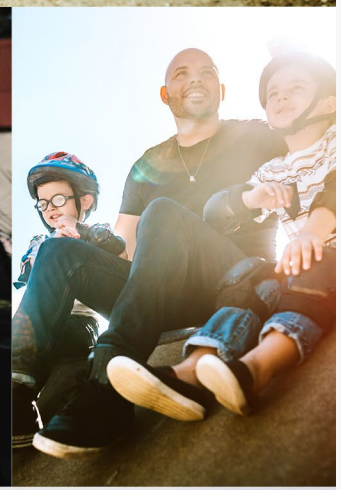
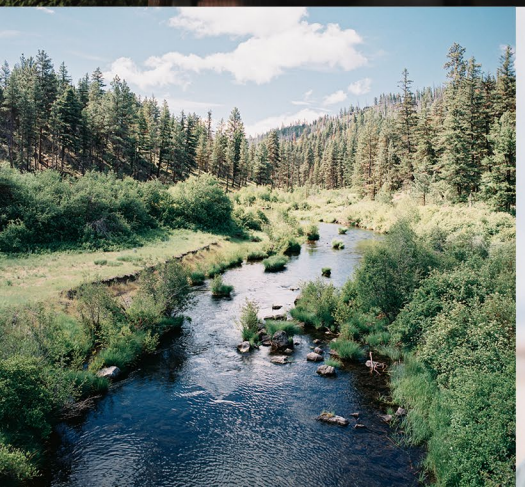




Learning Lab

Learning Lab # 9 - November 2, 2023

Meeting Logistics


Audio


Microphone


Chat box


Video


Raise Hand


Closed Caption

Operating Agreements

Establishing norms with our communities is foundational to building trust

To create a **safe space**, we established **common agreements** such as **respect, honoring diversity of thought**, and **inclusivity**

Practice curiosity and **seek to understand different perspectives**

Stay Engaged

Be Willing To Experience Discomfort

Speak Your Truth

Expect and Accept Non-closure

Share the Airtime

The courageous conversations framework
by Glenn Singleton and Curtis Linton

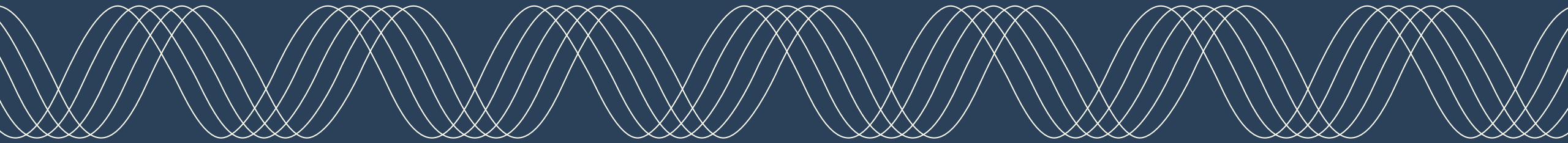
Meeting Objectives

Prepare stakeholders and customers to contribute to decarbonization through DER adoption

Agenda

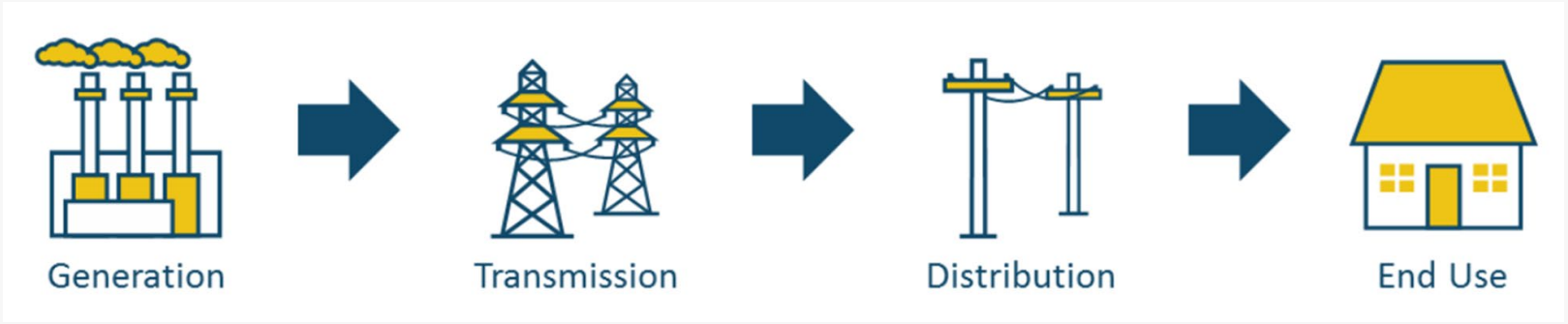
10:00 – 10:10	Welcome, Introductions, Meeting Logistics
10:10 – 10:35	The Grid and Its Parts
10:35 – 11:05	Energy & Carbon
11:05 – 11:25	Energy Efficiency
11:25 – 11:30	Electricity Rates in Context
11:30 – 11:55	Resource Grid Operations
11:55 – 12:00	Closing Remarks & Next Steps

The Grid and its Parts



The Electric Grid is Evolving

One way flow of power



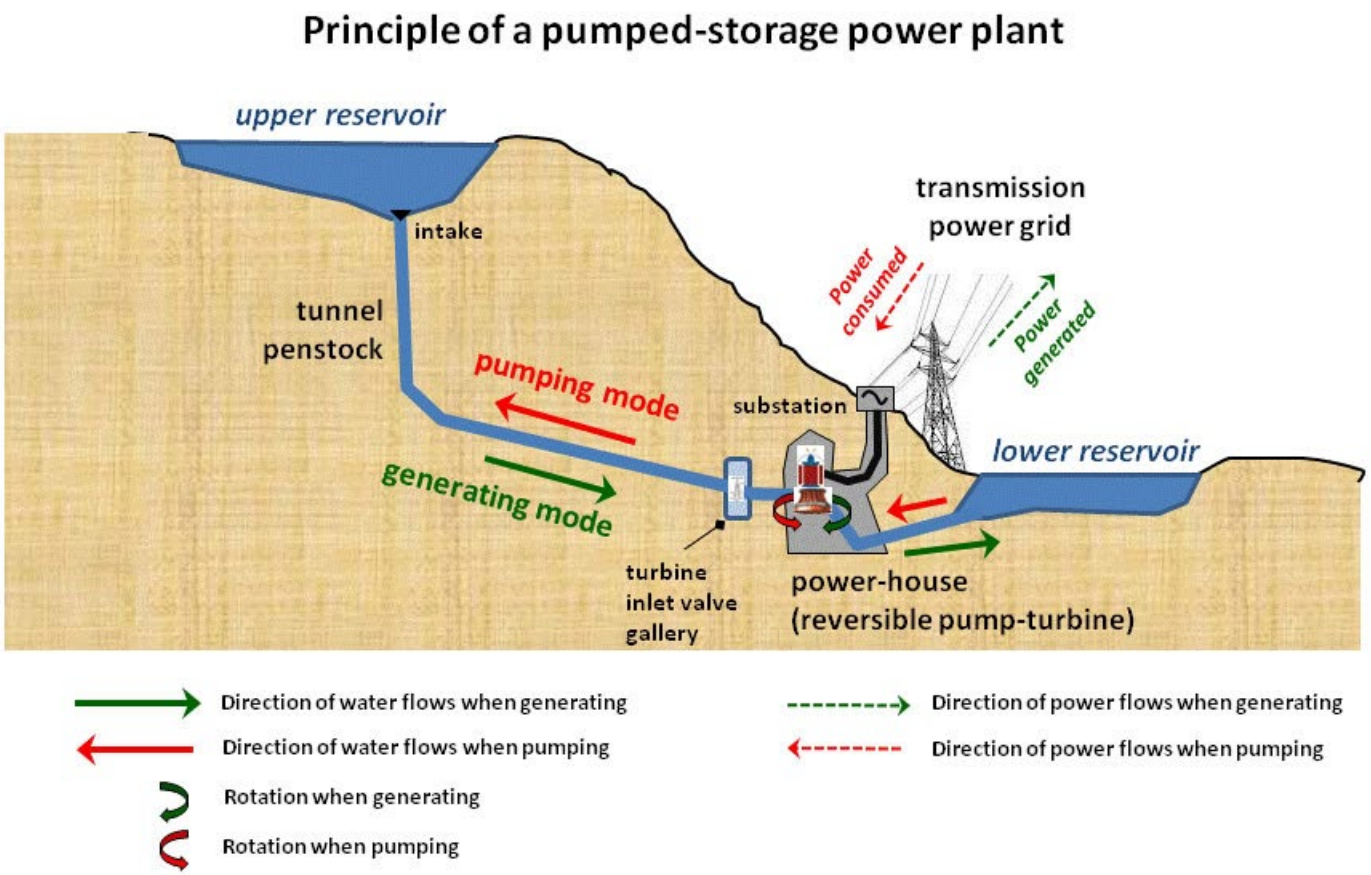
Electricity

Supply **Demand**

reliability

Generation Example: Hydroelectric Power

Generation Example: Pumped Hydro



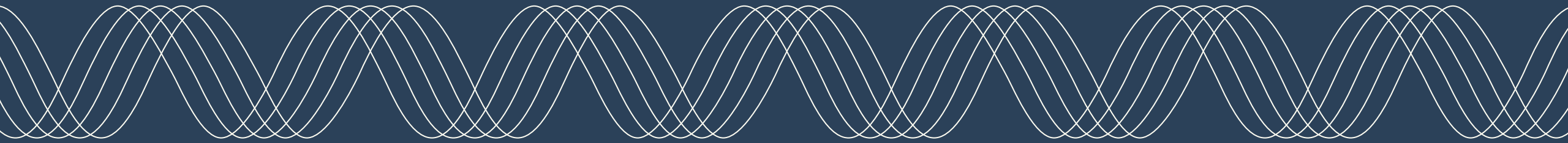
Generation Example: Combined Cycle Natural Gas Plant

Generation Example: Simple Cycle Natural Gas Plant

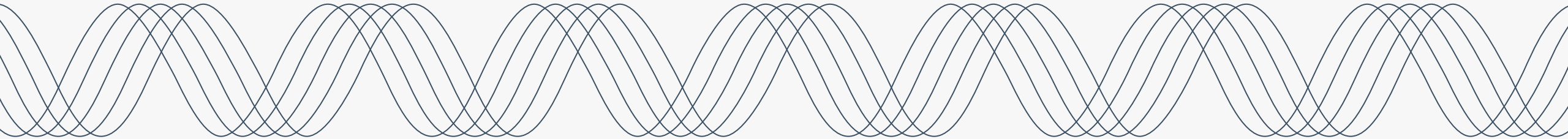
Generation Example: Wind Farm

Generation Example: Solar Plant

Energy and Carbon

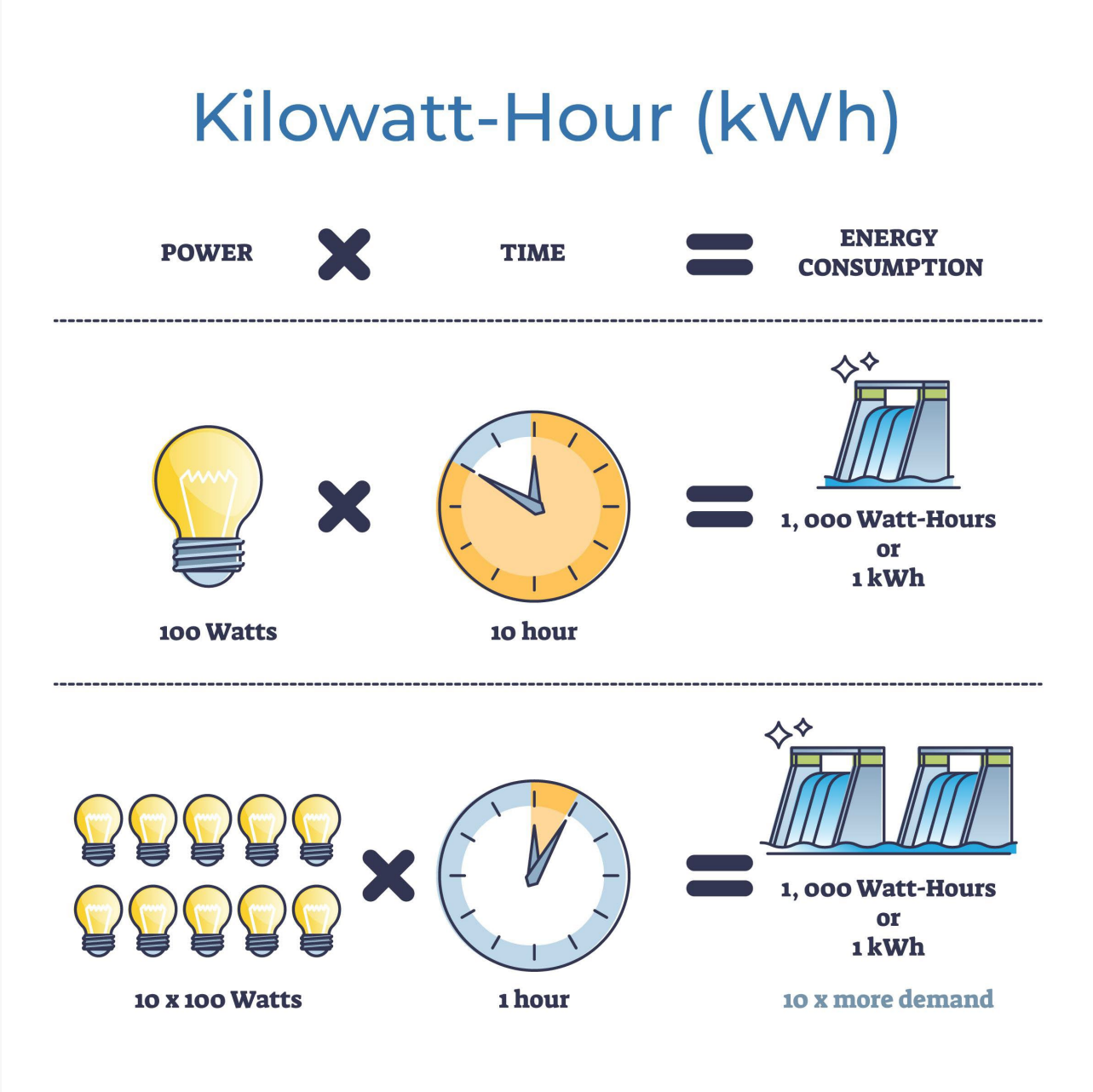


Energy and Carbon Measurement Units



Units of Energy

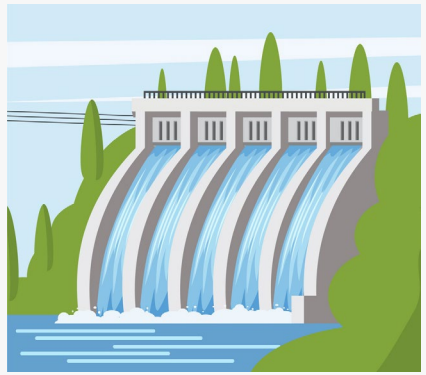
A **kilowatt-hour (kWh)** electricity consumption over 1 hr.



Units of Energy

Megawatts (MW)
energy output of a power plant

600 MW



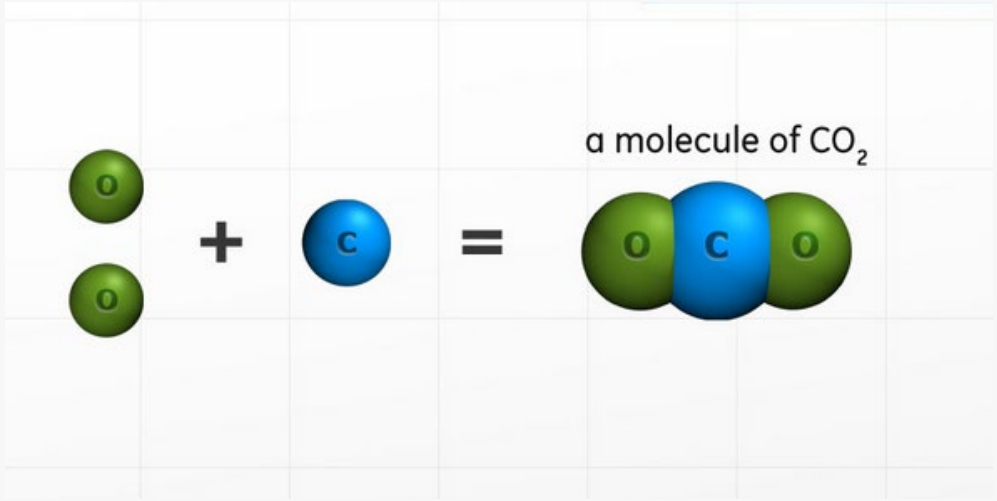
198,000 homes

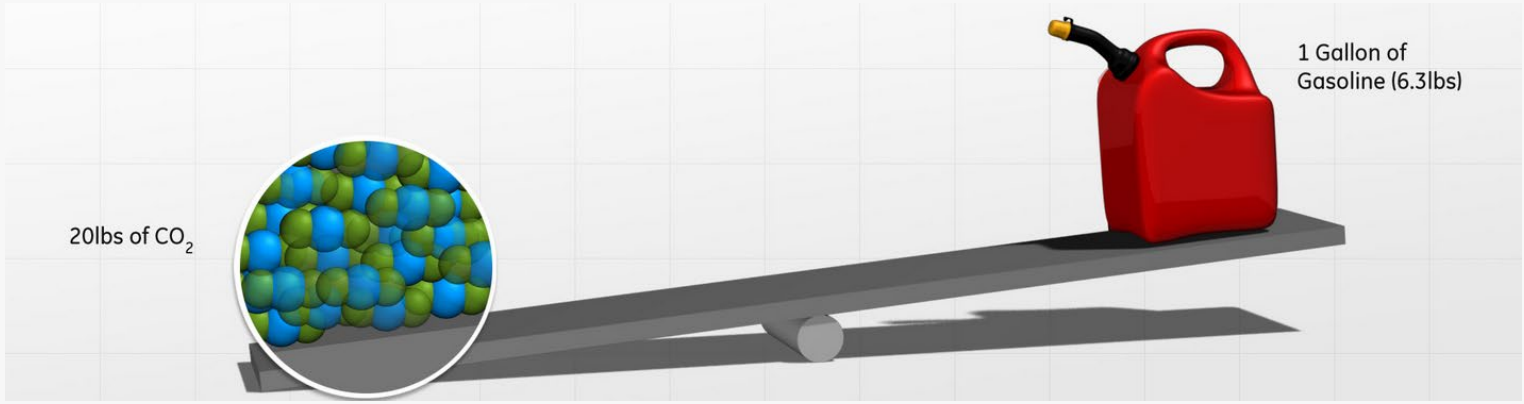
The Math Behind CO2

Whan gasoline is burned, carbon and hydrogen atoms are separated from one another. The hydrogen atoms combine with oxygen to form water (H_2O). The carbon atoms combine with oxygen to form CO_2 – a major greenhouse gas.

Carbon has an atomic weight of 12. Oxygen has an atomic weight of 16. This means that every molecule of CO_2 has an atomic weight of 44 – 3.7 times the weight of a single carbon atom.

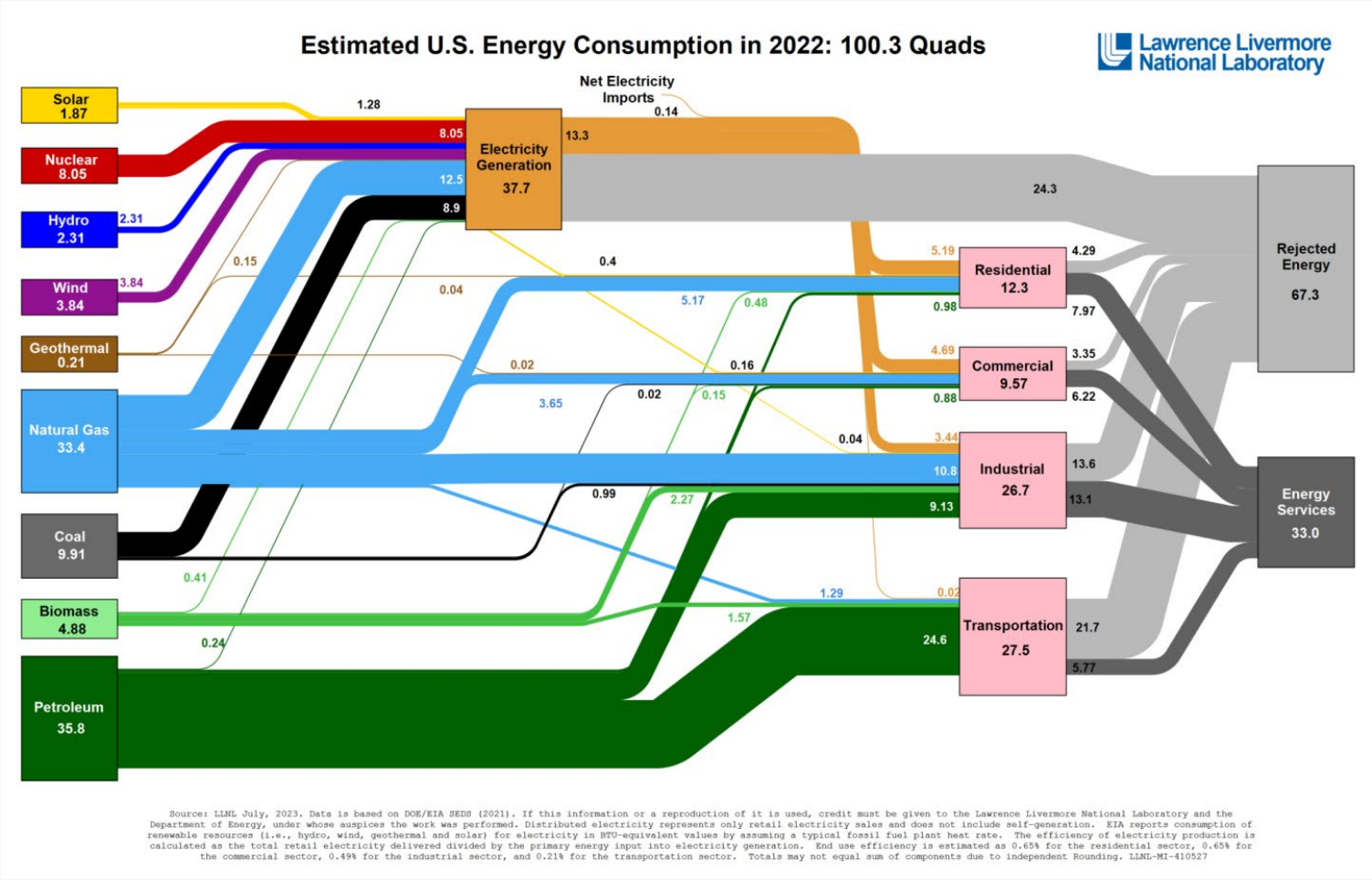
Gasoline is about 87% carbon, which means there is 6.3lbs/gallon x 0.87 = 5.5lbs of carbon in a single gallon of gasoline. When burned, this creates creates 5.5lbs x 3.7 = 20lbs of CO_2.





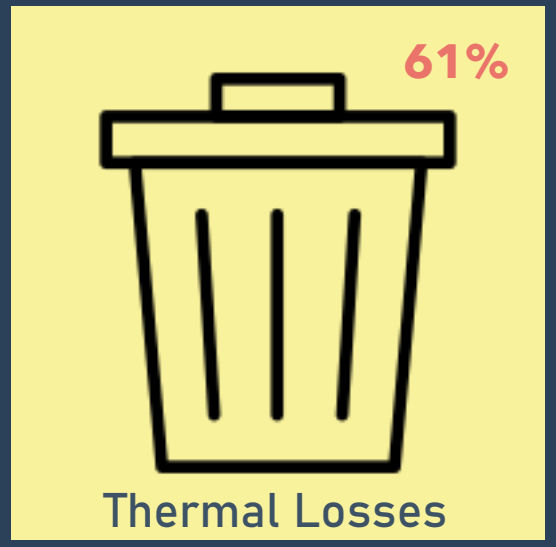
Energy Usage in the United States

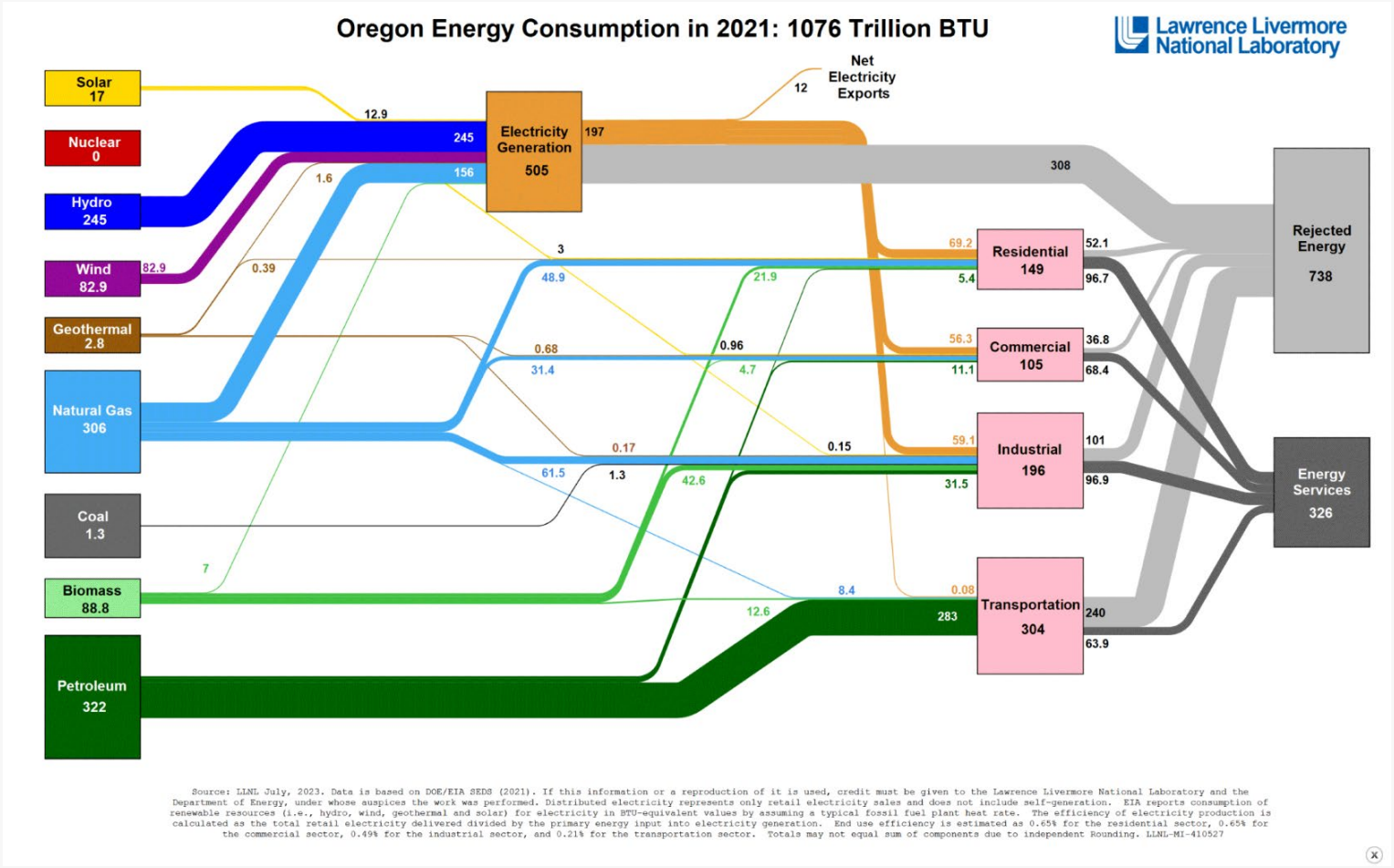
- Electricity Generation: **37.7 Quads**
- Rejected Energy on Electricity generation **24.3 Quads**



Energy Usage in Oregon

- Electricity Generation: **505 BTU**
- Rejected Energy on Electricity generation **308 BTU**





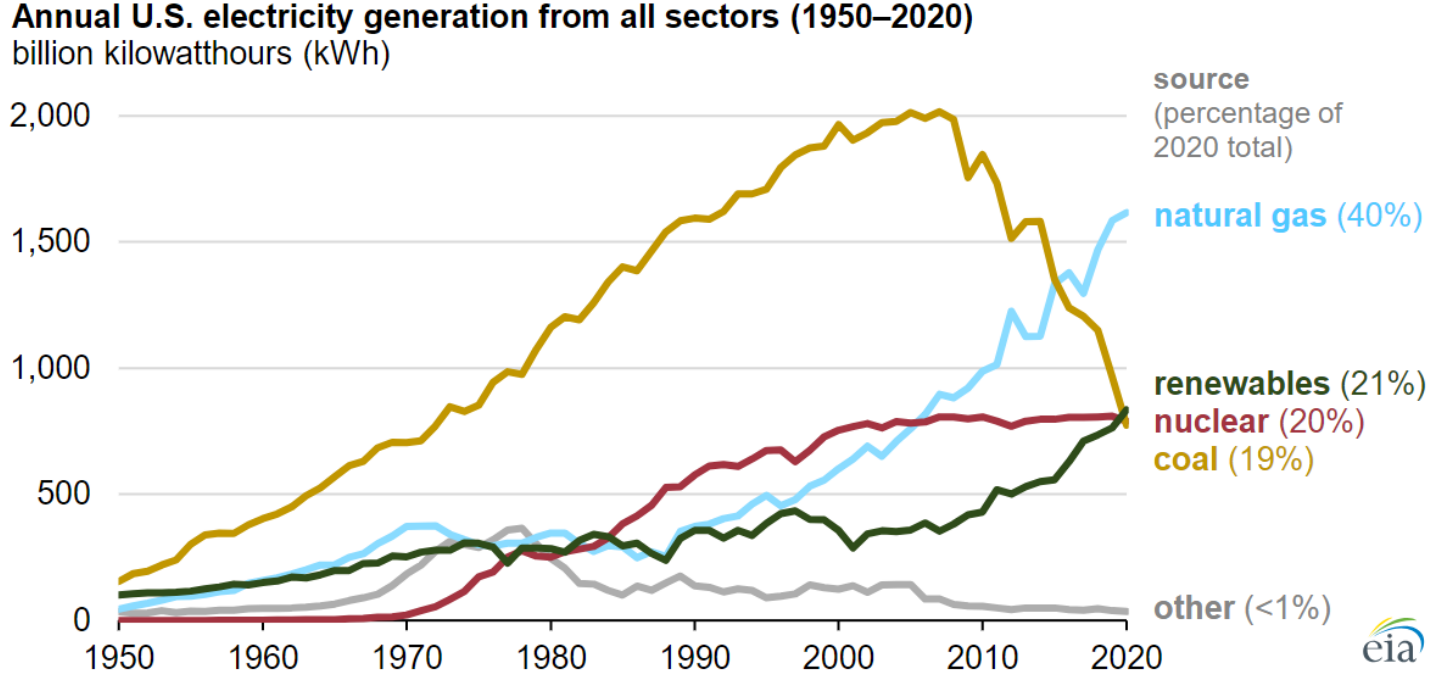
US Electricity Mix

Generation

- 2010-2020 - Coal
- 1990-2020 - Natural Gas
- 2000-2020 - Renewables

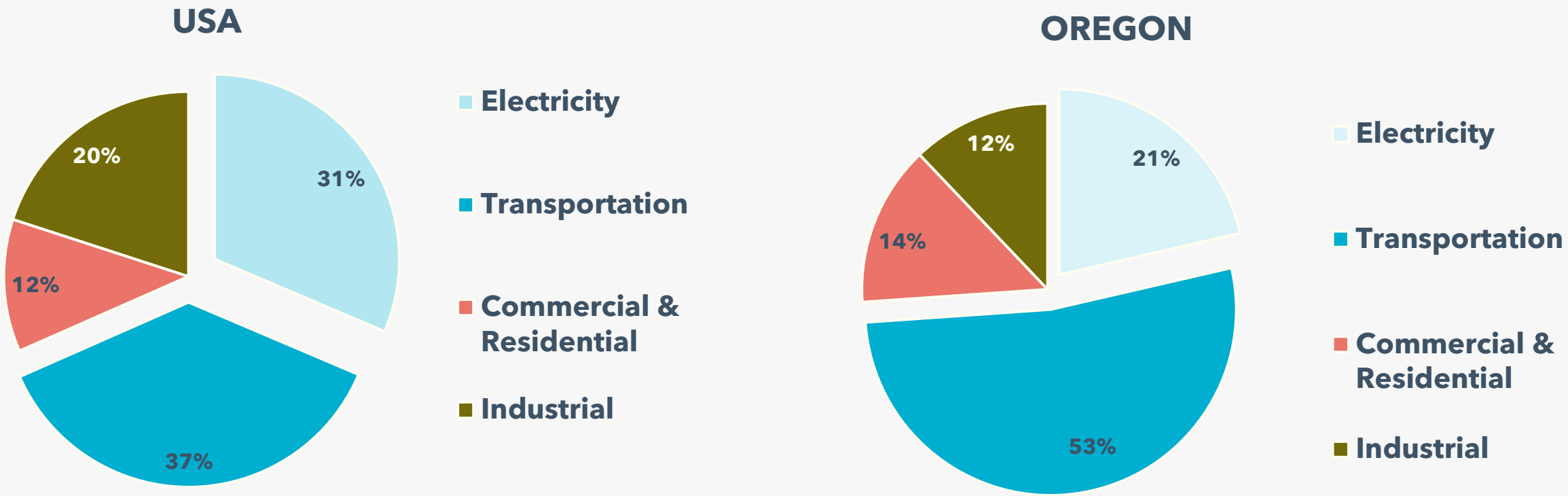
- Coal = 2000 lb/CO2 - MWhr
- Natural Gas = 898 lb/CO2 -MWhr

Renewables became the second-most prevalent U.S. electricity source in 2020



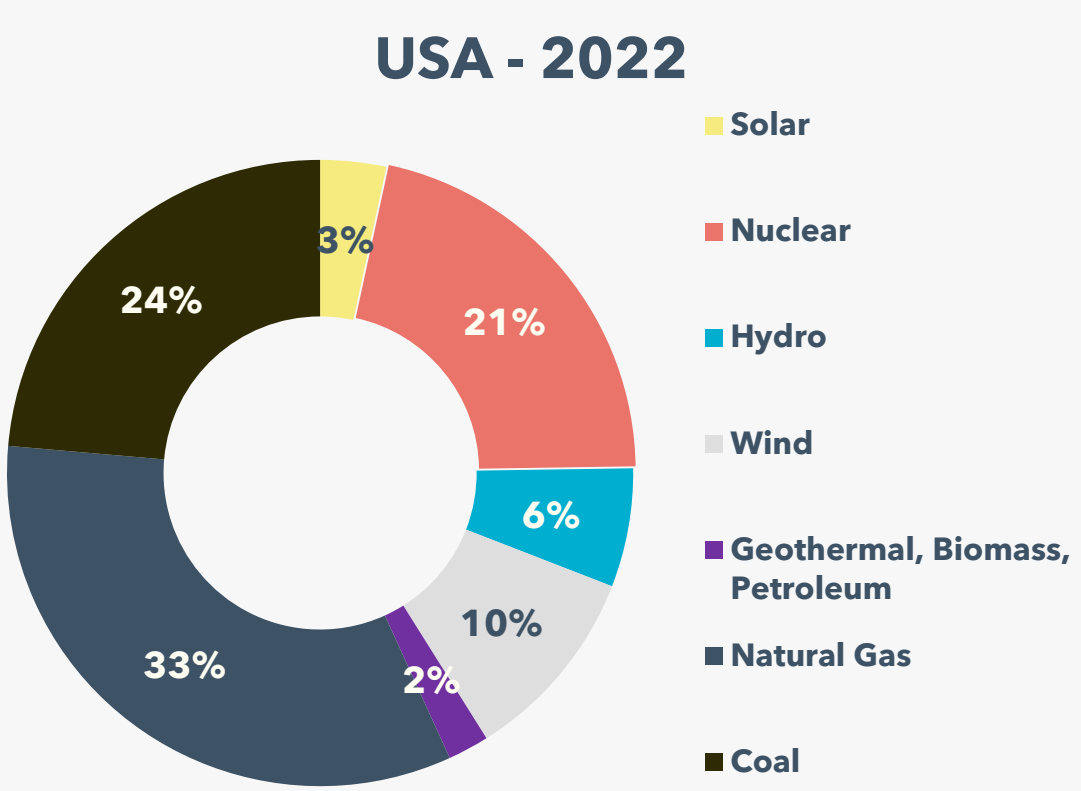
Source: U.S. Energy Information Administration (EIA), *Monthly Energy Review*
Note: This graph shows electricity net generation in all sectors (electric power, industrial, commercial, and residential) and includes both utility-scale and small-scale (customer-sited, less than 1 megawatt) solar.

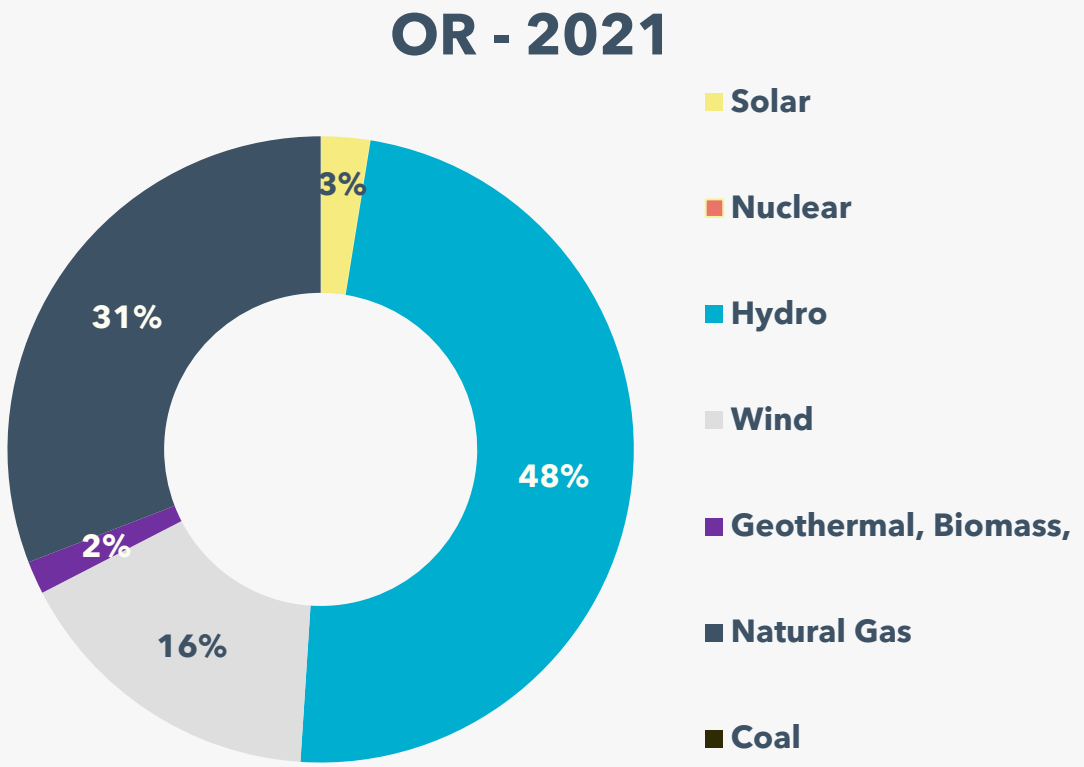
Energy Related Carbon Dioxide Emissions by Sector (2021)



Source: State Carbon Dioxide Emissions Data - U.S. Energy Information Administration (EIA)

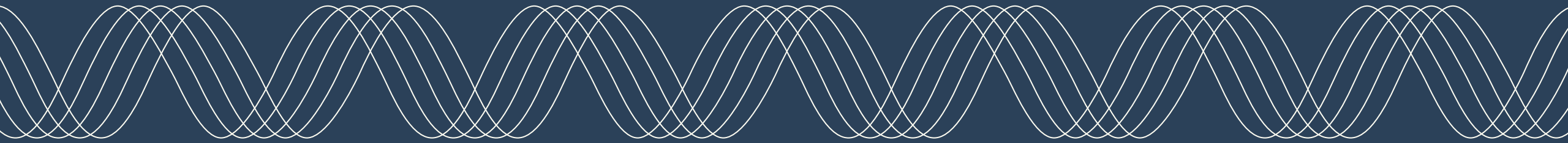
Electricity Generation by Resource





Source: [Lawrence Livermore National Lab]

Energy Efficiency



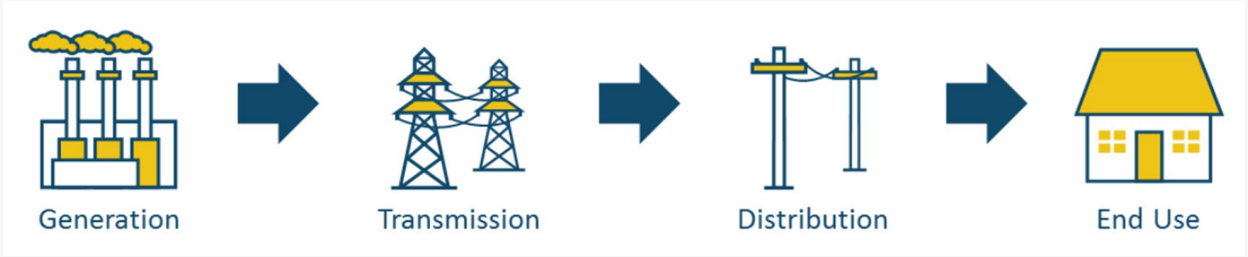
The Electric Grid is Evolving

Electricity

Supply **Demand**

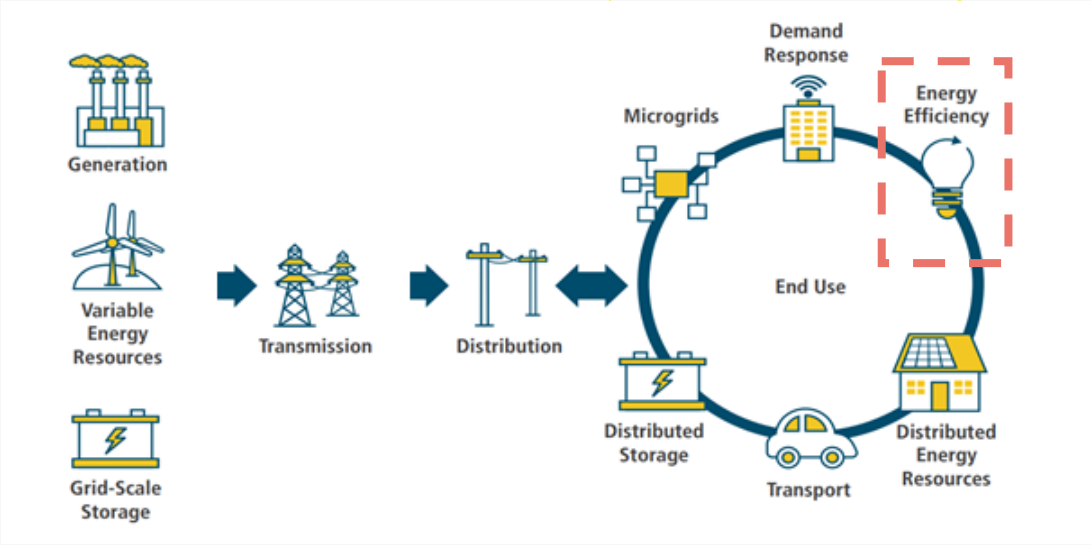
reliability

One way flow of power



FROM: one-way power flow - large generation facilities to end users/customers

Two-way flow of power



TO: two-way power flow – end users/customers can also generate power and/or interact with the electric grid

What is Energy Efficiency

Definition

Energy efficiency refers to the practice of ***using less energy to achieve the same or improved performance*** in a specific task or function, leading to reduced energy consumption and waste.

LED Lighting

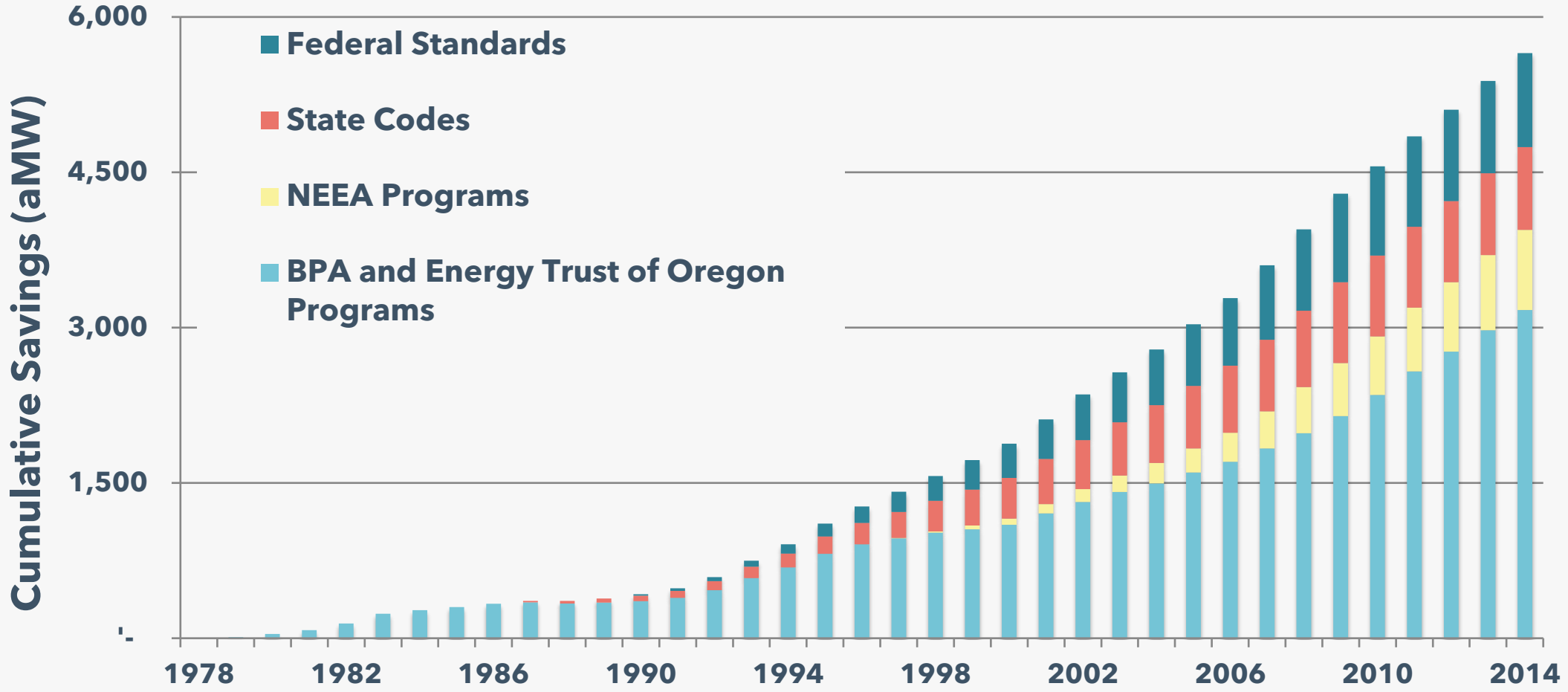
Energy Star Appliances

Building Insulation

Smart Thermostats

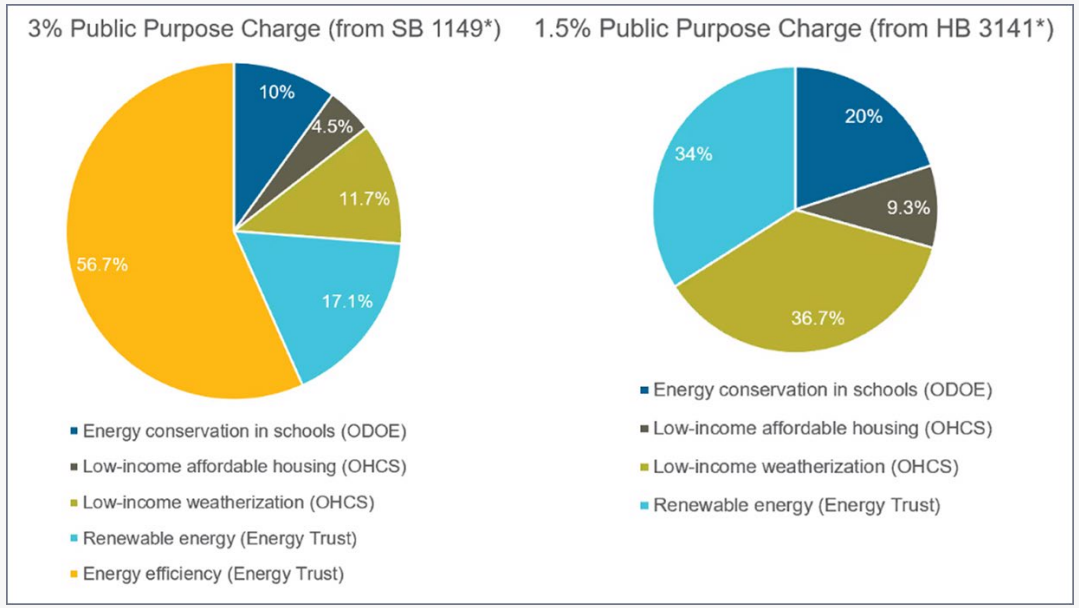
Hybrid and Electric Vehicles

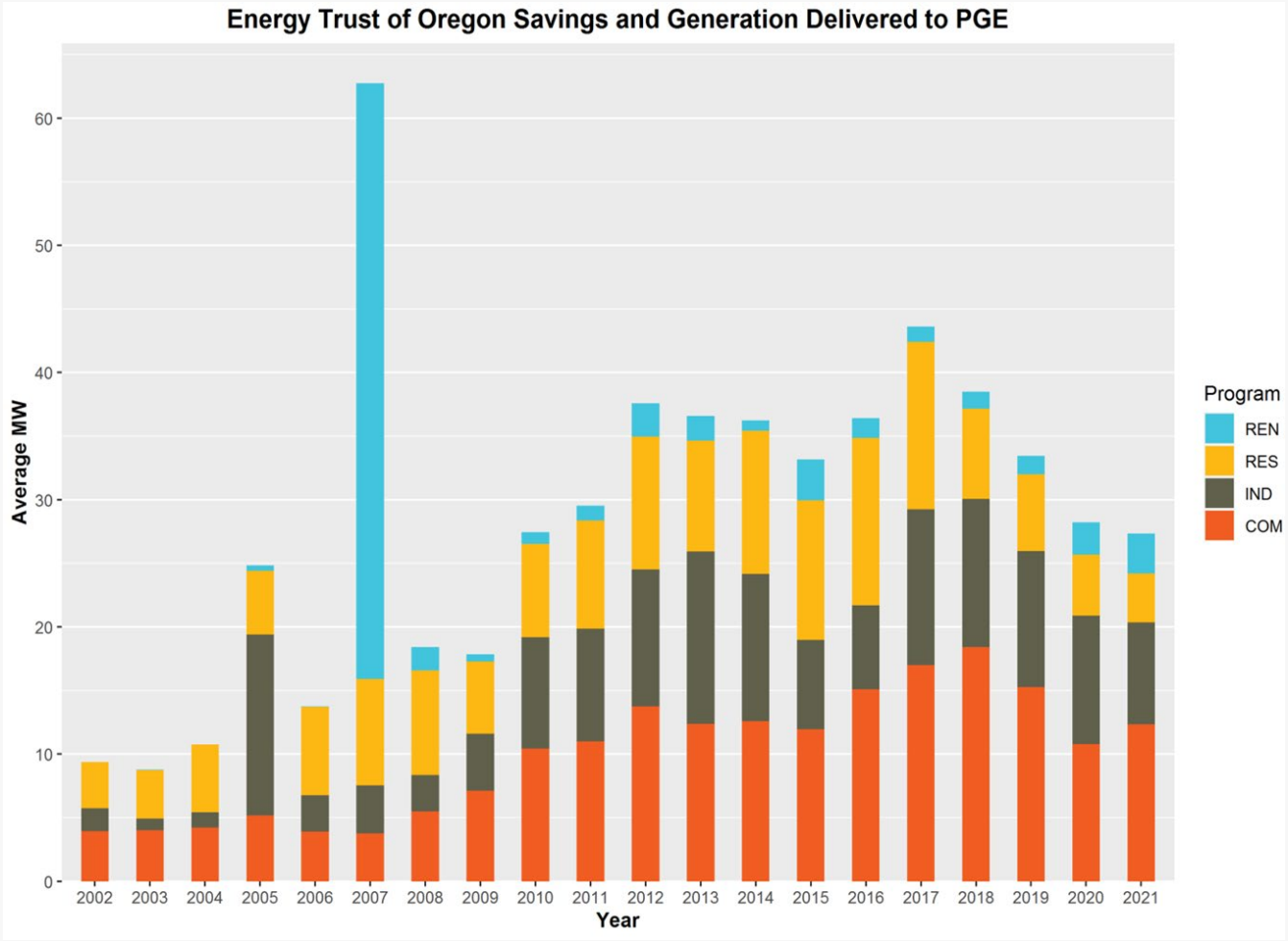
Since 1978 the Pacific Northwest created the single largest energy resource in the United States – 5700 aMW of Savings



Energy Trust of Oregon

Energy Efficient expert and partner (when they started), their programs

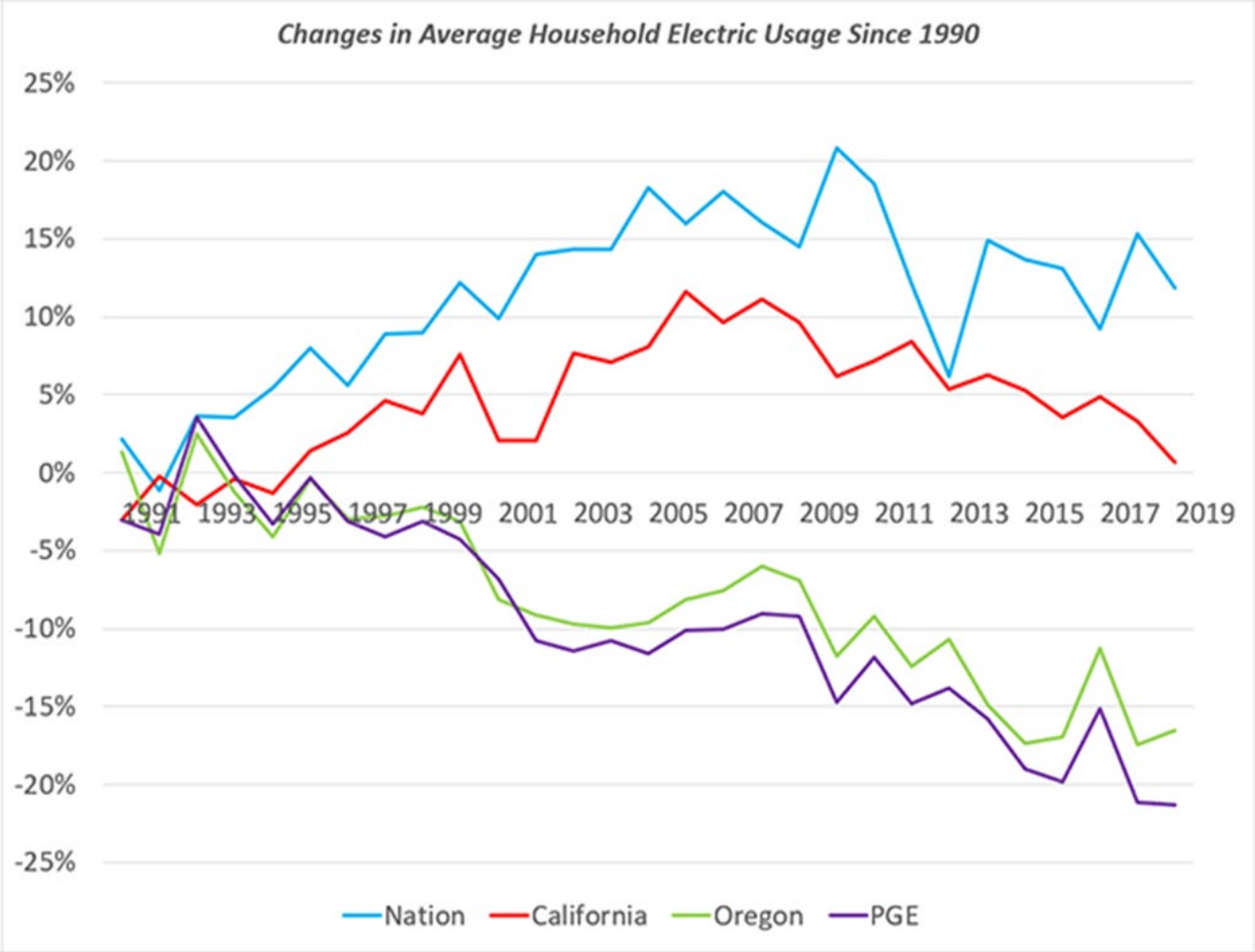




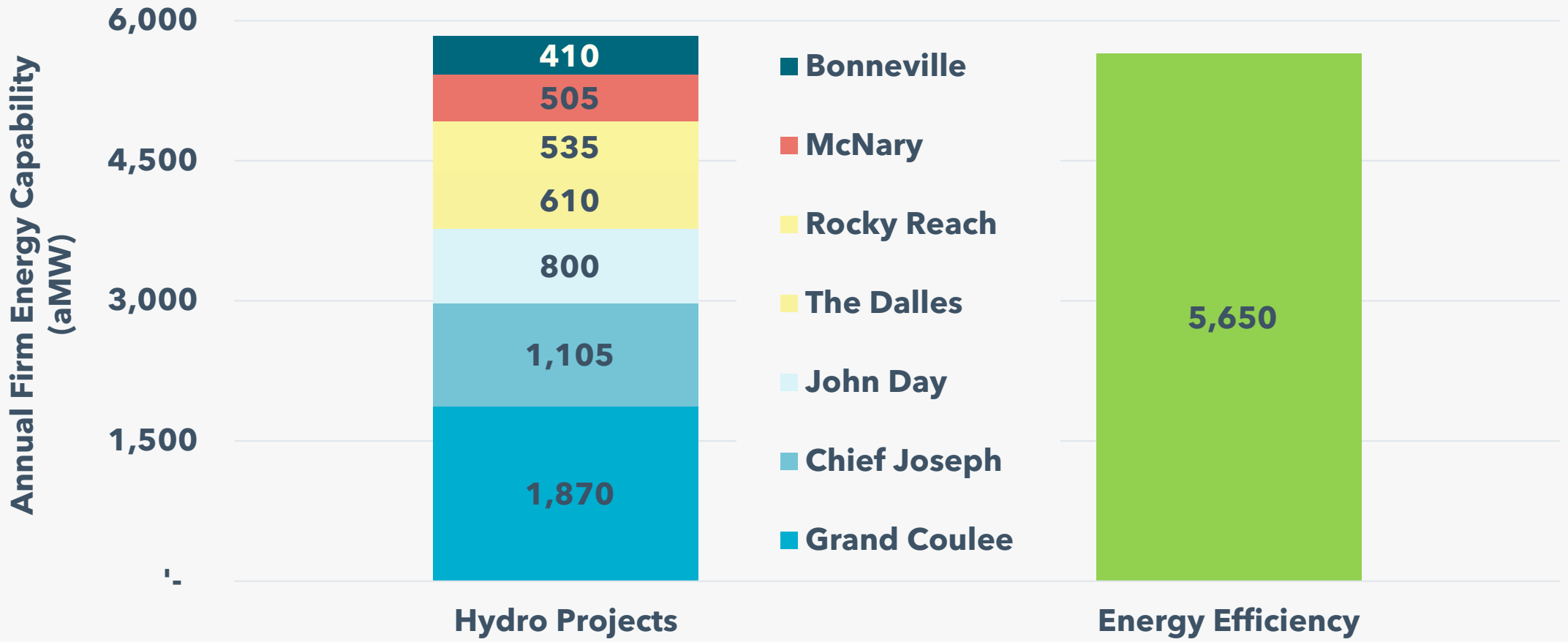
REN=renewables, the others are all energy efficiency
RES= residential
EE, IND = industrial EE
EE, COM= commercial

Energy Trust of Oregon

Energy Efficient expert and partner (when they started), their programs

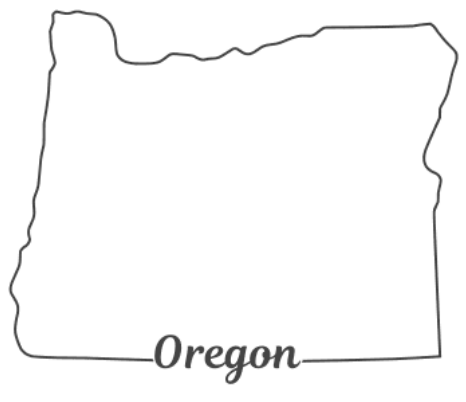


5700 aMW is Nearly Equal the Annual Firm Energy Output of the Seven Largest Hydro Projects in the Region



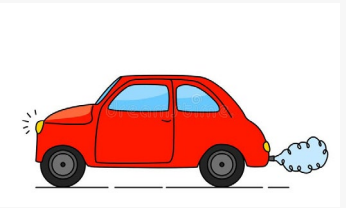
What is 5700 aMW Equivalent to?

It's enough electricity to serve the ***state of Oregon***



It saved the region's electricity consumers nearly ***$3.75 billion*** in 2014

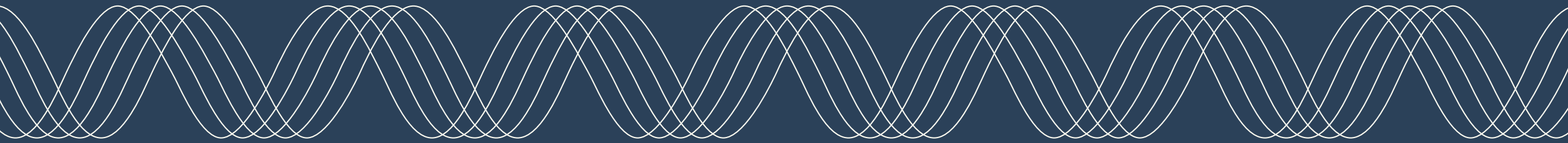
It lowered 2023 PNW carbon emissions by an estimated ***22 million*** metric tons



Emits 2.3 tons of CO2 a year

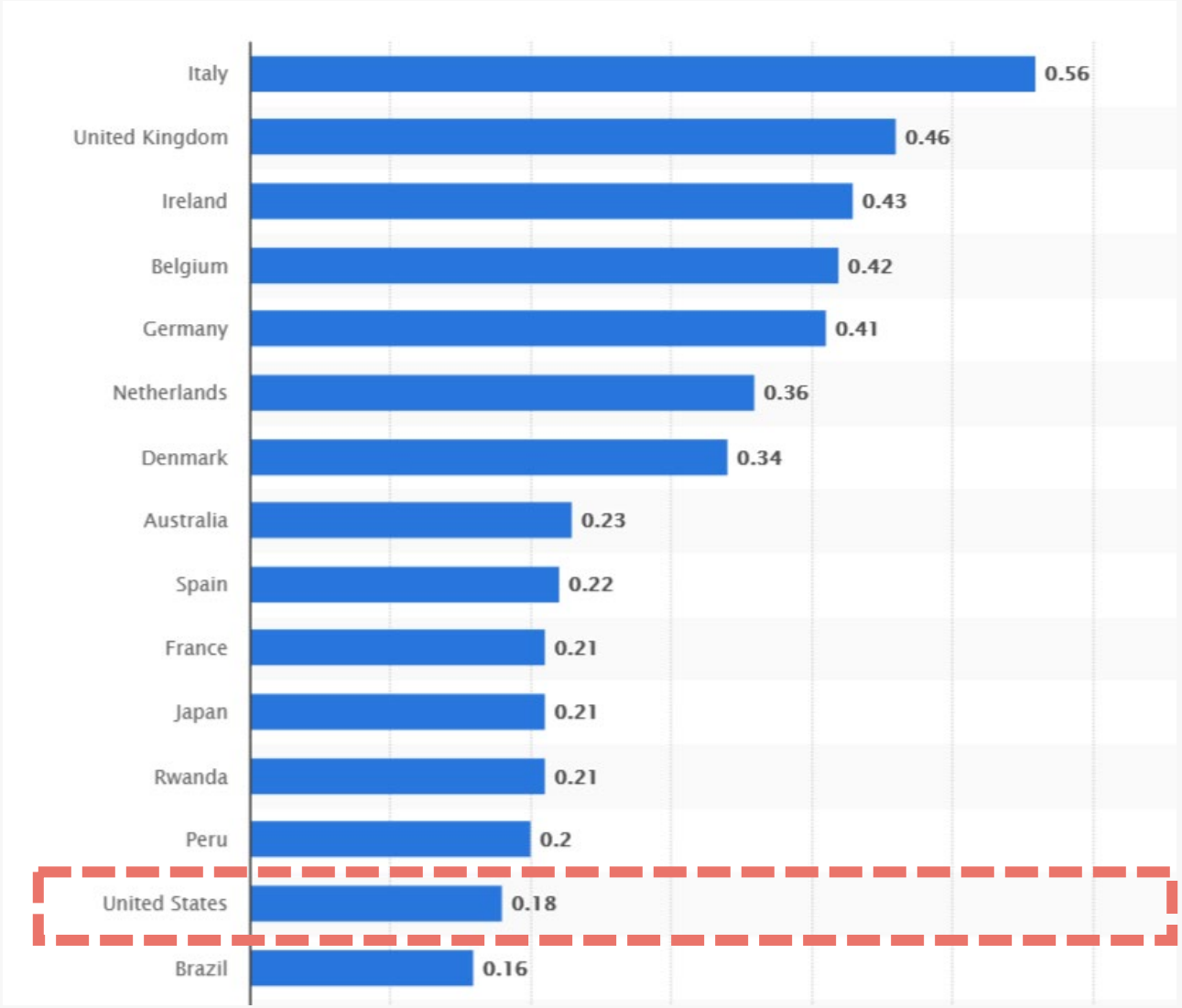
2 years CO2 emissions of all cars in Oregon

Electricity Rates in Context



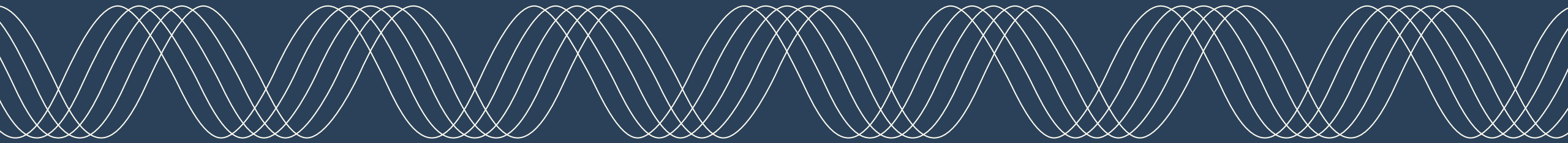
Household electricity prices worldwide in March 2023, by select country

World Avg	**14 cents/kWh**
US Avg	**18 cents/kWh**
OR Avg	**11 cents/kWh**



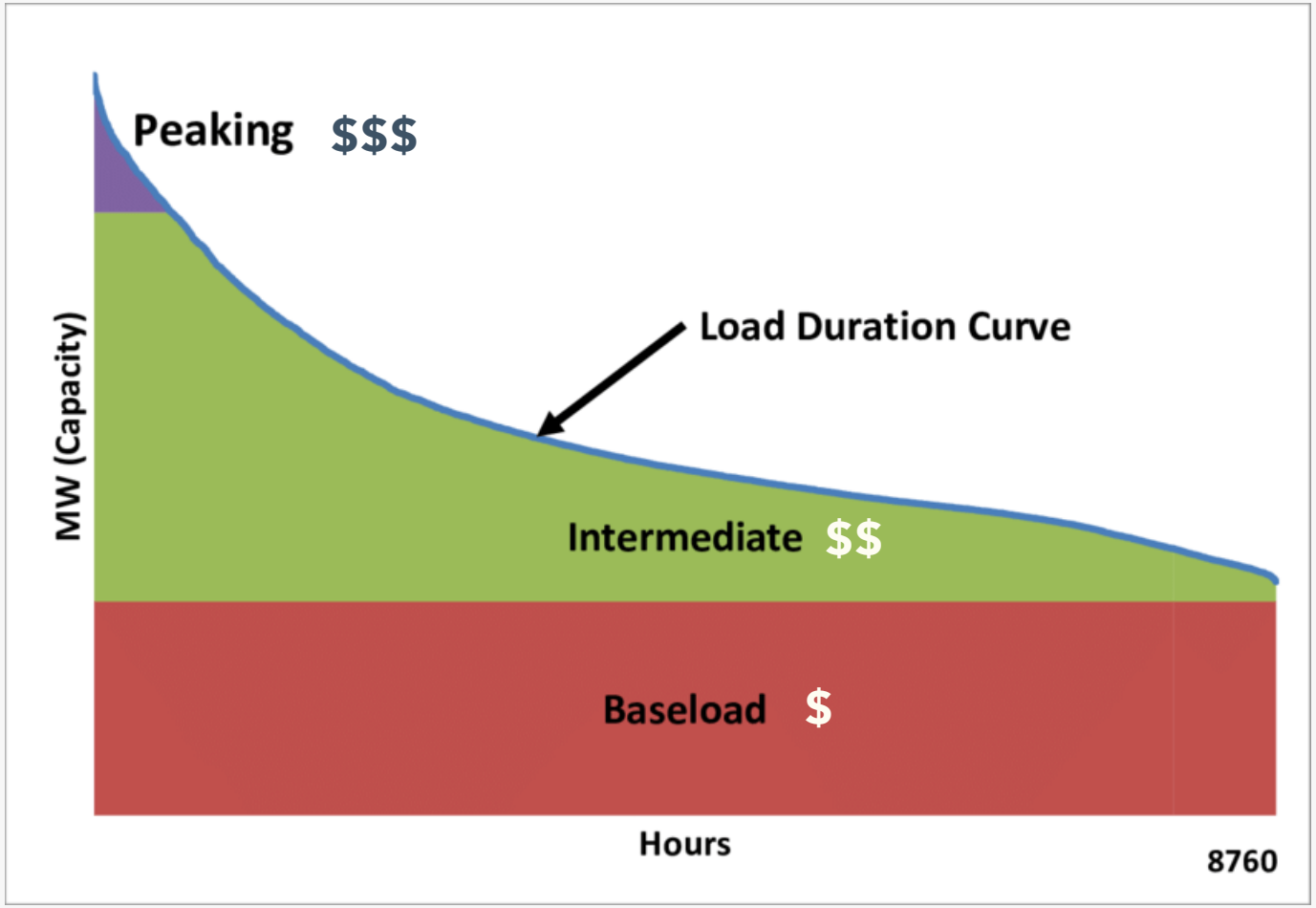
Cost of Electricity Per kWh by US State | Compare 2023-2022 (quickelectricity.com)

Resource & Grid Operations

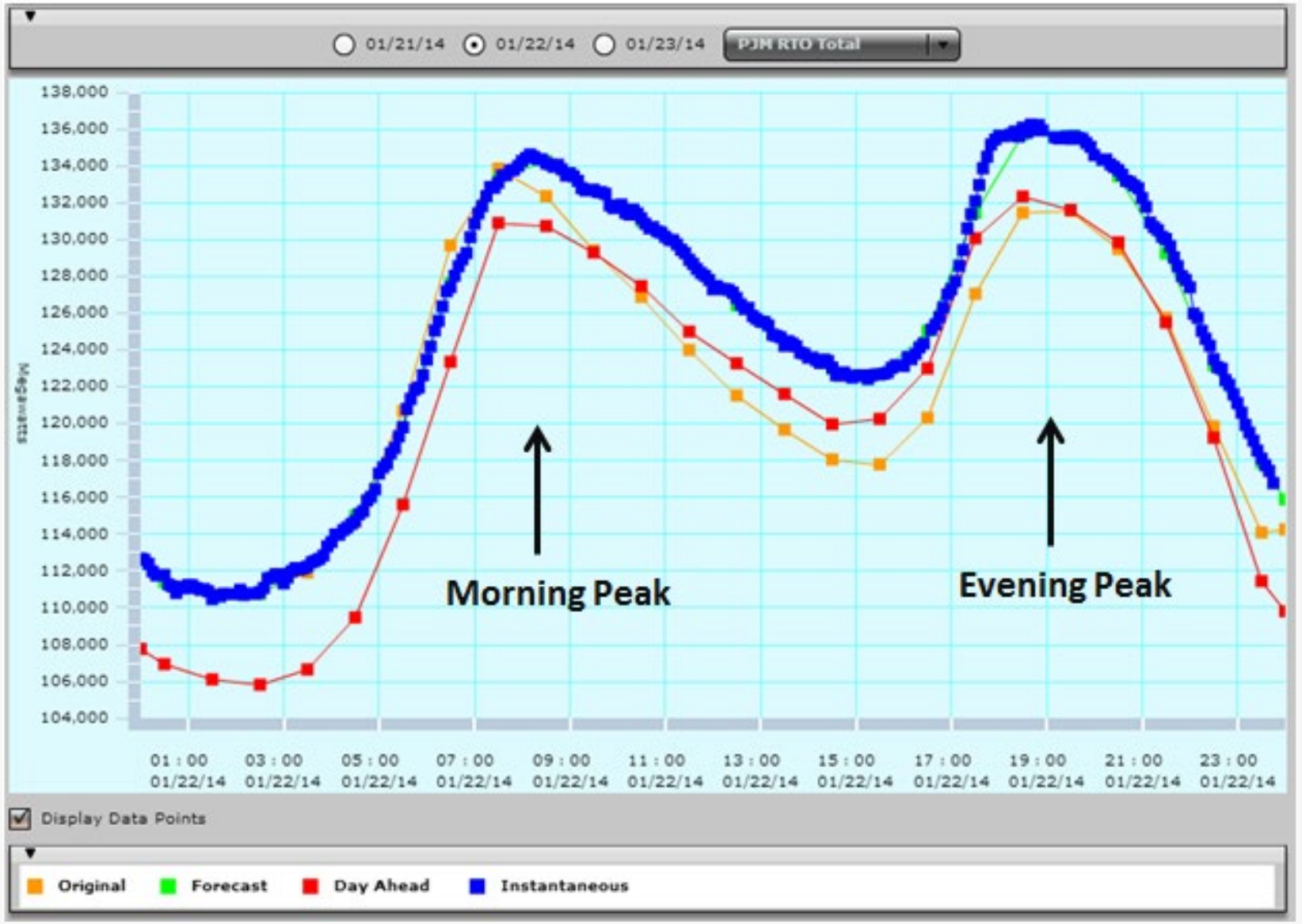


Why Shifting Energy Use Matters?

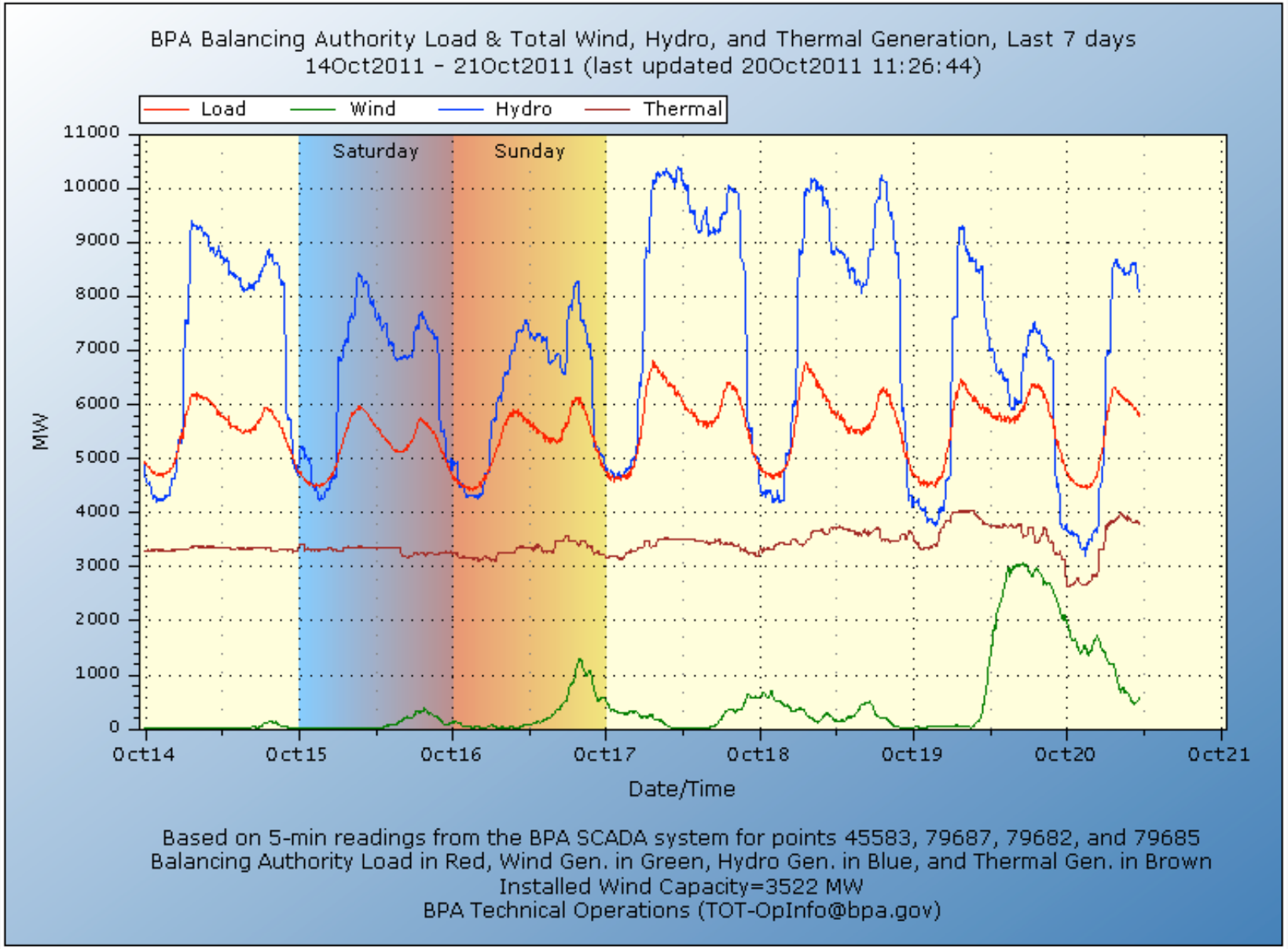
Generation Stack



Daily Energy Usage Patterns



Balancing Demand and Generation



Load Curve with Demand Response

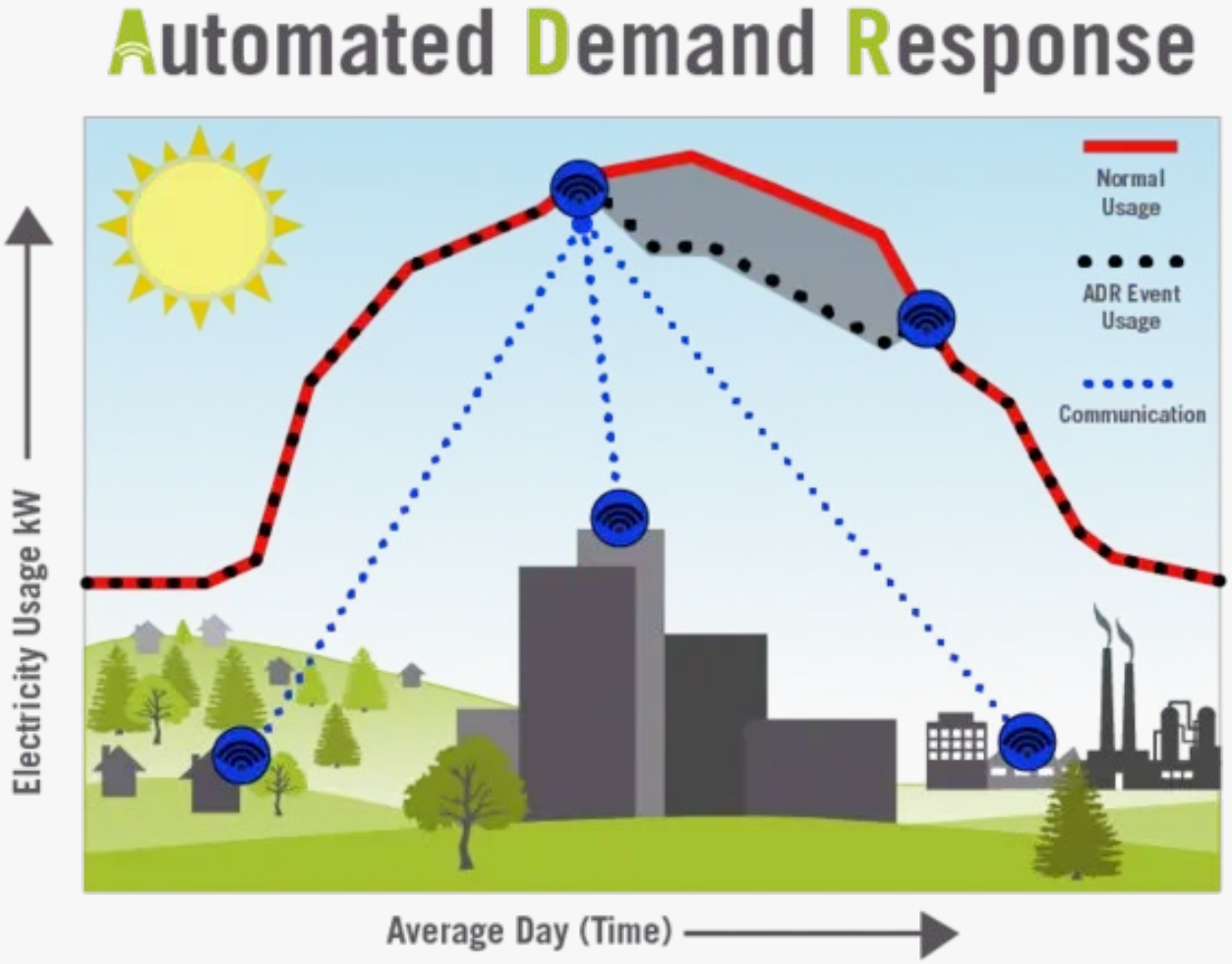


image credit: Energy Solutions

PGE

What is the Smart Thermostat program?

When you enroll in the program, your thermostat will automatically shift some of your energy use away from peak times when energy demand is high. There are typically 8 to 9 Peak Time Events each summer and 5 to 6 in winter, with a maximum of 15 per season. Events typically last 1 to 4 hours.

- You'll earn up to $25 for signing up, plus save $25 on your PGE bill each summer and winter season you're able to participate*.
- If you don't like the temperature it sets, you're always in control of your comfort and can override the change.

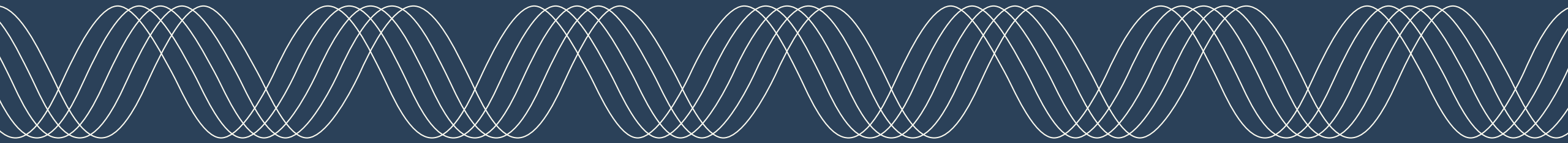
How it works

1. **After you enroll**, PGE will send you an email the day before a Peak Time Event and you'll get a message on your thermostat or mobile app. This'll let you know when the event will start and stop.

2. **Before the event**, we'll send a signal to your thermostat to pre-heat or pre-cool (depending on season). During the event, your thermostat will automatically adjust by 1 to 3 degrees to temporarily reduce your energy use. You don't have to do a thing!

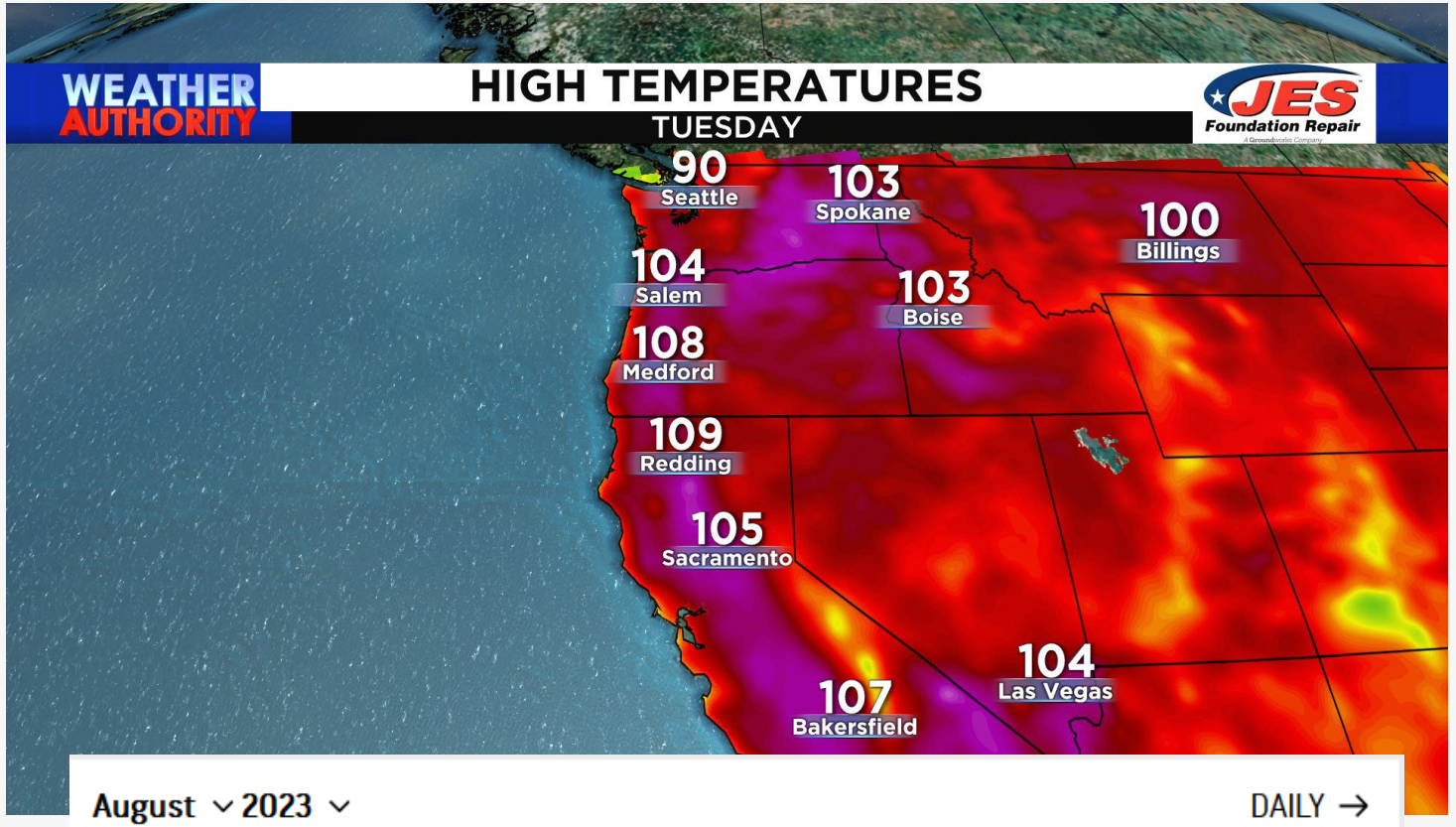
3. **After the event**, your thermostat will automatically return to its original setting. It's that easy and you're on your way to earning your $25 seasonal reward for participating*.

Summer Season Performance (& August Heatwave)



August 2023 Heatwave

- Monday Aug 14
- Tuesday Aug 15
- Wednesday Aug 16



August 2023 DAILY →

S	M	T	W	T	F	S
13	14	15	16	17	18	19
100° 67°	108° 65°	102° 68°	102° 69°	91° 65°	82° 60°	88° 53°

August 2023 Heatwave

- Monday Aug 14
- Tuesday Aug 15
- Wednesday Aug 16

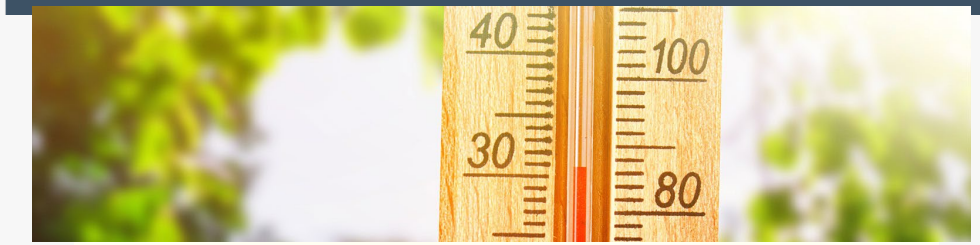
Energy Partner Smart Thermostat Summer Recap

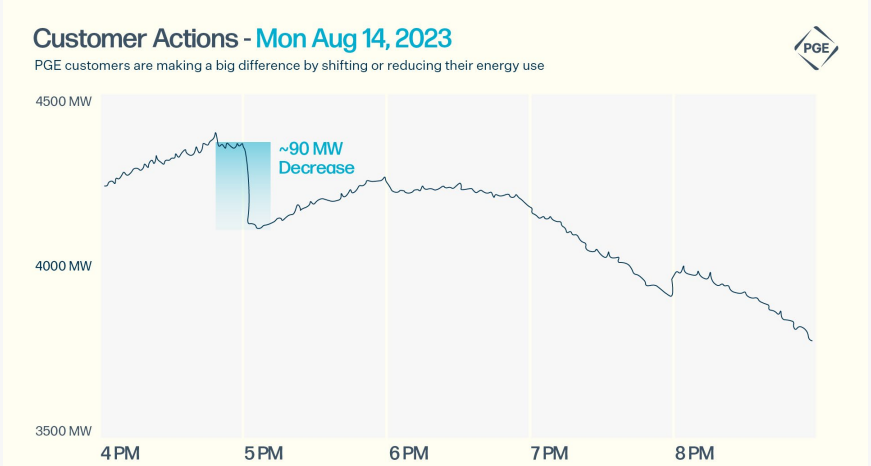
PGE's Energy Partner Smart Thermostat summer season wrapped up on September 30. Thank you for being a part of a community of business leaders taking action and helping shape Oregon's clean energy future.

August 2023 Heatwave

- Monday Aug 14
- Tuesday Aug 15
- Wednesday Aug 16

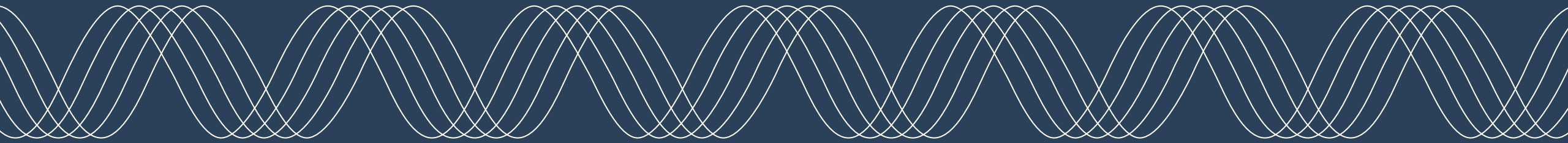
Together, we're making a difference





Questions/ Comments

Next Steps and Closing Remarks



Next Steps & Closing Remarks

- Nov 21 | 3p | IRP/CEP Staff Round 2 Comments & Recommendations due | LC 80
- Dec 14 | 10a-12p | Zoom | Learning Lab # 10

Meeting materials and recording will be posted to our Plan's Engagement webpage at Plan's Engagement | Portland General Electric

For more information or if you have questions, please email us at LearningLabs@pgn.com

Please continue participating in our dockets

- CEP/IRP Docket LC 80

An

kind of energy