Northwest **Power** and **Conservation** Council

November 6, 2018

MEMORANDUM

TO: **Power Committee Members**

FROM: **John Ollis**

SUBJECT: **Portland General Electric Strategic Initiatives**

BACKGROUND:

Presenter: Franco Albi, Manager of Strategy Integration and Planning, Portland General Electric

Summary: Franco Albi will brief the Power Committee on Portland General Electric (PGE) current strategic initiatives. Mr Albi will discuss how PGE is integrating their approach to decarbonization, transportation electrification, and energy storage, and how they are converging the processes related to integrated resource, transmission and distribution, and customer planning.

Relevance: Individual utility plans help gain context of the overall regional picture on energy resources and issues.

Workplan: 1.A. Implement Seventh Power Plan and related Council priorities

More Info: PGE's Energy Strategy
https://www.portlandgeneral.com/our-company/energy-strategy/oregons-clean-energy-future

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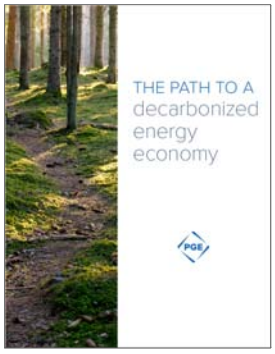
Utility of the Future

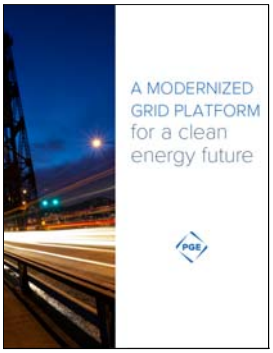
November 13, 2018

NWPCC Power Committee

Franco Albi
Strategy Integration
Portland General Electric

Defining our future



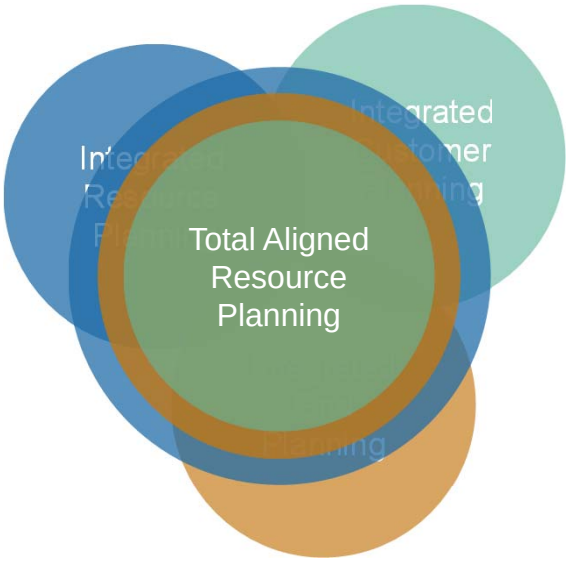


https://www.portlandgeneral.com/our-company/energy-strategy/oregons-clean-energy-future

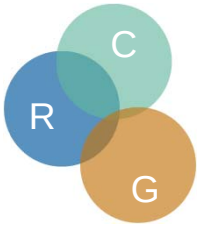
SB978 – understanding stakeholder preferences

Topic	OPUC Report Summary	PGE's Next Steps
Affordability, Equity and Environmental Justice	OPUC needs guidance from the legislature on how to address social equity issues and energy burden impacts into their work	PGE supports broadening stakeholder representation and increasing meaningful participation in OPUC and utility processes
Climate Change and GHG Mitigation	OPUC requires legislative direction and authority before requiring utilities to take new action to reduce GHGs	PGE is committed to reducing GHG emissions by more than 80% below 2010 levels by 2050 • Strategies: Development of clean resources; modernizing and enhancing the grid to integrate new technologies; and empowering customers to integrate their own technologies
Customer Choice	OPUC will continue to understand and quantify how choices available to customers impact the utility system overall	PGE supports robust distribution resource planning and accurate valuation of the electric system; will actively participate and contribute to regulatory proceedings that balance innovation and customer choice with fairness to all customers
Utility Incentive Alignment	OPUC will explore performance-based ratemaking to achieve public policy outcomes	PGE commits to actively participating in a Commission proceeding to examine augmenting the existing rate base system with performance or incentive rate structures
Regional Market Development	OPUC commits to remaining engaged in conversations about sharing regional resources • Affirms that a regional market is foundational to further evolution of the regulatory system	PGE is engaged in conversations related to regional market development
Participation	OPUC commits to developing a strategy for: • Engagement • Creating tools on PUC's website • Enhancing Citizen Advocate position from SB 420	PGE is looking at how and when we conduct stakeholder workshops by examining barriers to participation and changes needed to broaden stakeholder participation

Planning Alignment



T&D System Planning



Current State

IRP accounts for:

- Transmission projects and constraints
- Distribution-sited programs

IRP does not account for:

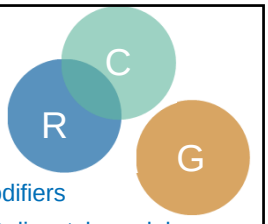
- Distribution system infrastructure investments
- System hardening, modernization, and smart grid
- Required upgrades for distributed generation & flexible loads

Future State

Iterative cross-departmental feedback process

- Transmission and Distribution Resource Planning
- Customer Resource Planning
- Integrated Resource Planning

DER Planning



Current State

- Distributed energy resource (DER) forecasts are load modifiers
- All distributed energy resource programs compiled in IRP dispatch model
- Does not fully account interactive effects
- Uses forecasts from multiple sources

Future State

- Two ends of DER design
  - Distribution Planning DER optionality
  - DER program design, paired with T&D locational value assessment
- DER portfolio compilation shared by Customer Programs and T&D, incorporated into IRP resource stack

Aligned Planning Evolution

Customer Planning

- Identifies services specific DERs can provide
- Designs applicable pricing structures
- Designs programs to maximize value of resources

Integrated Grid Planning

- Locates areas on the system that provide best use of specific attributes
- Screens projects for reliability, infrastructure upgrade requirements, changes in outage risk, and comparison to alternative projects

Integrated Resource Planning

- Integrates development forecasts, attributes, and dispatch characteristics of all DERs developed by Customer and Integrated Grid Planning into dispatch models as resource options
- IRP reports value of resources based on dispatch results

Customer program and Grid modernization targets based on results of IRP modeling

Enabling Studies

Distributed Energy Resource & Flexible Load Study

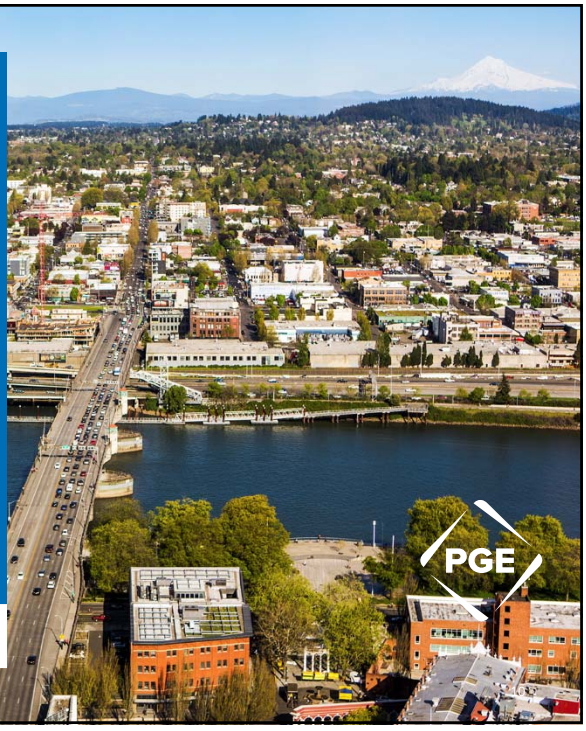
- Scenario-based forecasts for several DERs and flexible loads in conjunction
  - Interactive effects
  - Coordinated development
  - Phased granularity
  - Top-down and bottom-up
- Inter-departmental
  - Customer Planning, Integrated Grid, IRP, Load Forecasting
  - Iterative shared analysis

Distribution Resource Planning Study

- Assessment of planning elements required for DRP
- PGE planning gap analysis
- DRP development steps and timeline
- DRP action items

DR/DER Testbeds

- Proposal filed with OPUC in October
- $5.8M investment at three substations
  - Milwaukie
  - Portland
  - Hillsboro
- 22,000 Customers engaged



DR/DER Testbed Project

Background

- Commission Order 17-386 directs PGE to develop a Testbed to accelerate DR and DER offerings for customers

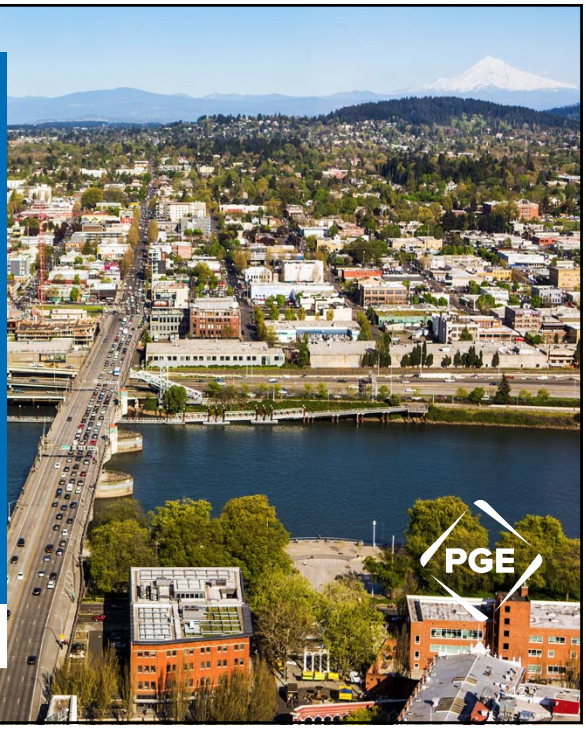
PGE Testbed objectives include

- Identifying the customer value proposition with the DR / DER
- Explore the coordination with energy efficiency and DR
- Learn how best to use DR and DER as system assets
- Coordinate activities within the Testbed to resource and grid interaction

Why this matters to Customers

- Customers desire a more active role in energy production and their insights help PGE shape products customers want
- To effectively utilize DR and DER, PGE needs to partner with customers to understand system impacts
- This project will inform the pace of modifications needed to the existing power system to achieve decarbonization goals

Energy Storage



Storage Potential Evaluation

Resource Optimization Model (ROM)

Co-Optimization of Use Cases

- Utilized ROM (production cost model) to maintain alignment with IRP evaluation framework

Simulation of Battery Operation

- ROM simulated the commitment and dispatch of PGE's resource portfolio with and without the proposed Energy Storage Systems

Use Cases Studied

- PGE evaluated all applications and use cases listed in Order 17-118

Key Metrics

- 1 Unit
- 2 MW Charge / Discharge Rate
- 4 MWh Energy Storage
- Estimated $2.8M-4.1M Overnight Capital
- Target In-Service: 2020

Baldock Mid-Feeder

A mid-feeder, solar-sited, PGE-owned energy storage asset

Key Features

- **Installed at Baldock 2 MW (4 MWh) Solar Array in Aurora, OR**
- **Feeder contains 59% residential, 39% commercial, and 2% industrial**

Use-cases

- **Typical: capacity, energy/ancillary services, transmission**
- **During Outage: extended reliability for customers sectionalized from the fault**

Baldock Mid-Feeder (NPV, $M)

TRC + RIM Tests	10-Year		20-Year	
	Low Cost	High Cost	Low Cost	High Cost
Benefits Total	$2.3	$2.3	$3.9	$3.9
Costs Total	$4.1	$6.9	$4.6	$7.8
Net Benefit	$(1.8)	$(4.6)	$(0.8)	$(3.9)
Benefit Cost Ratio	**0.57**	**0.34**	**0.84**	**0.50**

Key Metrics

- 1 Unit
- 17-20 MW Charge / Discharge Rate
- 68-80 MWh Energy Storage
- Estimated $30M-36M Overnight Capital
- Target In-Service: 2020

Coffee Creek Substation

A substation-sited, PGE-owned energy storage asset

Key Features

- **Tied to the 13 kV substation bus**
- **Sized to support the peak substation load**

Use-cases

- **Typical: capacity, energy/ancillary services, transmission services**
- **During Outage: extended reliability for all customers downstream of substation**

Coffee Creek Substation (NPV, $M)

TRC + RIM Tests	10-Year		20-Year	
	Low Cost	High Cost	Low Cost	High Cost
Benefits Total	$33.5	$33.5	$55.8	$55.8
Costs Total	$44.7	$55.0	$52.7	$64.8
Net Benefit	$(11.3)	$(21.5)	$3.2	$(9.0)
Benefit Cost Ratio	**0.75**	**0.61**	**1.06**	**0.86**

Key Metrics

- 1 Unit
- 4-6 MW Charge / Discharge Rate
- 16-24 MWh Energy Storage
- Estimated $5.9M-7.7M Overnight Capital
- Target In-Service: 2020

Generation Kick Start

A generation-sited asset that can provide spinning reserve without burning fuel

Key Features

- **Located at the Port Westward 2 generation facility**
- **Utilizes a relatively small storage device (4-6 MW) to realize the full value of spinning reserves of an off-line turbine (18.9 MW)**

Use-cases

- **Typical: capacity, energy/ancillary services (including increased spinning reserves), transmission services**

Generation Kick Start (NPV, $M)

TRC + RIM Tests	10-Year		20-Year	
	Low Cost	High Cost	Low Cost	High Cost
Benefits Total	$7.5	$7.5	$12.5	$12.5
Costs Total	$9.4	$12.9	$10.1	$15.1
Net Benefit	$(1.9)	$(5.5)	$2.3	$(2.7)
Benefit Cost Ratio	**0.79**	**0.58**	**1.23**	**0.82**

Key Metrics

- 2-5 storage devices
- 3-12.5 MW cumulative
- 6-100 MWh cumulative
- Estimated $12M-41M Overnight Capital
- Target for complete deployment: 2021

Microgrid Resiliency Pilot

Customer and Community Microgrids, PGE-owned / controlled energy storage asset

Key Features

- **Integrated storage with customer-owned generation (e.g., solar, generators)**
- **2-5 critical sites for community resiliency**
- **Pilot as an evolution to the DSG program**
- **Single Customer Microgrid**
  - Serves a single customer metered site with customer owned on-site generation to sustain power during an outage
- **Community Microgrid**
  - Serves a subset of customers on a feeder; a segment of the feeder is isolated during an outage event. This could be a neighborhood or otherwise closely located facilities on the same feeder section.

Use-cases

- **Typical: capacity, energy/ancillary services, transmission services**
- **During Outage: extended reliability for 1 or more critical facilities**

Key Metrics

- 2-5 storage devices
- 3-12.5 MW cumulative
- 6-100 MWh cumulative
- Estimated $12-41M Overnight Capital
- Target for complete deployment: 2021

Microgrid Resiliency Pilot

Customer and Community Microgrids, PGE-owned / controlled energy storage

10 Year ESS	Low Cost Estimate			High Cost Estimate		
	TRC	RIM	Partici pant	TRC	RIM	Partici pant
Benefits Total	$9.3	$7.3	$2.0	$23.0	$18.1	$4.9
Costs Total	$19.7	$19.7	-	$63.6	$63.6	-
Net Benefit	$(10.4)	$(12.4)	$2.0	$(40.6)	$(45.5)	$4.9
Benefit Cost Ratio	**0.47**	**0.37**	**n/a**	**0.36**	**0.28**	**n/a**

20 Year ESS	Low Cost Estimate			High Cost Estimate		
	TRC	RIM	Partici pant	TRC	RIM	Partici pant
Benefits Total	$15.5	$12.2	$3.3	$38.8	$30.5	$8.3
Costs Total	$24.3	$24.3	-	$76.9	$76.9	-
Net Benefit	$(8.8)	$(12.1)	$3.3	$(38.1)	$(46.4)	$8.3
Benefit Cost Ratio	**0.64**	**0.50**	**n/a**	**0.50**	**0.40**	**n/a**

Key Metrics

- 500 units
- 3-6 kW each (2-4 MW cumulative)
- 12-16 kWh each (6-8 MWh cumulative)
- Estimated $2.1-6.0M Overnight Capital

Residential Storage Pilot

A residential-sited, behind the meter, PGE-controlled energy storage asset

Key Features

- Storage device used for grid services except during an outage
- Utility-owned: Participant pays monthly fee for enhanced reliability
- Customer-owned: Participant paid for grid services

Use-cases

- Typical: capacity, energy/ancillary services, transmission services
- During Outage: extended reliability for participating customer's critical loads

Key Metrics

- 500 units
- 3-6 kW each (2-4 MW cumulative)
- 12-16 kWh each (6-8 MWh cumulative)
- Estimated $2.1M-6.0M Overnight Capital

Residential Storage Pilot

A residential-sited, behind the meter, PGE-controlled energy storage asset

Customer Ownership Model	Low Cost Estimate			High Cost Estimate		
	TRC	RIM	PCT	TRC	RIM	PCT
Benefits Total	$2.4	$1.4	$2.4	$2.6	$1.7	$5.0
Costs Total	$3.4	$2.8	$2.1	$6.3	$6.0	$4.3
Net Benefit	$(1.1)	$(1.4)	-	$(3.7)	$(4.4)	-
Benefit Cost Ratio	**0.69**	**0.50**	**1.15**	**0.42**	**0.28**	**1.16**

PGE Ownership Model	Low Cost Estimate			High Cost Estimate		
	TRC	RIM	PCT	TRC	RIM	PCT
Benefits Total	$2.8	$2.8	$1.4	$3.1	$3.1	$1.4
Costs Total	$3.9	$3.9	$1.4	$10.1	$10.1	$1.4
Net Benefit	$(1.1)	$(1.1)	-	$(7.0)	$(7.0)	-
Benefit Cost Ratio	**0.72**	**0.72**	**1.00**	**0.31**	**0.31**	**1.00**

GenOnSys system provides a foundation for integrating energy storage on our system.

Integrated Controls

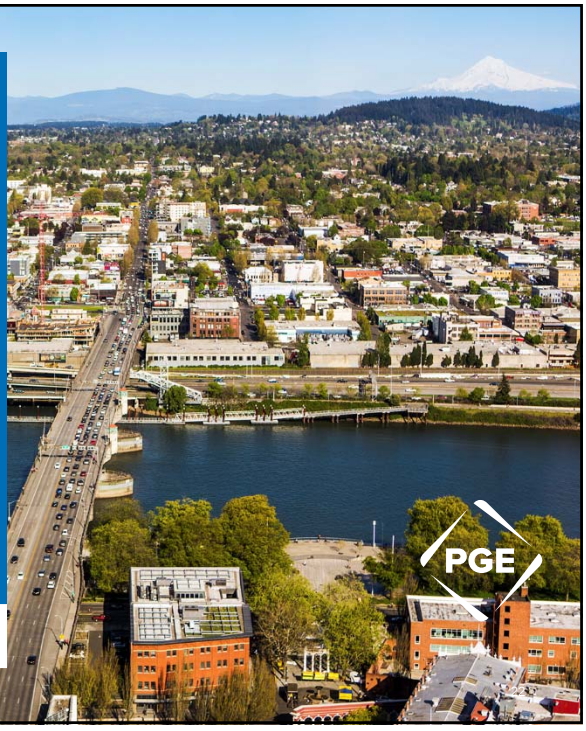
Key Features

- Hierarchical approach (system of systems)
- Allow for real time scheduling
- Provide two-way communication
- Capture and historize data for analysis and operational optimization
- Based on PGE's existing system to leverage existing technology

Use-cases

- Demand Response
- Frequency Response
- Capacity
- Resiliency

Transportation Electrification



The Future is Electric

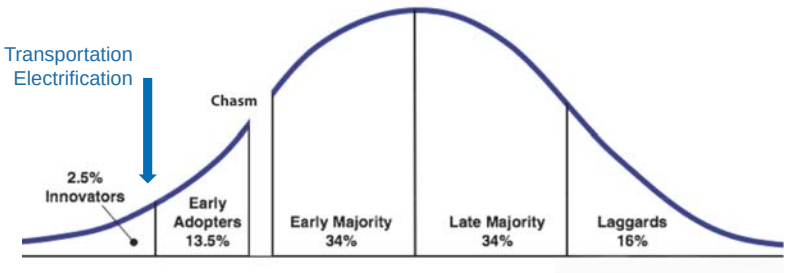









TECHNOLOGY ADOPTION LIFECYCLE



KEY INDUSTRY CHANGES IN FLIGHT

- Declining costs
- State of Oregon Rebate
- Increased Model availability
- Increased Range
- Increased Rate of Charge
- Charger deployments (PGE, PAC, Electrify America)
- Shared / Autonomous Vehicle deployments

Active Initiatives

Electric Avenue Expansion

- 6 new sites
- RFP complete; site selection on-going
- Milwaukie and Hillsboro planned for 2018
- Key Features:
  - Accessible
  - Visible
  - Reliable
  - Fast (50-kW)
  - Field Upgradeable (>300-kW)

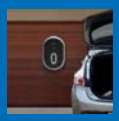
Electric Mass Transit

- 40-foot all-electric bus (200 kWh/ea)
  - 5 buses to go into service Q1/Q2 2019
- Charging equipment
  - 450 kW overhead fast charger
  - 100 kW depot charging
  - Upsized transformer pad, conduit, vault, and switchgear
  - Installation Q3/Q4 2018

Outreach & Technical Assistance

- Trainings: workplace and fleet charging classes offered to customers
- Ride & drives: National drive electric week; Uber
- Technical assistance support for customers
- Dealership engagement

Emerging Programs Under Development



Clean Fuels Program: Programs will support electrification, provide benefits to residential customers, and support traditionally underserved communities. Program proposals to be filed no later than March 31, 2019.

Residential Charging: rebates for customers installing a connected level 2 home charger and going on a time-of use rate schedule. Program proposals to be filed no later than February 16, 2019.

Business Charging: incentives for businesses to install workplace or fleet charging stations. Program proposals to be filed no later than February 16, 2019.