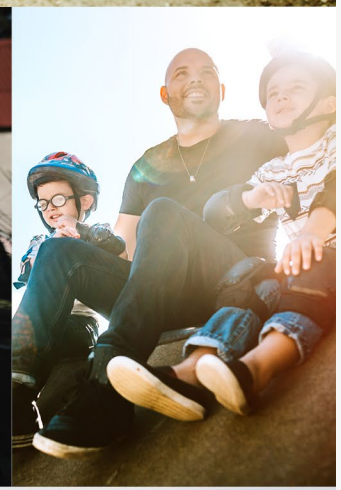
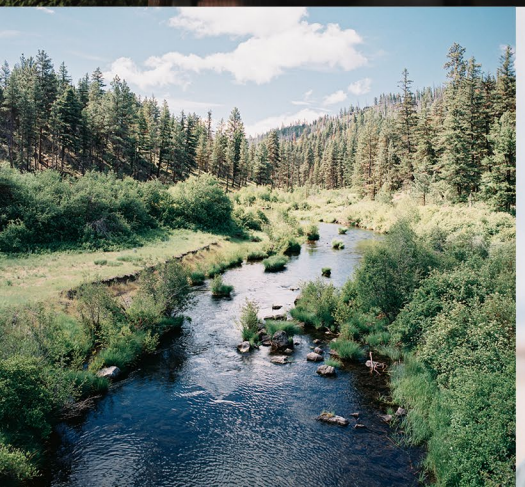




Learning Lab

Learning Lab # 10 - December 14, 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

Agenda

10:00 – Welcome & Meeting Logistics

10:10 - Distributed Energy Resources (DERs) Integration Opportunity

11:05 - Break

11:10 - Distribution System & DER Readiness

11:55 - Closing Remarks & Next Steps

12:00 - Adjourn

Meeting Objectives

Strategy and goals: Share with Stakeholders our strategy for increasing the number of distributed energy resources (DERs) on the distribution system

Distribution system 101: Provide an overview of considerations that go into planning for more DERs

Empowered Communities | We Heard

Themes identified in relation to community needs

- Outcomes
- Transparency
- Trust
- Financial Needs and Incentives
- Education and Awareness
- Community Benefits
- Community/Customer Involvement
- Customer Resilience
- Renters' vs Owners' Needs

Distributed Energy Resources (DERs) Integration Opportunity

Jason Salmi-Klotz, Senior Manager DER Strategy & Planning

Learning Lab # 10 - December 14, 2023

PGE An Oregon kind of energy.℠

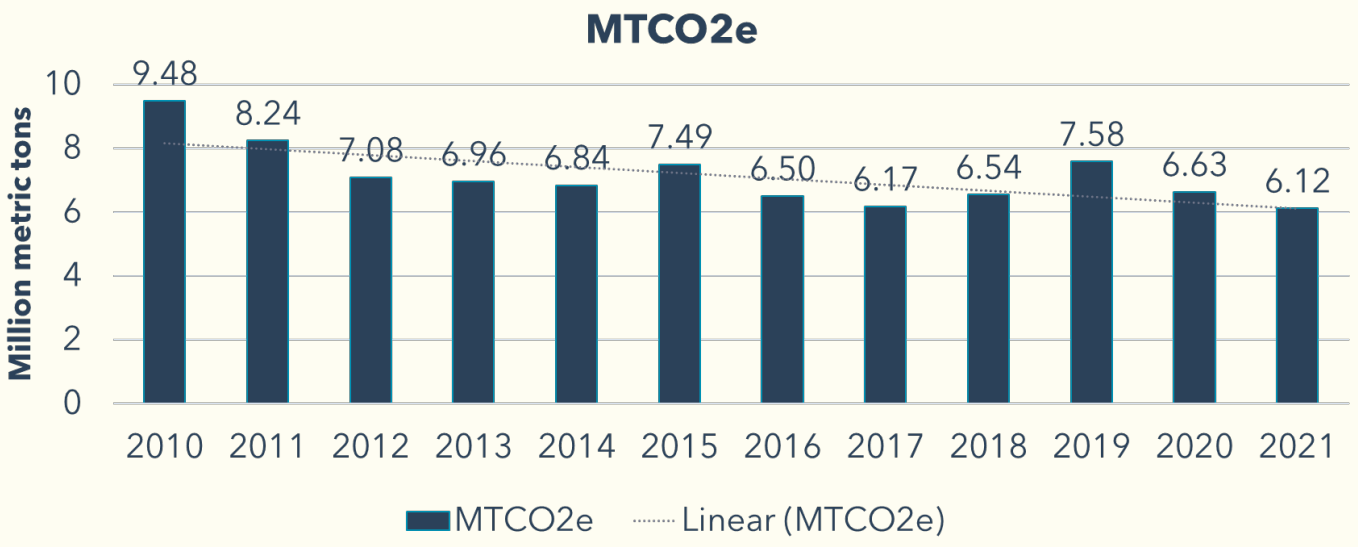
Objectives

Present our rationale for integrating Distributed Energy Resources (DERs) into the Distribution System

Elicit feedback on our rationale

Share our next steps

PGE's Annually Reported Emissions to DEQ*



*Anthropogenic emissions from power generated and purchased to serve Oregon retail customers.

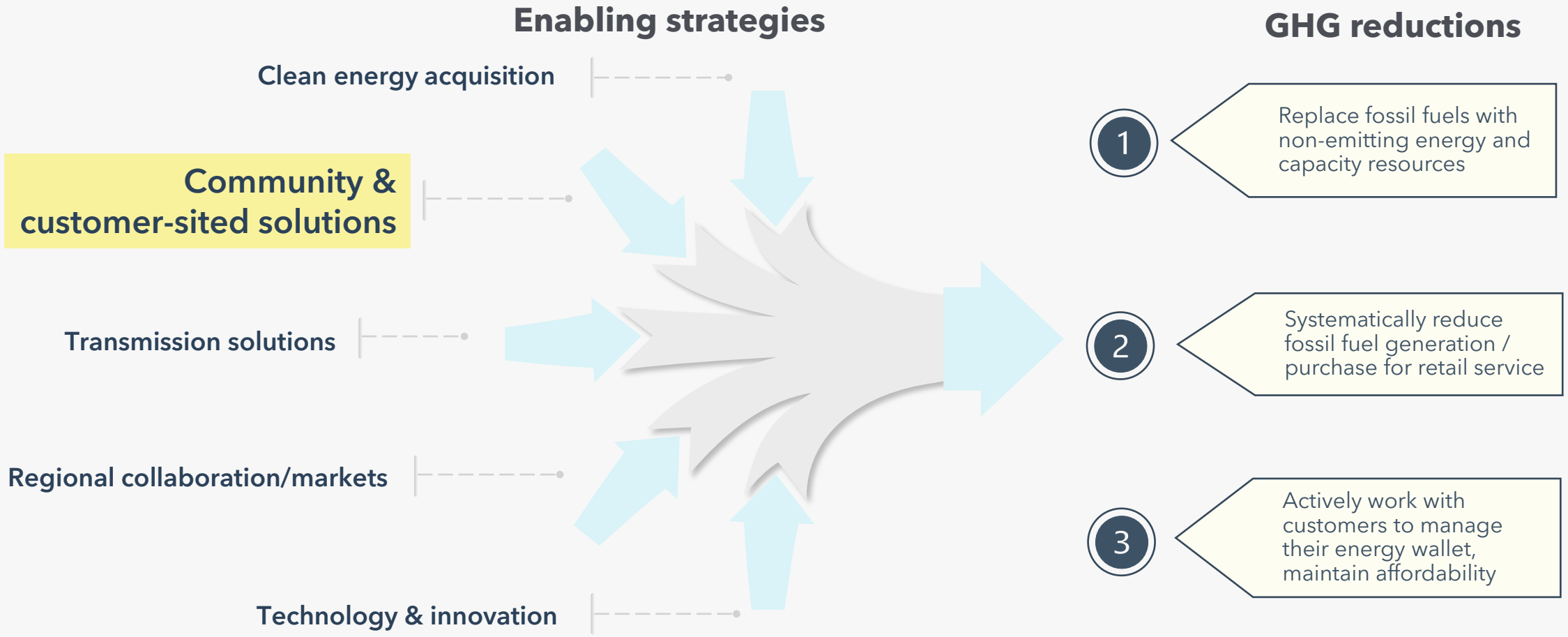
Emissions Targets

HB 2021 Requirements

	MMTCO2e	Reduction
Baseline	8.1	per DEQ
2030 Target	1.62	80%
2035 Target	0.81	90%
2040 Target	0	100%

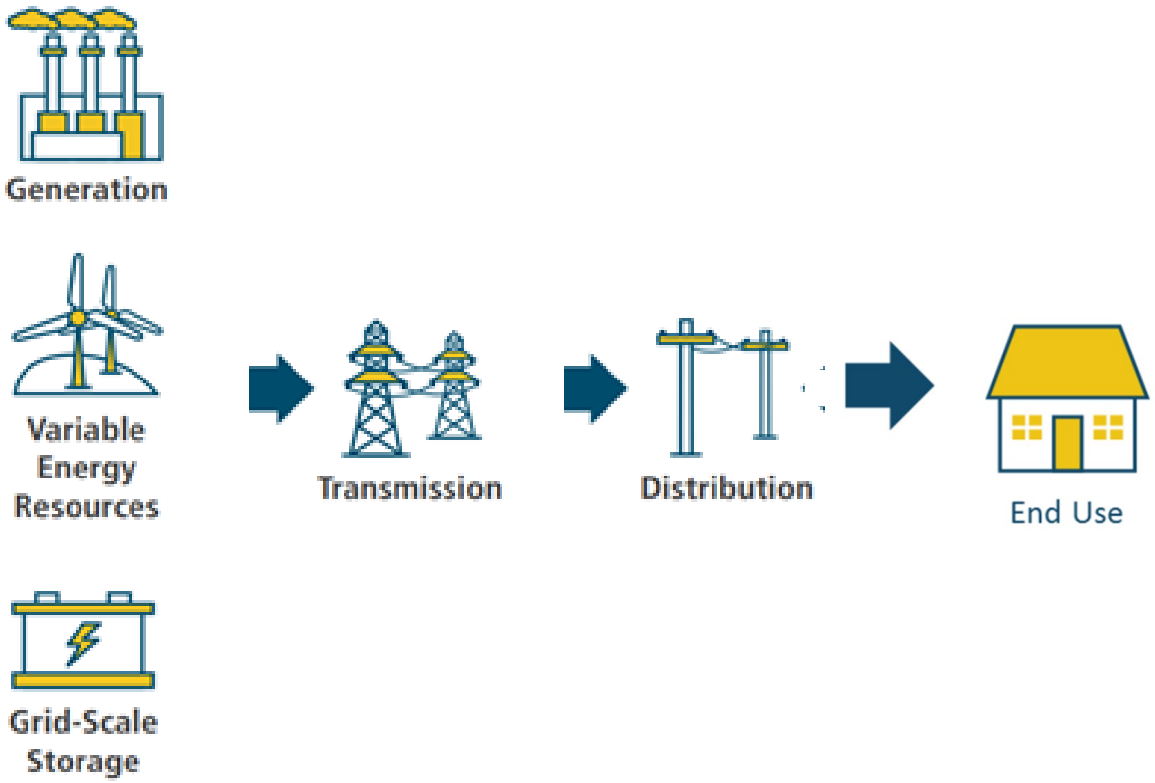
Path to 2030 Strategy

Our decarbonization strategy is multi-faceted to support reliable and affordable power



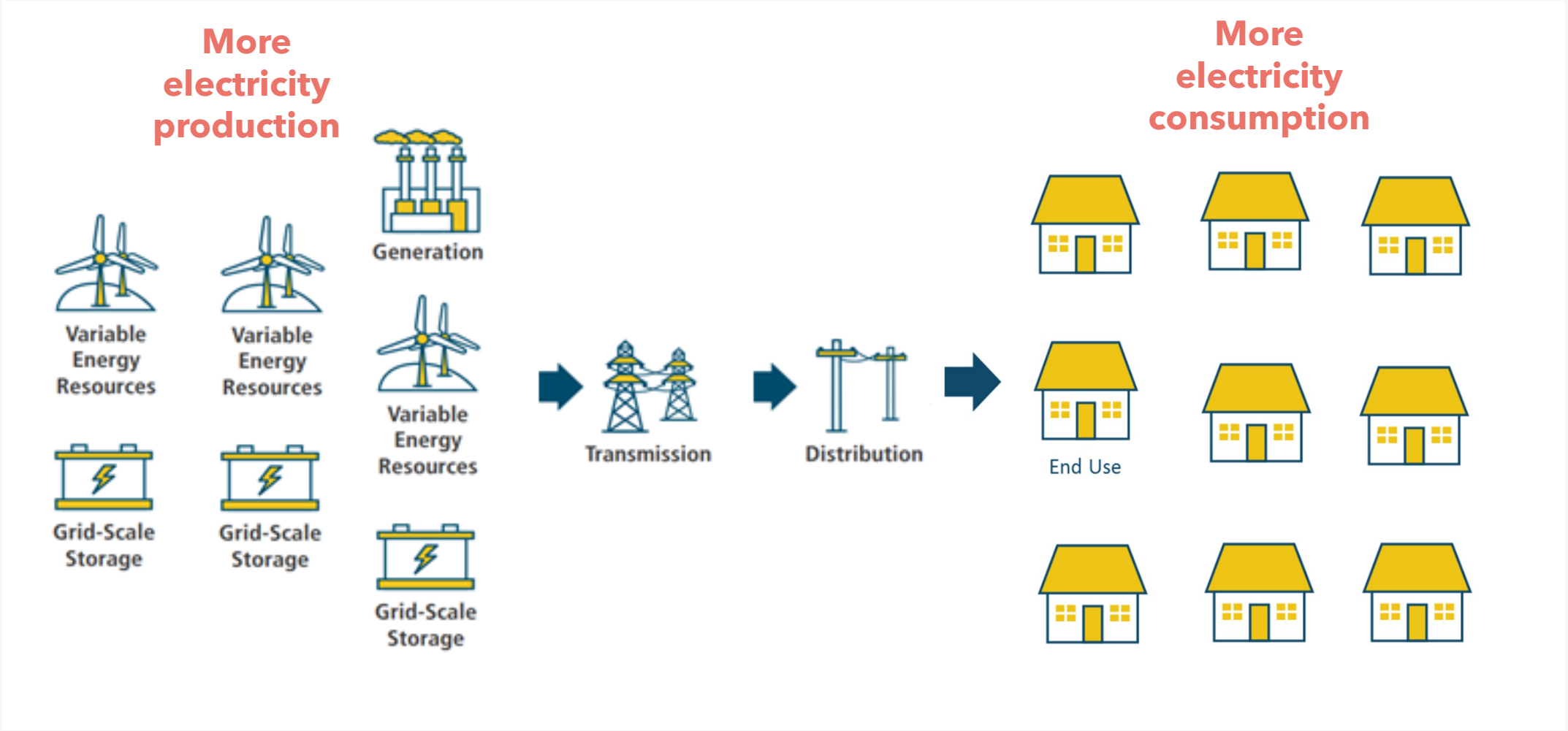
For illustration purposes only

Meeting energy needs today



For illustration purposes only

Meeting future energy needs – without DERs



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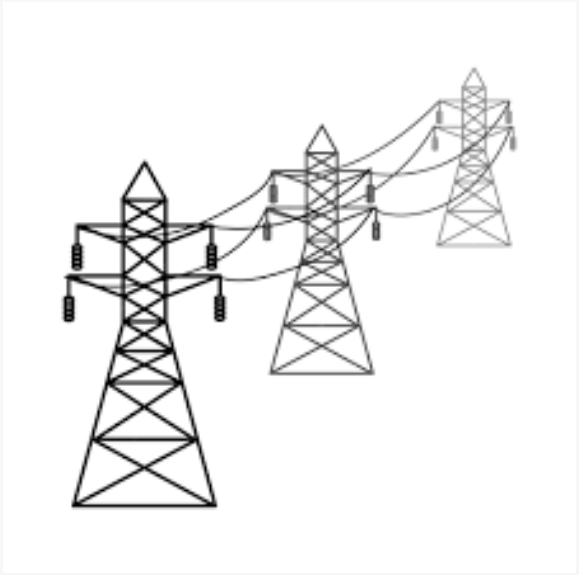
Zooming in on Transmission



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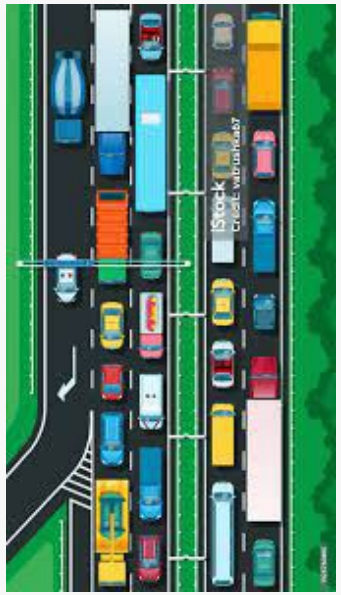
2023

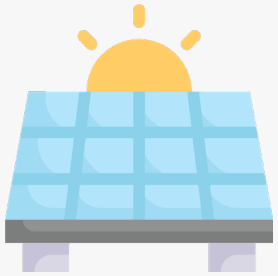


2030

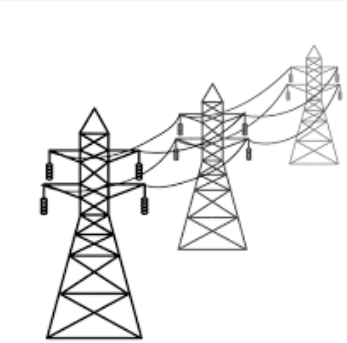
For illustration purposes only

Problem Statement

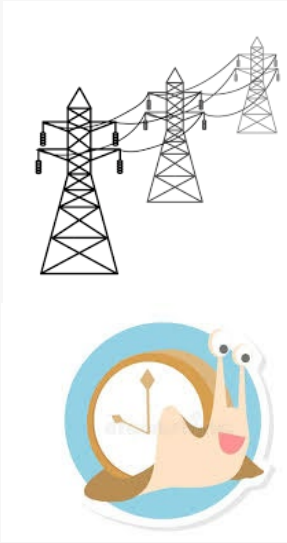
We have to add renewable resources



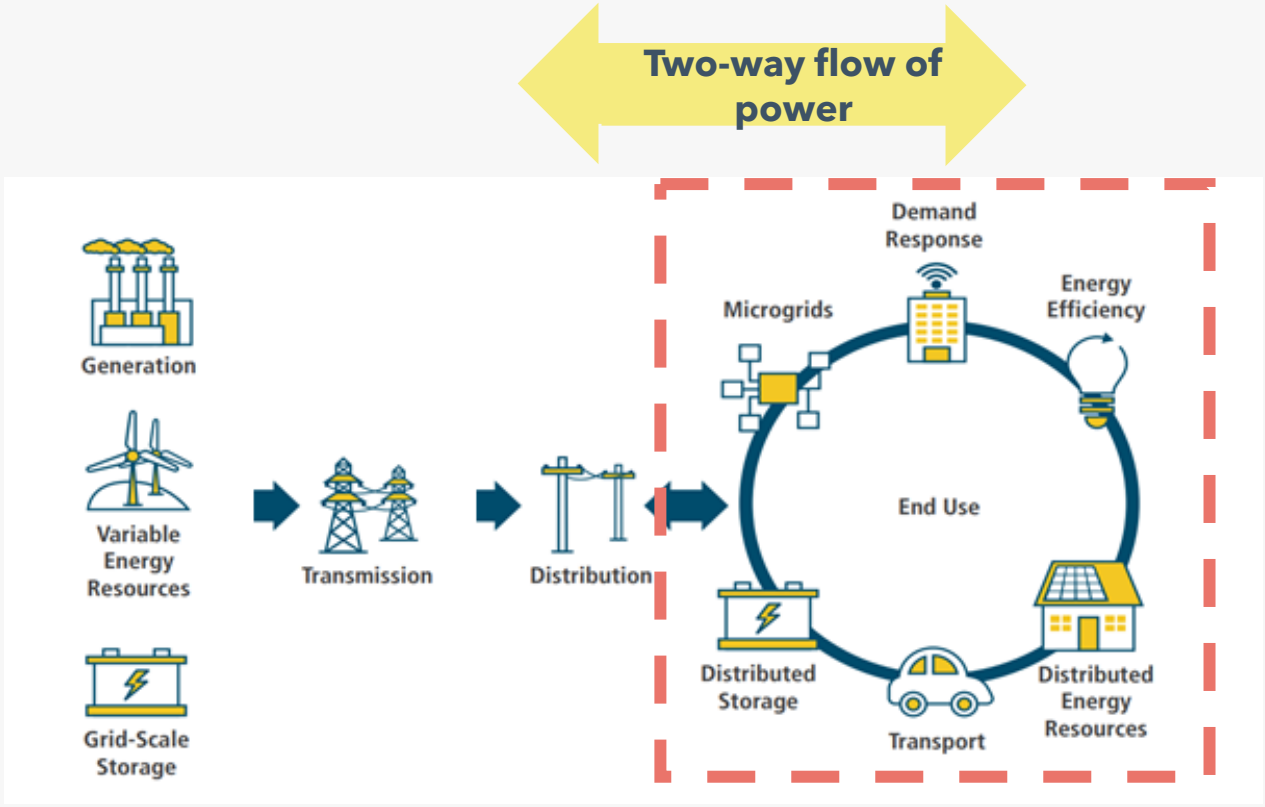
We are transmission constrained

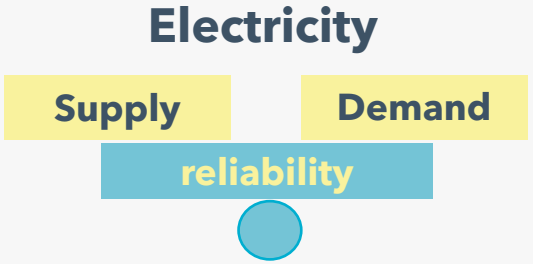


We need to add transmission, but it requires time



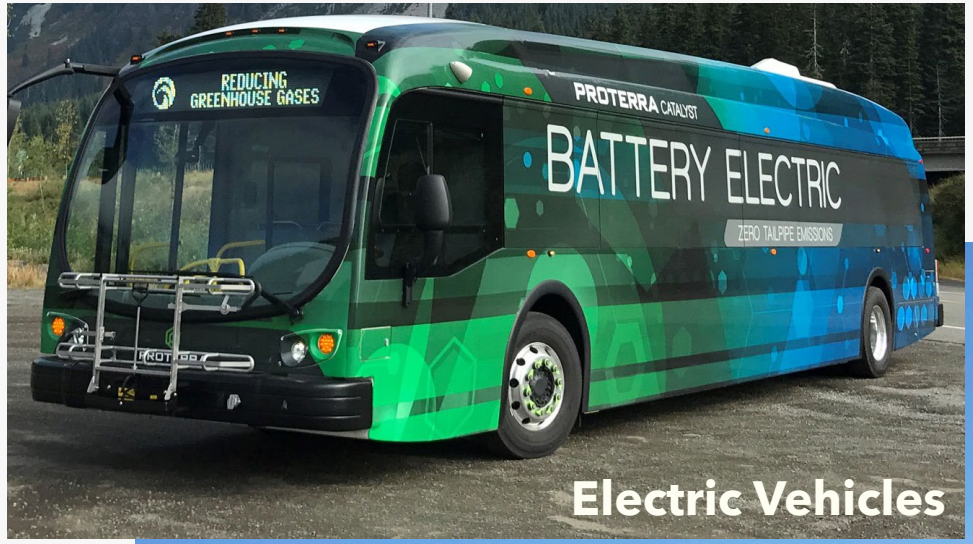
Continue & Accelerate Modernizing the Grid

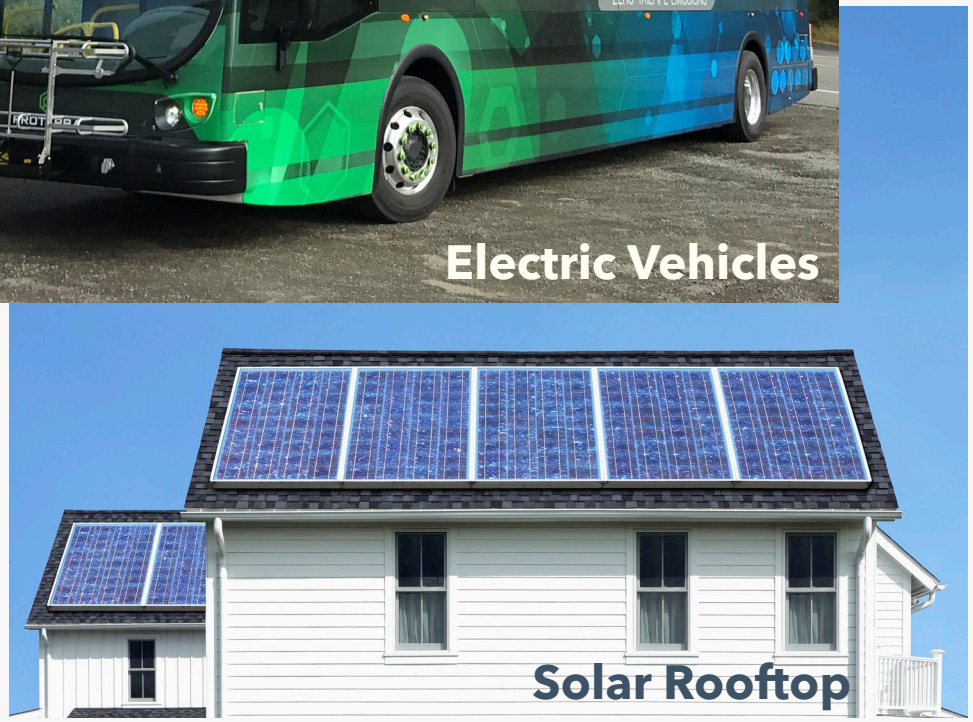




two-way power flow – end users/customers can also generate power and/or interact with the electric grid

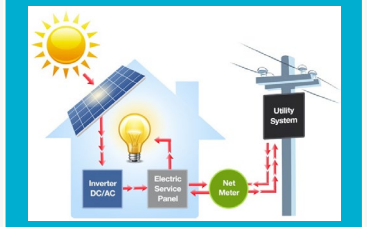
Distributed Energy Resources (DER) examples:



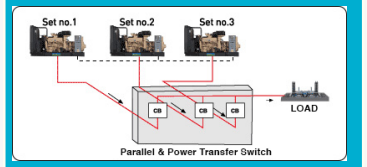


Distributed Energy Resources Efforts Over Time

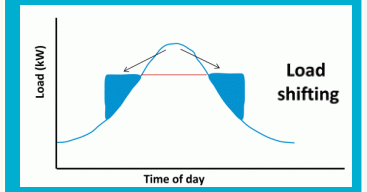
Energy Efficiency 1990's



Net Metering 1990's



Dispatchable Standby Generation 2000's

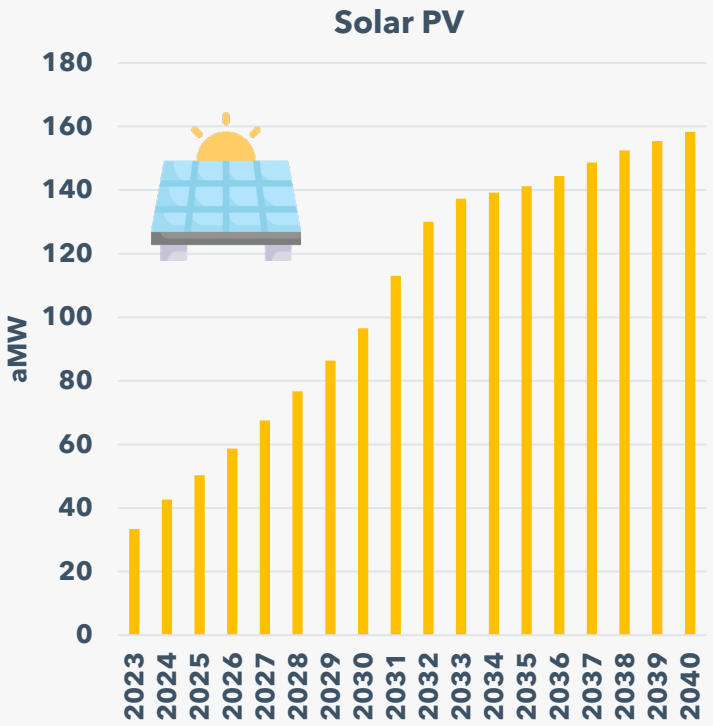


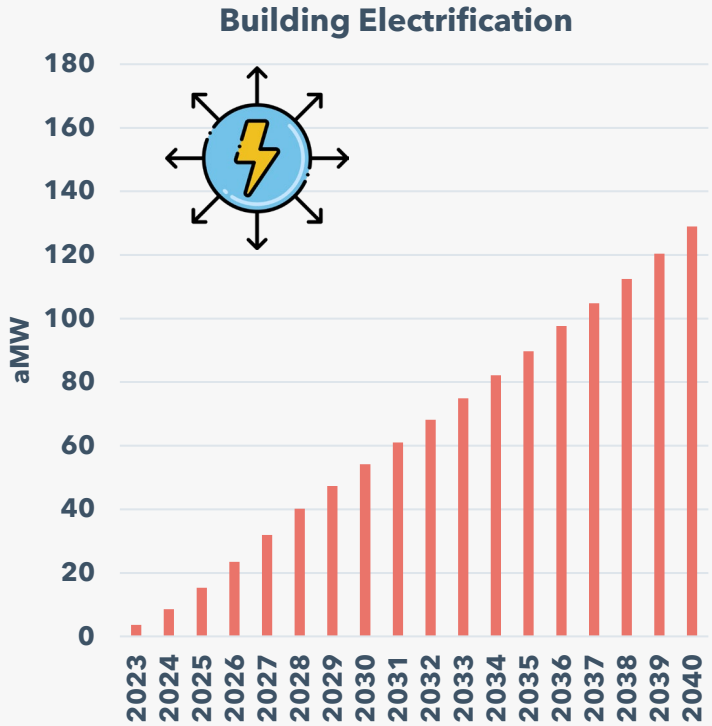
Demand Response 2013

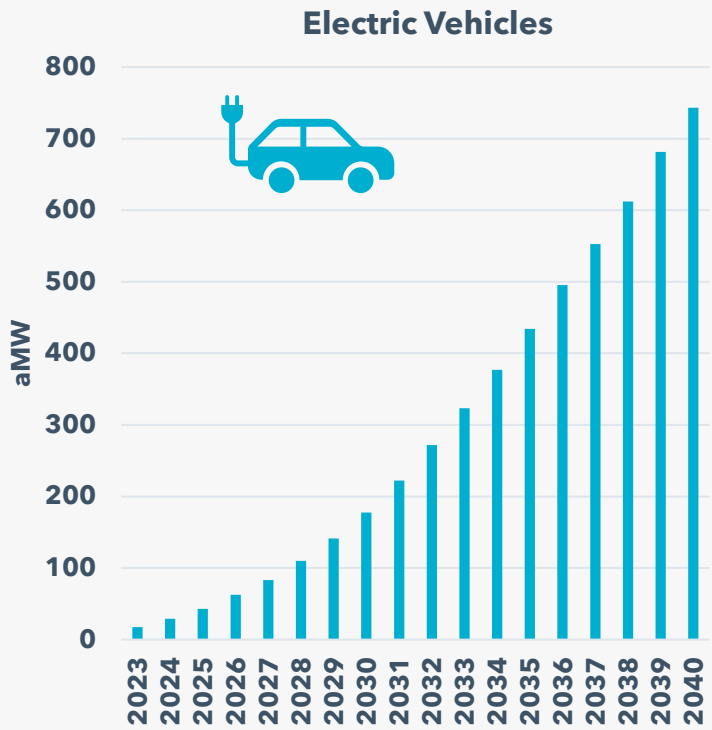
Transportation Electrification 2019

PGE Smart Grid Test Bed 2019

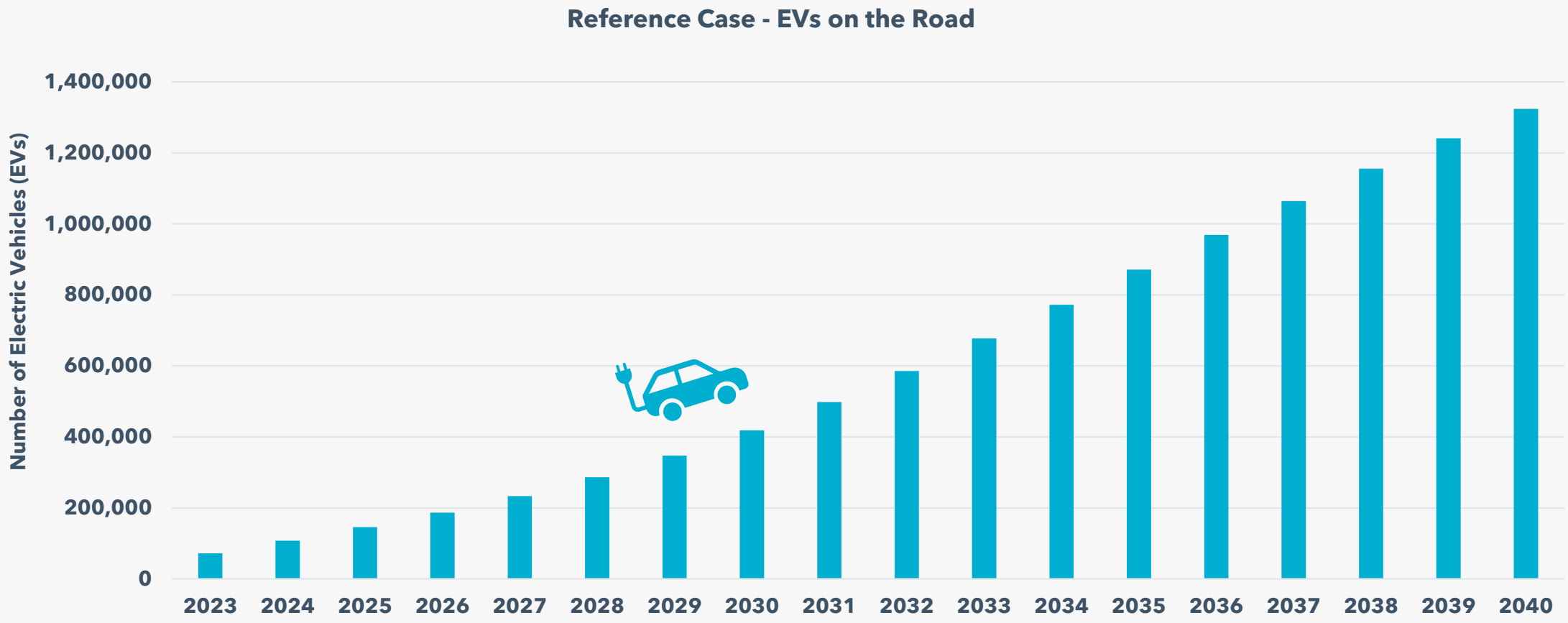
Long-term Energy Impacts from Distributed Energy Resources (DERs)



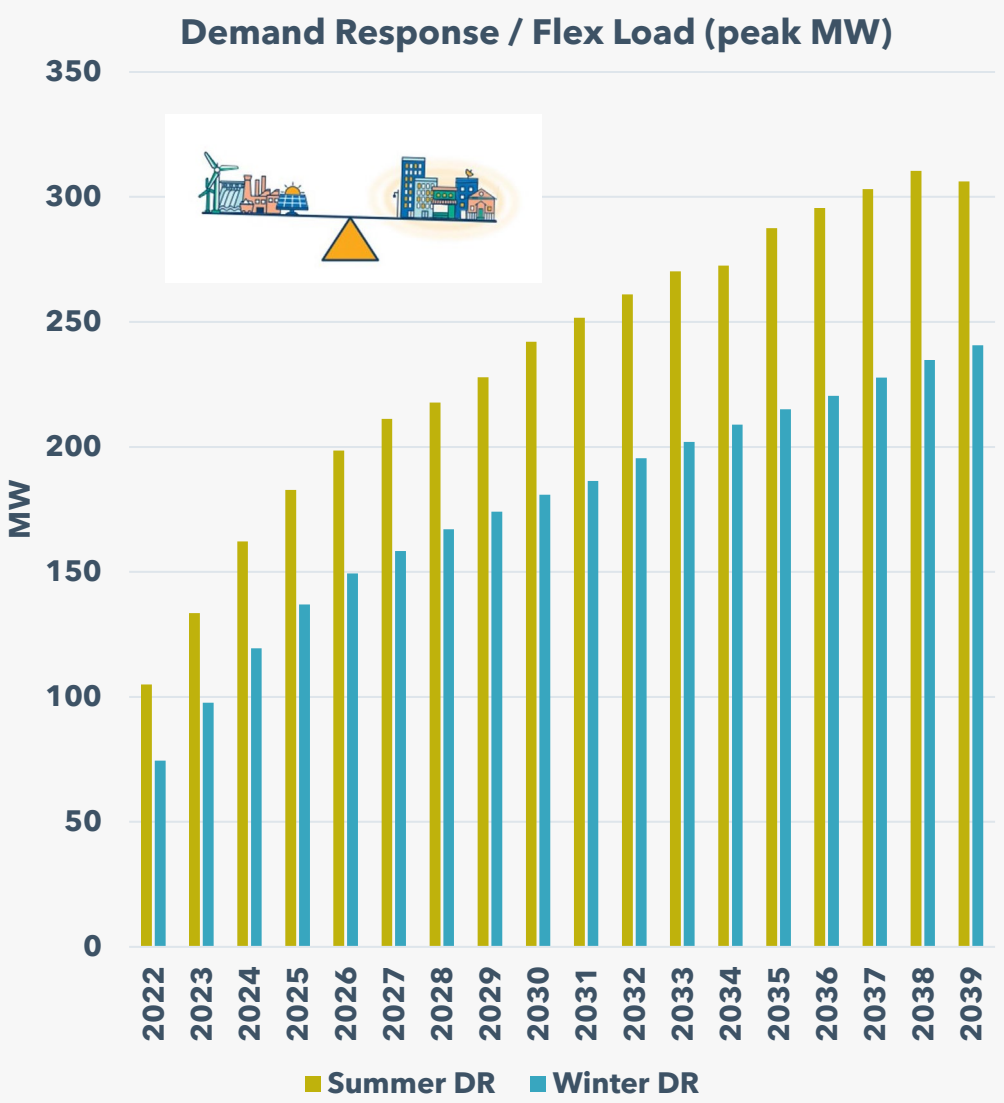


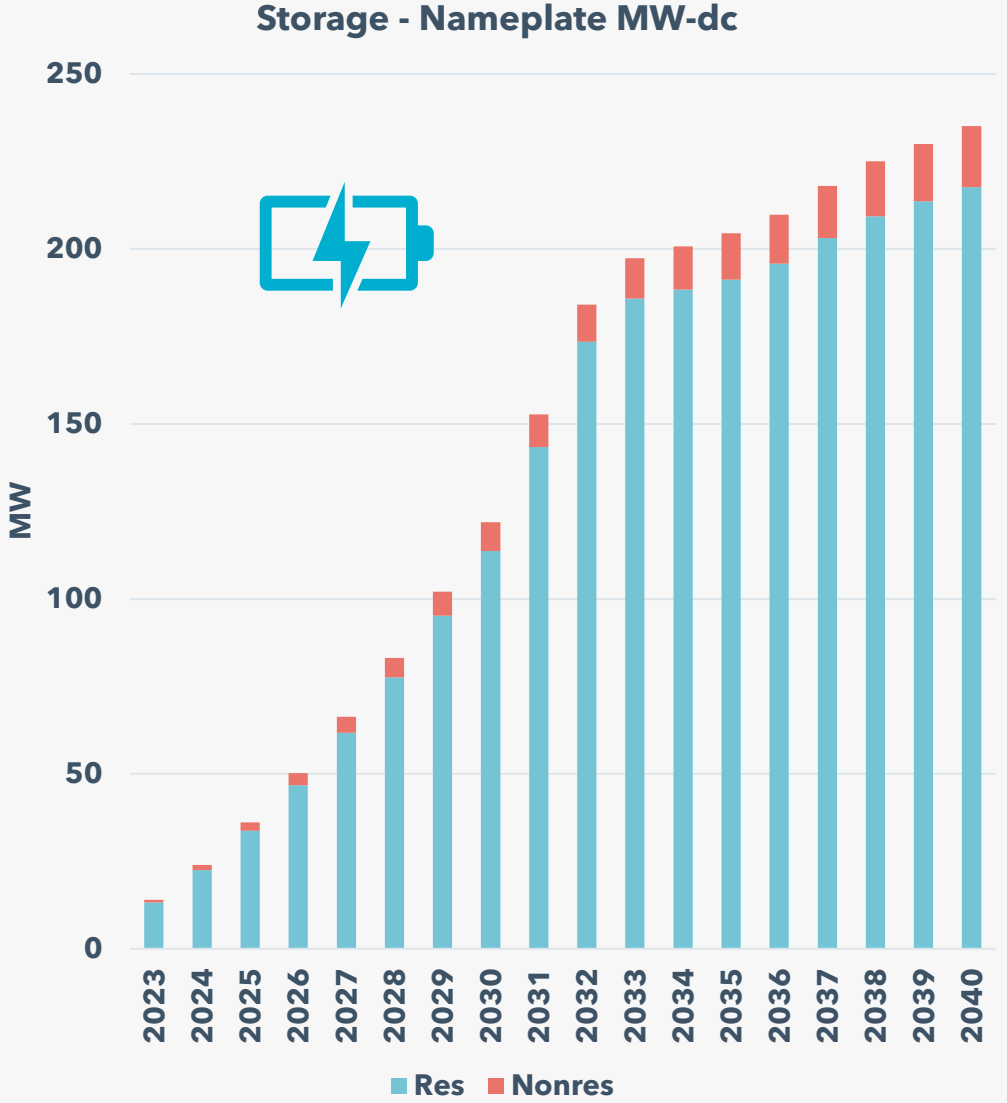


Number of Electric Vehicles Forecasted to 2040



Long-term Flex / Capacity Potential from Distributed Energy Resources (DERs)





Stages of DERs in the Distribution System

Connection

Stage 0

Physically connected to the utility grid

Delivery

Stage 1

Call and Delivering anytime

Utilization

Stage 2

Monitored for availability

Price

Stage 3

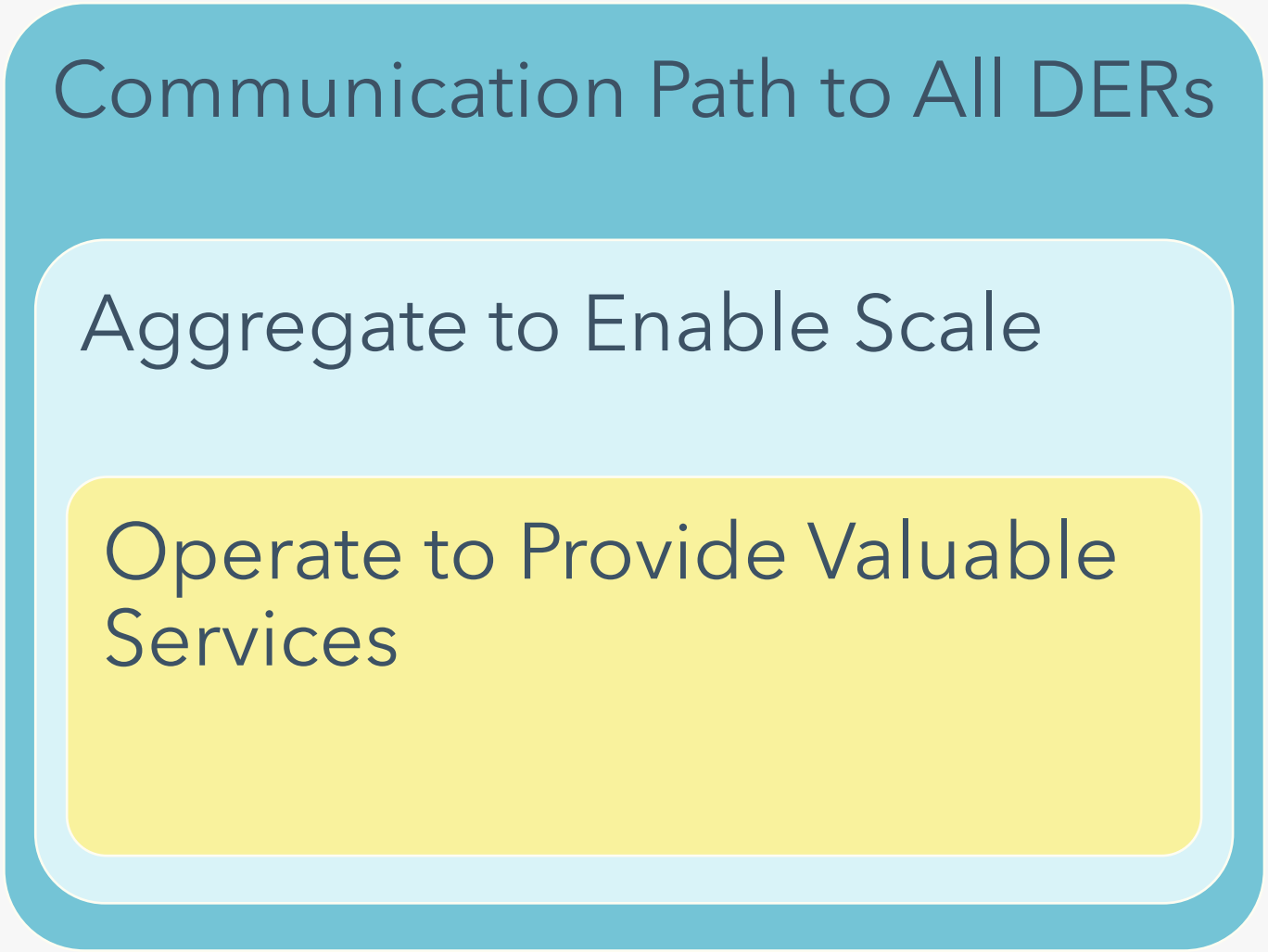
Send at the lowest cost available

DER integration & optimization

Examples

Multi-family Water Heaters		+ 	
Smart Thermostats		+ 	
Rooftop Solar			
Beaverton Public Safety Center (microgrid)		+ 	+ 

Advancing Our Ability to Deploy and Use DERs



Opportunity to Integrate DERs

If we continue on our current path

Current market

Current incentives

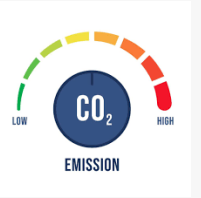
Under current assumptions

We will have a lot of DERs in the Distribution System

What is the Value for our Customers | Control

Customers will be in control of their energy journey

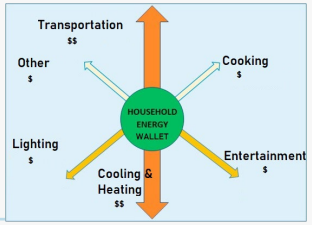
Reduce Carbon Emissions



Reduce Energy Consumptions

Sell Excess Energy Produced to Utility

Improve Efficiency of Energy Wallet



What is the Value for our Customers | Reliability

Climate Change
Multiple Day Extreme Weather Events

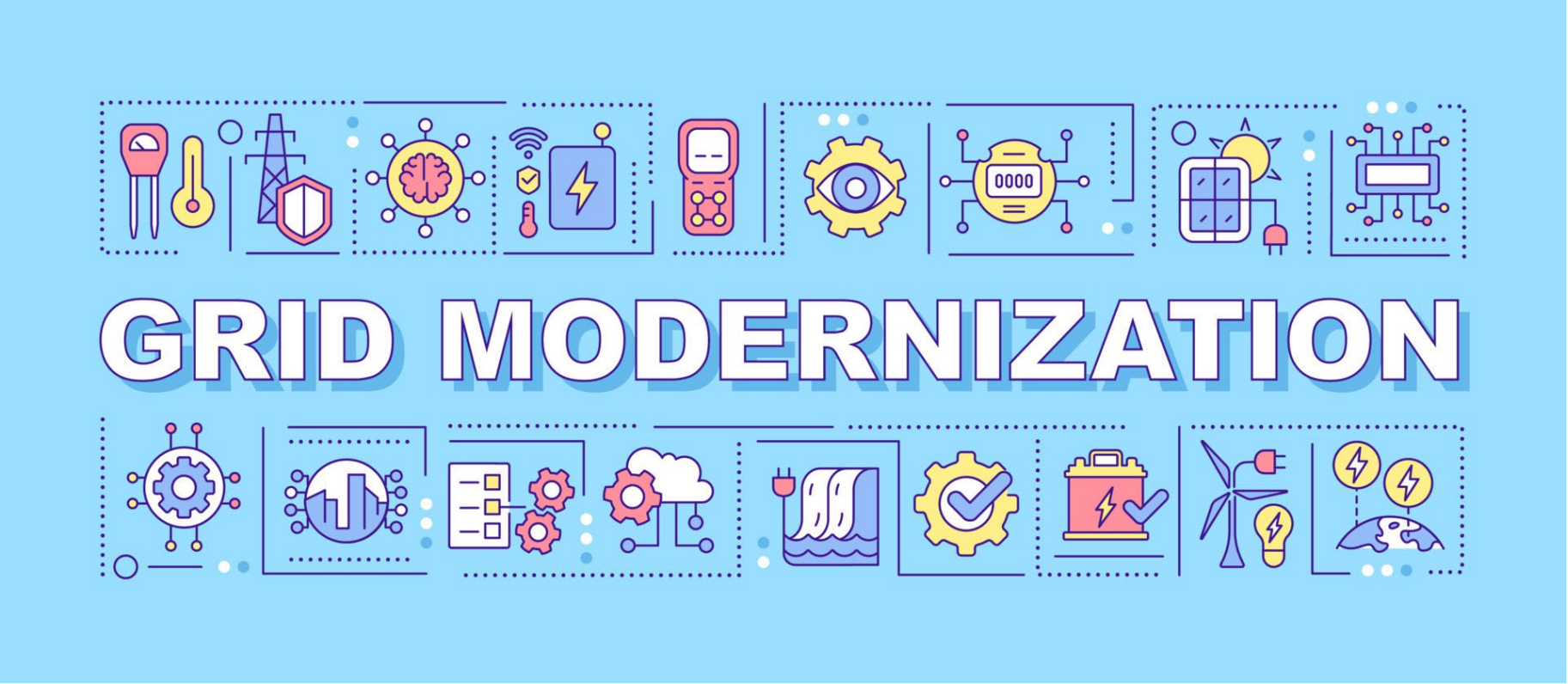
Example of DERs Use for Reliability
(3-day event Aug = 94 MW shaved off of peak)

Using August extreme weather event scenario

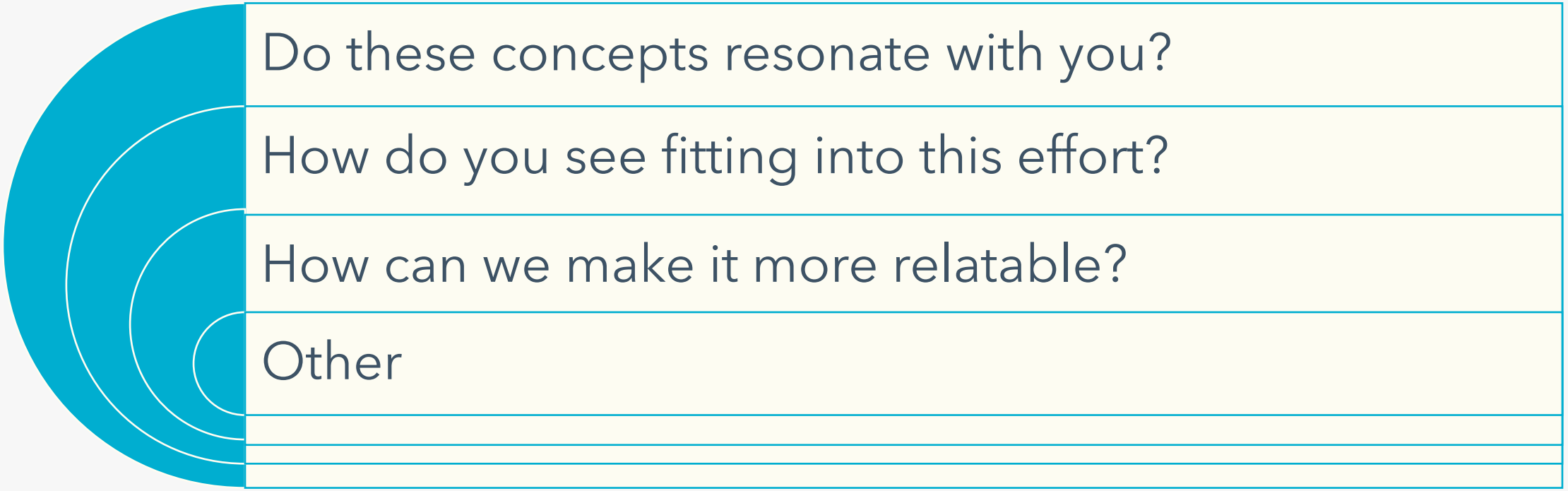
- Reduce risk of rolling brownouts and blackouts
- Avoid buying very expensive energy off the market during extreme weather event hours
- Avoid potential harm to system equipment
- Provide additional benefits to customers (DERs)

To Empower our Customers on their Energy Journey

To harness all Distributed Energy Resources (DERs) available in the distribution system, including our customers' DERs, we need to continue and accelerate modernizing our grid

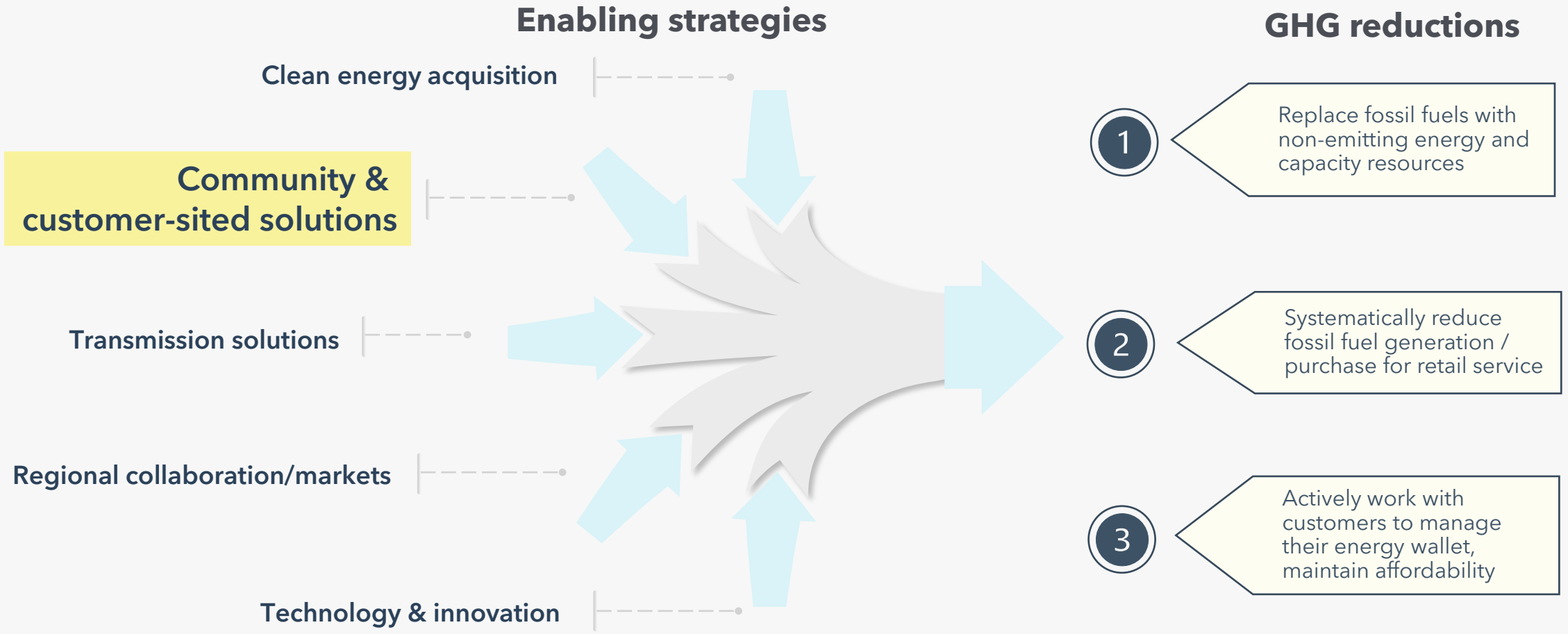


We want to elicit feedback



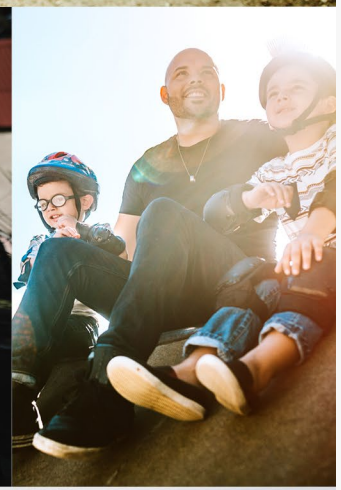
Path to 2030 Strategy

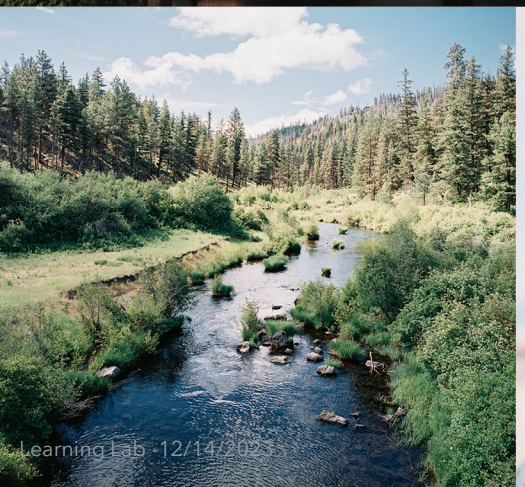
Our decarbonization strategy is multi-faceted to support reliable and affordable power



Questions/ Comments


BREAK





Distribution System & Distributed Energy Resources Readiness

Fatima Colorado, Manager, Distribution Planning

Learning Lab # 10 - December 14, 2023

Objective

Recap previous Distribution System 101
(*link to past ppt* Current Distribution System Planning Process)

Distribution system components that prepare the grid and customers for Distributed Energy Resources (DERs)
(*link to past ppt* Long Term Plan: Grid Modernization)

Distribution Information

Service Area

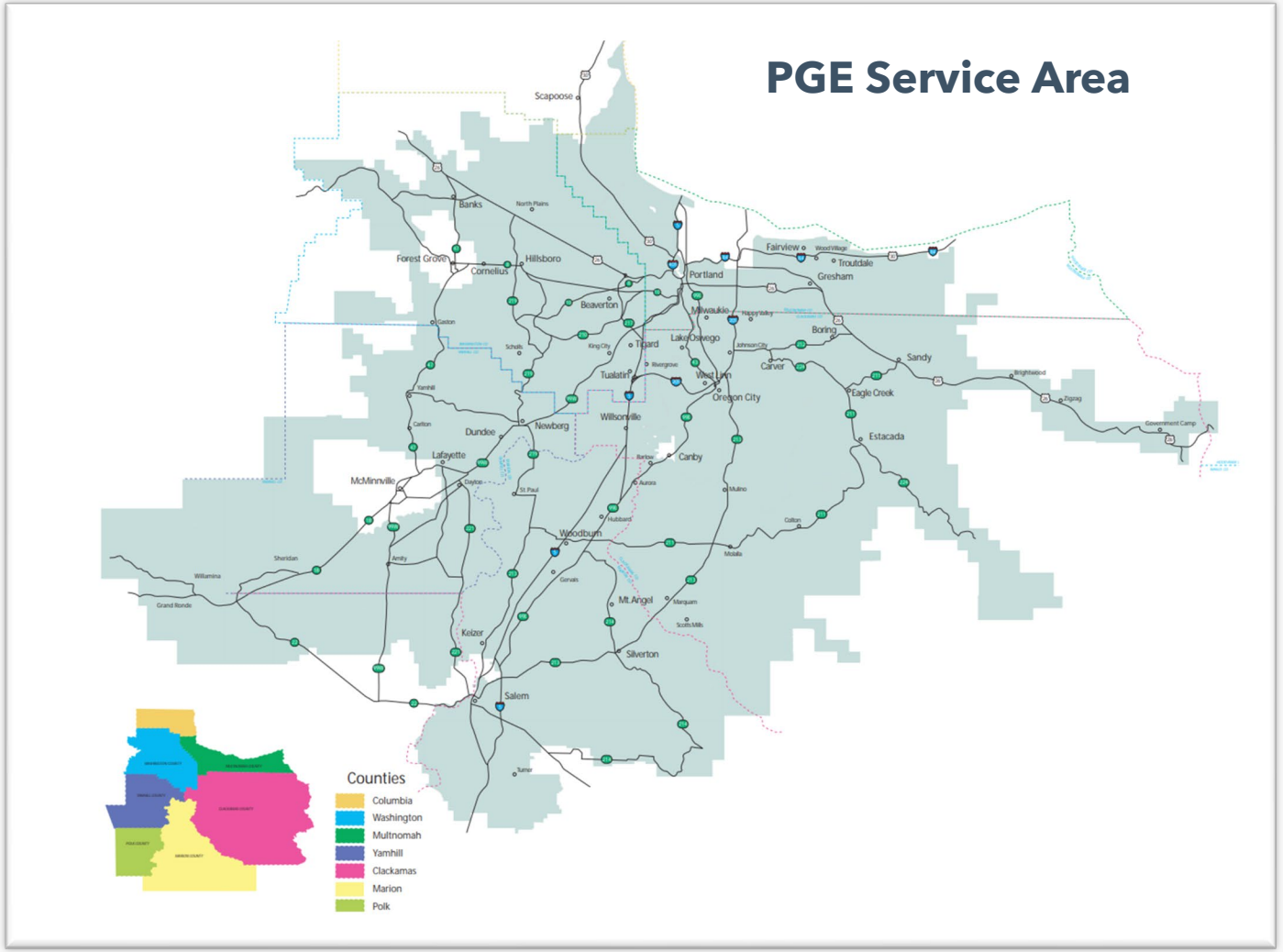
- 1.9 million population
- 4,000 square miles
- ~900,000 customers

Big Equipment

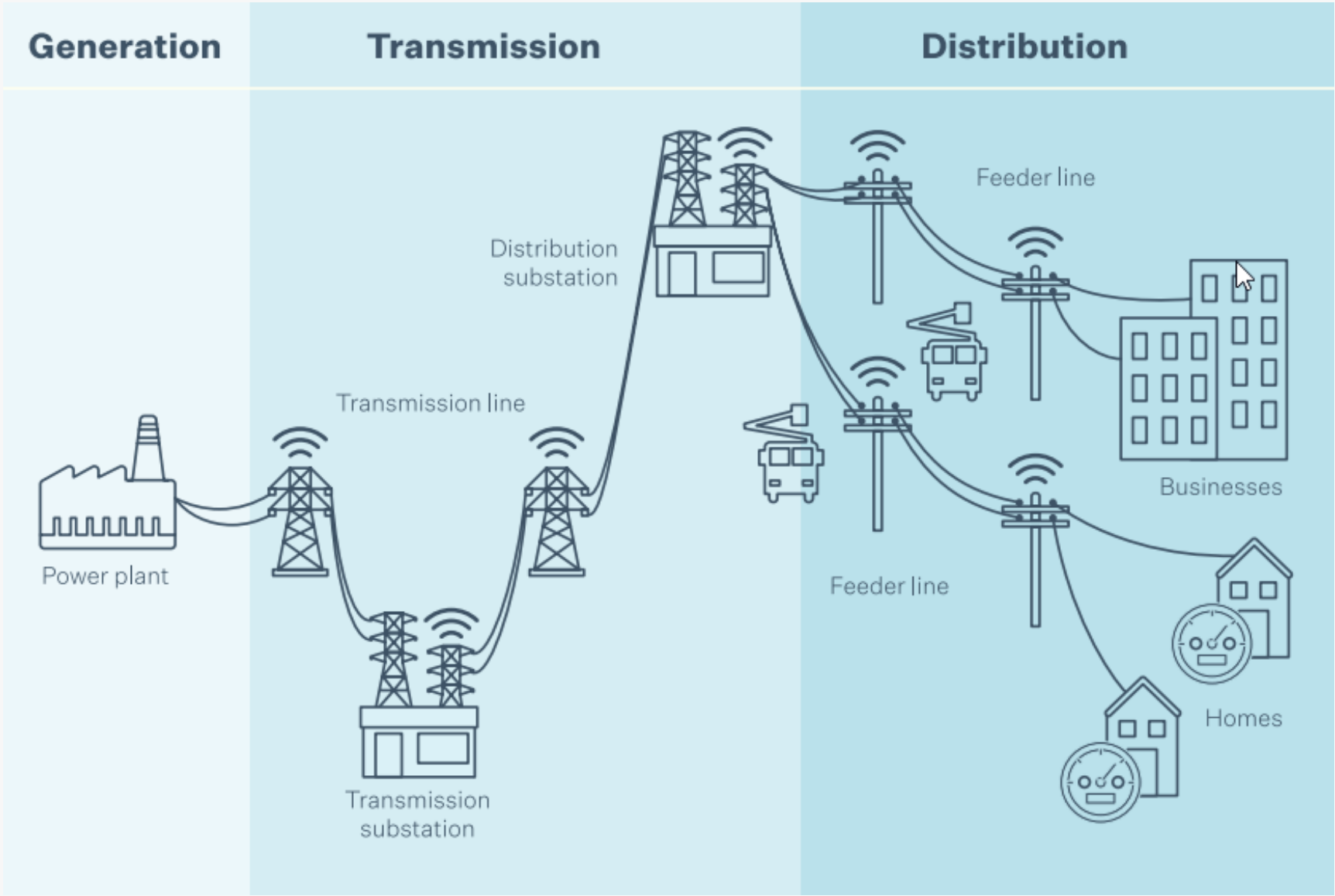
- 153 Substations
- 270 Power Transformers
- **701** Feeders

Net System Peak Load

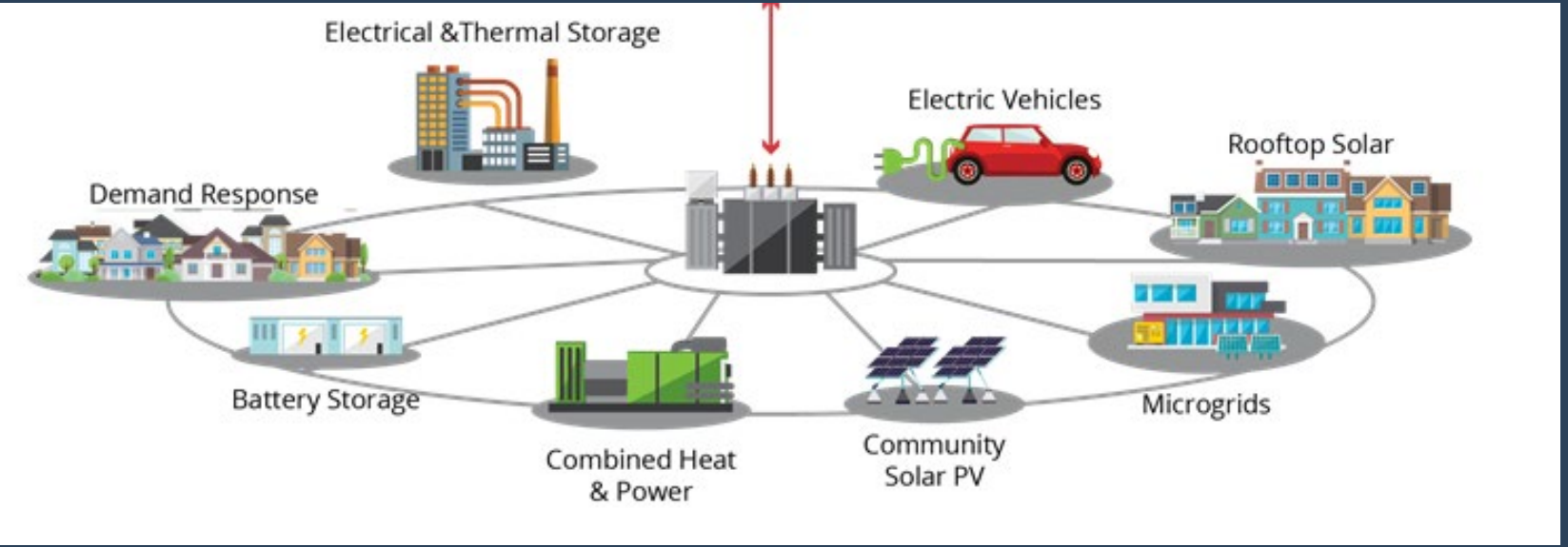
- Summer: 4,498 MW
- Winter: 4,116 MW



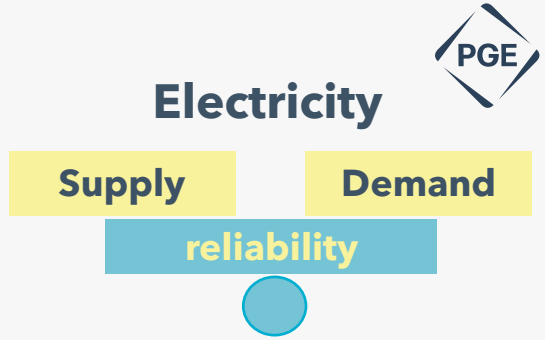
The Grid


Generation
Transmission
Distribution
Feeder line
Distribution substation
Transmission line
Businesses
Power plant
Feeder line
Homes
Transmission substation

Distribution System
&
Distributed Energy Resources Integration

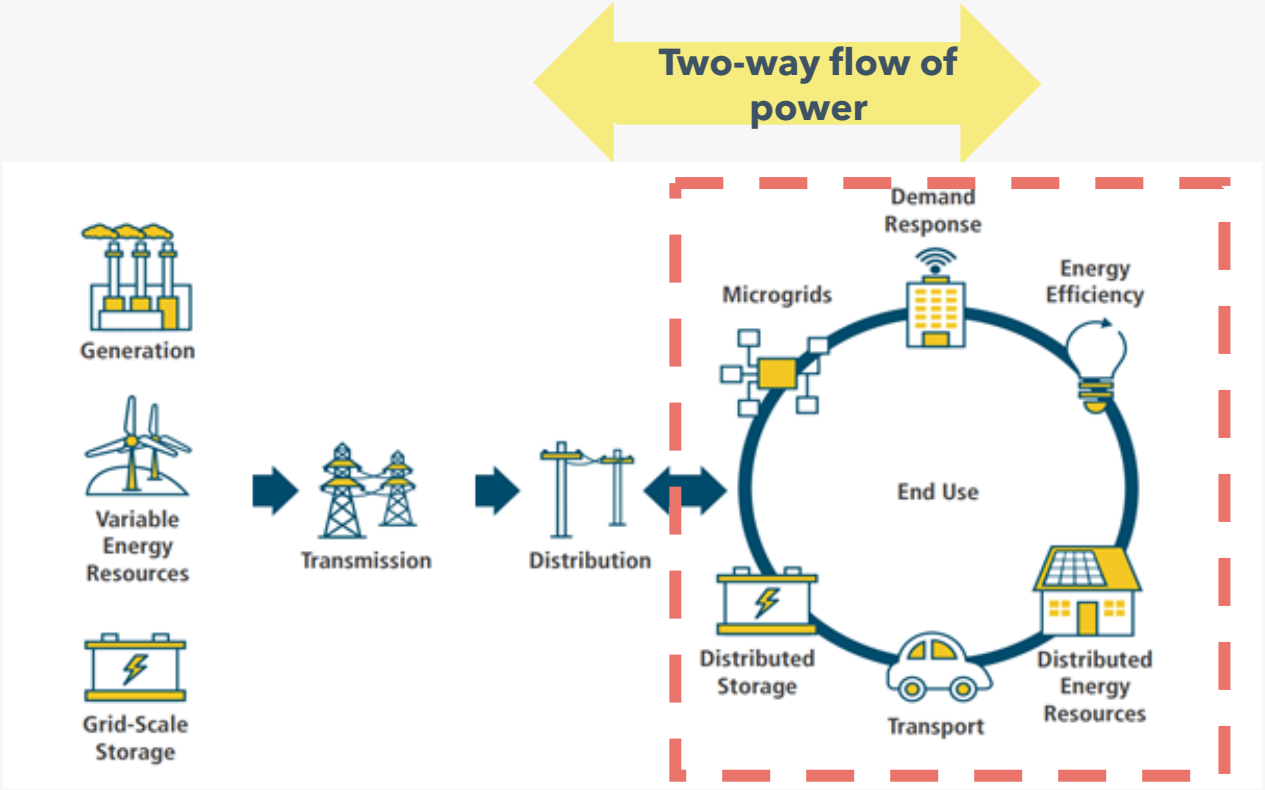


Moving from one-way to two-way power flow



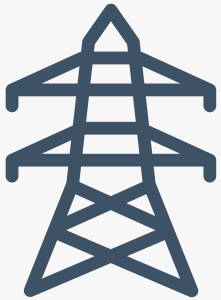
DERs have an impact in the Distribution System

Effective integration of DERs requires new types of energy management tools

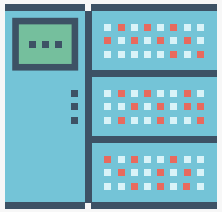


Moving to a two-way grid

Generation Plants



- Wind
- Solar
- Hydro
- Batteries



Integrated Operations Center

Two-way grid

- Electric Vehicles
- DSGs
- Hot water tanks
- Home batteries
- Smart Thermostat

Distribution Generation by DERs

Different types of DERs interact with grid differently

Energy Efficiency (EE)

- Double pane windows
- Wall insulation
- LED light bulbs

Reduce energy need

Flexible Loads/ Demand Response (DR)

- Smart Thermostats
- Peak Time Rebate
- Smart Water Heater
- Customer Batteries
- Managed Charging

Reduce energy need & shift energy use to another time

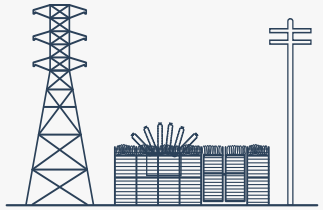
Generation and Storage Resources

- Solar Rooftop
- Customer Batteries
- Future EV Batteries

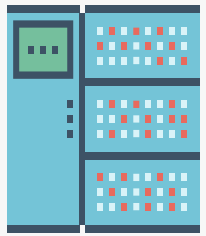
Produce energy

*some produce energy, some reduce energy need, some can do both, some are load and generation

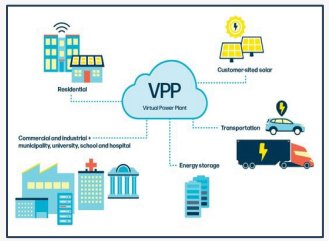
What is necessary to support two-way power flow?



Connected



Visible



Actionable

This affects how we

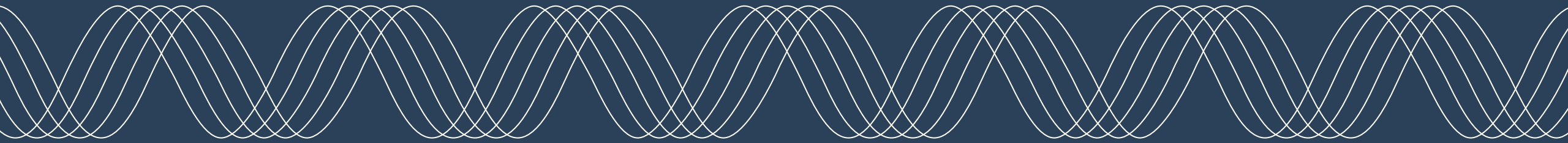
- Plan
- Operate
- Build

One-way street becoming a two-way street

Questions/ Comments

Next Steps and Closing Remarks

Please share your feedback for us to improve



Next Steps

We will evaluate your feedback and report back to you in January

01/25/2024 Learning Lab Topics:	Distribution System Vision
	Forecast and DER Forecast

Next Steps & Closing Remarks

- Dec 14 | IRP/CEP Staff Report and Final Recommendations| LC 80
- January 24 | 10a-12p | Zoom | CBIAG Meeting
- January 25 | 10a-12p | Zoom | Learning Lab # 1

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

Happy Holidays and Thank You for your participation in our plans

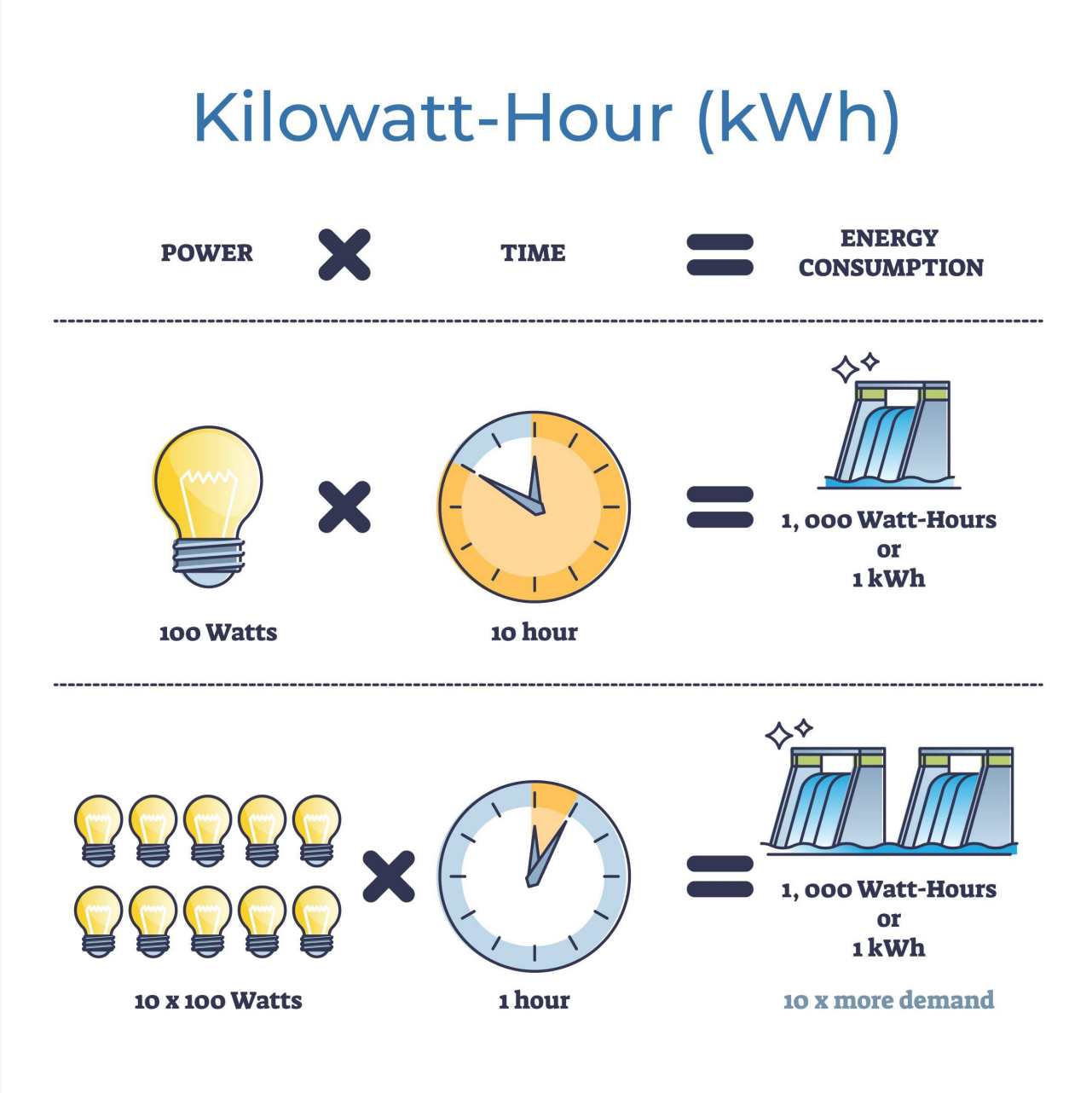
An

kind of energy

Appendix

Energy Unit

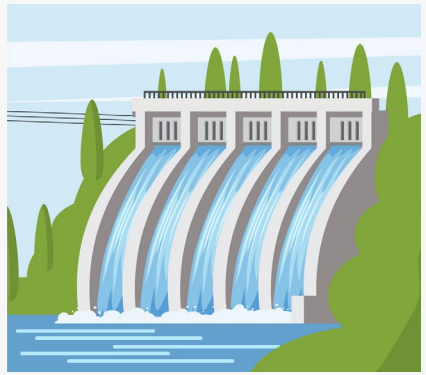
A **kilowatt-hour (kWh)** electricity consumption over 1 hr.



Capacity Units

Megawatts (MW)
energy output of a power plant

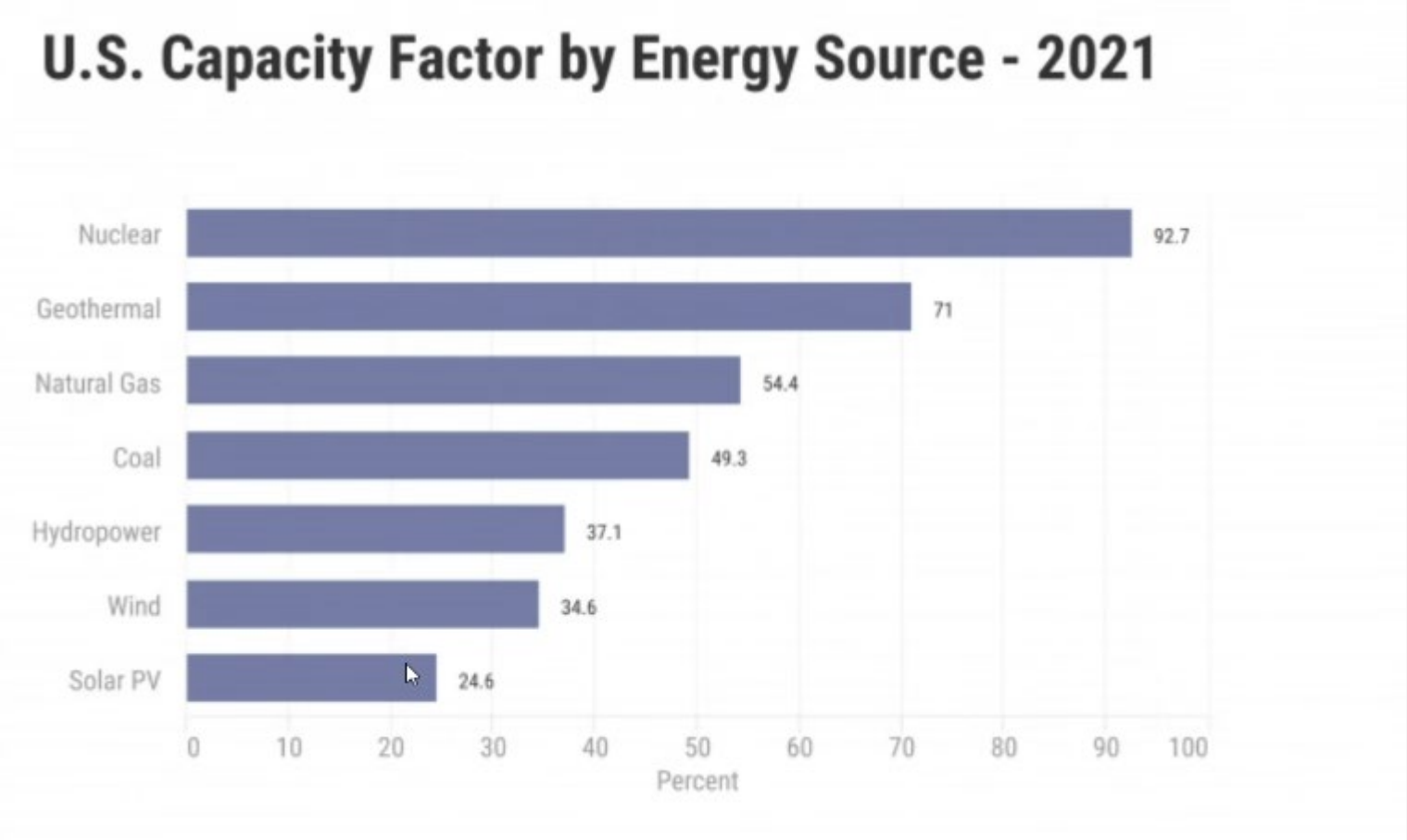
600 MW



198,000 homes

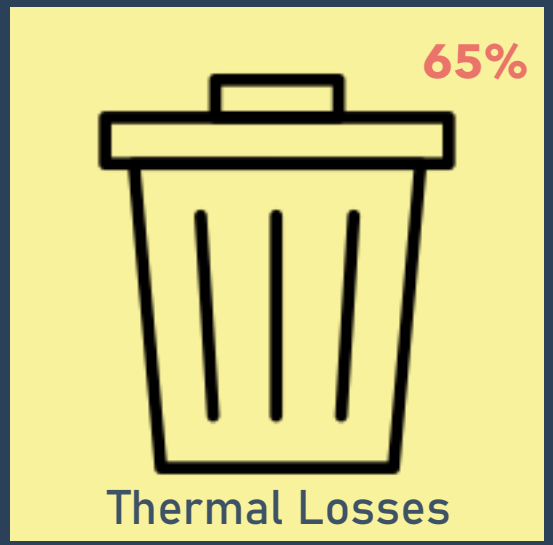
Capacity Factor

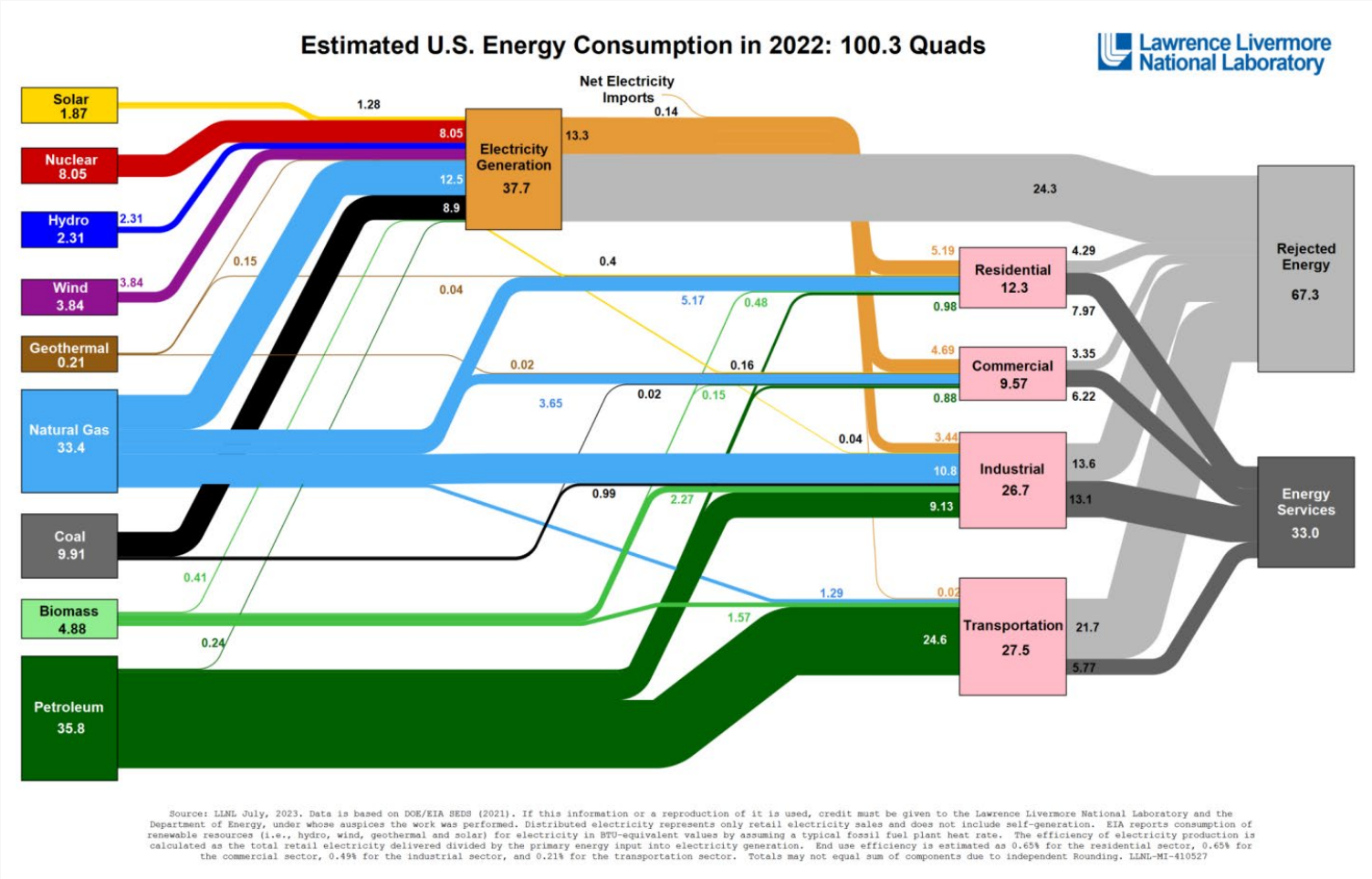
- Go the IRP and get the definition
- Can I get the amount of resource/energy from that generation unit whenever I want
- Consistency of delivery



Energy Usage in the United States

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



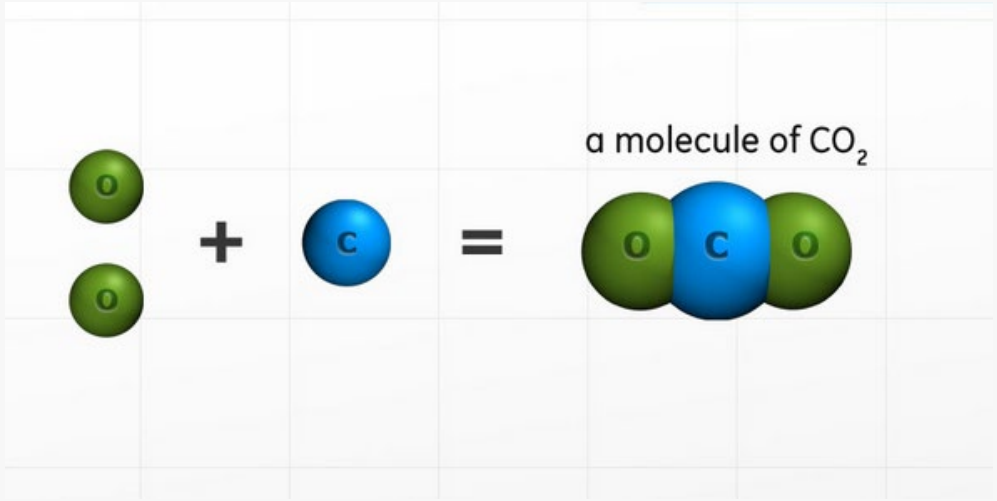


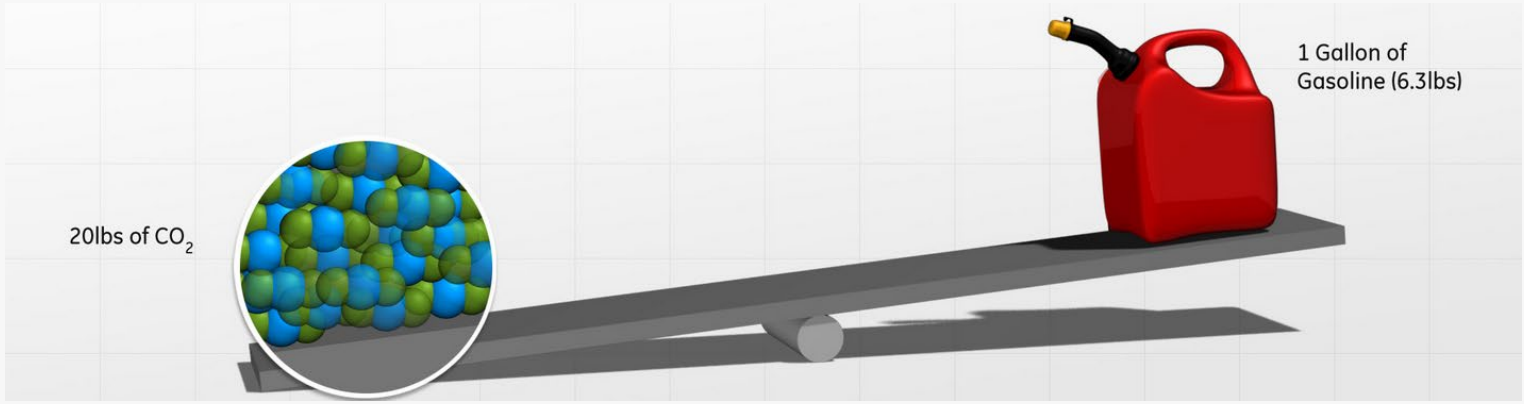
The Math Behind CO2

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.





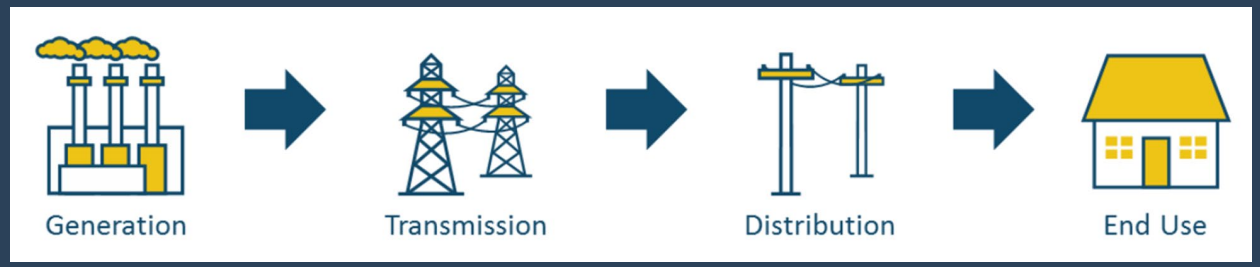
The Electric Grid is Evolving

Electricity

Supply **Demand**

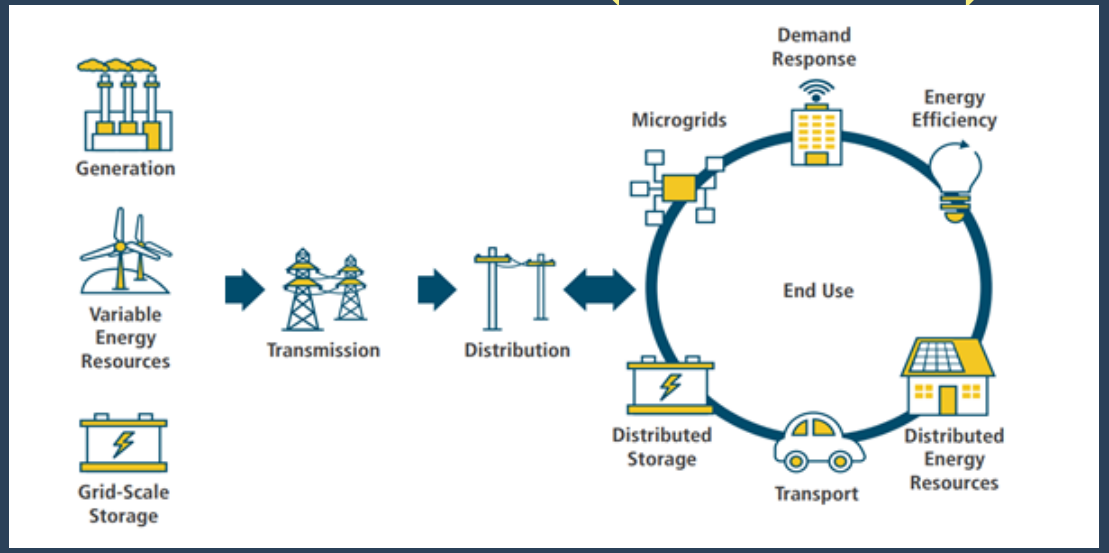
reliability

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

Types of energy needed to meet demand every day

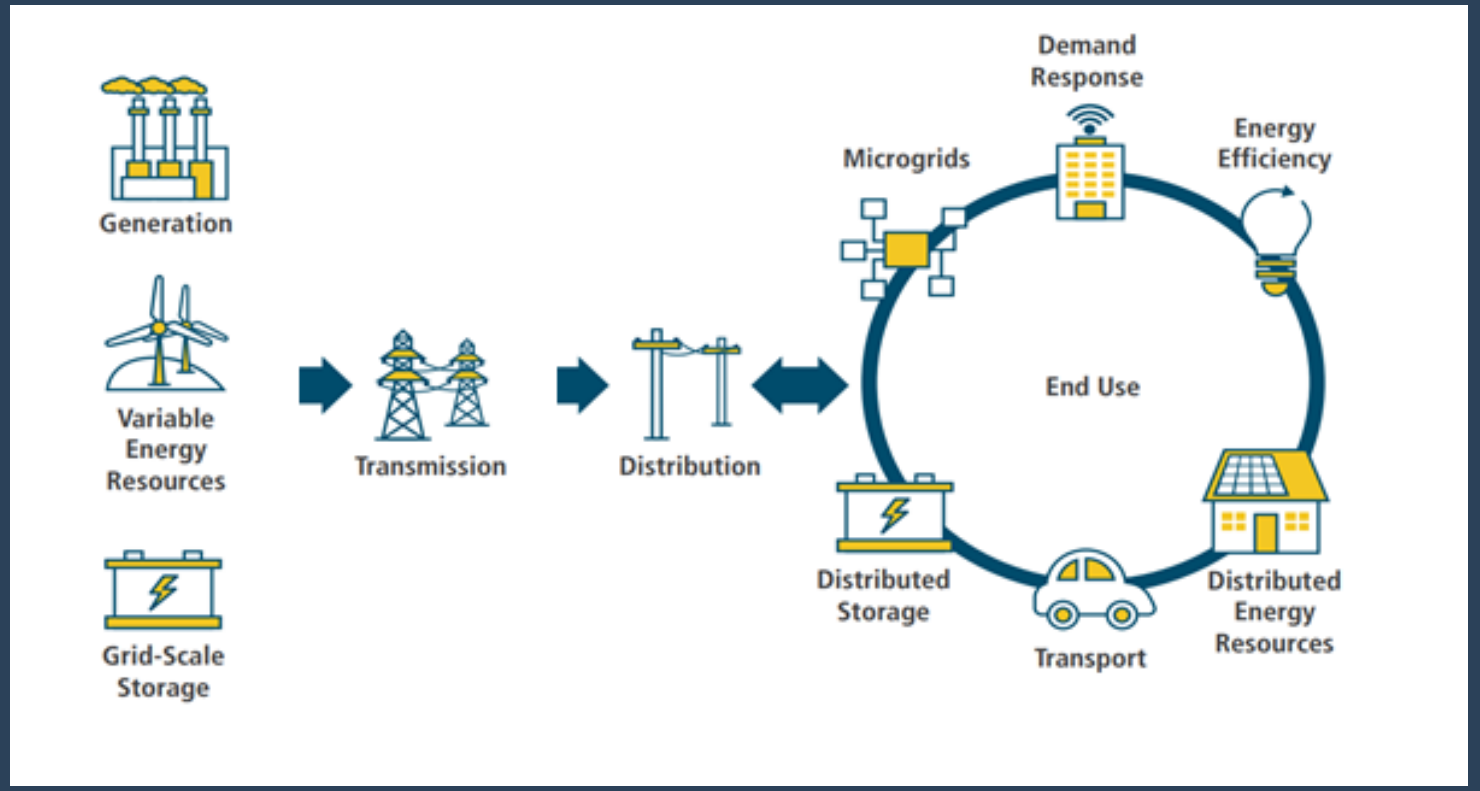
Electricity

Supply **Demand**

reliability

Utility-scale resources

Distributed resources

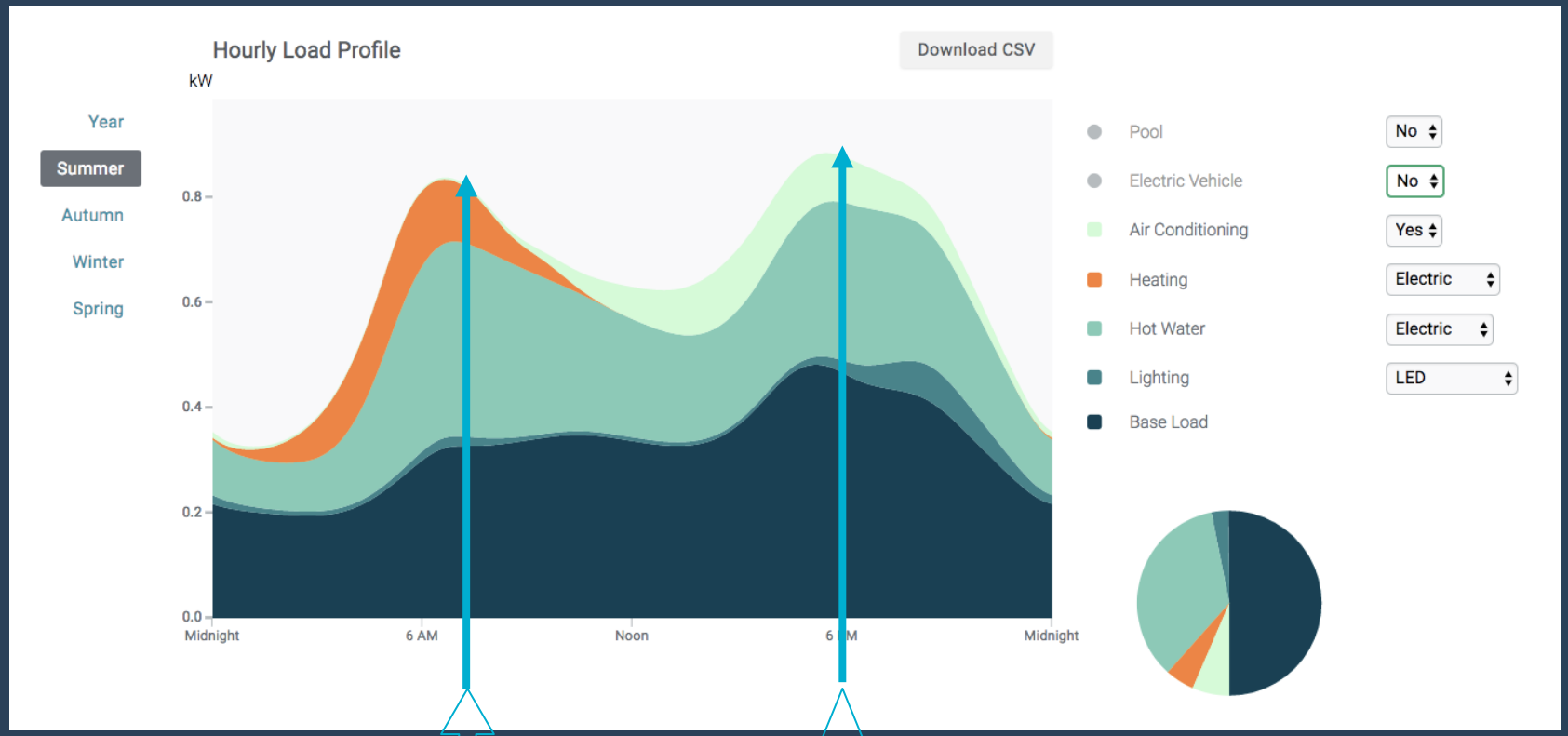


Distributed Energy Resources (DER) examples:

Electric Utility Operations

To ensure reliability, utilities must be capable of meeting customers' electricity demand at every second

Illustrative Example of demand for electricity on a summer day in Palo Alto, CA



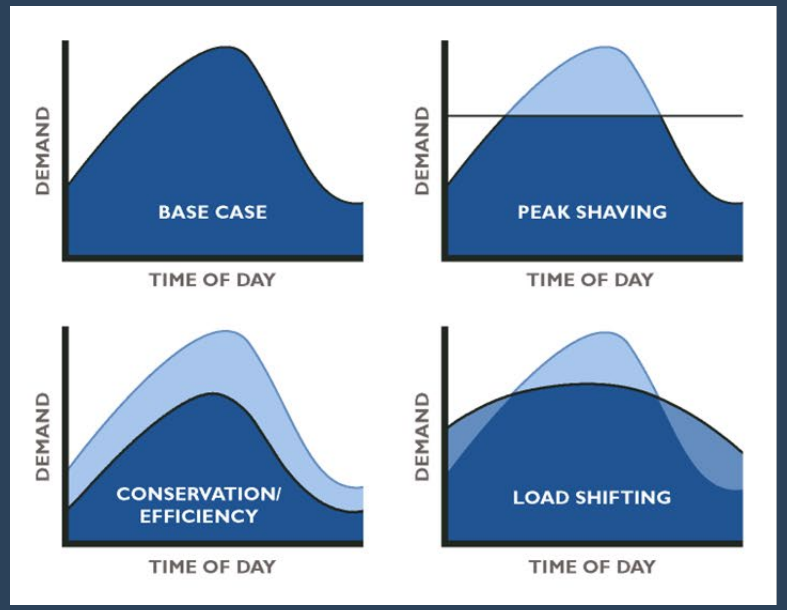
Source: Aurora Solar

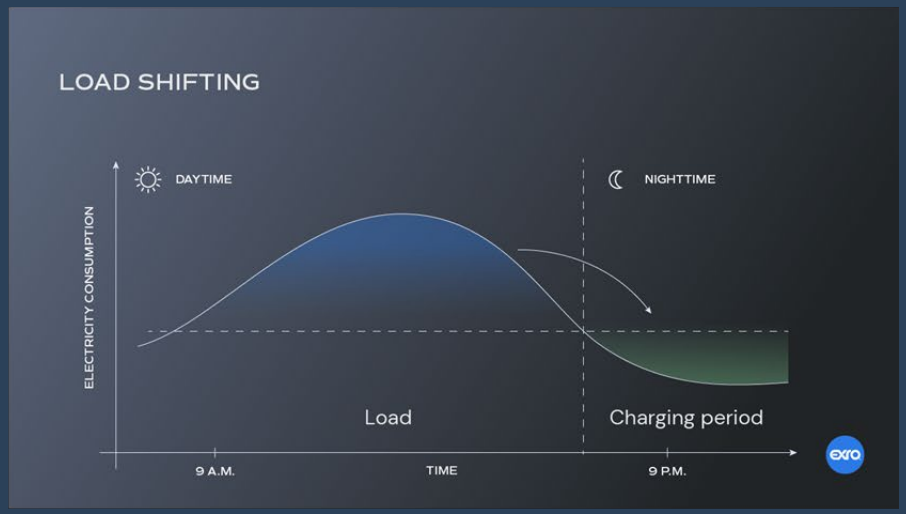
Electric Utility System Planning

The system must be built to support the forecasted highest possible demand

Increased energy demand requires additional:

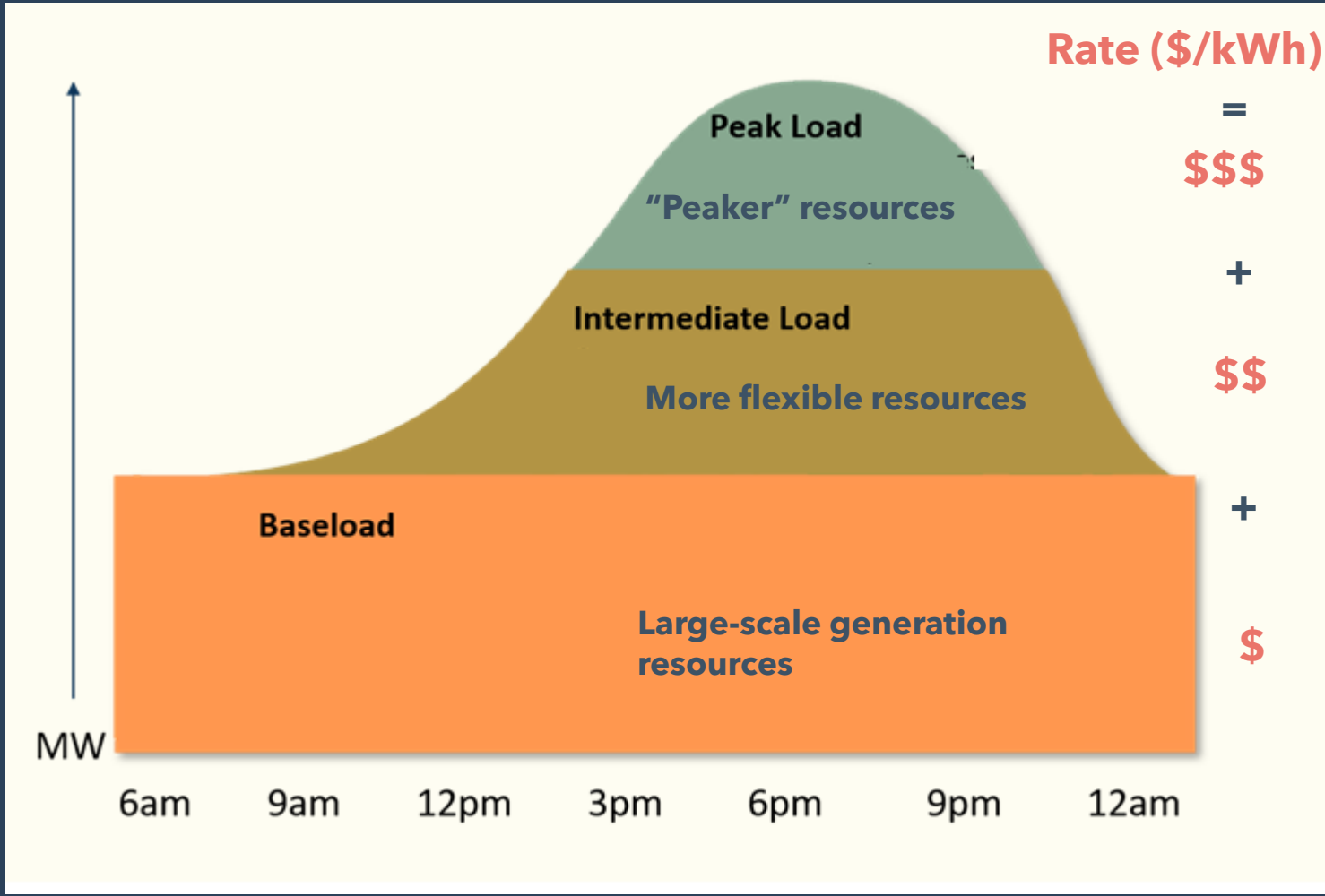
1. Physical Infrastructure | generation facilities and grid capacity
2. **Energy Efficiency and Demand Response |** encourage a change in the use of electricity





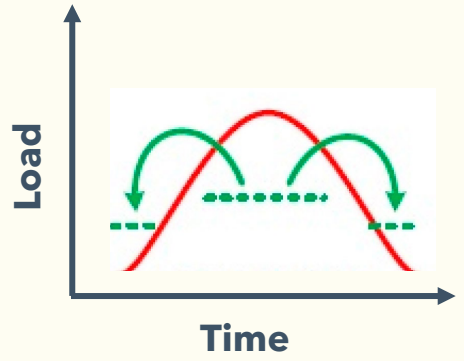
Scheduling energy resources to serve load

Resources used only when loads are highest (a few times per year) can have high price impacts



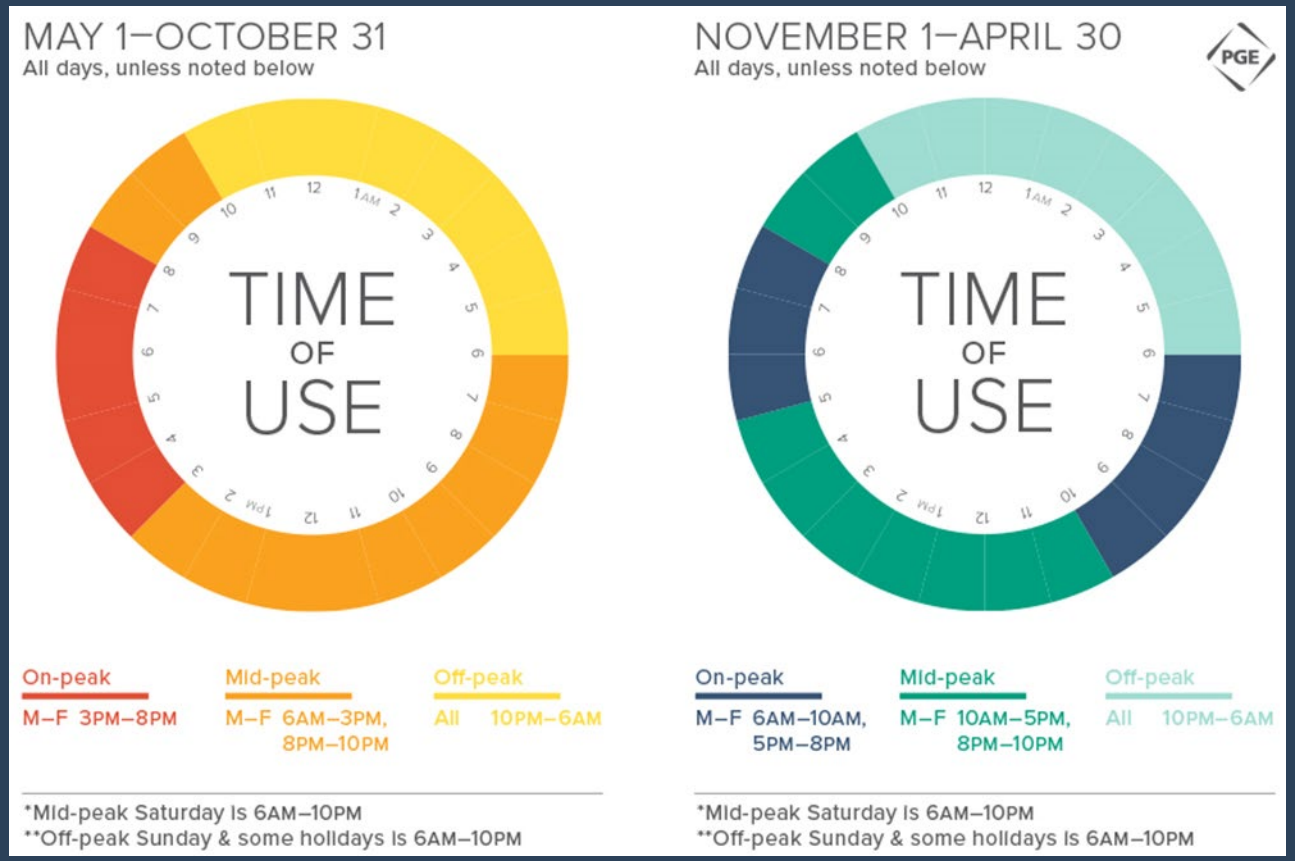
Demand Side Management

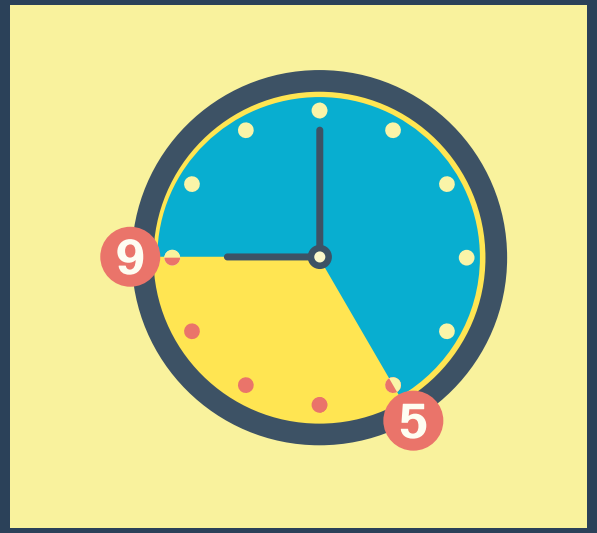
- Encourage a change in the use of electricity
- Move load from peak to off-peak
- Save customers money
- During extreme weather events can reduce the chance of brownouts and blackouts



Smart Devices enable load flexibility

Utility product & programs can encourage a change on the use of electricity





FACT:
The national average customer participation on Flex Load Programs is 12%;
at PGE it is 22%.

Demand Response (DR) Event Example
Aug 4, 2021, from 5- 8 pm (3hrs)

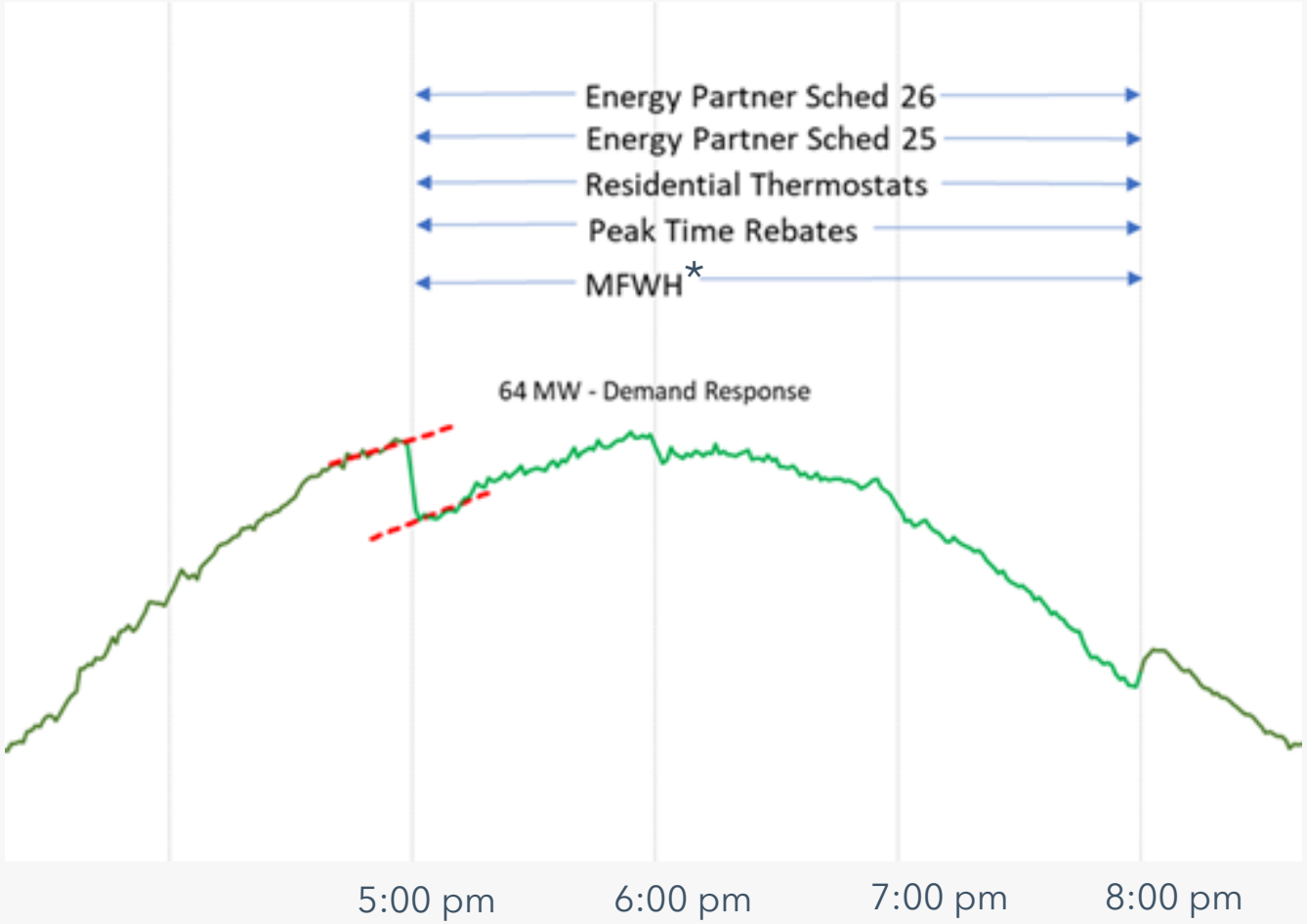
Summer 2021

11 Events

- 4 events in June
- 2 events in July
- 4 events in Aug
- 1 event in Sept

Range: ~25 MW ~69 MW

"All call" events consistently delivered 66 to 71 MW



* MFWH: Multi-family water heater