Resource Planning Advisory Group Meeting

2027 Integrated System Plan

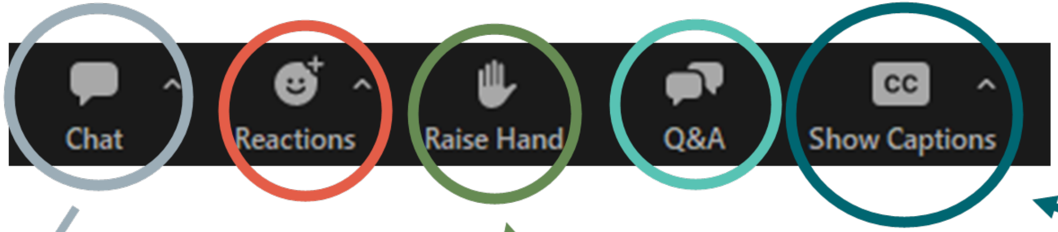
February 26, 2026

PUGET SOUND ENERGY

Welcome to the meeting!

Use the **Reactions** feature to respond to content with emojis

The **Q&A** tool will be turned off during the meeting



RPAG members and PSE staff are welcome to use the **Chat** feature

Use **Raise Hand** feature if you'd like to provide a comment or ask a question

Click **Show Captions** to see real-time closed captioning

Facilitator requests

- Engage constructively and courteously towards all participants
- Respect the role of the facilitator to guide the group process
- Avoid use of acronyms and explain technical questions
- Use the feedback form or email isp@pse.com for additional input to PSE
- Aim to focus on the webinar topic
- Public comments will occur after PSE's presentations

Safety moment

- February is American Heart Month
  - Tips for taking care of your heart:
    - Get enough quality sleep
    - Maintain a healthy weight
    - Eat more nutritious foods
    - Be more active
    - Stop smoking

Today's speakers

- Brian Tyson, Manager, Clean Energy Planning and Implementation, PSE
- Kara Durbin, Director, Clean Energy Strategy, PSE
- Jennifer Coulson, Manager, Operations and Gas Analysis, PSE
- Taylor Bettine, Senior Energy Specialist, Cadmus Group

Agenda

Time	Agenda Item	Presenter / Facilitator
1:00 p.m. – 1:05 p.m.	Welcome and introductions	Annie Kilburg Smith, Triangle Associates
1:05 p.m. – 1:15 p.m.	Feedback recap	Brian Tyson, PSE
1:15 p.m. – 2:00 p.m.	Introducing the cost test and societal impacts	Kara Durbin, PSE Brian Tyson, PSE
2:00 p.m. – 2:15 p.m.	Iterative analysis overview	Jennifer Coulson, PSE
2:15 p.m. – 3:00 p.m.	Electrification modeling approach (Scenarios 2 – 4) Scenario 1 - iterative analysis methodology overview	Taylor Bettine, Cadmus Group
3:00 p.m. – 3:15 p.m.	Next steps and public comment opportunity	Annie Kilburg Smith, Triangle Associates
3:15 p.m.	Adjourn	All

Meeting purpose

- Introduce the cost test framework
- Provide an overview of iterative gas and electric analysis for the 2027 ISP
- Discuss the electrification modeling approach for the 2027 ISP

What we need from you

- Share your questions, reflections, and advice on today's topics
- Let us know if anything is missing or unclear
- Flag areas where deeper discussion is needed
- Help us identify risks, tensions, or points of misalignment early

Recent feedback overview

Brian Tyson

Manager, Clean Energy Planning and Implementation

February 26, 2026

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Revised maximum customer benefit approach in response to Jan. 27 RPAG feedback

Single sensitivity which prioritizes **DER participation** and **reduction of GHG emissions**

- Maximize programmatic participation in energy efficiency (EE),distributed energy resources (DER), and demand response (DR)
- Prohibit new emitting resources
- Do not consider cost as a limiting factor

- Target customer benefit indicators (CBI) to maximize:
  - Energy and non-energy benefits
  - Resilience
  - Environment
  - Public health
- Secondary CBI benefits:
  - Risk reduction
  - Energy security
  - Burden reduction

Introducing the cost test and societal impacts

Kara Dubin, PSE
Director, Clean Energy Strategy

Brian Tyson, PSE

Manager, Clean Energy Planning and Implementation

February 26, 2026

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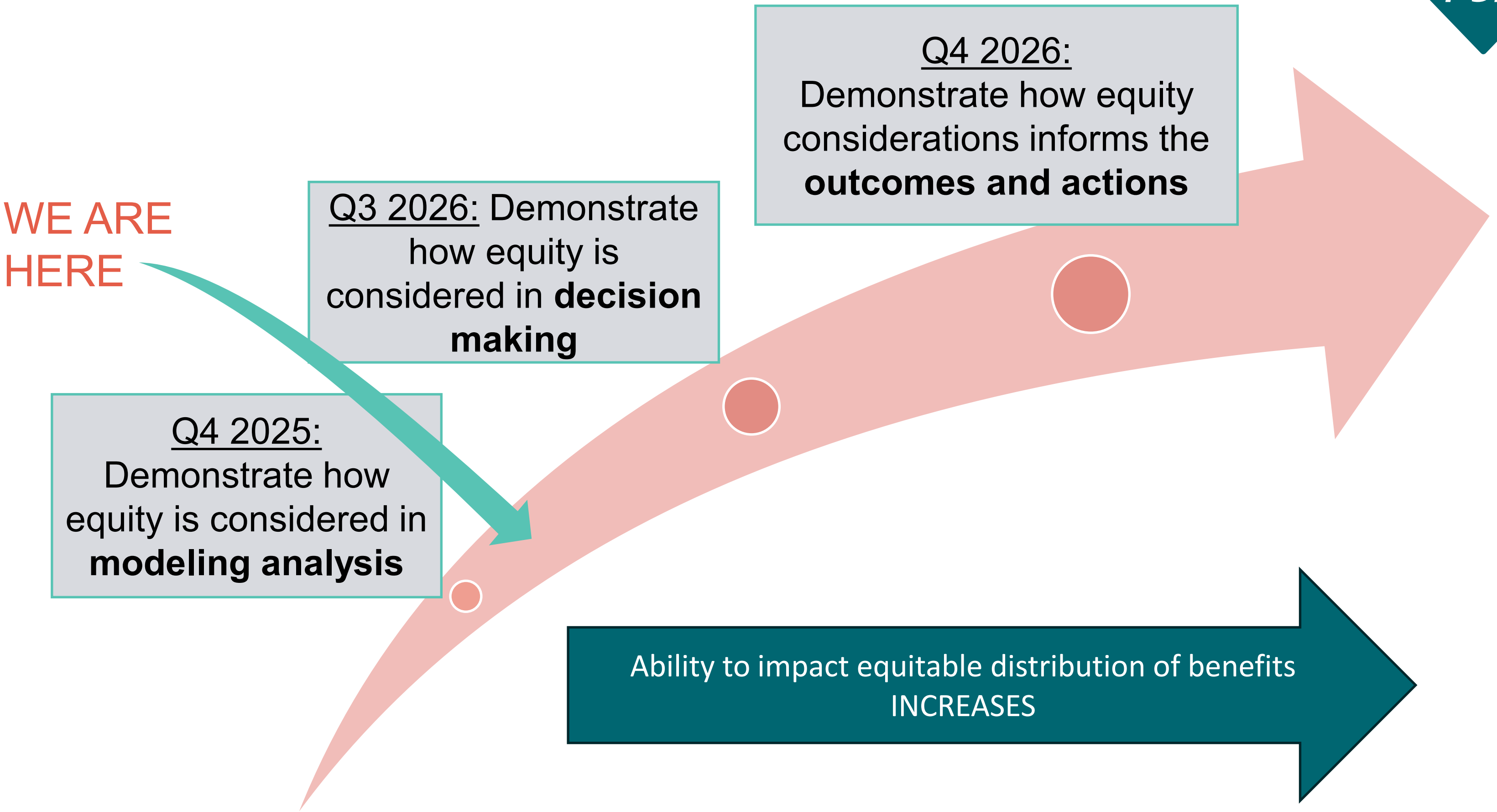
Objectives

- *Inform* RPAG of Cost Test framework provided in rules
- *Consult* RPAG on initial approach
- Feedback PSE needs for cost test framework
  - Initial reflections on approach (today)
  - Suggestions and ideas for measuring specific elements identified in cost test rules (March 26)
- How feedback will be used
  - PSE will consider all feedback in defining metrics for evaluating cost test elements

ISP process equity considerations



Cost test engagement timeline

Feb. 26 RPAG meeting*

March 16 EAG meeting

March 25 CRAG meeting

March 26 RPAG meeting

**CRAG and EAG members were invited to join us today as guests and will be provided materials and recording in preparation for their March meetings*

What is the cost test?

PSE

WAC 480-96-030 Integrated assessment and planning requirements.

(8) **Cost test.** Pursuant to RCW 80.86.020(9), each large combination utility must use the cost test for the purpose of determining the lowest reasonable cost of decarbonization and electrification measures in integrated system plans, at the portfolio level. Each large combination utility must use the cost test as a key input in the selection of its preferred portfolio per WAC 480-96-050(7), and as an input to the commission's determination on whether the ISP is in the public interest pursuant to WAC 480-96-080(6).

What does the cost test aim to do?

The cost test aims to monetize, quantify, or evaluate qualitatively various benefits and impacts at the portfolio level to inform the lowest reasonable cost portfolio.

1. Monetized	2. Quantitative	3. Qualitative
• Can be measured in or readily converted to dollars	• Can be measured in some way but not readily converted to dollars	• Cannot be measured quantitatively but impacts and benefits can be described

What are the elements to consider under the cost test rules framework?

Categories

- Monetized
- Quantitative
- Qualitative
- Undetermined
- Not applicable

Rate impacts

- Electric rate impact annually $/kWh
- Gas rate impact annually $/therm

Utility system impacts

- Electric revenue requirement with and without SCGHG*
- Gas revenue requirement with and without SCGHG*

Societal impacts

- Social cost of greenhouse gas (SCGHG)*
- Reliability*
- Resiliency*
- Security of supply*
- Host customer*
- Health and safety
- Risk reduction premium*
- Other environmental
- Equity
- Economic development
- Other fuels

Preliminary categorization of required cost test elements

**Embedded in planning model*

How will we measure rate impacts?

Parameter	What is it?	How is it measured?
Electric rate Quantitative	Estimated change in electric rate annually	$/kWh change
Gas rate Quantitative	Estimated change in gas rate annually	$/therm change

How will we measure utility system impacts?

Parameter	What is it?	How is it measured?
Electric utility revenue requirement* Monetized	Estimated cost to deliver the portfolio including operations, maintenance, and new infrastructure	Direct modeling output in dollars
Gas utility revenue requirement* Monetized	Estimated cost to deliver the portfolio including operations, maintenance, and new infrastructure	Direct modeling output in dollars

**Imbedded in planning model*

How will we measure monetized or quantified societal impacts?

Parameter	How might it be defined?	How might it be measured?	
Host customer* (Monetized)	Cost to customers for electrification or demand-side measures (e.g., heat pump purchase)	Estimated direct cost to customers, in dollars, for equipment purchase / install	Host customer impacts are also accounted for in energy efficiency modeling through NEIs
Greenhouse gas (GHG) emissions* (Monetized)	Estimated GHG emissions for all resources in portfolio	Direct modeling output in dollars using established social cost of greenhouse gas emissions value	
Other environmental (Quantitative)	Other emissions besides GHG, such as estimated NOx, SOx, PM 2.5	Direct modeling output in tons	

**Embedded in planning model*

How will we measure qualitative societal impacts?

Parameter	How might it be defined?	How might it be measured?
Reliability* Qualitative	Ability to maintain consistent and dependable supply based on federal standards and industry best practices	• Electric supply LOLE PRM • Gas supply planning standards • FERC/NERC reliability standards & contingencies
Resilience* Qualitative	Ability to withstand and recover from disruptions	• RA includes forced outages • FERC/NERC standards • Pipeline Hazardous Materials Safety Administration regulations • Federal/state/county standards
Security of supply* Qualitative	Consistent and reliable access to essential resources	• Volatility of firm fuel energy supply • Volatility of firm electric supply

**Embedded in planning model*

How will we measure other qualitative societal impacts?

Parameter	How might it be defined?	How might it be measured?
Equity Qualitative	Equitable distribution of benefits and reductions of burdens required by CETA	• Estimated over the CEAP's 10-year horizon • Describe how specific actions are consistent with the long-term strategy
Health and safety Qualitative	Must meet existing health and safety requirements (e.g., permitting and approval requirements)	Consistency with existing health and safety requirements

How will we measure undetermined societal impacts?

Parameter	How might it be defined?	How might it be measured?
Risk reduction premium* Undetermined	Accounts for allowance ceiling prices approved by Ecology (CCA RCW 70A.65)	Ceiling prices are assumed in all scenarios and captured in portfolio costs
Economic development Undetermined	Assessing how economic development, such as job creation, could be furthered	Estimated jobs by portfolio build (temporary and permanent)

**Embedded in planning model*

Questions to consider as we take a deeper dive into each element of the cost test rules?

- Are there elements that should be monetized that we have not yet identified? If so, how would you recommend the element(s) be monetized?
- Do you have any initial feedback on any of the societal impacts?
- What other feedback do you have on the approach?

Which elements should be prioritized with the various advisory groups?

RPAG

- Risk reduction premium
- Economic development
- Other?

EAG

- Economic development
- Equity impacts

CRAG

- Host customer

Note: This is Cost Test version 1.0. There may be differences between what we can practically do now vs. future ISPs.

ISP iterative analysis overview

Jennifer Coulson
Manager, Operations and Gas Analysis

February 26, 2026

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Purpose and desired outcomes – process overview

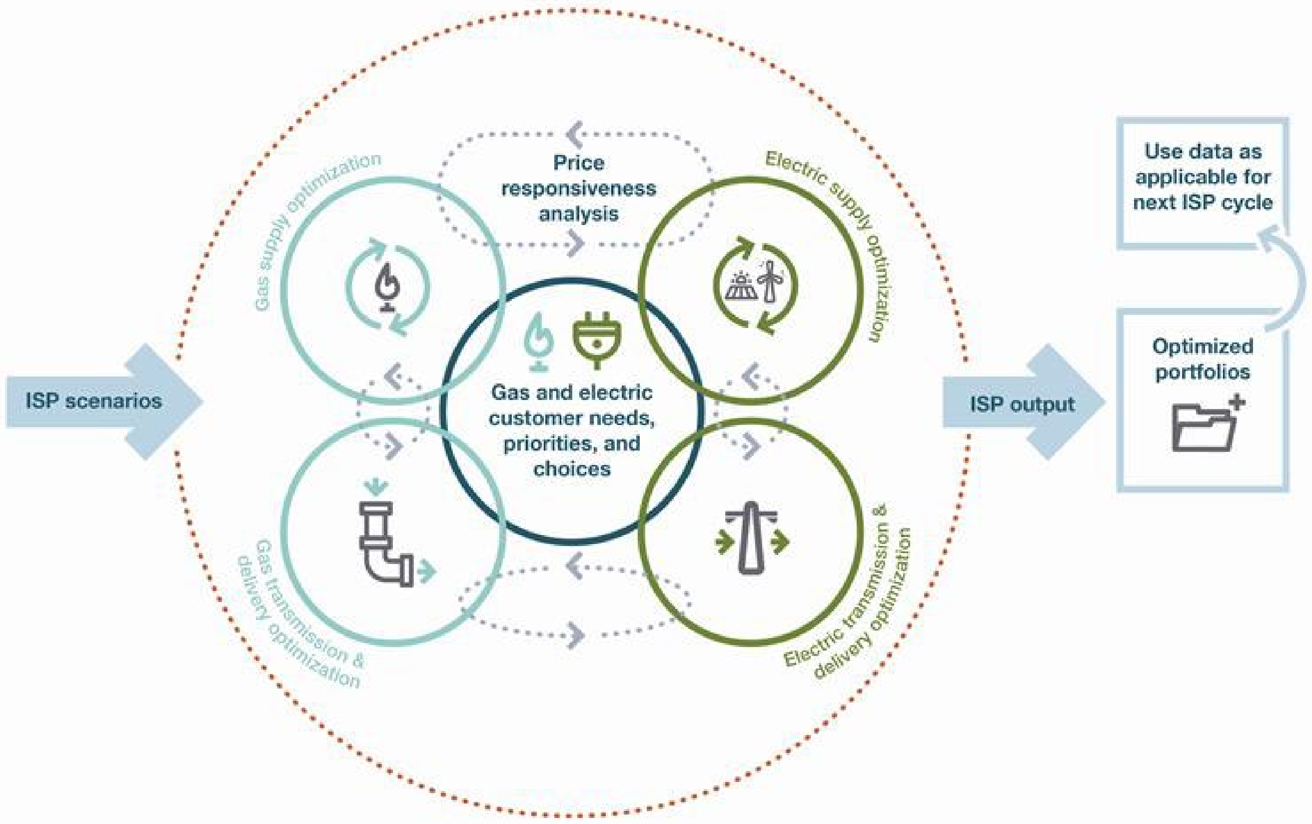
Purpose

- Preview iterative analysis concept and answer questions

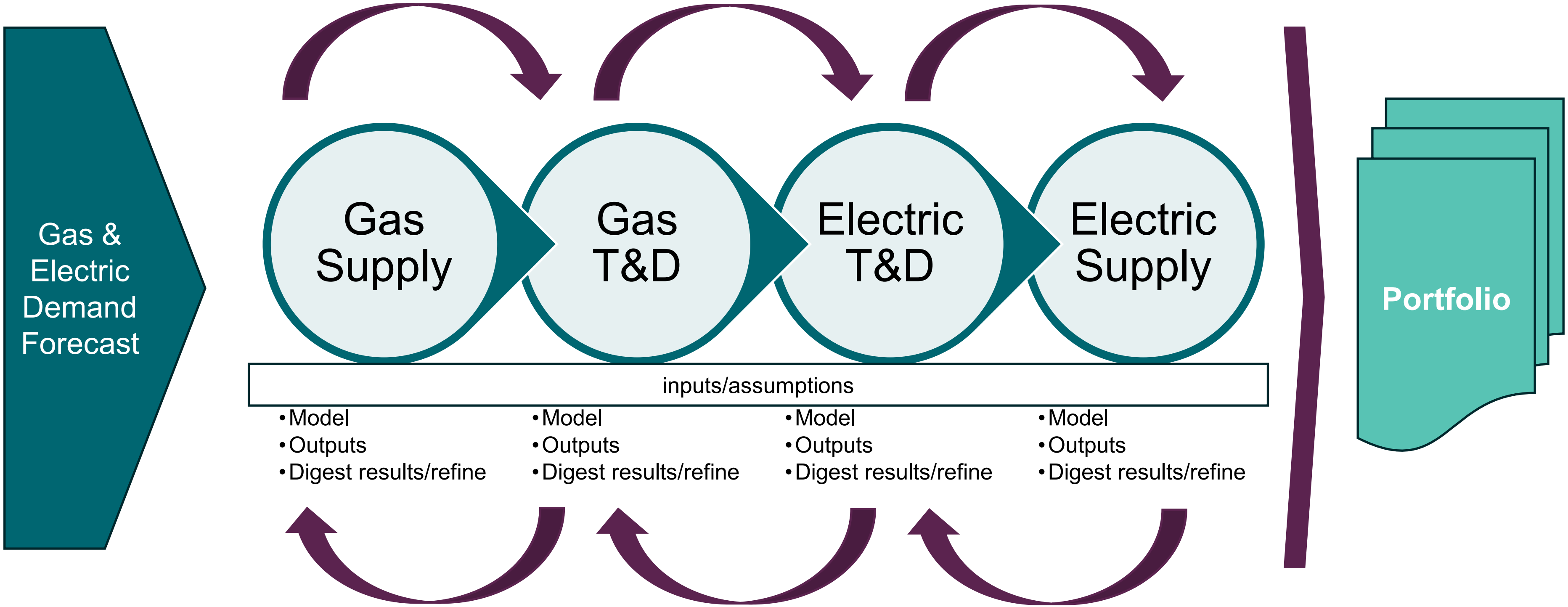
Desired outcomes

- Collective understanding of where iterative analysis is occurring with the 2027 ISP process

Iterative analysis overview



Example of how we are manually iterating through the ISP portfolio development process



Final 2027 ISP scenarios

Scenarios	Building Electrification	Large Load Requests	Customer Programs	EV Adoption
Reference (HB 1589): Current Trends	Current building electrification pilots, funding low-income through CCA	Data Centers (+ other new large load requests): based on high probability of interconnection *(lower demand impact)*	**Reference CPA for customer programs:** no gas appliance conservation, building codes restricting gas, 2% conservation & 10% DR or commercially feasible beginning in 2030 (electric only)	Reference
Scenario 1 (Mid): Incentivized electrification	Starting in 2030, building electrification based on equipment failure and market adoption rate with an incentive	Data Centers (+ other new large load requests): based on high probability of interconnection *(lower demand impact)*	Customer Programs (DR, DER, DSR, etc.) sized to load (adjusted CPA to demand levels)	Reference
***NEW* Scenario 2 (Mid +): Building Electrification Only**	Starting in 2030, electrify buildings at a pace that brings the emissions of both utilities **below** the utility's proportional share of the state GHG emission goals	Data Centers (+ other new large load requests): based on high probability of interconnection *(lower demand impact)*	Customer Programs (DR, DER, DSR, etc.) sized to load (adjusted CPA to demand levels)	Reference
Scenario 3 (High): Enhanced electrification	Starting in 2030, electrify buildings at a pace that brings the emissions of both utilities **below** the utility's proportional share of the state GHG emission goals. **Constrained by equipment failure**	Data Centers (+ other new large load requests): based on **mid probability** of interconnection *(higher demand impact)*	Customer Programs (DR, DER, DSR, etc.) sized to load (adjusted CPA to demand levels)	High
Scenario 4 (High+): Unconstrained electrification	Starting in 2030, electrify buildings at a pace that brings the emissions of both utilities **below** the utility's proportional share of the state GHG emission goals. **Unconstrained**	Data Centers (+ other new large load requests): based on **mid probability** of interconnection *(higher demand impact)*	Customer Programs (DR, DER, DSR, etc.) sized to load (adjusted CPA to demand levels)	High

Questions?

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Building Electrification Impact Tool:

Development for Integrated Electric and Gas Systems

February 26, 2026

CADMUS

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Overview of Building Electrification Impact Tool

Excel-based electrification scenario analysis tool

Baseline assumptions and inputs from CPA's Base Case Forecast

Predicts electrification uptake over time (key output is annual saturations for electric and gas appliances)

Key Topics:

1. Baseline assumptions
2. Electrification pathways of gas appliances
3. Granularity of analysis
4. Iterative modeling framework
5. Adoption modeling approach
6. Scenario 1: Estimating technology adoption trajectories
7. Scenario 1: Customer payback acceptance

1. Baseline assumptions

CPA Input Assumptions

- **End-use and measure inputs:** PSE Business Cases, Regional Technical Forum, Council's 2021 Power Plan, PSE Evaluations
- **End-use and measure saturation inputs:** PSE 2021 Residential Characteristics Study (RCS), NEEA 2017 RSBA II, NEEA 2019 CBSA IV
- Includes federal, state, and local codes and standards

Decarbonization Study

- 2021 contractor interviews (conversion costs)
- Cold-climate heat pump performance research
- Heat pump load shapes
- Rate forecast

2. Electrification pathways of gas appliances

Residential Electrification Measures Included in Each Scenario

New Electric Equipment	Replaced Gas Equipment	Scenarios 1-4
DHP or ccDHP	Boiler	✓
Hybrid DHP		Thru 2030
DHP or ccDHP	Furnace with Poor Ducts (no existing CAC)	✓
Hybrid DHP		Thru 2030
ASHP or ccASHP	Furnace w/o Existing CAC	✓
Hybrid ASHP		Thru 2030
ASHP or ccASHP	Furnace with Existing CAC	✓
Hybrid ASHP		Thru 2030
DHP or ccDHP	Room Heaters	✓
Hybrid DHP		Thru 2030
Cooking Oven (electric) [a]	Cooking Oven (gas)	✓
Cooking Range (electric) [a]	Cooking Range (gas)	✓
Dryer (electric, non heat pump)	Dryer (gas)	✓
Water Heater ≤55 Gal	Water Heater (gas)	✓
Water Heater >55 Gal		✓

DHP: ductless heat pump; ASHP: air-source heat pump;
CAC: central air conditioning; cc: cold climate

Commercial Electrification Measures Included in Each Scenario

New Electric Equipment	Replaced Gas Equipment
Air-Source Heat Pump	Boiler <300 kBtuh
	Boiler ≥300 kBtuh
	Furnace
Ductless Heat Pump	Room Heaters
Cooking (electric)	Cooking (gas)
Water Heater ≤55 Gal	Water Heater (gas)
Water Heater >55 Gal	Water Heater (gas)

All scenarios assume electrification of end-use equipment at the equipment's end of life. The analysis does not assume full home conversions*

*Scenarios 2 & 4 are ‘unconstrained’ meaning early retirement of equipment is required to meet the conditions of the scenario

[a] Cooking ovens and cooking ranges were analyzed separately because they each have a different federal standard.

3. Granularity of analysis

Modeled groups of customers with similar characteristics:

- Sector
- Building type
- County
- Vulnerable/standard population
- Building vintage (existing vs new construction)
- PSE customer type (electric-only, gas-only, combo)

Did NOT model individual buildings or sites

This granularity aligns with the Conservation Potential Assessment (CPA)

Electric-Only Service Area

Increase in electric sales

Gas-Only Service Area

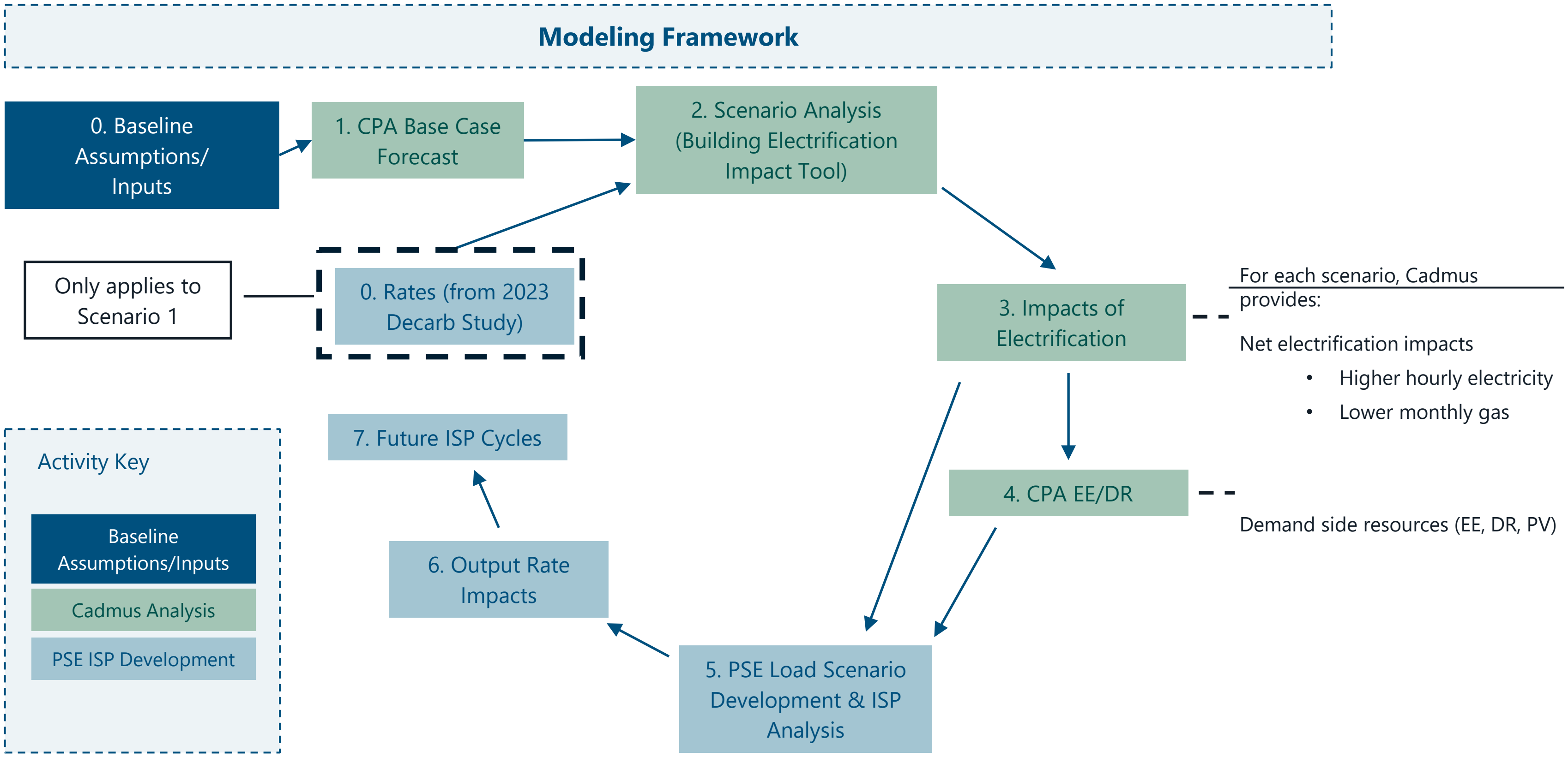
Decrease in gas sales

Combination Service Area

Increase in electric sales

Decrease in gas sales

4. Iterative modeling framework flowchart



5. Adoption modeling approach

$$\# \text{ Installations} = \text{Applicable Stock} * \text{Final Annual Adoption } \%$$

Number of installed units of a given type of equipment in a given county, customer segment, vintage, etc.

Number of equipment units that have failed and need to be replaced

Percentage of applicable stock that will install the given equipment

Approach options for scenario analysis:

- Customer decision modeling
  - (Scenario 1)
- Mandated - constrained by equipment failure
  - (Scenario 3)
- Early replacement
  - (Scenarios 2 & 4)

Scenario 1: Customer Decision Modeling

$$\text{Final Annual Adoption } \% = \text{Payback\_Acceptance} * \text{S\_Curve\_}\% * \text{CompShare}$$

Customer Payback Acceptance: A value between 0% and 100% that represents the highest attainable market share (based on project payback period from customer perspective)

The market diffusion of given equipment type*: A value between 0% and 100% based on Bass diffusion-of-innovation theory

* **Independent of project economics**

The portion of decision makers that choose a measure instead of competing alternatives

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6. Scenario 1: Estimating technology adoption trajectories

$$\textbf{Final Annual Adoption \%} = \textit{Payback\_Acceptance} * \text{S\_Curve\_\%} * \textbf{CompShare}$$

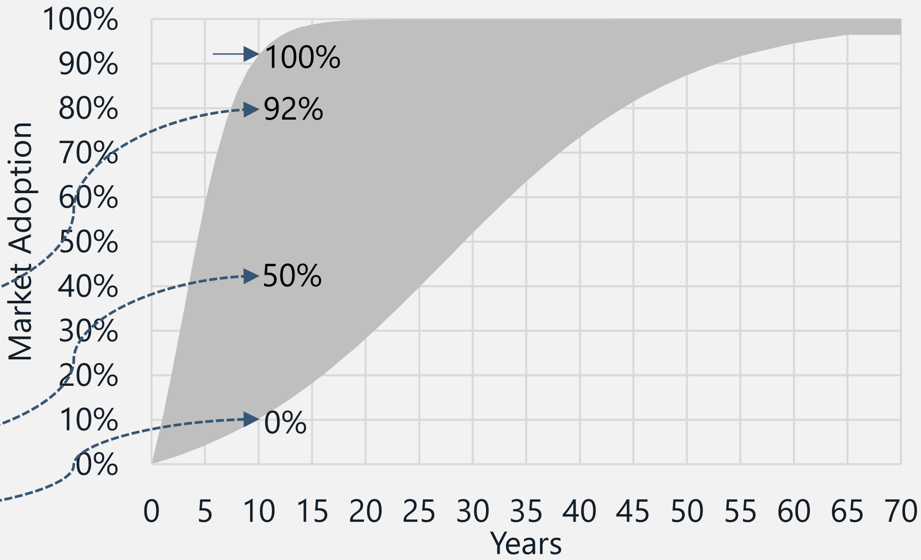
$$\text{S\_Curve\_\%} = \frac{1 - e^{-(p+q)t}}{1 + \left(\frac{q}{p}\right) e^{-(p+q)t}}$$

Scoring Matrix: Reference Attributes

Customer	Technology	Market Barriers
Captures the ease and willingness of customers to adopt a measure package (setting aside project payback)	Captures aspects of technologies (transaction costs, renovation, operational change, ancillary benefits)	Captures other characteristics that limit the adoption of measures (awareness, supply chain, etc.)

Measure Application	Customer	Technology	Market Barriers	Weighted Score
ASHP in SF	somewhat favorable	favorable	favorable	92%
ASHP in MF	somewhat unfavorable	favorable	favorable	83%
HPWH in MH	unfavorable	somewhat favorable	somewhat favorable	50%
Electric Cooktop in SF Low-Income	unfavorable	unfavorable	unfavorable	0%

These values vary by market segment (commercial/residential, low-income/standard-income)



SF: single-family home; ASHP: air-source heat pump;
MF: multi-family home; HPWH: heat pump water heater; MH: manufactured home

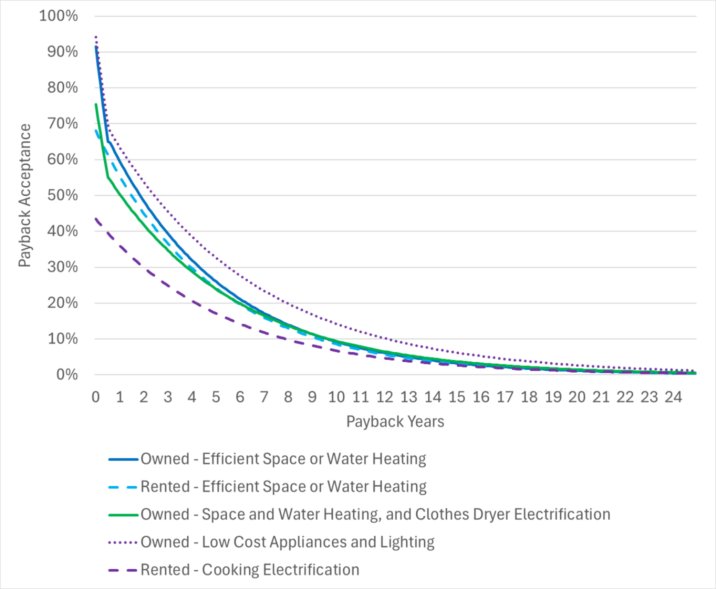
7. Scenario 1: Customer payback acceptance

$$\textbf{Final Annual Adoption \%} = \textbf{Payback\_Acceptance} * \textbf{S\_Curve\_\%} * \textbf{CompShare}$$

Project Payback Period

- Equipment capital and maintenance costs (from 2023 Decarb study)
- Customer bill impacts (from 2023 Decarb study)
- Incentives (HEEHRA, 25C, CCA, PSE; all budget capped)
- Customer discount rate

Example Payback Acceptance Curves (Standard



Cadmus created custom curves by synthesizing data from:

- Delphi panel results (2019 in Colorado; conducted by Guidehouse)
- Customer survey data (2025 in Wisconsin; conducted by Cadmus)

Key Features:

- Low acceptance of high payback periods
- Differentiation by technology, income, and owned vs. rented
- Data show that customer preference and access to capital are important factors

Any questions about the topics covered?

Building Electrification Impact Tool

1. Baseline assumptions
2. Electrification pathways of gas appliances
3. Granularity of analysis
4. Iterative modeling framework flowchart
5. Adoption modeling approach
6. Scenario 1: Estimating technology adoption trajectories
7. Scenario 1: Customer payback acceptance

Taylor Bettine

Senior Specialist

425.406.5810
Taylor.Bettine@cadmusgroup.com

Aquila Velonis

Principal

503.467.7156
Aquila.Velonis@cadmusgroup.com

Next steps

February 26, 2026

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Feedback process

01 — One week prior to meeting

The feedback window for the upcoming meeting opens.

02 — 3-5 business days prior to meeting

PSE posts the meeting agenda and slide deck on the Clean Energy website.

03 — Day of meeting

PSE engages RPAG for feedback and facilitates a public comment opportunity.

04 — One week post meeting

Feedback window for the latest RPAG meeting closes. Feedback received outside this window will go into the subsequent feedback report.

05 — Four weeks post meeting

PSE posts the meeting summary and feedback report from the latest RPAG meeting on the Clean Energy website.

Upcoming activities

Date	Activity
March 5, 2026	Feedback form for this meeting closes
March 26, 2026	RPAG meeting
April 2026	No scheduled RPAG meeting

Contact us

- Via email at isp@pse.com
- Via feedback form at: https://www.cleanenergyplan.pse.com/contact
- Leave us a voicemail at 425-818-2051
- Subscribe to our email list
- Visit our website: cleanenergyplan.pse.com

Public comment opportunity

February 26, 2026

How to participate in public comment opportunity

- Please use the “raise hand” feature if you would like to provide comment
- Each speaker will have up to 3 minutes to give comments
- Comments should relate to today’s meeting topics
- Please keep remarks respectful – no personal attacks
- Comments and questions will be included in the feedback report with PSE’s response
- You are welcome and encouraged to send written feedback and questions to isp@pse.com

Thank you for joining us!

February 26, 2026

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Appendix

Definitions and acronyms

Acronym	Definition
CCA	Climate Commitment Act
CEIP	Clean Energy Implementation Plan
CPA	Conservation potential assessment
DER	Distributed energy resources
DR	Demand response
DSM	Demand-side management
DSR	Demand-side resources
DSP	Delivery system planning
EE	Energy efficiency
EV	Electric vehicle

Acronym	Definition
GHG	Greenhouse gas
IRP	Integrated resource plan
ISP	Integrated system plan
NG	Natural gas
NPA	Non-pipe alternatives
RA	Resource adequacy
RFP	Request for proposal
RPAG	PSE’s Resource Planning Advisory Group
SCGHG	Social cost of greenhouse gas
WAC	Washington Administrative Code

Gas delivery system planning iterative analysis

Planning triggers

- Safety & health
- Asset reliability and integrity
- Customer requests
- Compliance with regulation
- **Load growth**
- Asset health management
- Equity advancement

The delivery system planning process requires many robust capabilities across PSE

- Intake of customer and community input
- Forecasting new customer growth, load changes from climate and electrification, customer retirements
- Monitoring and adaption to new regulations and policy
- System simulation and modeling (normal operation + contingencies)
- Benefit and cost analysis

Baseline

System needs identification → System modeling, & analysis → Alternatives & recommended solution →

Iterative Analysis

NG Customer impacts → Updated solutions (including NPA suitability)

Electric distribution planning iterative analysis

The delivery system planning process requires many robust capabilities across PSE; **load growth is one of many considerations**

Planning triggers

- Safety & health
- Equity advancement
- Customer requests
- **Load growth**
- Grid modernization
- Gas modernization
- Asset health management
- Asset reliability and integrity
- Compliance with regulation
- Resource integration

- Intake of customer and community input
- **Forecasting new customer growth, load changes from climate and electrification**
- Monitoring and adaption to new regulations and policy
- System simulation and modeling (normal operation + contingencies)
- Analysis of resource integration
- Benefit and cost analysis
- Project portfolio optimization

System evaluation → System needs, modeling, & analysis → Alternatives & recommended solution → Optimize with other projects → Final plan: portfolio of projects

Iterative Analysis (applies to: Optimize with other projects → Final plan: portfolio of projects)

Electric supply & transmission iterative analysis

ISP Inputs:

- Existing and future planned transmission capacity
- Transmission Costs (interconnection, wheeling, losses)

ISP Iteration:

- Iterate on resource portfolios and transmission builds to identify a cost-effective portfolio

ISP Outputs:

- Draft plan of optimized resource and transmission portfolio