Climate Change

Personal Action Options

Barry Romich and Fred Michel

Wayne County Sustainable Energy Network

WCSEN.org

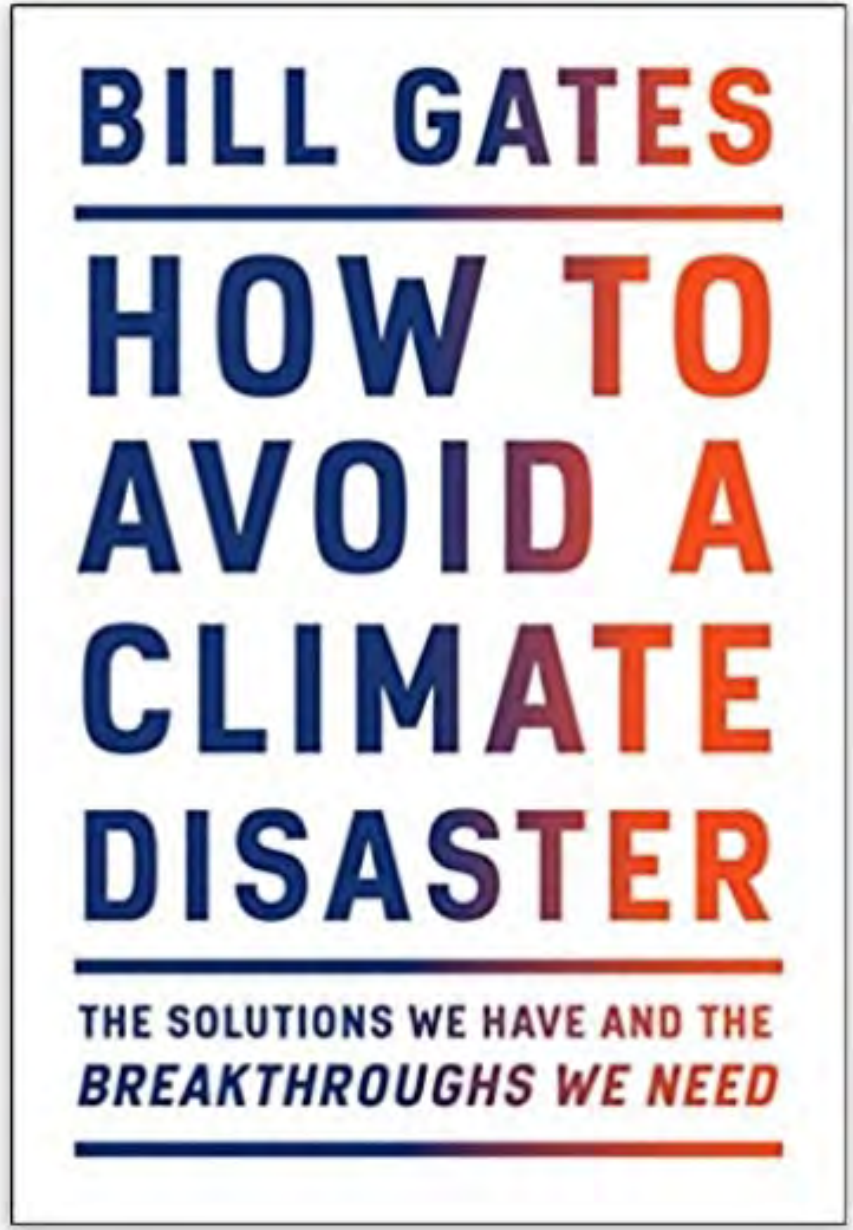
SUSTAINABLE ENERGY NETWORK
WAYNE COUNTY

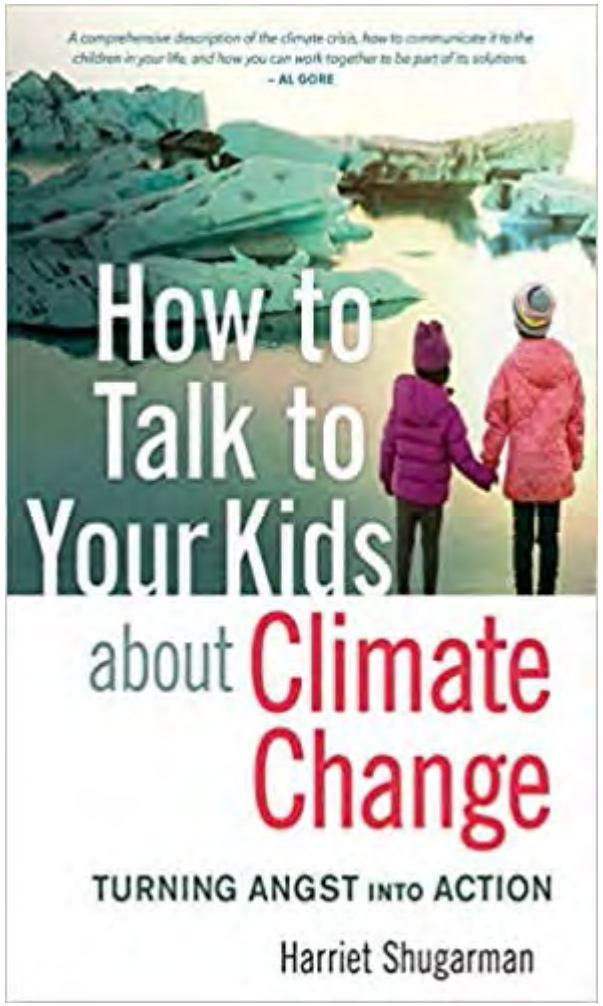
Do you have kids, grandkids, great grandkids?

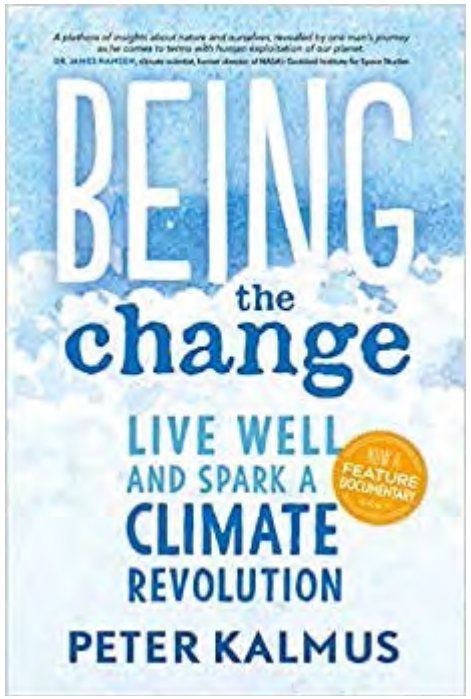
Do you care about them?

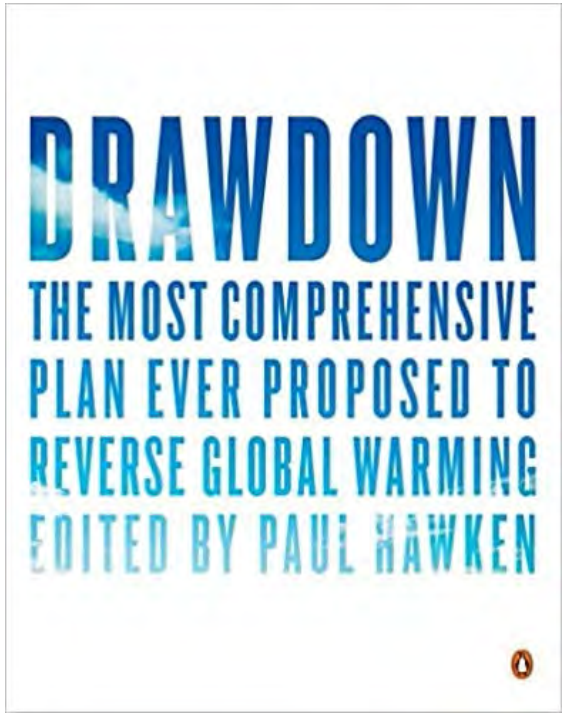
I have this conversation in my mind.
With my grandkids' grandkids.
They ask "What were you thinking?"

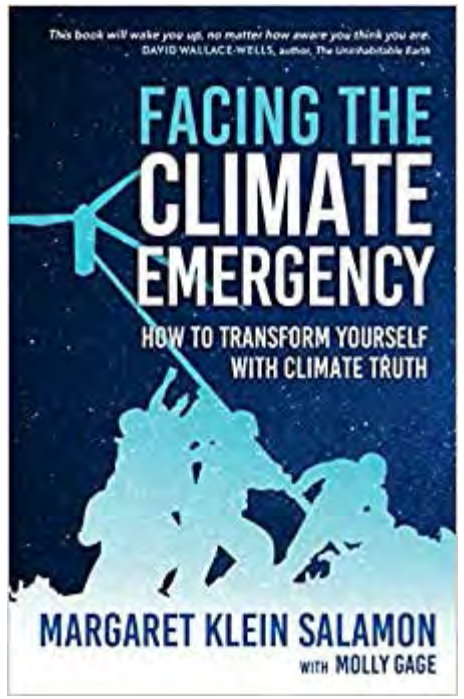
I cannot say I didn't know, just that I'm sorry.
This inspires me to do what I can now.


BILL GATES
HOW TO AVOID A CLIMATE DISASTER
THE SOLUTIONS WE HAVE AND THE BREAKTHROUGHS WE NEED

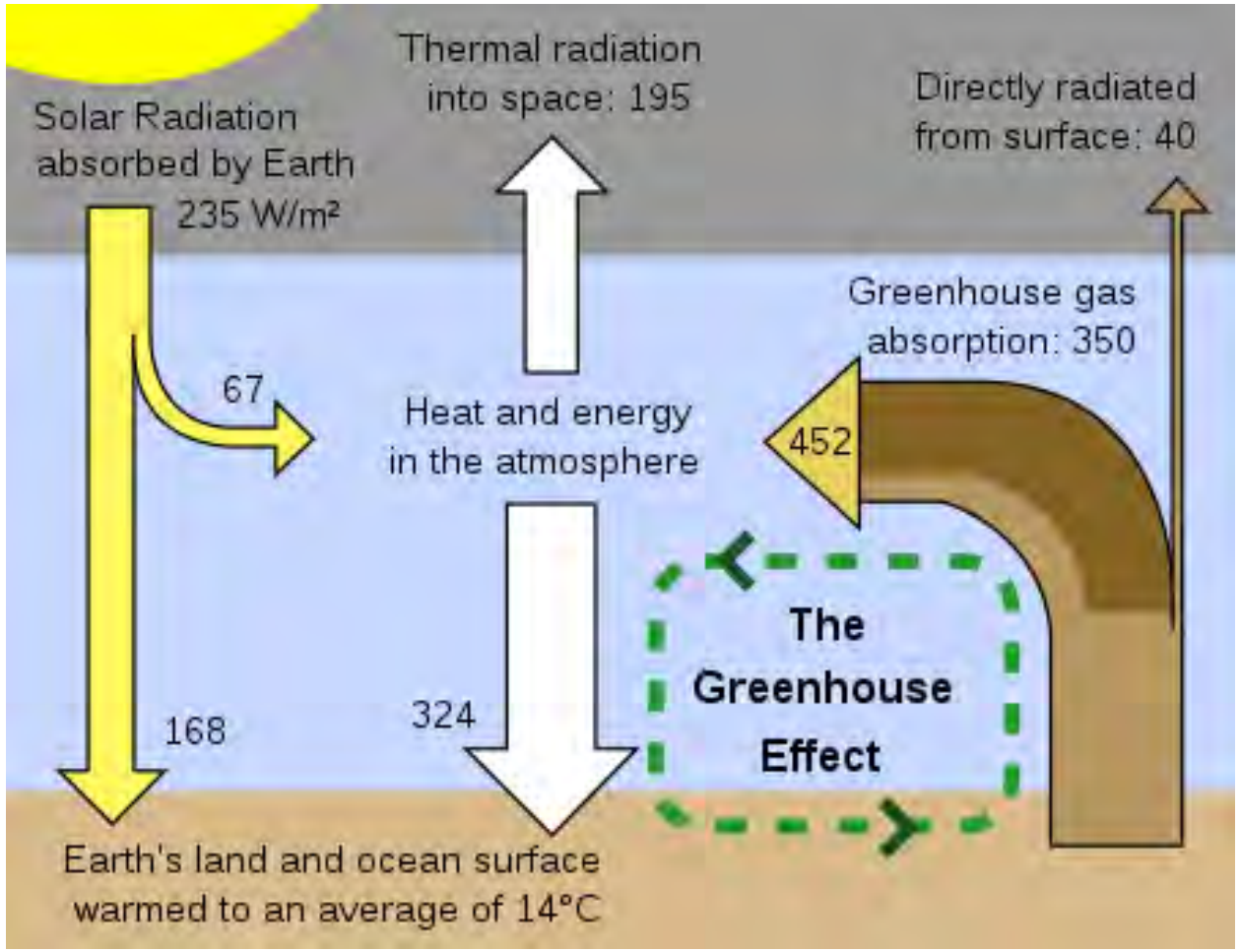

A comprehensive description of the climate crisis, how to communicate it to the children in your life, and how you can work together to be part of its solutions.
– AL GORE
How to Talk to Your Kids about Climate Change
TURNING ANGST INTO ACTION
Harriet Shugarman


BEING the change
LIVE WELL AND SPARK A CLIMATE REVOLUTION
FEATURE DOCUMENTARY
PETER KALMUS


DRAWDOWN
THE MOST COMPREHENSIVE PLAN EVER PROPOSED TO REVERSE GLOBAL WARMING
EDITED BY PAUL HAWKEN


This book will wake you up, no matter how aware you think you are.
DAVID WALLACE-WELLS, author, The Uninhabitable Earth
FACING THE CLIMATE EMERGENCY
HOW TO TRANSFORM YOURSELF WITH CLIMATE TRUTH
MARGARET KLEIN SALAMON
WITH MOLLY GAGE

What causes climate change?



Wikipedia

There are many issues,
Some of which are global in nature
and outside what we as individuals
can readily influence.

How much greenhouse gas is emitted by the things we do?

Making things (cement, steel, plastic)	31%
Plugging in (electricity)	27%
Growing things (plants, animals)	19%
Getting around (cars, trucks, planes, cargo ships)	16%
Keeping warm and cool (heating, cooling, refrigeration)	7%

Gates

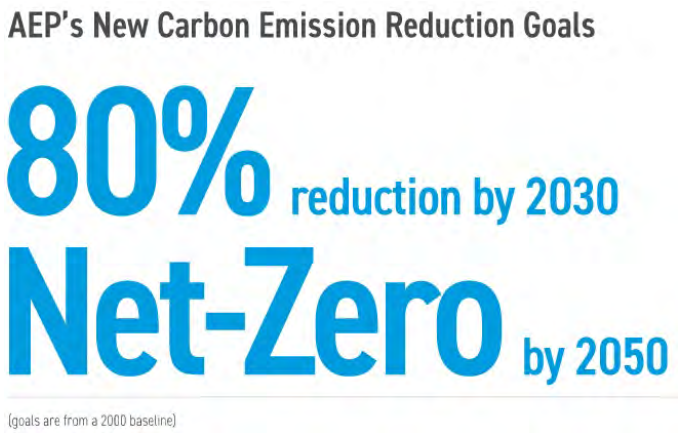
The focus for today is on actions that we as individuals can take now.

- **Home power (27%)**
- **How we grow things (19%)**
- **Transportation (16%)**
- **Home heating - A/C (7%)**
- **Investing**

Home Power (27%)

AEP Total Net Generation (2020) (MW-Hr)	**94,529,102**
Coal	**42,595,308**
Natural Gas	**18,530,960**
Nuclear	**18,268,937**
Renewable (wind, solar, hydro)	**15,133,897**

(~65% carbon-based fuel)



Home Power

What can I do?

Use less energy and choose renewable

(an option offered by many power companies)

Stop or reduce buying from AEP.

(Add your own renewable energy)

(wind, solar, hydro)

(Ask Ohio legislators to take action.)

(Colorado example)

Growing Things (19%)

Energy return (food energy / fossil fuel energy for production) for meat: ~ 35%

Energy return for plant-based food: ~ 330%

Diet

What can I do?

Eat less meat.

Try meat substitutes.

Get protein, calories, and other nutritional needs from other sources.

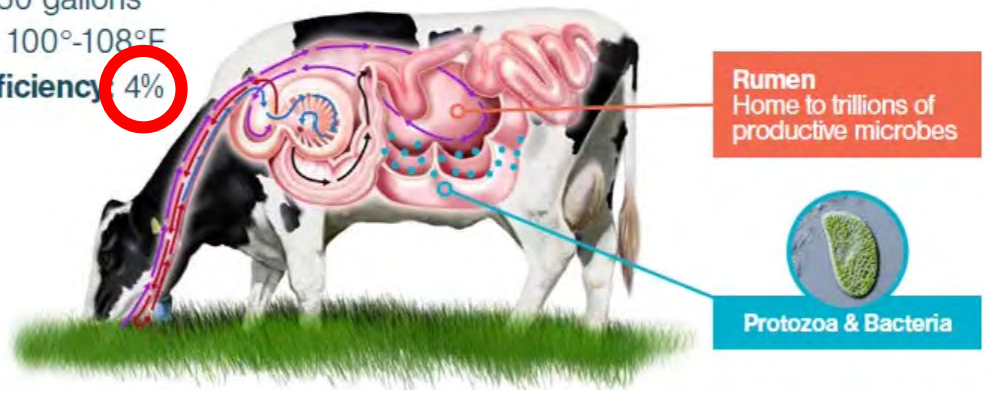
Be alert for changes coming. Agriculture is changing.

RethinkX:
The First Step To Replacing The Inefficient Cow, Milk

Cow Protein Production

Cow Rumen – the production of protein is the work of many microbes inhabiting the rumen of the cow.

Capacity: 40-50 gallons
Temperature: 100°-108°F
Feedstock Efficiency: 4%



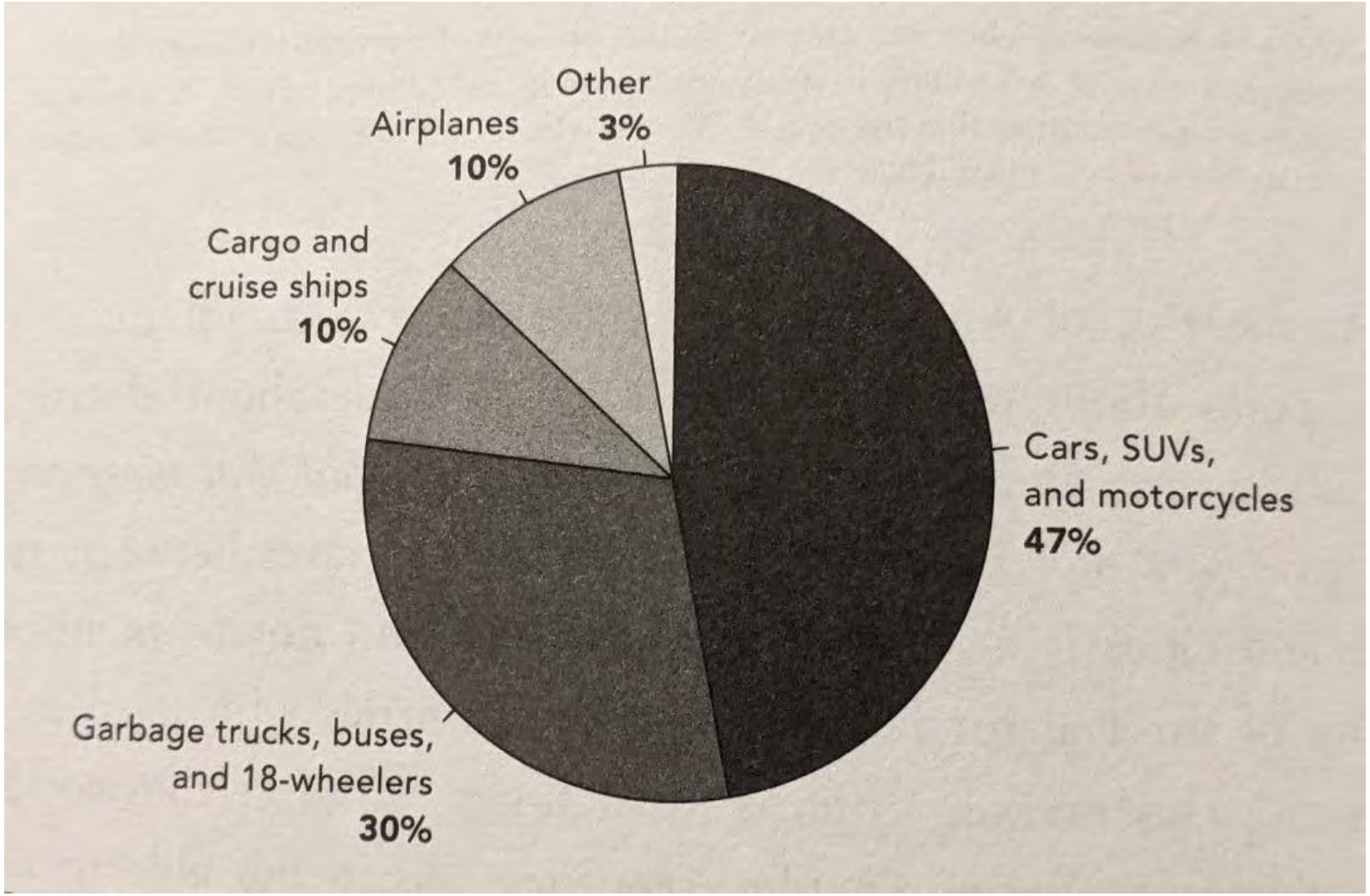
Precision Fermentation Protein Production

The production of protein is also the work of microbes, designed to manufacture desired proteins in tightly-controlled environments.

Capacity: 50-10,000 gallons
Temperature: Optimized
Feedstock Efficiency: 40%-80%

Source: RethinkX, Impossible Foods

Transportation (16%)



Transportation-Related Emissions

Transportation (16%)

What can I do?

Drive less.

Drive smarter. Carpool.

Drive on emission-free fuel. (It's cheaper.)

Buy smarter. (You're buying transportation)

Home Heating - A/C (7%)

Unwanted heat gain/loss has three components.

- **Conduction (maximize insulation R rating)**
- **Convection (stop air leaks)**
- **Radiation (use radiant barrier to reflect)**

~ 90% of homes in the USA have A/C.

Home Heating - A/C (7%)

What can I do?

Heat and air condition less.
(Adjust thermostat; Replace thermostat.)

Consider all three heat loss/gain factors
in new construction and remodeling.

Get off natural gas for heating. (California building code)
Change to geothermal.

Investing

What can I do?

Review your investment portfolio.
Eliminate investments in fossil fuel development.
Stop supporting organizations with fossil fuel investments.
Consider socially responsible investment management.

Resources

https://en.wikipedia.org/wiki/Climate_change

https://cleantechnica.com/

https://www.carbonbrief.org/

These slides will become available at wcsen.org.

Reducing Our Carbon Footprint

Fred Michel

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The Ohio State University

THE OHIO STATE UNIVERSITY
COLLEGE OF
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ENVIRONMENTAL SCIENCES

SEN
SUSTAINABLE ENERGY NETWORK
WAYNE COUNTY

“The American Way of Life is NON-NEGOTIABLE!”

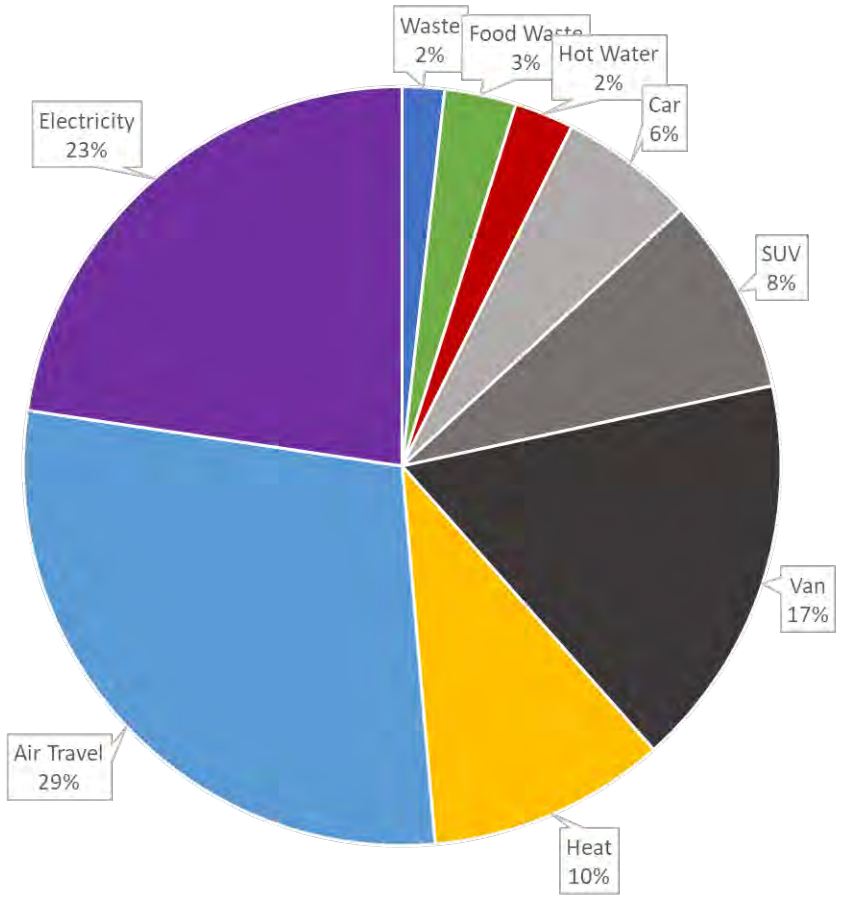
Dick Cheney

HOUSEHOLD CARBON FOOTPRINT

(US Avg 62,150 lb CO_2 eq/yr)

2009

66,682 lb CO_2 eq/yr



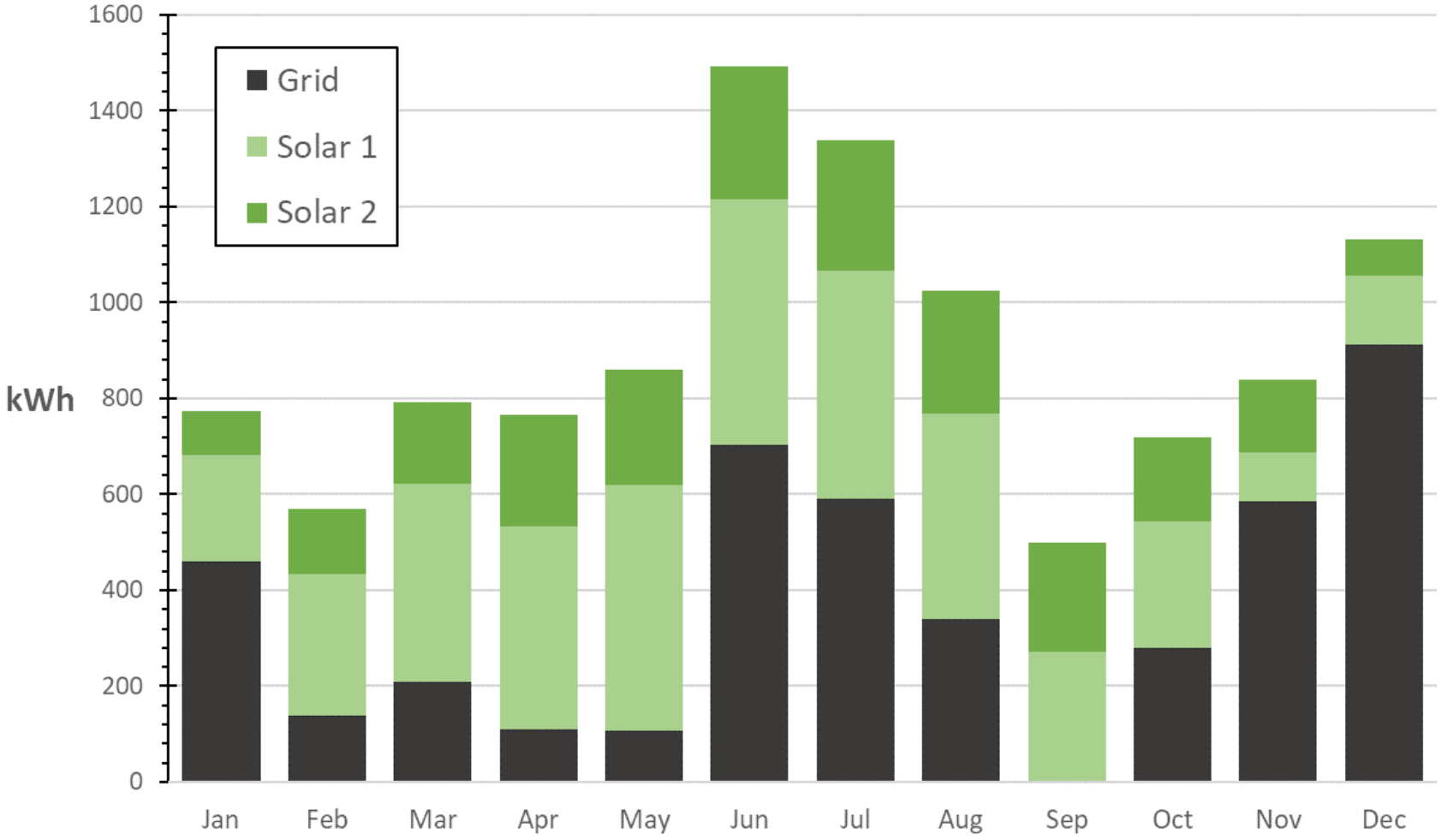
ENERGY	2009
Lighting	Incandescent
Electric	Grid
Autos	Gasoline
Air Travel	Jet Fuel
Heat	Nat Gas
Hot water	Tank Nat Gas
Mower	Gasoline
Air Conditioner	6 SEER Electric
Food Scraps	Landfill

Actions Taken to Reduce our Carbon Footprint

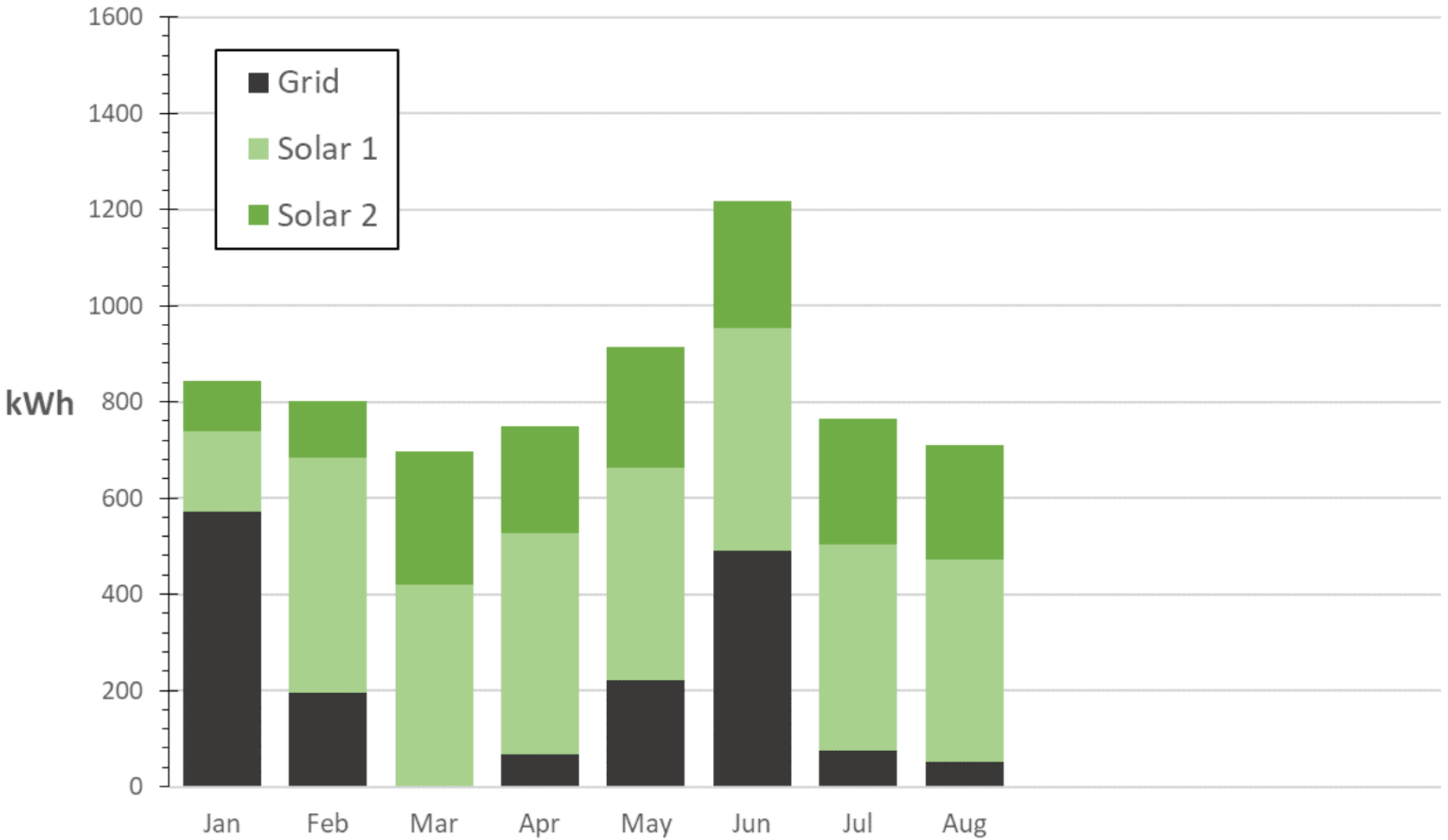
- Roof mounted photovoltaic solar electric system
- Passive solar design
- Purchase Wind based grid electricity
- Programmable thermostat
- Energy Star Appliances
- LED lighting
- Solar tubes and skylight
- Solar electric lawnmower/push mower
- Composting (reduces food waste methane)
- On demand water heater
- 6 SEER to 18 SEER HVAC system

ENERGY	2009	2020
Lighting	Incandescent	LED
Electric	Grid	PV/Wind purchased
Autos	Gasoline	Gasoline/EV/Hybrid
Air Travel	Jet Fuel	Jet Fuel/Less
Heat	Nat Gas	Nat Gas High Eff
Hot water	Tank Nat Gas	On demand Nat Gas
Mower	Gasoline	Solar Electric Robot
Air Conditioner	6 SEER Electric	18 SEER Electric
Food Scraps	Landfill	Backyard Compost

Electricity Use and Source
2020



Electricity Use and Source
2021



Impact of High efficiency AC System

www.energychoice.ohio.gov/ApplesToApplesComparision.aspx?Category=Electric&TerritoryId=2&RateCode=1

Apples to Apples Comparison Chart

American Electric Power (AEP)

To best utilize this offer comparison tool, it is suggested that you have your most current utility bill available for reference. Compare the supplier offers contained in the chart with the "Price to Compare" shown on your electric bill.

AEP's residential "Price to Compare" for the generation supply portion of your bill for the period of October 1, 2021 to December 31, 2021 is $ 0.0514/kWh.

Sign up for AEP rate change alerts

The offer prices below reflect that of the generation portion of your bill. Your distribution and transmission rates are determined through your local utility company.

EDU Chart Archive

AEP PTC Historical Rate Chart

Helpful Resources

- Steps to Switching
- What to Ask Suppliers
- What is Aggregation?
- Glossary of Terms

Find more answers in our FAQs

Search

32 RECORDS FOUND

O American Electric Power

My Current Rate (Optional)

Price per kWh:

From $ to $

American Electric Power : Residential

Click to Compare	Supplier	$/KWh	Rate Type	Renew. Content	Intro. Price	Term. Length	Early Term. Fee	Monthly Fee	Promo. Offers
☑	CleanSky Energy 3355 W. Alabama Suite 1170 Houston,TX 77098 (888) 355-6205 Company Url Offer Details Terms of Service Sign Up	0.0519	Fixed	100%	No	3 mo.	$0 details	$0	Yes details

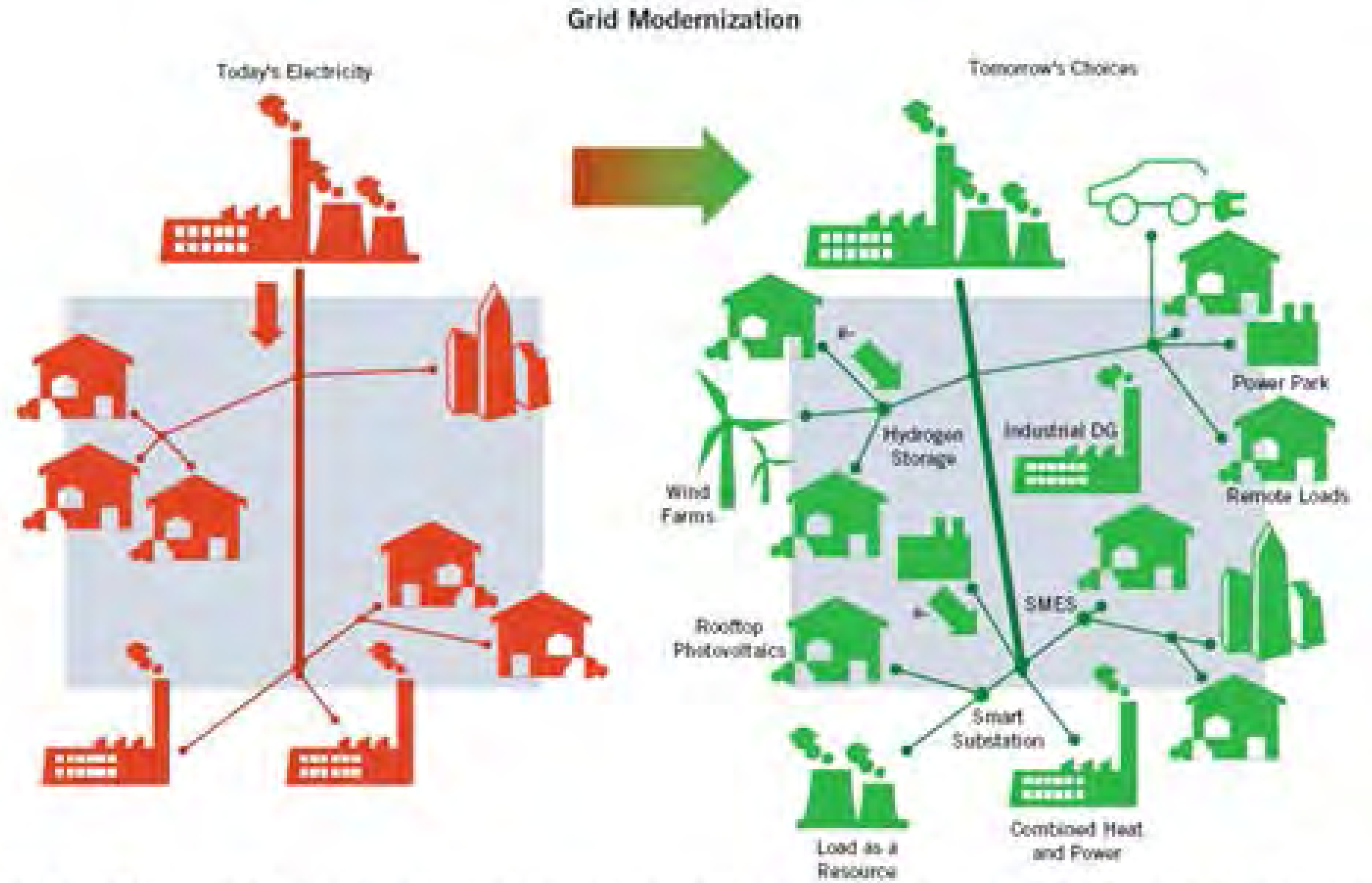
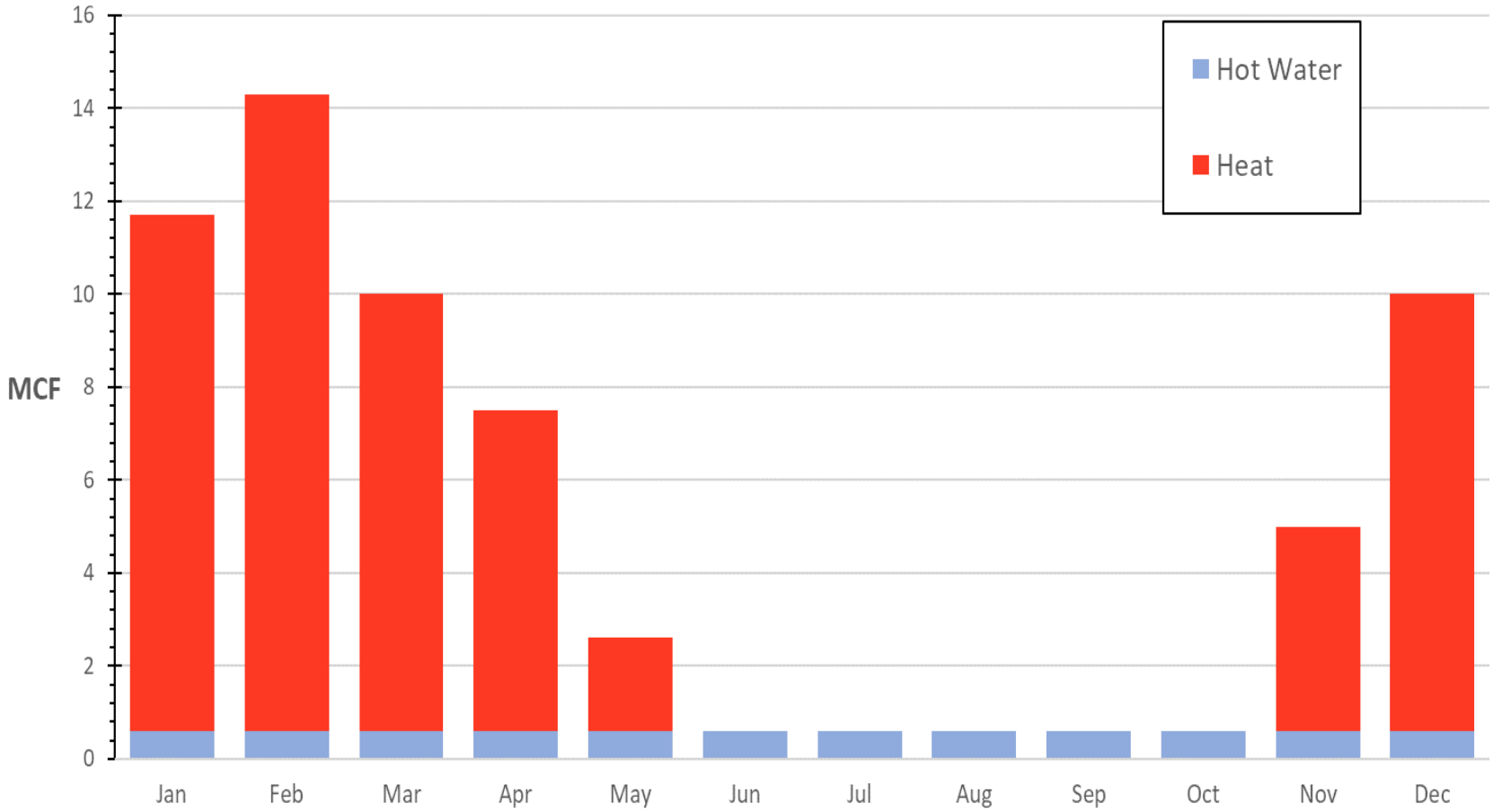


Fig. 1. The IEEE's version of the Smart Grid involves distributed generation, information networks, and system coordination, a drastic change from the existing utility configurations.

"The stone age did not end because we ran out of stones" Jay Warmke

Natural Gas Use
2020



Tankless Hot water system reduced water heating costs by 50%.
Improved insulation could further reduce CH_4 use

Lifecycle Green House Gas Emissions of Internal Combustion (ICEV) and Battery Electric Vehicles (BEV)

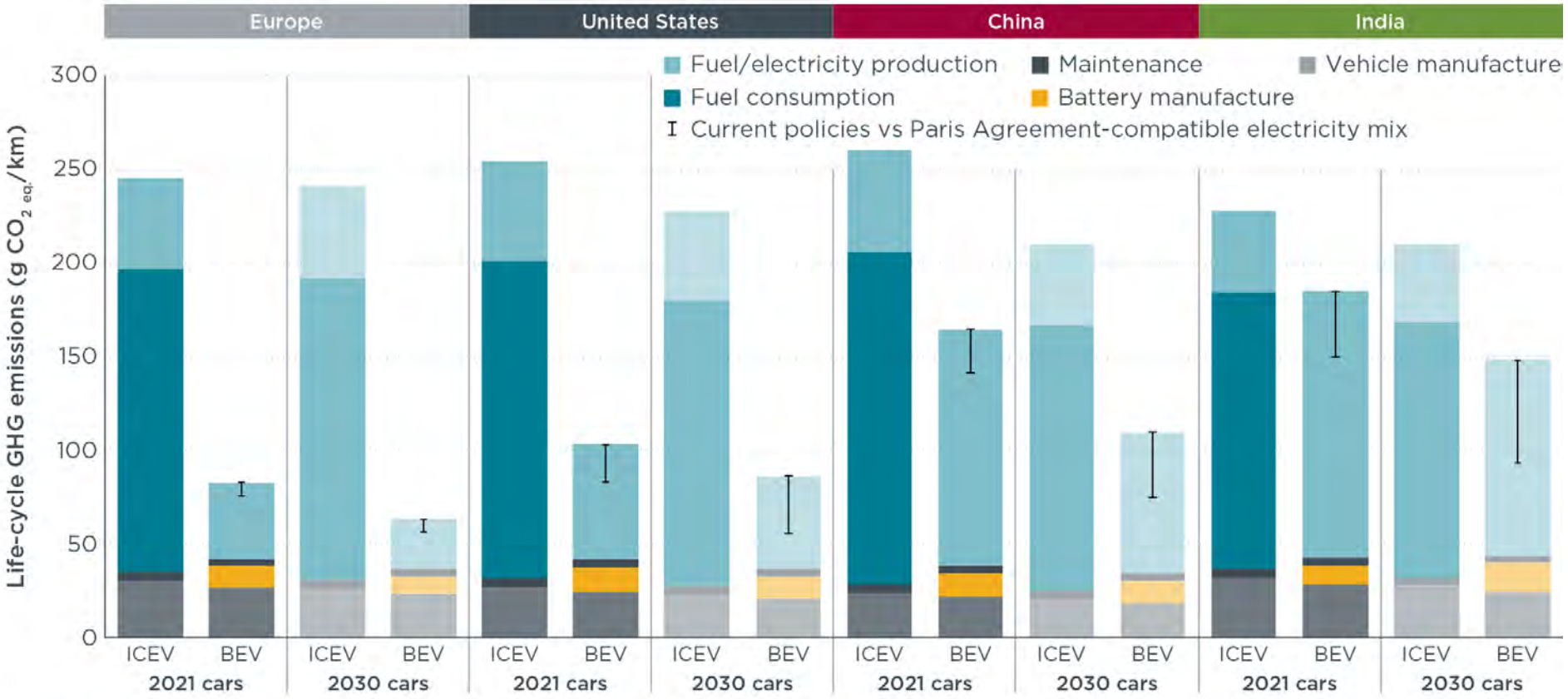
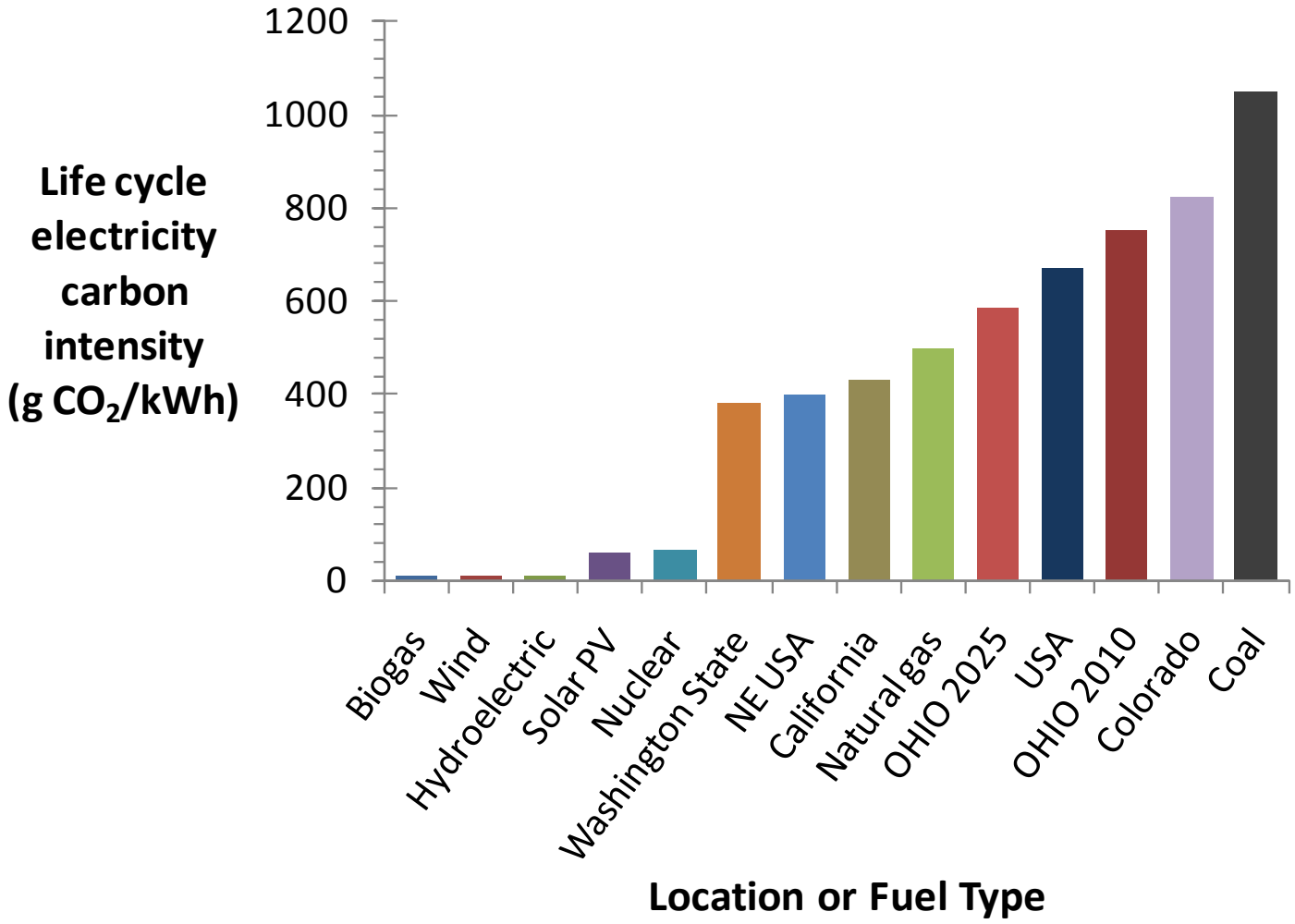


Figure ES.1. Life-cycle GHG emissions of average medium-size gasoline internal combustion engine (ICEVs) and battery electric vehicles (BEVs) registered in Europe, the United States, China, and India in 2021 and projected to be registered in 2030. The error bars indicate the difference between the development of the electricity mix according to stated policies (the higher values) and what is required to align with the Paris Agreement.

Carbon intensity of electricity



Tail pipe + upstream CO_2 Emissions of Vehicles

Vehicle	g CO_2 / mile (tail pipe+upstream)	Image
Bicycle	1	
Chevy Volt (electric mode, solar PV charged)	10	
Nissan Leaf Electric (NY electric)	120	
Chevy Volt (electric mode, NY electric)	126	
Toyota Prius hybrid (50 mpg)	222	
Nissan Leaf Electric (Ohio electric)	270	
Chevy Volt (electric mode, Ohio electric)	284	
Tesla Model 3	290	
Ford Escape PHEV with rooftop solar panel	322	
Mazda 3 (33 mpg)	335	
Ford Escape Hybrid (32 mpg)	346	
Porsche Boxster	504	
Dodge Caravan (20 mpg)	554	
Chevy Corvette (18 mpg)	616	
Ford Escape V6 4WD	644	
Ford F150 truck (12 mpg)	853	

Source: US DOE/EPA, www.fueleconomy.gov

Lawn Mowers

(1/3 Acre Lawn mowed 20 times per year)

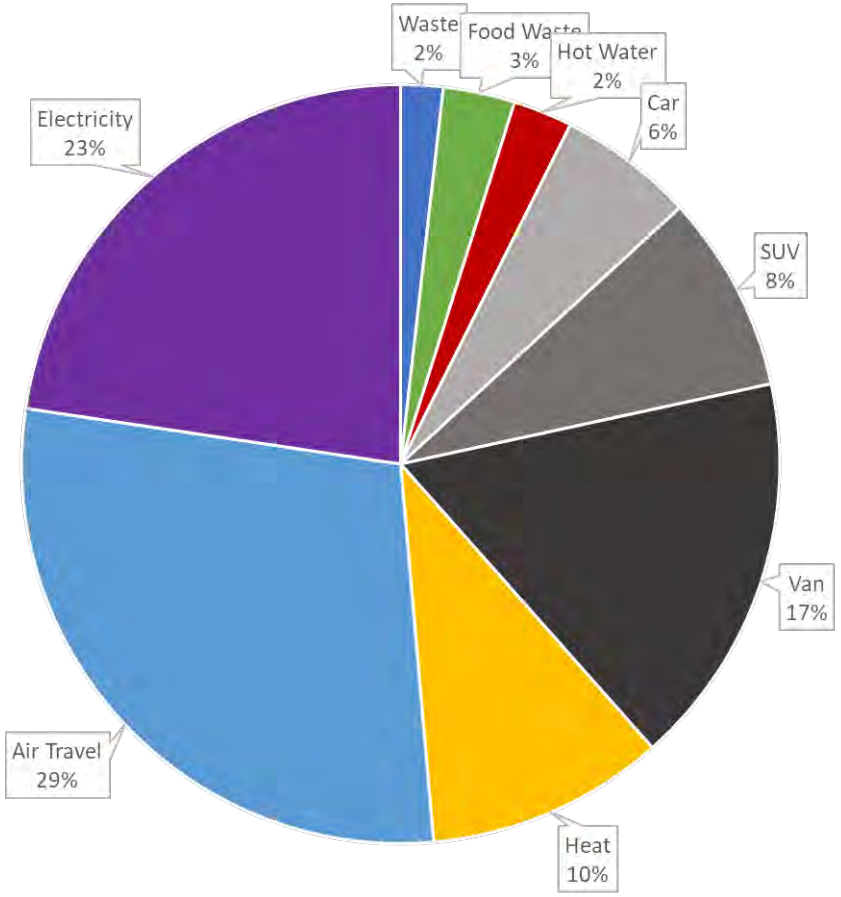
				
	Rider	Gas Push	Electric	Robot
Cost	$ 2,000	$ 250	$ 300	$ 900
Weight (lbs)	600	90	65	21
Gasoline Use (gal)	6.6	2.6	0	0
Electric Use (Kwh/acre)	0	0	8.6	7.2
CO2eq emission (lb/y)	124	49	15	11
Fuel Cost ($/y)	$ 19.80	$ 7.90	$ 1.03	$ 0.86
Noise (db)	95	88	75	63
Comments	Very loud, Disturbs all neighbors Causes ruts	Loud, ruins quiet meals and naps	Moderate noise Good workout	Quiet, undetectable Can nap while mowing

HOUSEHOLD CARBON FOOTPRINT COMPARISON

(US Avg 62,150 lb CO_2 eq/yr)

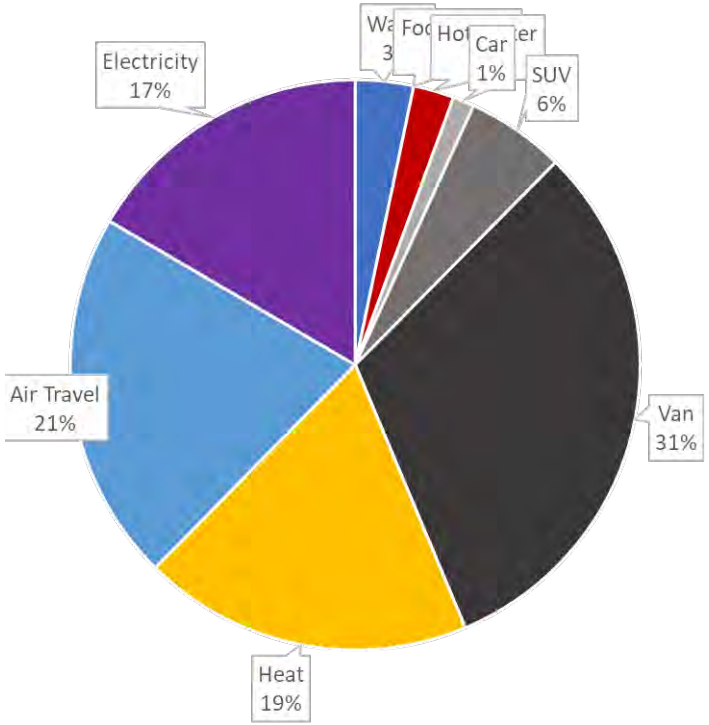
2009

66,682 lb CO_2 eq/yr



2020

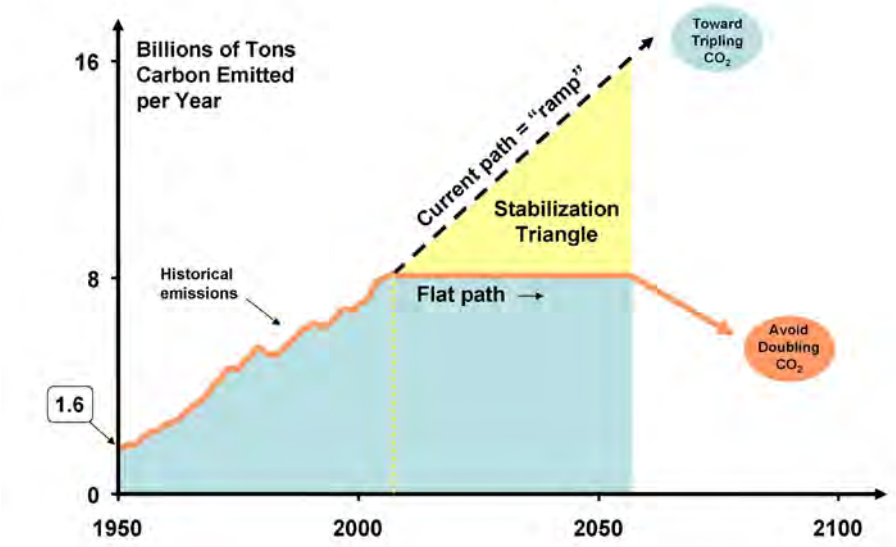
36,450 lb CO_2 eq/yr



"8 Wedges" needed to stabilize Global CO_2 emissions: 525 ppm CO_2, +5.4°F

(status quo = 850 ppm, +9°F). Each "Wedge" reduces CO2 emissions by 1 billion tons over 50 yrs.

- Efficient vehicles: increase from 30 to 60 mpg (2 billion cars)
- Drive less: from 10,000 to 5,000 miles/yr per driver
- Increase efficiency of buildings and appliances by 25%
- Double efficiency of coal plants
- Replace 1400 coal plants with natural gas plants (4X increase)
- Capture all CO_2 at power plants (800 coal or 1600 gas)
- Increase nuclear 2X to reduce coal use
- Increase wind 50X to reduce coal use
- Increase solar 700X to reduce coal use
- Increase wind 100X to produce H_2 for cars
- Increase biofuels 150X (using 1/6 of Earth's cropland)
- Stop all deforestation, 2X tree planting
- Use conservation tillage on all crop land (10X current)



Take Home Messages

- Cost Effective Actions can reduce the carbon footprint of a typical family by 50%.
- In order to avoid a doubling of atmospheric CO_2, we need to rapidly deploy low-carbon energy technologies and/or enhance natural sinks.
- We already have an adequate portfolio of technologies to make large cuts in emissions
- No one technology can do the whole job – a variety of strategies will need to be used to stay on a path that avoids a CO_2 doubling.
- Every “wedge” has associated impacts and costs.

Questions?

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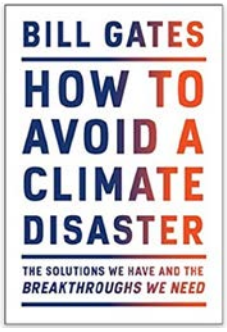
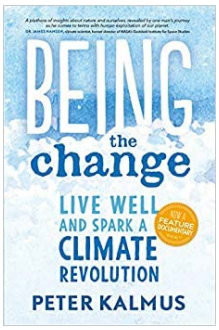
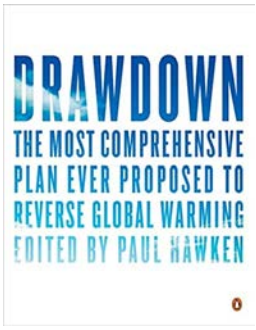
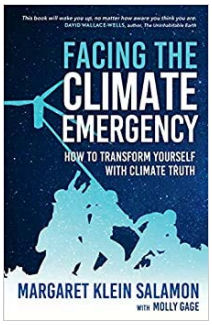
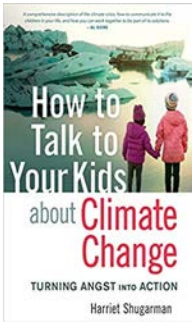
References and Resources











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https://en.wikipedia.org/wiki/Climate_change

https://cleantechnica.com/

https://www.carbonbrief.org/

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