

Chapter 1 Distribution System Overview

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- A description of existing practices
- A summary of the utility's distribution system assets
- A discussion of distribution system monitoring and control capabilities
- A discussion of advanced controls and communication systems
- Historical distribution system spend for the past 5 years
- DER Data
 - Net-metering and small generation
 - EVs, charging stations, and TE infrastructure
 - DR
- Reliability Report

Baseline Data & System Assessment Requirements & Staged Evolution

To foster transparency and enable effective decision-making.

	Baseline Data and System Assessment					
S	Stage 3			Refine asset financial planning processes and strengthen relationships with DER planning and integration processes.		
				Use software systems to proactively monitor and support operation of the distribution system and DERs.		
	Sh wit Stage 2 Le ins of		Shar with	hare asset financial planning processes and show relationships ith DER forecasting and planning processes.		
S			Leve insig of th	verage remote sensing technologies to provide detailed ight on physical infrastructure to support efficient operation the distribution system.		
S	Stage 1Identify existing grid related data with loc			equipment inventory and financial data, as well as DER- ational granularity.		
		2021-2022		2023 and beyond		

Service Area at a Glance

PGE serves approximately 900,000 customers over 4,000 square miles Our distribution system in composed of:

- 1,256 circuit miles transmission lines
- 27,627 circuit miles distribution lines
- 695 feeders
- 270 distribution power transformers
- 153 substations





Distribution System Overview

- Defining the distribution system •
- System baseline and assessment practices
- Distribution system historical capital investments
- Currently integrated DERs



The distribution system is defined as load-serving, PGE-owned equipment and lines at nominal voltage levels below 35 kV. The distribution system starts at the circuit breaker and highside disconnect of the substation distribution transformer.

- System baseline and assessment practices
 - Asset health monitoring ensures that we prioritize investments across a portfolio of distribution system assets in a manner that balances costs and maximizes improvements for reliability
 - Load forecasting pairs the top-down corporate load forecast with bottom-up customer load additions
 - **Powerflow studies** are conducted in CYME by our distribution planning team in order to study the impacts of changing loads on our system 14

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- We invested an average of about \$300 million per year on the distribution system from 2016 to 2020
- Baseline adoption of DERs across our service area:
 - 125 MW net metered generation, with 35 MW in queue
 - 63 MW of enrolled summer DR capacity
 - Approximately 23,000 electric vehicles throughout our service area

Distribution System Planning Drivers

PGE's distribution planning team has three key functions:

- 1. Perform system analysis and develop plans that ensure the distribution system maintains reliability
- 2. Provide support and guidance on distribution-related investments
- 3. Support grid modernization efforts



Distribution planning responds to a variety of changing needs, ranging from economic to regulatory to specific company initiatives.

Some of the key drivers impacting the scope and content of distribution planning studies are:

- Load growth forecast
- Economic development
- New large single loads
- Grid modernization
- Regulatory requirements
- Safety
- Reliability performance of the system
- Urban growth boundary
- Zoning changes
- DERs (EV charging, PV providing distributed generation, flexible loads)

DERs are Changing the Nature of the Grid

Historically

• The distribution system has been optimized for oneway flow with a relatively low granularity and visibility of the system's real-time state

Over the Last 15 Years

- More advanced and lower-cost sensor and control technologies have increased the level of detail received about the distribution system.
- Technology improvements and lower-cost DERs have expanded the amount of clean energy resources on the grid.

Recently

 New digital capabilities that can optimize DERs, we are entering a new age in which planning can help the distribution system accelerate decarbonization, provide community benefits and more.



Distribution of Yearly Spending by Expenditure Category

Examples of investments by category include:

New customer projects

- Minimum load agreements (MLA)
- Road widening
- Customer-driven distribution projects

System expansion or upgrades for capacity

 Cyclical in nature and driven by customer demand

Spending		Budget				
category		average				
	2016	2017	2018	2019	2020	2016-2020
New customer projects	\$49	\$84	\$86	\$87	\$86	\$78
Age-related replacements and asset renewal	\$50	\$52	\$60	\$86	\$175	\$85
System expansion or upgrades for reliability and power quality	\$39	\$51	\$76	\$122	\$84	\$74
System expansion or upgrades for capacity	\$32	\$67	\$82	\$37	\$30	\$50
Metering	\$9	\$7	\$7	\$12	\$9	\$9
Preventive maintenance	\$0.4	\$4	\$8	\$5	\$2	\$4
Grid modernization projects	\$0.01	\$2	\$3	\$4	\$5	\$3
Total	\$180	\$268	\$322	\$352	\$390	\$302

Net metering (NM) & Qualifying Facilities (QF) as of Sept. 2021

Solar continues to be the dominate DER for NM and QF

In-Service - Producing Power

NM < 2,000 kW						
Ganarater Tuna	Gene	erator	Capacity			
Generator Type	Number	% of Total	kW	% of Total		
Solar	13,454	99.59%	121,170	96.28%		
Methane Gas	4	0.03%	3,801	3.02%		
Wind	40	0.30%	650	0.52%		
Hydro	6	0.04%	185	0.15%		
Solar+Wind	2	0.01%	22	0.02%		
Fuel Cell	3	0.02%	21	0.02%		
Total	13,509	100%	125,848	100%		

QF > 2,000 kW < 10,000 kW

Gonorator Tuno	Gene	erator	Capacity		
Generator type	Number	% of Total	kW	% of Total	
Solar	1,698	99.71%	33,911	94.82%	
Methane gas	2	0.12%	1,833	5.13%	
Storage	3	0.18%	21	0.06%	
Total	1,703	100%	35,765	100%	

In-Queue - Not Producing Power Yet

NM < 2,000 kW						
Company Trans	Ger	nerator	Capacity			
Generator Type	Number	% of Total	kW	% of Total		
Solar	51	94%	117,921	99.85%		
Diesel	2	4%	175	0.15%		
Storage Only	1	2%	1.20	0.001%		
Total	54	100%	118,097	100%		

QF > 2,000 kW < 10,000 kW

Generator Tune	Gen	erator	Capacity		
Generator Type	Number	% of Total	kW	% of Total	
Solar	37	97%	82,965	98%	
Storage Only	1	3%	1,830	2%	
Solar	38	100%	84,795	100%	

Demand Response (DR) Capacity

- PGE' Flexible Load Plan was accepted by the Commission in June 2021 under Order 21-158
- At calendar year-end 2020, PGE had enrolled 63 MW of summer DR and 39 MW of winter DR



SUMMER

MM

WINTER

Registered EVs in PGE service area

- Battery-electric vehicles (BEV) projected to increase market share as vehicle ranges improve
- Continued growth in EVs even with the economic impacts of COVID for much of 2020



Public Charging Stations as of Q1 2021



Monthly Charging Load by Electric Avenues (EA) sites

• PGE owns and operates seven public fast charging locations, each with four Direct Current Fast Chargers (DCFC) charging ports (50 kW each) and two level 2 ports (7 kW each) for quick refueling



Chapter Take-Aways

The distribution system is a key part of the energy grid backbone



PGE's strategic asset management helps maximize the impact of investments to realize customer value



The changing nature of the grid, including more DER adoption, will require changes to past investments

Questions?

Please email us at dsp@pgn.com

