PSE 2021 Electric and Natural Gas Draft Integrated Resource Plans

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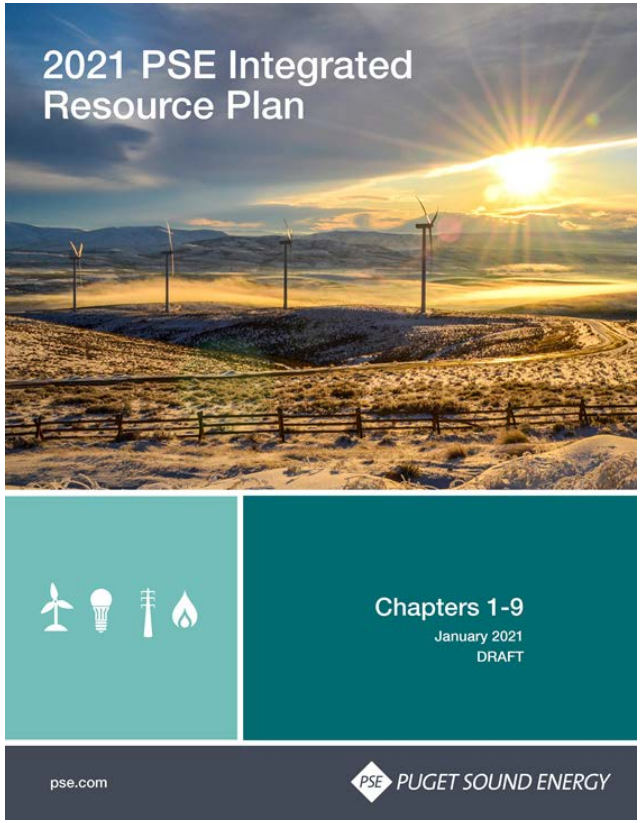
Development of Electric and Natural Gas IRPs

Updates since draft IRP:

- Finalized Flexibility Analysis
- Made portfolio model updates: corrected transmission costs, included T&D benefit for battery energy storage, updated biomass build limit
- Completed Economic, Health and Environmental Benefits Assessment
- Developed preliminary Customer Benefit Indicators for portfolio evaluations to inform the preferred portfolio

For stakeholder review on March 5 and final IRP:

- Complete electric and natural gas stochastic analyses
- Finalize all electric and natural gas portfolio scenarios and sensitivities
- Solicit feedback on market risk assessment
- Develop preferred portfolio and Clean Energy Action Plan



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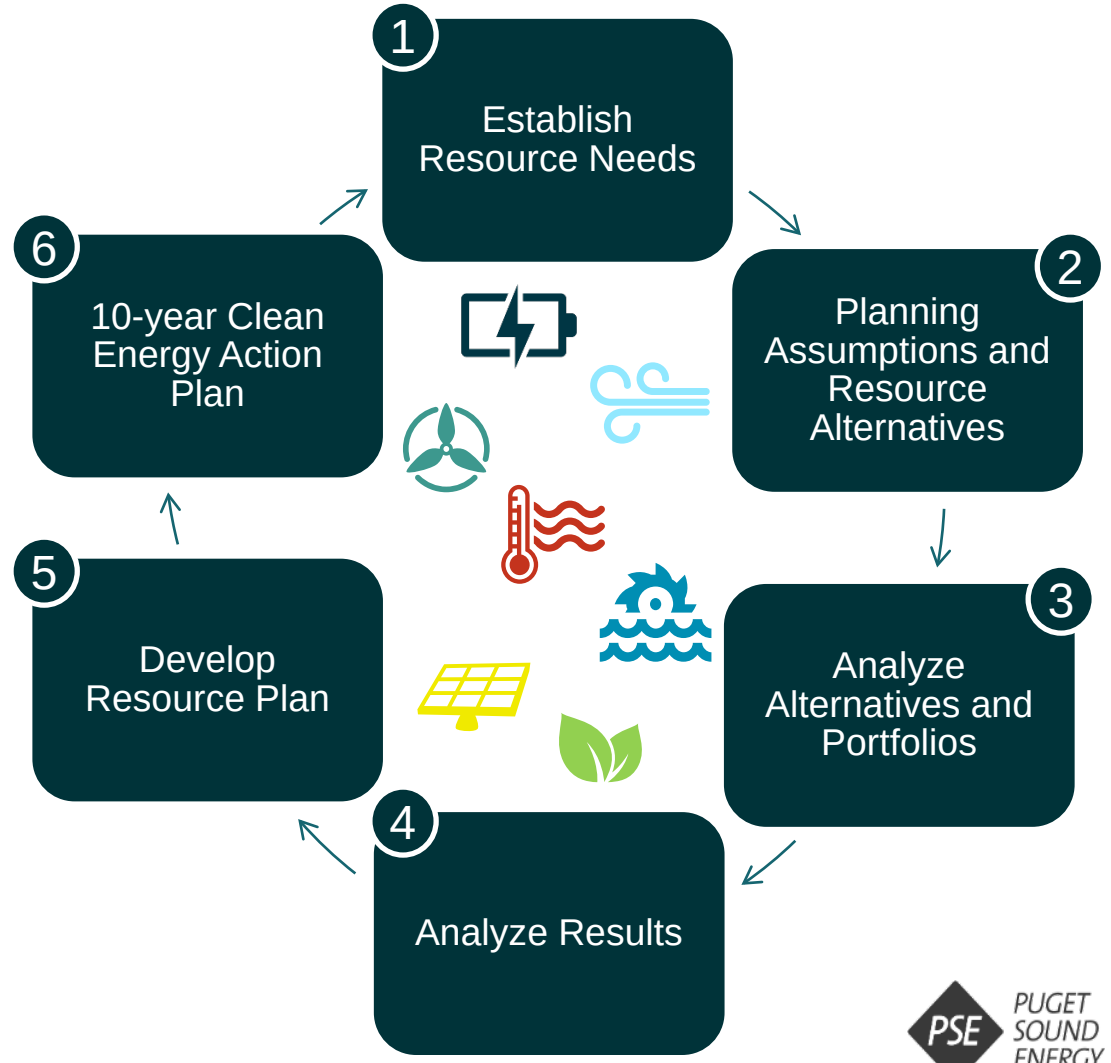
2021 IRP modeling process is iterative and includes numerous opportunities for stakeholder input

- Improved stakeholder engagement and made measurable progress towards CETA implementation under tight time constraints, incomplete rules and a global pandemic.
- Resource outlook includes accelerated acquisition of energy conservation, increased demand response and distributed energy resources and a significant investment in utility-scale renewable resources while maintaining resource adequacy.
- The CEIP and the procurement process will evaluate costs, permitting and other challenges and opportunities and make the final resource decisions.



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PSE achieved significant improvement in stakeholder engagement

Increased access through online webinars

12
IRP webinars recorded

68
Average number of webinar participants

201
Unique individual have participated in webinars

Improved stakeholder communication

29
Email communications distributed

1,441
Total audience members receiving IRP email communication

12,197
Visits to the website between May and February

20%
Average message open rate for all newsletters

Developed an online process for stakeholder feedback

Feedback Form

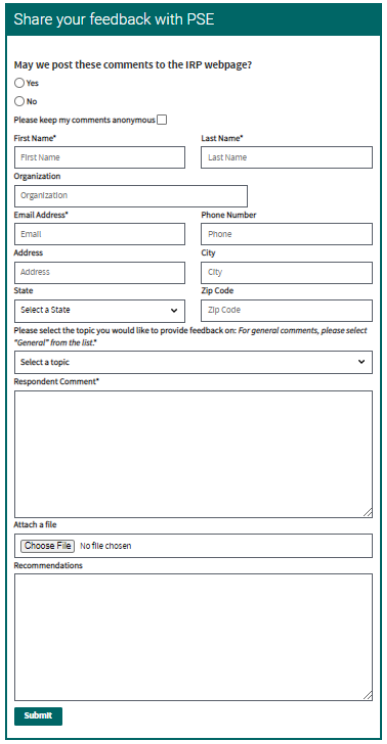
295
Feedback forms received

Feedback Report

11
Feedback Reports provide PSE's responses to 621 stakeholder comments

Consultation Update

11
Consultation Updates document how PSE used stakeholder feedback


Share your feedback with PSE

May we post these comments to the IRP webpage?
Yes
No
Please keep my comments anonymous
First Name* / Last Name*
Organization
Email Address* / Phone Number
Address / City
State / Zip Code
Please select the topic you would like to provide feedback on: *For general comments, please select "General" from the list.**
Select a topic
Respondent Comment*
Attach a file
Choose File No file chosen
Recommendations
Submit

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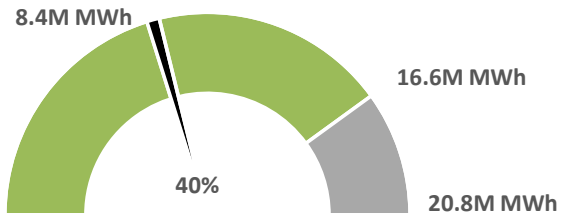
1 Establish Resource Needs

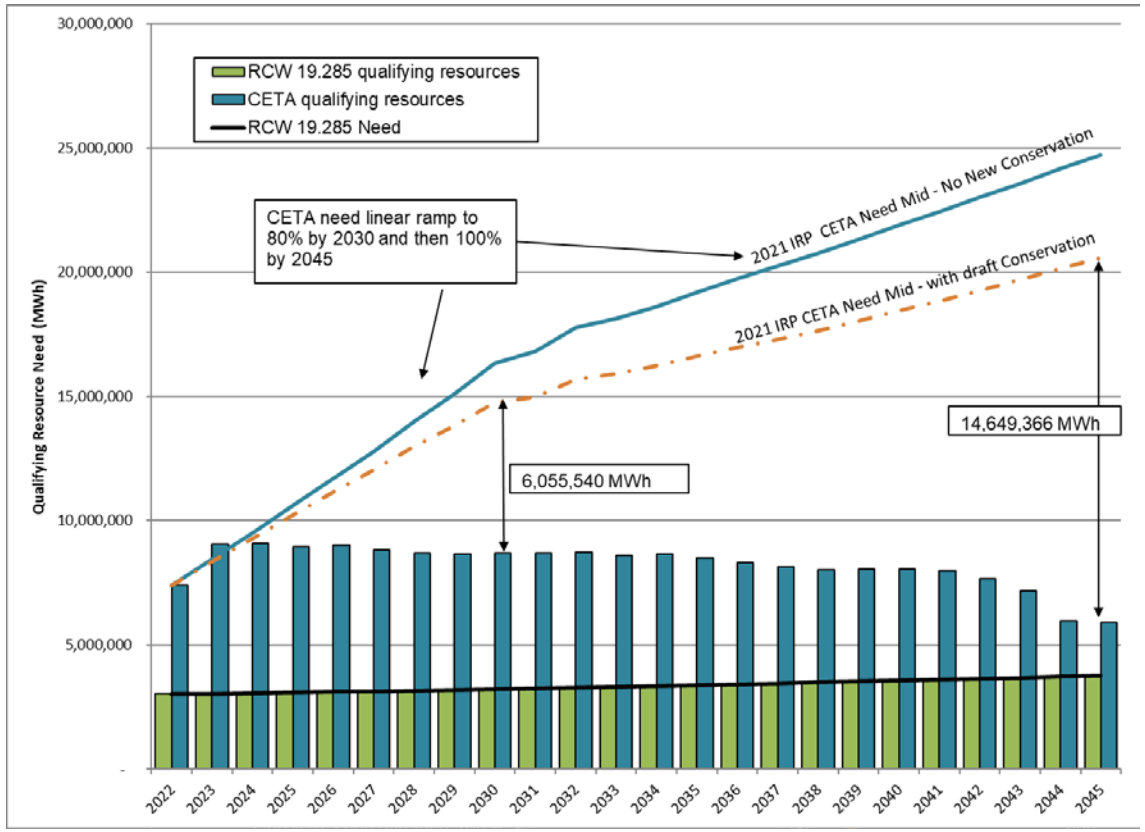
Three types of resource needs must be satisfied: renewable energy, peak hour capacity and hourly energy.

Resource Need	Requirement
Renewable Energy	RCW 19.285 CETA: 80% renewable target by 2030; 100% renewable target by 2045
Hourly Energy	2021 IRP demand forecast
Peak Capacity	Resource adequacy analysis

Current status towards 2030 CETA Target



Renewable Energy Need



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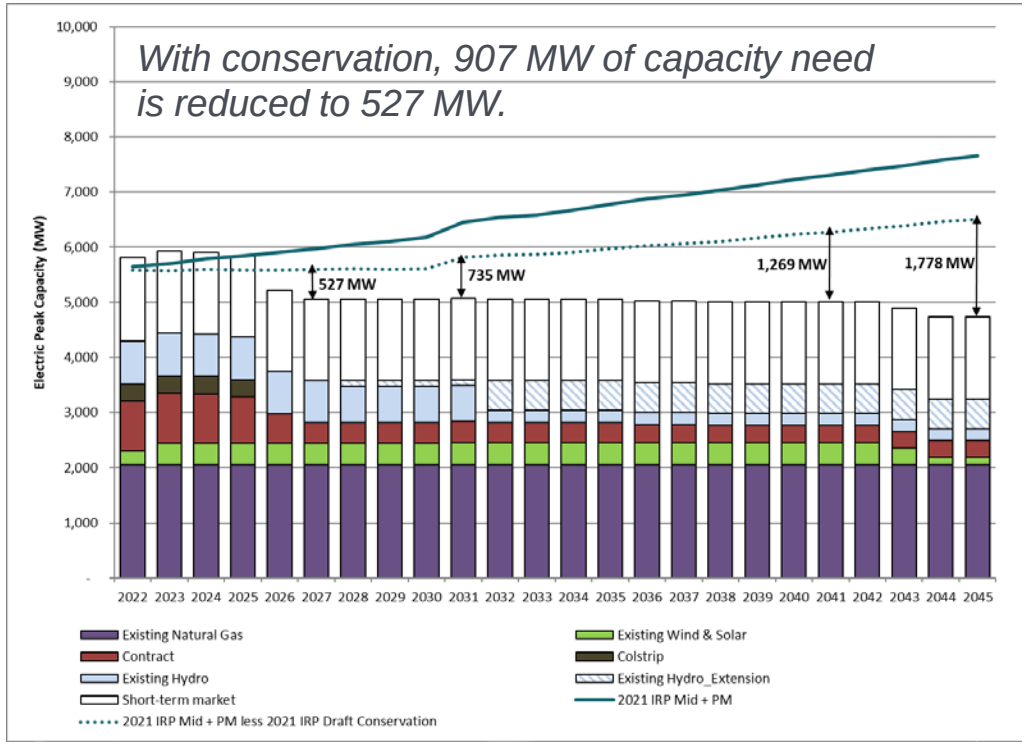
1 Establish Resource Needs: Resource Adequacy

Resource adequacy must be maintained to support the clean energy transition.

- Over 740 MW of firm capacity is removed from PSE portfolio at the end of 2025.
- Without new capacity, the loss of load probability is over 68%.



- RA analysis determined that 907 MW by 2027 is needed to achieve 5% loss of load probability.
- RA analysis ensures that customer load is met across a wide range of conditions with sufficient resources and considers variability in load, temperatures, hydro generation, wind and solar generation, potential outages and availability of Mid-C market.
- Energy efficiency, renewable resources, demand response and distributed generation contribute to meeting capacity needs.

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2 Planning Assumptions and Resource Alternatives

The portfolio planning assumptions were developed with stakeholder input.

Electric price forecast	Natural gas price forecast	Social Cost of Greenhouse Gases
New resource alternatives	Transmission constraints	Flexibility benefit

- Portfolio modeling meets 80% renewable resources target in 2030.
- Evaluated two cost alternatives to achieve the carbon neutral standard in 2030 and beyond:
  1. California carbon tax as a proxy for compliance cost *(selected).*
  2. 100% renewable energy target starting in 2030.

Findings

- ✓ Increase in renewable resources depresses wholesale electric market prices in comparison to past IRPs but increase the hourly volatility.
- ✓ Natural gas prices remain low with a slight decline.
- ✓ 25 unique supply-side resources evaluated and stakeholders helped to establish resource costs and assumptions.
- ✓ As more renewable resources are added, more balancing reserves are needed and flexible resources, such as demand response and energy storage, have higher flexibility benefits.

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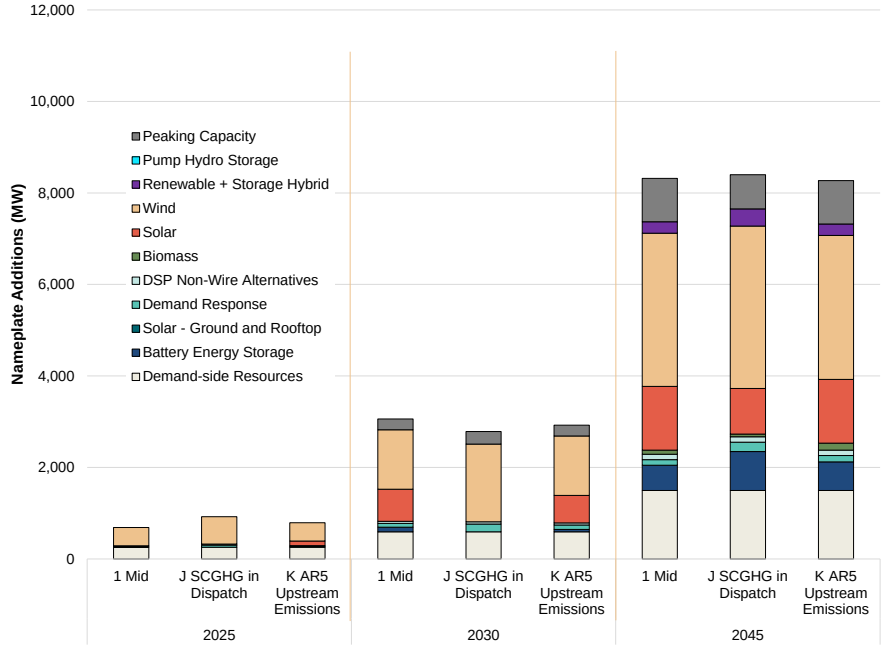
2 Planning Assumptions and Resource Alternatives: **Social cost of greenhouse gases and upstream emissions**

SCGHG is applied as a cost adder when evaluating conservation and resource additions. Upstream emissions AR4 methodology is used.



- Both 2019 and 2021 IRPs analyzed multiple modeling approaches for social costs of greenhouse gases.
- Renewable resources required to comply with CETA is the key constraint driving portfolio resource additions and costs.
- PSE assumes upstream emissions consistent with AR4 and evaluated AR5 in response to stakeholder requests.

Findings

- ✓ Different social cost of greenhouse gases modeling approaches do not have an impact on the cost-effective amount of conservation, demand response and other resource additions or retirements.
- ✓ Using upstream emissions consistent with AR5 does not change resource builds and portfolio costs in comparison to utilizing AR4.

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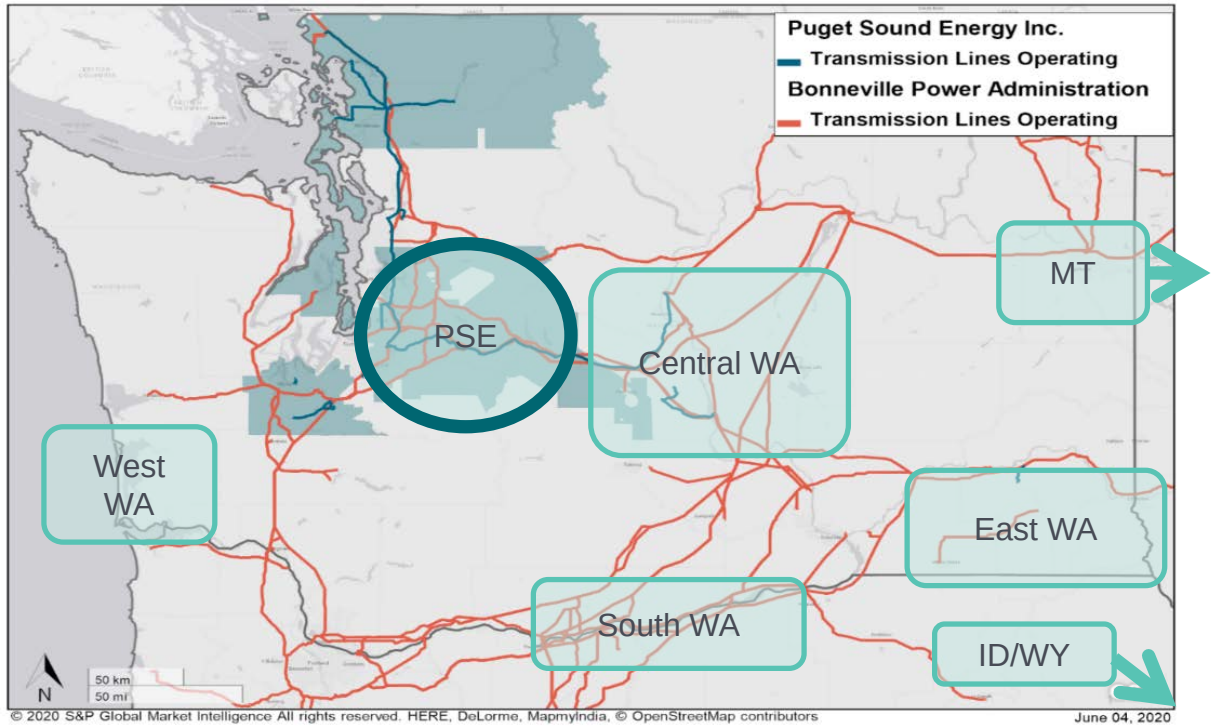
2 Planning Assumptions and Resource Alternatives: **Transmission Constraints**

Incorporated transmission constraints as aggregated resource build limits.

- New to the 2021 IRP.
- 7 resource group regions identified align with existing transmission resources.
- Evaluated long-term firm transmission rights acquisitions at less than resource capacity.



Findings

- Transmission constraints limit large scale resources, so lower capacity factor, higher cost distributed resources are substituted to meet CETA requirements.
- Montana and Wyoming wind offer higher capacity value and bring resource diversity along with some transmission risk.

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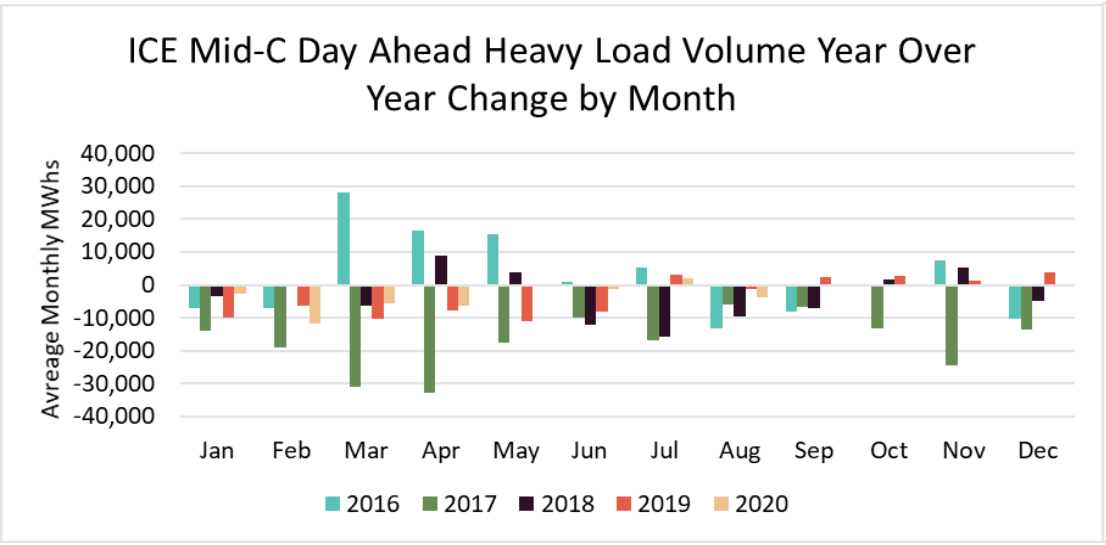
2 Planning Assumptions and Resource Alternatives: **Market Risk Assessment**

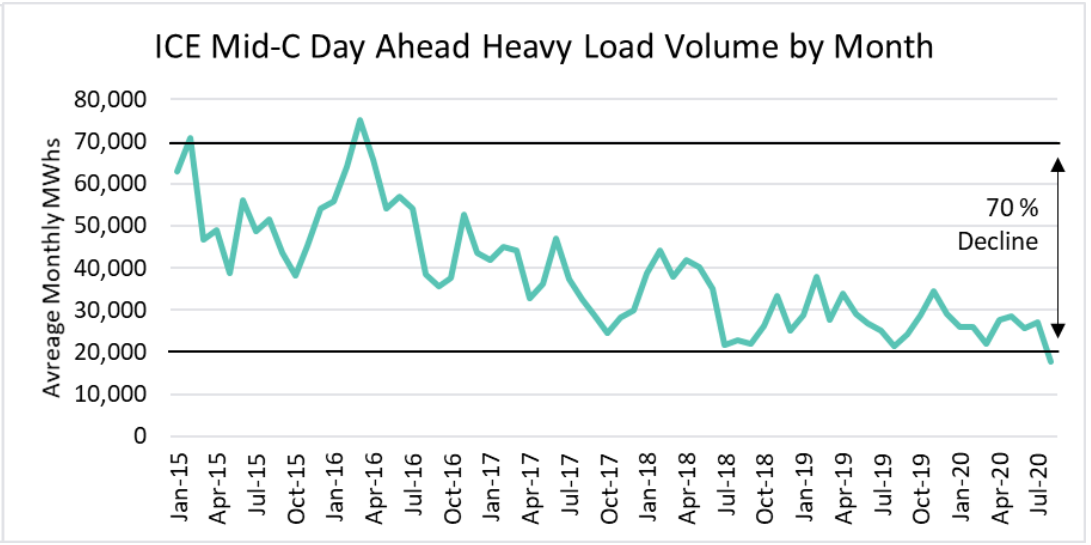
Market risk assessment will be discussed with stakeholders at March 5 webinar.

Several indicators show that PSE's market purchase limit for peak capacity planning is too high:

- Expected retirement of dispatchable, high-capacity resources throughout the WECC.
- PSE's market limit is higher when benchmarked with other IOUs.
- Several recent studies have concluded that the PNW faces a capacity shortfall in the near term.
- Trading volumes of day ahead physical energy for delivery at the Mid-C market hub have trended downward.

Anticipated 2021 IRP recommendation: Develop a resource procurement strategy to gradually decrease market purchases by 2027. A market risk adjusted capacity need will be reflected in the final IRP.





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3 Analyze Alternatives and Portfolios

Over 35 integrated scenarios and sensitivities, requested by stakeholders have been modeled.

Economic Conditions

- 1. Mid Economic Conditions (Reference)
- 2. Low Economic Conditions
- 3. High Economic Conditions

Future Market Availability
- Renewable Over-generation Test
- Reduced market access at peak

Transmission Constraints and Build Limitations
- Distributed
- Time Delayed
- Firm Transmission as a Percent of Nameplate

Conservation
- 6-yr Ramp Rate
- Non-Energy Impacts
- Social Discount Rate for DSR
- No DSR

Social Cost of Greenhouse Gases
- SCGHG as Dispatch Cost in Portfolio Model Only
- SCGHG as Dispatch Cost in both Power Price and Portfolio Models
- Modeling AR5 for upstream emissions
- SCGHG as Fixed Cost, Plus a Federal Carbon Tax

Emissions Reduction
- Biodiesel as a Fuel for Peakers
- No New Gas Generation
- Gas Generation Out by 2045
- 100% Renewable by 2030

Demand Adjustments
- Fuel Switching for Gas to Electric
- Temperature Sensitivity on Load

Balanced Portfolio
- Balanced Portfolio
- Balanced Portfolio with alternative fuel for Peakers

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4 Analyze Results: Distributed Energy Resources

Distributed energy resources are a significant component of the draft preferred portfolio.

Resource Additions (MW)	2022-2025	2026-2030	2031-2045	Total
Distributed Energy Resources				
Energy Efficiency	157 MW	245 MW	390 MW	793 MW
Distribution Efficiency	4 MW	6 MW	4 MW	15 MW
Codes & Standards	92 MW	71 MW	191 MW	354 MW
Battery Energy Storage	25 MW	150 MW	275 MW	450 MW
Solar - ground and rooftop	82 MW	188 MW	1,032 MW	1,302 MW
Demand Response	29 MW	154 MW	34 MW	217 MW
DSP Non-Wire Alternatives	22 MW	24 MW	72 MW	118 MW
Total DERs	412 MW	838 MW	1,999 MW	3,249 MW

- Delivery system planning (DSP) and IRP integration supports DERs.
- DSP Non-wire alternative solutions provide a DER forecast to the IRP.
- Further DER feasibility assessment will be required in the CEIP and ongoing learning through implementation.

Findings

- ✓ DERs have lower peak capacity contributions and increased cost but improve customer benefits such as resiliency, air quality and environment.
- ✓ Almost all technically feasible demand response programs evaluated are included in the preferred portfolio which means that 217 MW of 222 MW of demand response is included
- ✓ Energy efficiency is a low cost way to decrease renewable requirements and resulted in a 71% increase when compared to no CETA portfolios.

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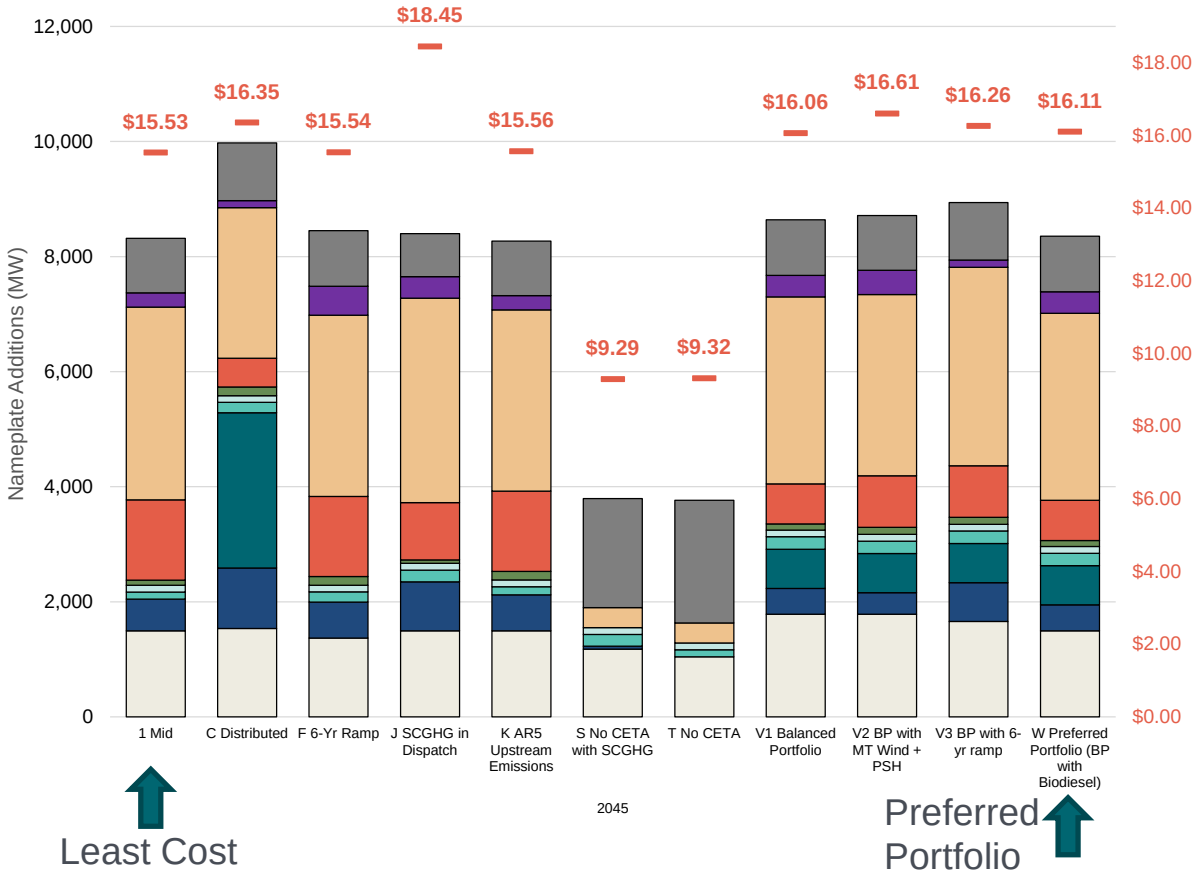
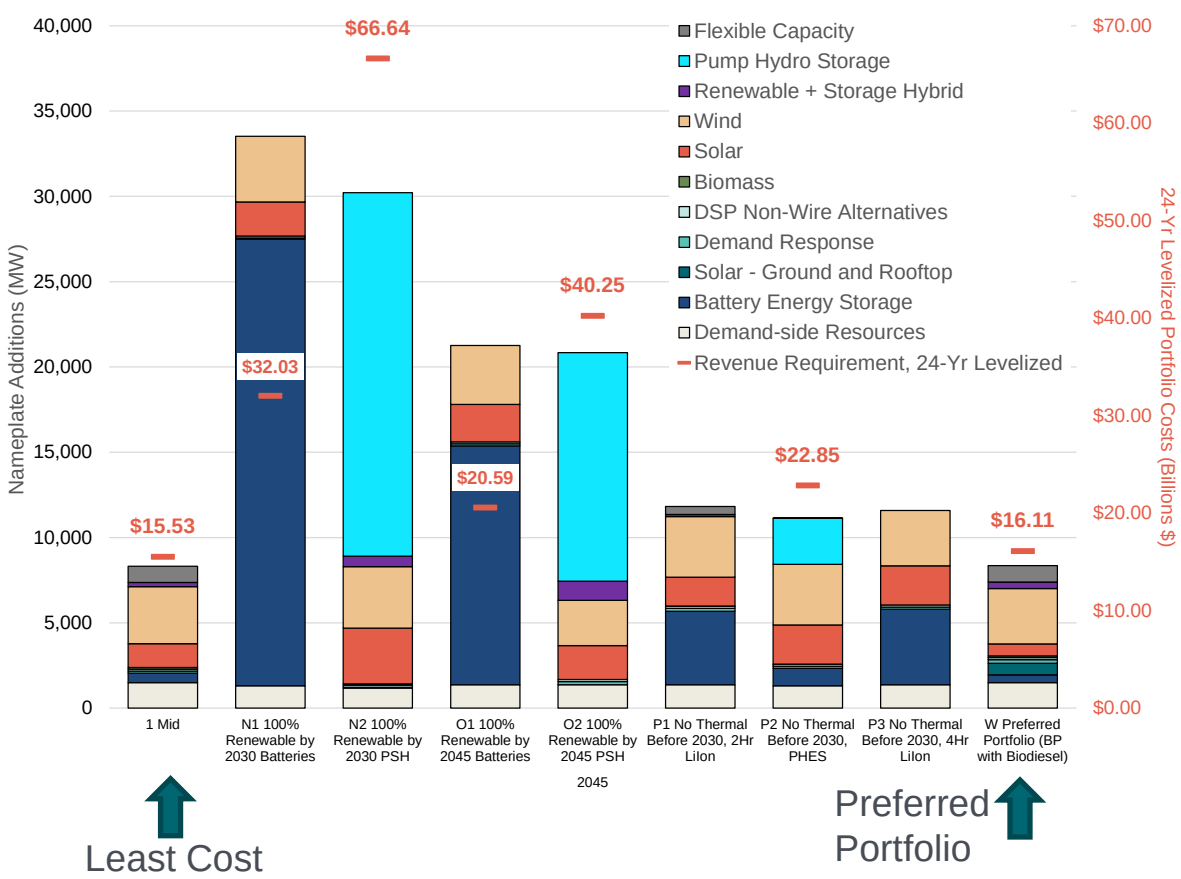
4 Analyze Results: Resource Additions and Costs

Portfolio sensitivity modeling evaluates tradeoffs between different resource additions and portfolio costs.

The procurement process will drive the acquisition of clean resources and will evaluate costs, permitting and other challenges and benefits.

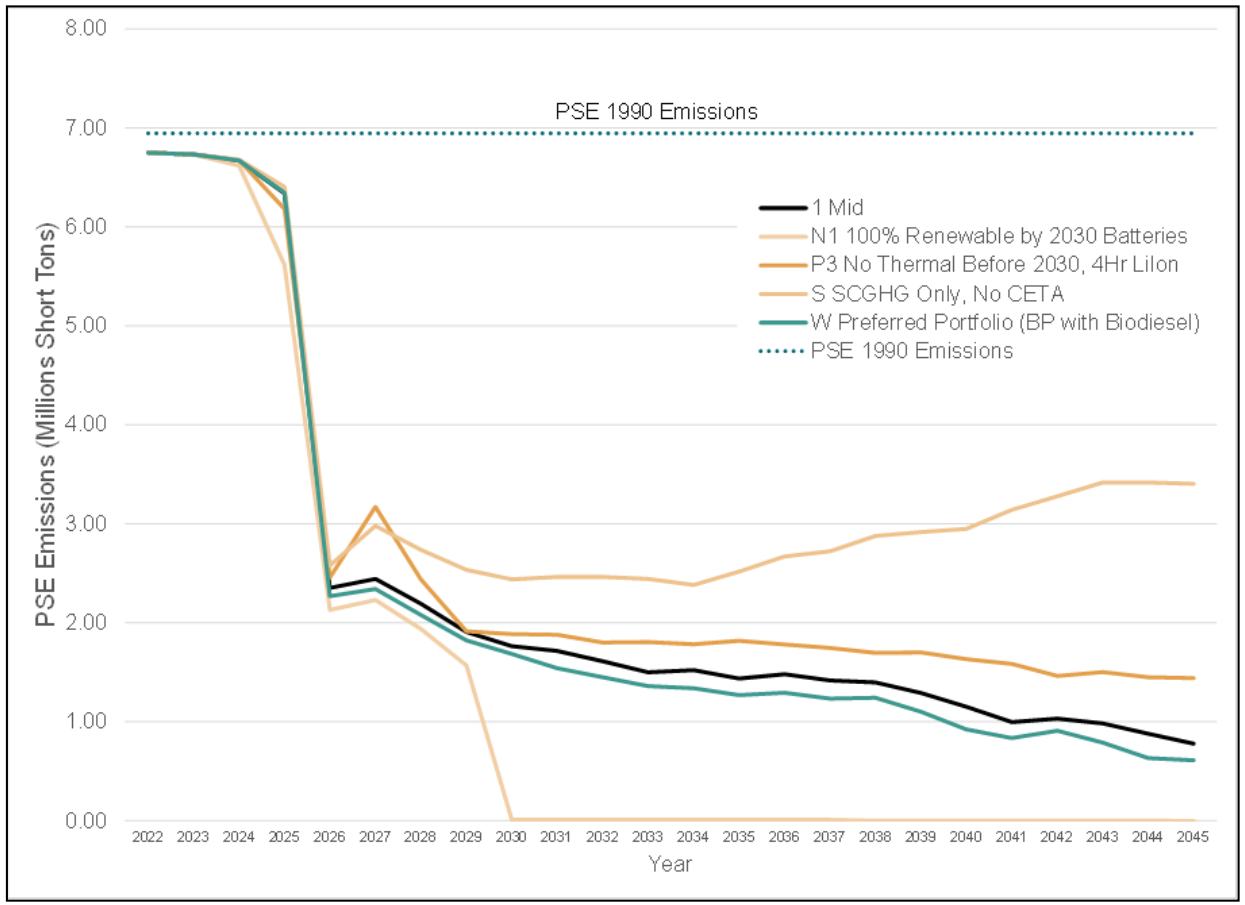




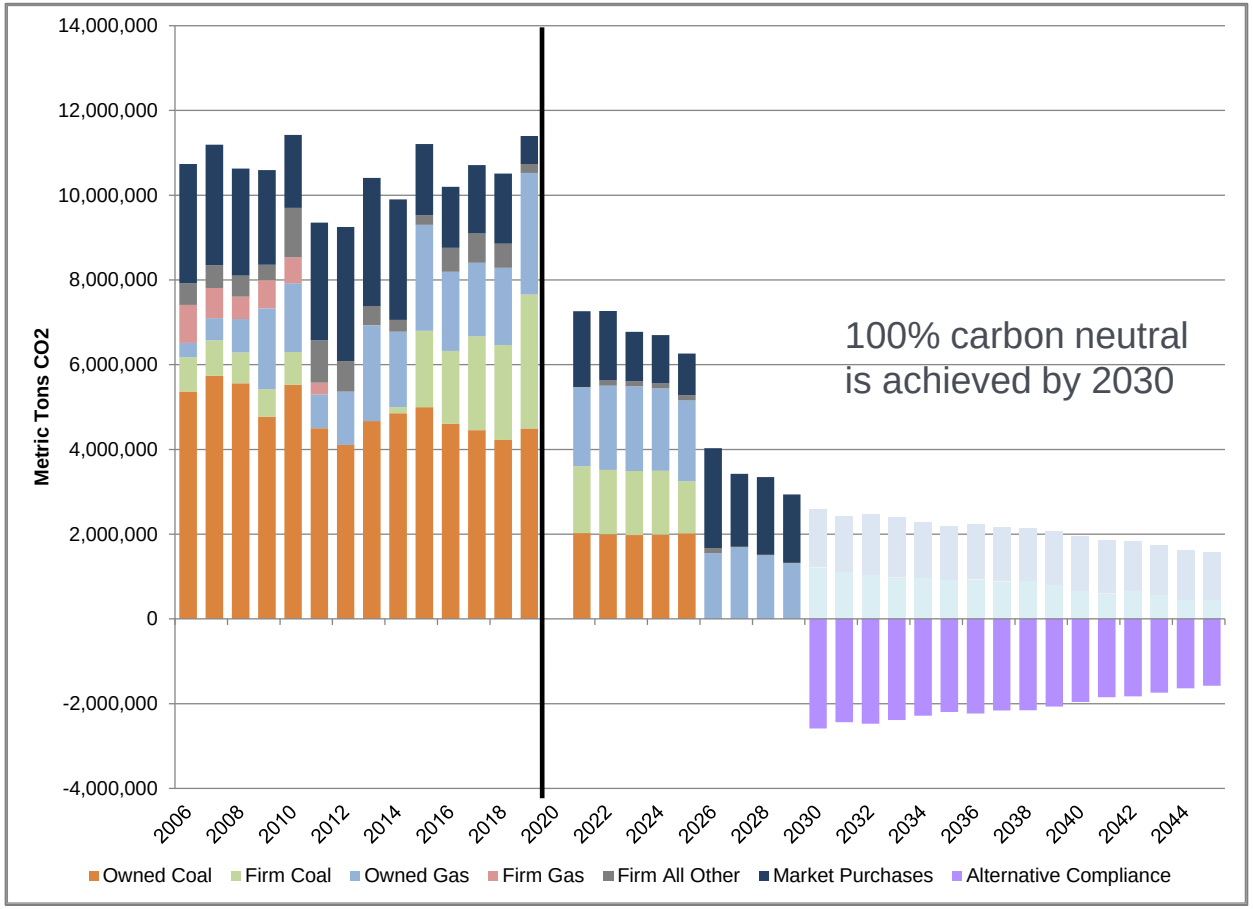
4 Analyze Results: Emissions

Significant emission reductions are achieved with the additions of non-emitting resources, retirement of coal resources and lower dispatch of existing resources.

Comparison of Direct CO2 Emissions & Upstream Emissions



Historical Emissions and Projected Emissions for Draft Preferred Portfolio



5 Develop Resource Plan: Assessing Current Conditions

Assessment of current conditions in the path to equitable transition to clean energy is evaluated through Economic, Health and Environmental Benefits Assessment.

IRP Resource Planning

Delivery System Infrastructure

Dept. of Health Cumulative Impact Analysis

Highly Impacted Communities

Vulnerable Populations

Economic, Health and Environmental Benefits Assessment

Equity Advisory Group input

IRP Portfolio Outputs

Customer Benefit Indicators

Preferred Portfolio

IRP 10-yr CEAP

4-yr CEIP

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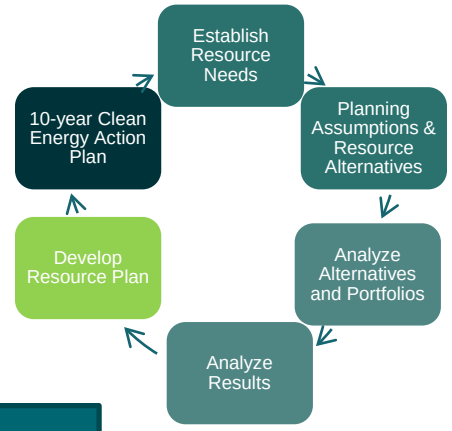
5 Develop Resource Plan: Incorporating Customer Benefits



Customer benefit indicators inform PSE's preferred portfolio.

Category	Customer Benefit Indicator Type	Customer Benefit Indicator
Environment	Climate Change	GHG Emissions
	Environment	Renewable Generation, Customer Programs, Energy Efficiency, Distributed Generation
Health	Air Quality	SO_2, NO_x, PM
Economic	Market Position	Market Purchases
	Cost	Portfolio Cost
Energy Security & Resiliency	Resource Adequacy	Market Risk, Demand Response
	Resiliency	Storage

6 Clean Energy Action Plan

Clean Energy Transformation Standards are met in the Draft Preferred Portfolio.

Draft Preferred Portfolio achieves:

- *100% carbon neutral by 2030*
- *100% carbon free by 2045*

Incremental Resource Additions (Nameplate MW)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	Total
Distributed Energy Resources											
Demand-side Resources	74	64	61	57	63	66	82	75	75	81	696
Battery Energy Storage	-	-	-	25	25	25	25	25	50	25	200
Solar - ground and rooftop	-	-	-	80	30	30	30	30	30	30	260
Demand Response	-	5	6	18	27	34	41	27	26	13	195
DSP Non-Wire Alternatives	3	6	9	4	3	5	6	5	4	4	50
Total DERs	77	75	76	184	148	160	184	162	185	153	1,401
Renewable Resources											
Wind	-	-	-	400	200	400	-	200	200	100	1,500
Solar	-	-	-	-	-	100	-	100	199	-	398
Total Renewable Resources	-	-	-	400	200	500	-	300	399	100	1,898
Flexible Capacity	-	-	-	-	255	-	-	-	-	-	255

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Natural gas IRP results in increased and continued conservation investments

- Conservation investments will eliminate the need for future regional pipeline infrastructure expansion for PSE's natural gas customers.
- Inclusion of social cost of greenhouse gases and upstream related carbon emissions have a significant impact on the amount of cost-effective conservation.

Short-term Comparison of Natural Gas Energy Efficiency	MDth over 2-year program
2018-2019 Actual Achievement	699
2020-2021 Target	795
2022-2023 Economic Potential in 2021 IRP Scenarios	1,192

Natural Gas Resource Plan Takeaways

- ✓ Increased and continued conservation investments are expected to meet future peak day natural gas capacity needs for PSE's natural gas customers.
- ✓ Further analysis of greenhouse gas reduction opportunities is needed, including fuel-switching.

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