2023 Electric Progress Report

September 13, 2022

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Safety Moment

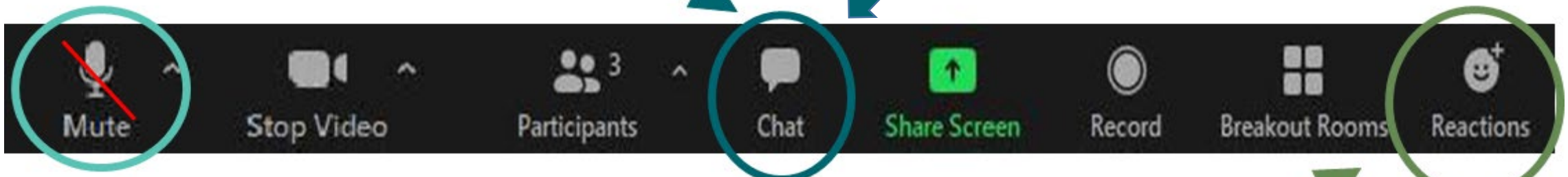
September is Food Safety Education Month

- Wash hands before you prepare your meal and before you eat
- Separate raw meat, chicken, turkey, seafood, and eggs from cooked food and fresh produce
- Use food thermometer to ensure food are cooked to an internal temperature that kills germs

Welcome to the webinar and thank you for participating!

If you **want to type a question regarding the presentation,** insert **"Slide X followed by your question"** in the chat box!

If you **have a technical issue or a general question**, please type it in the chat box.



Please **keep yourself on mute** unless you are speaking.

If you want to **ask a question verbally,** click the 'Reaction' button and click on the **'Raise Hand'** option and we will call on you.

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Facilitator Requests

- Engage constructively and courteously towards all participants
- Respect the role of the facilitator to guide the group process
- "Take space and make space"
- Avoid use of acronyms and explain the technical questions

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Agenda

Time	Agenda Item	Presenter
1:00 – 1:10 p.m.	Opening	Sophie Glass, Triangle Associates
1:10 – 1:20 p.m.	Process Check-In	Phillip Popoff , PSE Elizabeth Hossner, PSE
1:20 – 2:10 p.m.	Inflation Reduction Act Overview	Nate Davern, PSE Elizabeth Hossner, PSE
2:10 – 2:50 p.m.	Conservation Potential Assessment (CPA)	Gurvinder Singh, PSE Aquila Velonis, Cadmus Group
2:50 – 2:55 p.m.	Break	All
2:55 – 3:25 p.m.	Resource Alternatives	Elizabeth Hossner, PSE
3:25 – 3:55 p.m.	Achieving Clean Energy Transformation Act (CETA) Compliance: 100% Greenhouse Gas (GHG) Neutral by 2030	Elizabeth Hossner, PSE
3:55 – 4:00 p.m.	Next Steps	Sophie Glass, Triangle Associates
4:00 p.m.	Adjourn	Sophie Glass, Triangle Associates

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Today's Speakers

Phillip Popoff
Director, Resource Planning Analytics, PSE

Elizabeth Hossner
Manager, Resource Planning and Analysis, PSE

Gurvinder Singh
Consulting Resource Planning Analyst, PSE

Sophie Glass
Co-facilitator, Triangle Associates

Aquila Velonis
Senior Associate, Cadmus Group

Nathan Davern
Senior Government Affairs Representative, PSE

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Process Check-In

Phillip Popoff
Director, Resource Planning Analytics, PSE

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Feedback Timeline

- Feedback results for August 24 Resource Adequacy webinar will be discussed during the September 22 webinar

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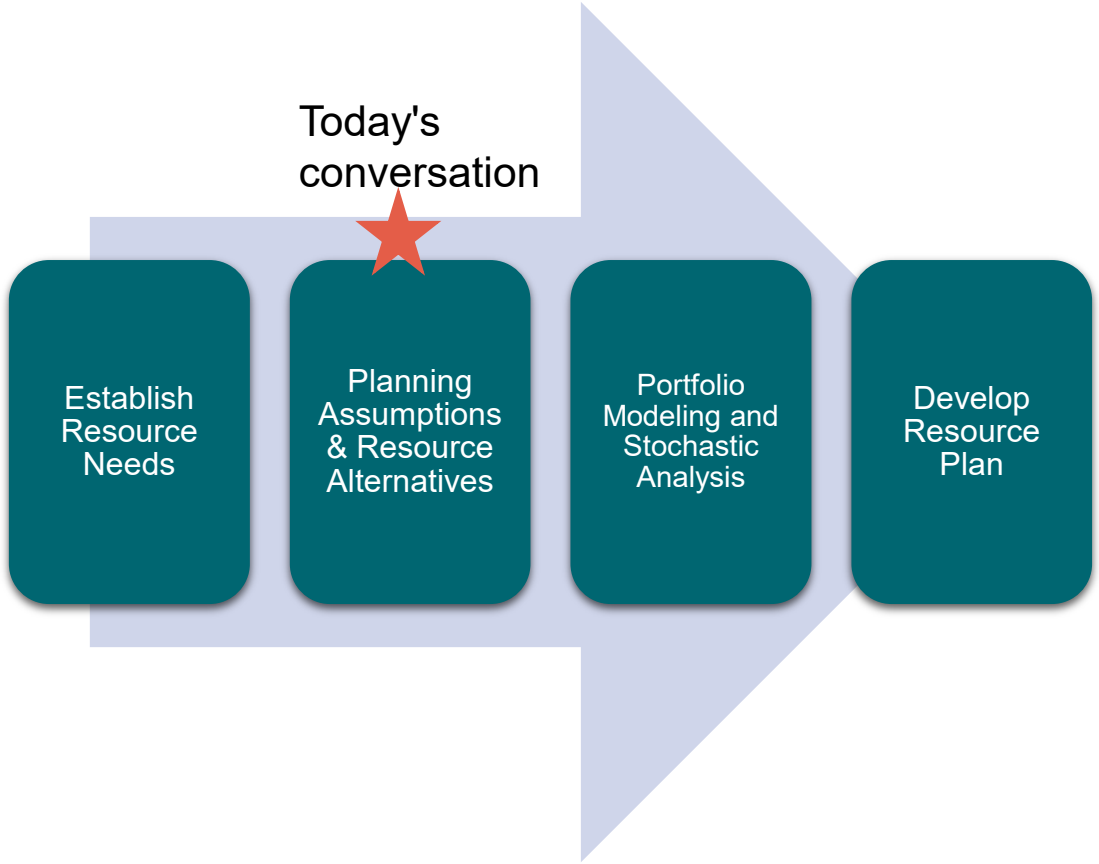
2023 Electric Progress Report Modeling Process

The 2023 Electric Progress Report will follow a 4-step process for analysis:

1. Analyze and establish resource need
    - Energy Need
    - Capacity Need
    - Renewable Need
2. Determine planning assumptions and identify resource alternatives
3. Portfolio Modeling and Stochastic Analysis
4. Develop resource plan



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Inflation Reduction Act Overview

Nathan Davern
Sr. Government Affairs Representative

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Background

- The “IRA” is smaller version of the President’s 2021 legislative agenda
- Spending primarily through the tax code
- More certainty for renewable developers, battery deployment
- Electric Vehicles (EV) adoption impacts
- Provide lower-income customers with energy retrofit rebates

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Important Tax Changes

- Clean energy tax credits extended through 2032
- New credits are transferable for investor-owned utilities
- New “tech neutral” regime in 2025
- Credit value can fluctuate based on Labor utilization

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New Renewable Energy & Storage Tax Credits

- Renewable tax credits eligible for new bonuses:
  - +10% if certain domestic content requirements are met;
  - +10% if resources are placed in an “energy community”

- New battery storage credit available with a normalization opt-out

- Hydrogen equipment eligible for either a Production Tax Credit (PTC) or Investment Tax Credit (ITC)
  - $3/kg credit for green hydrogen production possible

- New renewable natural gas (RNG) property credit

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EV Purchases and Charging Infrastructure

- Existing manufacturer caps removed
- New vehicles eligible for $7,500 credit
  - On SUVs & Trucks < $80k; cars < $55k
- Used vehicles get a $4,000 credit
- Commercial vehicles up to $40k in credit
- Charging infrastructure credit triples to $100k per station
- $1 billion supplemental for EV school buses

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Customer Tax Credits and Rebates

- Rooftop solar installations and batteries are eligible for 30% credit through 2032

- HOMES Rebates ($4.3 billion):
  - Whole-home energy reductions of 15%+
  - Single- and multi-family rebates available
  - Electric and natural gas appliances eligible

- Electric Home Rebate Program ($4.5 billion):
  - Appliance-specific rebates for electric exclusively:
    - $8,000 for heat pumps for space heating
    - $840 for electric stoves, clothes dryers
  - Rebates available for service upgrades, wiring
    - $4,000 for service upgrades; $2,500 for wiring costs

Methane Emission Fee and Emission Reduction Grants

- A new “upstream” emission fee created
  - Primarily applies to production, processing, transmission and storage facilities

- Administered by EPA

- Fee begins at $900/MT in 2024
  - $1,200/MT in 2025
  - $1,500/MT in 2026 and beyond, inflation adj.

- EPA to broadly award $850 M in grants to help reduce emissions as fee takes effect

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Timelines & Next Steps

- Some portion of the new law takes immediate effect, but many features begin in 2023

- PSE awaiting guidance from the Treasury Dept. on some provisions, such as credit transfer rules
  - It's not clear when guidance could be released

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Inflation Reduction Act and Electric Progress Report Changes

Elizabeth Hossner
Manager, Resource Planning and Analysis

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Production Tax Credit (PTC)

Provides $/MWh inflation adjusted rate tax credit based on the first 10 years of output of the for the wind project. Current PTC is $25/MWh

Old Rules

- Applicable to wind projects
- The percentage of the PTC allowed in any given year is based on the year in which construction starts as defined in the tax bill.
- The project must be completed within four years to qualify for PTC.
- PTC had expired for projects starting in 2022.

New Rules

- Projects placed into service through 2024 eligible for 100% value, subject to forthcoming labor requirement guidance
- Technology neutral starting in 2025
- Provides long term stability in making investment decisions
- The elimination of the start of construction requirement provides more of even playing field.

Investment Tax Credit (ITC)

Provides an upfront percentage reduction to taxes based on the amount of the investment in the project.

Old Rules

- Applicable to solar projects and batteries paired with solar.
- The ITC percentage in any given year is based on the year in which construction starts as defined in the tax bill.
- Safe harbor rules are the same at PTC.
- Project must be completed by 2025 to get the more favorable percentage rate. Then 10% of the rate is applied thereafter regardless of the start date.
- ITC were ramping down to 10% in 2024 and beyond. Extended to 2025.

New Rules

- Technology neutral
- The new ITC is now open to a wider range of renewable resources including stand-alone energy storage, microgrid technologies and renewable natural gas (termed "biogas") property.
- Maximum 30% ITC for projects meeting forthcoming IRS labor requirements.
- Provides long term stability in making investment decisions.
- The elimination of the start of construction requirement provides more of even playing field.

What will be included in 2023 Electric Progress Report

2023 Electric Progress Report

- Extend PTC at 100% for planning horizon
- Extend ITC at 30% for planning horizon
- Include ITC on stand-alone battery and pumped hydro energy storage*
- ITC for new technologies which include small modular nuclear
- There are additional PTC and ITC bonus incentives in the IRA that are not captured in this progress report.

** The statute is silent on technology type, but we believe the intent of the law was to cover pumped hydro storage along with batteries, so we will be including it in the 2023 Electric Progress Report*

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2023 IRP: Conservation Potential Assessment - Electric

September 13, 2022

Meeting Agenda

1. Scope Overview
2. Results
   a) Energy Efficiency
   b) Demand Response
   c) Rooftop Solar PV
   d) Combined Heat and Power
   e) Distribution Efficiency

Study Scope

Resources	Energy Efficiency (EE) Demand Response (DR) Solar PV Combined Heat and Power (CHP) Distribution Efficiency

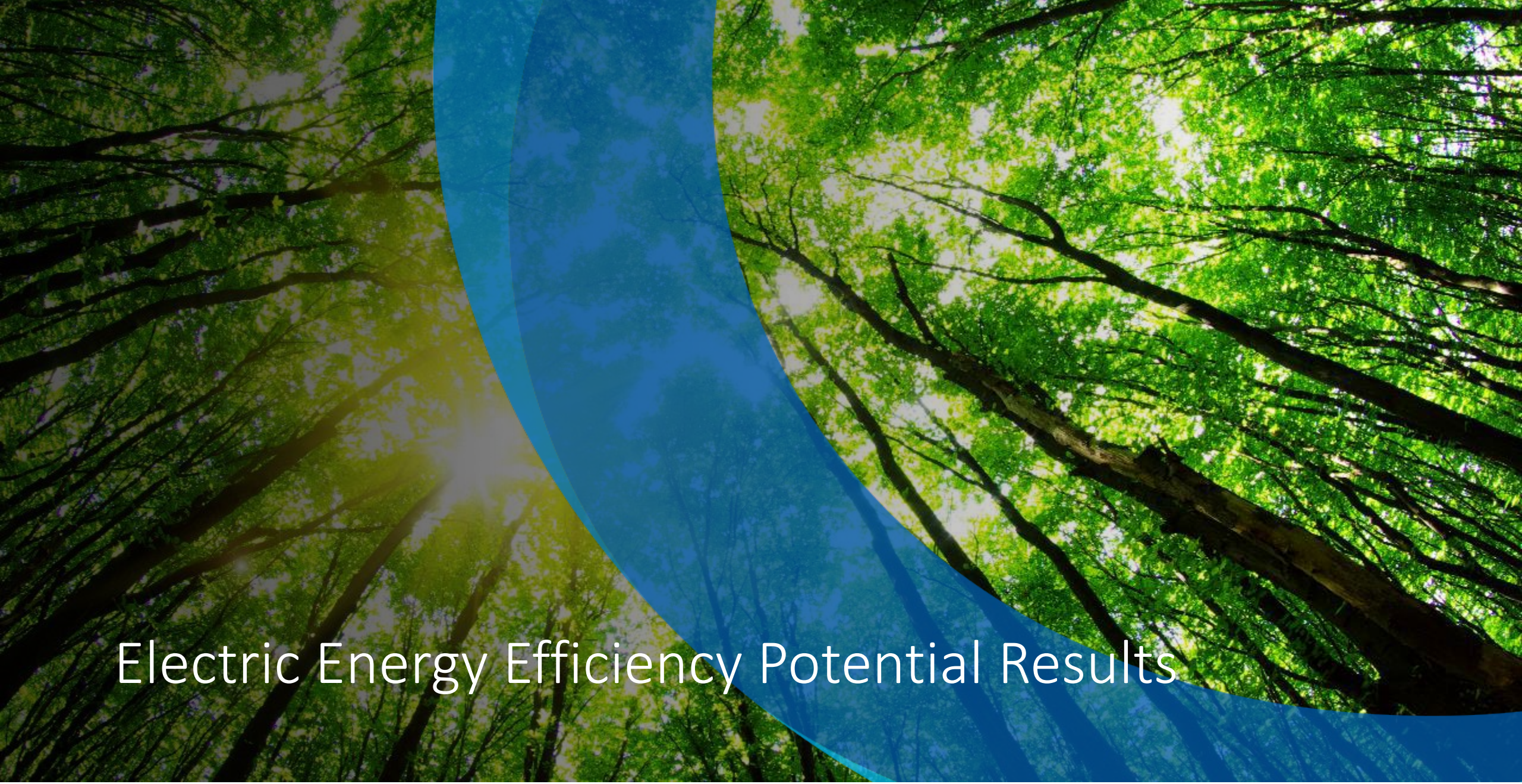
Fuels	Electric - EE, Solar PV, DR, CHP

Electric Primary Objectives

- Produce updated forecasts of achievable technical potential
- Electric: 2024 - 2050
- Develop supply curve inputs

Updated Data

- Load and customer forecasts
- Updated customer segmentation
- PSE measure case and RTF UES updates
- NWPCC 2021 Draft Plan updates
- Program accomplishments
- Updates based on codes and standards
- Avoided energy and T&D data
- Climate change adjustments
- Non-Energy Impacts (NEIs)
- Name Communities & Equity



Electric Energy Efficiency Potential Results

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Electric Energy Efficiency Potential

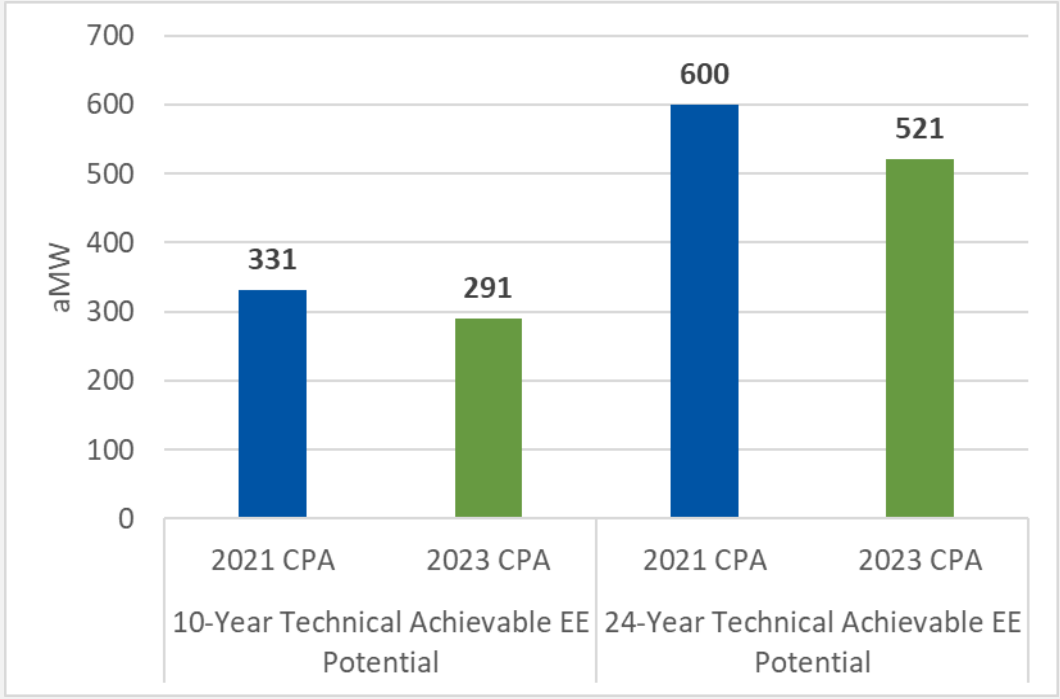
2023 Achievable Technical Potential

Sector	2-year (2025)	4-year (2027)	10-year (2033)	27-year (2050)
Cumulative Achievable Technical Potential (aMW)				
Residential	15	32	103	298
Commercial	32	64	169	231
Industrial	4	7	18	18
Total	50	104	291	548
Winter Coincident Peak Capacity - Achievable Technical Potential (MW)				
Residential	27	58	177	484
Commercial	29	59	154	201
Industrial	4	8	21	21
Total	60	125	352	706

Vulnerable Population Potential:

- 35% of the residential potential (105 aMW) by 2050
- Levelized cost bundles are changed to 2/3 of TRC to reflect vulnerable populations on the supply curve

Comparison to 2021 CPA



12% decrease in 10-year total potential 13% decrease in 24-year total potential

The 2023 IRP electric study period spans 27 years

The 2021 IRP spans 24 years

Figure shows only the first 24 years for comparison purposes

Top Residential Measures

Cumulative Achievable Technical Potential (aMW)
Presents all CPA measures including non-economic measures

Measure Name	10-Year	27-Year
Heat Pump Dryer	4.0	43.0
Heat Pump Water Heater - Tier 4 - No Resistance, Split System	3.7	37.8
Zonal to Ductless Heat Pump	5.2	23.7
Heat Pump Water Heater - Tier 3	2.2	22.7
HVAC Upgrade - Heat Pump Upgrade to 12 HSPF/18 SEER	2.2	22.0
Refrigerator - ENERGY STAR 2022 Most Efficient	5.8	21.9
Install Ductless Heat Pump in House with Existing FAF - HZ1	2.9	13.5
Central Air Conditioner - Enhanced	1.8	10.9
Set Top Box - ENERGY STAR	3.4	7.4
Smart Thermostat	5.9	6.5

Measure Changes from the Last CPA:

- Added Heat Pump Water Heater - Tier 4 - No Resistance, Split System
- Lighting measures – only included for vulnerable populations
- Adjusted ramp rates for some equipment measures to better match programs
- Higher saturation of AC
- Climate change impacts (lower heating loads and higher cooling loads)
- Lower showerhead potential (WA code)

Top C&I Measures

Cumulative Achievable Technical Potential (aMW)
Presents all CPA measures including non-economic measures

Commercial

Measure Name	10-Year	27-Year
Lighting - Interior - Control	46.6	51.4
Lighting - Interior - LED	20.4	20.5
Fan - VSD	3.0	15.1
Window - Upgrade	12.4	13.7
Cooling DX	2.4	11.2
Exit Sign	8.1	8.4
Very High Efficiency Dedicated Outside Air System (DOAS)	1.1	8.4
Lighting - Exterior - LED	6.5	7.0
Rooftop HVAC Controls - Advanced	6.9	7.0
Pump - Efficient	3.6	6.9

Industrial

Measure Name	10-Year	27-Year
Wastewater	3.9	3.9
Water Supply	2.2	2.2
Energy Management	1.6	1.6
HVAC	0.9	0.9
Streetlight - HPS 100W - Group Relamp - to LED 38W - Retro	0.8	0.8
Lighting Controls	0.8	0.8
Energy Management2	0.8	0.8
Streetlight - HPS 100W - Group Relamp - to LED 53W - Retro	0.7	0.7
Pump Optimization	0.6	0.6
Advanced Motors - Material Processing	0.5	0.5

Demand Response Potential

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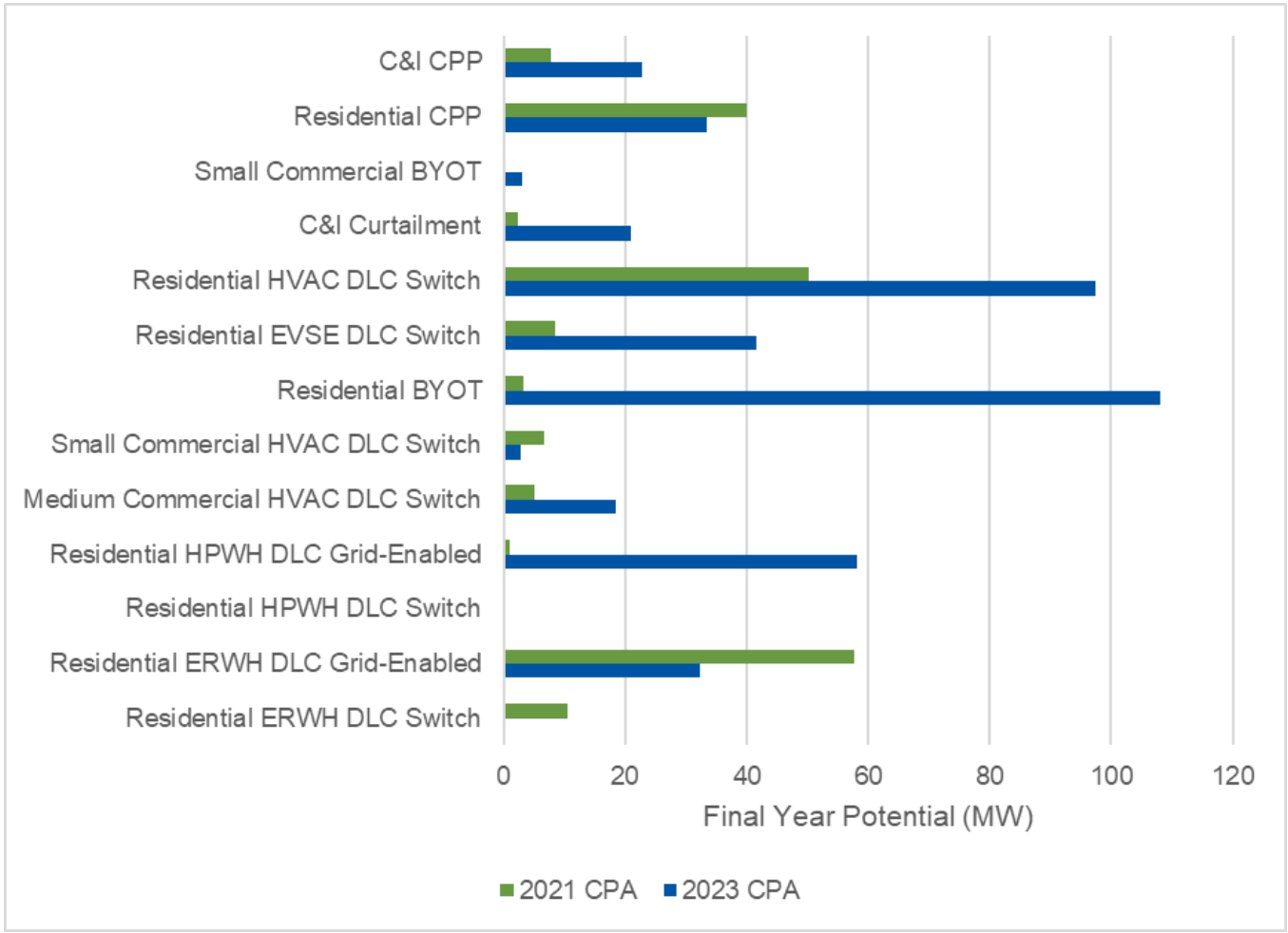
Demand Response Products

2023 IRP DR Approach

- Modeled Direct Load Control (DLC), Critical Peak Pricing (CPP), C&I Curtailment products
- Modeled winter and summer peak demand impact
- EE interactions
- Aligned with Council's draft 2021 Plan's ramp rates (accelerated ramps compared to 2021 IRP)
- Where applicable, 2023 IRP aligned input assumptions with 2021 Plan (kW reduction values, product costs, event participation)
- Split product deployment costs by season (prior 2021 IRP did not split costs when estimating levelized cost bundles)
- T&D Deferral Costs changed from $16/kW-year to $75/kW-year
- Accounted for climate change that induced AC saturation growth over time
- Assumed full AMI deployment
- Used updated C&I segmentation

Comparison to 2021 CPA



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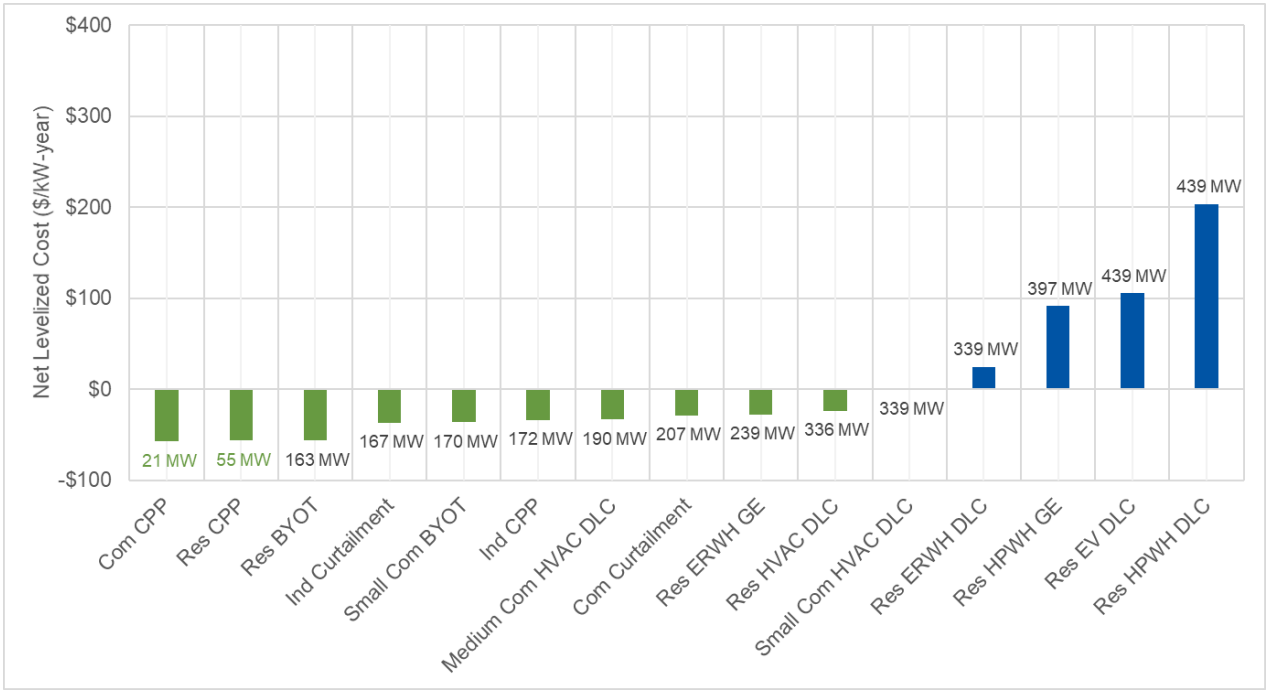
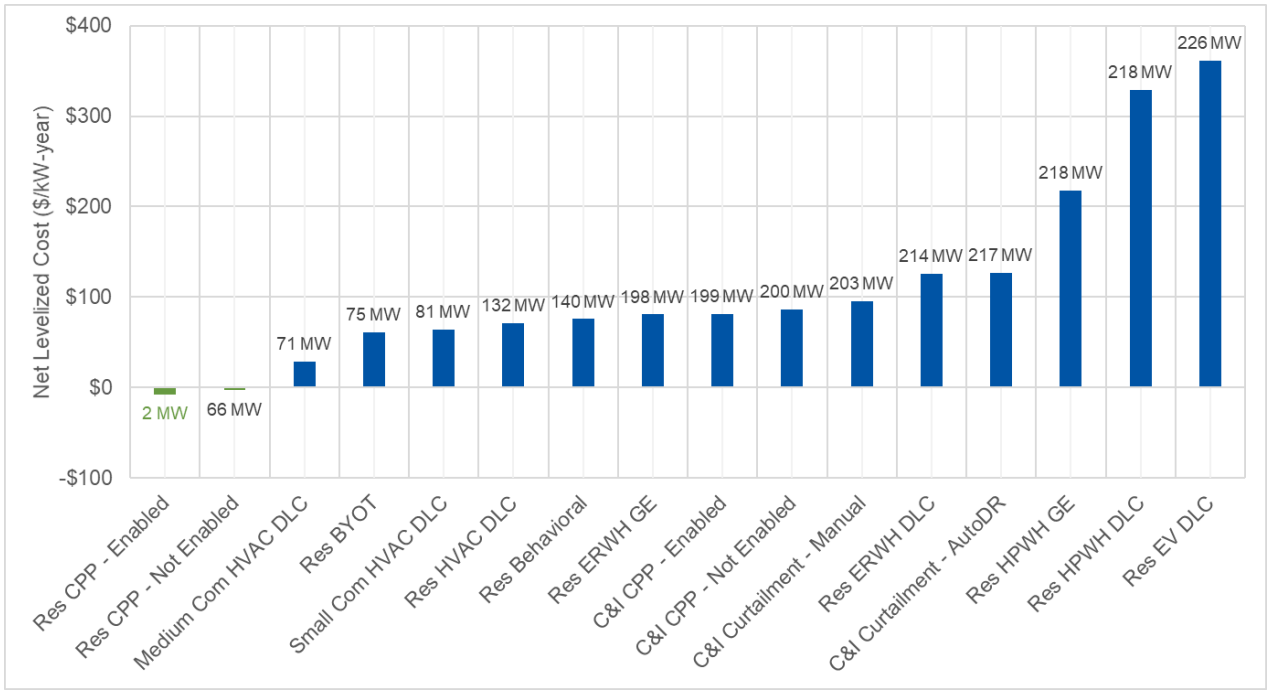
Potential and Levelized Cost Comparison to 2021 CPA

2023 CPA



2021 CPA



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Rooftop Solar PV Potential

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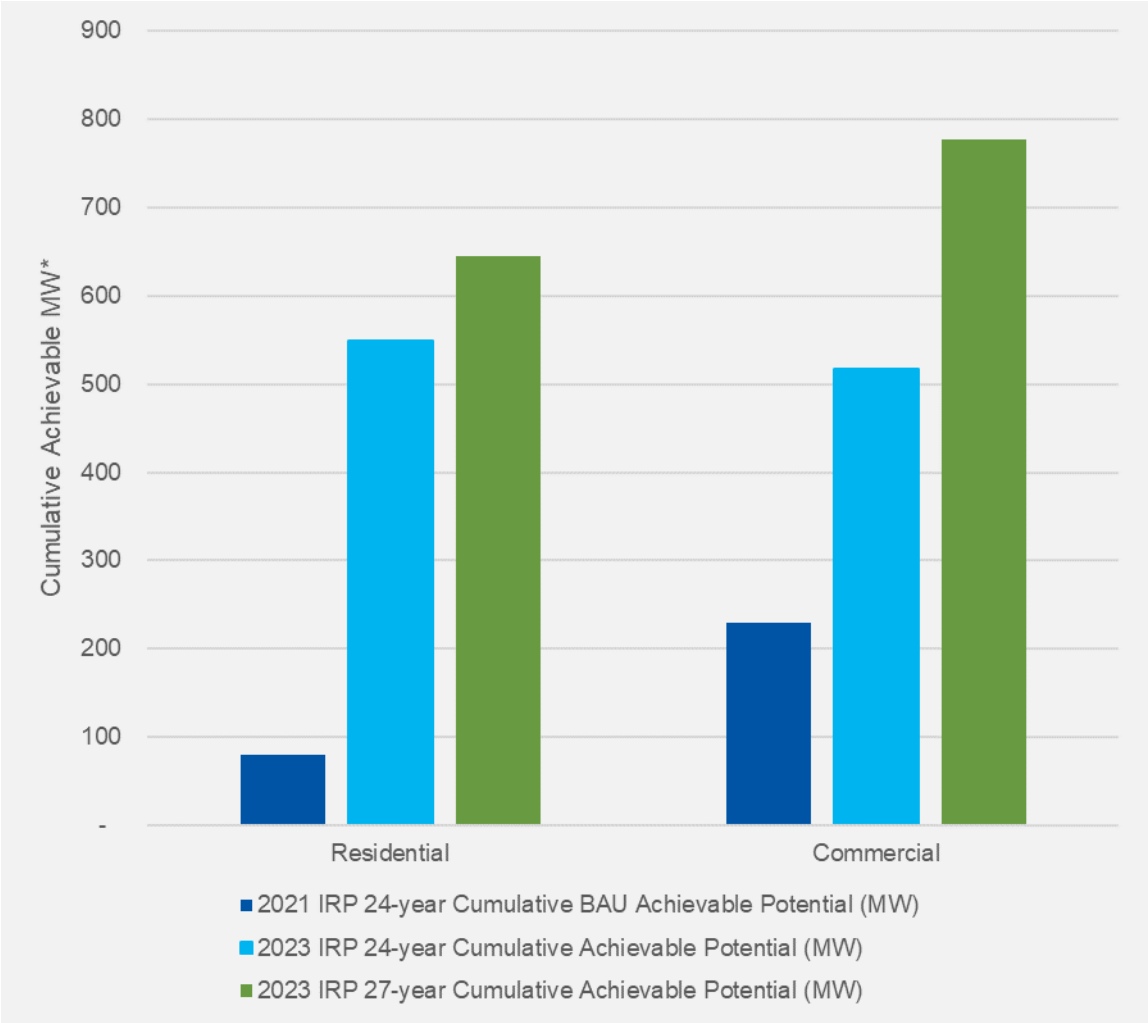
Comparison to 2021 CPA



* System nameplate MW

Key Changes

- Updated **technical square footage** estimates
- Updated solar **system costs** and price forecasts
- **Transition** to DGEN modeling
  - Accounts for **more economic factors**
  - Updated **bass diffusion curves** to be based on historical PSE adoption
  - Updated **maximum market share curves** for more aggressive adoption to align with PSE historical adoption
- Inclusion of **vulnerable populations** as an independent segment with differing adoption assumptions

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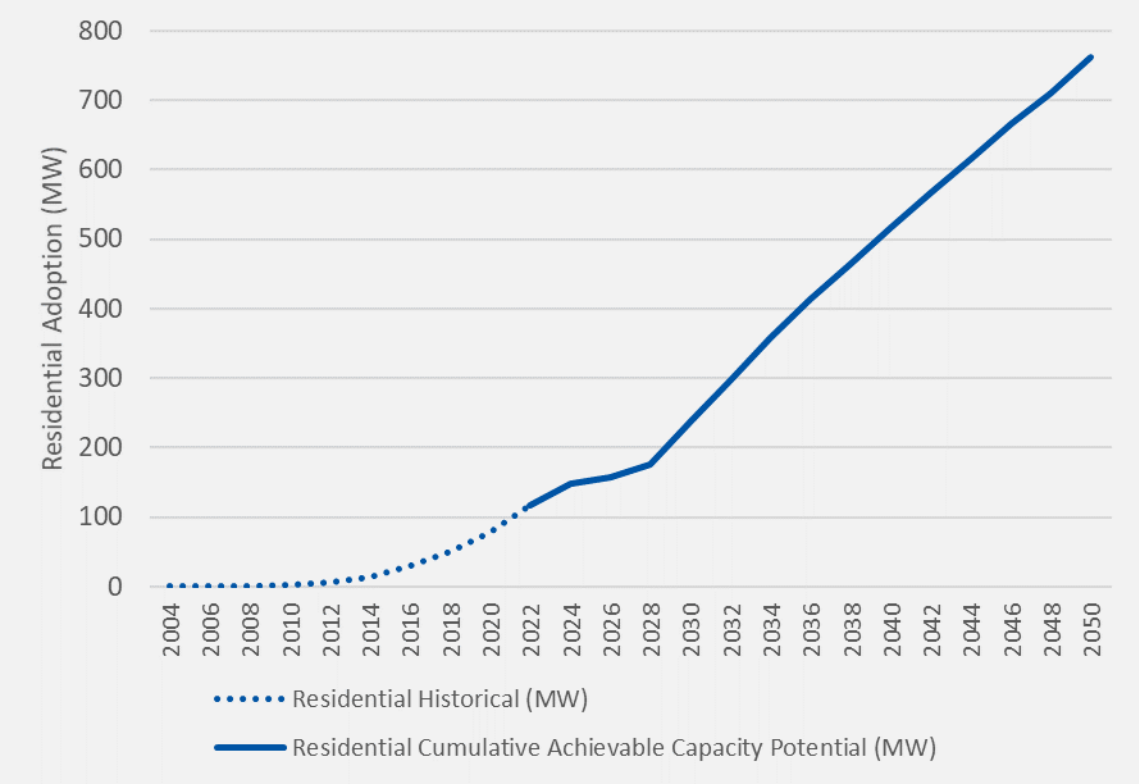
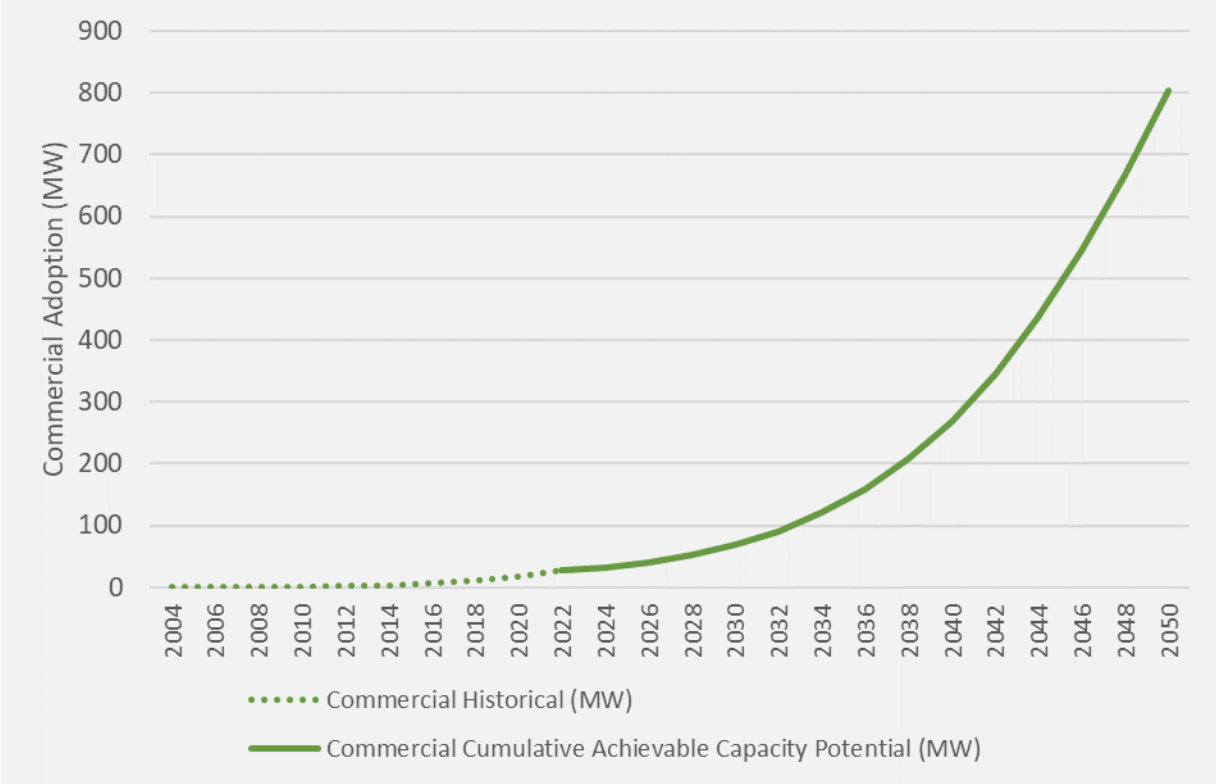
Solar PV Achievable Potential

Sector	2024 – 2050 Cumulative Achievable MW (Nameplate)	2024 - 2050 Cumulative Achievable aMW
Residential	617.0	68.9
Residential Vulnerable Population	29.8	0.4
Commercial	777.5	92.64
Total	1,424.3	161.94





Combined Heat and Power Potential

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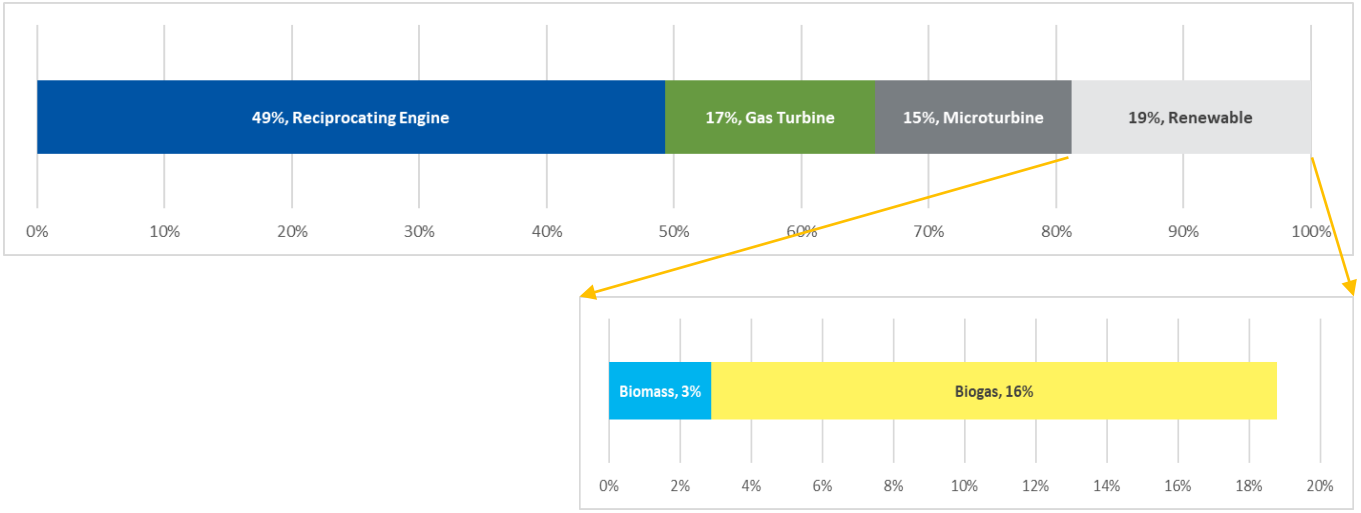
Achievable CHP Potential Results

2050 Cumulative Achievable Potential (aMW)

Technology	Ach. Potential (aMW)
Nonrenewable - Natural Gas (Total)	
30 – 99 kW	1.15
100 – 199 kW	0.93
200 – 499 kW	1.19
500 – 999 kW	0.86
1 – 4.9 MW	1.33
5.0 MW+	0.98
Renewable - Biomass (Total)	
< 500 kW	0.00
500 – 999 kW	0.00
1 – 4.9 MW	0.00
5.0 MW+	0.22
Renewable - Biogas (Total)	
Landfill	0.23
Farm	0.91
Paper Mfg	0.09
Wastewater	0.04
Total CHP	**7.91**

2050 Cumulative System Installations

Technology	Number of installations
Nonrenewable - Natural Gas (Total)	49
Reciprocating Engine	25
Gas Turbine	21
Microturbine	2
Renewables	1
Total CHP	50



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Distribution Efficiency

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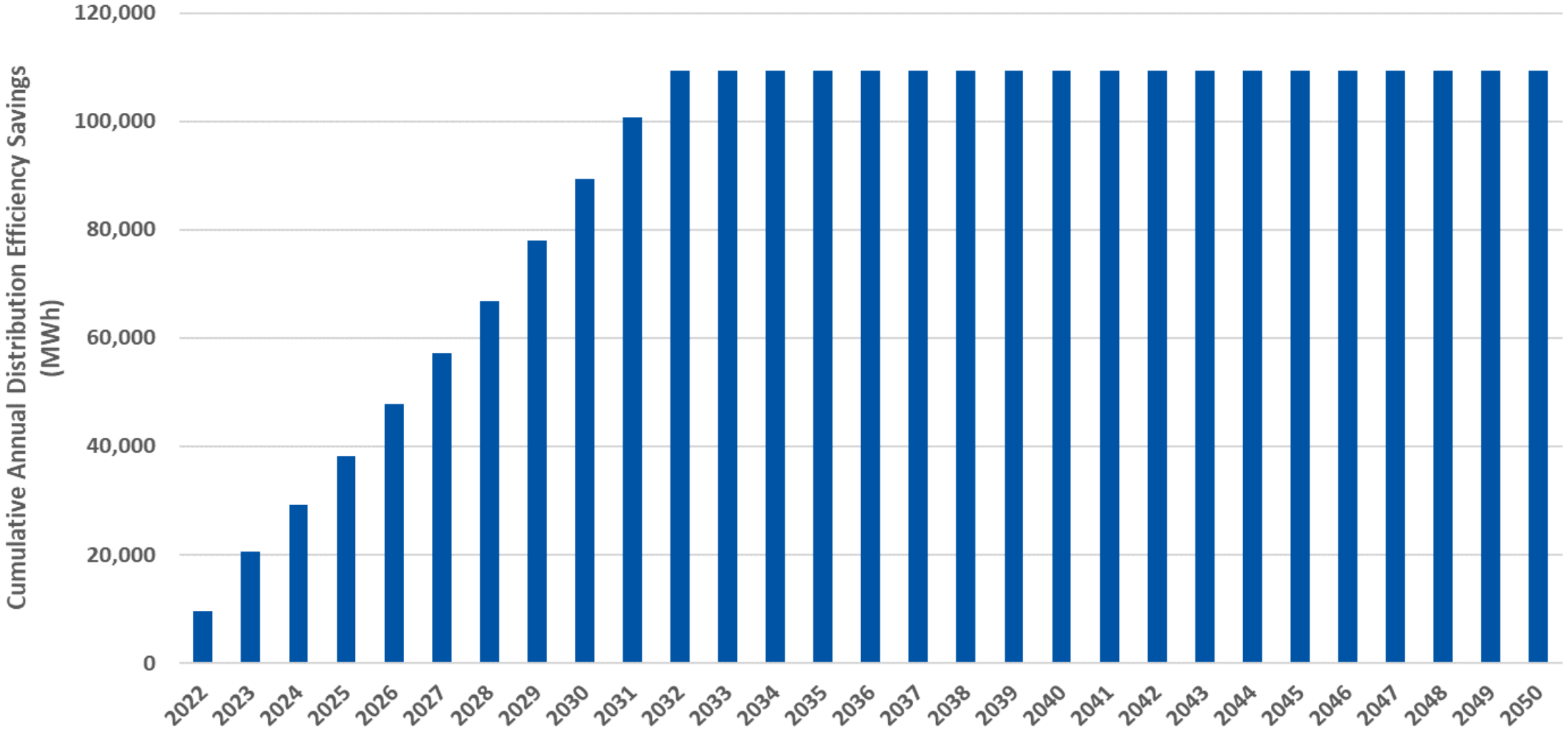
Distribution Efficiency



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Questions

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Resource Alternatives

Elizabeth Hossner
Manager, Resource Planning and Analysis

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Updates to the generic resource alternatives

2023 Electric Progress Report

- The draft generic resource alternatives were presented at the March 22, 2022 meeting
- The following slides summarize the updates to the costs and assumptions following suggestions and feedback from the March meeting and the final 2021 IRP
- A full documentation of the feedback received and updates can be found at pse.com/ipr/get-involved
- Details of the numbers and calculations can be found online at pse.com/ipr/get-involved

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Updates to Generic Resource Alternatives

Hybrid Configuration for Montana Resources

- Stand-alone resources better optimize PSE's 400 MWs of available transmission from MT.
- Wind and PHES have different siting requirements: no significant capital cost savings from a hybrid.
- The MT PHES generic resource able to charge from Clearwater Wind Project, generic MT wind resources, market purchases.

Capital Costs

- Capital cost data from the NREL 2022 ATB.
- Reciprocating peaker technology was sourced from the EIA's 2022 AEO.
- Resource-specific spur lines were calculated and added to capital costs (replacing a standardized 5-mile spur line).

Operating Assumptions

- Updated to 2022 ATB assumptions (operating life, O&M).
  - Hybrid O&M is a weighted average (using capacity) of individual technology O&M.
  - Thermal resources O&M from FERC Form 1 data and CAISO Variable Operations and Maintenance Cost Review.

Updates to Generic Resource Alternatives

Battery Cycling

- Aligned with 2022 ATB assumptions.
- Annual limit of 365 cycles per year.

Energy Storage Alternatives

- PSE examined 5 alternative energy storage technologies: 3 types of gravity storage, compressed air energy storage, and liquid air energy storage.
- Excluded these technologies because reliable data is unavailable (emerging technology).

2021 IRP stakeholder feedback

- Wind + solar + battery hybrid included.
- Hybrid technology updated to 4-hour Li-ion batteries (instead of 2-hour batteries in 2023 IRP).
- PHES modeled in 100 MW increments with 8-hour storage and expanded the state of charge from 0 – 100%.
- PSE models AC-coupled systems due to modeling restrictions.

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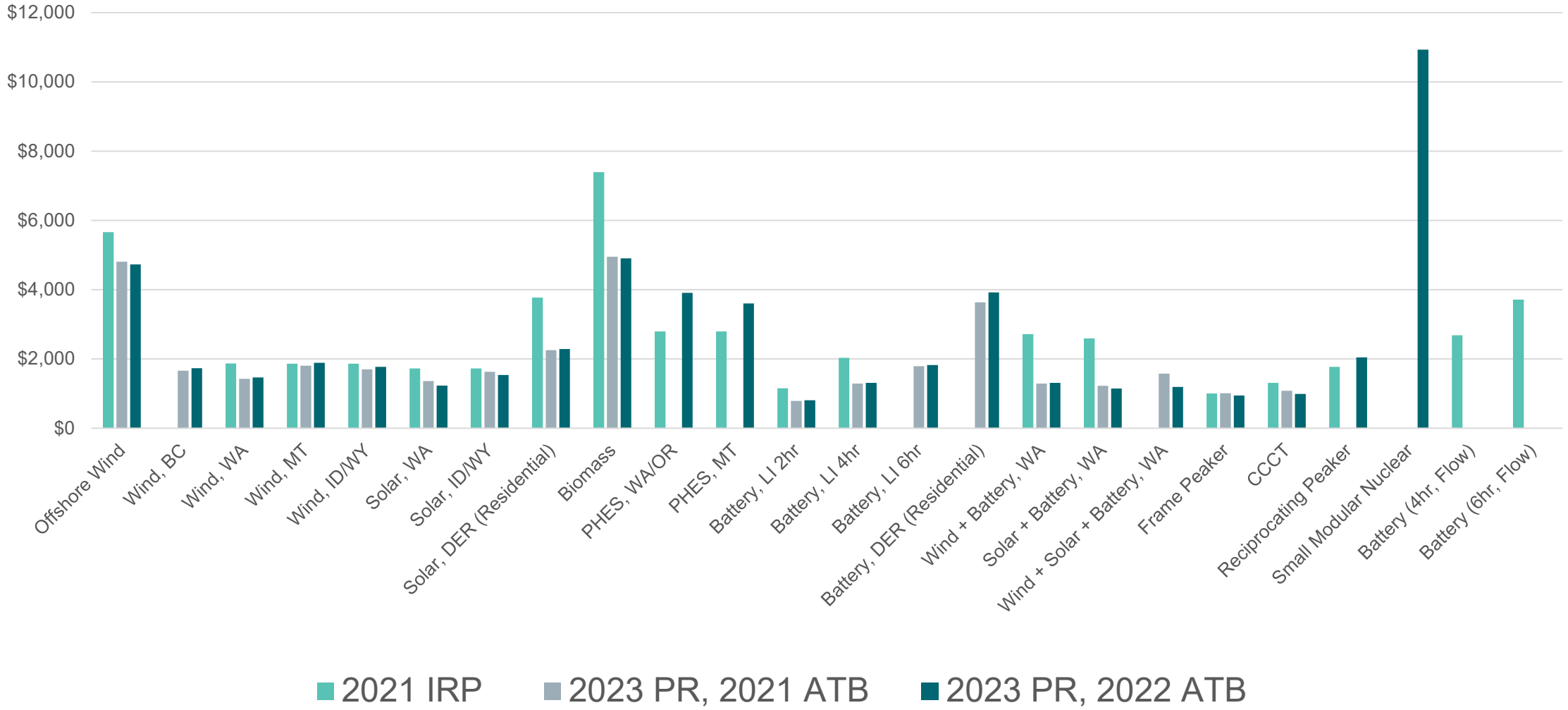
Capital Cost Comparison, 2020 $/kw, Vintage 2023

Note: capital costs include interconnection costs



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Achieving CETA Compliance: 100% Greenhouse Gas Neutral by 2030

Elizabeth Hossner
Manager, Resource Planning and Analysis

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Achieving 100% GHG neutrality by 2030

- CETA requires 100% greenhouse gas (GHG) neutrality by 2030
  - Pursue cost-effective, reliable, available conservation
  - Combination of renewable and non-emitting resources
  - Minimum of 80% of energy delivered must be met with renewable or non-emitting resources, with the remaining energy delivered met by alternative options.
- Options for meeting remaining 20% of energy delivered
  - Alternative compliance payment
  - Unbundled renewable energy credits (RECs)
  - Carbon reduction project investments (carbon offsets)
- For the 2023 electric progress report, PSE is focusing on unbundled RECs and carbon offsets as an option for meeting 100% GHG neutrality

RECs vs Carbon Offsets

RECs

- Unbundled Renewable Energy Credits (RECs) are traded credits that verify that one MWh or renewable energy was provided to the grid
    - Unbundled RECs decouple the actual energy produced from the purchase
- RECs ensure that an equal amount of renewable energy was generated for any fossil fuel generation during the compliance period

Carbon Offsets

- Offsets are quantifiable carbon reduction measured in metric tons CO2e compared to a “business as usual” case
- Offset measures are broader in scope and can extend to things outside of energy (e.g., reforestation)
- Carbon offsets mitigate GHG emissions directly to counteract emissions from generation during the compliance period

Current REC Markets

- RECs are traded in many different national markets
- Regional markets are usually created due to local renewable portfolio standards
- In general, REC prices are expected to increase over the next decade as a result of tightening carbon/climate policies
- One REC market includes the Texas REC market which a is high-volume, largely voluntary market
  - Stable and inexpensive market over the last decade

GHG

Current Offset Market

- Most market purchases are voluntary and internally motivated
- Offset markets are newer and not as robust as the REC market
- Ecosystem Marketplace provides voluntary offset market data – Non-profit that tracks transactions through reports by buyers and sellers
- Current market prices are inexpensive, but Bloomberg predicts large price spikes with tightening climate policy
- Ultimately, there is insufficient market maturity and data availability, which prevents an accurate forecast

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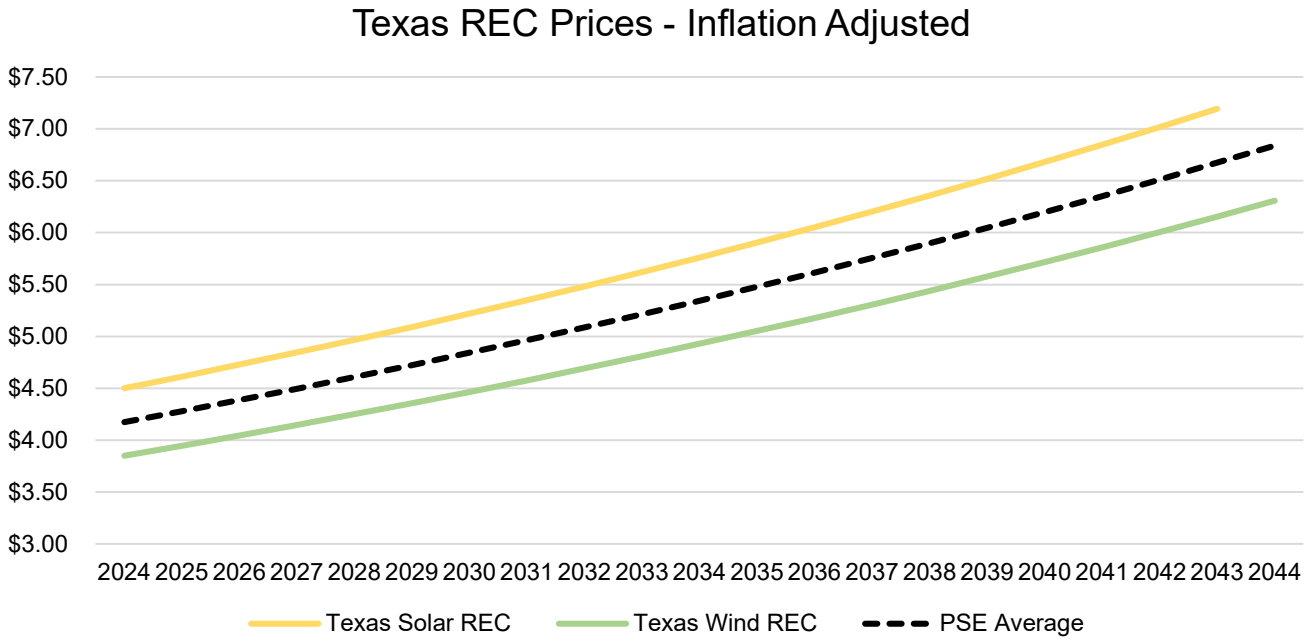
Final Proposal for Unbundled REC Pricing

- With no geographical restriction on unbundled RECs, we propose to use the Texas market
  - Has the most data available
  - Historically stable prices
  - Currently high volumes traded
- Start with current 2024 price forecast + inflation



Data provided by -- *S&P Global Market Intelligence; [Renewable Energy Credits]*

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Modeling Approach

- The base model requires that the portfolio attains a minimum of 80% renewable or non-emitting resources by 2030 with a linear ramp to 100% by 2045
- The model can build more than 80% renewable or non-emitting resources by 2030 if cost-effective and the remaining delivered energy will be met with unbundled RECs
- Proposed Sensitivity: 100% renewable or non-emitting resources in 2030, no need for RECs

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Next Steps

Sophie Glass, Co-facilitator, Triangle Associates

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IRP stakeholder feedback process

Feedback form: PSE IRP - Feedback Form

September 15	A recording of the webinar and the transcript of the chat will be posted to the IRP website so those who were unable to attend can review.
September 20	Feedback forms are due. Feedback should focus on questions regarding the presentation.
October 11	A feedback report of **questions** collected from the feedback form, along with PSE's responses, and a meeting summary will be shared with stakeholders and posted to pse.com/irp

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Next steps and stay in touch

Next meetings with IRP stakeholders

- Sept. 22, 2022 – Gas Utility IRP: Final scenarios and gas alternatives, and CPA results
- Sept. 28 and 30, 2022 – Portfolio Benefits Drop-In Sessions
- Nov. 17, 2022 – Updates Gas Utility IRP Final scenarios and gas alternatives, and feedback on draft results of electric and gas portfolio

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Appendix

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Common Acronyms

Acronym	Meaning
ATB	Annual Technology Baseline
CETA	Clean Energy Transformation Act
CHP	Combined Heat and Power
CPA	Conservation Potential Assessment
EPA	Environmental Protection Agency
DR	Demand Response
EE	Energy Efficiency
EV	Electric Vehicle
GHG	Greenhouse Gas
IRA	Inflation Reduction Act
ITC	Investment Tax Credit
NEIs	Non-Energy Impacts
NREL	National Renewable Energy Laboratory
PRM	Planning Reserve Margin
PTC	Production Tax Credit
RECAP	Renewable Energy Capacity Planning Model
RECs	Renewable Energy Certificates
T&D	Transmission & Distribution
UTC	Utilities and Transportation Commission