

All Electric Home

Presentation by Green Hudson - 5 December 2023



Agenda

Why Electrify?

Weatherization

Hudson Electricity Supply

Home Heating & Cooling

Hot Water

Cooktops

Lawn Equipment

Financing



Why Electrify your Home

Replace old equipment at lowest cost

Reduce operating costs

Easier equipment maintenance

Enjoy a more comfortable space

Reduce indoor air pollution

Reduce carbon footprint





Weatherization



To Get started call [1-888-772-4242](tel:1-888-772-4242) to schedule a free energy assessment with Energy New England (ENE)

Energy Efficiency report for 1-4 unit homes

Energy efficient lighting

Summary of rebates

DIY Weatherization Supplies (weather stripping, etc)



Weatherization

EVERSOURCE

To Get started call [1-866-527-SAVE \(7283\)](tel:1-866-527-SAVE) to schedule a free energy assessment

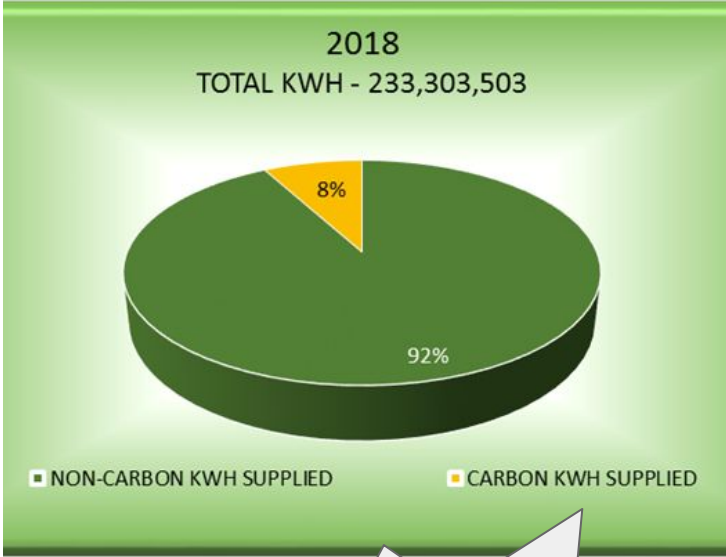
Energy Efficiency report for 1-4 unit homes

75% off home insulation

On the spot zero cost air sealing

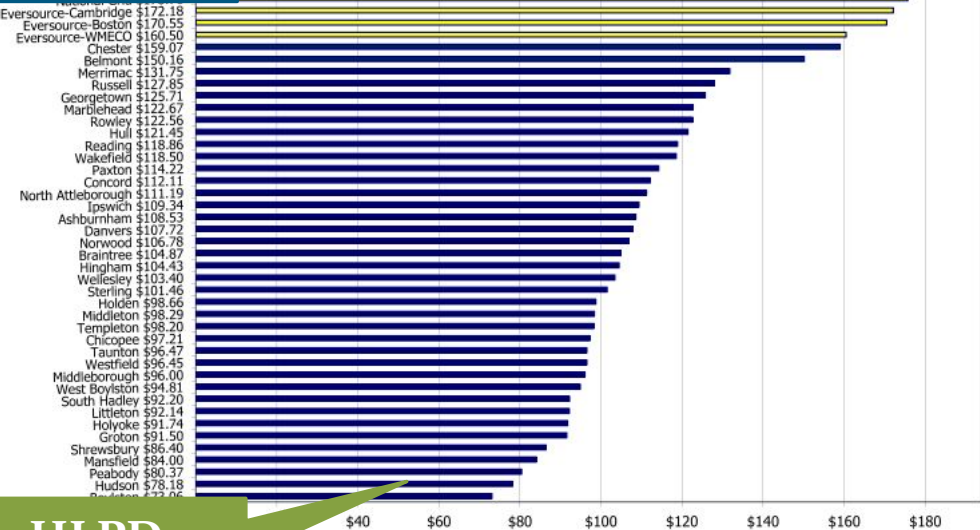
HEAT Loan Eligibility*

Hudson Light And Power



MA Avg
\$0.22+/kWh

Residential Rate Comparison 750 kWh
12 Month Average Rate (July 2017 - June 2018)

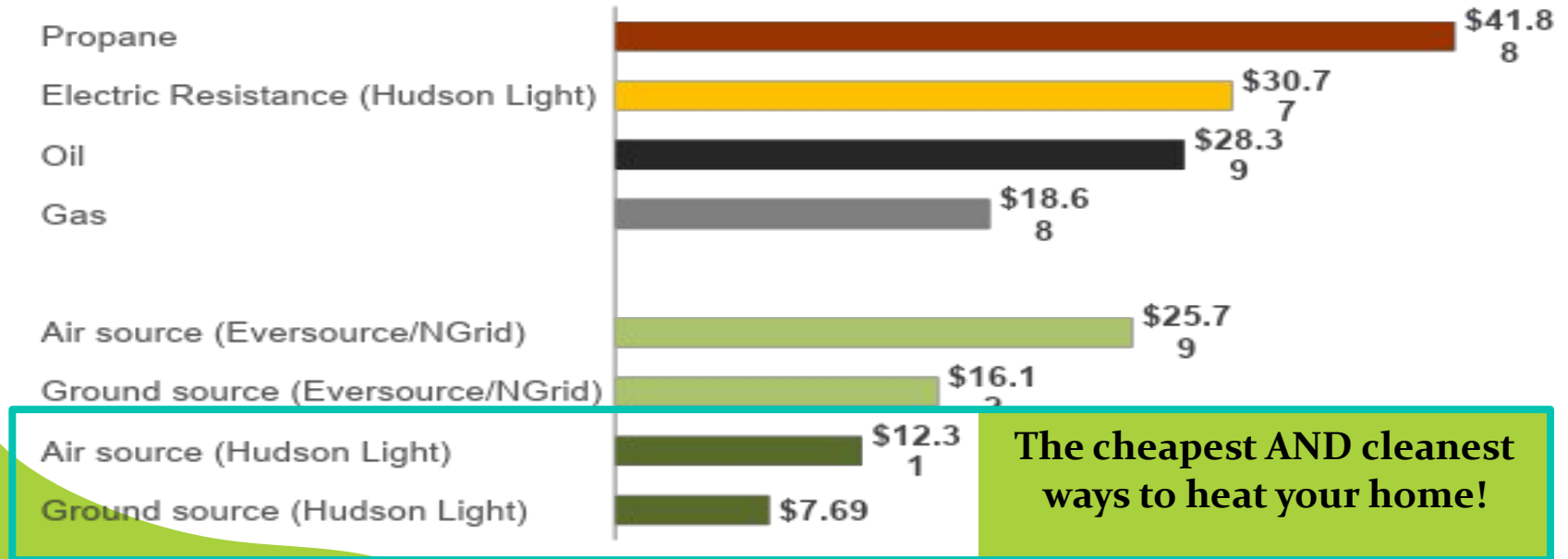


HLPD
\$0.077/kWh

HLPD
Low Cost
Energy

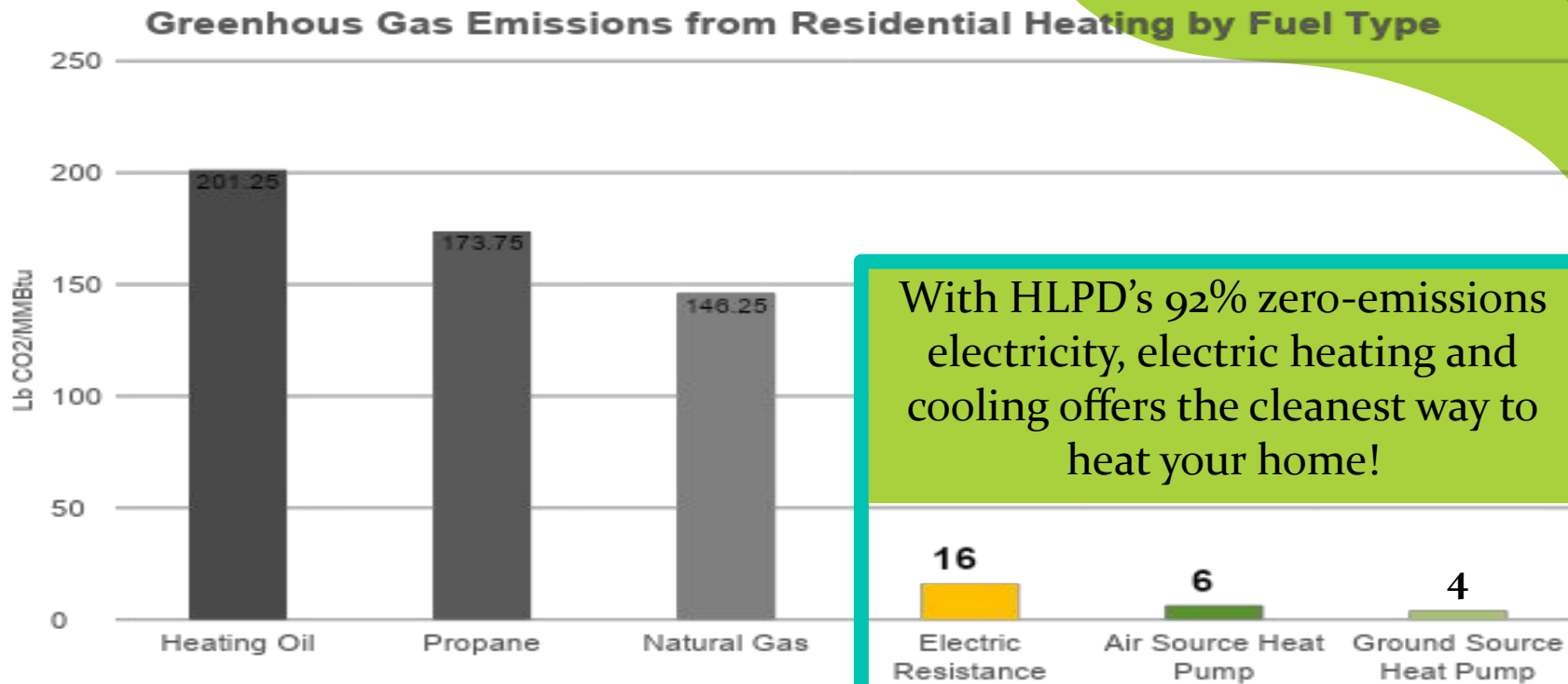
Lowest Cost Heating

Comparison of Residential Heating Fuel Costs(\$/MMBtu)



Assumptions: 2018-2019 fuel costs; gas from EIA (\$1.49/therm), oil (\$3.15/gallon) and propane (\$3.06/gallon) from DOER, electricity from Hudson Light and Power (\$0.105/kWh), COP 1 for electric resistance, COP 2.5 for ASHP, COP 4.0 for GSHP, AFUE 80 for propane/oil/gas.

Cleaner Air from Electric Homes



Sources & Assumptions: COP of 2.5 for ASHP, COP of 4.0 for GSHP; AFUE efficiencies of 80% for oil, propane, and gas; assumed HLPD grid emissions of 54.6 lb/MMBtu (92% zero-emissions + 8% ISO NE at 682 lb/MMBtu); EIA Fuel Conversion; EIA (2016) Carbon Dioxide Emissions Coefficients

Air Source Heat Pump

Interior



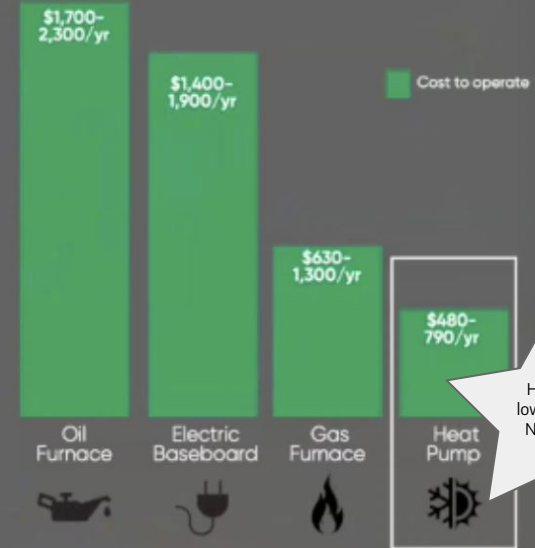
Exterior



Benefits

- Heating & Cooling
- Energy savings
- Quiet
- Healthier Internal Air
- Flexible solutions
- More comfort
- Address hot/cold spots and additions

Operating Cost



HLPD is lower than National rates

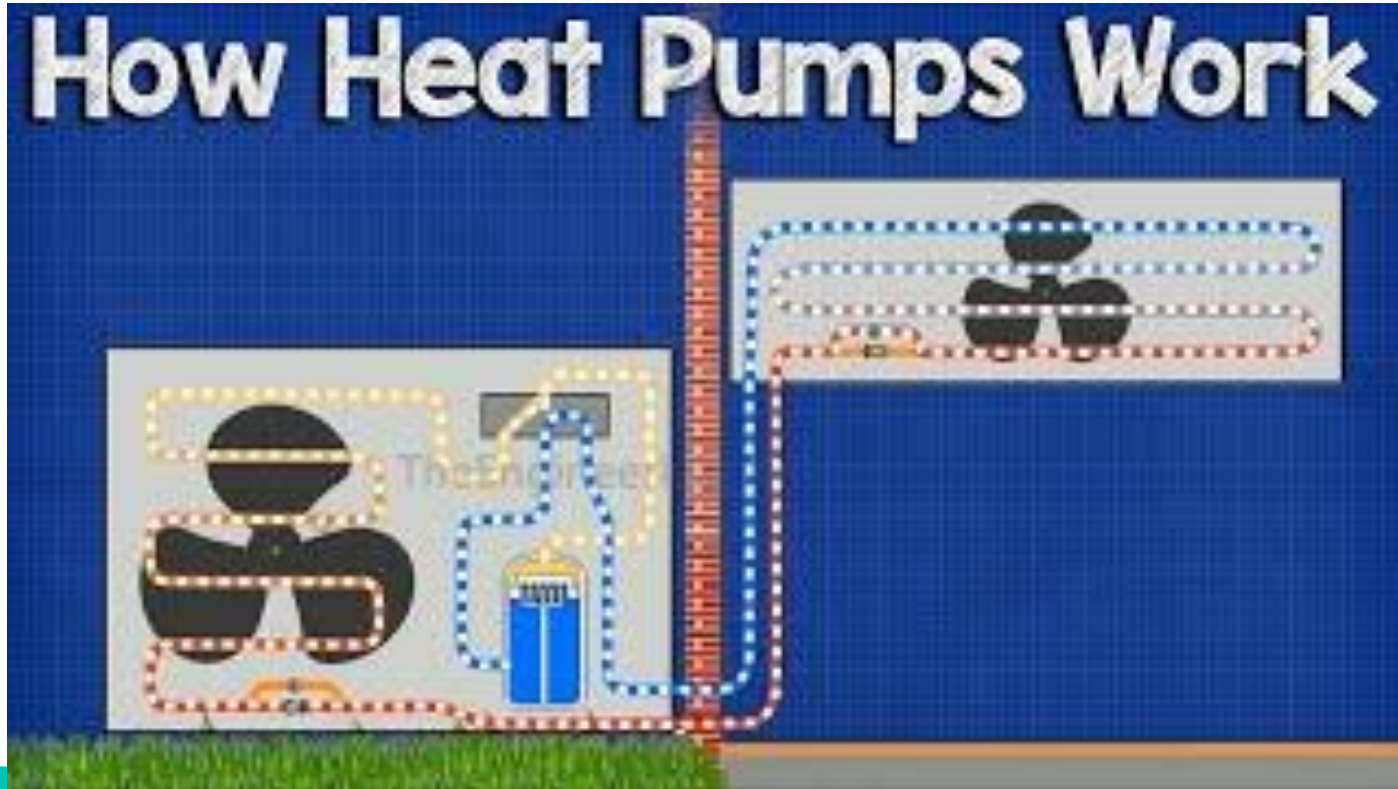
Rebates

Hudson Light	\$1750
MassSave	\$16000
State	NA
Federal	30% to \$2000

Installation Cost

Traditional: \$6000 - \$15000
 Heat Pump: \$2000 - \$8000

How Heat Pumps Work



Ground Source Heat Pump

Exterior



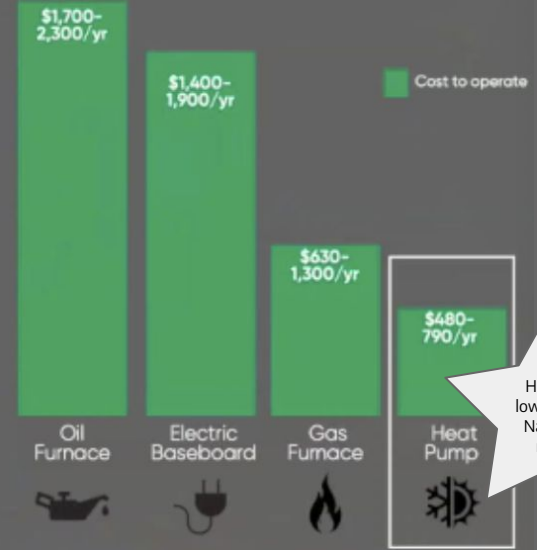
Benefits

- Heating and Cooling
- Lowest operating cost
- Long system lifetime
- No above-ground outdoor components
- Incorporates Hot Water
- Healthier Indoor Air

Rebates

Hudson Light	\$1750
MassSave	\$25000
State	NA
Federal	30%

Operating Cost



Installation Cost

Traditional: \$6000 - \$15000
 Heat Pump: \$10000 - \$17000

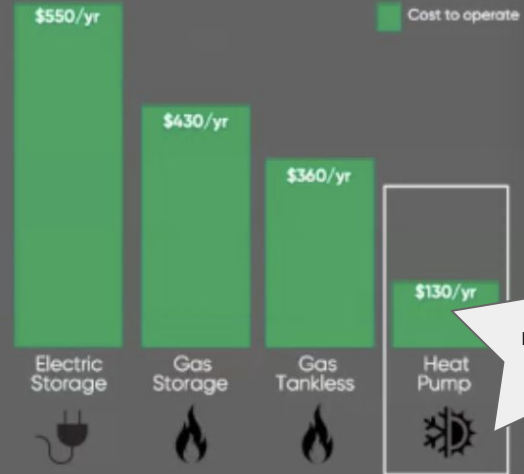
Hot Water Heat Pump



Benefits

- Lowest operating
- Exceptionally low cost after rebate
- Dehumidify

Operating Cost



Rebates

Hudson Light	\$750
MassSave	\$750
State	NA
Federal	30% to \$2000

Installation Cost

Traditional: \$800 - \$3000
Heat Pump: \$380 - \$8500

Induction Cooktop



Benefits

- Lowest operating
- Greater heating control
- Faster heating time
- Improve indoor air quality (over gas/propane)

Rebates

Hudson Light	\$50
MassSave	\$200
State	NA
Federal	TBD '24



Lawn Equipment



Benefits

- Low operating and maintenance cost
- No fuel to purchase, mix, or store
- Easier Start
- Quiet
- Improved air quality



Rebates

Hudson Light	\$40 - \$100
MassSave	\$75
State	NA
Federal	TBD '24



HEAT Loan



The Mass Save® HEAT Loan offers zero interest financing opportunities up to \$50,000*.

Interest-free financing of up to \$50,000 (heat pumps).

Interest-free financing of up to \$25,000 (other efficiency upgrades).

Call 866-527-SAVE (7283) to receive guidance on programs and incentives.

	Owner Occupied	Non-Owner Occupied
Clinton Savings Bank	Yes	Yes
Main Street Bank	Yes	No
Shrewsbury FCU	Yes	No



PACE



HUDSON
MASSACHUSETTS

Property Assessed Clean Energy (PACE)

Energy Efficiency Upgrades for owners of 5+ unit residences

20 year financing

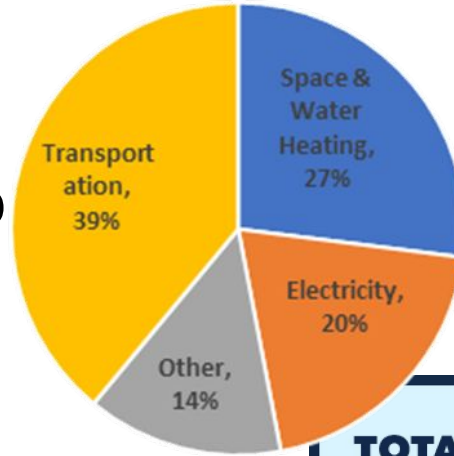
Assessment and Lien on Property

Transfer on sale

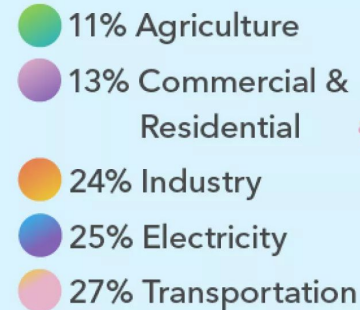
Reduce Carbon Pollution

1. Stop putting CO2 into the atmosphere
2. Get CO2 out of the atmosphere
3. Support a health ecosystem to endure climate changes damage

MA GHG Emissions



TOTAL U.S. GREENHOUSE GAS EMISSIONS BY ECONOMIC SECTOR (2020):



All Electric Home Rebate Summary

	ASHP (ducted)	ASHP (mini-split)	GSHP	Hot Water	Lawn	Appliances	Weatherize
HLPD	1750	\$625 - \$1250	\$1750	\$750	\$40-\$100	\$50 per appliance (\$250 max per year)	
Mass Save	\$16000	\$16000	\$25000	\$750	\$75	\$50-\$200	75%
Federal	30% up to \$2000	30% up to \$2000	30%	30% up to \$2000	TBD '24	TBD '24	30% of cost

The Mass Save® HEAT Loan offers 7yr zero interest financing opportunities up to \$50,000*.

Property Assessed Clean Energy (PACE) offers 20 year financing for multi-family investment properties.

References

<https://www.energy.gov/save>

<https://www.masssave.com/en/residential/rebates-and-incentives/heat-loan-program>

https://www.masssave.com/-/media/Files/PDFs/Save/Residential/rebate-forms/2024-Rebate-Matrix_Announcement.pdf

<https://www.hudsonlight.com/rebates>

<https://programs.dsireusa.org/system/program?state=MA>

<https://www.massdevelopment.com/what-we-offer/key-initiatives/pace/>



Green

Thank you

Hudson



Climate Change Solutions

Home

- **Switch home and water heating to energy efficient Heat Pump technology**
- **Replace lawn equipment with electric alternatives**

Civic Engagement

- Remind your elected officials and preferred candidates, schools, religious, and civic organizations of their role
- Solutions are only too expensive because we place financial priorities elsewhere
- Tell your favorite companies how much you like them and that you want them to be greener. Be willing to switch to a greener alternative

Food

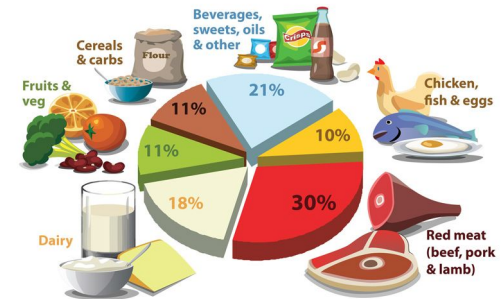
- **Support Organic and Sustainable Agriculture that increases natural carbon sequestration**
- Reduce Beef, Dairy, and Palm Oil consumption
- Minimize waste & packaging
- Compost and support native plants

Transportation

- **Minimize Air Travel**
- Maximize public transit
- Carpool
- Consolidate trips
- When it is time, purchase an electric vehicle that are right sized for your needs
- **Live local, work local, buy local**

Economic consumption

- Reduce & Reuse before Recycle
- **Buy furniture used or build for sustainable sources**
- Avoid fast fashion
- **Replace gas powered machines with electric versions, at end of service life**
- Reduce energy consumption during peak hours
- Question everything, watch out for Green-washing



Introduction

Brian White

Head of CE Software Advanced Development & Consumer Audio Outloud Software Development, Bose Corp.
Founder & Co-president, Green Hudson
Founder & Director, Hudson Land Trust

I'm a software engineer, not a climate scientist

I'm an introvert

More hobbies than I have time for:

- Hiking
- Biking
- Gardening
- Playing Clarinet
- Wildlife and Landscape Photography
- Playing Basketball
- Playing board games
- Making computer programs



End Fossil Fuels

The background of the slide features a sunset over a body of water. In the foreground, there are several silhouettes of oil pumpjacks (jack-o'-lanterns) against the bright, low sun. The sky is filled with soft, colorful clouds in shades of orange, yellow, and purple.

Coal, Oil, and Natural Gas have been critical to human progress over the last two centuries, but they are holding us back.

We need to break free from what is easy and do what is right

Embrace Clean Renewable Energy



Work with nature

Generate energy that doesn't contribute to global warming

Begin the process of drawing down atmospheric and oceanic CO₂

Are we the victims of natural processes? – No!



Solar Cycles

- “grand solar minima” - a slight cooling

Changes in Earth's orbit

- Can cause significant climate change
- Ice age projected in the next 1500 years

Volcanos

- Can impact the climate
- Generally short term, <20 years, cooling effect.

Plate Tectonics & Ocean Currents

- New ocean and a new currents
- Exposure of reactive rocks which absorb CO₂.
- Long term cooling trend

Evolutionary Change

- New life forms can significantly alter the climate
- Proto-plants and plant life captured and sequestered CO₂
- Several periods of rapid cooling.

Climate Change in New England

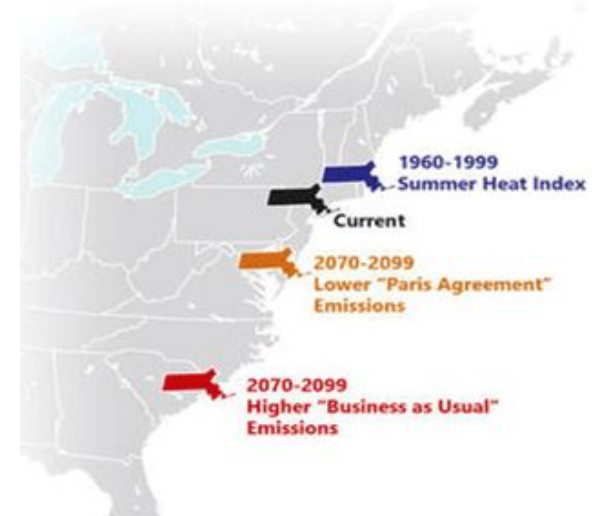
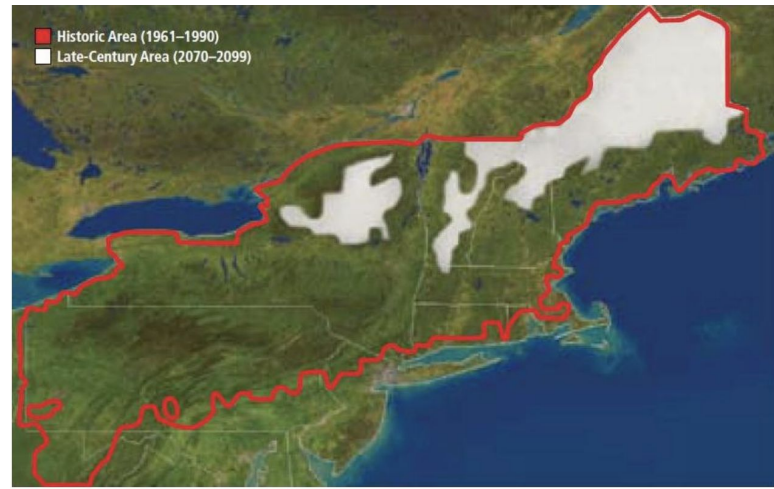
Reduced Snowfall

Reduced # cold days

Increased # hot days & high extreme temperatures

Increase in extreme weather events

Ocean Warming & Sea Level Rise





“I’d put my money on sun and solar energy.
What a source of power! I hope we don’t
have to wait until oil and coal run out before
we tackle that.”

—Thomas Edison (1931)

What Causes Climate Change?



CO₂ (Carbon Dioxide)

Wood & Fossil Fuel Combustion
Human & Animal Respiration
Plant Decay
Volcanos

CH₄ (Methane -- ie Natural Gas)

More potent than CO₂
Oil Drilling
Natural Gas Drilling
Natural Gas Transportation
Human & Animal Digestion
Anaerobic (without oxygen) Plant Decay
Landfill & Waste Treatment

N₂O (Nitrous Oxide)

Synthetic Fertilizer
Fuel Combustion
Waste Treatment

- 5000 BCE - 1850 - Pre-industrial world (**270 ppm**)
 - 1861 - 1865 Railroads were a major front in the American Civil War
 - 1862 John Tyndall discovered that certain gases, including CO₂, helped to trap heat inside the atmosphere.
 - 1875 Oil discovered in Warren, PA
 - 1885 Karl Benz car invented
 - 1890 Electric vehicle invented
 - 1896 Svante Arrhenius Swedish scientist that was the first to claim that fossil fuel combustion may eventually result in enhanced global warming.
- CO₂ PPM = 282 ppm (estimated)**

Action Corner:

Create an Energy transition plan for town
Stop expansion of Natural Gas infrastructure
Weatherize your home to reduce individual energy consumption
Convert homes to be all electric with heat pumps

Why do GHGs cause Climate Change?

Sun's energy -> full spectrum light

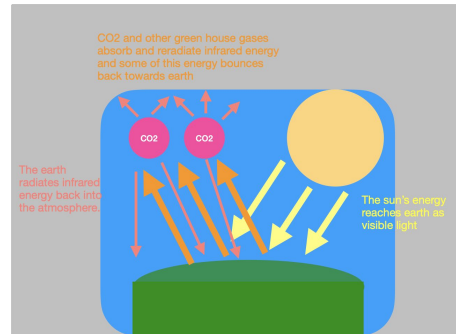
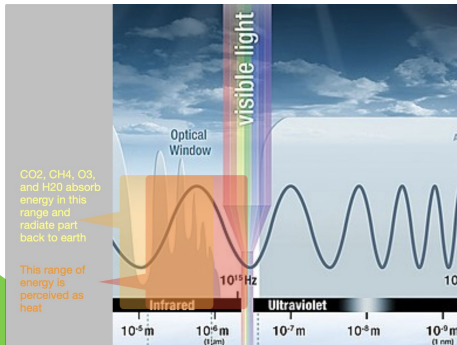
Earth reflects energy -> Infrared (heat)

GHG react with the infrared energy and reflect it back towards earth, instead of exiting the atmosphere

- 1824 Joseph Fourier began to explore the question “Why doesn't the planet keep heating up as it receives sunlight? What is regulating our atmospheric temperature?”
- 1825 Steam Locomotives begin operation in the UK

CO2 PPM = 280 ppm (estimated)

For all of human history, up to the industrial revolution, CO2 levels have been around **270ppm (estimated)**

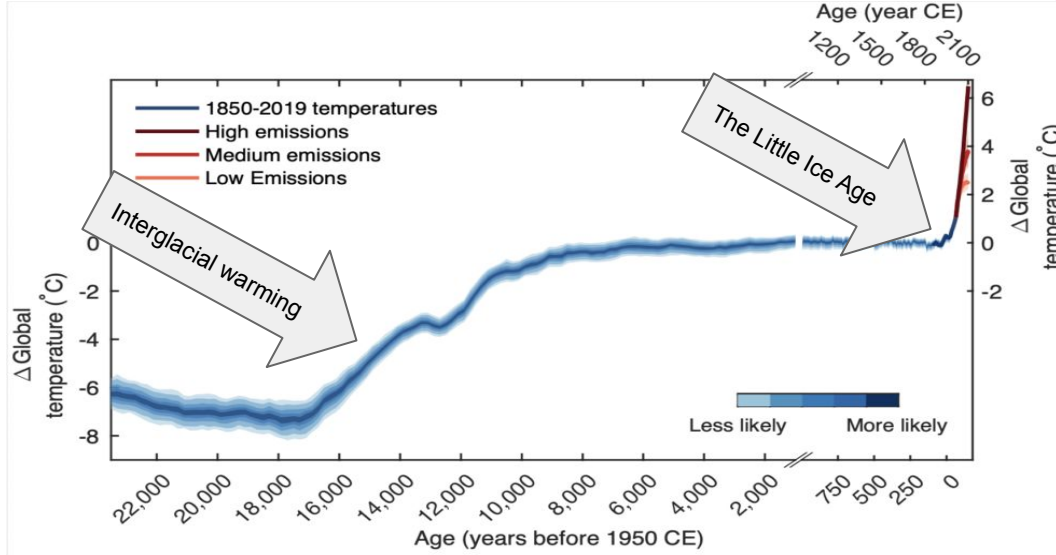


Action Corner:

Plant Native Trees & Shrubs
Support rewilding of unused areas
Plan to reduce suburban sprawl
Preserve and connect wild places
Avoid palm oil and other products that incentivize deforestation practices.

Hockey Stick

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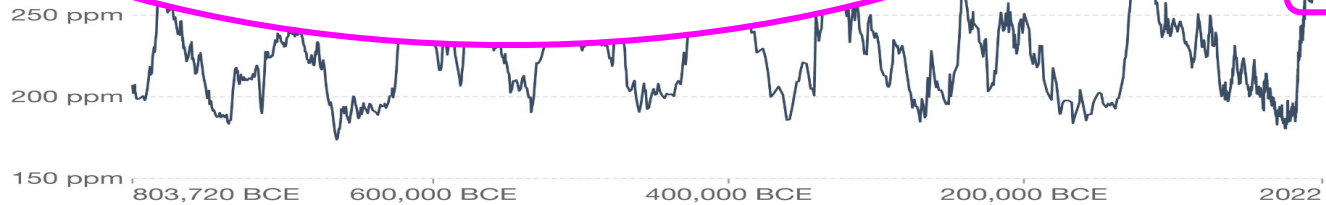


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Our World
in Data

World



Efficient energy use (WIP)

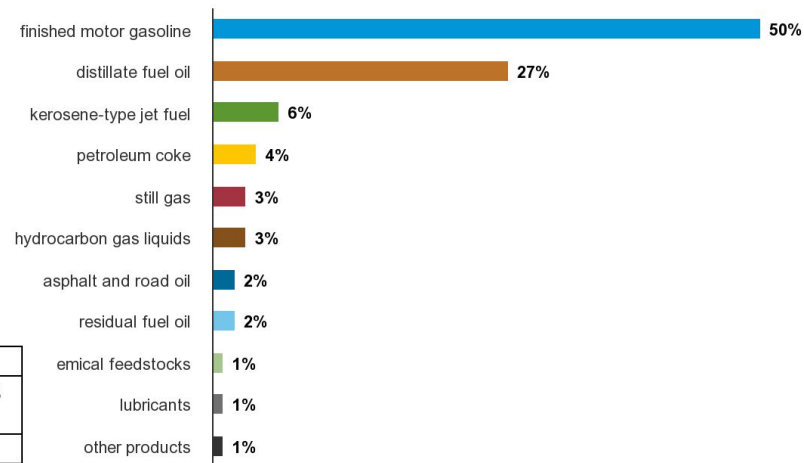


Table 5. Refining Energy Efficiencies for Individual Petroleum Products

	Overall Petroleum Refinery Efficiency	
	90.1% (with all products included)	86.4% (with less desirable products excluded)
Gasoline	87.7%	83.3%
Diesel	90.3%	86.7%
LPG	94.3%	92.1%
Residual oil	94.3%	92.1%
Naphtha	94.3%	92.1%

U.S. refiner and blender net production of petroleum products, 2020

total = 6.40 billion barrels



source: U.S. Energy Information Administration, *Petroleum Supply Annual*, August 2021