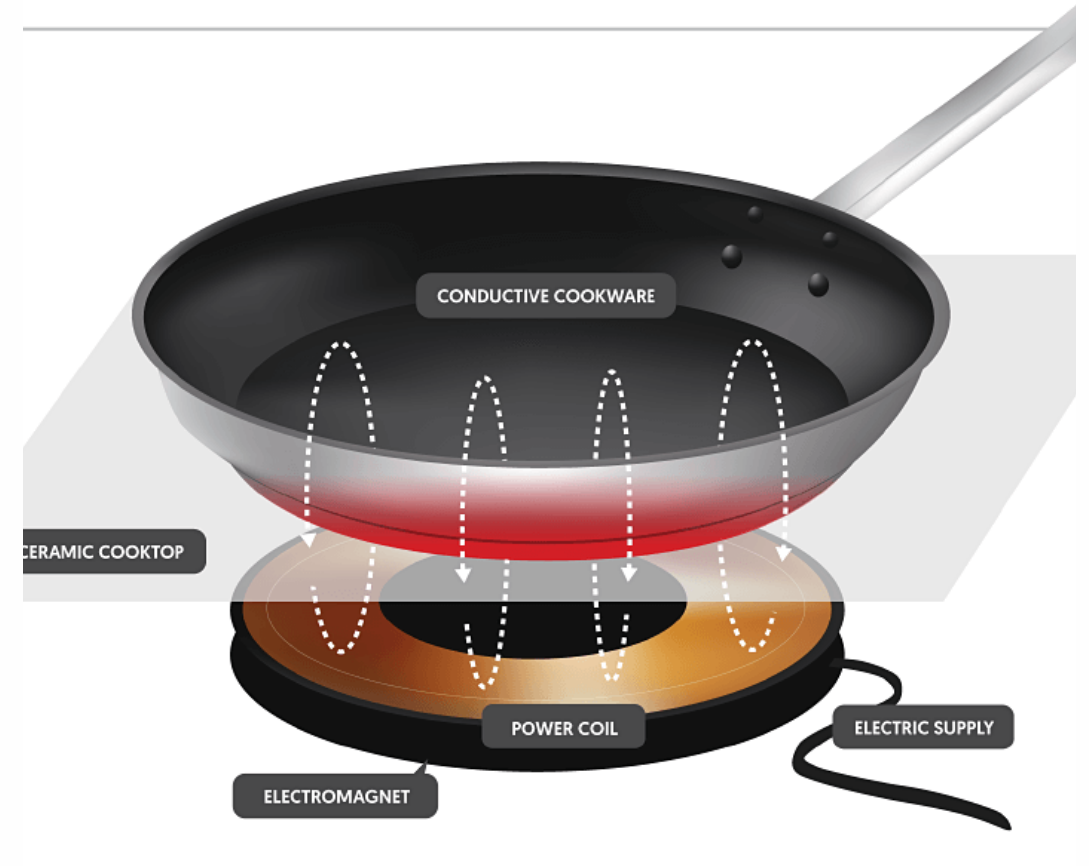
- Condensing Dryers
- Heat Pump Dryers
 - \$840 incentive



INDUCTION COOKING

How it works

- \$840 incentive
- No wasted energy heating the air
- Energy transferred directly to metal pans using magnetism
- Extremely fast, efficient & safe
- Better than gas (Yes, really!)



INDUCTION COOKING

Convenience Benefits

- More precise, consistent cooking
- Prepare foods faster
- Boil water in seconds
- Easier cleanup (saves time)
- Great party trick!



INDUCTION COOKING

Safety Benefits

- Zero risk of burns or fires
- Safer for pets, kids, elderly
- Features auto-shutoff
- No carbon monoxide fumes being breathed in
- Reduce CO₂ emissions

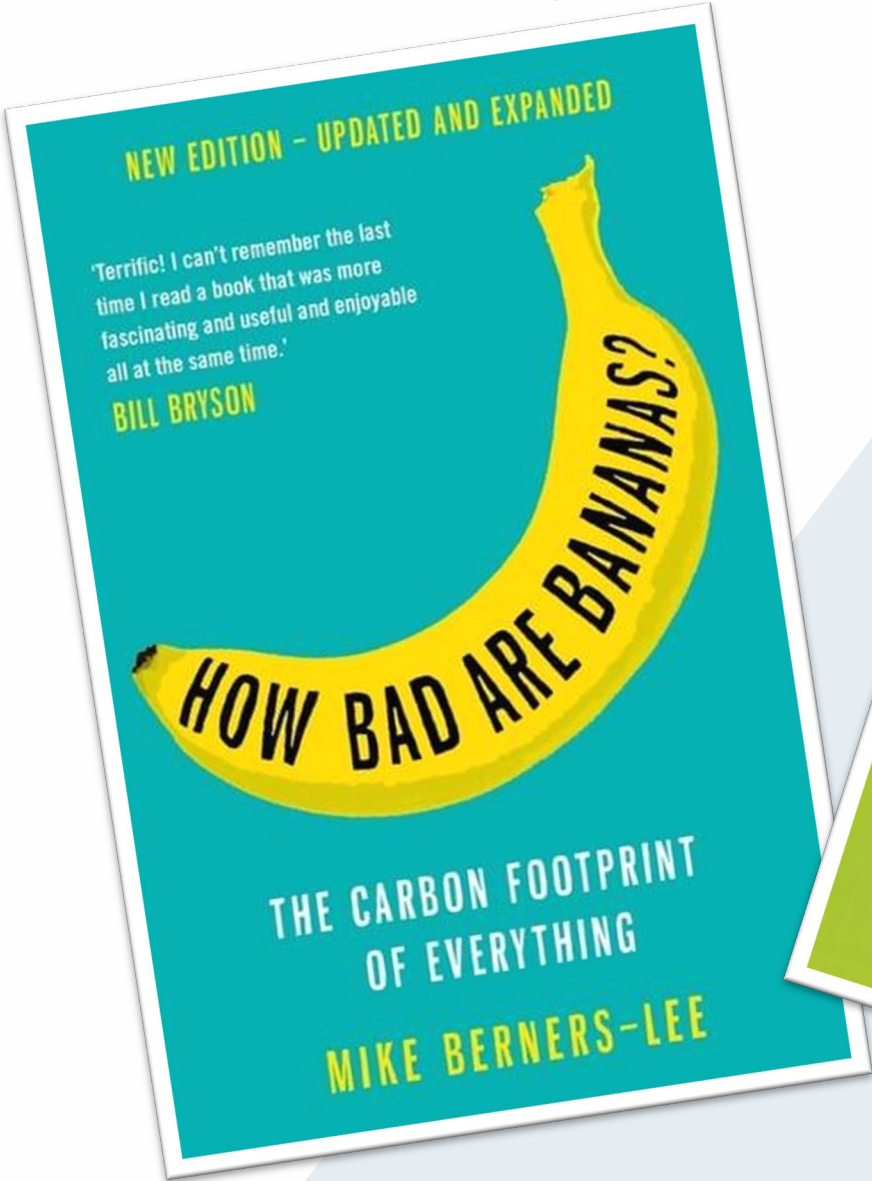


HEAT PUMP WATER HEATERS



- Also called “Hybrid Electric”
- Uses ‘free heat’ from ambient air around unit
- 4x more efficient than standard electric water heaters
- 70% energy savings
- No combustion = safer, lower carbon footprint
- Ideal location in 40-90F space
- \$1,750 incentive

MORE READING



Any
Questions

THANK YOU!

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Sustainability Director of North America



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