2023 Integrated Resource Plan
IRP Public-Input Meeting

September 1-2, 2022




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Agenda – Day 1

(approximate times shown in Pacific time zone)

Day 1

- 9:00 - 9:15 a.m. – Introductions
- 9:15 - 9:30 a.m. – Inflation Reduction Act
- 9:30 - 10:30 a.m. – Supply Side Resource Table
- 10:30 - 11:15 a.m. – Existing Thermal Resource Options
- 11:15 - 11:30 a.m. – Transmission Modeling
- 11:30 - 12:15 p.m. – Lunch Break
- 12:15 - 1:00 p.m. – Price Forecasting
- 1:45 – 2:00 p.m. – Customer Preference
- 2:00 - 2:15 p.m. – Qualifying Facility Renewal
- 2:15 - 4:00 p.m. – Conservation Potential Assessment Draft Results

Agenda – Day 2

(approximate times shown in Pacific time zone)

Day 2

- 9:00 - 9:15 a.m. – Introductions
- 9:15 – 9:30 a.m. – Conservation Potential Assessment Draft Results – Part II
- 9:30 – 9:45 a.m. – Stakeholder Feedback
- 9:45 – 10:15 a.m. – Market Reliance Assessment
- 10:15 – 10:30 a.m. – Oregon and Washington Update
- 10:30 – 11:30 am – Generation Transition Equity and Justice
- 11:30 - 12:15 p.m. – Lunch Break
- 12:15 – 2:30 p.m. – Offshore Wind Workshop
- 2:30 – 3:00 p.m. – Hydro Forecast Under Climate Change
- 3:00 – 3:15 p.m. – Wrap-Up / Next Steps

Inflation Reduction Act of 2022




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Credit Overview: Inflation Reduction Act of 2022

- Date of Enactment: August 16, 2022
- Begins with technology specific tax credits (PTC / ITC) for projects placed in service after December 31, 2021; solar eligible for PTCs
- Transitions to technology neutral tax credits (PTC / ITC) for projects placed in service after December 31, 2024; choice of credit up to taxpayer
  - Any technology that generates electricity and does not emit greenhouse gases
- Energy storage property is newly eligible for ITC w/normalization opt-out
  - Examples include lithium-ion batteries and pumped-storage hydroelectric facilities
- PTC = 1.5 cents/kWh, inflation adjusted; ITC = 30%
  - If newly created labor requirements are not met, credits are one-fifth of the values above
- 10% bonus credits available for projects placed in energy communities or that meet domestic content requirements
- Increased tax credit for carbon capture, utilization, and sequestration (CCUS)

Data and Modeling Considerations

- Supply-side resources will be updated for Inflation Reduction Act
  - Tax credits for PTCs and ITCs related to renewables will be updated
    - Green resources eligible for PTCs and ITC
    - Storage Resources now eligible ITC
  - Higher CCUS 45Q Tax Credits

- The company is exploring impacts of Inflation Reduction Act for customers
  - Private Generation
    - Extension residential clean energy credit
    - Extension nonbusiness energy property credit
  - Potential update to load forecast to include updated Private Generation and Electric Vehicle forecasts
    - Electric vehicle tax credit
    - New energy efficiency home credit
  - CPA assessment based on load forecast
    - Energy efficient commercial buildings deduction

Supply Side Resource Table




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Supply-Side Resource Table

Natural Gas/Hydrogen

Description	Resource Characteristics				Costs			
Resource	Elevation (AFSL)	Net Capacity (MW)	Commercial Operation Year	Design Life (yrs)	Base Capital ($/KW)	Var O&M ($/MWh)	Fixed O&M ($/KW-yr)	Demolition Cost ($/kW)
SCCT Aero x4	1,500	216	2027	30	1,619	0.30	19.77	45.80
SCCT Frame "J" x1	1,500	338	2027	40	853	2.43	14.76	28.29
SCCT Frame "J" x1, 30H2	1,500	322	2028	40	4,118	2.55	46.92	37.95
SCCT Frame "J" X1, 100H2	1,500	345	2035	40	6,903	2.38	73.77	41.21
SCCT Frame "J" X1, 100H2, BF	1,500	345	2033	40	6,176	2.38	69.54	41.21
CCCT Dry "J", 1X1	1,500	523	2028	40	1,427	1.68	23.81	27.74
CCCT Dry "J", DF, 1x1	1,500	63	2028	40	0	1.15	0.00	0.00
SCCT Aero x4	3,000	205	2027	30	1,712	0.32	20.92	46.13
SCCT Frame "J" x1	3,000	320	2027	40	901	2.57	15.61	28.96
SCCT Frame "J" x1, 30H2	3,000	305	2027	40	4,355	2.70	49.63	37.87
SCCT Frame "J" X1, 100H2	3,000	327	2034	40	7,297	2.52	77.98	42.56
SCCT Frame "J" X1, 100H2, BF	3,000	327	2034	40	6,529	2.52	73.52	42.56
CCCT Dry "J", 1X1	3,000	495	2027	40	1,507	1.78	25.15	27.37
CCCT Dry "J", DF, 1x1	3,000	63	2028	40	0	1.15	0.00	0.00
SCCT Aero x4	5,050	190	2028	30	1,844	0.34	22.54	41.83
SCCT Frame "J" x1	5,050	296	2029	40	971	2.78	16.83	24.85
SCCT Frame "J" x1, 30H2	5,050	282	2029	40	4,696	2.91	53.53	33.72
SCCT Frame "J" X1, 100H2	5,050	303	2035	40	7,869	2.72	84.10	37.42
SCCT Frame "J" X1, 100H2, BF	5,050	303	2035	40	7,041	2.72	79.29	37.42
CCCT Dry "J", 1X1	5,050	459	2029	40	1,625	1.92	27.13	25.05
CCCT Dry "J", DF, 1x1	5,050	63	2029	40	0	1.15	0.00	0.00
SCCT Aero x4	6,500	171	2028	30	2,044	0.38	24.98	49.31
SCCT Frame "J" x1	6,500	283	2028	40	1,017	2.91	17.63	28.64
SCCT Frame "J" x1, 30H2	6,500	270	2029	40	4,918	3.05	56.05	39.78
SCCT Frame "J" X1, 100H2	6,500	289	2036	40	8,241	2.84	88.09	44.16
SCCT Frame "J" X1, 100H2, BF	6,500	289	2034	40	7,374	2.84	83.04	44.16
CCCT Dry "J", 1X1	6,500	437	2027	40	1,704	2.01	28.46	43.32
CCCT Dry "J", DF, 1x1	6,500	63	2027	40	0	1.15	0.00	0.00

Supply-Side Resource Table

Proxy Carbon Capture Utilization & Storage

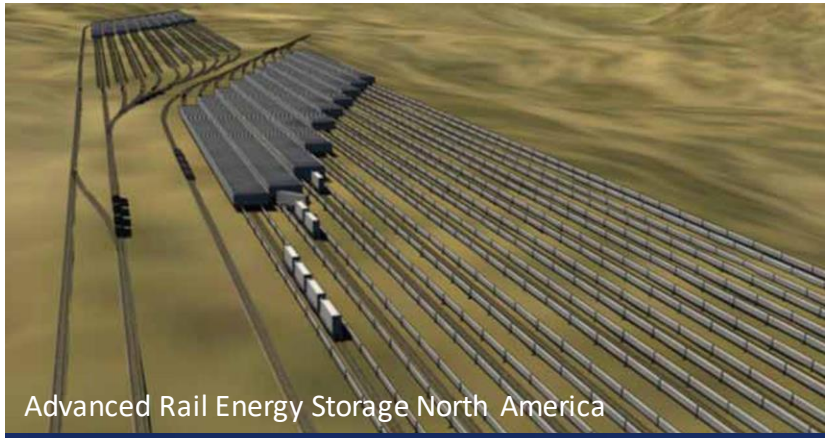
Description	Resource Characteristics				Costs			
Resource	Elevation (AFSL)	Net Capacity (MW)	Commercial Operation Year	Design Life (yrs)	Base Capital ($/kW)	Var O&M ($/MWh)	Fixed O&M ($/kW-yr)	Demolition Cost ($/kW)
PC CCS Oxy-Combustion retrofit @ 100 MW pre-retrofit basis	6,500	(39)	2026	30	4,046	20.83	54.87	37.00
PC CCS retrofit @ 330 MW pre-retrofit basis	6,500	(99)	2028	20	2,421	22.54	33.05	37.00
PC CCS retrofit @ 700 MW pre-retrofit basis	6,500	(187)	2028	20	1,613	23.29	23.91	37.00

Renewables and Storage

- Updates
  - Gravity energy storage added
  - Larger energy storage resources
  - Offshore wind added
  - Geothermal data updated by consultant

- NOT INCLUDED in the reported results:
  - Inflation Reduction Act
    - Investment Tax Credits (ITC)
    - Production Tax Credits (PTC)
    - Any other tax credits

Gravity Energy Storage


Advanced Rail Energy Storage North America


https://www.heindle-energy.com


https://www.energyvault.com

Supply-Side Resource Table

Stand-alone Energy Storage: Li-Ion, Flow and Gravity Batteries

Description	Resource Characteristics			Costs			
Resource	Net Capacity (MW)	Commercial Operation Year	Design Life (yrs)	Base Capital ($/kW)	Var O&M ($/MWh)	Fixed O&M ($/kW-yr)	Demolition Cost ($/kW)
Li-Ion, 4-hour, 200 MW	200	2025	20	1,817	Included	8.46	24.00
Incremental, double energy capacity	200	2025	20	1,486	Included	8.46	24.00
Li-Ion, 4-hour, 500 MW	500	2025	20	1,775	Included	20.68	24.00
Incremental, double energy capacity	500	2025	20	1,460	Included	20.68	24.00
Li-Ion, 4-hour, 1000 MW	1,000	2025	20	1,729	Included	40.31	24.00
Incremental, double energy capacity	1,000	2025	20	1,422	Included	40.31	24.00
Flow Battery, 4 hour, 200 MW	200	2025	25	2,458	0.03	12.85	34.00
Incremental, double energy capacity	200	2025	25	2,060	0.00	1.40	34.00
Flow Battery, 4 hour, 500 MW	500	2025	25	2,201	0.06	27.35	33.00
Incremental, double energy capacity	500	2025	25	1,809	0.00	1.69	33.00
Flow Battery, 4 hour, 1000 MW	1,000	2025	25	2,281	0.13	54.86	32.00
Incremental, double energy capacity	1,000	2025	25	1,892	0.00	1.66	32.00
Gravity Battery, 4 hour,	200	2025	50	3,474	Included	16.19	0.30
Incremental, double energy capacity	200	2025	50	1,894	Included	0.00	0.30
Gravity Battery, 4 hour,	500	2025	50	3,249	Included	37.88	0.24
Incremental, double energy capacity	500	2025	50	1,695	Included	0.00	0.24
Gravity Battery, 4 hour,	1,000	2025	50	2,026	Included	47.25	0.18

Supply-Side Resource Table

Stand-alone Energy Storage: CAES

Description	Resource Characteristics				Costs			
Resource	Elevation (AFSL)	Net Capacity (MW)	Commercial Operation Year	Design Life (yrs)	Base Capital ($/kW)	Var O&M ($/MWh)	Fixed O&M ($/kW-yr)	Demolition Cost ($/kW)
Adiabatic CAES, RESC, 125 MW, 1000 MWh	6500'	125	2026	30	2,310	1.05	16.91	49.31
Adiabatic CAES, RESC, 125 MW, 1250 MWh	6500'	125	2026	30	2,332	1.05	16.95	49.31
Adiabatic CAES, RESC, 125 MW, 1500 MWh	6500'	125	2027	30	2,574	1.05	16.99	49.31
Adiabatic CAES, RESC, 125 MW, 2000 MWh	6500'	125	2027	30	2,659	1.05	17.07	49.31
Adiabatic CAES, RESC, 125 MW, 3000 MWh	6500'	125	2027	30	2,854	1.05	17.23	49.31
Adiabatic CAES, RESC, 125 MW, 6000 MWh	6500'	125	2029	30	3,867	1.05	17.71	49.31
Adiabatic CAES, RESC, 250 MW, 2000 MWh	6500'	250	2027	30	2,123	1.05	12.49	49.31
Adiabatic CAES, RESC, 250 MW, 2500 MWh	6500'	250	2027	30	2,164	1.05	12.53	49.31
Adiabatic CAES, RESC, 250 MW, 3000 MWh	6500'	250	2027	30	2,203	1.05	12.57	49.31
Adiabatic CAES, RESC, 250 MW, 4000 MWh	6500'	250	2028	30	2,440	1.05	12.65	49.31
Adiabatic CAES, RESC, 250 MW, 6000 MWh	6500'	250	2029	30	2,734	1.05	12.81	49.31
Adiabatic CAES, RESC, 250 MW, 12000 MWh	6500'	250	2032	30	7,917	1.05	13.29	49.31
Adiabatic CAES, RESC, 500 MW, 4000 MWh	6500'	500	2028	30	2,013	1.05	10.28	49.31
Adiabatic CAES, RESC, 500 MW, 5000 MWh	6500'	500	2028	30	2,027	1.05	10.32	49.31
Adiabatic CAES, RESC, 500 MW, 6000 MWh	6500'	500	2029	30	2,169	1.05	10.36	49.31
Adiabatic CAES, RESC, 500 MW, 8000 MWh	6500'	500	2030	30	2,315	1.05	10.44	49.31
Adiabatic CAES, RESC, 500 MW, 12000 MWh	6500'	500	2032	30	5,243	1.05	10.60	49.31
Adiabatic CAES, RESC, 500 MW, 24000 MWh	6500'	500	2035	30	947	1.05	11.08	49.31

Supply-Side Resource Table

Stand-alone Energy Storage: PHES

Description	Description	Resource Characteristics			Costs			
Fuel	Resource	Net Capacity (MW)	Commercial Operation Year	Design Life (yrs)	Base Capital ($/kW)	Var O&M ($/MWh)	Fixed O&M ($/kW-yr)	Demolition Cost ($/kW)
Storage	Pumped Hydro, Southern OR	400	2028	100	4,303	0.51	18.00	485.00
Storage	Pumped Hydro, Portland North Coast	400	2028	100	4,303	0.51	18.00	485.00
Storage	Pumped Hydro, Central WY	400	2028	100	4,303	0.51	18.00	485.00
Storage	Pumped Hydro, Eastern WY	400	2028	100	4,303	0.51	18.00	485.00
Storage	Pumped Hydro, Central UT	400	2028	100	4,303	0.51	18.00	485.00
Storage	Pumped Hydro, Southern ID	400	2028	100	4,303	0.51	18.00	485.00
Storage	Pumped Hydro, MT	400	2028	100	4,303	0.51	18.00	485.00

Supply-Side Resource Table

Stand-alone Solar & Solar + Energy Storage

Description	Resource Characteristics				Costs			
Resource	Elevation (AFSL)	Net Capacity (MW)	Commercial Operation Year	Design Life (yrs)	Base Capital ($/kW)	Var O&M ($/MWh)	Fixed O&M ($/kW-yr)	Demolition Cost ($/kW)
Idaho Falls, ID, 20 MW, 26.1% CF	4,700	20	2025	25	1,427	0.00	20.87	29.40
Idaho Falls, ID, 200 MW, 26.1% CF	4,700	200	2023	25	1,152	0.00	20.87	29.40
Lakeview, OR, 20 MW, 27.6% CF	4,800	20	2023	25	1,527	0.00	20.87	31.50
Lakeview, OR, 200 MW, 27.6% CF	4,800	200	2023	25	1,234	0.00	20.87	31.50
Milford, UT, 20 MW, 30.2% CF	5,000	20	2023	25	1,412	0.00	20.87	29.10
Milford, UT, 200 MW, 30.2% CF	5,000	200	2023	25	1,140	0.00	20.87	29.10
Rock Springs, WY, 20 MW, 27.9% CF	6,400	20	2023	25	1,469	0.00	20.87	30.30
Rock Springs, WY, 200 MW, 27.9% CF	6,400	200	2023	25	1,187	0.00	20.87	30.30
Yakima, WA, 20 MW, 24.2% CF	1,000	20	2023	25	1,498	0.00	20.87	30.90
Yakima, WA, 200 MW, 24.2% CF	1,000	200	2025	25	1,211	0.00	20.87	30.90
Idaho Falls, ID, 200 MW, 26.1% CF + BESS: 100% pwr, 4 hours	4,700	200	2025	25	2,879	0.00	63.19	54.06
Lakeview, OR, 200 MW, 27.6% CF + BESS: 100% pwr, 4 hours	4,800	200	2025	25	2,864	0.00	63.19	56.16
Milford, UT, 200 MW, 30.2% CF + BESS: 100% pwr, 4 hours	5,000	200	2025	25	2,881	0.00	63.19	53.76
Rock Springs, WY, 200 MW, 27.9% CF + BESS: 100% pwr, 4 hours	6,400	200	2025	25	2,902	0.00	63.19	54.96
Yakima, WA, 200 MW, 24.2% CF + BESS: 100% pwr, 4 hours	1,000	200	2025	25	2,977	0.00	63.19	55.56

Supply-Side Resource Table

Wind & Wind + Energy Storage

Description	Resource Characteristics				Costs			
Resource	Elevation (AFSL)	Net Capacity (MW)	Commercial Operation Year	Design Life (yrs)	Base Capital ($/kW)	Var O&M ($/MWh)	Fixed O&M ($/kW-yr)	Demolition Cost ($/kW)
Pocatello, ID, 20 MW, CF: 37.1%	4,500	20	2026	30	2,167	0.00	43.00	59.46
Pocatello, ID, 200 MW, CF: 37.1%	4,500	200	2026	30	1,602	0.00	43.00	59.46
Arlington, OR, 20 MW, CF: 37.1%	1,500	20	2026	30	2,155	0.00	43.00	59.46
Arlington, OR, 200 MW, CF: 37.1%	1,500	200	2026	30	1,573	0.00	43.00	59.46
Monticello, UT, 20 MW, CF: 29.5%	4,500	20	2026	30	2,192	0.00	43.00	59.46
Monticello, UT, 200 MW, CF: 29.5%	4,500	200	2026	30	1,632	0.00	43.00	59.46
Medicine Bow, WY, 20 MW, CF: 43.6%	6,500	20	2026	30	2,135	0.00	43.00	59.46
Medicine Bow, WY, 200 MW, CF: 43.6%	6,500	200	2026	30	1,573	0.00	43.00	59.46
Goldendale, WA, 20 MW, CF: 37.1%	1,500	20	2026	30	2,280	0.00	43.00	59.46
Goldendale, WA, 200 MW, CF: 37.1%	1,500	200	2026	30	1,660	0.00	43.00	59.46
Offshore, Northern, CA, CF: 45.0%	0	200	2028	30	5,229	0.00	103.00	158.23
Pocatello, ID, 200 MW, CF: 37.1% + BESS: 100% pwr, 4 hours	4,500	200	2026	30	3,353	0.00	85.32	83.46
Arlington, OR, 200 MW, CF: 37.1% + BESS: 100% pwr, 4 hours	1,500	200	2026	30	3,227	0.00	85.32	83.46
Monticello, UT, 200 MW, CF: 29.5% + BESS: 100% pwr, 4 hours	4,500	200	2026	30	3,395	0.00	85.32	83.46
Medicine Bow, WY, 200 MW, CF: 43.6% + BESS: 100% pwr, 4 hours	6,500	200	2026	30	3,314	0.00	85.32	83.46
Goldendale, WA, 200 MW, CF: 37.1% + BESS: 100% pwr, 4 hours	1,500	200	2026	30	3,454	0.00	85.32	83.46
Offshore, Northern, CA, CF: 45.0% + BESS: 100% pwr, 4 hours	0	200	2028	30	7,383	0.00	145.32	182.23

Supply-Side Resource Table

Solar + Wind + Energy Storage

Description	Resource Characteristics				Costs			
Resource	Elevation (AFSL)	Net Capacity (MW)	Commercial Operation Year	Design Life (yrs)	Base Capital ($/kW)	Var O&M ($/MWh)	Fixed O&M ($/kW-yr)	Demolition Cost ($/kW)
Idaho Falls, ID Solar + Wind + BESS: 100% pwr, 4 hours	4,700	200	2026	25	6,194	0.00	148.51	113.52
Lakeview, OR Solar + Wind + BESS: 100% pwr, 4 hours	4,800	200	2026	25	6,052	0.00	148.51	115.62
Milford, UT Solar + Wind + BESS: 100% pwr, 4 hours	5,000	200	2026	25	6,238	0.00	148.51	113.22
Rock Springs, WY Solar + Wind + BESS: 100% pwr, 4 hours	6,400	200	2026	25	5,703	0.00	148.51	114.42
Yakima, WA Solar + Wind + BESS: 100% pwr, 4 hours	1,000	200	2026	25	5,898	0.00	148.51	115.02

Supply-Side Resource Table

Geothermal

Description	Resource Characteristics				Costs			
Resource	Elevation (AFSL)	Net Capacity (MW)	Commercial Operation Year	Design Life (yrs)	Base Capital ($/kW)	Var O&M ($/MWh)	Fixed O&M ($/kW-yr)	Demolition Cost ($/kW)
Dual Flash Expansion of Blundell Plant	4,500	200	2026	40	3,835	0.00	115.00	117.00
Greenfield Binary Plant	4,500	200	2026	40	5,568	0.00	115.00	117.00

Existing Thermal Resource Options

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Modeling Approach for Coal Units

- Plexos will determine coal generator selections from among modeled options
- Proposed coal retirement portfolio configurations:
  - 2019 IRP: 78
  - 2021 IRP: > 260,000
  - 2023 IRP: > 5,000,000,000,000 (5 trillion, not counting SCR/CCUS/conversion alternatives)
- ***Ultimate model performance may require changes to these assumptions***
  - Priorities will be based on Plexos data, such as micro resource evaluations
  - The 2023 IRP may include gas generator retirement options if performance allows
- In the 2021 IRP, for owned/operated coal units, potential retirement dates were based upon avoiding major overhauls, assuming a unit would be able to operate five years after an overhaul
- In the 2023 IRP, any reasonable year of the unit's planned operating life can be selected for retirement
- Minority-owned coal units Colstrip 3 & 4 are subject to discussion with joint-owner; Craig and Hayden have agreed-upon retirement dates
- Environmental compliance requirements are being incorporated into the methodology, including but not limited to Regional Haze, the Ozone Transport Rule, and carbon capture

NOx Reduction Equipment

Selective Catalytic Reduction (SCR) and Selective Noncatalytic Reduction (SCNR)

- **Similarities between SCR and SCNR**

  Post combustion technologies using reagents (such as ammonia) to reduce Nitrogen Oxide (NOx) into water vapor, nitrogen gas, and trace amounts of carbon dioxide

- **Selective Catalytic Reduction**
  - Using a catalyst allows the chemical reaction to take place at a lower temperature, lowering the energy needed to begin the reaction
  - Can achieve a 90% NOx emission reduction

- **Selective Noncatalytic Reduction**
  - Without using a catalyst, the reaction requires much higher temperatures
  - Can achieve 30% to 70% NOx emission reduction

Carbon Capture Utilization and Sequestration

- Existing Coal Fleet
  - Proxy carbon capture resources include flue gas pre-treatment systems, as applicable
  - All federal and state environmental compliance requirements will be met
- 45Q Tax Credits
  - Credit Life: 12 Years
  - Credit Amount: $60/tonne (use) and $85/tonne (storage) (increased under IRA)
  - Construction must start by: January 1, 2033 (extended under IRA)
  - CO_2 Minimum Capture: 18,750 tonnes/year (decreased under IRA)
  - Design Capacity Requirement: must capture at least 75% of units' CO_2 production (additional requirement under IRA)

Jim Bridger Units 1-4 Operating Variants

Jim Bridger Units 1 and 2	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Gas conversion-2024		Gas														Retired				

Jim Bridger Units 3 and 4	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Coal Ret-2024 thru 2037																Retired				
Gas conversion-2026				Gas												Retired				
Coal CCUS-2028						CCUS												Retired		

- Jim Bridger Units 1 & 2
  - Units will be converted to gas in 2024; 14 retirement years are considered
- Jim Bridger Units 3 & 4
  - Units currently have SCR installed
  - 14 retirement years are considered, up from 4 in the 2021 IRP
  - Gas conversion option beginning in 2026 with 12 retirement options
  - A CCUS retrofit option (coal) assumes capture begins in 2028, allowing 12 years of operation with 45Q tax credits

Naughton Units 1-3 Operating Variants

Naughton Units 1 and 2	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Coal Ret-2025				Retired																
Gas-2026				Gas											Retired					

Naughton Unit 3	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Gas Ret-2026 thru 2036															Retired					

- Naughton 1 & 2
  - Coal boilers and coal combustion residual (CCR) ponds must achieve final closure by October 2028
  - To achieve final closure of ponds by 2028, coal boilers will need to cease operation by the end of 2025
  - Gas conversion option in 2026 with 11 retirement years
- Naughton 3
  - Operates on gas
  - 11 retirement years targeted for consideration

Dave Johnston Units 1-4 Operating Variants

Dave Johnston 1 and 2	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Coal Ret-2024 thru 2032							Retired													

Dave Johnston 3	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Coal Ret-2024 thru 2027						Retired														

Dave Johnston 4	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Coal Ret-2024 thru 2039																		Retired		
Gas-2027					Gas													Retired		
Coal CCUS+SCR 2028						CCUS+SCR												Retired		

- In the 2021 IRP each Dave Johnston unit considered 2 retirement years, 8 total retirement options
- The 2023 IRP is targeting between 4 and 16 coal retirement years for each unit, 30 total retirement options
- Dave Johnston 4
  - Gas conversion option in 2027 with 13 retirement years
  - A CCUS+SCR retrofit option (coal) assumes capture begins 2028, allowing 12 years of operation with 45Q tax credits

Wyodak
Operating Variants

Wyodak	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Coal Ret-2024 thru 2039																		Retired		
Gas-2027					Gas													Retired		
Coal SCR-2026				SCR														Retired		
Coal SNCR-2026				SNCR														Retired		
Dual Fuel-2027					Dual Fuel													Retired		

- 16 coal retirement years are considered, up from 5 in the 2021 IRP
- SCR and SCNR options are added in the 2023 IRP, with a 2026 operation and is available to retire in any later year
- A dual fuel option is added, modeled in 2027 and retiring any later year through 2039

Hunter Units 1-3
Operating Variants

Hunter 1	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Coal Ret-2024 thru 2042																				
Coal SCR-2026				SCR																
Coal SNCR-2026				SNCR																

Hunter 2	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Coal Ret-2024 thru 2042																				
Coal SCR-2026				SCR																
Coal SNCR-2026				SNCR																

Hunter 3	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Coal Ret-2024 thru 2042																				
Coal SCR-2026				SCR																
Coal SNCR-2026				SNCR																

- 19 retirement years considered for each unit, up from 5 per unit in the 2021 IRP
- SCR and SCNR options are added in the 2023 IRP, 2026 operation and retiring in any later year

Huntington Units 1-2 Operating Variants

Huntington 1	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Coal Ret-2024 thru 2036															Retired					
Coal SCR-2026				SCR											Retired					
Coal SNCR-2026				SNCR											Retired					

Huntington 2	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Coal Ret-2024 thru 2036															Retired					
Coal SCR-2026				SCR											Retired					
Coal SNCR-2026				SNCR											Retired					

- 13 retirement years considered for each unit, up from 4 per unit in the 2021 IRP
- SCR and SCNR options are added in the 2023 IRP, 2026 operation and retiring in any later year

Other Jointly Owned Operating Variants

Colstrip 3 & 4	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Coal Ret-2025				Retired																

Craig	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Craig 1 Coal Ret-2025				Retired																
Craig 2 Ret-2028							Retired													

Hayden	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Hayden 1 Ret-2028							Retired													
Hayden 2 Ret-2027						Retired														

- Colstrip 3 & 4 assumed retirement dates stay the same for the 2023 IRP, informed by ongoing discussions with joint owners
- Craig and Hayden minority-owned coal units have agreed-upon retirement dates
- Hayden unit 1 and 2 retirements occur 2 years and 3 years earlier compared to the 2021 IRP

Natural Gas Unit Operating Variants

Chehalis	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Gas Ret-2026 thru 2042																				

Currant Creek	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Gas Ret-2026 thru 2042																				

Hermiston 1/2	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Gas Ret-2026 thru 2036															Retired					

Lakeside 1	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Gas Ret-2026 thru 2042																				

Lakeside 2	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Gas Ret-2026 thru 2042																				

- Gas retirement options are new to the 2023 IRP
- The company is currently looking at options to increase Lakeside 1 & 2 output via a turbine upgrade and/or wet compression equipment

Natural Gas Unit Operating Variants, Continued

Gadsby 1	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Gas Ret-2026 thru 2032											Retired									

Gadsby 2	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Gas Ret-2026 thru 2032											Retired									

Gadsby 3	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Gas Ret-2026 thru 2032											Retired									

Gadsby 4	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Gas Ret-2026 thru 2032											Retired									

Gadsby 5	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Gas Ret-2026 thru 2032											Retired									

Gadsby 6	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Gas Ret-2026 thru 2032											Retired									

- Seven retirement years for each Gadsby gas unit leading up to end-of-life, expanding significantly on past IRP options

Transmission Modeling




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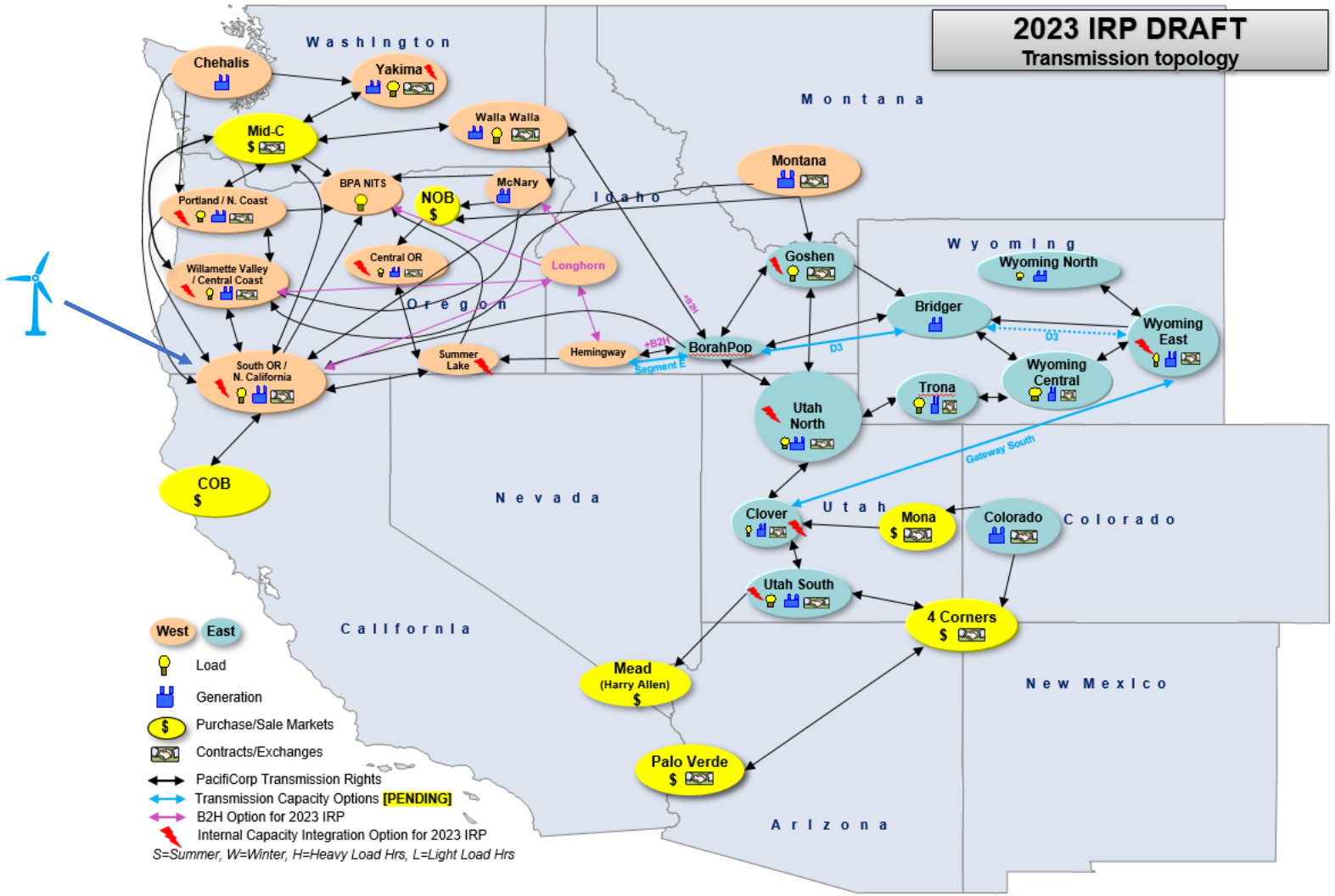
2023 IRP Topology

Using Transmission to Serve Load



Key Topology Updates

- PacifiCorp is updating its transmission arrangements with BPA and Idaho Power. This can facilitate further changes once B2H is in service.
  - BPA Midpoint-Meridian contract converted to PTP
  - Hermiston was renamed McNary, which is a key tie between PAC and BPA, and applies to several transmission contracts.
  - Longhorn is the planned northern terminus of B2H (near but not at Boardman), several transmission service contracts with BPA have been or will be modified to use this location once B2H is in service.
- Jim Bridger recently moved to the east balancing authority area.
  - Dynamic transfers of unspecified system power between PACE and PACW are still possible, but now can more readily use any available resources in actual operations.
  - In modeling, this primarily impacts where operating reserves get counted.
  - Resources in Jim Bridger and Borah-Populus transmission areas now count toward east reserve requirements.

Price Forecasting

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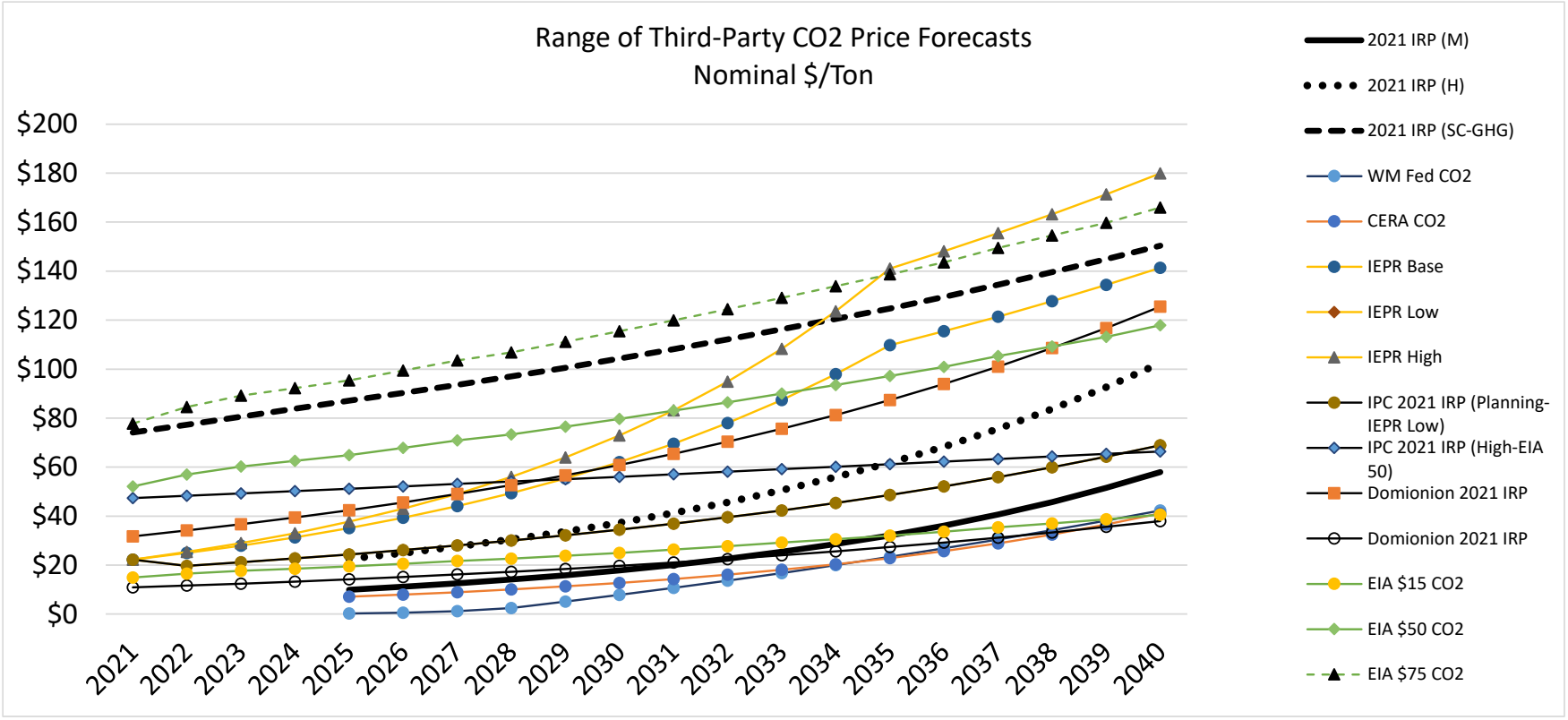
CO_2 Forecast

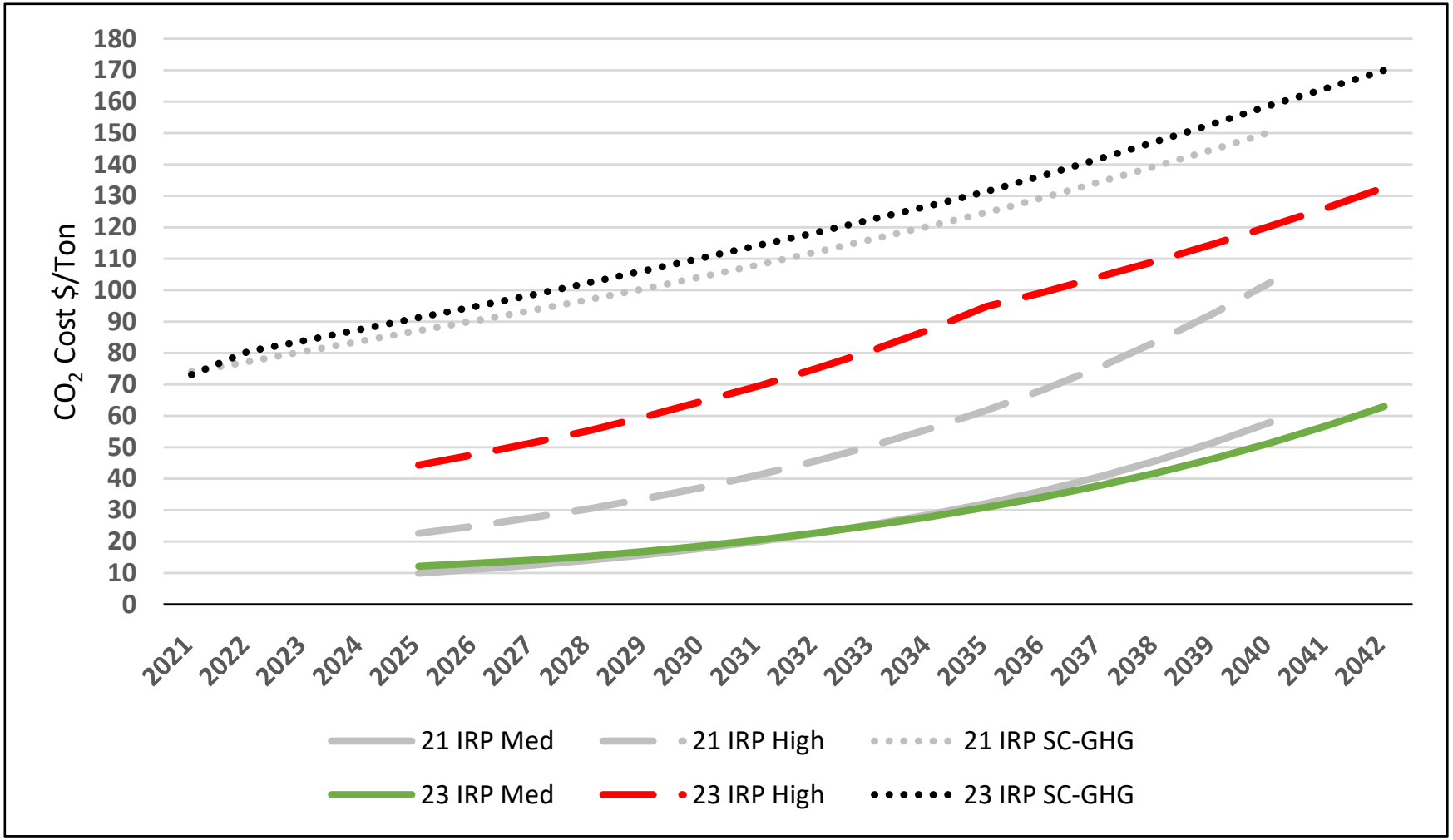
Overview

- Developed from publicly and governmental forecasts grouped into categories:
  - Medium
  - High
  - Social Cost of Greenhouse Gases (SCGHG)
- Medium and High forecasts each aggregated 6 outside sources
- SCGHG derived from the EPA Interagency workgroup
  - Aligned with CETA requirements
  - Updated for recent WUTC order
- The modeled CO_2 costs are not intended to explicitly account for a future tax on CO_2 emissions.
  - Rather, these costs capture the effect of policies incentivizing reduced emissions through benefits or imposing costs through penalties or other costs resulting from market dynamics driving the need for zero-emission resources or customer preferences

CO_2 Forecasts



CO_2 Forecasts vs. 2021 IRP



Social Cost of Greenhouse Gas CO2 Price

- Washington Utility and Transportation updates the social cost of greenhouse gases annually to adjust for inflation
- Order 03 in Docket U-190730 updated costs to 2021 dollars
- Inflation escalation was applied to state in nominal dollars
  - 2022 8.03%
  - 2023 and afterwards 2.28% per year

Year	Social Cost of CO2	
	2021 dollars per metric ton	2023 IRP nominal dollars
2010	$64	
2015	$72	
2020	$79	
2025	$87	$91
2030	$94	$110
2035	$100	$131
2040	$108	$159
2045	$114	$188
2050	$122	$225

Forward Price Forecasting

Siemens Price Curve Development

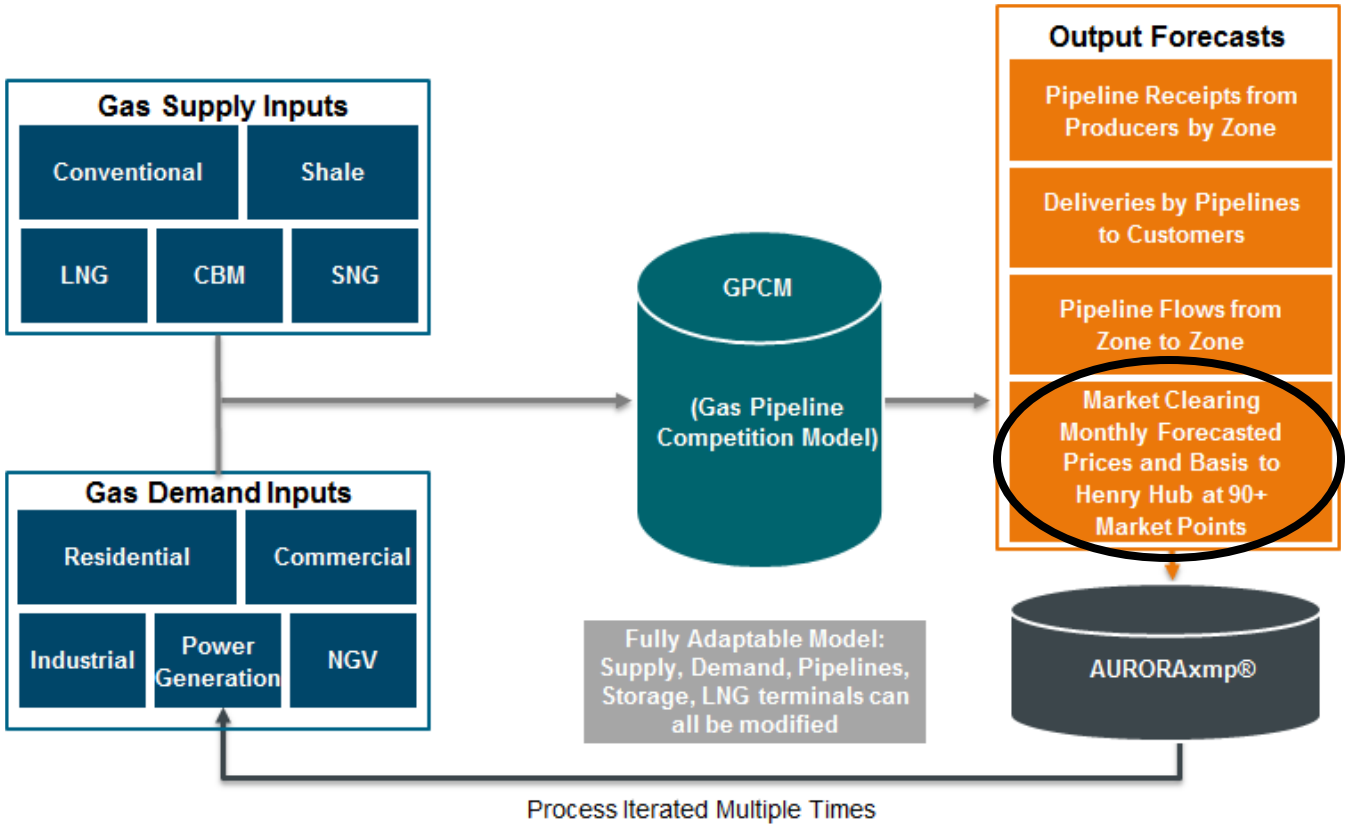
- PacifiCorp retained Siemens PTI to develop and deliver customized quarterly price forecasts for gas and electricity prices in the WECC region, develop price sensitivities and provide ad hoc regulatory support
- Siemens PTI delivers 30-yr monthly price forecast for the following power and gas hubs:

Price Hub	Associated Gas Hub
COB	Malin
Mid Columbia	Stanfield
Palo Verde	San Juan
Four Corners	San Juan
Mead	Southern California Border
Nevada/Oregon Border	Malin
Mona	Opal
	Henry Hub
	Sumas

Natural Gas Price Development

- Siemens PTI utilizes the Gas Pipeline Competition Model (GPCM) to provide rigorous natural gas market evaluations.
- GPCM incorporates natural gas supply and pipeline constraints from different producing basins and integrates natural gas demand from power generation (Aurora) to develop the price forecast for different natural gas hubs
- High level overview of the Siemens' integration of GPCM and Aurora:
  - The GPCM modeling framework receives inputs from Aurora on current and expected power sector gas demand based on expected generation capacity additions and dispatch.
  - The Aurora model then in turn receives gas pricing inputs from GPSM based on the supply economics, pipeline expansion plans and all gas consuming sectors of the economy
  - The final "equilibrated level" is such that gas price levels and the implied power sector gas demand levels are consistent across both models

Gas Price Forecasting Process Flow



- **Output:** Monthly gas prices at various market hubs

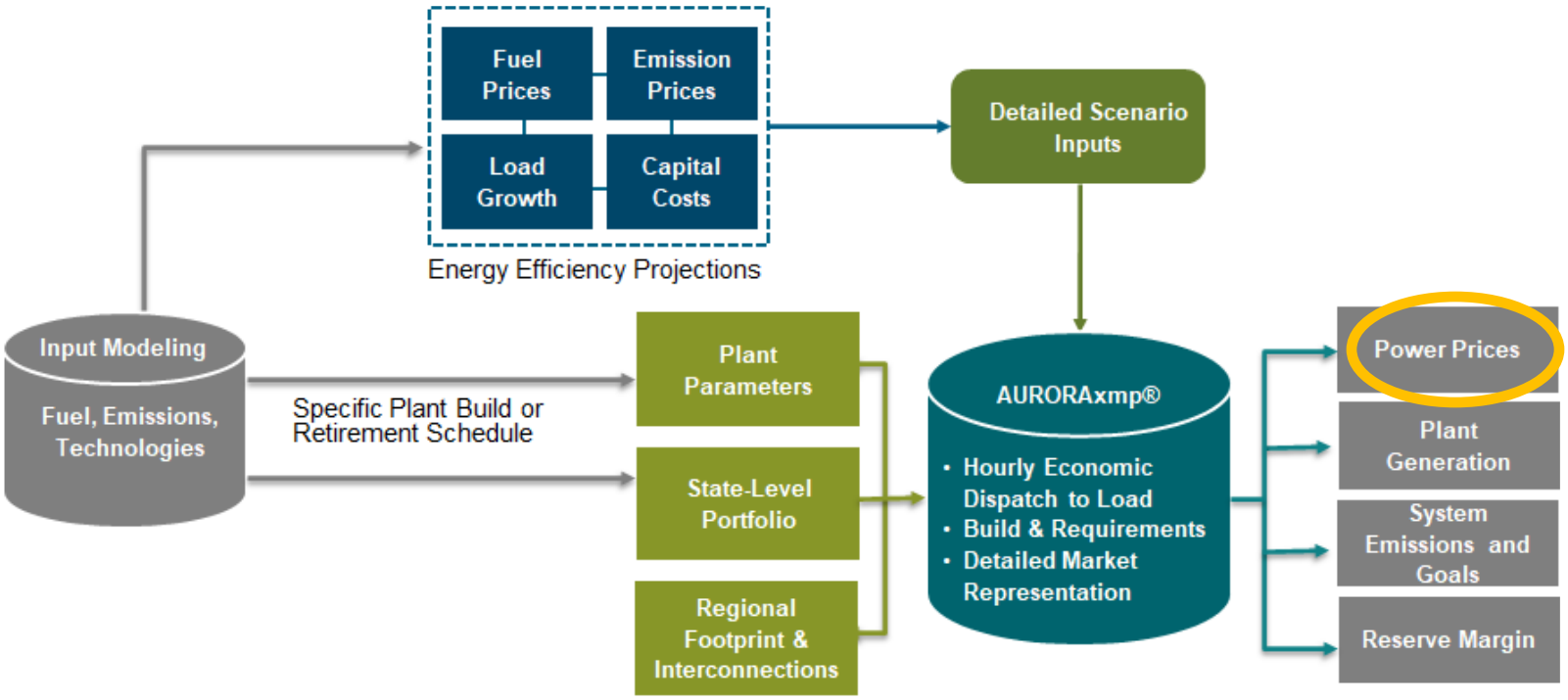
Siemens Power Price Forecast Modeling Overview

- Siemens PTI utilizes Aurora as the primary tool to develop PacifiCorp's forward price curves for WECC region
- Aurora is an industry standard chronological unit commitment and dispatch model with extensive presence throughout the electric power industry
- The model uses a state-of-the-art mixed integer linear programming approach to capture details of power plant and transmission network operations while observing real world constraints such as:
  - Emission reduction targets
  - Ozone transport rule
  - Transmission limitations
  - Plant operational limitations
  - Renewable energy availability
  - Mandatory portfolio targets (RPS)

Varying inputs and Assumptions into Aurora Model

- Gas price forecast
- Coal price forecast
- WECC Load forecast
- Capital cost
- Emission prices
- Transmission Topology
- EV/DG Penetration
- RPS and CO2 reduction targets
- Announced builds and retirements (EIA Form No. 860-M)

Aurora Dispatch Model Framework



- **Output:** Monthly Heavy Load Hour/Light Load Hour power prices at various market hubs
- Sensitivities with alternative gas and CO2 price inputs are also prepared for use in the IRP.

Customer Preference

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Tariffs and Projects

- There are several existing and proposed programs to allow customers to voluntarily support renewable resources:
- Larger Customers:
  - Utah Schedule 32: Renewable resource costs, including delivery, are included on customer bill. Load in excess of the renewable output is billed under rates in the schedule.
  - Utah Schedule 34: Incremental costs for renewable resources are added to the customer's normal cost of service rates (or a different treatment approved by the Commission).
  - Utah Community Renewable Energy Act (HB 411): Local communities can establish net-100% renewable electricity goals. The incremental costs of resources to meet these goals apply to all customers in their jurisdiction who do not opt out.
  - Oregon Schedule 272: Renewable Energy Credit purchase option, added to customer's normal cost of service rates.
  - Oregon Accelerated Clean Tariff: proposed in ongoing general rate case. In addition to their normal cost of service rates, customers pay renewable resource costs and receive a credit for the energy and capacity benefits the resource provides to other customers.
- Smaller Customers:
  - Blue Sky – Renewable Energy Credit purchases, Community Solar (OR), Subscriber Solar (UT)

Tariffs and Projects

- Role in the IRP
  - The IRP preferred portfolio has resources that are cost-effective for all customers, or necessary to meet state obligations.
  - IRP proxy resource costs and performance are uniform, so it is hard to identify the "next best" option that would be suitable for a voluntary customer program.
  - In a Request for Proposals (RFP), bids with above average costs that wouldn't otherwise be cost-effective can be procured in conjunction with a customer commitment under a voluntary program. This can work for all of the large programs except Utah Schedule 32.
  - PacifiCorp's ongoing 2022 All-Source RFP may provide voluntary program opportunities. To proceed in this RFP:
    - Customer expressions of interest would be required by March 2023: identifying price, volume, contract term, and any other specifications.
    - Additional projects consistent with specific voluntary program requests can be included in the Final Shortlist in June 2023.
    - Under the RFP, resource negotiations and contract execution will be complete by November 2023.
    - A timeline for customer commitments and any required Commission approvals will also need to be identified.

Qualifying Facility Renewal




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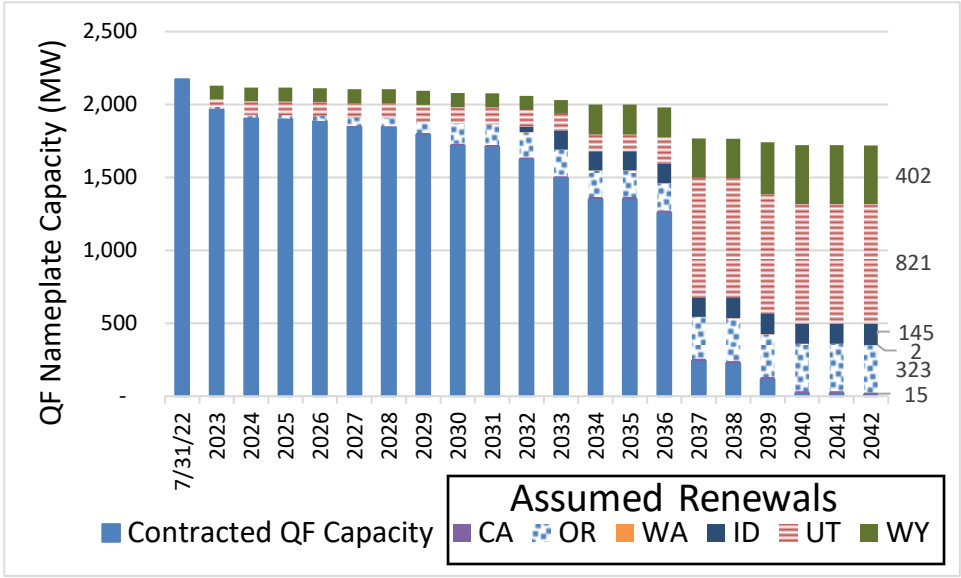
Qualifying Facility (QF) Renewal Proposed Methodology

- PacifiCorp evaluated its QF contracts over the past ten years.
  - Operating QF contracts have nearly tripled since 2012, many are still on their first contract.
  - 21% of the QF contract capacity that expired between 2012 and 2022 did not renew.
- For the 2023 IRP, PacifiCorp proposes that at the end of their current contract, QFs continue operating at 79% of their expected output, unless it has specific information about a project.

QF MW Capacity, as of	Operating	Total Expiring Contracts, prior five years	Expired, did not renew	Did not renew, %
7/31/2012	757	n/a	n/a	
7/31/2017	1,914	286	48	
7/31/2022	2,173	79	30	
		365	78	21%



2023 Conservation Potential Assessment Draft Results

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Schedule and Milestones

Throughout the 2023 CPA development process, we will continue to request feedback from interested parties.

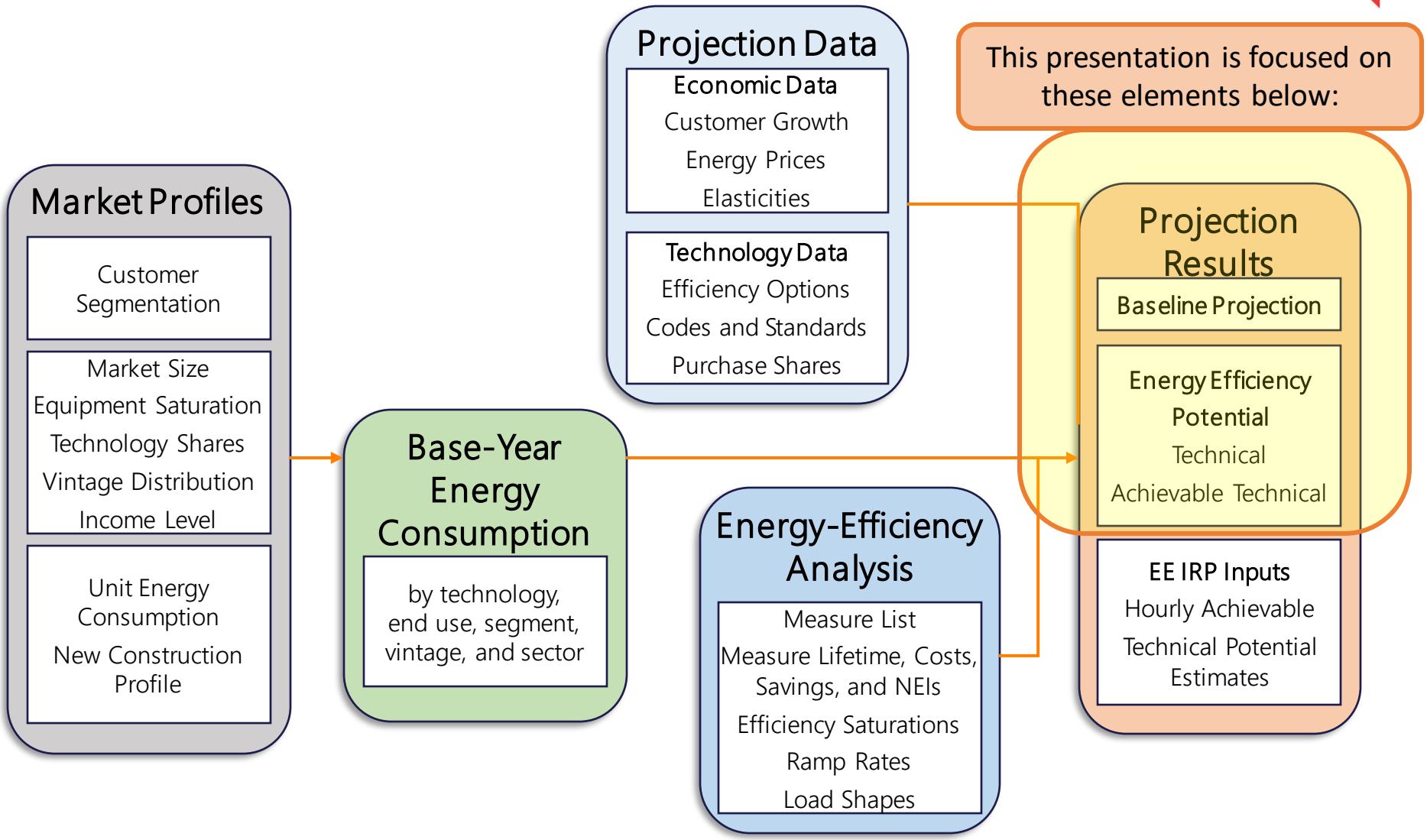
Timeframe	Milestone	Public Input Request
February 22, 2022	Share Work Plan	Provide input on scope (2 emails)
February 25, 2022	Present on Scope of Work	Additional input on scope (0 forms)
April 1 and April 7, 2022	Share Draft Lists, Present on Resource List	Provide feedback by April 11. **(2 emails)**
April 18, 2022	Finalize Resource Lists	n/a – feedback incorporated
May 12, 2022	Share Key Drivers of Potential, Assumptions	Participate in meeting, provide input
September 1/2, 2022	Present Draft Results – Residential and Commercial	Review materials and provide feedback
December 1/2, 2022	Present Final Results	Provide final feedback
November/December 2022	Draft CPA Report for Review	Provide input on draft report
January 2023	Publish Final Report	n/a – feedback incorporated

Recap of Key Discussion Topics from May 2022 CPA Workshop #3

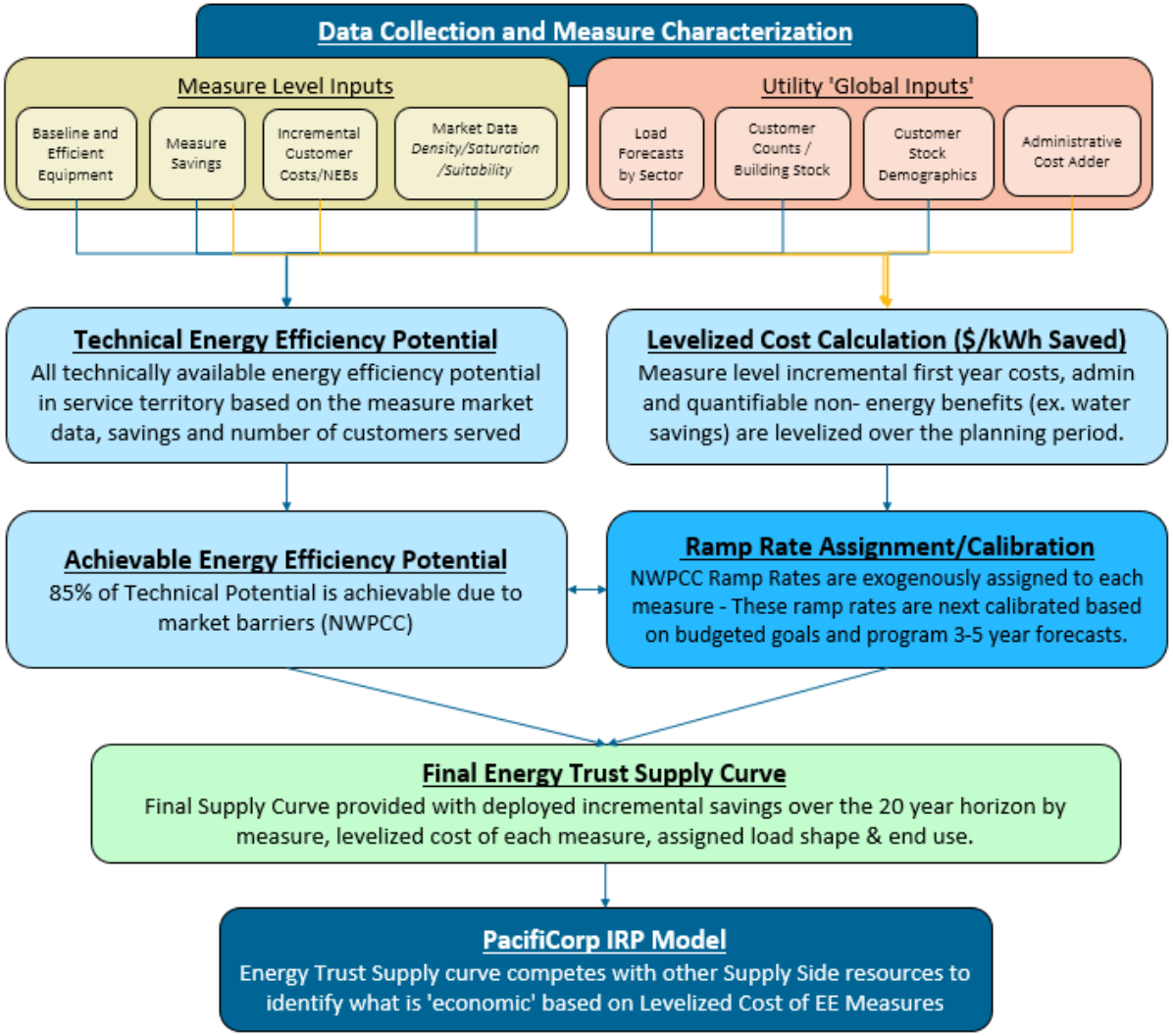
- Drivers of Difference in Forecasted Potential by State:
  - Distribution of Customers and Sales by Sector
  - Forecasts by Sector
  - Sub-Sector Share of Load
  - Sector-Specific Measures
  - Climate
  - Equipment Saturations
  - Ramp Rates

- Differences in State-level consumption by sector and impacts to overall potential savings opportunities.
  - Residential and commercial sectors generally have higher savings potential as a proportion of load.

CPA Methodology (except Oregon)



Energy Trust of Oregon Methodology



2023 CPA Analysis Themes

CPA Forecasting is Dynamic	• CPA forecasting is dynamic and markets change quickly • Analysis every two years to capture these changes
Lighting Changes	• Finalization of federal EISA 2020 backstop in 2022 • Adjusted federal lamp type definitions
Segmentation	• Income thresholds for residential sector in all states
State Specificity	• Regional measure and market data sourcing • State specific codes, standards and lighting assumptions
Load Forecast	• Baseline forecast includes climate change, building and vehicle electrification

Energy Efficiency Drivers of Change

Key Updates Relative to the 2021 CPA

Change Area	Detail
State-Specific Adjustments	Improved state-specific measure and market data sourcing
	Updated residential surveys
	Updated load forecast data
	Codes & Standards updates
	Expanded integration of non-energy impacts in Washington
Forecasting Methodology	Residential Low- and Moderate-Income segmentation added
	Lighting savings methods (market baseline and EISA)
	Inclusion of climate change in main forecast
	Building electrification assumed in baseline forecast in all states
	Scenario and sensitivity analysis
Other	Other updated secondary sources (AEO purchase shares and trends)
	Renewed emerging technology screen
	Applicability and Saturation Sourcing Updates (2019 CBSA)
	Incremental HERs only in California/Oregon and New Construction

State-Specific Adjustments

- Used state-specific resource hierarchy for energy efficiency resource data.
  - Resource hierarchy presented at February and May meetings
  - Applied to <u>all</u> measures, where possible

- Updated load research and survey data from PacifiCorp
- Codes and Standards:

WA	WAC 51-11R/C	ID	IECC 2018-ID
CA	Title 24-2022	UT	IECC 2015(R), 2018 (C)
OR	2021 OEESC	WY	None; Use IECC 2009

Lighting

- The 2021 CPA incorporated state-specific standards for general service lighting (GSL) and Regional Technical Forum (RTF) market baselines where applicable
- Since that time:
  - U.S. DOE codified the 2020 backstop (45 lm/W) provision for GSL (effective July 2022)
  - Finalized bulb type definitions for exempted vs general service lighting (original rule from 2017, rescinded in 2019, effective July 2022)
- The 2023 CPA incorporates the latest federal standards, current state-specific standards, and RTF market baselines where applicable.

- Trends:
  - Significant reduction in exempted lighting (almost all previously exempted bulbs now categorized as general service lighting)
  - UECs for exterior lighting have dropped significantly based on CBSA 2019
  - More pronounced increase in lighting efficiency (lower LPDs) in Rocky Mountain Power states relative to 2021 CPA.

Other Notable CPA Changes

Load Forecast

- Climate Change inclusion
- Higher AC saturation
- EVs and Electrification

Secondary Source Updates

- Measure Characterization Updates
- Segmentation Updates
- EIA Annual Energy Outlook 2021

Emerging Techs

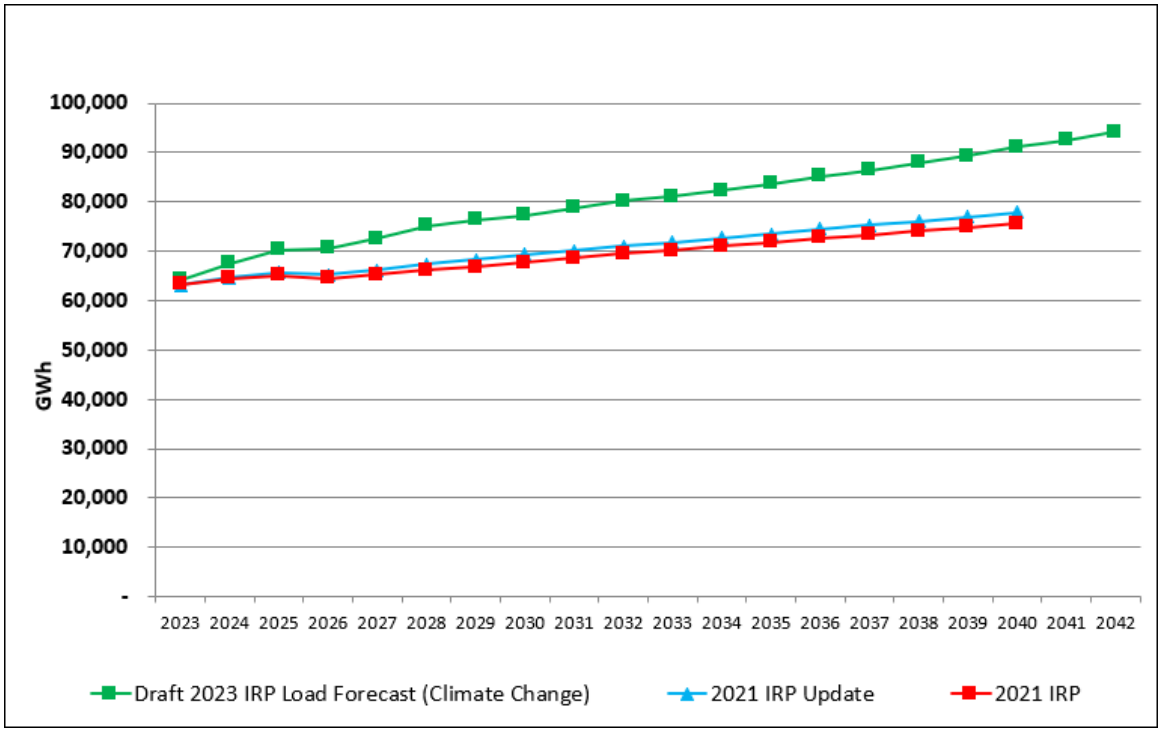
- New Emerging Technologies
- More Efficient Options (e.g., NEEA Tier 5 HPWH)

Applicability & Saturation Updates

- Updated residential survey
- Final NWPCC 2021 Power Plan
- CBSA 2019

Load Forecast Changes

- Changes in the load forecast drive changes in the potential
  - Most impactful load forecast drivers for EE/DR potential: building and vehicle electrification, climate change, cooling saturations



State-Level Administrative, Incentive & Participation Analysis Results

Administrative Cost Analysis

- Included 2014-2021 program years in 2023 CPA for average cost analysis
- Administrative costs high for WA and WY in 2020/2021

2023 CPA Administrative Cost as Percent of Incremental Measure Cost						
Program Year	UT	WA	CA	ID	WY	OR*
2014	18%	30%	46%	54%	44%	n/a
2015	21%	35%	29%	32%	38%	n/a
2016	24%	35%	41%	30%	29%	n/a
2017	23%	44%	73%	36%	34%	n/a
2018	23%	41%	55%	59%	40%	n/a
2019	22%	46%	36%	39%	59%	n/a
2020	22%	68%	44%	34%	75%	n/a
2021	21%	83%	37%	39%	62%	n/a
2023 CPA (2014-2021)	**22%**	**48%**	**45%**	**40%**	**48%**	**29%**
2021 CPA (2014-2018)	20%	38%	54%	46%	37%	28%
2019 CPA (2014-2016)	18%	35%	44%	36%	27%	20%

**OR based on 2021 program data*

Incentive Cost Analysis

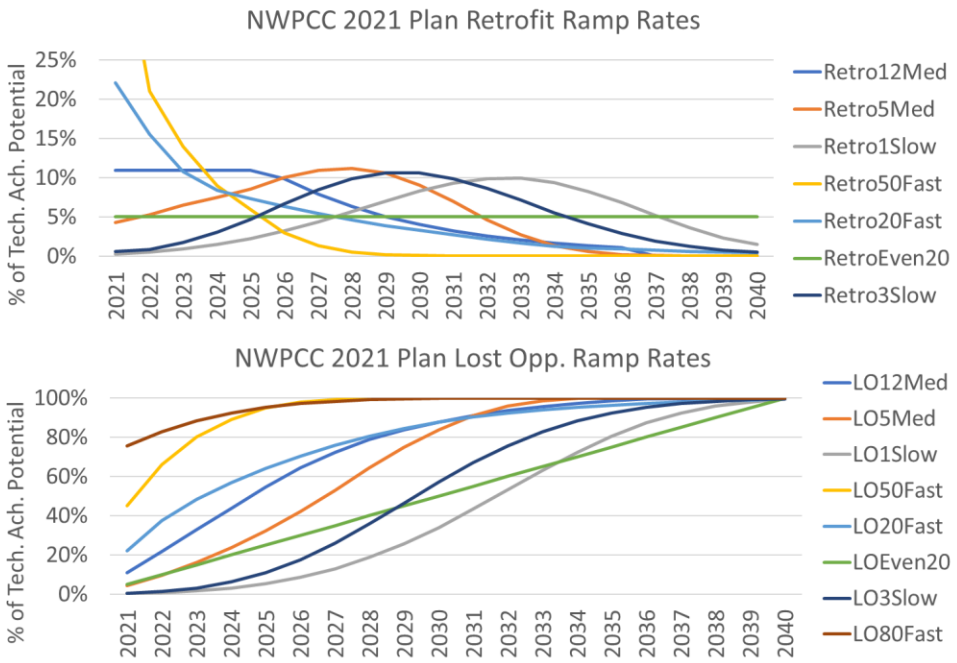
- Affects ID, UT, and WY, which utilize the Utility Cost Test (UCT) as the as the primary cost-effectiveness criterion, rather than the Total Resource Cost (TRC)

2023 CPA Incentive Cost as Percent of Incremental Measure Cost						
Program Year	UT	WA	CA	ID	WY	OR
2014	41%	42%	47%	46%	34%	n/a
2015	41%	43%	32%	42%	47%	n/a
2016	33%	44%	29%	39%	28%	n/a
2017	38%	39%	35%	44%	40%	n/a
2018	37%	44%	38%	46%	52%	n/a
2019	30%	45%	34%	33%	43%	n/a
2020	44%	56%	46%	33%	51%	n/a
2021	39%	66%	41%	27%	45%	n/a
2023 CPA (2014-2021)	**38%**	**47%**	**38%**	**39%**	**43%**	**42%**
2021 CPA (2014-2018)	38%	42%	33%	43%	40%	n/a

The 2019 CPA utilized 70% of customer incremental cost for all states and all measures except Non-Res Lighting, which assumed 50%.

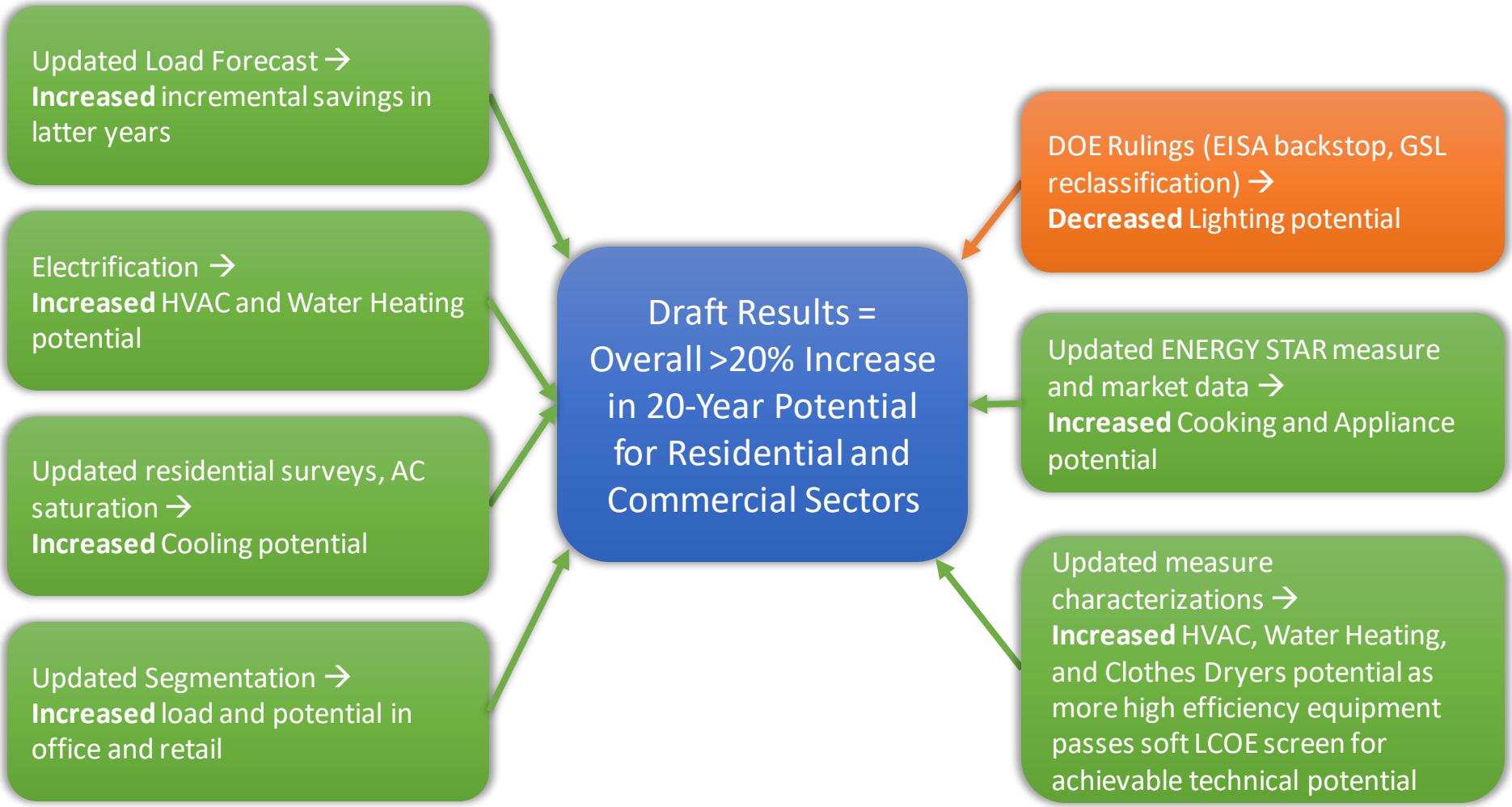
Ramp Rate Adjustments

- In 2021 CPA, AEG made several adjustments to ramp rate assignments in the NWPCC 2021 Power Plan
- Many residential categories were adjusted for faster ramp rates
- For C&I, only lighting went to faster ramp rate from 2021 Plan
- PacifiCorp/AEG team still reviewing appropriate ramp rates and any necessary changes. Will present any updates at final results meeting.
- A similar process is used for Oregon, though measure categories are slightly different.
- Worth noting that some non-programmatic acquisition is embedded in ramp rates. For example, Codes and Standards are naturally occurring adoption.

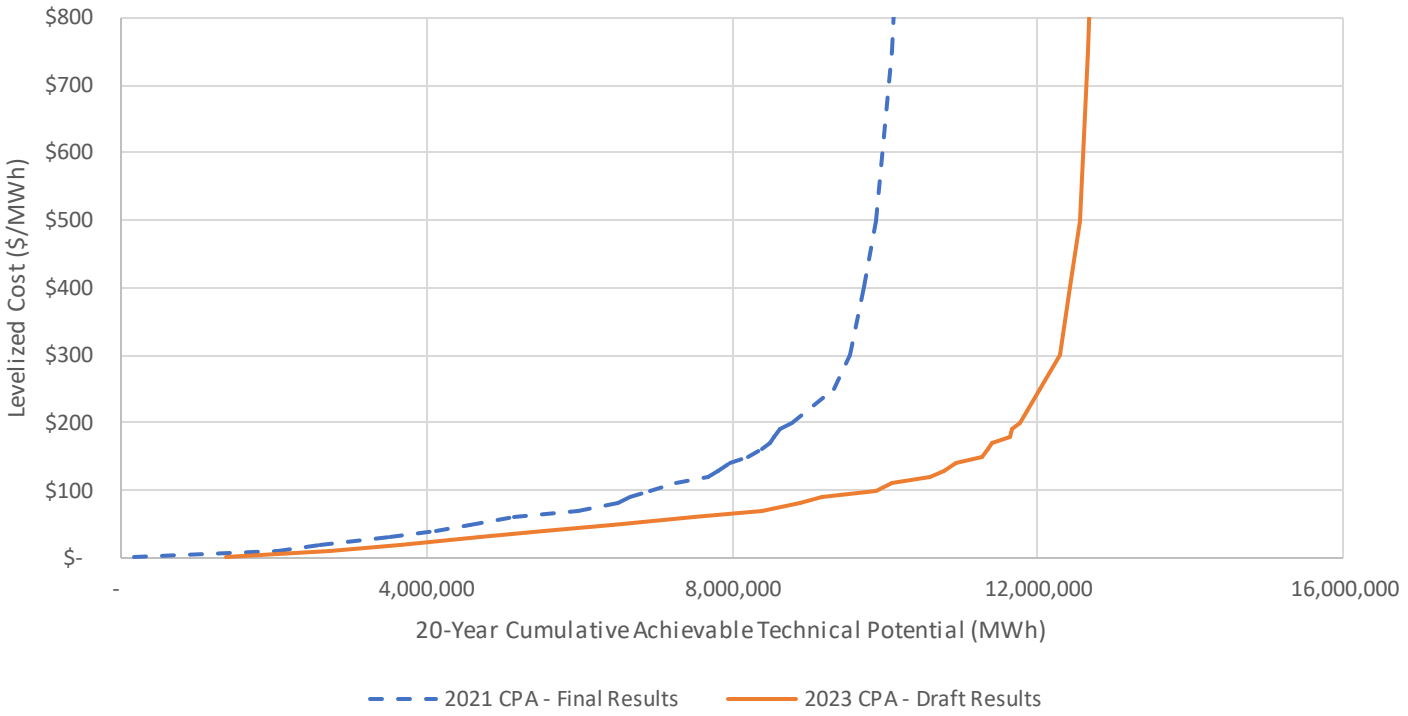


2023 CPA – Energy Efficiency Draft Potential Results

Key Drivers of Potential

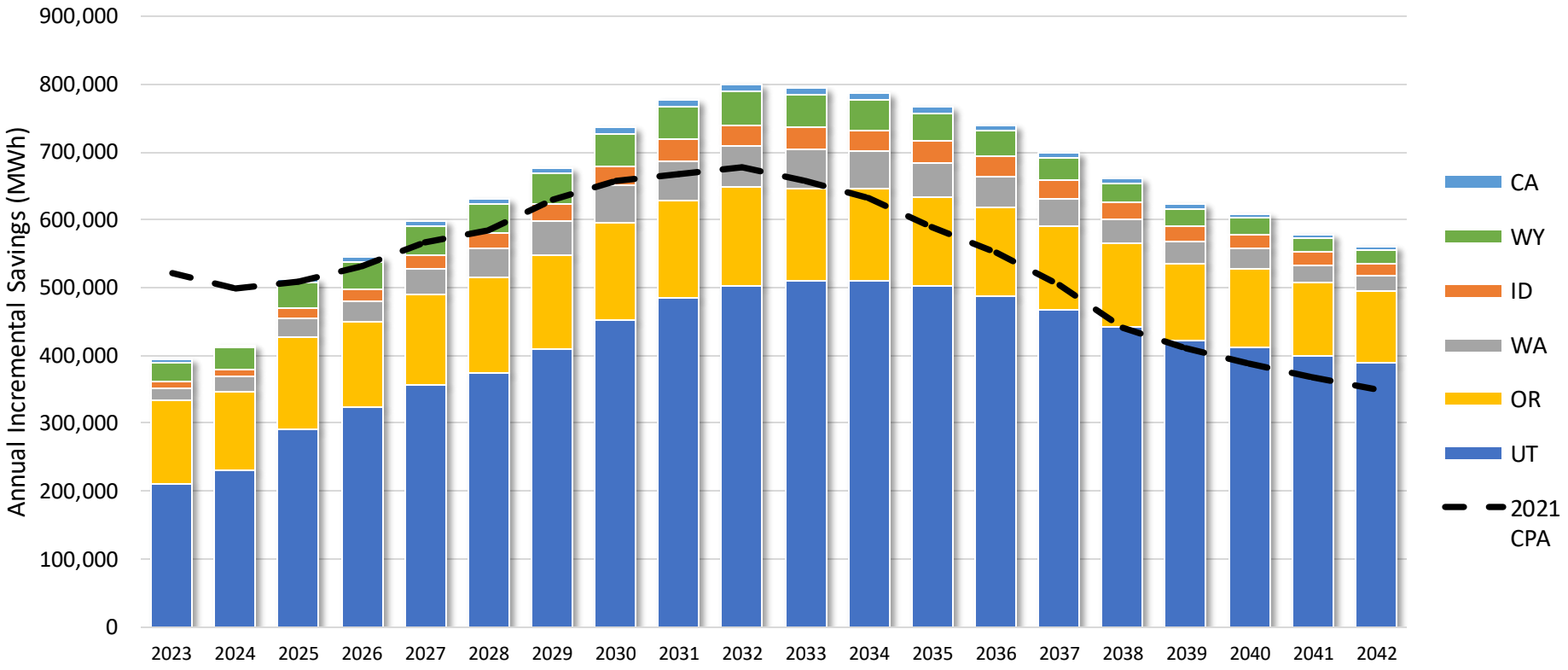


Achievable Technical Potential Supply Curve (All States, Cumulative MWh, Res and Com Only)



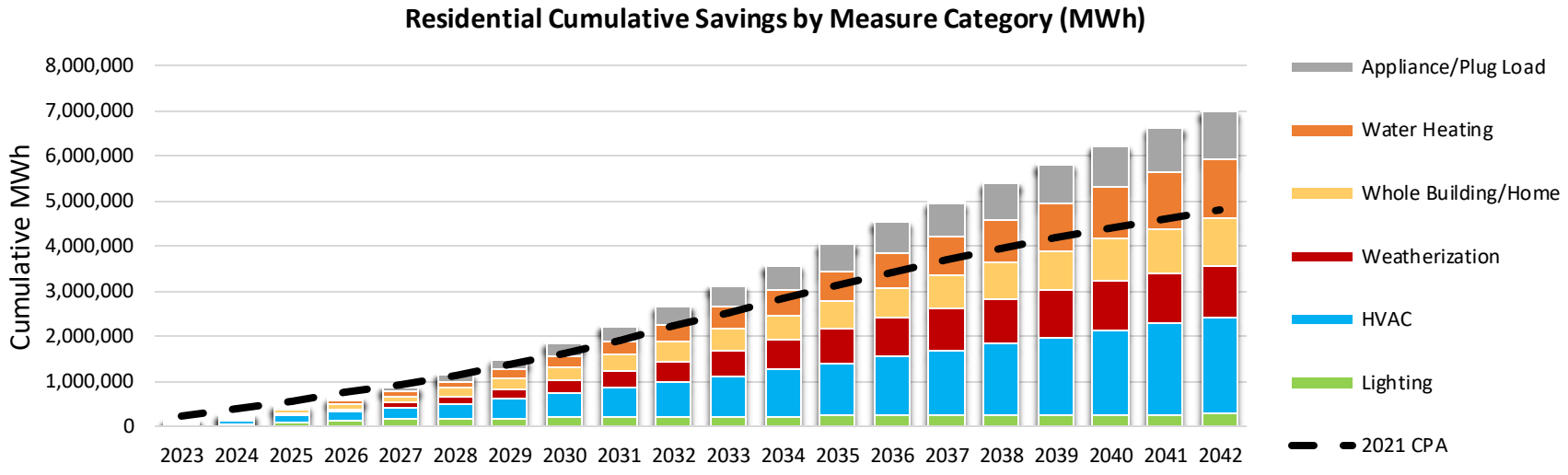
Total Residential and Commercial Cumulative 20-year Potential Comparison (GWh)		
2021 CPA	**2023 CPA**	**% Difference**
10,408	12,849	+23%

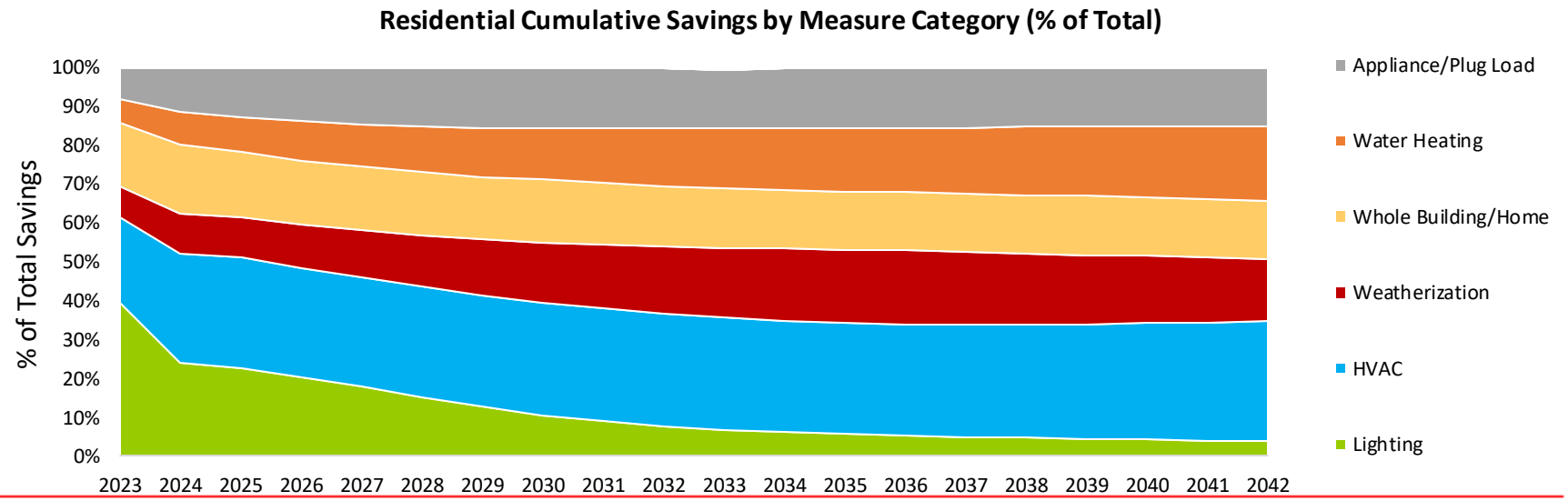
Achievable Technical Potential Comparison (All States - Incremental MWh - Res & Com Only)



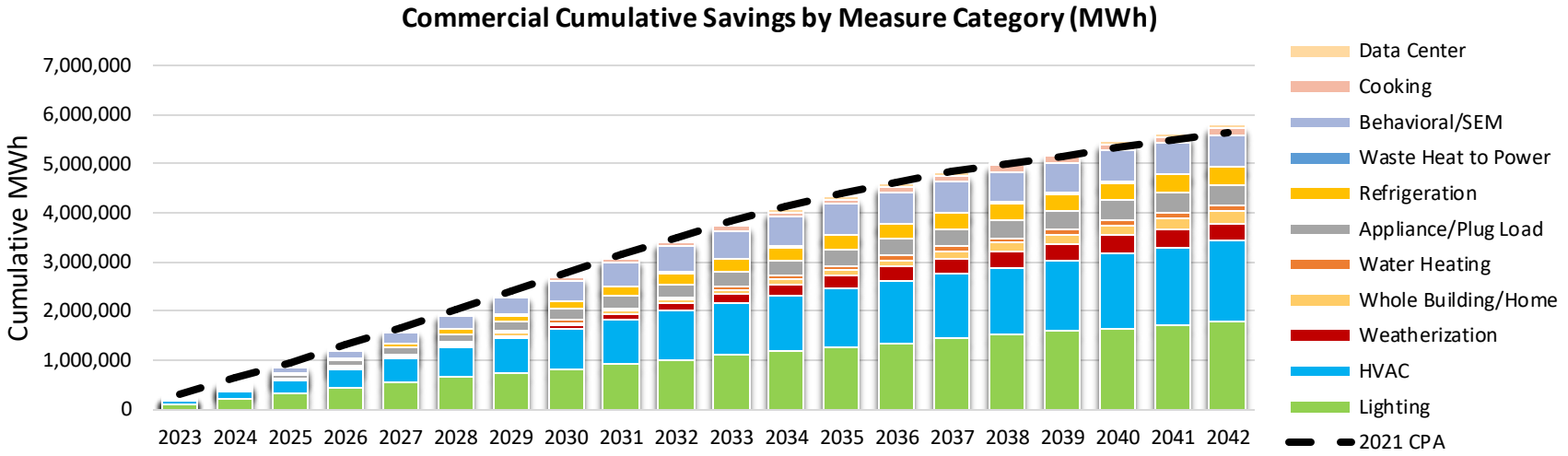
*All curves only show residential and commercial sectors in all states

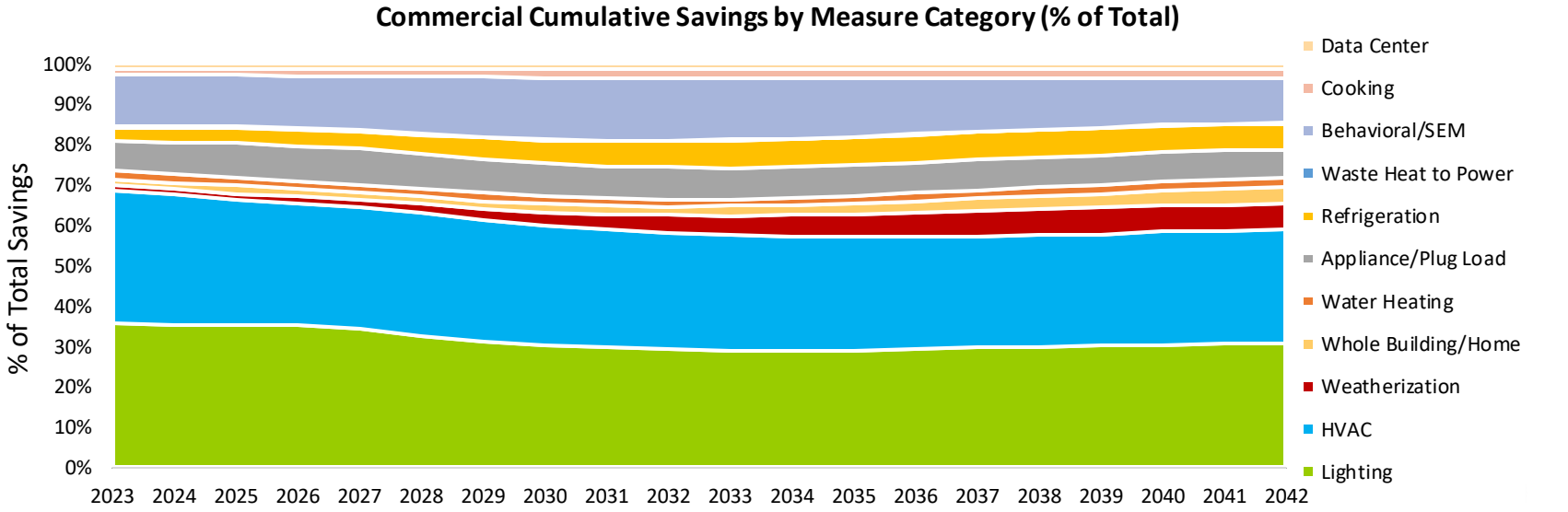
Residential Draft Results (All States)





Commercial Draft Results (All States)

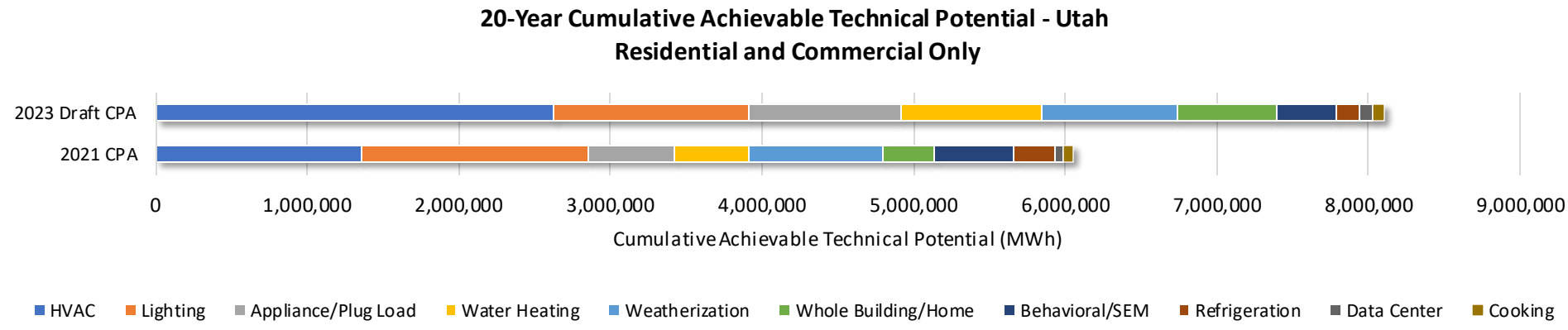




Note: Industrial and Irrigation results not ready for presentation across all states at this time.

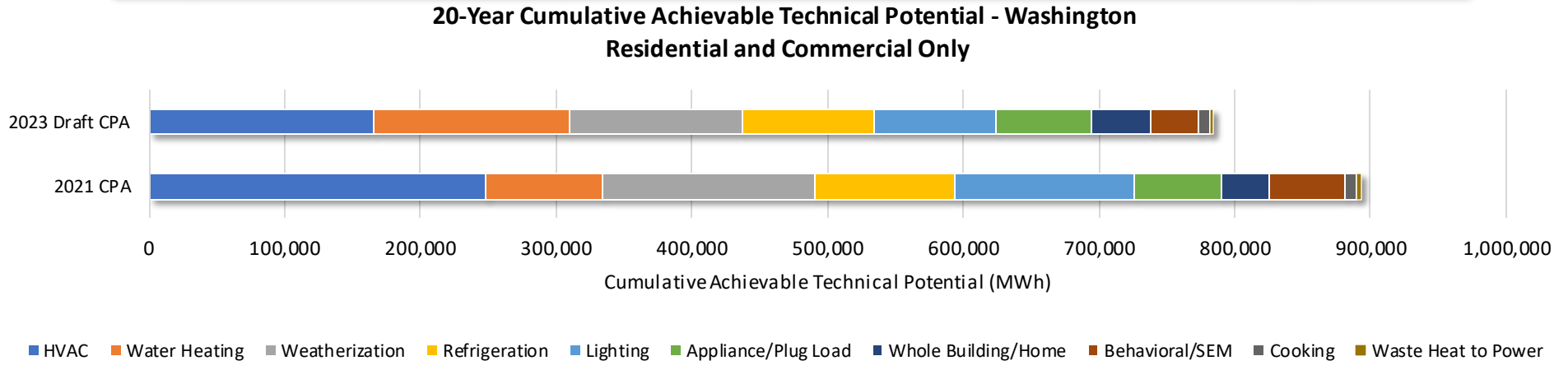
Utah – Top Measure Types (Res & Com)

2042 Rank	Measure Type	2023 CPA Draft: 20-Year Cumulative Potential	% of Total	2021 CPA 20 Year Cumulative Potential	% Change
1	HVAC	2,625,004	32.3%	1,360,330	+93.0%
2	Lighting	1,289,715	15.9%	1,497,815	-13.9%
3	Appliance/Plug Load	1,004,063	12.4%	565,206	+77.6%
4	Water Heating	928,135	11.4%	494,013	+87.9%
5	Weatherization	893,007	11.0%	876,029	+1.9%
6	Whole Building/Home	659,410	8.1%	346,637	+90.2%
7	Behavioral/SEM	390,007	4.8%	520,109	-25.0%
8	Refrigeration	156,203	1.9%	272,386	-42.7%
9	Data Center	85,828	1.1%	52,767	+62.7%
10	Cooking	74,985	0.9%	63,408	+18.3%
11	Waste Heat to Power	16,475	0.2%	19,438	-15.2%
	Total	**8,122,831**	**100.0%**	**6,068,139**	**+33.9%**



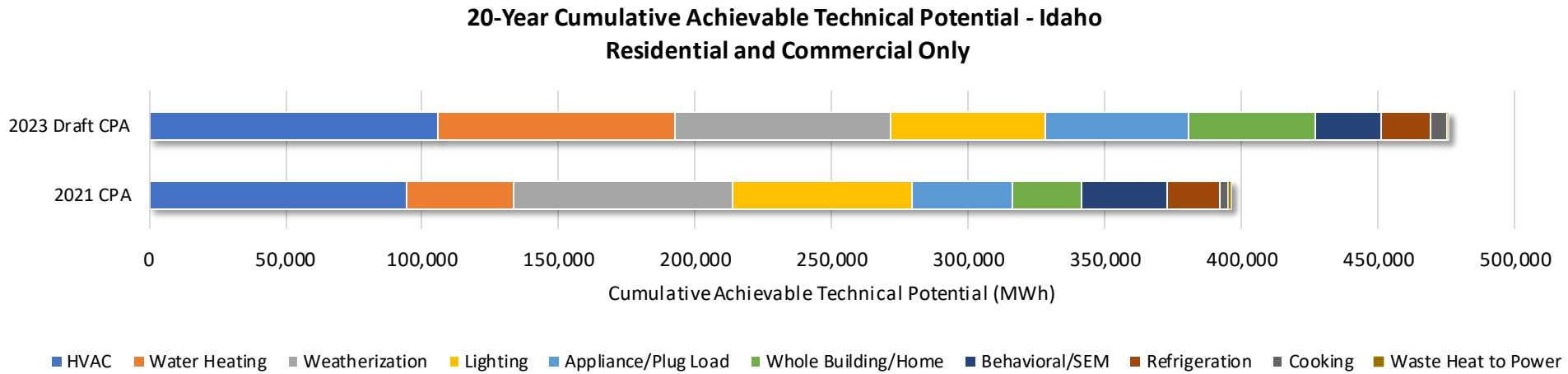
Washington – Top Measure Types (Res & Com)

2042 Rank	Measure Type	2023 CPA Draft: 20-Year Cumulative Potential	% of Total	2021 CPA 20 Year Cumulative Potential	% Change
1	HVAC	165,813	21.1%	248,092	-33.2%
2	Water Heating	144,260	18.4%	86,422	+66.9%
3	Weatherization	127,652	16.3%	156,113	-18.2%
4	Refrigeration	96,496	12.3%	102,968	-6.3%
5	Lighting	89,937	11.5%	131,901	-31.8%
6	Appliance/Plug Load	70,786	9.0%	64,809	+9.2%
7	Whole Building/Home	43,179	5.5%	35,695	+21.0%
8	Behavioral/SEM	34,763	4.4%	55,758	-37.7%
9	Cooking	9,345	1.2%	7,559	+23.6%
10	Waste Heat to Power	2,010	0.3%	4,406	-54.4%
11	Data Center	114	0.0%	124	-7.6%
	Total	**784,358**	**100.0%**	**893,847**	**-12.2%**



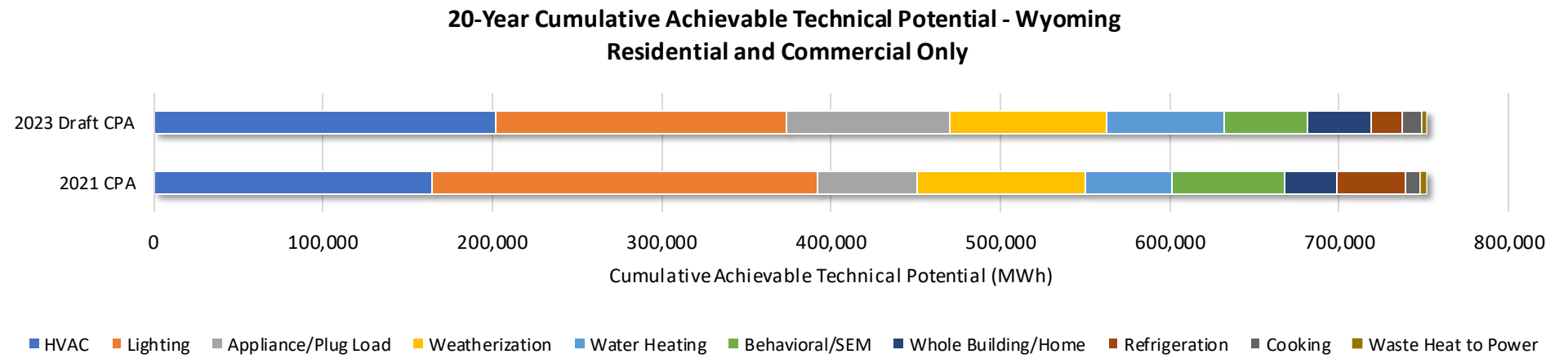
Idaho – Top Measure Types (Res & Com)

2042 Rank	Measure Type	2023 CPA Draft: 20-Year Cumulative Potential	% of Total	2021 CPA 20 Year Cumulative Potential	% Change
1	HVAC	105,520	22.2%	94,234	+12.0%
2	Water Heating	87,233	18.3%	39,120	+123.0%
3	Weatherization	78,605	16.5%	80,478	-2.3%
4	Lighting	56,873	12.0%	65,732	-13.5%
5	Appliance/Plug Load	52,536	11.0%	36,398	+44.3%
6	Whole Building/Home	46,448	9.8%	25,629	+81.2%
7	Behavioral/SEM	24,019	5.0%	30,994	-22.5%
8	Refrigeration	18,221	3.8%	19,474	-6.4%
9	Cooking	5,647	1.2%	3,358	+68.1%
10	Waste Heat to Power	642	0.1%	1,157	-44.5%
11	Data Center	43	0.0%	31	+41.5%
	Total	**475,788**	**100.0%**	**396,604**	**+20.0%**



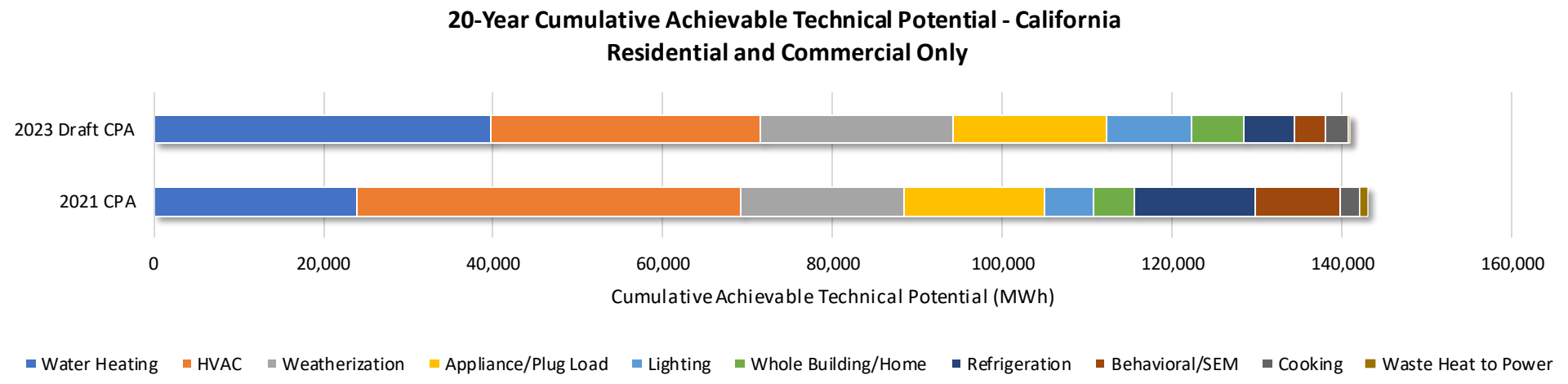
Wyoming – Top Measure Types (Res & Com)

2042 Rank	Measure Type	2023 CPA Draft: 20-Year Cumulative Potential	% of Total	2021 CPA 20 Year Cumulative Potential	% Change
1	HVAC	202,166	26.9%	164,436	+22.9%
2	Lighting	172,034	22.9%	227,160	-24.3%
3	Appliance/Plug Load	95,779	12.7%	59,184	+61.8%
4	Weatherization	92,534	12.3%	99,332	-6.8%
5	Water Heating	70,086	9.3%	51,223	+36.8%
6	Behavioral/SEM	49,329	6.6%	67,027	-26.4%
7	Whole Building/Home	37,114	4.9%	30,262	+22.6%
8	Refrigeration	18,467	2.5%	41,105	-55.1%
9	Cooking	11,088	1.5%	8,526	+30.1%
10	Waste Heat to Power	3,089	0.4%	4,002	-22.8%
	Total	**751,686**	**100.0%**	**752,257**	**-0.1%**



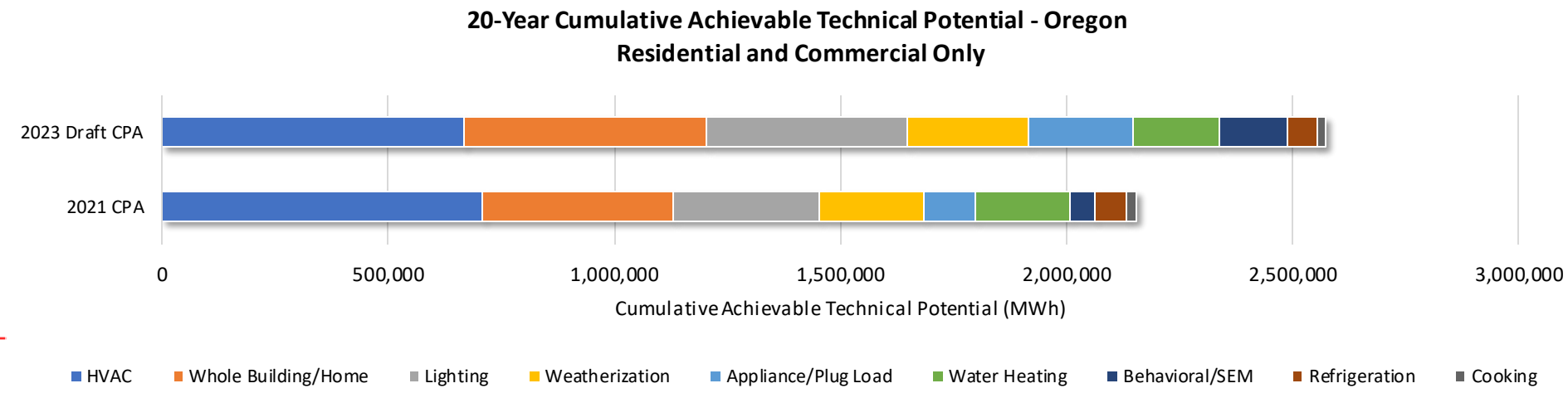
California – Top Measure Types (Res & Com)

2042 Rank	Measure Type	2023 CPA Draft: 20-Year Cumulative Potential	% of Total	2021 CPA 20 Year Cumulative Potential	% Change
1	Water Heating	39,637	28.1%	23,863	+66.1%
2	HVAC	31,814	22.6%	45,281	-29.7%
3	Weatherization	22,765	16.1%	19,172	+18.7%
4	Appliance/Plug Load	18,104	12.8%	16,556	+9.3%
5	Lighting	9,968	7.1%	5,824	+71.2%
6	Whole Building/Home	6,154	4.4%	4,927	+24.9%
7	Refrigeration	5,980	4.2%	14,137	-57.7%
8	Behavioral/SEM	3,656	2.6%	10,047	-63.6%
9	Cooking	2,578	1.8%	2,323	+11.0%
10	Waste Heat to Power	310	0.2%	843	-63.2%
	Total	**140,966**	**100.0%**	**142,974**	**-1.4%**



Oregon - Top Measure Types (Res & Com)

2042 Rank	Measure Type	2023 CPA Draft: 20-Year Cumulative Potential	% of Total	2021 CPA 20 Year Cumulative Potential	% Change
1	HVAC	666,733	25.9%	708,672	-5.9%
2	Whole Building/Home	536,055	20.8%	420,129	+27.6%
3	Lighting	446,702	17.4%	322,881	+38.3%
4	Weatherization	265,342	10.3%	234,190	+13.3%
5	Appliance/Plug Load	233,778	9.1%	112,464	+107.9%
6	Water Heating	190,866	7.4%	209,235	-8.8%
7	Behavioral/SEM	147,858	5.7%	54,868	+169.5%
8	Refrigeration	68,323	2.7%	70,290	-2.8%
9	Cooking	17,691	0.7%	21,132	-16.3%
	Total	**2,573,349**	**100.0%**	**2,153,861**	**+19.5%**



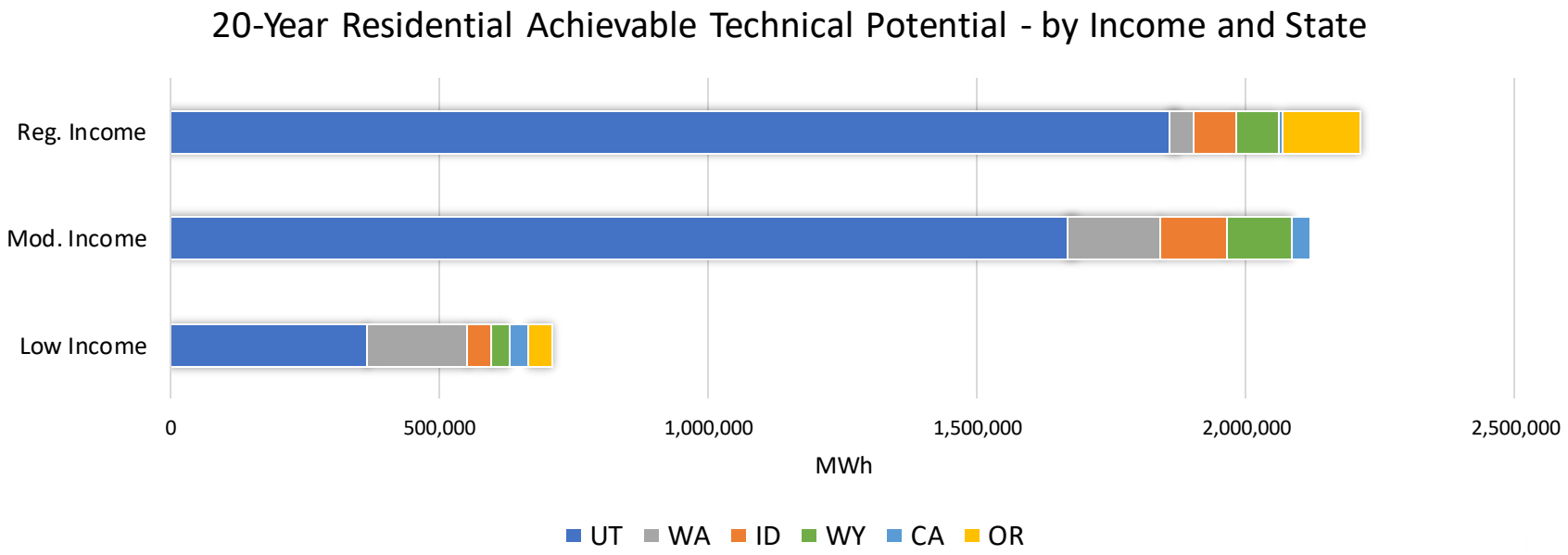
Low-Income Segmentation

- In 2021 CPA, segmented residential low-income customers for Washington
- In 2023 CPA, segmenting residential low-income customers in all states
- Threshold definitions for 2021 (same as Residential Survey year)
  - Three income categories: low, moderate, and regular income
  - Combination of federal poverty guidelines (FPG) and state median income (SMI), depending on LIHEAP annual income and household size levels

Jurisdiction	Threshold Definitions		
	Low-Income:	Moderate-Income: Above LI and Below:	Regular Income:
CA	≤ 60% SMI	≤ 100% SMI	> 100% SMI
ID	≤ 200% FPG		
OR	≤ 200% FPG		
UT	≤ 200% FPG		
WA	≤ minimum of (60% SMI, 200% FPG)		
WY	≤ 60% SMI		

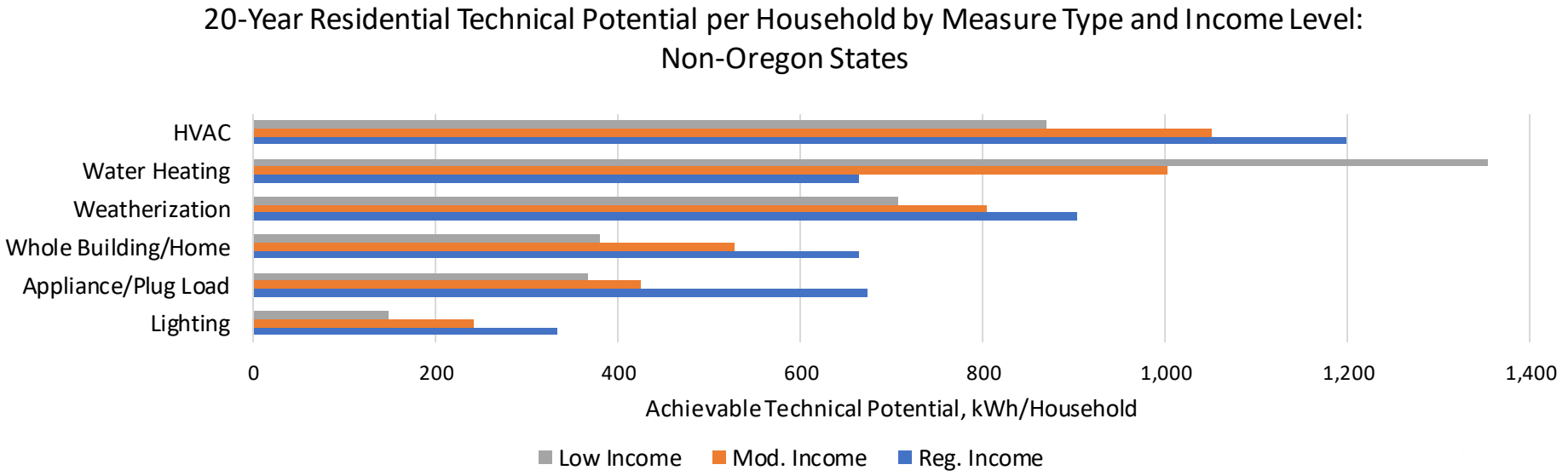
Residential Low-Income Results

- Trends:
  - Income thresholds vary across states and drive some of the potential variation
  - Significant low-income potential in WA relative to regular and moderate income
  - Moderate income potential higher than regular or low in ID and WY



Residential Potential by Income Savings per Household

- Trends:
  - HVAC, lighting more dependent on household size. Larger income = larger size = more load
  - For weatherization, disparity between income levels isn't as large as in HVAC
  - For water heating, dependent on number of occupants per household. Typically, more occupants in low-income homes, resulting in higher low-income water heating potential



Scenario Analysis

- End-use load forecasting model allows for deep insight into EE potential **and** customized scenario analysis around inputs
- In 2023 CPA, PacifiCorp proposes to run a scenario and sensitivity analysis for two distinct energy efficiency scenarios.
  - Climate change already in main load forecast – using Bureau of Reclamation Study
- Proposed High Scenario:
  - More aggressive ramp rates, higher incentive and administrative costs to drive measure take-up.
  - Risky to assume that accelerated measure take-up is only driven by broader policy shifts, C&S, or upstream manufacturer processes
- Possible Low Scenarios:
  - Higher costs based on more recent inflationary estimates
    - Ramp rates would be consistent, higher costs should result in similar achievable technical potential but different LCOEs and bundling in IRP
  - Potential without electrification in load forecast
    - How much of the base case potential is tied to electrification?

Demand Response

Key Changes Relative to the 2021 CPA

Key Similarities

- Program options cover traditional and smart/interactive DLC, energy storage, and third-party curtailment
- Incorporates changes in equipment efficiency and adoption of enabling technology from energy efficiency forecast
- Assesses impacts from sustained and fast events enabled by technology
- Aligns with CTA 2045 water heaters regulations in Washington and Oregon

Key Differences

- Uses a technology-based and program-based approach
  - Allows for separate impacts when appropriate (e.g., electric resistance vs. heat pump water heaters)
  - Weights impacts using EE study saturations while treating as traditional program bundles for shared costs
- Limits grid service assessment to technologies that enable a faster, automated response
- Updates assumptions to reflect the final NWPCC 2021 Power Plan

DR Resources Assessed

Program Category	Program Bundle	Eligible for Fast Event Potential?*	Current Offering
Direct Load Control (Conventional)	Electric Vehicle Connected Charger Direct Load Control (DLC)	X	
	HVAC DLC	X	UT
	Irrigation Load Control	X	UT, ID, Pilot in OR
	Pool Pump DLC	X	
	Domestic Hot Water Heater (DHW) DLC	X	
Direct Load Control (Smart / Interactive)	DLC of Smart Home		
	Grid Interactive Water Heater	X	
	Connected Thermostats DLC		
Energy Storage	Battery Energy Storage DLC	X	UT, Pilot in ID
Curtailment	Third-Party (Fast Event)	X	Underway in UT
	Third-Party (Sustained Event)		Underway in UT

*All program bundles eligible for sustained events, some are eligible for fast events

Resource Options

Consistent with the 2021 CPA, AEG modeled impacts for two types of events. These were defined to reflect PacifiCorp's main use-cases for demand responses.

Fast Events

Represent the impacts that could be achieved over a shorter event period (≤ 1 hour). Notification times are typically 15 minutes or less with a near-instantaneous response.

Sustained Events

Represent the impacts that could be realized over a longer event period (> 1 hour). Notification could be day-ahead, hour ahead, or day-of.

DR Potential Methods

Step 1: Gather program assumptions

Participation Inputs
- Steady-state participation rates
- Years to full ramp
- Program dropout rates
- Event non-performance rates

Impact Inputs
- Per-customer peak reductions (summer and winter kW/%)

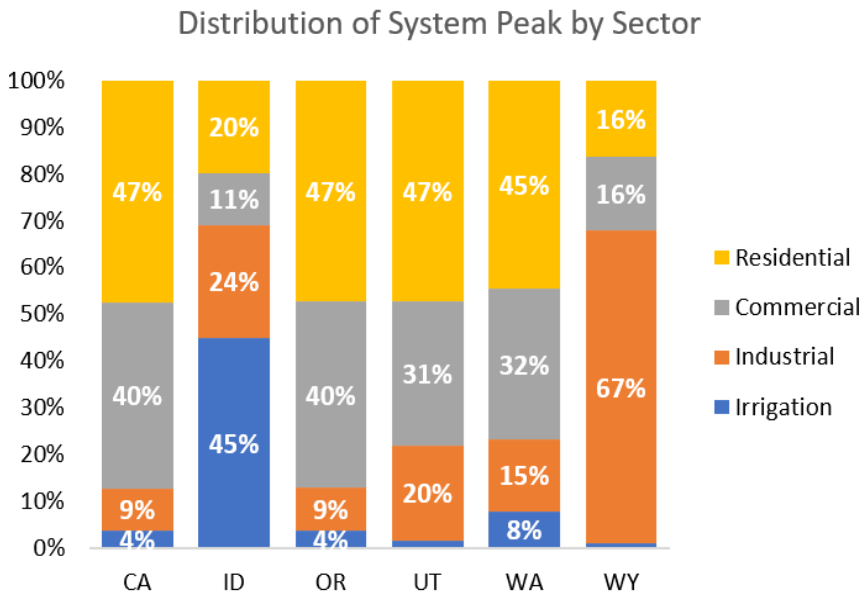
Cost Inputs
- Marketing/Recruitment costs
- Annual O&M costs
- Equipment + installation costs
- Participant incentives
- Administrative costs
- Development costs

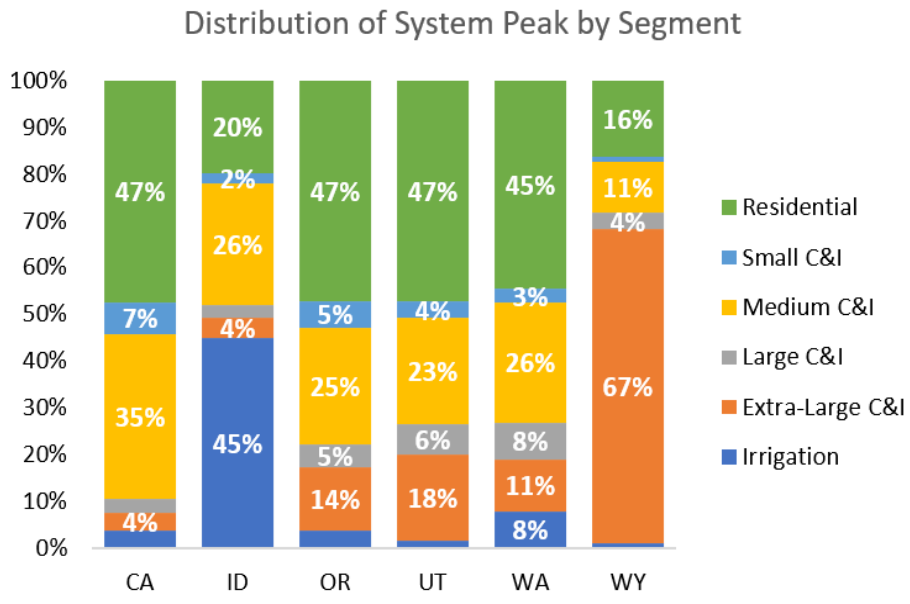
Main Data Sources:
1. Existing program data, when available (UT Cool Keeper, UT Batteries, Irrigation Load Control)
2. Northwest Power Conservation Council's 2021 Power Plan
3. Regional studies (e.g., 2018 BPA CTA-2045 water heater demonstration report)

DR Potential Methods

Step 2: Customer Segmentation and Contribution to System Peak

1. By sector (Residential, Commercial, Industrial, and Irrigation)
   → Using historical peak load data (special contracts excluded).
2. By size bin (C&I only)
   → Using max monthly billed kW for customer on demand rate and demand rate thresholds

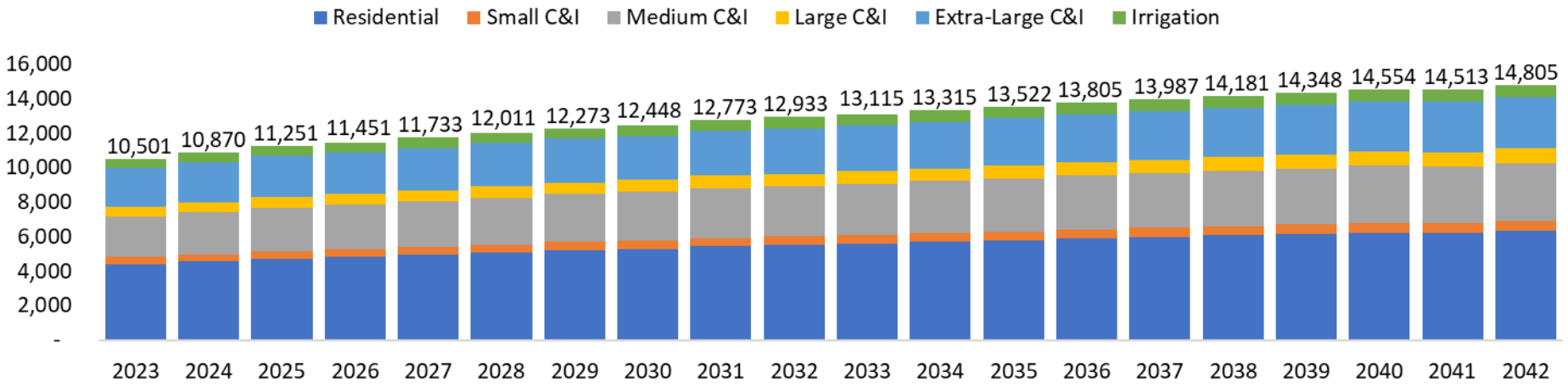




DR Potential Methods

Step 3: Develop Peak Demand Forecast

1. First, distribute PacifiCorp's peak forecast by sector and C&I size bin (shown below)
2. Next, will incorporate increased efficiency from equipment adoption using the realistic achievable technical demand forecast from the energy efficiency study



DR Potential Methods

Step 4: Identify Eligible Customers

Program Option	Eligibility Requirements
Water Heater DLC	Water Heater (ER or HP)
GIWH DLC	Grid-Interactive Water Heater (ER or HP)
Pool Pump DLC	Pool Pump
HVAC DLC	At least one: • Central AC • Air-Source Heat Pump • Geothermal Heat Pump • Electric Furnace • RTU
Third-Party - Fast	Energy Management System
Smart Thermostats	ENERGY STAR Thermostat + at least one of: • Central AC • Air-Source Heat Pump • Geothermal Heat Pump
DLC of Smart Home	Home Energy Management System

*Saturations align with those calculated for the EE study.

DR Potential Methods

Step 5: Establish Program Hierarchy

Lower in Hierarchy = Decreased Eligibility Pool

1. Existing and Planned Resources

- AC Cooling Switches
- Batteries
- Third-Party Contracts
- Irrigation Load Control
- Water Heaters
- Smart Thermostats

2. Firm Resources

- HVAC DLC
- Grid-Interactive Water Heating
- EV DLC
- Pool Pump DLC
- DLC of Smart Home

3. Rates and Behavior-Driven Resources – not part of IRP

- TOU
- CPP
- PTR
- RTP
- BDR

Within tiers, prioritize based on potential or costs.

2023 CPA – Demand Response Draft Potential Results

Interpreting Draft Potential

Caveats

- **Potential is overestimated** - no interaction between competing resources to avoid double counting (e.g., DLC of central AC and controllable thermostats)
- **Potential is cumulative** - Includes modeled impacts of existing PacifiCorp programs, which will be netted out when assessing new resource options within the IRP
- Potential for customer-sited energy storage not included
- Program-specific inputs and some equipment saturations still undergoing review and are subject to change

Notes

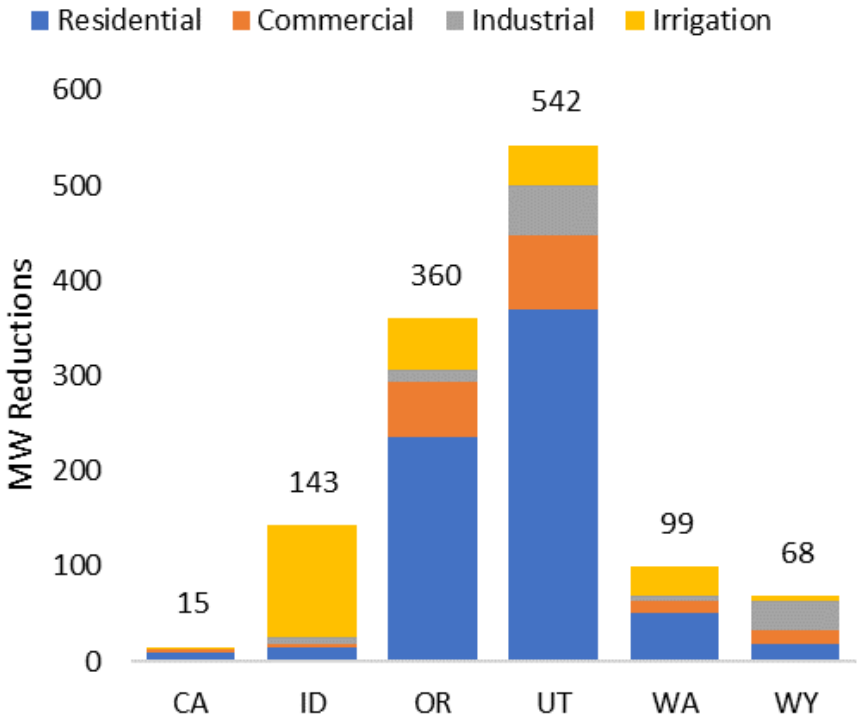
- Results represent the potential in 2042
- Impacts are based on PacifiCorp's summer and winter system peaks and may not align with state, sector, or technology peaks
- Assumes all programs (except existing) available for the model in 2023.
- Impacts associated with fast events in progress and not presented

20-Year Potential Summary - Summer

Forthcoming updates that will affect draft results:

- **Add potential from battery storage** (increase: battery storage contributed >400 MW in 20th year to the 2021 CPA potential)
- **Account for dual-participation in similar programs**, e.g., HVAC DLC and smart thermostats (decrease: will lower the number of eligible customers in subsequent programs)
- **Remove existing and planned resources** (decrease affecting HVAC DLC, irrigation, batteries, water heaters, third-party contracts, and smart thermostats)

Class 1 Sustained Resources in 20th Year (2042)



20-Year Potential Summary - Winter

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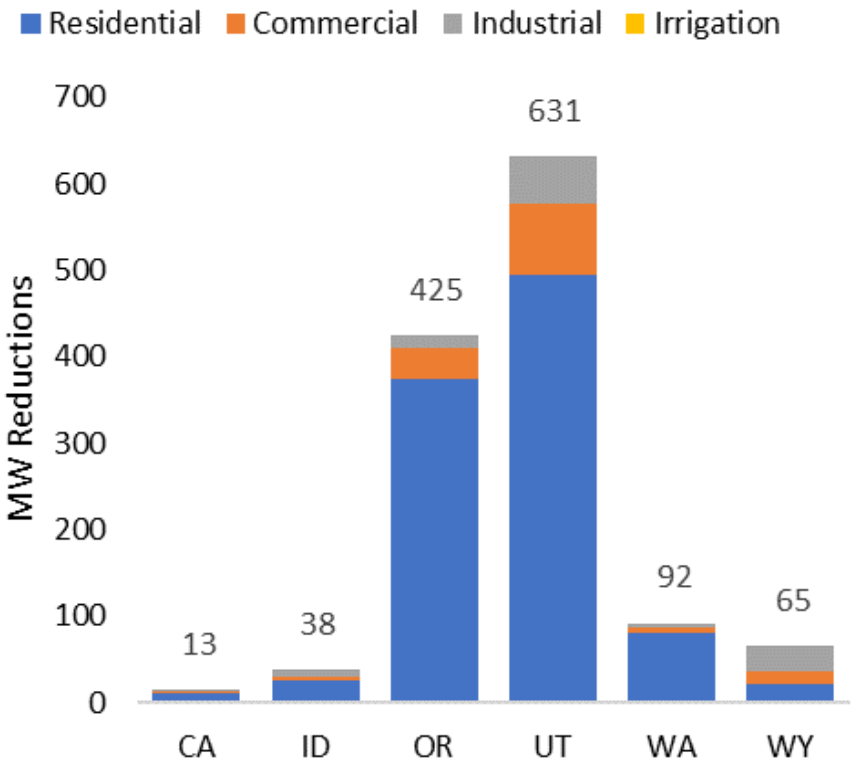
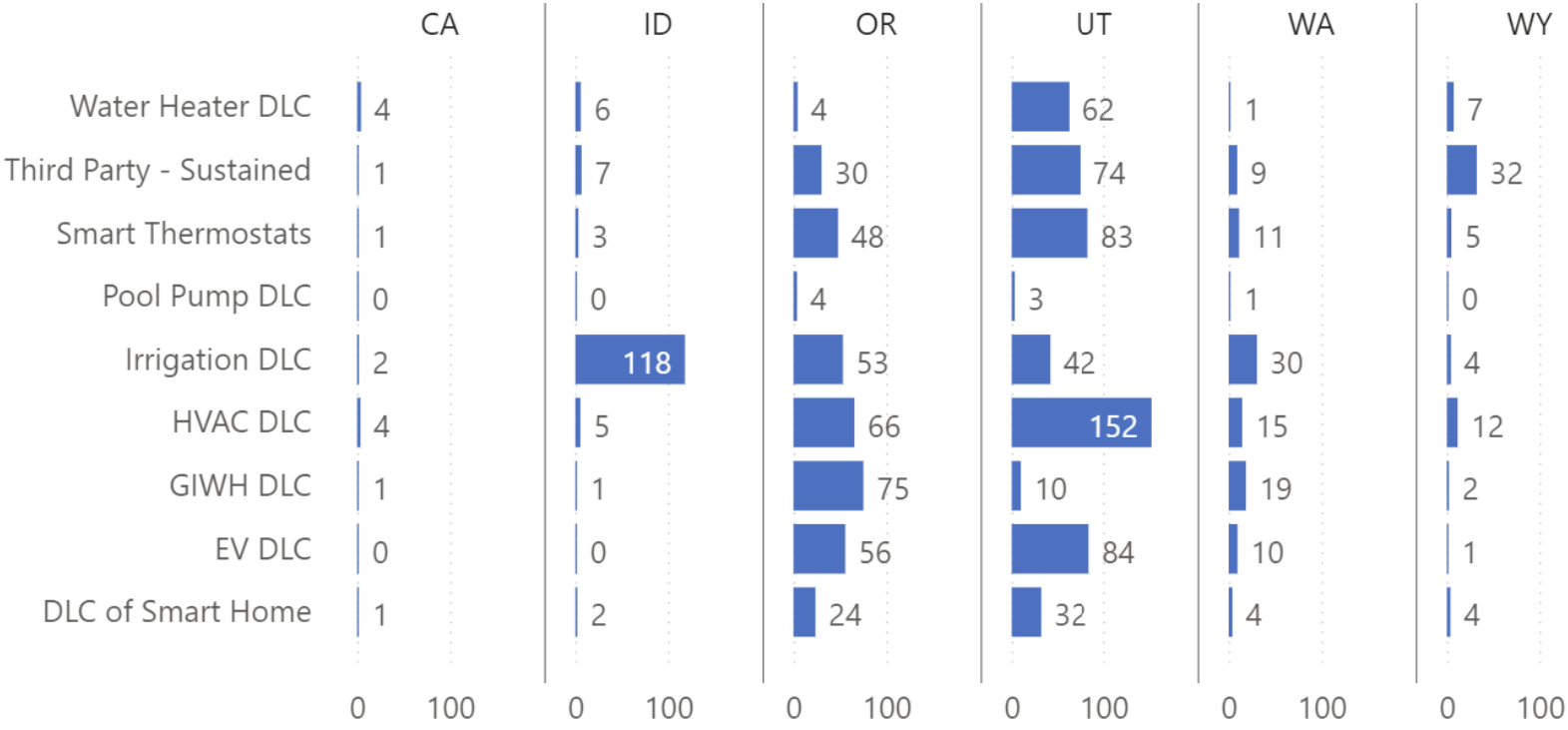


20-Year Potential Summary - Summer

- Some calibration to existing and planned resources required
- Grid-Interactive Water Heaters (GIWH) saturation is conservative in states where there are no current or planned codes for adoption (CA, ID, UT, and WY)

20-Year Summer Potential (MW) by Program Option and State



20-Year Potential Summary - Winter

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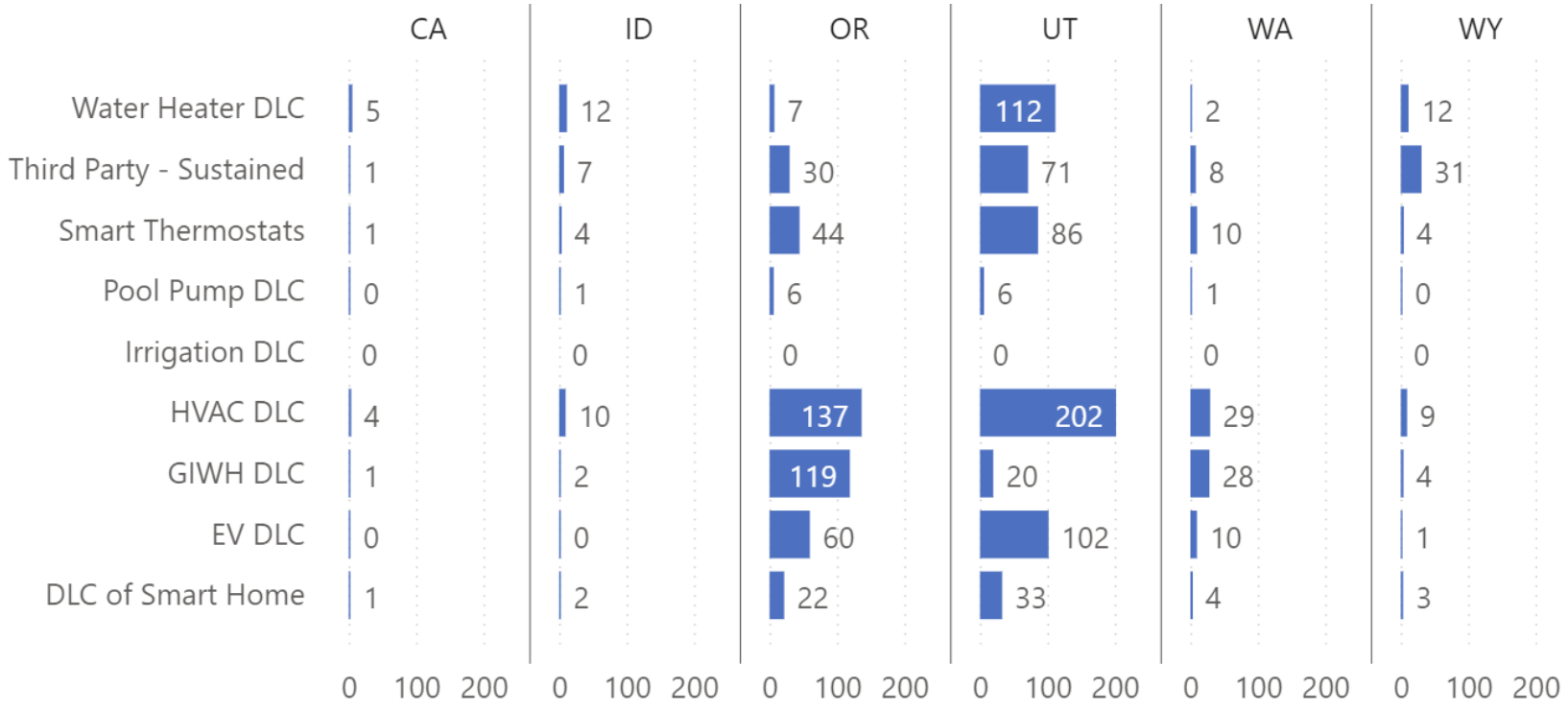
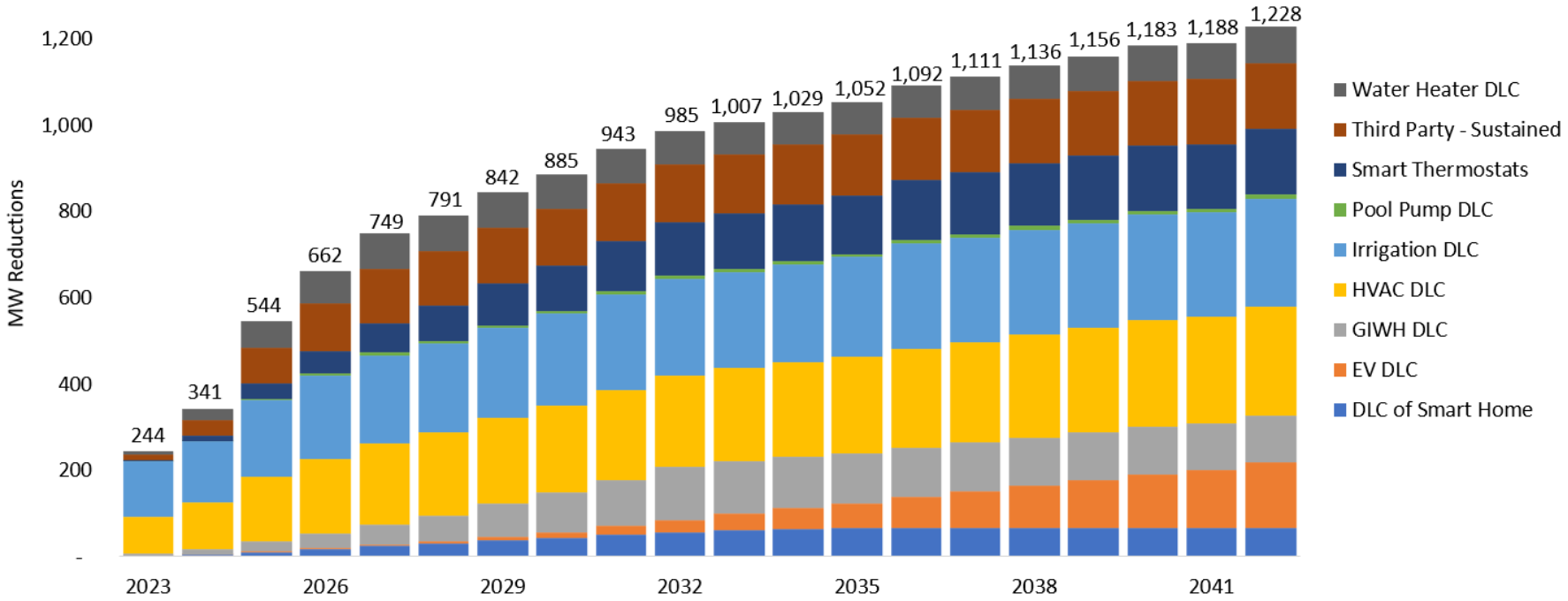
20-Year Winter Potential (MW) by Program Option and State



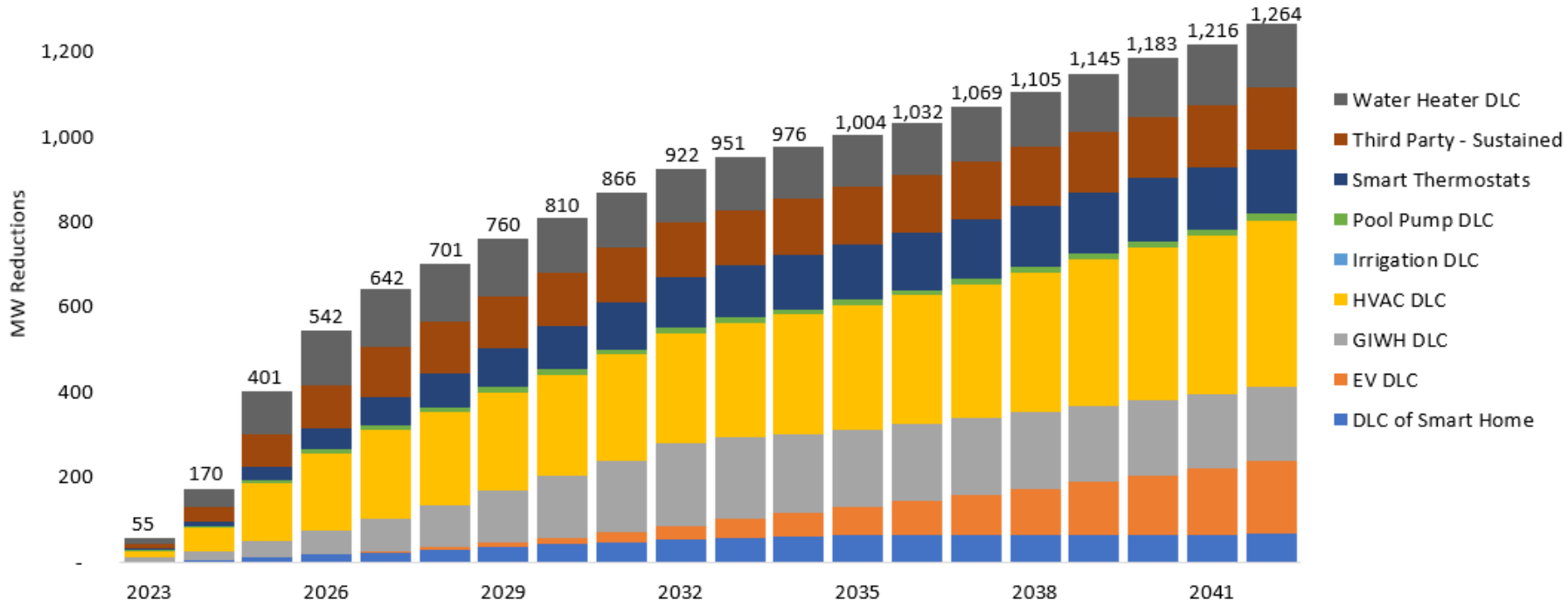
20-Year Potential Summary - Summer

- Large customer growth leading to increased potential over the previous CPA.
- Increased opportunity for water heating DLC through grid-interacted models required in WA and OR
- Potential ranges from ~2% of system summer peak in 2023 to ~8% in 2042



20-Year Potential Summary - Winter

- Winter similar, despite no irrigation potential
- Differences made up by increased water and space heating impacts in winter months
- Potential ranges from ~1% of system winter peak in 2023 to ~8% in 2042



CPA Next Steps

CPA/IRP Analysis

- Finish potential modeling for all states and sectors, develop final supply curves

Presentations

- Final CPA Technical Achievable Potential results in December 2023 IRP Stakeholder Meeting
- Prepare draft report for review by December

Stakeholder Feedback

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Stakeholder Feedback Form Update

- 18 stakeholder feedback forms submitted to date
- Stakeholder feedback forms and responses can be located at:
  pacificorp.com/energy/integrated-resource-plan/comments
- Depending on the type and complexity of the stakeholder feedback, responses may be provided in a variety of ways including, but not limited to, a written response, a follow-up conversation, or incorporation into subsequent public-input meeting material
  - Generally, written responses are provided with the form and posted online at the link mentioned above
- Stakeholder feedback following the previous public input meetings is summarized on the following slides for reference

Summary – Recent Stakeholder Feedback Forms

Stakeholder	Date	Topic	Brief Summary*	Response*
Western Resource Advocates	July 11, 2022	Jim Bridger modeling, energy mix disclosure, GHG reporting, natural gas resources, hydrogen updates.	Reiteration of recommended actions from WRA's comments on the 2021 IRP/ requests for additional resource information.	**Response Posted 8/19/22**
Salt Lake City Corporation	July 14, 2022	Capacity expansion planning	Suggested evaluating wind and solar generation at an hourly rate vs using monthly data.	**Response Posted 7/21/22**
Utah Division of Public Utilities	July 21, 2022	Reiterating DPU positions on natural gas in the 2021 and 2023 IRP process	Outlines stranded cost risks and resource depreciation from conventional natural gas generation and asks to re—evaluate the use of natural gas proxy resources.	**Response Posted 8/19/22**
Utah Clean Energy & SWEEP	July 21, 2022	DSM sensitivities	Asks for PacifiCorp to develop three DSM sensitivities (low, medium, and high)	**Response Posted 8/19/22**

*Full comments and PacifiCorp's responses can be found online at https://www.pacificorp.com/energy/integrated-resource-plan/comments.html

Summary – Recent Stakeholder Feedback Forms

Stakeholder	Date	Topic	Brief Summary*	Response*
Oregon Public Utilities Commission	August 5, 2022	AC/ EV Load Forecast Assumptions	Determining assumptions used on installation of new AC units, conversion rates and how the daily shape of EV charging is modeled.	**Response Posted 8/24/22**
Utah Division of Public Utilities	August 17, 2022	20-year weather pattern/BOR Study	The Reclamation Study may not represent the most accurate climate change scenario in developing the IRP load forecast for Utah.	**Pending Review**
Fervo Energy	August 24, 2022	Supply-side resources	Geothermal is becoming a less cost-prohibitive resource option that has potential to create new jobs.	**Pending Review**

*Full comments and PacifiCorp's responses can be found online at https://www.pacificorp.com/energy/integrated-resource-plan/comments.html

Market Reliance Assessment




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Modeling Assumptions

- At least as restrictive as the 2021 IRP and supported by NERC Summer Assessment

Market Hub/Proxy FOT Product Type	IRP Study Megawatt Limit and Availability (MW)					
	Summer (July)			Winter (December)		
Available over Study Period	2017	2019	2021	2017	2019	2021
Mid-Columbia (Mid-C)						
Flat Annual ("7x24") or Heavy Load Hour ("6X16")	400	400	350	400	400	350
Heavy Load Hour ("6X16")	375	375	150	375	375	0
California Oregon Border (COB)						
Flat Annual ("7x24") or Heavy Load Hour ("6X16")	400	250	0	400	250	250
Nevada Oregon Border (NOB) Heavy Load Hour ("6X16")	100	100	0	100	100	100
Mona Heavy Load Hour ("6X16")	300	300	0	300	300	300
Total	1,575	1,425	500	1,575	1,425	1,000

Market Reliance

- NERC Summer Assessment
  - Energy output from western hydro generators is being affected by drought and below-normal snowpack
  - An active late-summer wildfire season in the Western United States and Canada is anticipated, posing bulk power system (BPS) reliability risks
  - While being identified as having sufficient resources to manage normal summer peak demand, the seasonal risk assessment for WECC jurisdictions remains elevated.
    - Despite heightened vulnerabilities, elevated risk criteria still infers that anticipated reserve margins meet or surpass the reference margin level and present low-capacity deficiency risk under "normal conditions"

- Options
  - ➢ Non-critical market only
  - ➢ Escalating price critical market
  - ➢ Both

Oregon and Washington Update




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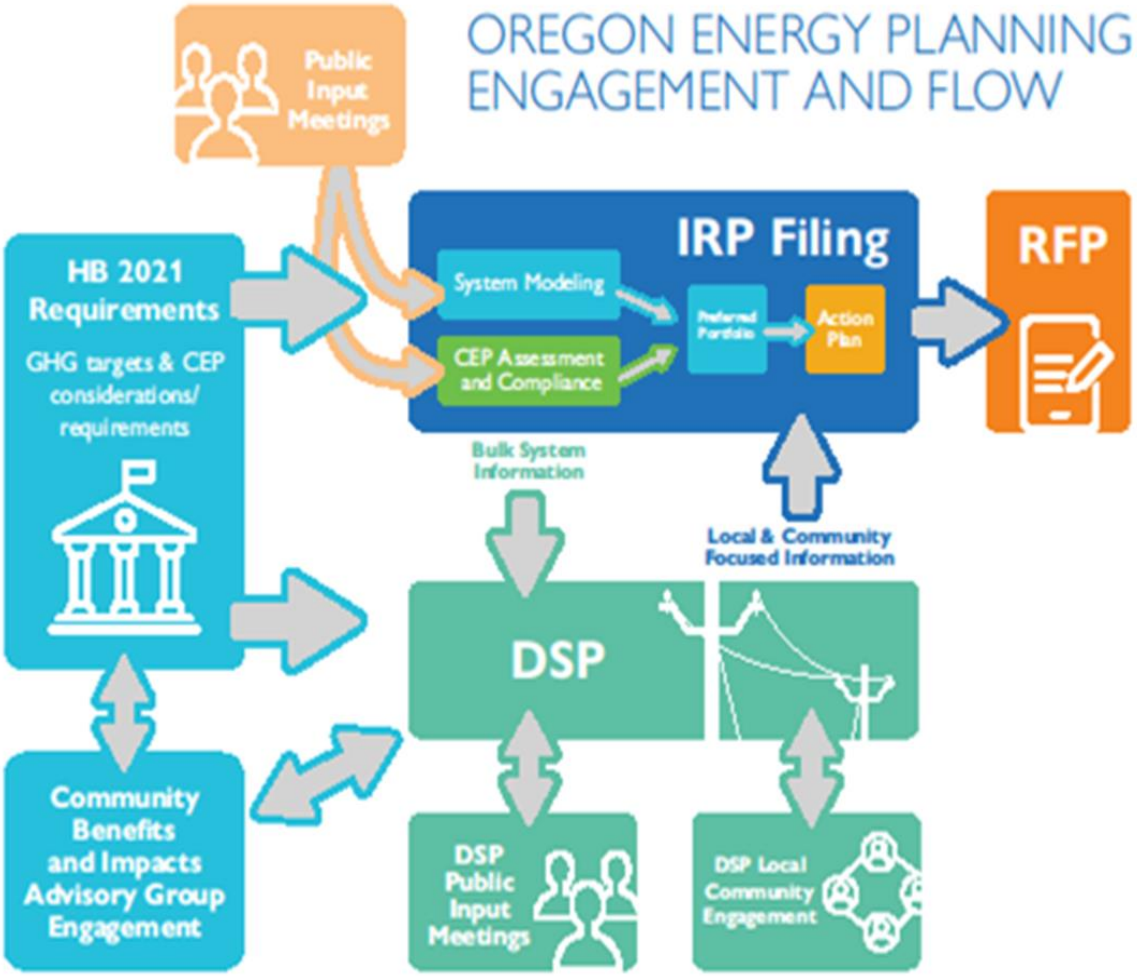
Oregon Clean Energy Plan (CEP)

Oregon Clean Energy Plan Updated Engagement Strategy : Filed August 4, 2022



Washington Clean Energy Implementation Plan (CEIP) Update

- [Slide contents to be updated following the upcoming Washington August 31st CEIP Workshop].

IRP Engagement Upcoming Topics

- Modeling:
  - Reliability assessment
  - Stochastics final
- Portfolio Development
  - Variants
  - Sensitivities
- State allocation methodology and Multi-State process
- Regional Haze Update
- Distributed Resource Planning Update
- Conservation Potential Assessment (final)
- 2022 AS RFP Request for Proposal Update
- State Policy Update
  - Oregon HB 2021
  - Washington Clean Energy Transformation Act
  - Wyoming and Utah (SF159, HB200, & HB411)
- Draft IRP results
- Multi-State Process Update
  - Nodal Pricing Model
  - Extended Day-Ahead Market
- Stakeholder Feedback Updates

Generation Transition
Equity and Justice Workshop

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Transition Interest

- Oregon Order No. 22-178, p. 17
  - 'We direct PacifiCorp to hold at least one workshop on equity and justice issues related to the generation transition in its 2023 IRP, and we will ask members of our Staff with expertise on these issues to participate. We recognize PacifiCorp's relationship to employees and to the communities where its resources are located and encourage the company to explain how consideration of both factor into the planning processes.'

- 2023 IRP resources are yet to be identified. However, we can review our ongoing and current activities and engagement with impacted communities

Ongoing Activity

- **PacifiCorp's overarching role is to facilitate and support engagement with employees and coal plant retirement communities**
- Community action:
  - Long-term and agile outreach strategy to respond to future integrated resource plan outcomes
  - Assigned certified economic developer to identify and share grant opportunities, resources and support community economic diversification plans
- Bring communities and resources together:
  - Coal transition communities, state agencies, trade associations, federal and state resources, local and state elected officials
  - Midwest Governor's Association (MGA) final report/initiative to prepare coal plant communities for generation transition
  - Industrial redevelopment best practices outlined by MGA

Ongoing Activity, continued

- Promotion and Organization of Resources:
  - Coordination with the Interagency Workgroup on Coal Plant and Power Plant Communities and Economic Revitalization
  - Engagement with the Just Transition Fund, providing resources and technical assistance to impacted communities
  - Partnered with Wyoming County Commissioner's Association, and TerraPower, to provide fully-funded access to contracted federal grant writer
  - Coordinated with U.S. Senator Cynthis Lummis's office on development of a database highlighting federal grant availability
  - More than 300 grants identified as eligible in Wyoming
  - Early support included matching grant to fund coal community economic diversification plan. Grant approved for $277,000
  - Provided funds for coal community development of online tools to support economic diversification; the community's new website focuses on business attraction, marketing and workforce

Ongoing Activity, continued

- Employee transition Plan, Engagement and Support
  - Internal transition strike team with broad participation to address concerns, impacts and needs
  - Funding, equipment and technical support for Western Wyoming College's New Powerline Technology Program
  - Created and shared Impacted Employee Reference Guide
  - Working directly with union partners to assist those impacted

- Transition Program
  - Any employee who wants continued employment with the Company is afforded the opportunity
  - Human resources promotes open positions to impacted employees
  - Extended preferential hiring for impacted employees
  - Significant expansion of employee education assistance program
  - Hosting meeting on building resume and interviewing skills
  - Creation of in-house job fairs

Current Actions

- **PacifiCorp continues to engage with employees and coal plant communities that will be impacted by the company's planned energy transition**

- **Recent Activities Include:**
  - Bi-monthly resume and interviewing skills sessions
  - Internal job fair Identifying and sharing economic development grant opportunities and strategies with energy transition communities, elected officials and state agency partners
  - Joined the City of Kemmerer and TerraPower for a 'coal to nuclear' panel hosted by the Energy Communities Alliance
  - Outlined PacifiCorp's coal plant and employee transition plan with Western Governors Association to encourage future regional discussion and strategy
  - Shared and discussed the Midwestern Governors Associations' final recommendations for transitioning communities as a valuable resource
  - Committed funding to the Sweetwater County Economic Development Coalition for new marketing initiative

Offshore Wind Workshop




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Offshore Wind Background

- There has been significant stakeholder interest in offshore wind resources, and the Oregon Commission directed that they be addressed in the 2023 IRP:

Oregon Order No. 22-178, page 15

- Recommendation 17 would require PacifiCorp to conduct a stakeholder process to determine what source the offshore wind cost data in the 2023 IRP will rely on. We adopt this recommendation.

- Recommendation 18 would require PacifiCorp to conduct and publish an analysis that compares the development of offshore wind with the resources associated with the 2023 AS RFP Final Shortlist. We understand that PacifiCorp agreed that some sort of study is reasonable, but we believe study details will be best fleshed out in the RFP process.

- Recommendation 19 seeks to have PacifiCorp engage with PacifiCorp Transmission prior to the 2023 IRP to request a power flow study regarding the addition of offshore wind near Brookings, Oregon. Although we understand that PacifiCorp does not have authority over PacifiCorp Transmission, we observe that transmission information will be necessary to carry out Recommendation 17, which we adopted above. We expect PacifiCorp to engage in the company's local transmission planning process as appropriate and to request that sufficient information to inform consideration of offshore wind.

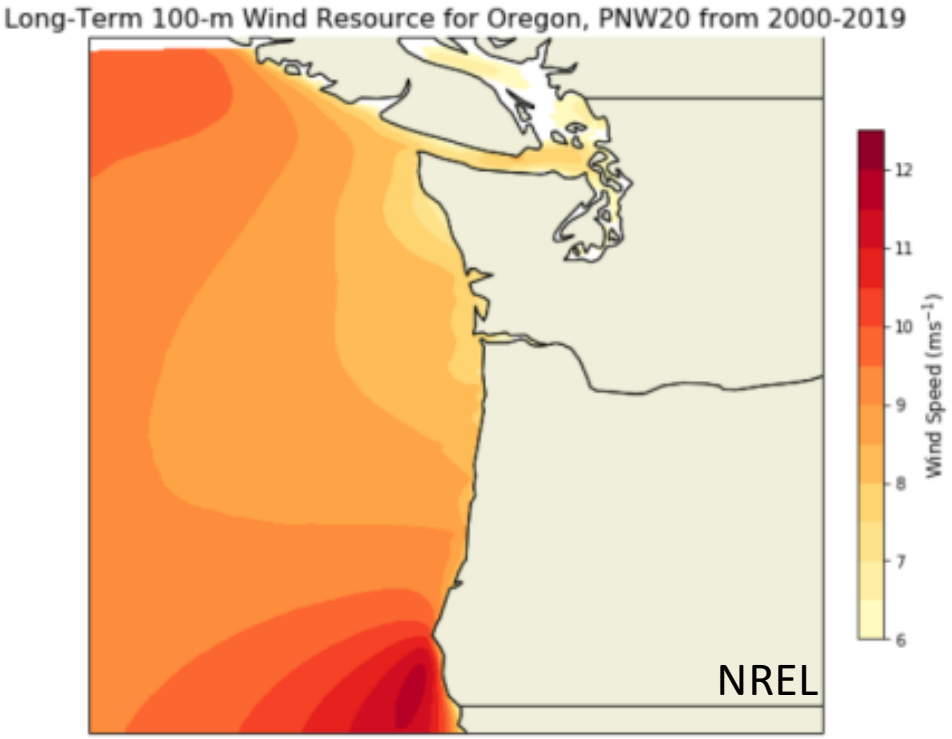
Offshore Wind Background

Oregon Department of Energy (ODOE) is conducting a Floating Offshore Wind Study as directed by HB 3375: www.oregon.gov/energy/energy-oregon/Pages/fosw.aspx

- **Timeline (2022):**
  - January: Literature review posted, kickoff meeting
  - March/April/May: Public meetings (presentations available at link above)
  - July: Draft findings
  - September 15th: Submit report to legislature

Offshore Wind Background

- Oregon has significant offshore wind potential, with highest availability in southern Oregon.
  www.nrel.gov/docs/fy22osti/81244.pdf



Offshore Wind Background

- Deepwater siting/leasing is managed by the Bureau of Ocean Energy Management ("BOEM", part of U.S. Dept. of Interior)
- Two call areas under active consideration for leasing:
  - 12 miles offshore of Coos Bay and Brookings.
  - Estimated 14 GW potential wind capacity
  - Depth approx. 400-1100 ft., so this will need to be floating offshore wind.

ODOE Key Benefits

www.oregon.gov/energy/energy-oregon/Documents/2022-07-FOSW-Key-Findings.pdf

Key Benefits (released in July)

- Immense potential size
- Grid diversity value: available in evenings, nights, winter months
- Economic development
- Power system reliability: closer to load, east of Cascades
- Local energy resilience
- Balance land use impacts from onshore resource development

ODOE Key Challenges

www.oregon.gov/energy/energy-oregon/Documents/2022-07-FOSW-Key-Findings.pdf

- **Key Challenges (released in July)**
  - Siting and permitting
  - Technology
  - Port infrastructure
  - Transmission infrastructure
  - Investment magnitude requires a consortium of buyers

➢ Collaboration can optimize scale, location, cost, risks and impacts.

Offshore Wind Transmission Options

- Two transmission interconnection options for Southern Oregon allow offshore wind:

  Incremental Transmission 1 GW: $947m

  - Reinforces Southern Oregon, and allows 1000 MW transfer to Central Oregon
  - Coos Bay - Dixonville - Chiloquin North (Whispering Pines) – Ponderosa
  - ~250 miles of new 500 kV transmission lines, plus transformers and reinforcement

  Incremental Transmission 3.5 GW: $1,115m

  - All of the above, plus additional reinforcement in Southern Oregon.
  - Allows 3500 MW transfer to Central Oregon
- Both options are available starting 12/31/2032.

Supply-Side Resource Table

Wind & Wind + Energy Storage

Description	Resource Characteristics				Costs			
Resource	Elevation (AFSL)	Net Capacity (MW)	Commercial Operation Year	Design Life (yrs)	Base Capital ($/kW)	Var O&M ($/MWh)	Fixed O&M ($/kW-yr)	Demolition Cost ($/kW)
Pocatello, ID, 20 MW, CF: 37.1%	4,500	20	2026	30	2,167	0.00	43.00	59.46
Pocatello, ID, 200 MW, CF: 37.1%	4,500	200	2026	30	1,602	0.00	43.00	59.46
Arlington, OR, 20 MW, CF: 37.1%	1,500	20	2026	30	2,155	0.00	43.00	59.46
Arlington, OR, 200 MW, CF: 37.1%	1,500	200	2026	30	1,573	0.00	43.00	59.46
Monticello, UT, 20 MW, CF: 29.5%	4,500	20	2026	30	2,192	0.00	43.00	59.46
Monticello, UT, 200 MW, CF: 29.5%	4,500	200	2026	30	1,632	0.00	43.00	59.46
Medicine Bow, WY, 20 MW, CF: 43.6%	6,500	20	2026	30	2,135	0.00	43.00	59.46
Medicine Bow, WY, 200 MW, CF: 43.6%	6,500	200	2026	30	1,573	0.00	43.00	59.46
Goldendale, WA, 20 MW, CF: 37.1%	1,500	20	2026	30	2,280	0.00	43.00	59.46
Goldendale, WA, 200 MW, CF: 37.1%	1,500	200	2026	30	1,660	0.00	43.00	59.46
Offshore, Northern, CA, CF: 45.0%	0	200	2028	30	5,229	0.00	103.00	158.23
Pocatello, ID, 200 MW, CF: 37.1% + BESS: 100% pwr, 4 hours	4,500	200	2026	30	3,353	0.00	85.32	83.46
Arlington, OR, 200 MW, CF: 37.1% + BESS: 100% pwr, 4 hours	1,500	200	2026	30	3,227	0.00	85.32	83.46
Monticello, UT, 200 MW, CF: 29.5% + BESS: 100% pwr, 4 hours	4,500	200	2026	30	3,395	0.00	85.32	83.46
Medicine Bow, WY, 200 MW, CF: 43.6% + BESS: 100% pwr, 4 hours	6,500	200	2026	30	3,314	0.00	85.32	83.46
Goldendale, WA, 200 MW, CF: 37.1% + BESS: 100% pwr, 4 hours	1,500	200	2026	30	3,454	0.00	85.32	83.46
Offshore, Northern, CA, CF: 45.0% + BESS: 100% pwr, 4 hours	0	200	2028	30	7,383	0.00	145.32	182.23

Offshore Wind Modeling

- Offshore wind can be selected to use capacity from the two transmission upgrades previously identified.
  - There is no minimum offshore wind capacity
  - Maximum 3.5 GW, consistent with transmission.
- Other proxy resources can also use this capacity.
- Offshore wind competes with other options:
  - Transmission projects
  - Other supply side resources in Southern and Central Oregon
  - No guarantee offshore wind will be selected
- If offshore wind is not selected, an assessment of its economics will be performed.

Hydro Forecast Under Climate Change

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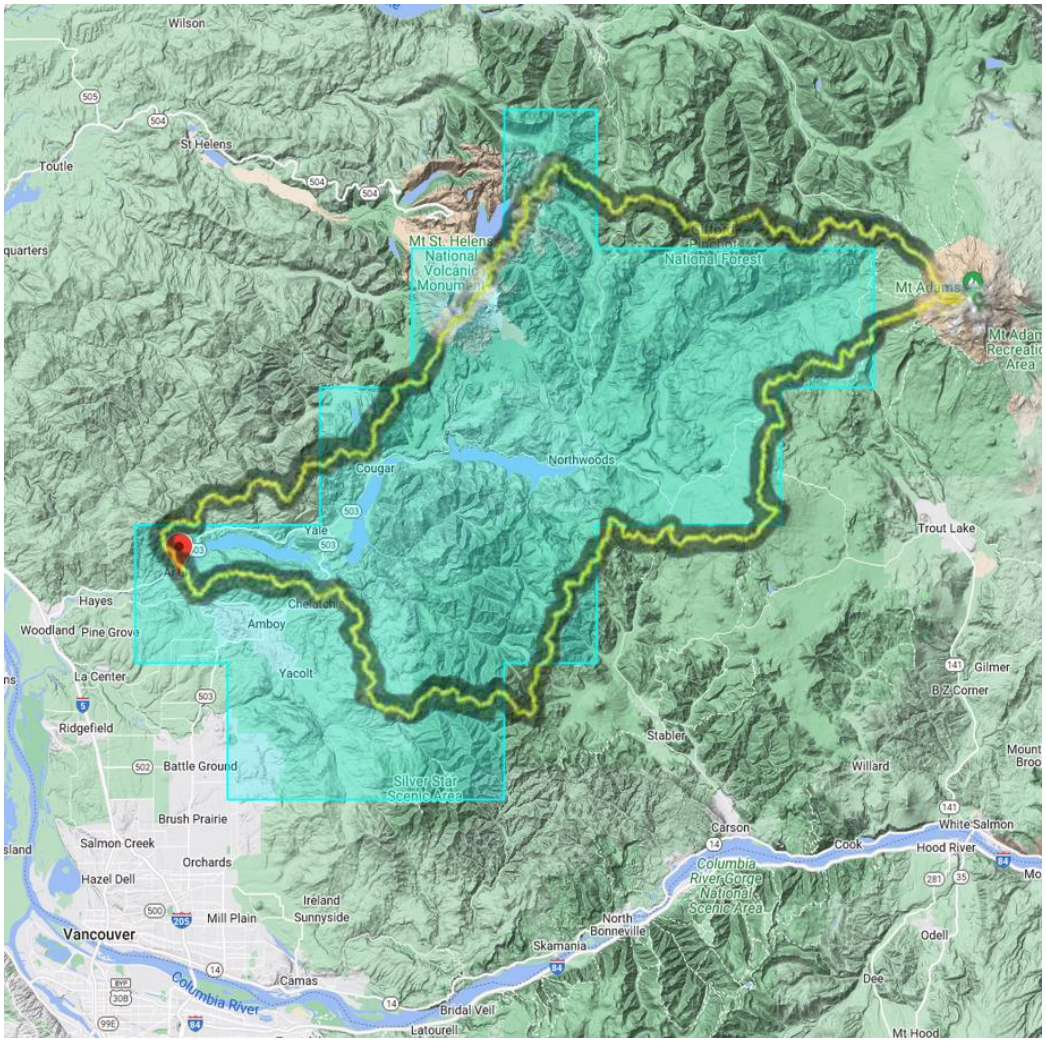
Downscaled Climate and Hydrology Projections

- Projection Set
  - Downscaling Method: BCSD (Bias Correction Spatial Disaggregation)
  - Data Set: CMIP5 Hydrology Monthly
- Spatial Resolution
  - 1/8 Degree
  - Catchment (watershed) defined by control point and topography
- Target Variable
  - Total Runoff (mm/month)
  - Unit Conversion: mm/month to 1,000 acre-ft/month (kAF/month)
- Available online at:
  - https://gdo-dcp.ucllnl.org/downscaled_cmip_projections/
- For background:
  - https://gdo-dcp.ucllnl.org/downscaled_cmip_projections/techmemo/LOCA_BCSD_hydrology_tech_memo.pdf

Lewis Catchment

- Control Point Coordinate
  (45.9518, -122.5652)
- Catchment Area
  - CMIP 629,356 acre (green grids)
  - USGS 468,501 acre (yellow line)
- Conversion
  - Conversion Factor = 1.537



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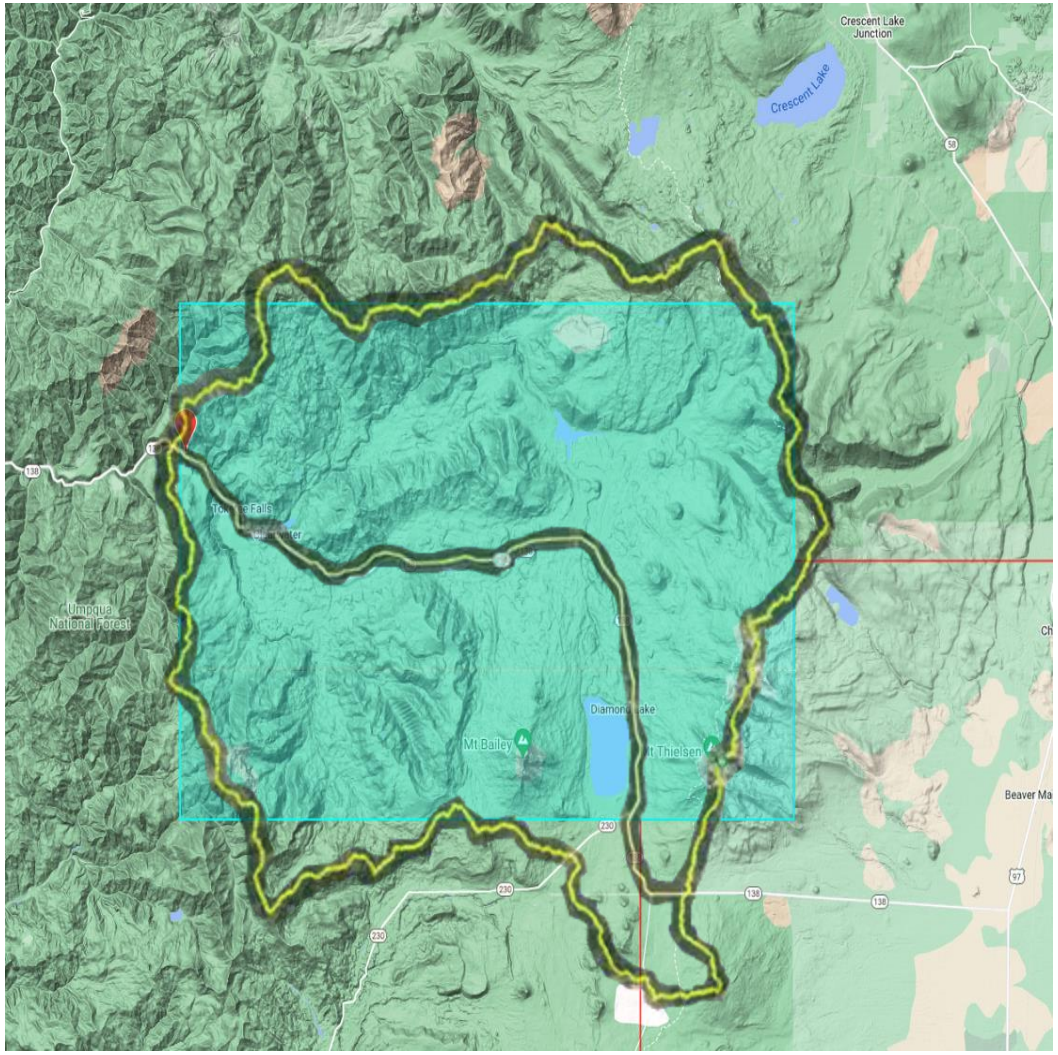
N Umpqua Catchment

- Control Point Coordinate
  (43.3028, -122.4952)
- Catchment Area
  - CMIP 278,122 acre (green grids)
  - USGS 278,400 acre (yellow line)
- Conversion
  - Conversion Factor = 0.913



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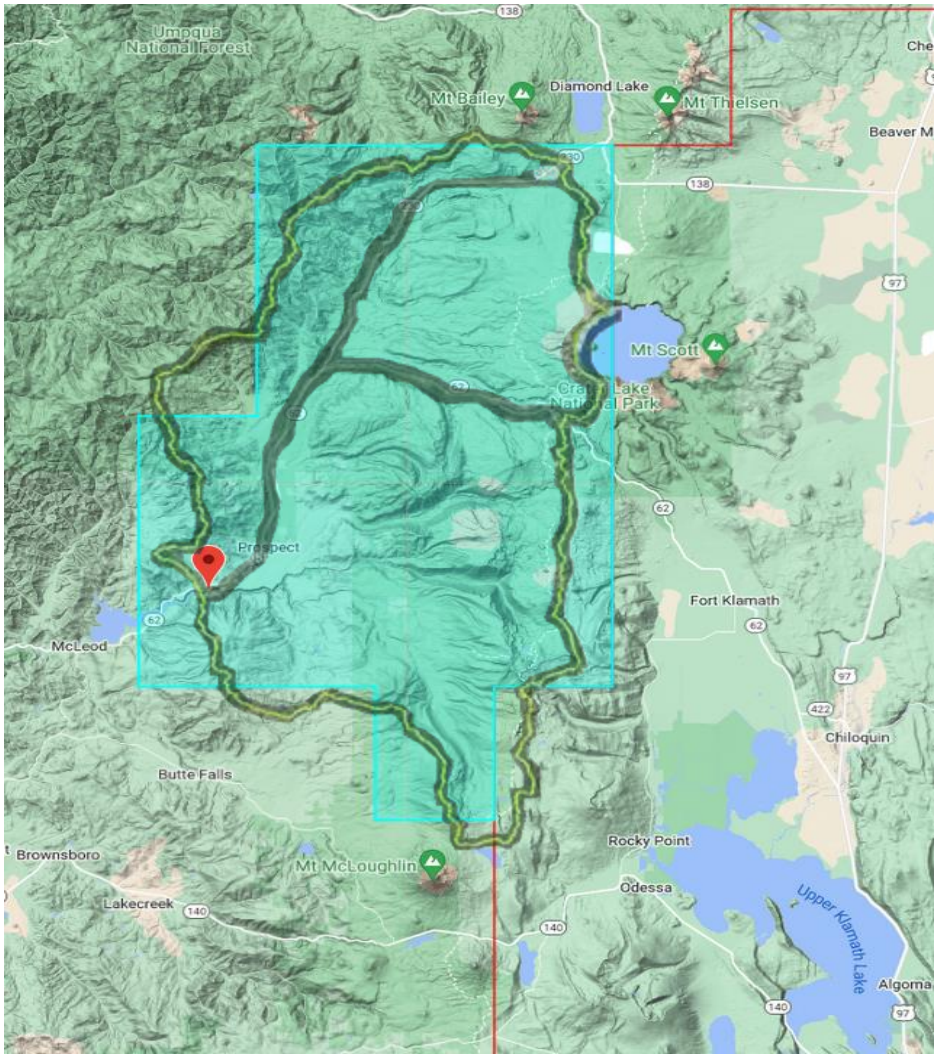
Prospect (Rogue) Catchment

- Control Point Coordinate

  (42.7127, -122.5509)

- Catchment Area
  - CMIP 525,088 acre (green grids)
  - USGS 410,240 acre (yellow line)
- Conversion
  - Conversion Factor = 1.346



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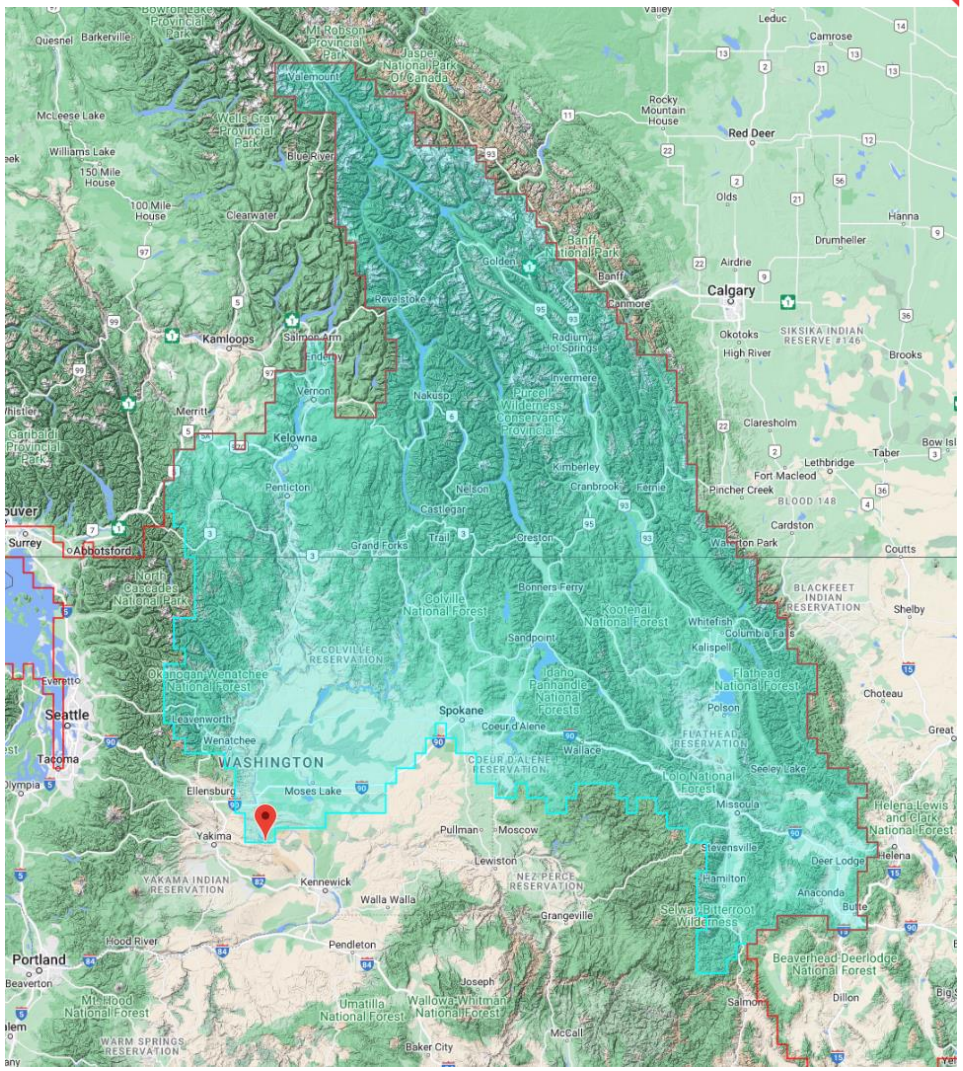
Mid-C Catchment

- Control Point Coordinate

  (46.6279, -119.8654)

- Catchment Area
  - CMIP 23,722,117 acre (green grids)
  - USGS NA
- Conversion
  - Conversion Factor = 77.81



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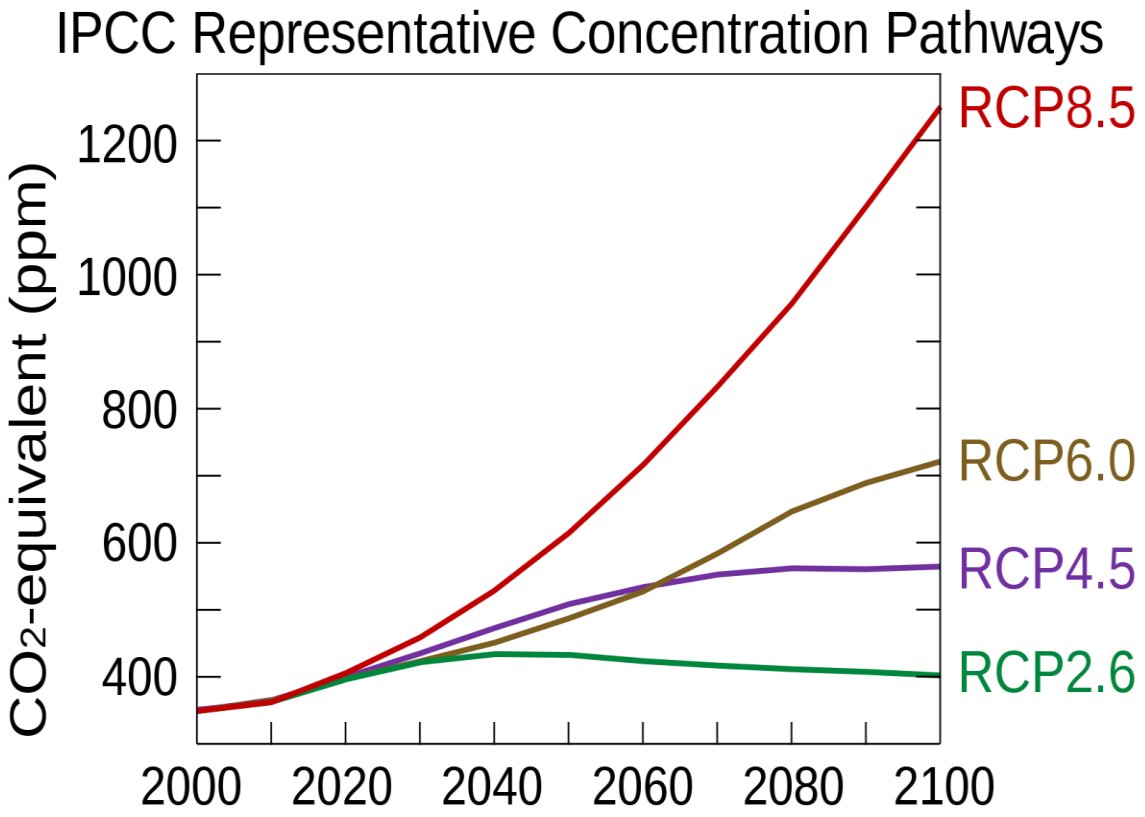
Emission Scenarios & Climate Models

- RCP (Resident Concentration Pathway)
  - RCP 2.6
  - RCP 4.5
  - RCP 6.0
  - RCP 8.5
- Models
  - bcc-csm1-1.1
  - canesm2.1
  - ccsm4.1
  - cesm1-cam5.1



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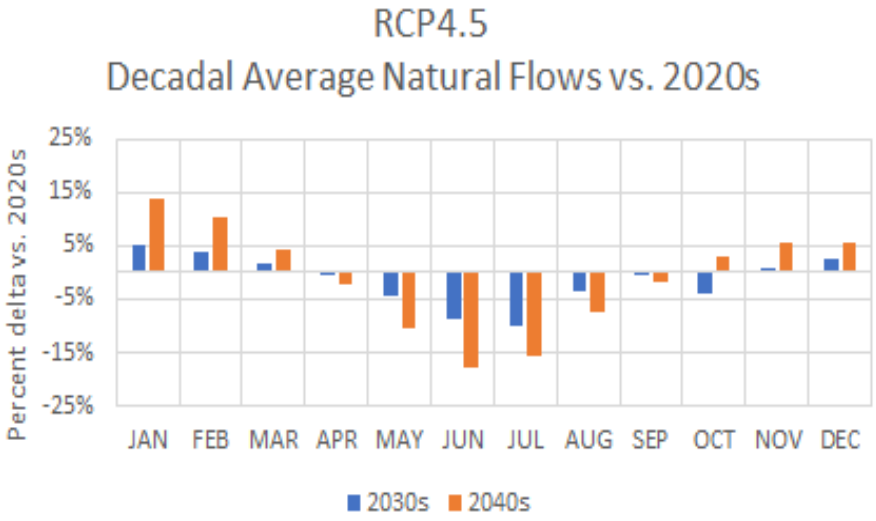
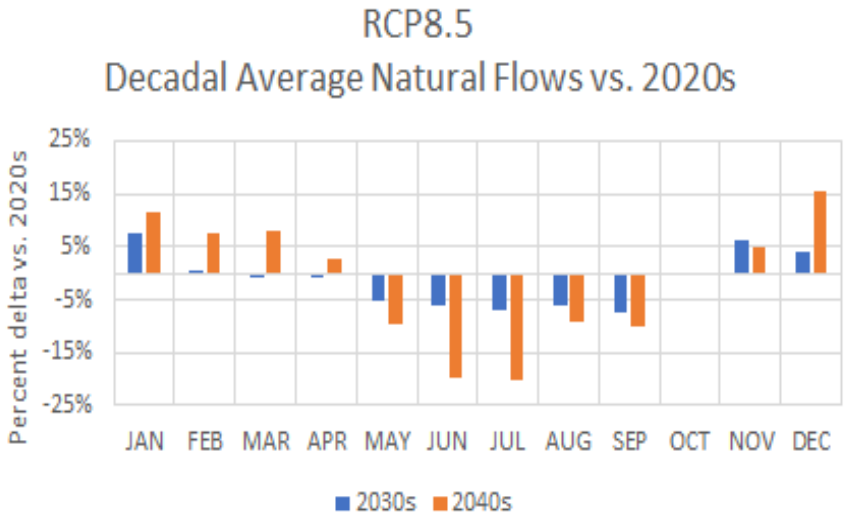
Natural Flows and Climate Change

- How might natural flows in 2030s or 2040s differ vs. 2020s?
- RCP 4.5 and RCP 8.5
- Comparison of flows as derived from climate models for 2020s vs. 2030s vs. 2040s
  - Apples-to-apples comparison
  - Projected trends

Lewis River

- Swift 1 → 240 MW nameplate
- Yale → 134 MW nameplate
- Merwin → 136 MW nameplate
- Annual production under IRP planning flows → 1.7 million MWh





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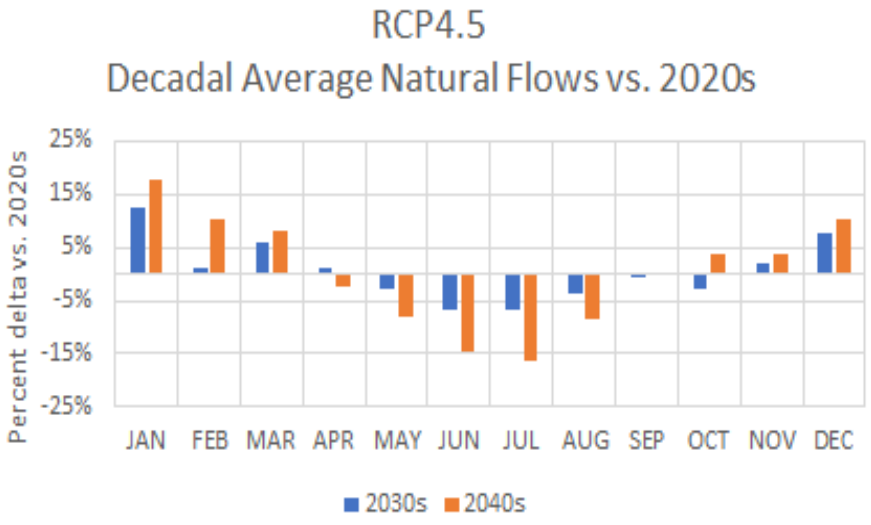
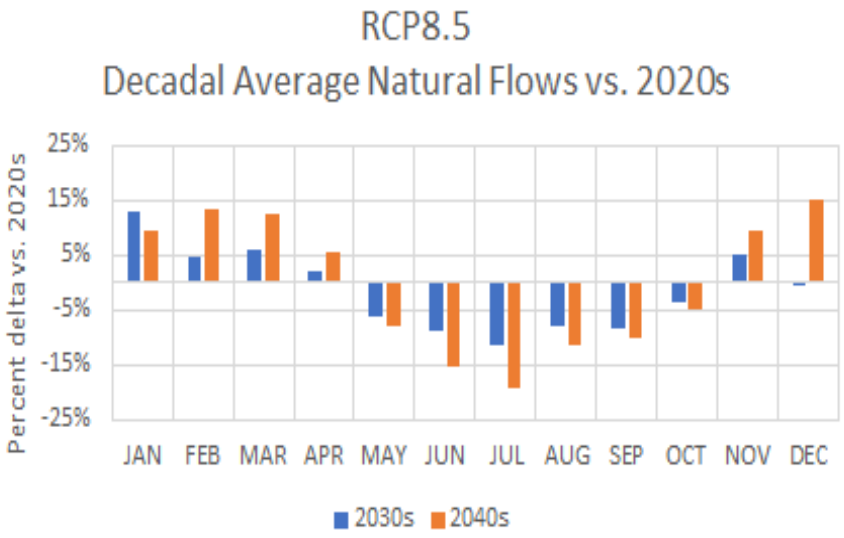
North Umpqua River

- 194 MW nameplate spread over eight hydroelectric developments
- Annual production under IRP planning flows → 800 GWh





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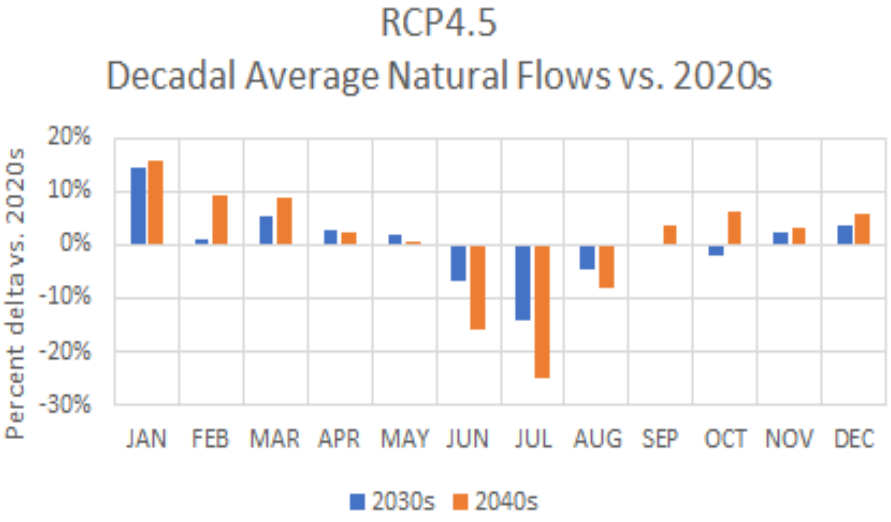
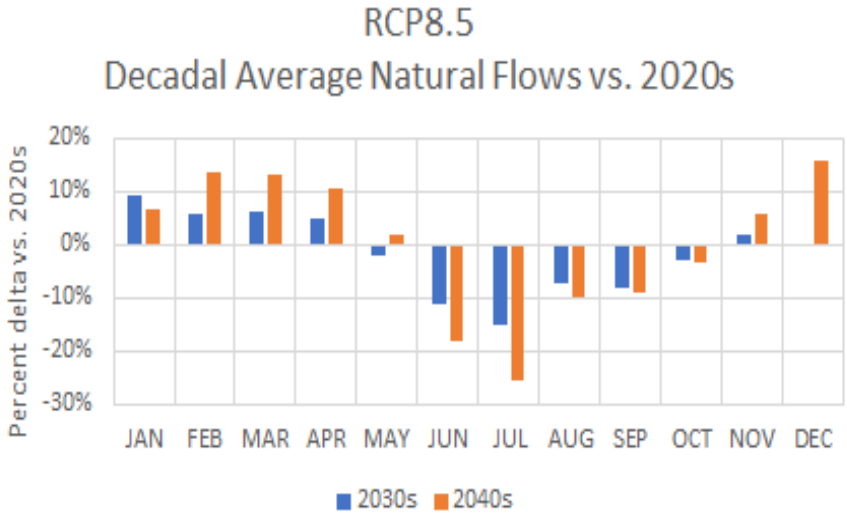
Prospect (Rogue River)

- 52 MW nameplate spread over five hydroelectric developments
- Annual production under IRP planning flows → 300 GWh





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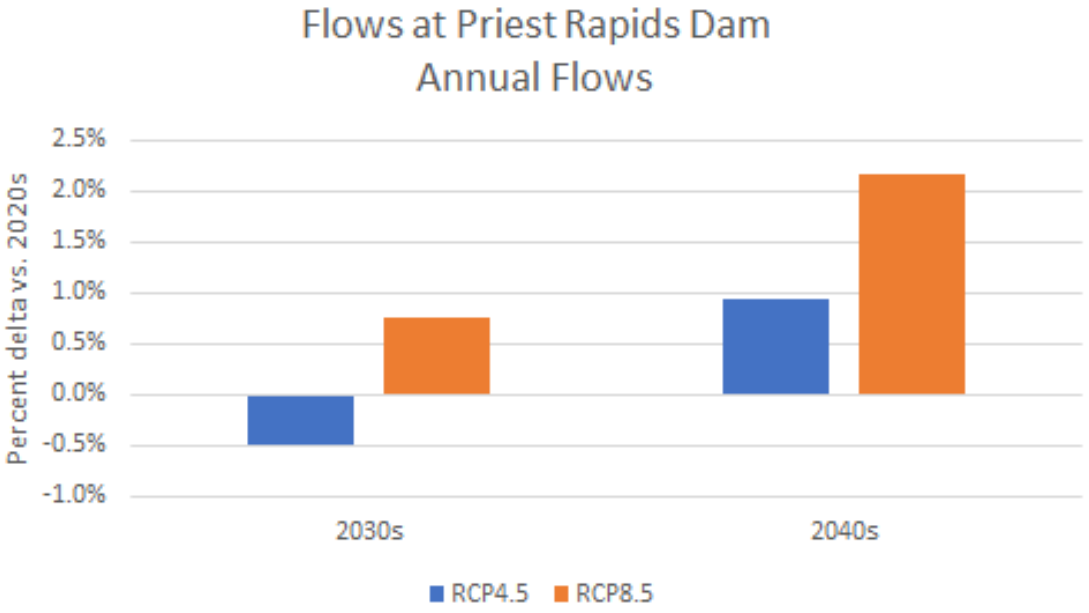
Mid-Columbia Contracts (Priest Rapids Project)

- Hydroelectric developments at Wanapum and Priest Rapids Dams in Mid-Columbia reach
- Energy/capacity purchased under contract from Grant PUD
- Natural flows modified by substantial upstream seasonal reservoir storage (e.g., storage above Grand Coulee Dam)
- Projections for annual volumes



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Decadal Average Annual Natural Flows vs. 2020s

		2030s	2040s
Lewis	**RCP4.5**	99.6%	100.5%
	RCP8.5	99.9%	101.8%
N Umpqua	**RCP4.5**	100.2%	98.6%
	RCP8.5	98.9%	100.0%
Rogue	**RCP4.5**	100.0%	98.7%
	RCP8.5	98.4%	100.3%
Mid-C	**RCP4.5**	99.5%	100.9%
	RCP8.5	100.8%	102.2%

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Climate Change Impacts on Hydroelectric Production

- Winter flows increase
- Summer flows decrease
- Annual flow volumes lack pronounced trends
- PacifiCorp water management practices in reservoir systems with seasonal storage may mitigate trends in natural flow patterns, particularly Lewis River

Wrap-Up/Additional Information




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Additional Information

- 2023 IRP Upcoming Public Input Meetings:
  - October 13-14, 2022 (Thursday-Friday)
  - December 1-2, 2022 (Thursday-Friday)
- Public Input Meeting and Workshop Presentation and Materials:
  - pacificorp.com/energy/integrated-resource-plan/public-input-process
- 2023 IRP Stakeholder Feedback Forms:
  - pacificorp.com/energy/integrated-resource-plan/comments
- IRP Email / Distribution List Contact Information:
  - IRP@PacifiCorp.com
- IRP Support and Studies:
  - pacificorp.com/energy/integrated-resource-plan/support