2023 Electric Integrated Resource Plan

Technical Advisory Committee Meeting No. 1 Agenda

Wednesday, December 8, 2021
Virtual Meeting

Topic	Time	Staff
Introductions	9:00	John Lyons
2021 Action Item Review	9:10	John Lyons
Summer 2021 Heat Event	9:45	
Resource Adequacy		James Gall
Feeder Outages		David Thompson
NW Power Pool Resource Adequacy Program	10:45	Scott Kinney
Lunch	11:30	
Resource Adequacy Program Impact to IRP	12:30	Michael Brutocao
IRP Resource Adequacy/Resiliency Planning	1:00	James Gall
Break	1:45	
TAC Survey Results & Discussion	2:00	Lori Hermanson
Washington State Customer Benefit Indicators	2:45	Annette Brandon James Gall
2023 Draft IRP Workplan	3:15	John Lyons
Adjourn	3:30	

Microsoft Teams meeting
Join on your computer or mobile app: Click here to join the meeting
Or call in (audio only): +1 509-931-1514,,643047233# United States, Spokane
Phone Conference ID: 643 047 233#

2023 IRP Introduction

2023 Avista Electric IRP

TAC 1 – December 8, 2021

John Lyons, Ph.D. Senior Resource Policy Analyst

Meeting Guidelines

- IRP team is still working remotely and is available by email and phone for questions and comments
- Stakeholder feedback form
  - Responses shared with TAC at meetings, by email and in Appendix
  - Would a form and/or section on the web site be helpful?
- Other IRP data posted to web site – will set up better descriptions and navigation this time due to the amount of data shared
- Virtual IRP meetings on Microsoft Teams until back in the office and able to hold large group meetings again
- TAC presentations and meeting notes posted on IRP page

Virtual TAC Meeting Reminders

- Please mute mics unless speaking or asking a question
- Raise hand or use the chat box for questions or comments
- Respect the pause
- Please try not to speak over the presenter or a speaker
- Please state your name before commenting for the note taker
- This is a public advisory meeting – presentations and comments will be documented and may be recorded if the tech cooperates

Integrated Resource Planning

The Integrated Resource Plan (IRP):

- Required by Idaho and Washington* every other year
  - Washington now requires IRP every four years and update at two years
- Guides resource strategy over the next twenty + years
- Current and projected load & resource position
- Resource strategies under different future policies
  - Generation resource choices
  - Conservation / demand response
  - Transmission and distribution integration
  - Avoided costs
- Market and portfolio scenarios for uncertain future events and issues

Technical Advisory Committee

- The public process piece of the IRP – input on what to study, how to study, and review of assumptions and results
- Wide range of participants involved in all or parts of the process
  - Ask questions
  - Always looking for help with soliciting new TAC members
- Open forum while balancing need to get through topics
- Welcome requests for studies or different assumptions.
- Available by email or phone for questions or comments between meetings
- Do TAC members want a calendar invite for the meetings?

Today's TAC Agenda

9:00 – Introductions, Lyons

9:10 – 2021 Action Item Review, Lyons

9:45 – Summer 2021 Heat Event, Gall and Thompson

10:45 – NW Power Pool Resource Adequacy Program, Kinney

11:30 – Lunch

12:30 – Resource Adequacy Program Impact to IRP, Brutocao

1:00 – IRP Resource Adequacy/Resiliency Planning, Gall

1:45 – Break

2:00 – TAC Survey Results and Discussion, Hermanson

2:15 – Washington State Customer Benefit Indicators, Brandon and Gall

3:00 – 2023 IRP Draft Work Plan

3:30 – Adjourn

2021 IRP Action Item Review

2023 Avista Electric IRP

TAC 1, December 8, 2021 – TAC 1

John Lyons, Ph.D. – Senior Resource Policy Analyst

2021 IRP Action Item Review

- Investigate and potentially hire a consultant to develop both a hydro and load forecast to include a shift in climate in the Inland Northwest. This analysis would include a range in new hydro conditions and temperatures so the Company can utilize the new forecast for resource adequacy planning and baseline planning.
  - **Avista is internally studying temperature and precipitation trends at Natural Resources Conservation Service (NRCS) Snow Telemetry (SNOTEL) sites.**
  - **Studying when snowpack peaks, experiences total melt out, and whether the total amount of snow is increasing or decreasing at various locations during specific months.**
  - **Studying Clark Fork and Spokane River flow trends:**
    - **Is the annual flow amount increasing or decreasing?**
    - **Are the flow amounts during specific months increasing or decreasing?**
  - Working though CEATI (Centre for Energy Advancement through Technological Innovation) to examine the effects of Climate Change. The members of CEATI contracted with Artelys Canada Inc. to create the Streamflow Assessment Toolkit for Changing Conditions. Members of CEATI are using this program to look at:
    1. Future Streamflow Scenarios from Available Model Datasets
    2. Historic vs. Future Streamflow Variability
    3. Streamflow correlation with climate indices
    4. Timing of the Spring Freshet
    5. Agreement among Climate Projections
    6. Change in drawdown low-flows

- This is currently a work in progress.

2021 IRP Action Item Review

- Investigate streamlining the IRP modeling process to integrate the resource dispatch, resource selection and reliability verification functions.
  - **With the RAP progressing, the need for reliability verification functions may not be necessary.**
  - **Avista is evaluating Plexos to perform this task. We are assessing the dispatch of the system and have not tested the Capacity Expansion logic. Avista does not anticipate using Plexos for the 2023 IRP with the exception of risk assessments.**

- Study options for the Kettle Falls CT regarding potential reductions of the natural gas supply in winter months. The Company will investigate alternatives for this resource including fuel storage, retirement or relocation of the asset.
  - **Avista is still investigating when the plant will be impacted from potential changes and is currently studying alternatives.**

2021 IRP Action Item Review

- Determine how to best implement the Washington Commission’s strong encouragement under WAC 480-100-620 (3) regarding distribution energy resource planning as a separate process or in conjunction with the 2025 IRP.
  - **This is an area of ongoing work that will be shared with the TAC in 2022.**
  - **Additional staff budgeted for 2022 to help with this effort.**
- Form an Equity Advisory Group to ensure a reduction in burdens to vulnerable populations and highly impacted communities and to ensure benefits are equitably distributed in the transition to clean energy in the state of Washington. This group will provide guidance to the IRP process on ways to achieve these outcomes.
  - **Equity Advisory Group is up and running. They are a major component of the Clean Energy Implementation Plan.**

2021 IRP Action Item Review

- Avista will conduct an existing resource market potential to estimate the amount and timing of existing resources available through 2045.
  - **Avista is conducting an all-source RFP in Q1 2022 to identify resources through 2030.**
  - **Avista will study resource opportunities between 2030 and 2045 after the RFP and other regional RFPs are complete.**

- Conduct further peak credit analysis to understand the reliability benefits of all resources including demand response options with different duration and call options of the wide range of DR program options.
  - **Avista plans to use the Resource Adequacy Program Qualifying Capacity Credit (QCC).**
  - **Avista expects the RAP to develop QCC values in Q1 or Q2 of 2022.**

2021 IRP Action Item Review

- Avista will partner with a third-party consultant to identify non-energy impacts that have not historically been quantified for both energy efficiency and supply side resources.
  - **DNV was awarded a contract to study these impacts and will present their draft report at the March 2022 TAC meeting.**
  - **TAC participants will be able to provide comments prior to the final draft in April 2022.**

- Formalize the process for public to submit IRP-related comments and questions and for Avista to share responses to those requests.
  - **Realized we need a better system and structure with the shear amount of data being shared.**
  - **Still deciding if we will set something up and change as needed or provide options for feedback.**

- Develop a transparent methodology to include pricing data and consider available options for new renewable generation and energy storage options.
  - **The 2021 IRP included Avista’s spreadsheet for resource cost calculations, due to the complexity of the analysis, Avista seeks input from TAC members on how to best share the information.**

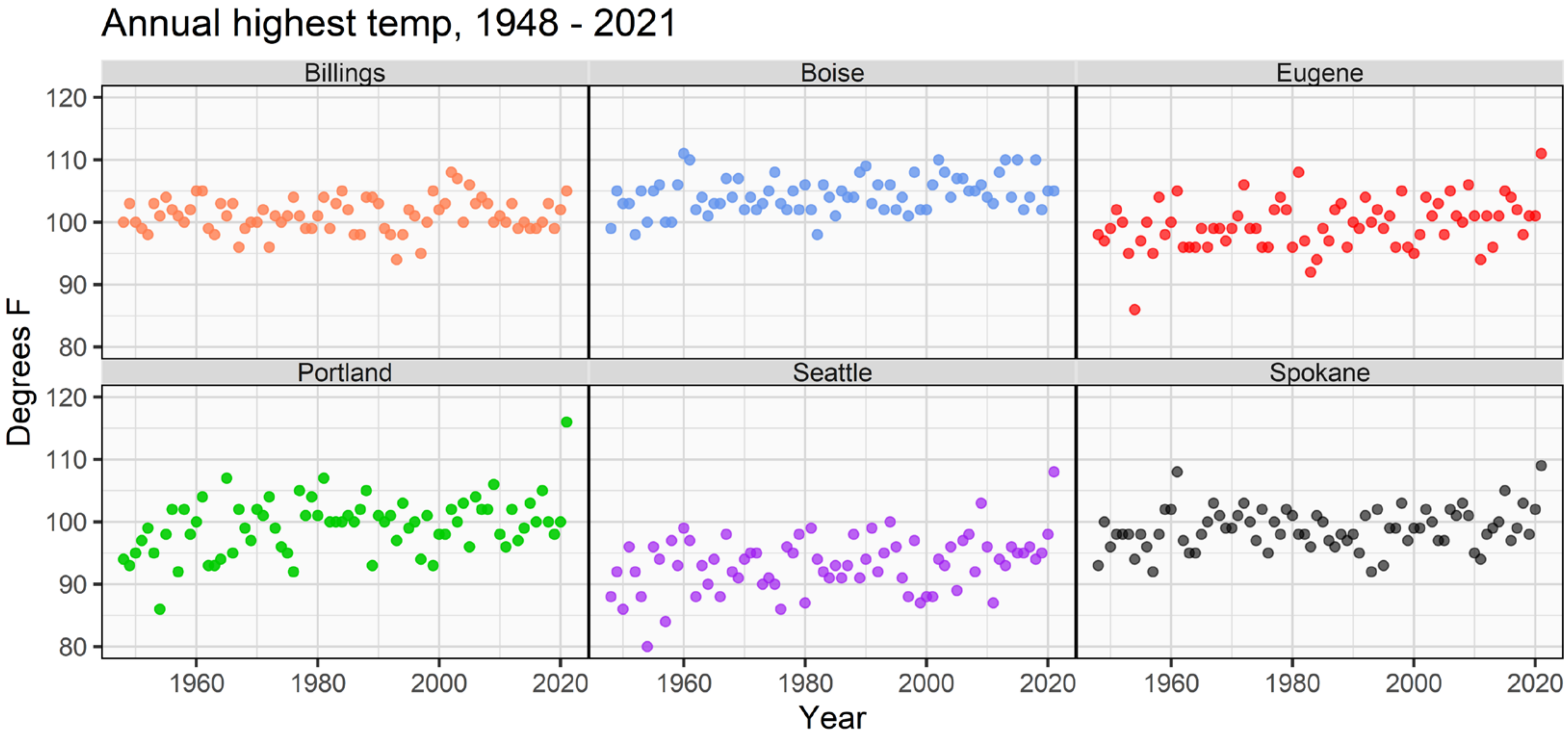
2021 Heatwave Loads & Resources

Avista, Electric Technical Advisory Committee

December 8th, 2021 – TAC 1

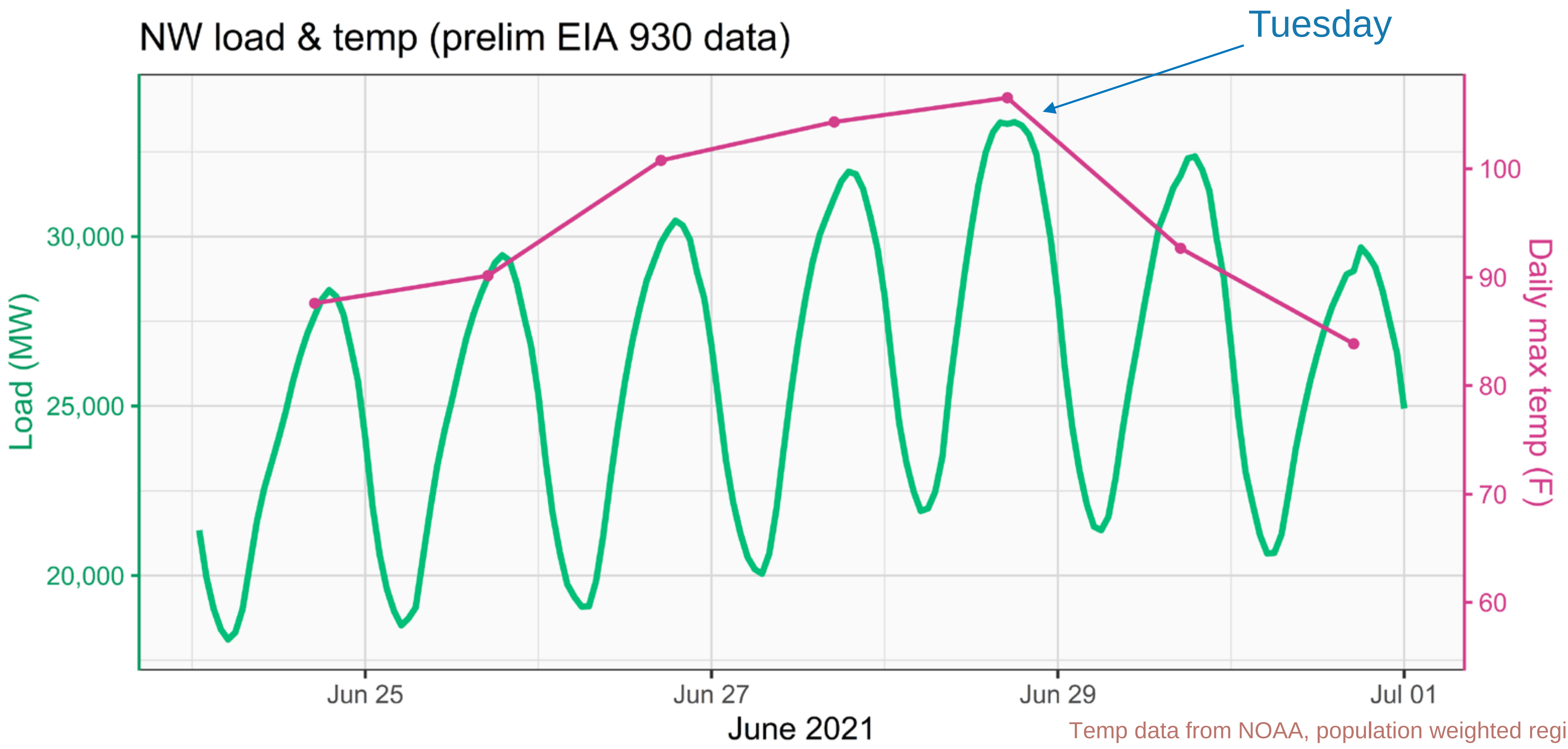
James Gall, Electric IRP Manager

Regional Temperatures



Data from NOAA. Updated with data through July 1, 2021. Graphic used with permission from the PNUCC

Pacific Northwest Loads vs Temperature

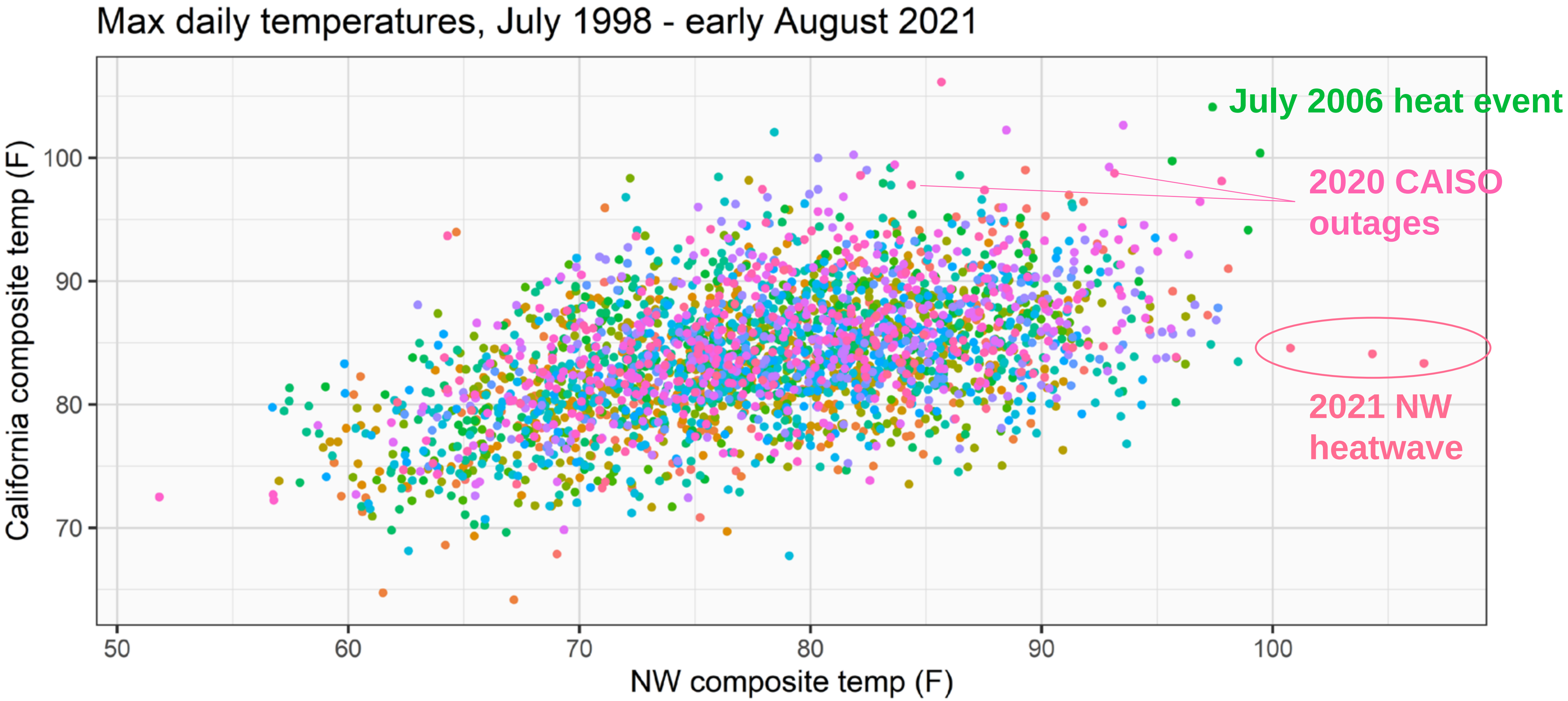


Tuesday

Temp data from NOAA, population weighted regional average (*SEA .40; PDX .24; BOI .12; GEG .11, BIL .07, EUG .05*)
Load data from EIA 930; 12 NW BA coincident loads (AVA, BPA, CHPD, DOPD, GCPD, IPC, NWE, PACW, PGE, PSE, SCL, TWPR)

Graphics used with permission of the PNUCC

NW vs California Loads

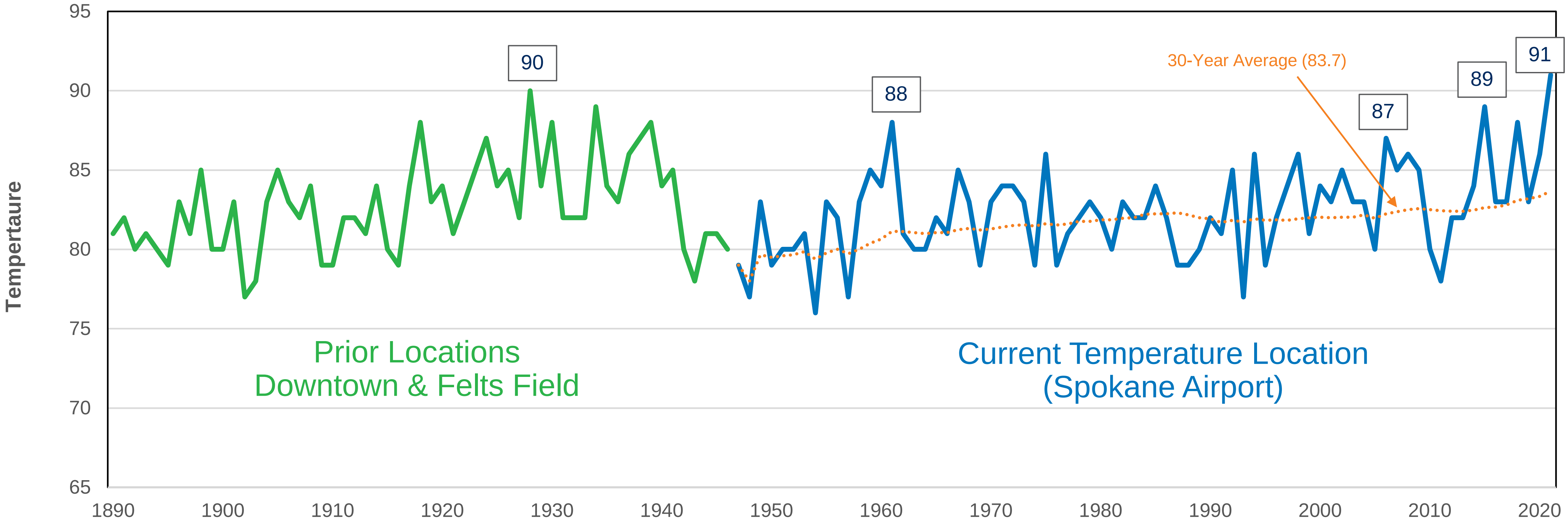


Northwest temp data from NOAA, population weighted regional average (*SEA .40; PDX .24; BOI .12; GEG .11, BIL .07, EUG .05*)
California temp data from NOAA, roughly weighted average (LA (USC), SAN, SMF, FAT, SJC)

Graphics used with permission of the PNUCC

Spokane Historical Hottest Days

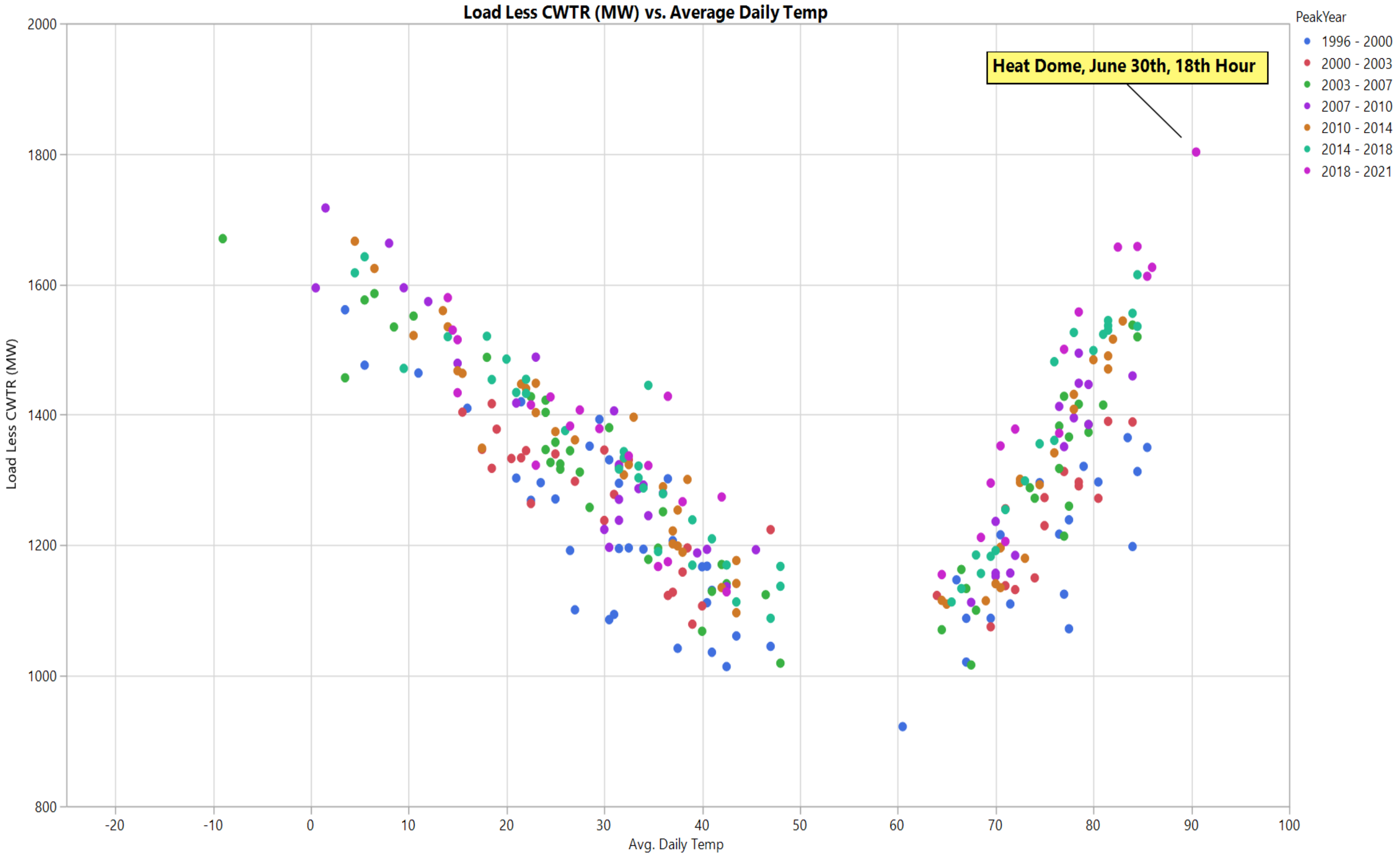
(Avg High & Low Daily Temperature)



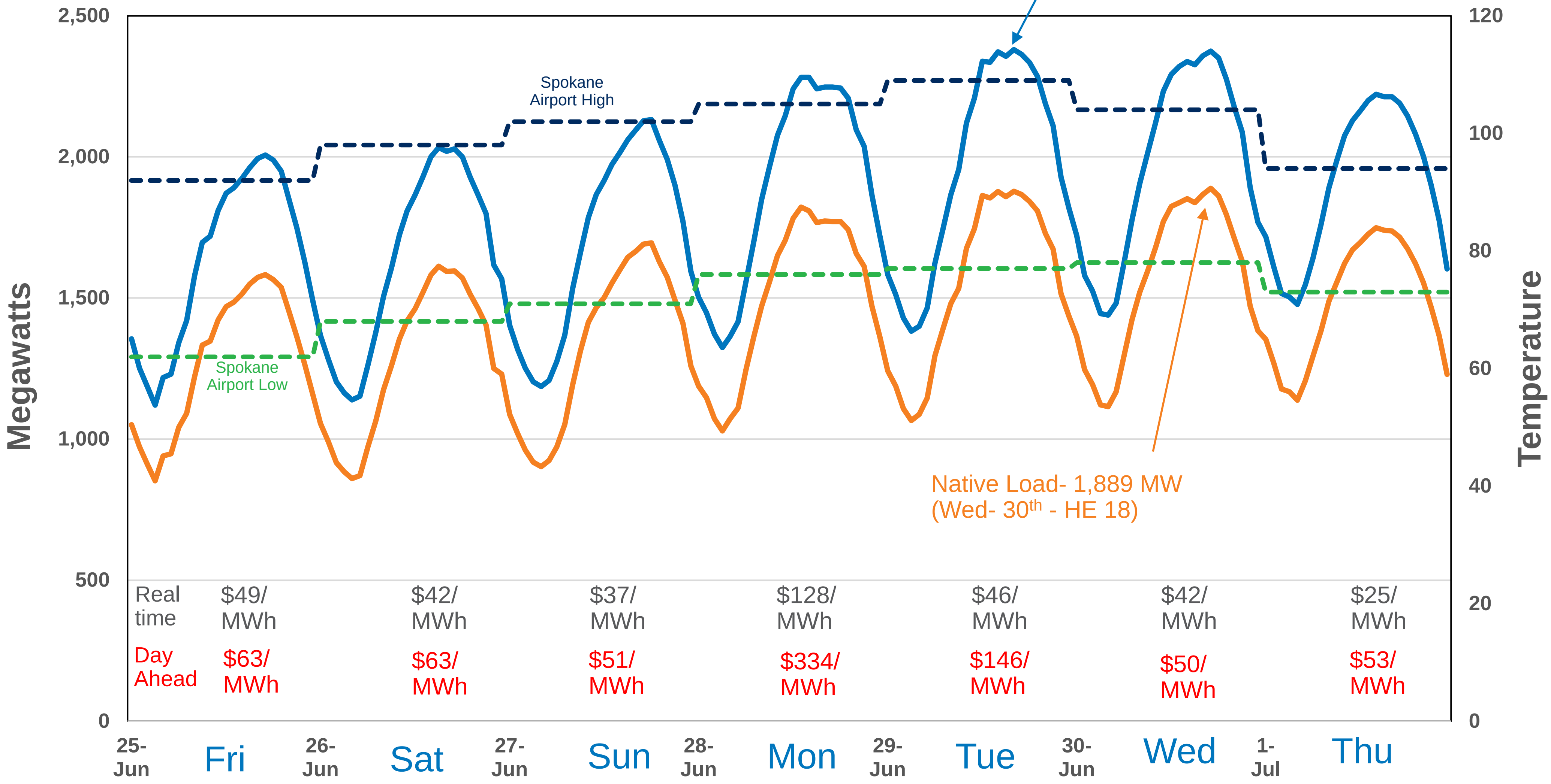
Note: temperatures are not adjusted for locational differences, but summer months

Data from NOAA

Avista Peak Loads in Perspective



Avista Hourly Loads

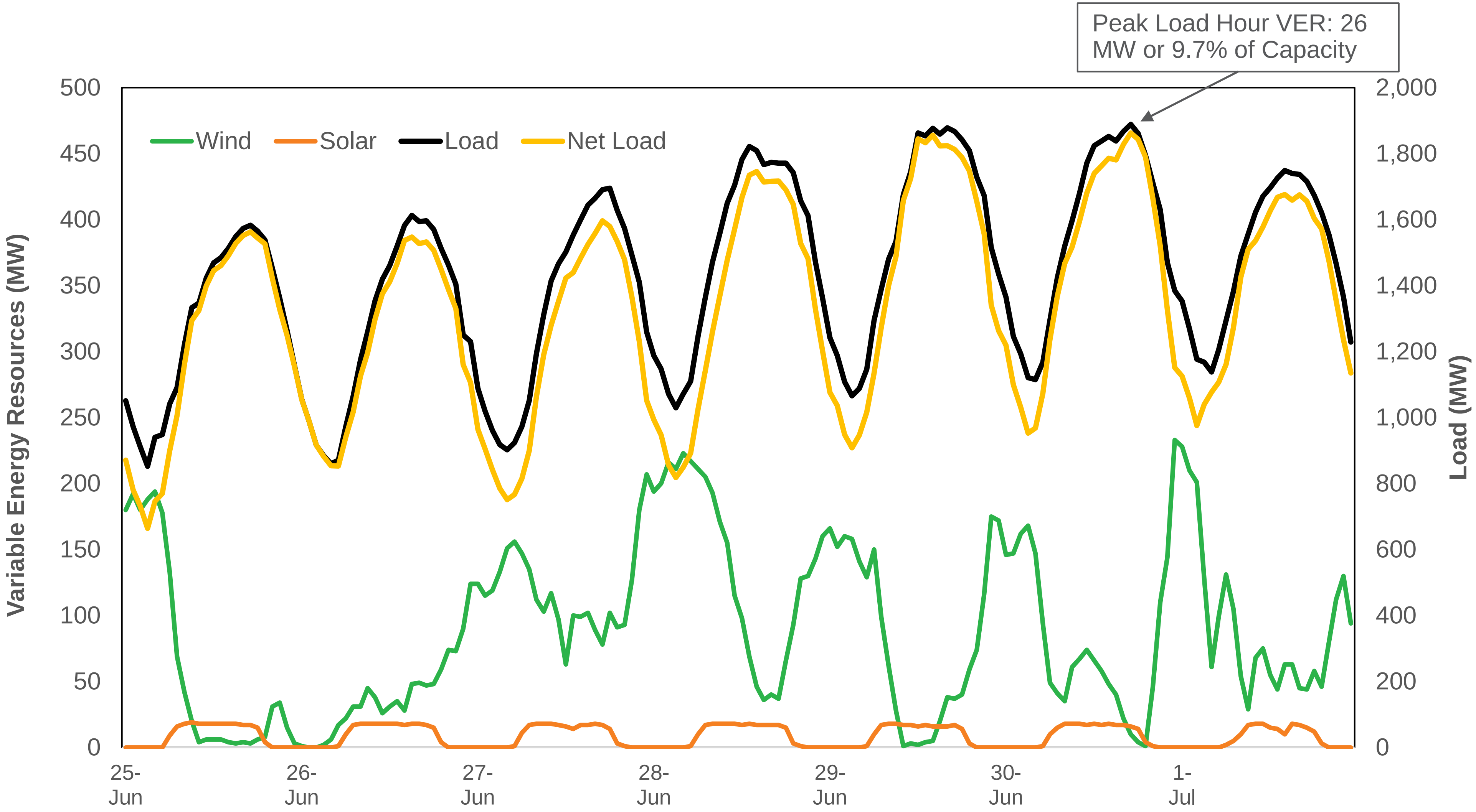


Balancing Authority Area Load- 2,381 MW (Tues- 29th - HE 17)

Native Load- 1,889 MW (Wed- 30th - HE 18)

	Fri	Sat	Sun	Mon	Tue	Wed	Thu
Real time	$49/ MWh	$42/ MWh	$37/ MWh	$128/ MWh	$46/ MWh	$42/ MWh	$25/ MWh
Day Ahead	$63/ MWh	$63/ MWh	$51/ MWh	$334/ MWh	$146/ MWh	$50/ MWh	$53/ MWh

Load vs Variable Energy Production



Summer Peak Load Forecast Implications

- Actual peak load was 92 MW higher (5%) then fundamental forecast given the actual temperature.

- Avista will move to a 30-year average hottest day for summer peak load forecasting.

- Improve peak load forecast techniques.

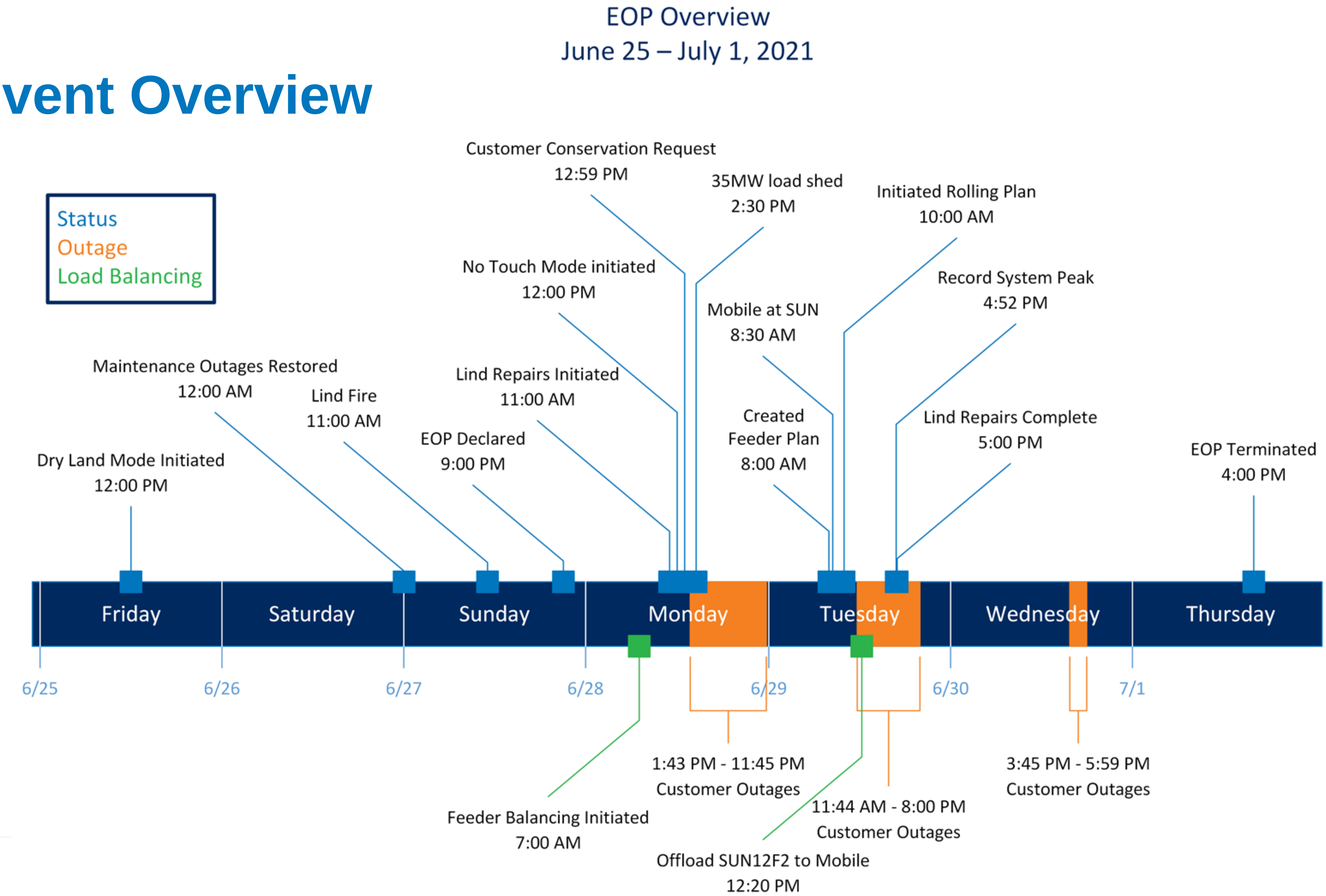
Heat Event-
Emergency Operating Plan
June 28 – July 1, 2021

2023 Electric IRP – TAC 1

December 8, 2021

David Thompson, System Planning Engineer

Event Overview



EOP Overview

June 25 – July 1, 2021

Status

Outage

Load Balancing

Friday

Saturday

Sunday

Monday

Tuesday

Wednesday

Thursday

6/25

6/26

6/27

6/28

6/29

6/30

7/1

Dry Land Mode Initiated
12:00 PM

Maintenance Outages Restored
12:00 AM

Lind Fire
11:00 AM

EOP Declared
9:00 PM

Lind Repairs Initiated
11:00 AM

No Touch Mode initiated
12:00 PM

Customer Conservation Request
12:59 PM

35MW load shed
2:30 PM

Created
Feeder Plan
8:00 AM

Mobile at SUN
8:30 AM

Initiated Rolling Plan
10:00 AM

Record System Peak
4:52 PM

Lind Repairs Complete
5:00 PM

EOP Terminated
4:00 PM

Feeder Balancing Initiated
7:00 AM

1:43 PM - 11:45 PM
Customer Outages

Offload SUN12F2 to Mobile
12:20 PM

11:44 AM - 8:00 PM
Customer Outages

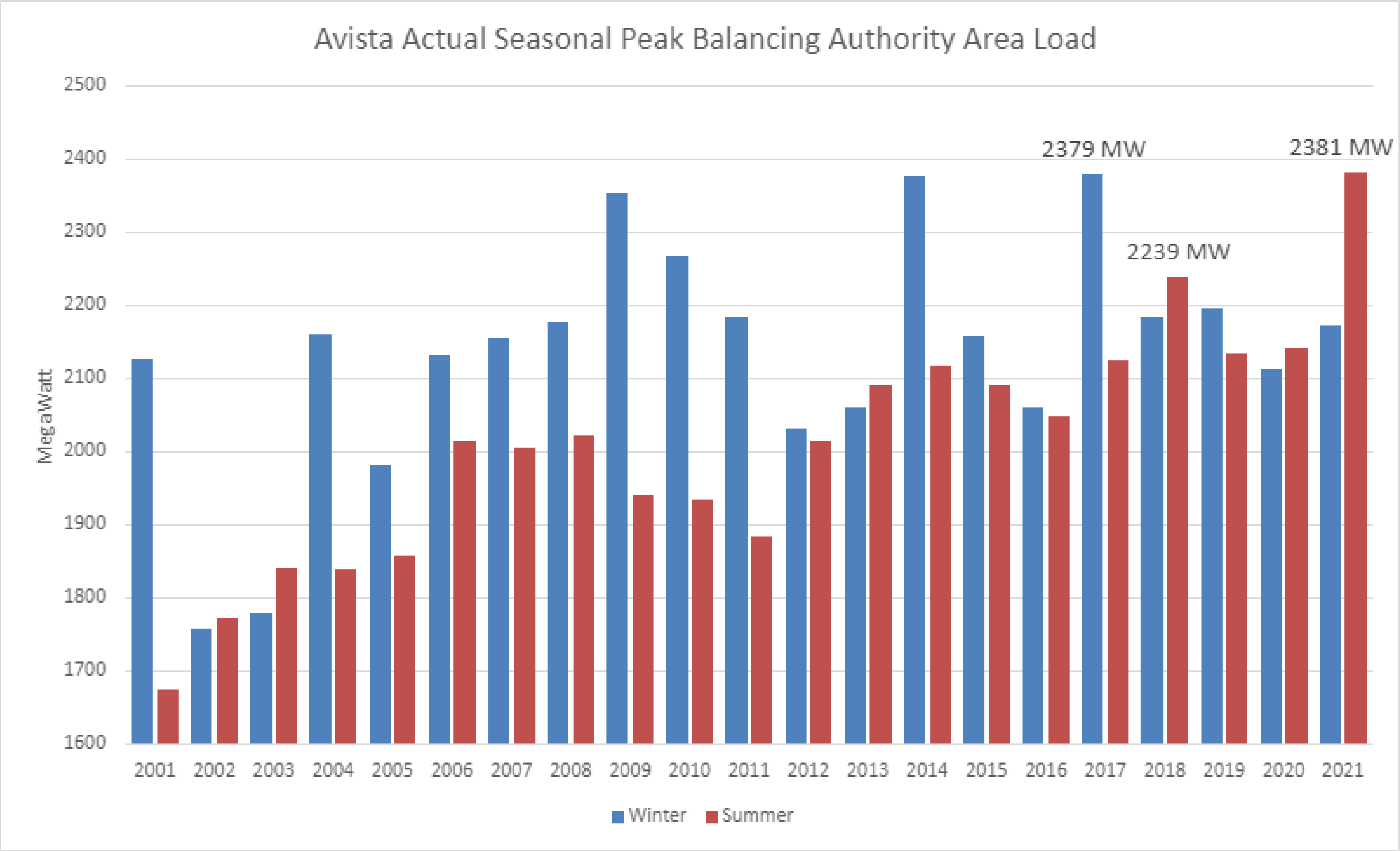
3:45 PM - 5:59 PM
Customer Outages

Temperature Metrics

	High Temperature (°F)		Low Temperature (°F)	
Date	Forecast	Actual	Forecast	Actual
Monday, 6/28	108	105*	73	76
Tuesday, 6/29	110	109*	74	77
Wednesday, 6/30	108	104	74	78
Thursday, 7/1	106	94	73	73

- Record high daily temperatures forecasted by National Weather Service
- Expected significant customer demand for HVAC with indoor activities
- Relatively high "low" temperatures limited equipment cooling

Balancing Authority Area Peak



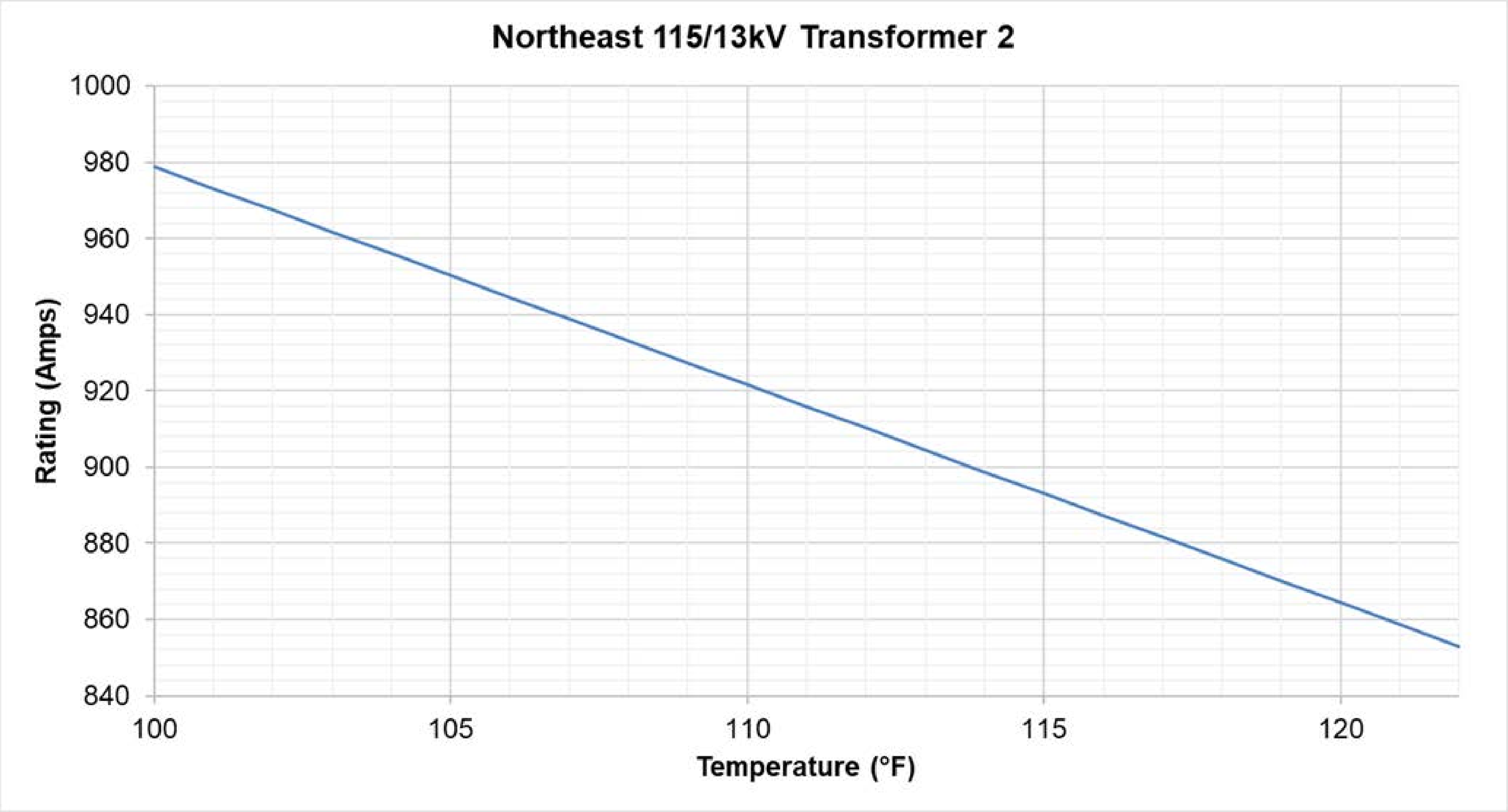
June 28	2,285 MW
June 29	2,381 MW
June 30	2,358 MW

New peak load is 6% increase over prior record.

Summer Challenges

- Equipment capacity ratings are typically reduced with increasing ambient temperatures

- Cooling systems can adjust capacity ratings



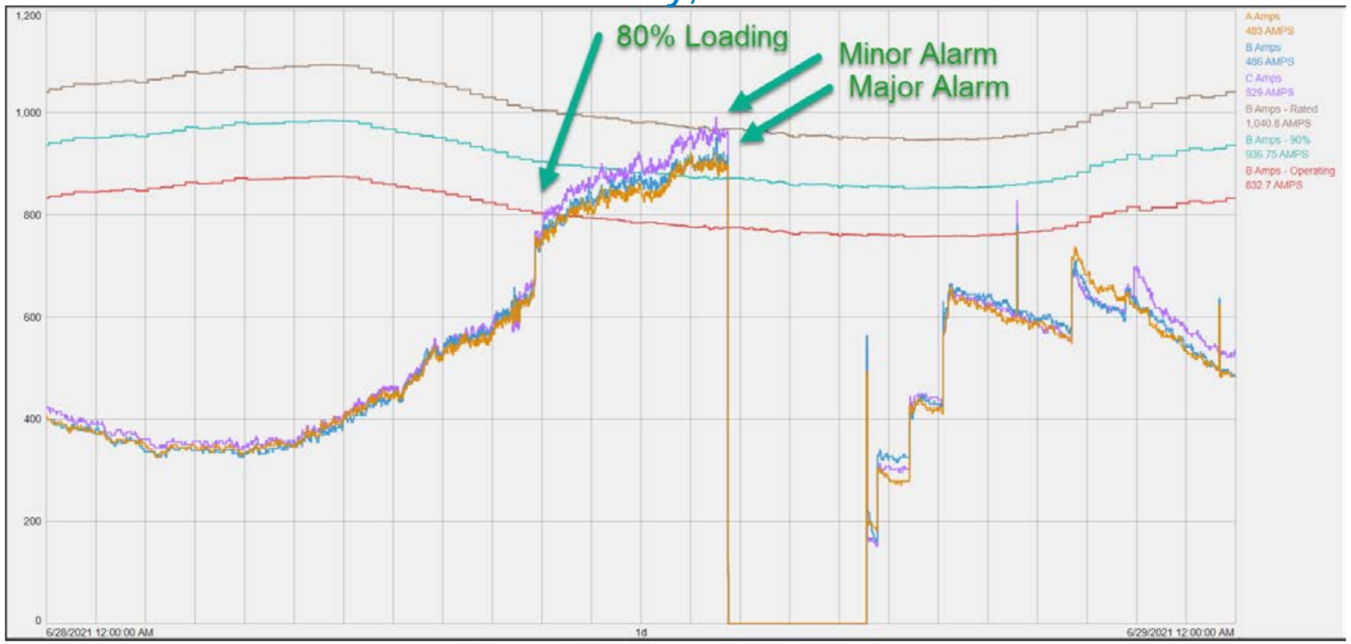
Heat EOP Performance-Distribution Transformers

- Operating limits are monitored for equipment protection
- 201 transformers in 140 substations throughout Avista's service territory
- Minor alarm at 80°C (176°F), monitored for continued safe operation
- Major alarm at 115°C (239°F), transformer to be taken out of service

Operating Limit	June 28	June 29	June 30
≥80%	19	32	19
≥90%	7	7	1

Northeast 115/13kV Transformer 2

Monday, June 28

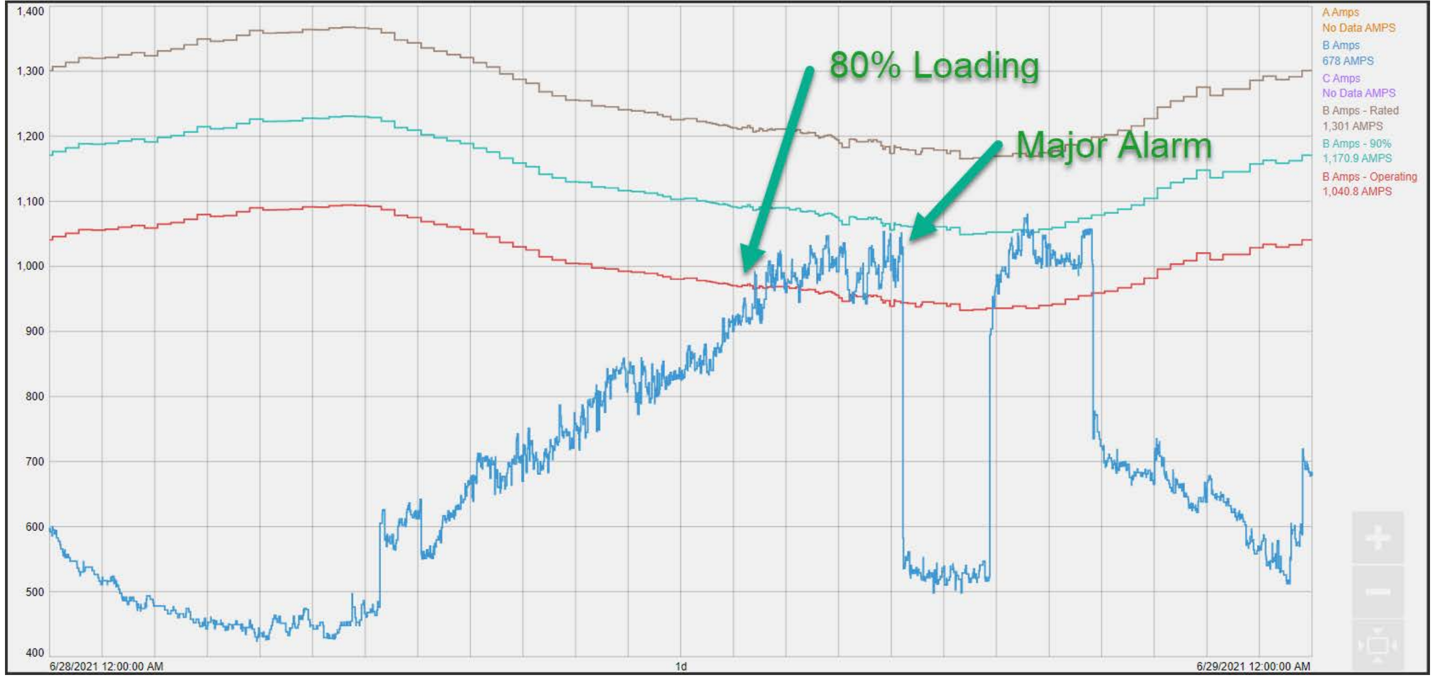


- 9:50 a.m. - Transferred ROS12F1 feeder to Northeast
- 10:18 a.m. – 80% loading
- 1:32 p.m. – minor alarm at 96%
- 1:41 p.m. – major alarm, dropped customers
- Investigation found three cooling fans nonfunctional

Sunset 115/13kV Transformer 2

- 1:44 p.m. – reached 80%
- 4:12 p.m. – major alarm at 89%, dropped customers on SUN12F2
- 5:30 p.m. – restored SUN12F2
- 7:47 p.m. – major alarm, dropped SUN12F1
- Mobile Substation 4 used to energize SUN12F2, required 4-hour outage

Monday, June 28



Heat EOP Performance-Distribution Feeders

- Operating limits are monitored for equipment protection
- 369 distribution feeders connecting substations to customer load
- Operation at 80% of limit initiates notification
- Operation at 100% of limit requires unloading

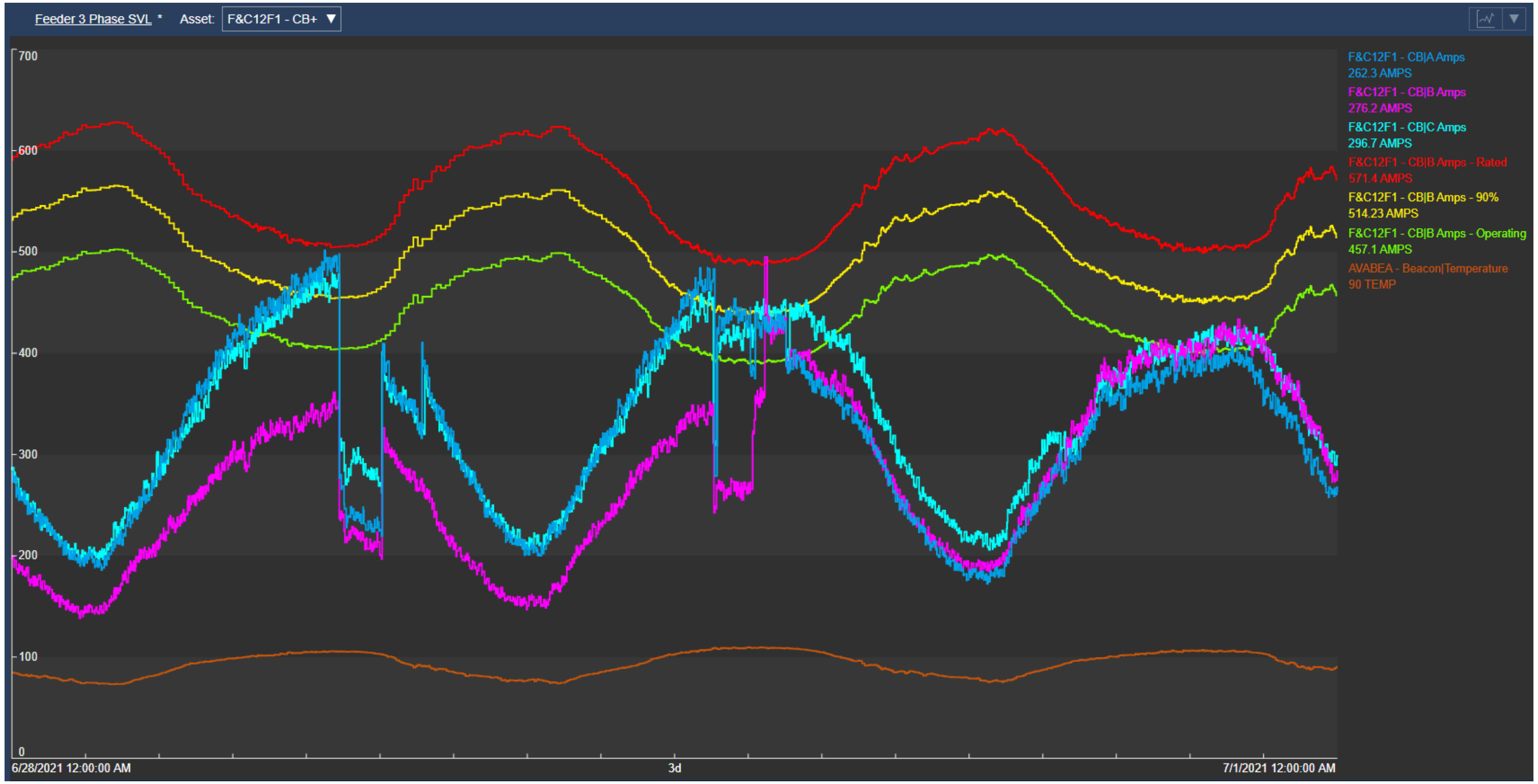
Operating Limit	June 28	June 29	June 30
≥80%	39	53	32
≥90%	13	16	5

Transferring Load

- Move load from heavily loaded feeder to adjacent feeder
- Requires surplus capacity on adjacent feeders
- Transfers accomplished remotely or with field crews, depending on feeders

Timestamp	Switching Notice	Load Transfer Action
6/24, 7:18 a.m.	CDA 21-56	HUE142 to HUE141[1]
6/28, 8:30 a.m.	SPD 21-92	COB12F2 to MEA12F3
6/28, 9:30 a.m.	CDA 21-57	PRA222 to PF212
6/28, 9:50 a.m.	SPD 21-91	ROS12F1 to NE12F1
6/28, 11:30 a.m.	SPD 21-93	GLN12F1 to 3HT12F2
6/28, 11:30 a.m.	SPD 21-94	GLN12F2 to SE12F2
6/28, 3:12 p.m.	CDA 21-58	APW112 to APW115
6/28, 3:44 p.m.	SPD 21-96	WAK12F1 to MEA12F2
6/28, 5:18 p.m.	CDA 21-59	HUE142 to DAL132
6/28, 11:33 p.m.	DO210629	Restore SUN12F1 from C&W12F4 and SUN12F6
6/29, 1:45 a.m.	DD210628	MEA12F2 to WAK12F1
6/29, 8:00 a.m.	CDA 21-60	DAL132 to DAL135
6/29, 9:00 a.m.	PAL 21-18	M15513 to M15514
6/29, 10:41 a.m.	SPD 21-99	NE12F4 to BEA12F2
6/29, 10:45 a.m.	LC 21-20	SLW1358 to LMR1530
6/29, 1:00 p.m.	PAL 21-19	TUR116 to TUR112
6/29, 1:30 p.m.	CDA 21-62	DAL131 to AVD151
6/29, 2:10 p.m.	CDA 21-63	DAL132 to DAL136
6/29, 7:39 p.m.	DO2100629-1	H&W12F2 to H&W12F5 SUN12F2 to H&W12F1
6/30, 9:30 a.m.	CDA 21-64	SPT4521 to SAG742
6/30, 12:01 p.m.	CDA 21-61	PRA221 to PRA222

Feeder Balancing



Feeder	June 28	June 29	June 30
3HT12F2	--	4	--
3HT12F4	--	4	--
BEA12F5	--	--	1
BKR12F1	--	1	--
DAL131	3	--	--
F&C12F1	--	1	1
F&C12F2	2	--	--
F&C12F4	--	--	1
IDR253	--	--	1
L&S12F4	--	1	--
LMR1530	--	1	--
NE12F1	--	2	--
PRA221	--	1	--
Total	5	15	4

Customer Engagement

- Demand response conservation requests
- Commercial customer reduced 35MW on Monday afternoon
- Two high schools
- College campus
- Local water district

Heat EOP Performance-Transmission System

- Equipment issues
  - Three 230kV breakers
  - One 230/115kV transformer
  - Next issue would pose significant outage challenges

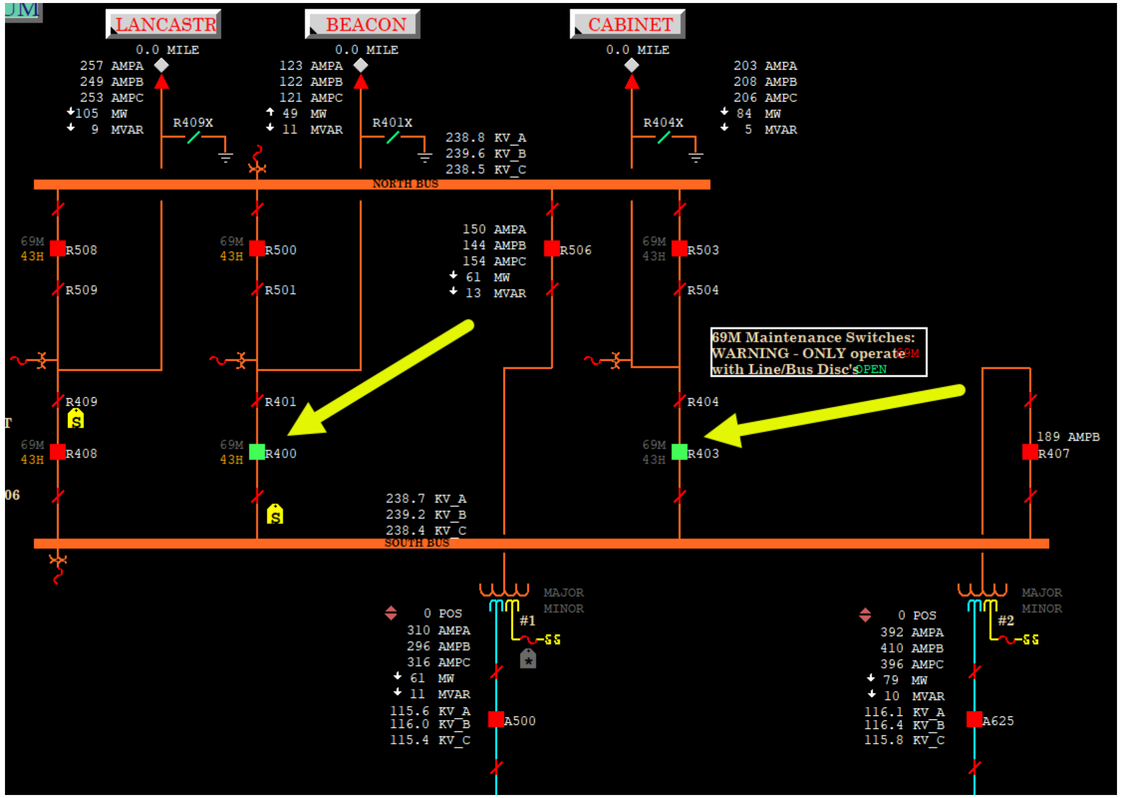
- No impacts to customers

Rathdrum Station

- Breaker R-403
  - Cabinet – Rathdrum transmission line
  - Failed bushing
  - Monday 4:47 a.m. until Friday

- Breaker R-400
  - Beacon – Rathdrum transmission line
  - Leaking bushing
  - Wednesday 9:05 a.m. until Thursday

- Additional device failure would likely cause transmission outage

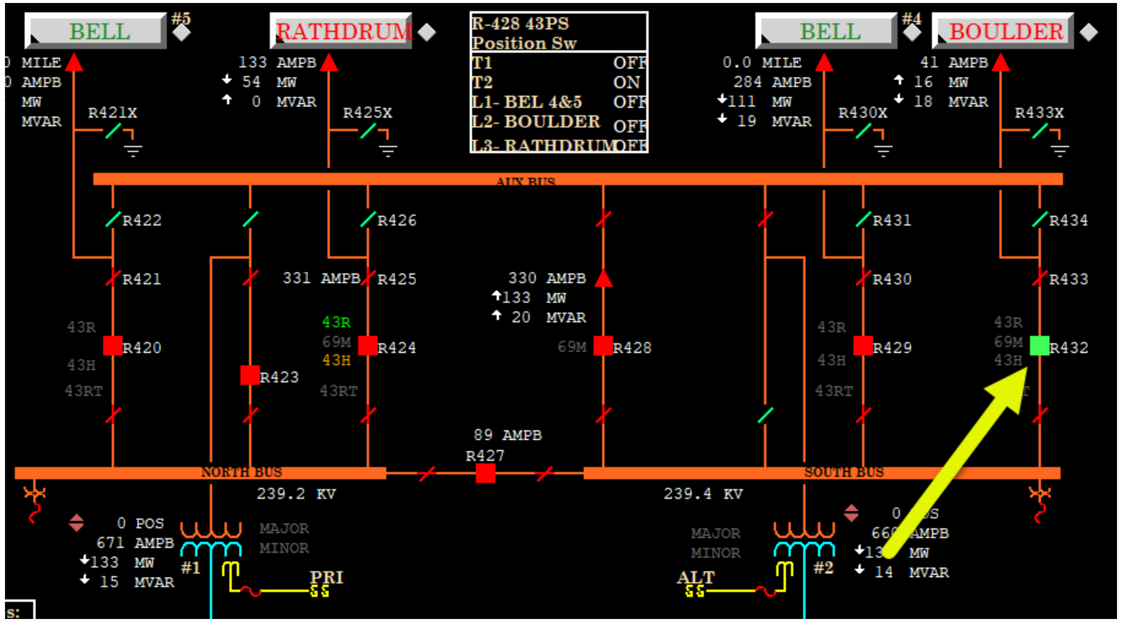


69M Maintenance Switches:
WARNING - ONLY operate 69M
with Line/Bus Disc's OPEN

Beacon Station

- Breaker R-432
  - Beacon – Boulder transmission line
  - Failed bushing
  - Monday 11:39 p.m. until Tuesday 5:13 p.m.

- Beacon 230/115kV Transformer 2
  - Multiple major alarms on Tuesday but operating at 80% of capacity
  - Cooling fan bank loss of power



Heat EOP Summary

- 31 protective events caused customer outages
  - 16,029 customer outages on Monday, June 28
  - 5,523 customers with outages on Tuesday, June 29
  - 603 customers with outages on Wednesday, June 30

- Customer outages regions
  - South Lewiston area
  - Greater Spokane area

Recommendation Summary

Capacity Mitigation

Distribution System Planning Assessment

Feeder Balancing Program

Operational Planning

Major Equipment Utilization

Q&A

Thank You

WESTERN RESOURCE ADEQUACY PROGRAM

AVISTA TAC MEETING

DECEMBER 8, 2021

NORTHWEST
PowerPool

AGENDA

- » Overview
- » Timeline
- » Participation
- » Design Framework
- » Governance
- » Costs and Benefits
- » Next Steps

OVERVIEW

- The WRAP is a regional capacity program
  - *Similar programs are available across North America*
  - *Significant effort to build organizational structure necessary to administer program*
  - *Capacity will improve reliability in most expedient manner*
- Not building a market – relying on current bilateral structure
  - *Will not set prices for energy*
  - *Load Responsible Entity (LRE) remain responsible for determining which resources participate and are potentially deployed*

BENEFITS

RELIABILITY

- *Ensure sufficient generation and transmission resources are installed and committed to reliably serve demand, during stressed grid and market conditions, with a high degree of confidence*

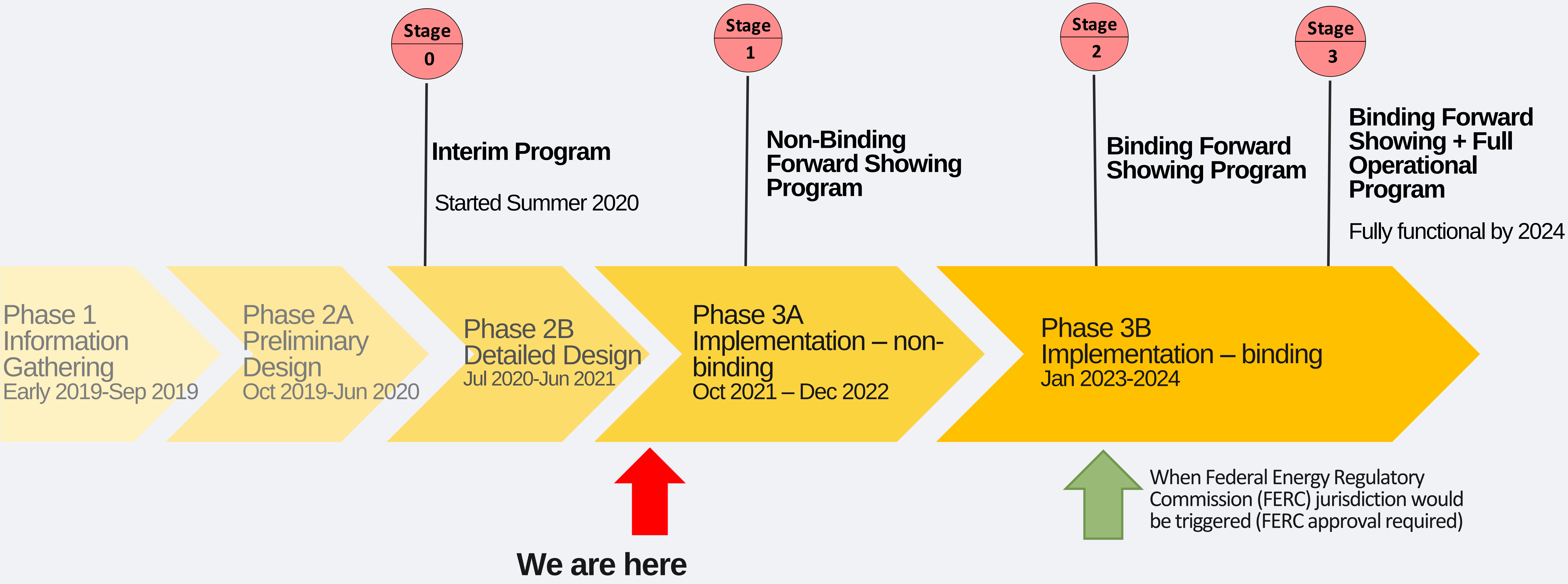
COST SAVINGS

- *Unlock the benefits of diversity in supply and demand in a safe and equitable way*

IMPROVED VISIBILITY & COORDINATION

- *Enable members to make fully informed RA planning decisions, using common industry planning metrics and methods*

PROJECT TIMELINE



Stage 0

Interim Program

Started Summer 2020

Stage 1

Non-Binding Forward Showing Program

Stage 2

Binding Forward Showing Program

Stage 3

Binding Forward Showing + Full Operational Program

Fully functional by 2024

Phase 1
Information Gathering
Early 2019-Sep 2019

Phase 2A
Preliminary Design
Oct 2019-Jun 2020

Phase 2B
Detailed Design
Jul 2020-Jun 2021

Phase 3A
Implementation – non-binding
Oct 2021 – Dec 2022

Phase 3B
Implementation – binding
Jan 2023-2024

We are here

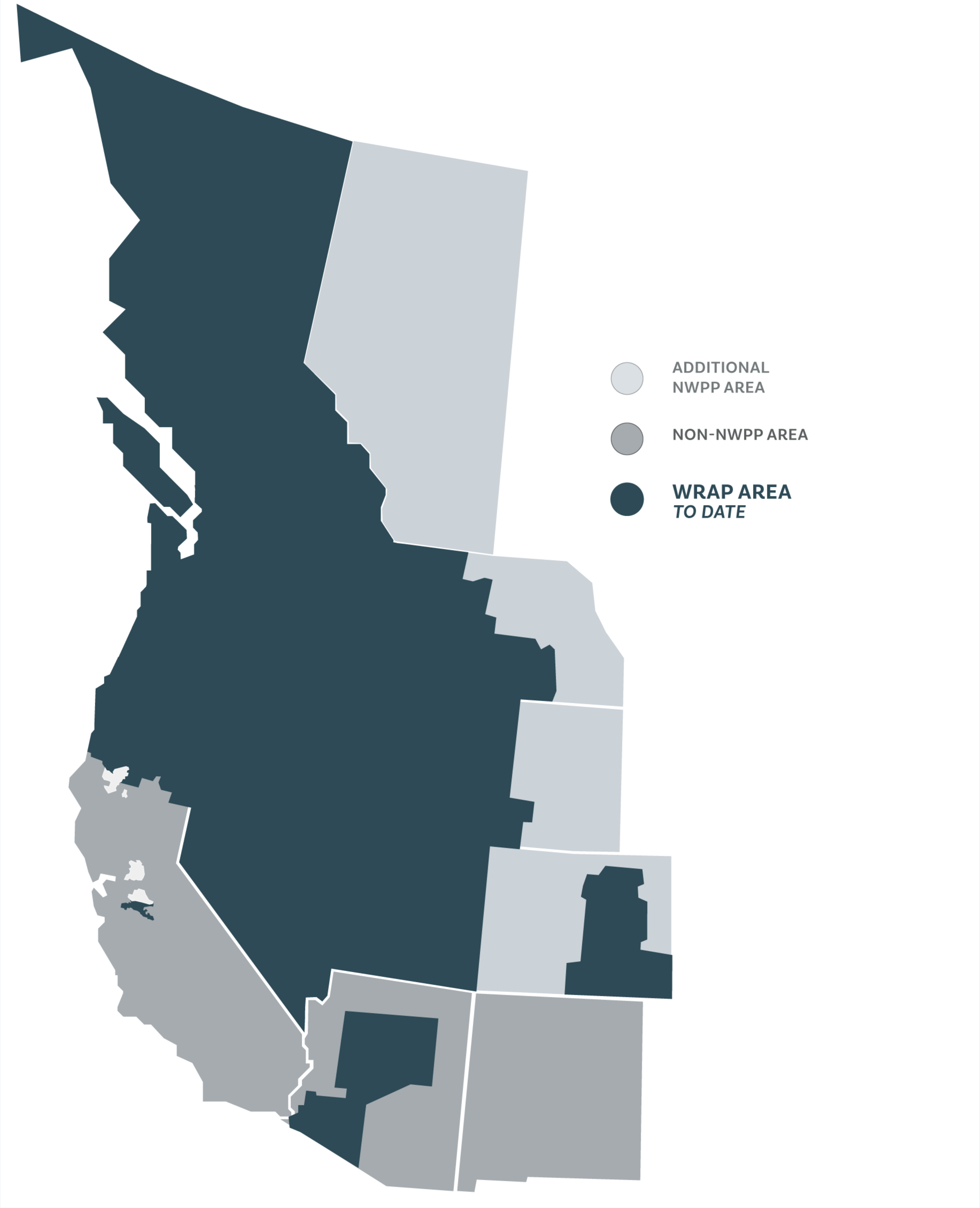
When Federal Energy Regulatory Commission (FERC) jurisdiction would be triggered (FERC approval required)

PROGRAM PARTICIPATION

- Participation open to Load Responsible Entities (LREs) – both in and outside current NWPP footprint
- Voluntary entry (absent any contractual or other regulatory requirements), followed by obligation to comply
- Participants decide how they will meet the program resource requirements – through resource ownership or contracts
- Participants agree to use common resource planning metrics
- IPPs and LREs (program Participants and those not participating) are all eligible to contract with Participants

Initial Phase 3A Participants

APS
Avangrid
Avista
Black Hills
BPA
Calpine
Chelan PUD
Clatskanie PUD
Douglas PUD
EWEB
Grant PUD
Idaho Power
NorthWestern
NV Energy
PacifiCorp
PGE
Powerex
PSE
SRP
SCL
Shell
Snohomish PUD
Tacoma Power
TEA
TID

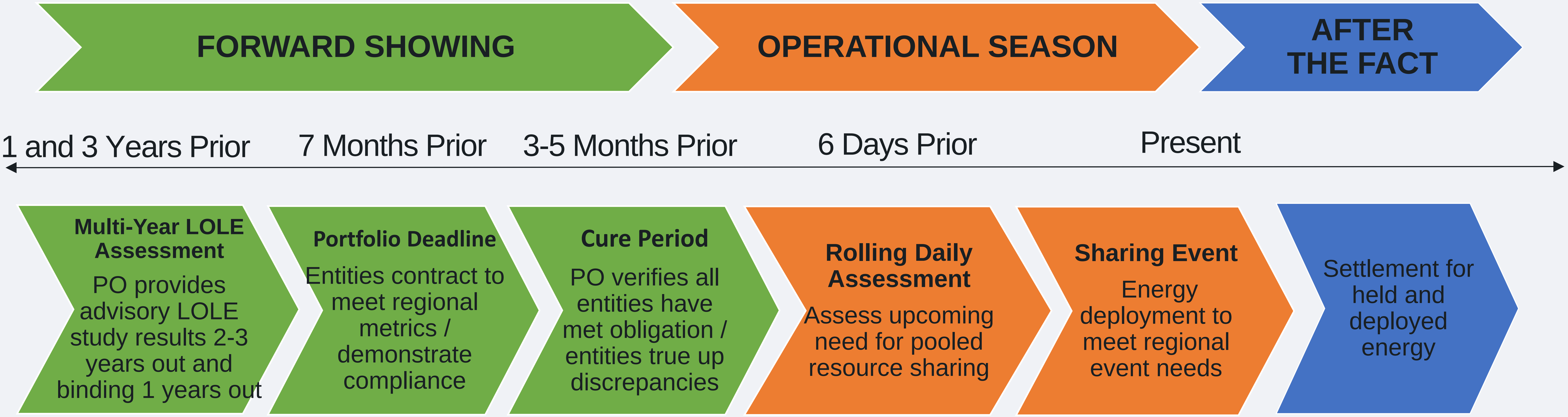


PHASE 3A – NONBINDING TRIAL

- Phase 3A began Oct 1
- Runs through Dec 2022
- 25 Participants so far
- Approximately 70,000 MWs of peak season load
- Data collected for participating entities on Nov 8
- No penalty for non-compliance
- First forward showing for Winter 2022-2023 on May 15, 2022
- Second forward showing in September 2022 for Summer 2023

PROGRAM FRAMEWORK

TWO TIME HORIZONS



FORWARD SHOWING

OPERATIONAL SEASON

AFTER THE FACT

1 and 3 Years Prior

7 Months Prior

3-5 Months Prior

6 Days Prior

Present

Multi-Year LOLE Assessment

PO provides advisory LOLE study results 2-3 years out and binding 1 years out

Portfolio Deadline

Entities contract to meet regional metrics / demonstrate compliance

Cure Period

PO verifies all entities have met obligation / entities true up discrepancies

Rolling Daily Assessment

Assess upcoming need for pooled resource sharing

Sharing Event

Energy deployment to meet regional event needs

Settlement for held and deployed energy

Note: PO refers to Program Operator

FORWARD SHOWING

BALANCING LOADS AND RESOURCES

DEMAND SIDE

Calculate: “PURE” CAPACITY NEEDED BASED ON:

- **P50 LOAD FORECAST +**
- **Contingency Reserves +**
- **PRM needed to meet The RA metric (1 in 10 LOLE)**

SUPPLY SIDE

Calculate: “PURE” CAPACITY AVAILABLE BASED ON:

- **Total Supply, de-rated and qualified as follows:**
  - *Wind and solar – ELCC*
  - *Thermals – UCAP*
  - *Run of River Hydro – ELCC*
  - *Storage Hydro – UCAP + NWPP developed hydro methodology*
  - *Other (Storage, Demand Response, etc.)*

“PURE” CAPACITY NEEDED < “PURE” SUPPLY AVAILABLE

Show 75% of capacity is backed by firm or conditional firm transmission

NWPP

TWO BINDING SEASONS

Season	Binding/ Advisory	Duration	Compliance Showing Date	Cure Period
Winter	Binding	Nov-March 15	March 31	June 1 – July 31
Summer	Binding	June-Sept 15	October 31 (of prior year)	Jan 1 – Feb 28
Spring	Advisory	April-May	N/A	N/A
Fall	Advisory	October	N/A	N/A

Program Operator will provide additional out-year (2-3 years) assessment of RA requirements for planning purposes

OPERATIONAL PROGRAM

- Need ability to access diversity in real-time
- PO monitors participants needs 5-7 days in advance
- Day ahead assessment
  - *Participants with unplanned conditions may be eligible for next day assistance*
  - *Participants with planned extra capacity asked to hold back*
- Operating day assessment
  - *If a participant meets hour ahead criterion, then they will be provided energy*
  - *Long participants must deploy energy*
- Transmission
  - *All transactions scheduled to a hub (Mid-C and ?)*
  - *Delivering participant must schedule firm transmission to the hub*
  - *Receiving participant can schedule firm or non-firm transmission from the hub*
- Settlement of both day ahead capacity hold and/or energy deployed

GOVERNANCE

PROPOSED APPROACH

- NWPP governing authority – “Public Utility”
- Independent **Board of Directors** (BOD)
  - *Once the initial structure of the board and program is established, the board has authority to approve budgets; provide direction and set priorities*
  - *Proposed governance preserves structures and functions of exiting NWPP program*
- **Participant Committee** (RAPC) with influence
  - *Substantive authority to modify amendments to the RA Program*
  - *Substantive authority to modify RA Program rules*
  - *Subject to stakeholder right of appeal to independent board*
- Program Operator – Southwest Power Pool
- Point of compliance - Load Responsible Entity (LRE)

GOVERNANCE

PROPOSED APPROACH

- **State Officials Committee** (SOC) – meeting through end of year to refine the role of this committee
- **Nominating Committee** (NC) – the members of the BOD will be selected by a NC comprised of multi-sector representatives.
- **Program Review Committee** (PRC) – future changes to the program rules will be recommended through a multi-sector committee
- **Independent Evaluator** (IE) – Reports to BOD for annual review of program

NEXT STEPS

Phase 3A – Non-binding Program

(October 2021-December 2022)

- Non-Binding Forward Showing Program
  - *Determine regional PRM and resource capacity credits in Q1 2022*
  - *Perform two Forward Showings: Winter 2022/23, Summer 2023*
- Preparation for later phases
  - *Prepare for FERC filing (filing targeted for March 2022)*
  - *Prepare for NWPP independent board (transition in 2023)*
  - *Work through outstanding design considerations for Operations program*

Phase 3B - Full Binding Program

(March 2023 showing for winter 2023/24)

QUESTIONS

[Northwest Power Pool (nwpp.org)](https://www.nwpp.org)

Resource Adequacy Program Impact to IRP

Avista, Electric IRP – TAC Meeting 1

December 8th, 2021

Michael Brutocao, Natural Gas Analyst

Planning Reserve Margin

Summer

- 2021 IRP method: ~14.6%
  - **Planning Margin (7%)** + Operating Reserves + Regulation
- RAP: ~13%
  - **Planning Margin (12%)** + Operating Reserves for Non-Avista Load in Balancing Authority + Regulation

Winter

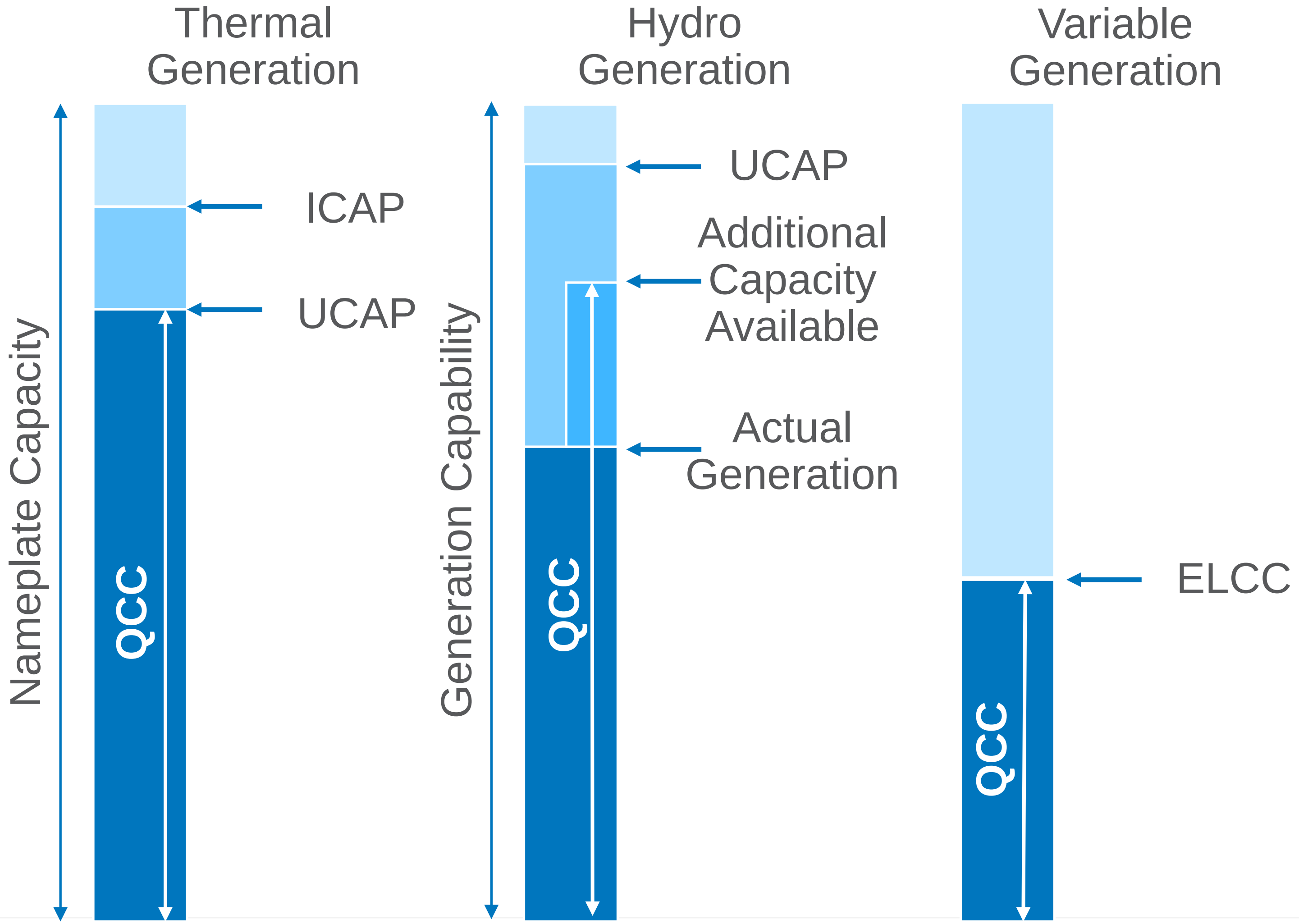
- 2021 IRP method: ~24.6%
  - **Planning Margin (16%)** + Operating Reserves + Regulation
- RAP: ~18%
  - **Planning Margin (16%)** + Operating Reserves for Non-Avista Load in Balancing Authority + Regulation

Obligations – RAP

- Peak Load
- System Sales
- Demand Response (-)
- Regulation
- Operating Reserves for BA Load (only non-native load)
- ~~Avista Operating Reserves~~

Rights – RAP

- Power Deal Purchases
- Thermal Generation
- Hydro Generation
- Variable Generation
- Small Power (QF, PURPA)
- Storage
- ~~Operating Reserve Credit – Hydro~~



Calculating Net Position – RAP

Planning Margin
~~Operating Reserves (load)~~
~~Operating Reserves (generation)~~

Obligations

- Peak Native Load
- Power Deal Sales
- Capacity Services
- Demand Response
- Regulation
- Operating Reserves for BA Load
- ~~Operating Reserves~~

(1) **Total Obligation**

Rights

- Power Deal Purchases
- Coal
- Wood
- Wind
- Solar
- CCCT
- Peaker
- Spokane
- Clark Fork
- Mid-Columbia
- Small Power
- Storage
- ~~Oper Reserve Credit-hydro~~

(2) **Total Rights**

(3) Planning Margin

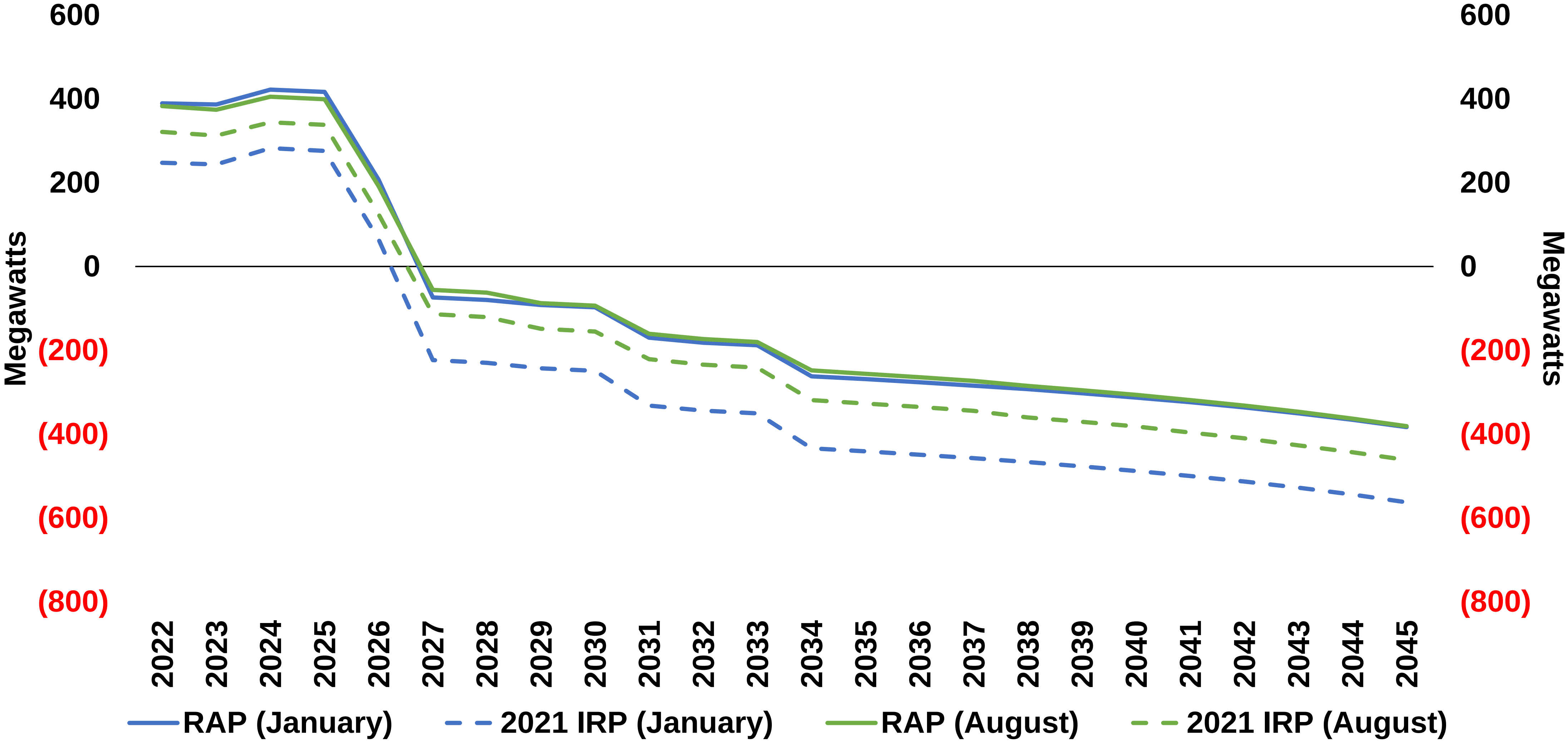
Net Position (2) - (1) - (3)

Resource Capability
x Qualified Capacity Contribution
Net Capability

Example: Lancaster GS

282.00
x 98%
273.36

2021 IRP Net Position with RAP Changes



*Net positions subject to change

Conclusions

- Participating utilities will use the same methodology for resource adequacy on determination

- Lower capacity requirements using RAP should lower customer cost

- RAP will result in additional market risk due to regional ELCCs for variable resources and storage

Resource Adequacy & Resiliency

Avista, Electric Technical Advisory Committee

December 8th, 2021 – TAC 1

James Gall, Electric IRP Manager

Resource Adequacy (RA)

- In the simplest terms, RA is just a regulatory construct developed to ensure that there will be sufficient resources available to serve electric demand under all but the most extreme conditions. – Gridworks
  - The result is a utility must plan for a certain “Planning Margin” or “Loss of Load Probability”
- Our utility Commissions have not required a specific RA requirement, but utilities have an obligation to serve (i.e. RCW 80.28.010 (2))
  - ”safe, adequate and efficient, and in all respects just and reasonable”
- Sufficient Resource Adequacy requires either regional coordination or additional resource supply

NERC Defines Reliability

The NERC defines reliability of the bulk electric system via two main responsibilities – adequacy and security.

Adequacy is defined as “the ability of the bulk power system to supply the aggregate electrical demand and energy requirements of the customers at **all times** (e.g., 1 day in 10 years), taking into account scheduled and reasonably expected unscheduled outages of system elements”.

Security (operating reliability) is defined as the “ability of the bulk power system to withstand sudden disturbances such as electric short circuits or unanticipated loss of system elements from credible contingencies”

North American Electric Reliability Corporation (NERC) “Reliability Issues Steering Committee report on Resilience.” (November 18, 2018)

Past IRP’s Resource Adequacy Considerations

- Planning margin requirements
- Loss of load probability studies
- Annual energy acquisition targets
- Resource peak credit estimates
- Largest single contingency

Resiliency

- Resilience is generally defined as increasing the ability of the power system to prevent or mitigate the impact of unusual or catastrophic events (e.g., storms, fires, earthquakes, cyber and physical attacks).

  - Finster, M., Phillips, J., Wallace, K. "Front-Line Resilience Perspectives: the Electric Grid." Prepared for U.S. Department of Energy, Office of Energy Policy and Systems Analysis – Global Security Sciences Division, Argonne National Laboratory (November 2016)

- Washington's CETA calls out energy security and resiliency as benefit from the transition to clean energy
  - This benefit is tracked as a customer benefit indicator"

Resiliency Area's of Concern

Generation

Transmission

Distribution

Operations & Access

Customer

Resiliency Risks

Flooding	Wind, Snow, and Ice Load	Extreme weather (drought, heat, rainfall, wind, etc.)
Cyber Security, Civil Unrest, Terrorism	Wildfires	Permafrost and Land Movement
Funding	Organizational Silos	Supply Chain & Personnel

Hall, P., Vanderbeck, R., and Triano, M. (May 2019) Electric utilities: An industry guide to enhancing resilience. Resilience Primer. Wood Group PLC and Resilience Shift, UK.

Past IRP’s Resiliency Considerations

- Critical water planning (10th percentile)
- Fuel supply limitations
- Fuel price risk
- Weather protections included in resource costs
- Modeling weather related generation constraints
- Transmission interconnection requirements
- Non-energy impacts for energy efficiency

Resource Adequacy & Resiliency Changes for the 2023 IRP

- Resource acquisition will target monthly & seasonal Resource Adequacy Program targets
    - Use RA Qualified Capacity Credits (QCC) for each existing and potential resource
    - Use RA required planning margin
- Ensure Avista has energy resources to meet each month's energy need assuming 10th percentile hydro conditions and 90th percentile loads
    - With increasing amounts of wind and solar generation, Avista will need to plan for lower expected generation
    - Should Avista plan for average monthly energy or both On-Peak vs Off-Peak?
    - Draft CETA "use" rules require hourly clean energy delivery "planning"
- Conduct stochastic risk assessment to measure market exposure risk
    - Risk assessment may lead to higher planning margins or need for additional transmission

Resiliency Group Discussion

- What resiliency topics should be evaluated in the IRP vs other planning forums?
- What level of resiliency should utilities plan for?
  - Spectrum of probability
  - Outage time and service level
  - Utility cost vs societal cost
- How interchangeable is DERs with grid improvements?
- Customer resiliency
  - Self generation, fuel diversity, shell improvements, shelters, critical infrastructure
- Should we conduct resiliency related scenario analysis and what should we change in the plan based on the results?
- Include resiliency credit for local resources
  - May have locational and benefit limitations
  - Additional resources cost are likely for resources to be responsive to distribution outages
  - Require feedback loop between T&D planning
- Integrated Resource and Resiliency Planning
- Resiliency product offerings (i.e., home generators or storage)

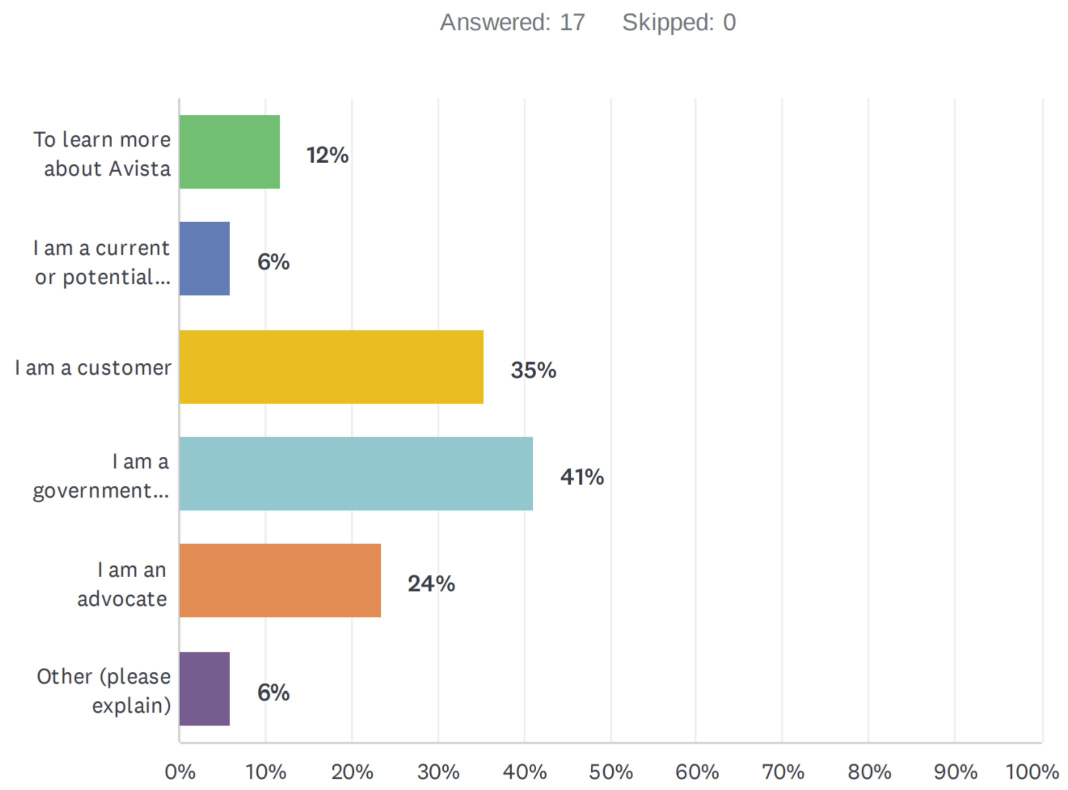
Technical Advisory Committee Participant Survey

2023 Electric IRP

First Technical Advisory Committee Meeting, December 8, 2021

Lori Hermanson, Senior Power Supply Analyst

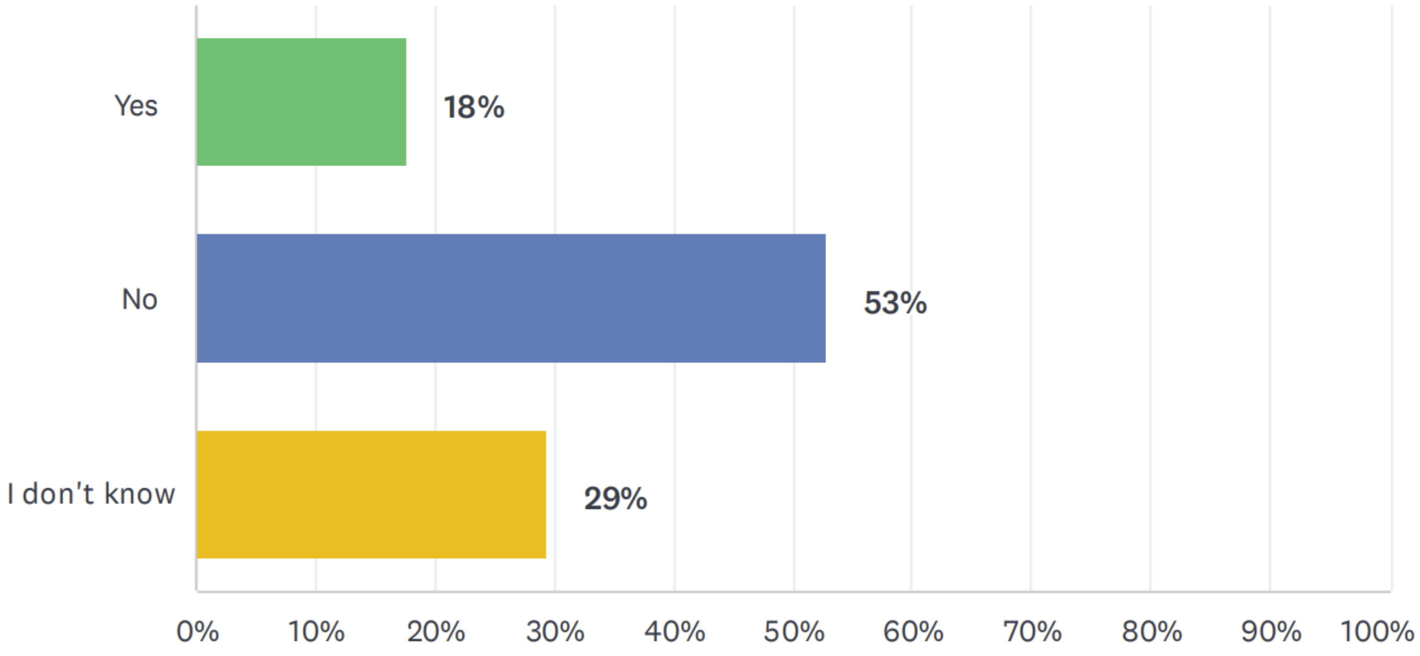
Why are you involved in the IRP process?



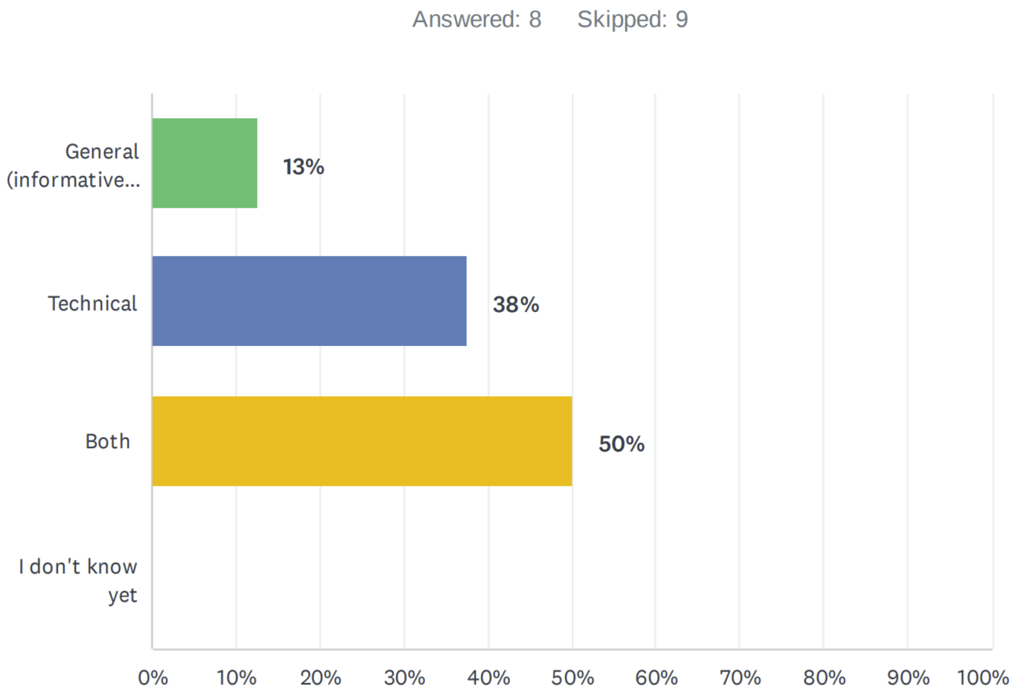
- Majority of participants are non-customers from government entities
- Many are customers
- One wants to drive solar

Would two IRP tracts (i.e. informative vs. technical) be better?

Answered: 17   Skipped: 0

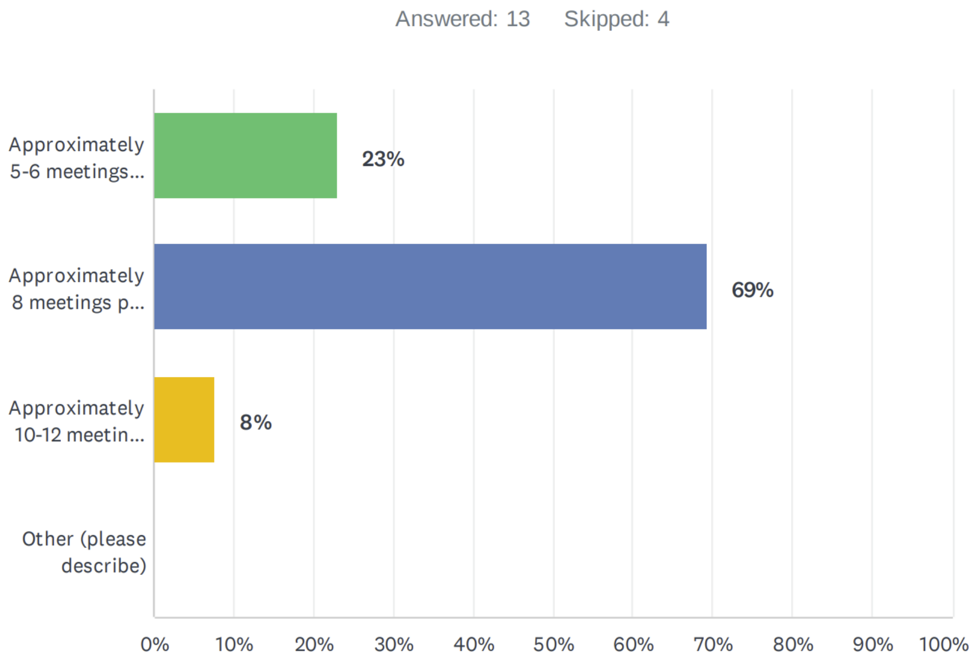


Which tract would you prefer to participate in?



- 88% prefer to participate in technical or both technical and informative

What is your preference for meeting occurrence and length?



- 69% prefer approximately 8 meetings per IRP with meetings no more than 3-4 hours in length

What topics would you like to discuss?

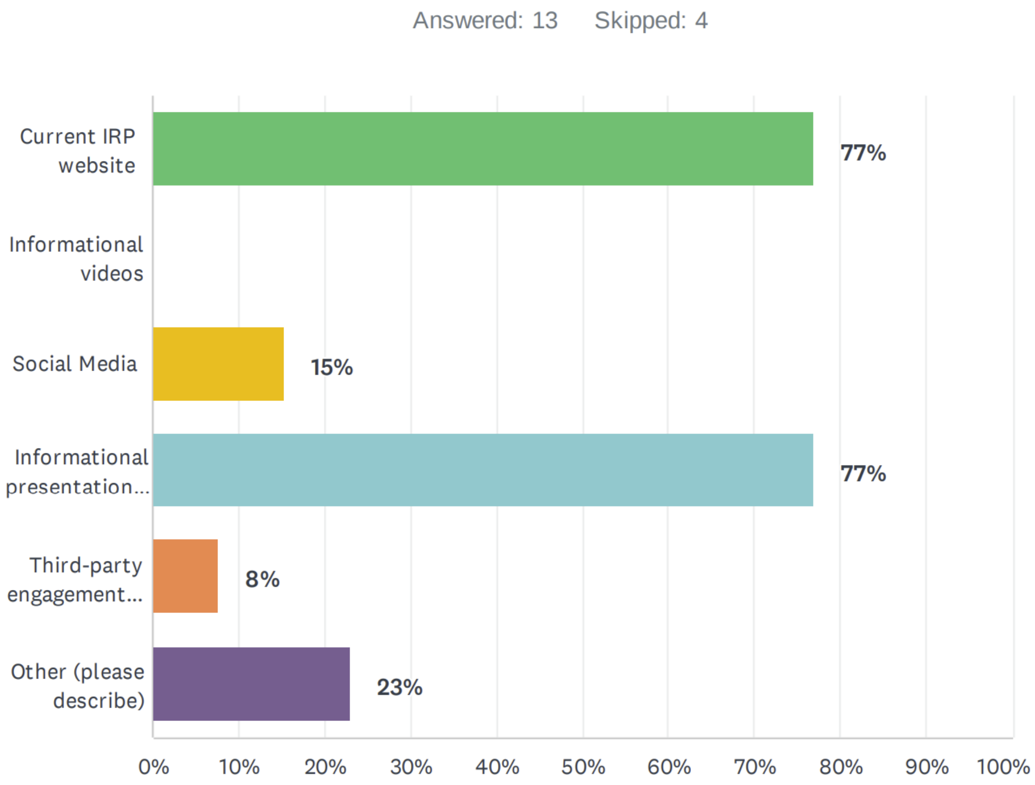
- Customer partnerships – local resource options (DR, EE, DER, electrification)
- Resource adequacy*
- Regional area network vulnerability and Avista's contingency plan to prevent loss of service*
- Stakeholder review and feedback of Avista's generic resource assumptions*
- Potential sources of renewable energy realistic for Avista's service territory, DER and energy storage options*
- Transmission and distribution technologies; T&D capacity limits; improvement needs (both regionally and local)*
- Regulatory strategy to protect legacy power generating capacity
- Nuclear power to replace coal (long-term, low-cost) instead of wind or solar; use natural gas for peaking not energy
- Impact of customer benefit indicators on IRP process*
- Resource cost/benefits analysis (new resources vs PPAs)
- Load & resource balance*
- EV adoption forecast*
- Action items status*
- Climate change*
- Reliability*
- Jurisdictional allocations

*Covered in today's or future TAC meetings.

What additional supporting data would you like to see?

- Balance was right – a strength of the 2021 IRP
- Chart of portfolio with annual operating costs and risk profile of each resource strategy – shows customers' risk exposure
- Updated climate modeling
- Refined resource adequacy considerations that target multiple characteristics including need, duration, probability and size; modeling that allows a suite of storage resources to be selected
- Current plan is to comply with WA law – plan should provide reliable, low-cost power to customers
- Modernize resource modeling with tools like WIS:dom-P (Vibrant Clean Energy) that models load, grid and renewable potential to the neighborhood level and identify where DER + storage deployment is least-cost investment
- Utilize existing biomass energy resource, not wind or solar

What are your preferences to engage customers?



- Majority prefer the website or informational presentations to engage customers
- Improved website that explains the issues and steps instead of text and links
- Newspaper articles
- Input from actual customers not outside environmental groups since customers pay the bills and hold the financial risk

What did you like about the 2021 IRP Process?

- Process was complete and detailed. Appreciated how Avista endeavored to implement the WA clean energy law and meet Idaho policy expectations (challenging!)
- Increased transparency; amount of data and presentations for varying levels of technical expertise
- Large audience
- Nice job of explaining the data and modeling tools/techniques used so folks understood the outcomes
- Logic was to comply with CETA only – we need a customer-focused IRP!
- Good presentations/presenters
- Remote meetings and format

What improvements would you like to see?

- Stop assuming Idahoans want methane gas plants. We want reliable, affordable energy.

- Focus on providing low cost, reliable power from sources that have a long-term stable cost outlook. Natural gas costs driven up as its used to firm wind/solar. Should be using nuclear and biomass with limited natural gas for peaking.

- Continue to find ways to make complicated concepts accessible to the general public.

- Online index of what topics were covered during various TAC meetings.

- Promote the process.

- Ensure Avista’s modeling tools are able to conduct modern day resource planning (e.g. consider a suite of storage resources to meet capacity shortfalls, multiple characteristics of resource adequacy, modern climate modeling and aligning inputs with a fast-evolving industry)

Washington State Clean Energy Implementation Plan Customer Benefit Indicators

December 8, 2021 – 2023 Electric IRP TAC 1

Annette Brandon

Clean Energy Transformation
IRP to CEIP

Integrated Resource Plan (IRP)

20+ year resource planning identifying customer future resource needs

- Lowest reasonable cost of resource mix including societal benefits
- Maintain and protect safety, reliable operation and balancing of electric system
- Economic, health and environmental benefits

Clean Energy Action Plan (CEAP)

Sets 10-Year targets for resources based on the lowest reasonable cost plan including; filed jointly with IRP

- Societal costs;
- Clean energy requirements; and
- Reliability Requirements.

Clean Energy Implementation Plan (CEIP) 2022-2025

CEIP establishes the actions the utility will take to comply with CETA goals over the next four years. Including:

- Interim Targets
- Specific Targets
- Public Participation Process
- Customer Benefit Indicators

Public Participation Inputs

Identify Named Communities

Highly Impacted Communities
Vulnerable Populations

Benefits/Barriers “Equity Areas”

Benefits of Clean Energy
Prioritization
Barriers to Participation

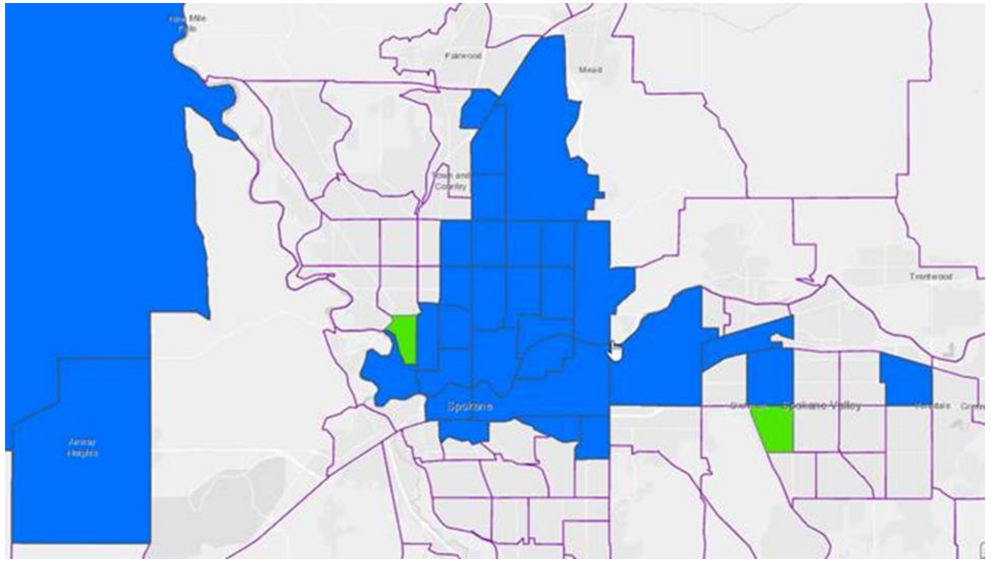
Customer Benefit Indicators

Measurable
Accountable

CEIP

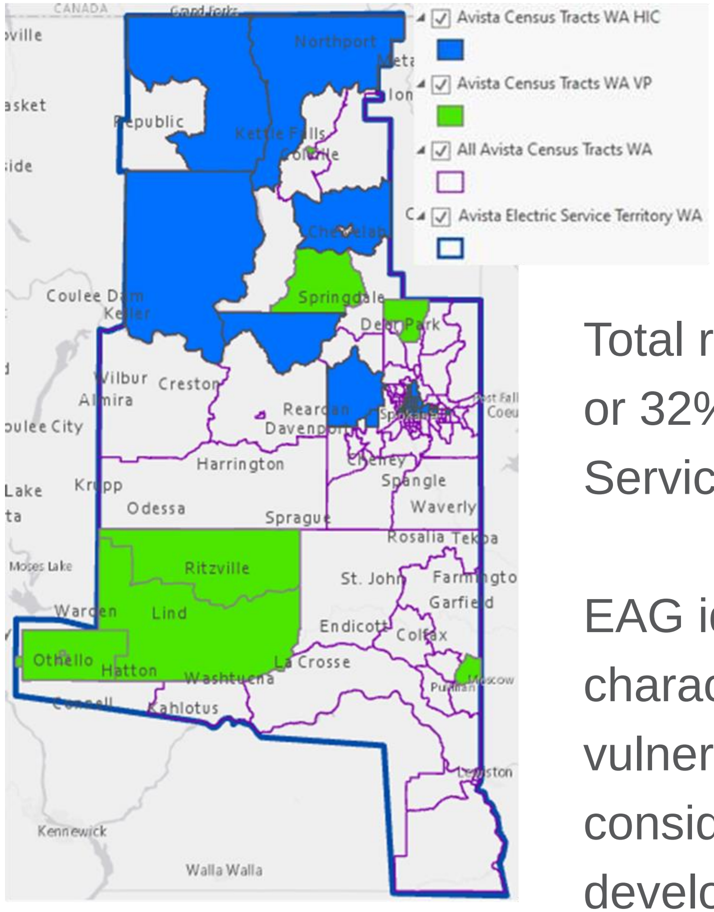
Resource Mix
Lowest Reasonable Cost
Resource Adequacy

Highly Impacted Communities and Vulnerable Populations (“Named Communities”) Who is most Impacted?



- <u>Highly Impacted Communities</u>
  - Designated by DOH
  - 34 Census Tracts (25%)

- <u>Vulnerable Populations</u>
  - Socioeconomic and sensitive population areas 9 or higher
  - 13 Census Tracts (7%)



Total represents 47 areas or 32% of total Washington Service Territory.

EAG identified additional characteristics for vulnerable populations considered as part of CBI development.

Benefits of Clean Energy Transition

Utilities must consider input from advisory group members (including equity advisory group), and customers to meet requirement that all customers benefit from the transition to clean energy through:

Equity

- Equitable distribution of energy and nonenergy benefits and reductions of burdens to vulnerable populations and highly impacted communities

Public Health and Environmental

- Long term and short-term public health and environmental benefits and reductions of costs and risks;
- Such as less air pollution which results in lower asthma rates

Energy Security and Resiliency

- Energy Security – strategic objective to maintain energy services and protecting against disruption
- Energy Resiliency – ability to adapt to challenging conditions from disruptions

Meet Planning Standards

- Maintaining and protecting the safety, reliable operation and balancing of the electric system
- Lowest reasonable cost including social costs

Developing Customer Benefit Indicators – From 86 touchpoints to 12 Final

- How could the transition to clean energy benefit (or unintentionally harm) customers?
  - Affordability
  - Environmental
  - Access to clean energy
  - Energy security, resiliency
  - Community/economic development
  - Health and well-being
- What may be some barriers or burdens?
  - Language
  - Cultural
  - Awareness
  - Transportation Access

Prioritizing Customer Benefit Indicators

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- Communication Power
  - To what extent is the indicator easily understandable by a broad audience?
- Proxy Power
  - Which are critically tied to everyone benefiting equitably from the transition to clean energy? (“Data Herd”)
- Data Power
  - Which are most able to be tracked, measured, and counted?

Customer Benefit Indicators

Customer Benefit Indicator (CBI) – is an attribute, either quantitative or qualitative of a resource or related distribution investment associated with customer benefits

Customer Benefit Indicators

Affordability
Participation in Company Programs
Number of Households with high energy burden (>6%)

Community Development
Named Community Clean Energy
Investment in Named Communities

Access
Outreach and Communication
Transportation Electrification

Energy Resiliency & Security
Energy Availability
Generation Location

Environmental
Greenhouse Gas Emissions
Outdoor Air Quality

Public Health
Employee and supplier diversity
Indoor Air Quality

CBIs are measurement tools for evaluating progress towards ensuring customers are benefitting from the transition to clean energy.

Areas considered:

- ✓ Affordability
- ✓ Access to Clean Energy
- ✓ Environment and Public Health
- ✓ Energy Security and Resiliency
- ✓ Community and Economic Development

Directly Related IRP CBIs

Number of Households With High Energy Burden	Energy Burden by All Customers and Named Communities
Named Community Clean Energy	Percent of Energy Efficiency, Non-Emitting, Renewable Energy in Named Communities
Energy Availability	Resource Adequacy Planning Margin
Energy Generation Location	Percent of Generation Located in Washington or Connected to Avista T&D system
Outdoor Air Quality	Avista Plant Air Emissions
Greenhouse Gas Emissions	Avista’s GHG emissions

Number of Households with High Energy Burden

The goal is to reduce the number of customers, especially in Named Communities, with an energy burden of six percent or more.

BASELINE METRIC

County	Households Energy Burdened in Excess of 6% (electric heat)	Energy burdened households as a percent of total households (electric heat)	Average excess burden per household (electric heat)
Adams	802	22%	$752
Asotin	810	13%	$669
Ferry	198	18%	$754
Lincoln	427	18%	$638
Spokane	14,211	16%	$533
Stevens	2,355	20%	$718
Whitman	1,543	11%	$589
Total	20,346	16%	$621

Baseline (preliminary) a point-in-time estimate (as of year end 2020) developed by Empower DataWorks.

Named Community detail in progress.

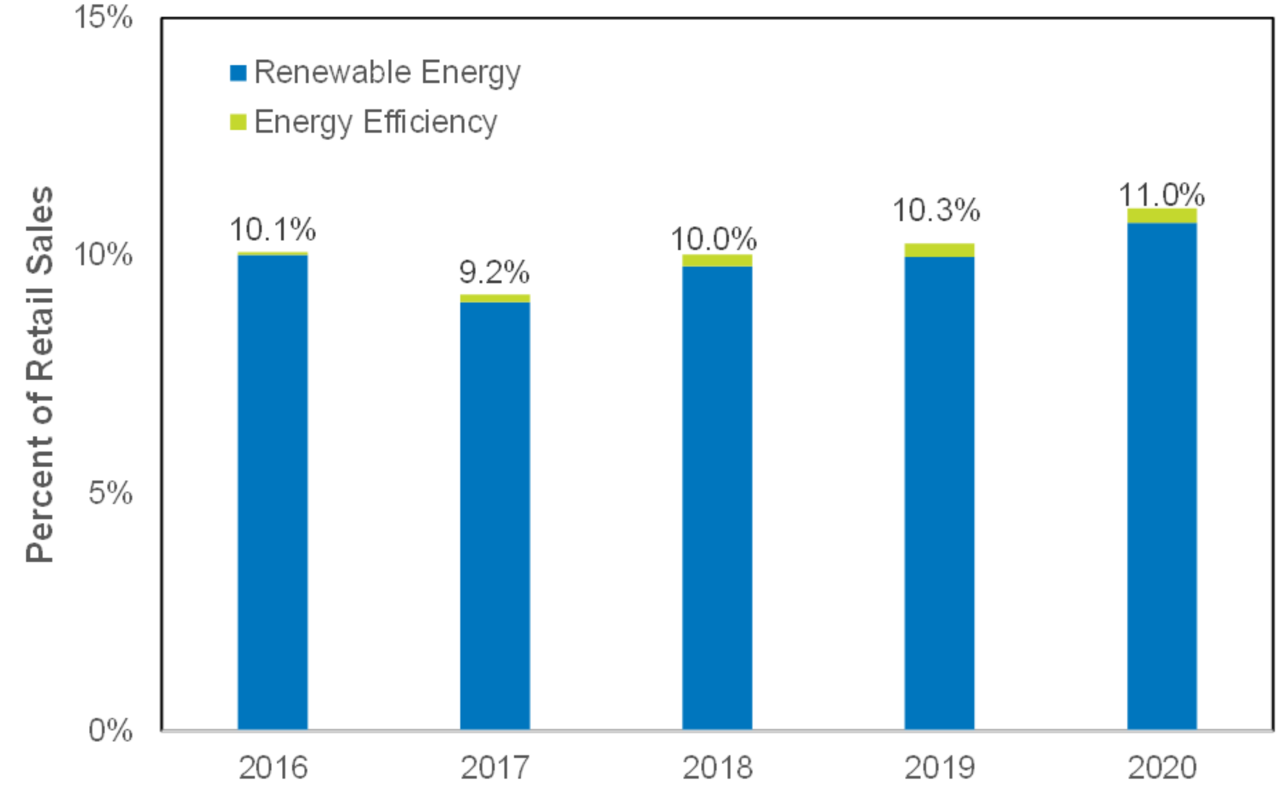
Lowest Reasonable Cost Resource calculation benefits customers in terms of

- ✓ Reduction of Burdens (if located in Named Community)
- ✓ Reduction of Cost (for all Customers)

Named Community Clean Energy

The Named Community Clean Energy CBI concentrates on the percent of non-emitting or clean energy resources, including distributed generation or energy efficiency in Named Communities.

Percent of Non-Emitting/Renewable Energy in Named Communities

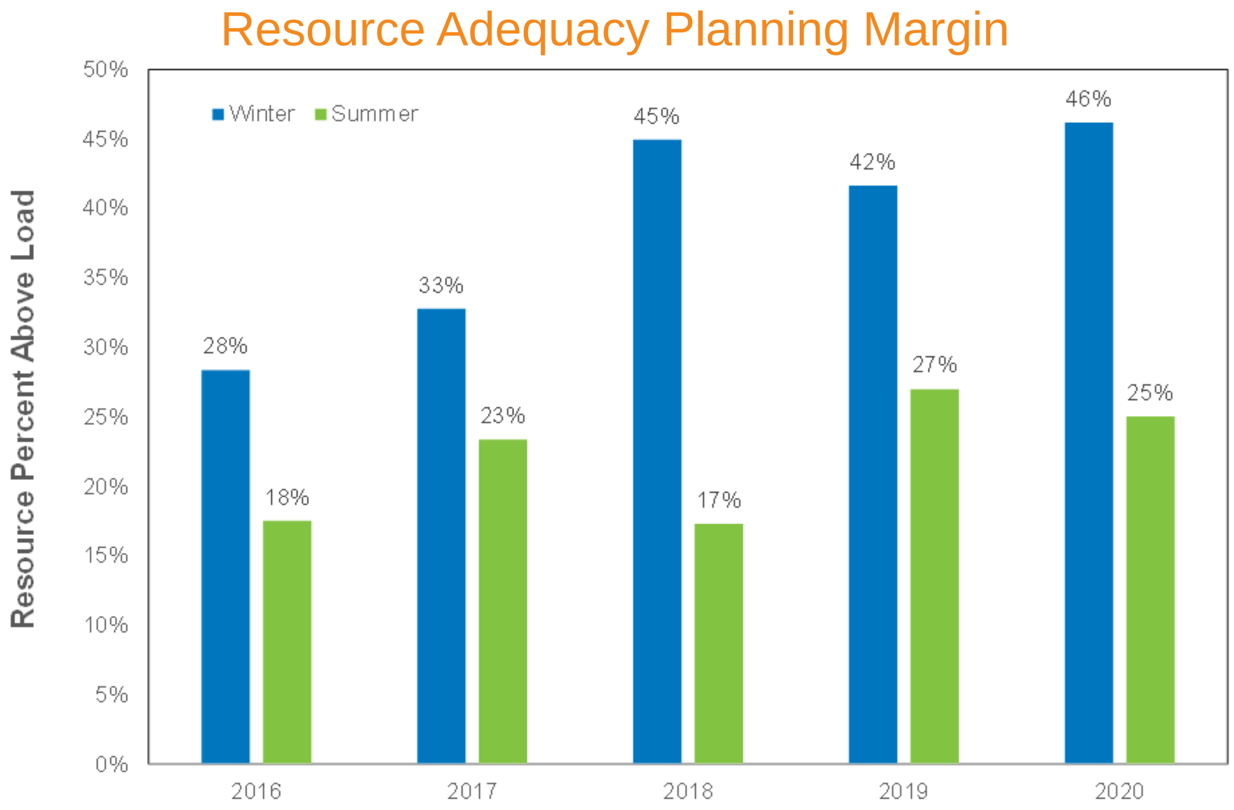


Power Supply Contribution:

- ✓ Reducing energy burdens and costs.
- ✓ New distributed energy resources may aid in faster recovery from outages.
- ✓ Non-energy benefits such as labor and economic development

Energy Availability

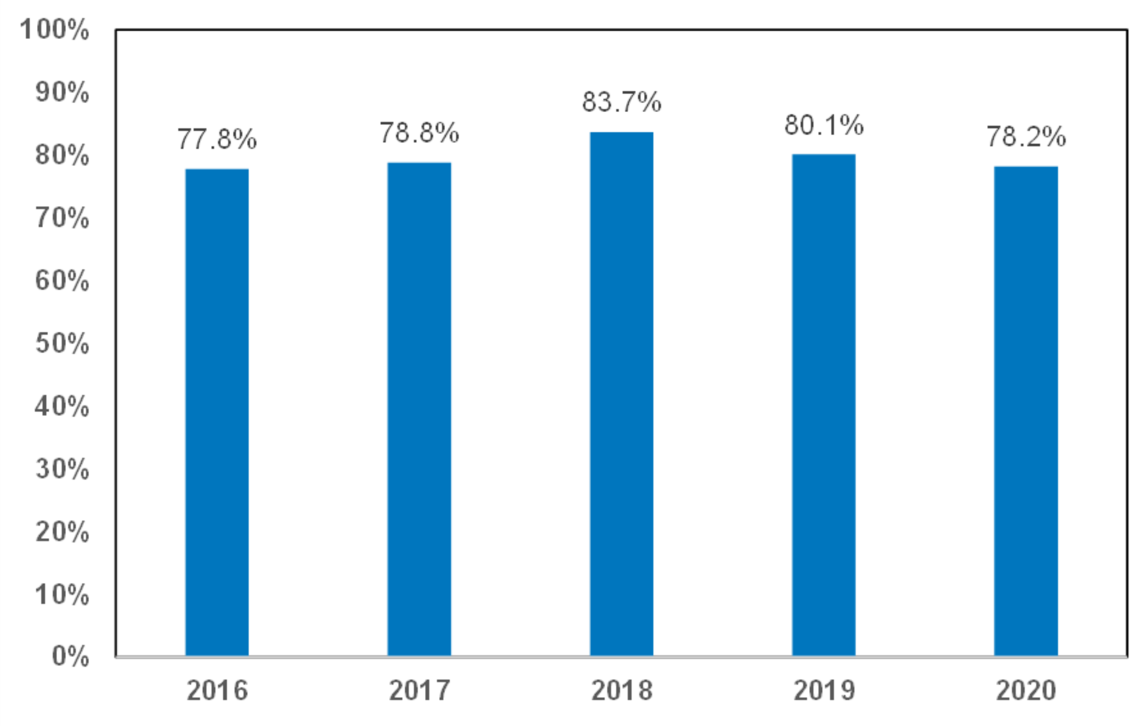
Avista’s resource Planning Margin is a measure of resource adequacy indicating the level of customer exposure to resource outages or market reliance.



Energy Generation Location – Energy Security

As part of Named Community development, Avista will track the amount of clean generation and energy efficiency in its annual system resource mix. The benefits associated with this metric will provide economic opportunities to these communities and a more energy secure pathway.

Percent of Generation located in WA or Connected to Avista Transmission system

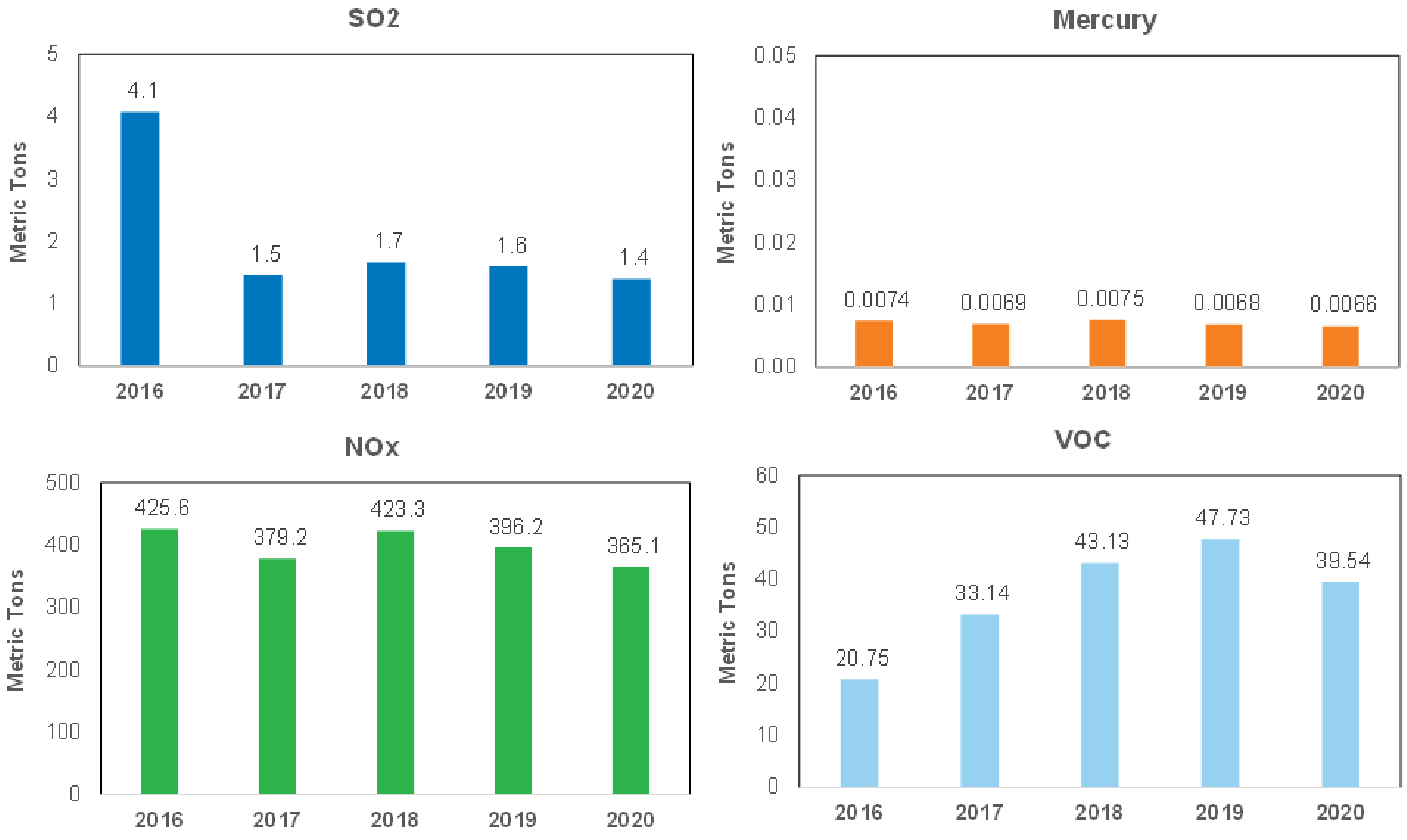


- Locating resources closer to customers will not eliminate disruptions.
- Local generation may create benefits by reducing transmission of power risk and/or policy issues from out-of-state resources.
- There are risks to utilizing local generation such as lack of diversity of weather, for example

Outdoor Air Quality

Avista will monitor Avista-specific Plant Air Emissions on a locational basis.

Avista Plant Air Emissions

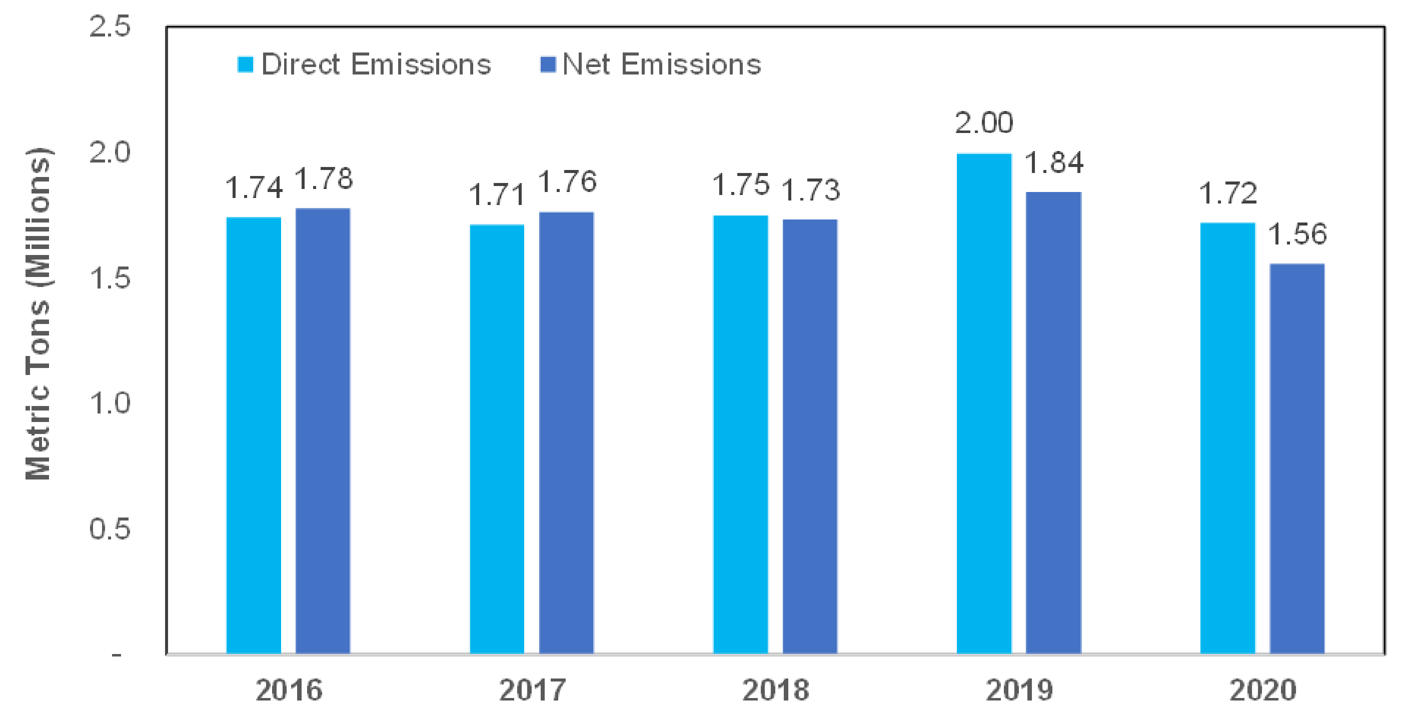


Greenhouse Gas Emissions

Avista will monitor the greenhouse gas emissions from Avista resources and how it interacts with the wholesale market.

Renewable Energy Projects will contribute to the overall reduction in Regional GHG as we move towards 2030.

Avista-specific GHG



CBIs and Resource Selection

CBIs must be incorporated into resource selection and program prioritization in order to ensure customers are benefitting from the transition to clean energy.

Energy Efficiency	Used to prioritize programs Focus on impacts to Named Communities
Demand Response	Will be used in development of Time of Use and Peak Time Rebate pilots
Renewable Energy Acquisition	Considered in weighting of RFP evaluation

CBIs and Resource Selection

IRP Portfolio Analysis and Preferred Portfolio must consider:

- Lowest Reasonable Cost
- Include cost-effective, reliable and feasible conservation and efficiency resources and distributed energy sources
- Consider acquisition of existing renewable resources
- Maintain and Protect safety, reliable operation and balancing of the utility's electric system
- Include long-term strategy and interim steps to equitable distribute benefits or reduce burdens to highly impacted in vulnerable populations
- Assess the environmental health impacts to highly impacted communities

How to incorporate CBIs into this mix?

Prioritization

- one CBI is not determined to be more important than another on a stand-alone basis.
- Dependent upon resource selection, how much weight should be given?
- What about those that are not able to be quantified

- Weighting of factors?
- Develop standard weighting?

CBI’s Indirectly Related to the IRP

Participation in Company Programs	Participation in weatherization programs and energy assistance programs (State and Named Community statistic)
Availability of Methods/Modes of Outreach & Communication	Number of outreach contacts Number of marketing impressions
Transportation Electrification	Number of trips provided by community-based organizations Number of public charging stations located in Named Communities
Investments in Named Communities	Incremental spending each year in Named Communities Number of customers/and/or community-based organizations served
Employee Diversity	Employee diversity equal to communities served by 2035 (goal)
Outdoor Air Quality	Weighted Average Days Exceeding Healthy Levels
Energy Availability	Average Outage Duration
Greenhouse Gas Emissions	Regional GHG Emissions by Sector
Supplier Diversity	Supplier diversity at 11 percent by 2035 (goal)
Indoor Air Quality	In development

How will the IRP address CBI’s?

- Directly related IRP CBI’s will be quantitatively forecasted in the IRP.
  - including of non-energy impacts and transitioning to 100% clean energy by 2045 may improve these indicators
- Indirectly related IRP CBI’s will be qualitatively discussed in the IRP.
- In the event an indicator does not improve
  - Describe why the indicator is not improving
  - Document options for improvement, including impacts to other CBI’s
- Other ideas?

CBI List

Participation in Company Programs	Participation in Energy Efficiency and Weatherization ("other") Saturation Rate for Energy Assistance Programs
Number of Households With High Energy Burden	Energy Burden by All Customers and Named Communities
Availability of Methods/Modes of Outreach / Communication	Number of Outreach Contacts Number of Marketing Impressions
Transportation Electrification	Number of Annual Trips to CBOs and passenger miles for individuals utilizing electric transportation Number of Public Charging ports available to public in Named Communities
Named Community Clean Energy	Percent of Non-Emitting/Renewable Energy in Named Communities
Investment in Named Communities	Incremental annual spending of investments in Named Communities Number of customers and/or CBOs served each year
Energy Availability	Average Outage Duration Resource Adequacy Planning Margin
Energy Generation Location	Percent of Generation Located in Washington or Connected to Avista TX system
Outdoor Air Quality	Weighted Average Days Exceeding Healthy Levels Avista Plant Air Emissions (SO2, Mercury, Nox, VOC)
Greenhouse Gas Emission	Regional GHG Emissions by Sector Avista's GHG emissions
Public Health	Employee and Supplier Diversity Indoor Air Quality

2023 IRP Draft Work Plan

2023 Electric IRP

TAC 1 – December 8, 2021

John Lyons, Ph.D. – Senior Resource Policy Analyst

2023 IRP Work Plan

- IRP regulations require an IRP to be filed in Idaho on April 1, 2023, and a progress report in Washington on January 1, 2023.

- Avista will ask Commissions to extend the filings to June 1, 2023, to allow for the completion of the 2022 All-Source RFP which will fundamentally change the resource strategy.
  - For the progress report in Washington, Avista will have 3 of the 4 requirements for the report by January 2023 but would prefer to hold off on filing a resource strategy until new contracts are signed.

- The IRP will incorporate resource selections from the 2022 All-Source RFP and meet capacity requirements in the Northwest Power Pool’s Resource Adequacy Program.

2023 IRP Work Plan – Modeling

- Use Aurora for electric market prices, resource valuation and Monte-Carlo style risk analyses of the electric marketplace.

- Aurora modeling results will be used to select the PRS and alternative scenario portfolios using Avista's proprietary PRiSM model.

- Qualitative market risk evaluations involve separate analyses with Avista's ARAM model or Plexos.

- Applied Energy Group (AEG) is conducting energy efficiency and demand response potential studies.

- DNV is conducting non-energy impact study for supply-side resources to improve customer benefit indicators for Washington customers. DNV recently completed a similar study for energy efficiency.

Tentative 2023 Electric IRP TAC Schedule

- **TAC 1 (Wednesday, December 8, 2021):** 2021 IRP Action Item Review, Summer 2021 Heat Event Review, NWPP Resource Adequacy Program Overview, Resource Adequacy Program Impact to the IRP, IRP Resource Adequacy/Resiliency Planning Discussion, TAC Survey Results and Discussion, Washington State Customer Benefit Indicators, and 2023 IRP workplan.

- **TAC 2 (Tuesday, February 8, 2022):** Process Update, Demand and economic forecast, and Preliminary Load & Resource Balance.

- **TAC 3 (Wednesday, March 9, 2022):** Preliminary natural gas market overview and price forecast, Preliminary wholesale electric price forecast, Non-Energy Impact Study by DNV, and Existing resource overview.

Tentative 2023 Electric IRP TAC Schedule

- **TAC 4 (Late July 2022):** Conservation Potential Assessment (AEG), Demand Response Potential Assessment (AEG), energy efficiency inclusion of Social Cost of Greenhouse Gas (WA only)

- **TAC 5 (Early August 2022):** IRP transmission planning studies, distribution planning within the IRP, and NWPP Resource Adequacy Program update

- **TAC 6 (August 2022):** Supply side resource cost assumptions including DERs, ancillary services and intermittent generation analysis, update on All-Source RFP, update to energy and peak forecast, and update to Load & Resource balance

- **TAC 7 (September 2022):** Hydro impacts from global climate change studies, load impacts from global climate change studies, DER study scope for 2025 IRP, Clean Energy Implementation Plan update, final wholesale natural gas and electric price forecast, and discuss portfolio and market scenarios options

Tentative 2023 Electric IRP TAC Schedule

- **Technical Modeling Workshop (October 2022):** PRiSM model overview, risk assessment overview (Plexos or ARAM), and Washington use of electricity modeling

- **TAC 8 (February 2023):** Wholesale market scenario results, RFP update, jurisdictional allocation update, draft Preferred Resource Strategy, Washington 100% clean energy planning standard modeling, and market risk assessment

- ***Virtual Public Meeting- Natural Gas & Electric IRP (February/March 2023)***

- **TAC 9 (March 2023):** Final Preferred Resource Strategy, portfolio scenario analysis, final report overview and comment on plan, and Action Items

- Agendas, presentations & minutes: https://myavista.com/about-us/integrated-resource-planning

Tentative 2023 Draft Electric IRP Timeline

Task	Target Date
Update and finalize energy & peak forecast	May 2022
Transmission & distribution studies complete	June 2022
Identify Avista’s supply resource options	July 2022
Finalize demand response options	July 2022
Finalize energy efficiency options	July 2022
Finalize natural gas price forecast	August 2022
Finalize electric price forecast	September 2022
Determine portfolio & market future studies	October 2022
Due date for study requests from TAC members	**October 1, 2022**
Finalize PRiSM model assumptions	October 2022
Simulate market scenarios in Aurora	November 2022
Portfolio Analysis	February 2022

Tentative 2023 IRP Writing Tasks

Writing Tasks	Target Date
File 2023 IRP Work Plan	January 1, 2022
Washington Partial Progress Report	January 1, 2023
External draft released to the TAC	March 17, 2023
Public Comments from TAC due	**May 12, 2023**
Final IRP submission to Commissions and TAC	June 1, 2023

Tentative 2023 Electric IRP Timeline – Public Data Releases

Task	Targeted Release
Peak & Energy Load Forecast	June 2022
Supply Side Resource Options	July 2022
Energy Efficiency Potential Study	July 2022
Demand Response Potential Study	July 2022
Transmission Interconnect Costs	July 2022
Wholesale Natural Gas Price Forecast	August 2022
Wholesale Electric Price Forecast	September 2022
Climate Change Impact Study Data	October 2022
Load Scenario Data	October 2022
PRiSM Model Available	November 2022
Draft PRiSM Model & Results	February 2023
Final PRiSM Model & Results	March 2023

2023 Electric IRP Draft Outline

1. **Executive Summary**

2. **Introduction, Stakeholder Involvement, and Process Changes**

3. **Economic and Load Forecast**
   - Economic Conditions
   - Avista Energy & Peak Load Forecasts
   - Load Forecast Scenarios

4. **Existing Supply Resources**
   - Avista Resources
   - Contractual Resources and Obligations
   - Customer Generation Overview

2023 Electric IRP Draft Outline

5. **Long-Term Position**
    - Regional Capacity Requirements
    - Energy Planning Requirements
    - Reserves and Flexibility Assessment

6. **Transmission Planning & Distribution**
    - Overview of Avista's Transmission System
    - Future Upgrades and Interconnections
    - Transmission Construction Costs and Integration
    - Merchant Transmission Plan
    - Overview of Avista's Distribution System
    - Future Upgrades and Interconnections

2023 Electric IRP Draft Outline

7. **Distributed Energy Resources**
   - Energy efficiency potential
   - Demand response potential
   - Supply side resource options
   - Named Community Actions

8. **Supply Side Resource Options**
   - New Resource Options
   - Avista Plant Upgrades
   - Non-Energy Impacts

2023 Electric IRP Draft Outline

9. **Market Analysis**
    - Wholesale Natural Gas Market Price Forecast
    - Wholesale Electric Market Price Forecast
    - Scenario Analysis

10. **Preferred Resource Strategy**
    - Preferred Resource Strategy
    - Market Exposure Analysis
    - Avoided Cost
    - Customer Benefit Indicator Impact
    - Clean Energy Action Plan Update

2023 Electric IRP Draft Outline

9. **Portfolio Scenarios**
    - Portfolio Scenarios
    - Market Scenario Impacts

10. **Action Plan**

AVISTA

2023 Electric Integrated Resource Plan

Technical Advisory Committee Meeting No. 2 Agenda

Tuesday, February 8, 2022
Virtual Meeting

Topic	**Time**	**Staff**
Introductions	9:00	John Lyons
Process Update	9:10	John Lyons
Demand & Economic Forecast	9:30	Grant Forsyth
Load and Resource Balance Update	11:00	James Gall
Adjourn	11:30	

Microsoft Teams meeting

Join on your computer or mobile app

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+1 509-931-1514,,935268410#   United States, Spokane

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2023 IRP Introduction

2023 Avista Electric IRP

TAC 2 – February 8, 2022

John Lyons, Ph.D. Senior Resource Policy Analyst

Meeting Guidelines

- IRP team is working remotely and is available for questions and comments
- Stakeholder feedback form
  - Responses shared with TAC at meetings, by email and in Appendix
  - Would a form and/or section on the web site be helpful?
- IRP data posted to web site – updated descriptions and navigation are in development
- Virtual IRP meetings on Microsoft Teams until able to hold large meetings again
- TAC presentations and meeting notes posted on IRP page
- This meeting is being recorded and an automated transcript made

Virtual TAC Meeting Reminders

- Please mute mics unless speaking or asking a question
- Raise hand or use the chat box for questions or comments
- Respect the pause
- Please try not to speak over the presenter or a speaker
- Please state your name before commenting for the note taker
- This is a public advisory meeting – presentations and comments will be documented and recorded

Integrated Resource Planning

The Integrated Resource Plan (IRP):

- Required by Idaho and Washington* every other year
    - Washington requires IRP every four years and update at two years
- Guides resource strategy over the next twenty + years
- Current and projected load & resource position
- Resource strategies under different future policies
    - Generation resource choices
    - Conservation / demand response
    - Transmission and distribution integration
    - Avoided costs
- Market and portfolio scenarios for uncertain future events and issues

Technical Advisory Committee

- The public process piece of the IRP – input on what to study, how to study, and review of assumptions and results
- Wide range of participants involved in all or parts of the process
  - Please ask questions
  - Always soliciting new TAC members
- Open forum while balancing need to get through topics
- Welcome requests for new studies or different modeling assumptions.
- Available by email or phone for questions or comments between meetings

2023 IRP Process Update

- Draft Work Plan sent with today’s presentations
  - Are any days of the week better or worse for future meetings?
  - Based on feedback from last TAC – aiming for shorter and more frequent meetings
- Intend to file 2023 IRP on June 1, 2023 – allow time to incorporate results of 2022 All-Source RFP
- Idaho Extension
  - Filed request under Docket No. AVU-E-22-01 to file the next IRP on June 1, 2023, instead of April 1, 2023
  - January 25, 2022: Staff recommendation to set a public comment deadline of February 24, 2022, and Company reply due by March 5, 2022
- Washington IRP update on January 1, 2022, with 3 of the 4 requirements – only Preferred Resource Strategy will not be ready with RFP results

2023 IRP TAC Meeting Schedule

- TAC 3: Wednesday, March 9, 2022
    - Preliminary Natural Gas Market Overview and Price Forecast
    - Preliminary Wholesale Electric Price Forecast
    - Non-Energy Impact Study (DNV)
    - Existing Resource Overview
- TAC 4: August 2022
    - Conservation Potential Assessment (AEG)
    - Demand Response Potential Assessment (AEG)
    - Energy Efficiency Inclusion of Social Cost of Greenhouse Gas (WA Only)
- TAC 5: Early September 2022
    - IRP Generation Option Transmission Planning Studies
    - Distribution System Planning with the IRP
    - Western Resource Adequacy Program update

2023 IRP TAC Meeting Schedule

- TAC 6: End of September 2022
  - Supply Side Resource Cost Assumptions, including DERs
  - Ancillary Services and Intermittent Generation Analysis
  - All-Source RFP Update
  - Energy and Peak Forecast update
  - Load & Resource Balance update

- TAC 7: October 2022
  - Hydro Impacts from Global Climate Change studies
  - Load Impacts from Global Climate Change studies
  - DER Study Scope for 2025 IRP
  - Clean Energy Implementation Plan update
  - Final Wholesale Natural Gas and Electric Price Forecasts
  - Discuss portfolio and market scenario options

2023 IRP TAC Meeting Schedule

- Technical Modeling Workshop October 2022
  - PRiSM model overview
  - Risk Assessment overview
  - Washington use of electricity modeling

- TAC 8: February 2023
  - Wholesale Market Scenario results
  - RFP update
  - Jurisdictional allocation update
  - Draft Preferred Resource Strategy
  - Washington 100% clean energy planning standard modeling
  - Market risk assessment

2023 IRP TAC Meeting Schedule

- Virtual Public Meeting – Natural Gas & Electric IRPs (February/March 2023)
  - Recorded presentation
  - Daytime comment and question session
  - Evening comment and question session

- TAC 9: March 2023
  - Final Preferred Resource Strategy
  - Portfolio scenario analysis
  - Final report overview & comment plant
  - Action Items

Key 2023 IRP Dates

- Finalize 2023 IRP Work Plan – February/March 2022
- Due date for study requests from TAC members – October 1, 2022
- Washington IRP Progress Report – January 1, 2023
- External IRP draft released to the TAC – March 17, 2023
- Public comments from TAC due – May 12, 2023
- Final 2023 IRP submission to Commissions and TAC – June 1, 2023

Today’s Agenda

9:00	Introductions, Lyons
9:10	Process Update, Lyons
9:30	Demand and Economic Forecast, Forsyth
11:00	Load and Resource Balance Update
11:30	Adjourn

TAC Meeting
February 8, 2022

2023 IRP: Preliminary Economic Conditions and Forecasts

Grant Forsyth, Ph.D.
Chief Economist
Grant.Forsyth@avistacorp.com

Outline

- **Service Area Economy**
- **Long-run Energy Forecast**
- **Peak Load Forecast**

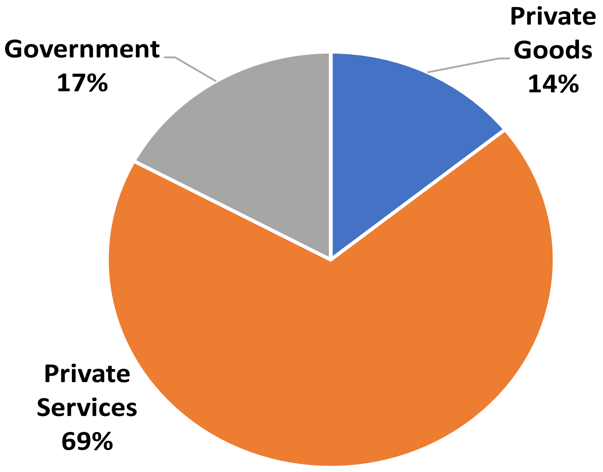
“Models are predicting what’s normal in a world that isn’t normal.”

-Erica Groshen, former head of the BLS and current economic advisor to Cornell University’s Industrial and Labor Relations School.

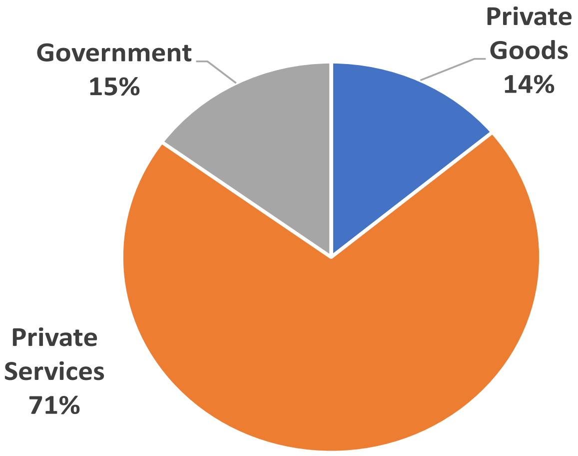
Quote from: “Here’s another thing the pandemic messed up: economic forecasts,” by David J. Lynch, *The Washington Post*, January 11, 2022

Service Area Economy: Non-Farm Employment Structure

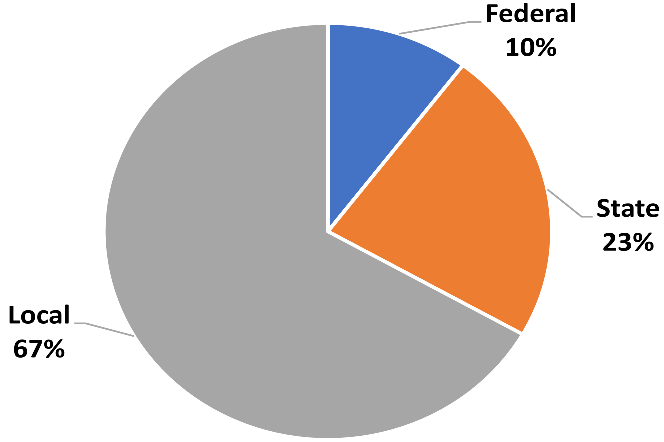
Avista WA-ID MSA



U.S.



Avista WA-ID MSA Government



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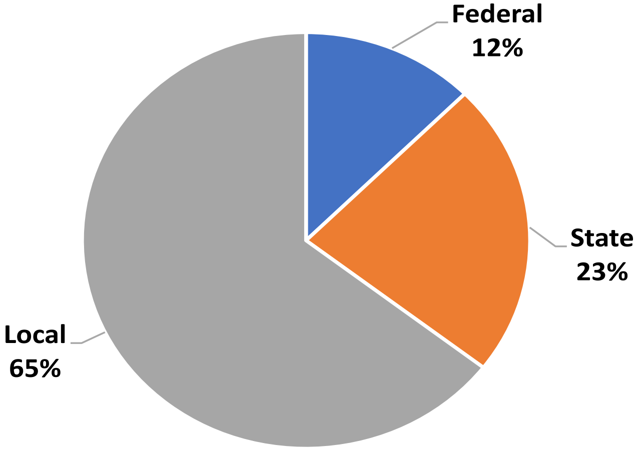
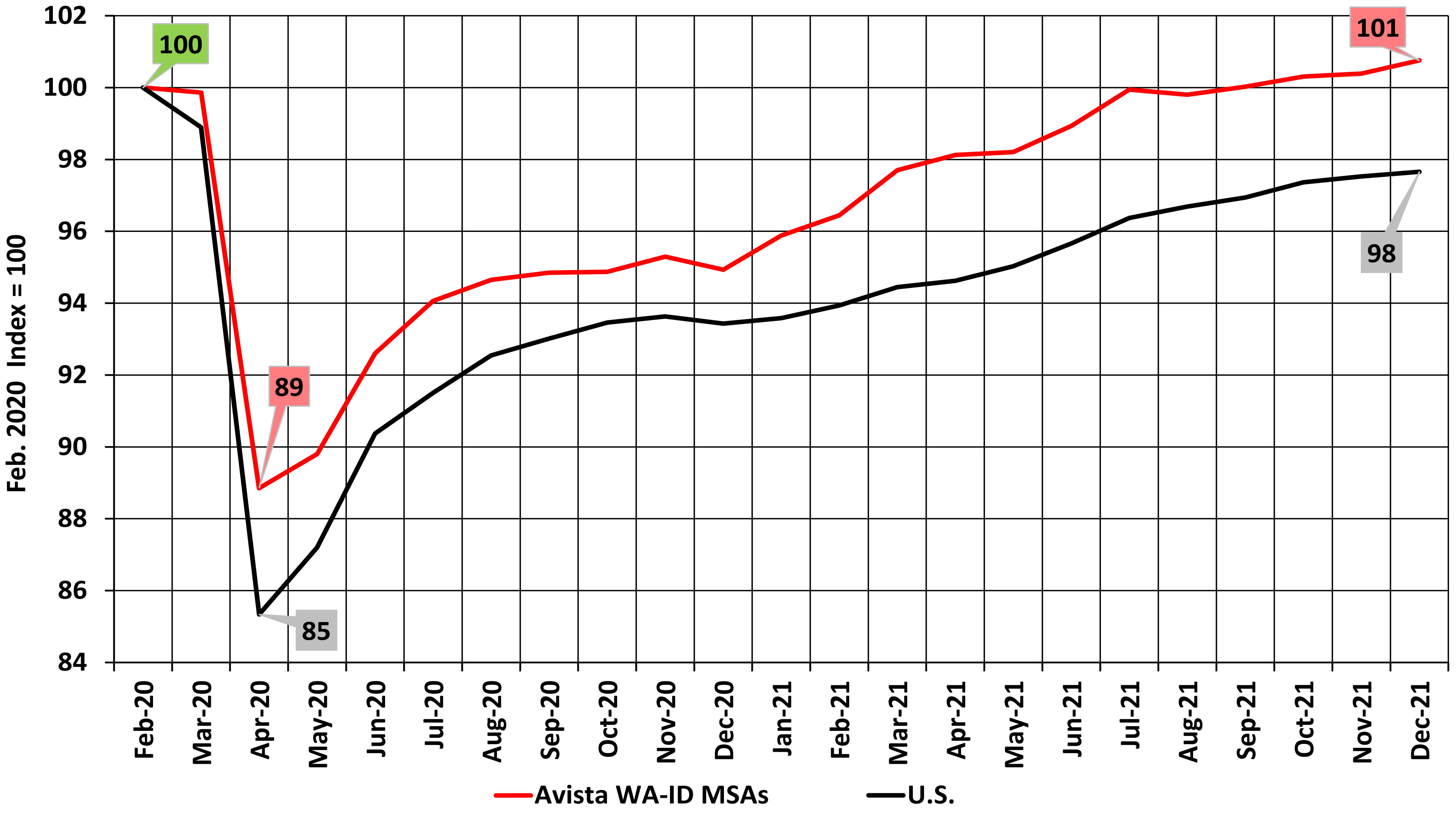


Source: BLS and author’s calculations.

Comments

- Employment structure very similar to the U.S.
- Employment dominated by private services. Without service sector growth, very little employment growth will be generated.
- Majority of public sector employment is local and related to education.
- If agriculture is considered, it would account for about 1% to 1.5% of employment.

Service Area Economy: Non-Farm Employment

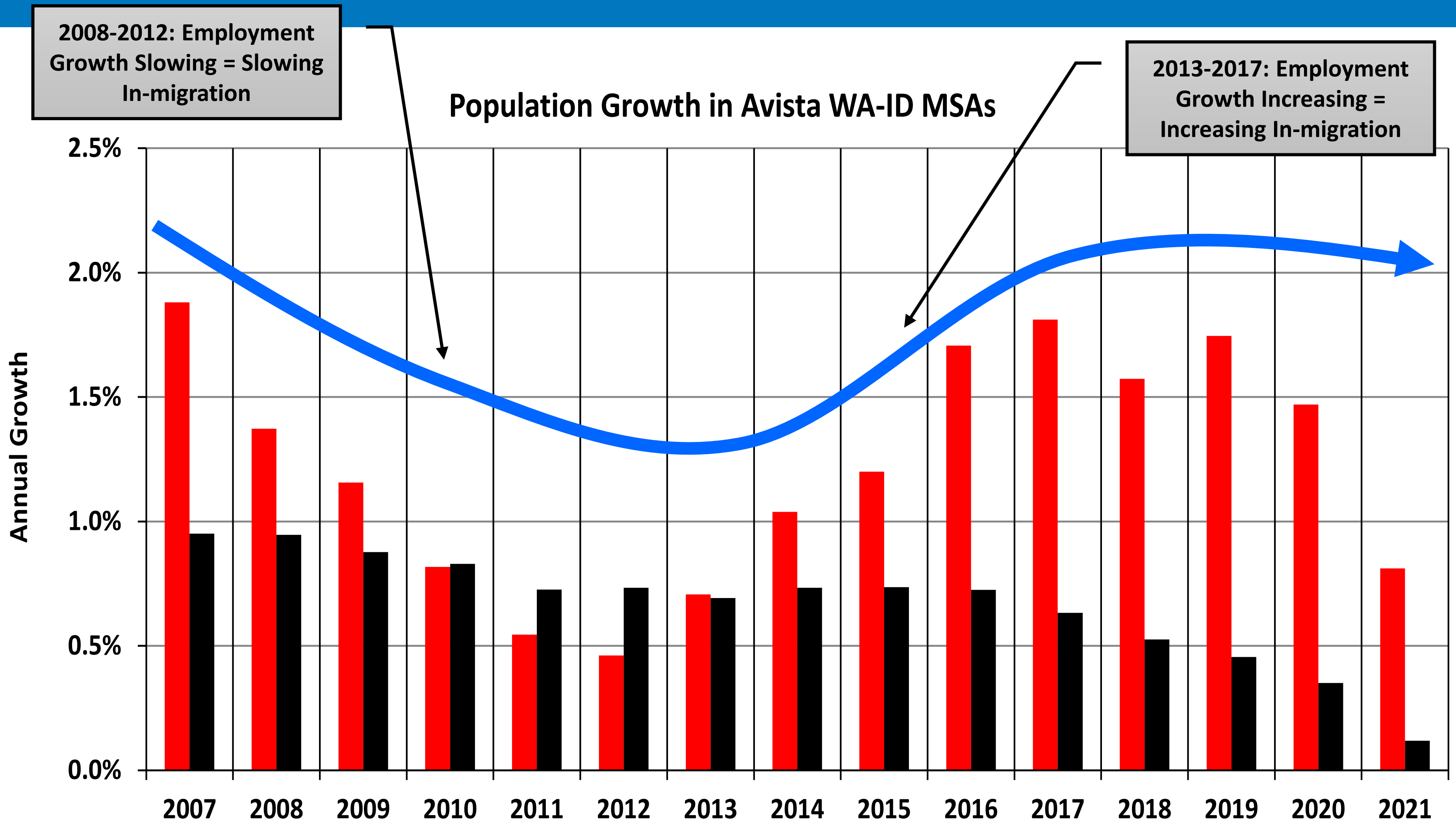


Source: BLS, WA ESD, and author's calculations.

Comments

- **Region has recovered from the pandemic faster than the U.S.**
- **Strong growth in ID and an Amazon expansion in WA were important drivers.**
- **However, the region is still suffering many of the same problems seen in the rest of the U.S.: labor shortages, supply disruptions, and inflation. Shelter cost growth has been some of the fastest in the U.S.**

Service Area Economy: WA-ID Metro Population Growth



2008-2012: Employment Growth Slowing = Slowing In-migration

2013-2017: Employment Growth Increasing = Increasing In-migration

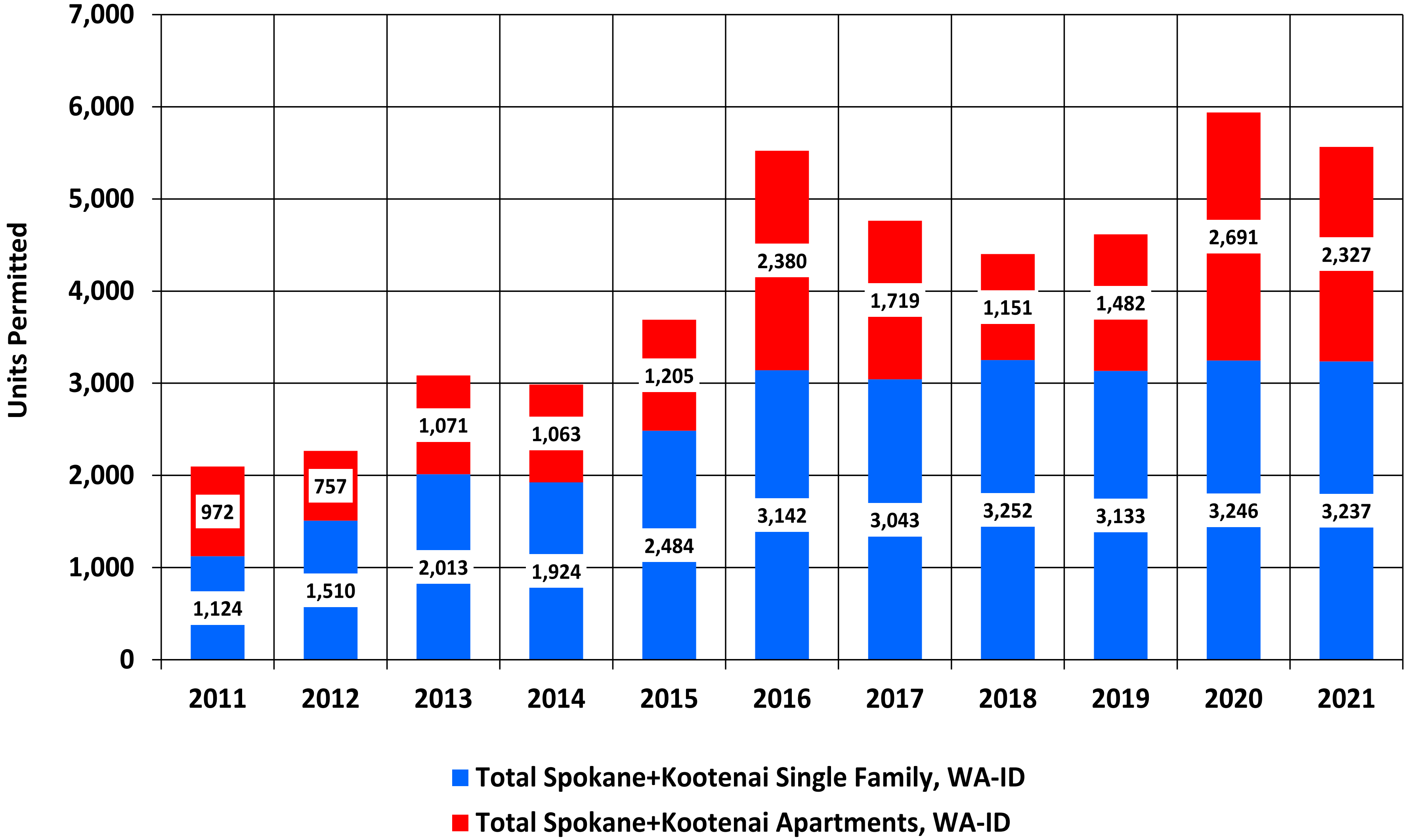
Population Growth in Avista WA-ID MSAs

Comments

- Population growth drives most of our customer growth.
- Significantly higher than U.S. growth because of in-migration. Without in-migration, growth would look like U.S.
- Pandemic suppressed growth in 2021. We expect a rebound in service area growth after 2021.
- Growth is highest on the ID side.

Source: BEA, U.S. Census, and author’s calculations.

Service Area Economy: Spokane+Kootenai Residential Units Permitted

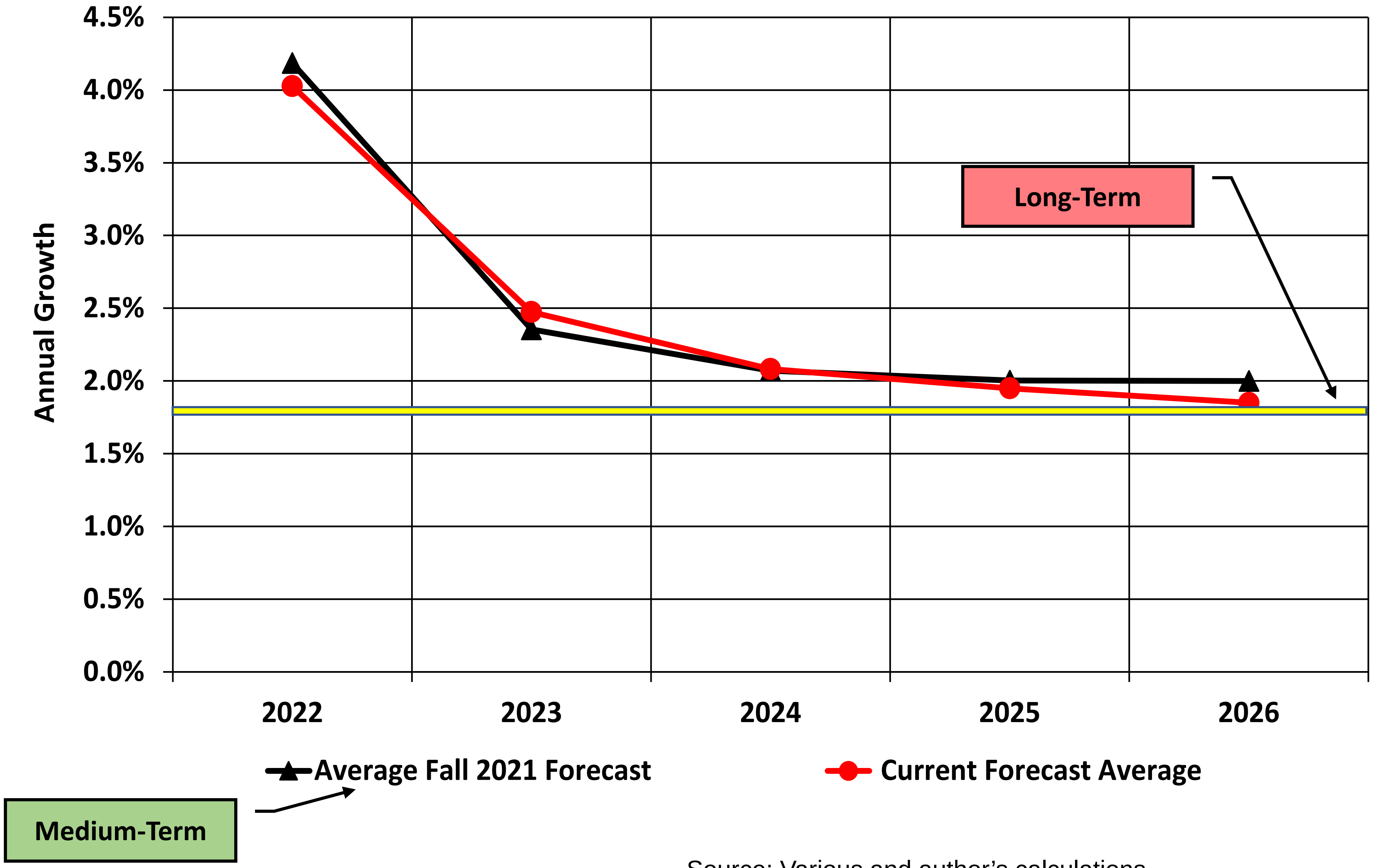


Source: Construction Monitor and author’s calculations.

Comments

- **Strongly connected to population growth.**
- **Held up surprisingly well in the pandemic. Recessions would normally push down permitting.**
- **Even with strong permitting, demand has outstripped supply of housing. This has pushed price growth to some of the highest in the U.S.**
- **Apartments and duplexes have been an important source of new housing in both WA and ID. Duplexes are counted as “single family” in the graph.**

Service Area Economy: U.S. GDP Growth Assumptions

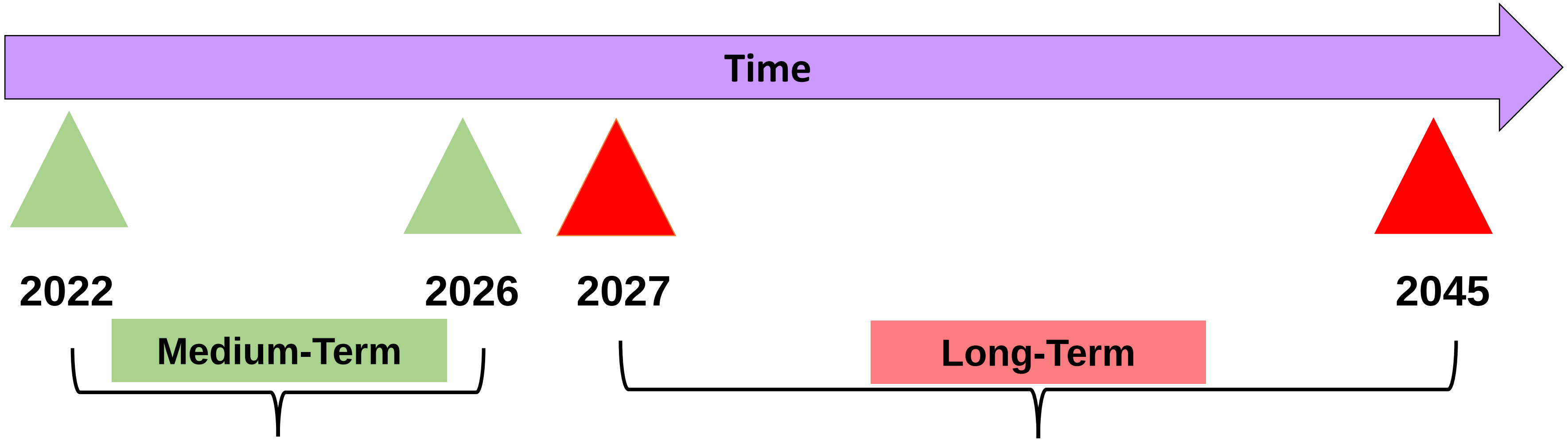


Source: Various and author's calculations.

Comments

- Long-run growth is a function of population growth and labor productivity growth.
- U.S. continues to have weak productivity growth and weak population growth.
- The Fed's long-run expectation for GDP growth has fallen from 2% to 1.8% (yellow line). This is the growth rate assumed from 2027 to 2045.
- The assumed long-run GDP forecast is lower compared to previous IRPs. Long-run GDP growth must exceed 2.3% before forecasted industrial load will grow.

Long-term Energy Forecast: Basic Approach



Time

2022

2026

2027

2045

Medium-Term

1) Monthly econometric model by schedule for each customer class.
2) Customer and UPC forecasts.
3) 20-year moving average for “normal weather.”
4) Economic drivers: GDP, industrial production, employment growth, population, price, natural gas penetration, and ARIMA error correction.
5) Native load (energy) forecast derived from retail load forecast.
6) Current forecast is the Fall 2021 Forecast.

Long-Term

1) Boot strap off medium term forecast.
2) Apply long-run load growth relationships to develop simulation model for high/low scenarios.
3) Include different scenarios for roof top solar penetration with controls for price elasticity, EV/PHEVs, GDP growth, population growth, weather, and natural gas penetration.

Long-term Energy Forecast: Growth Relationships

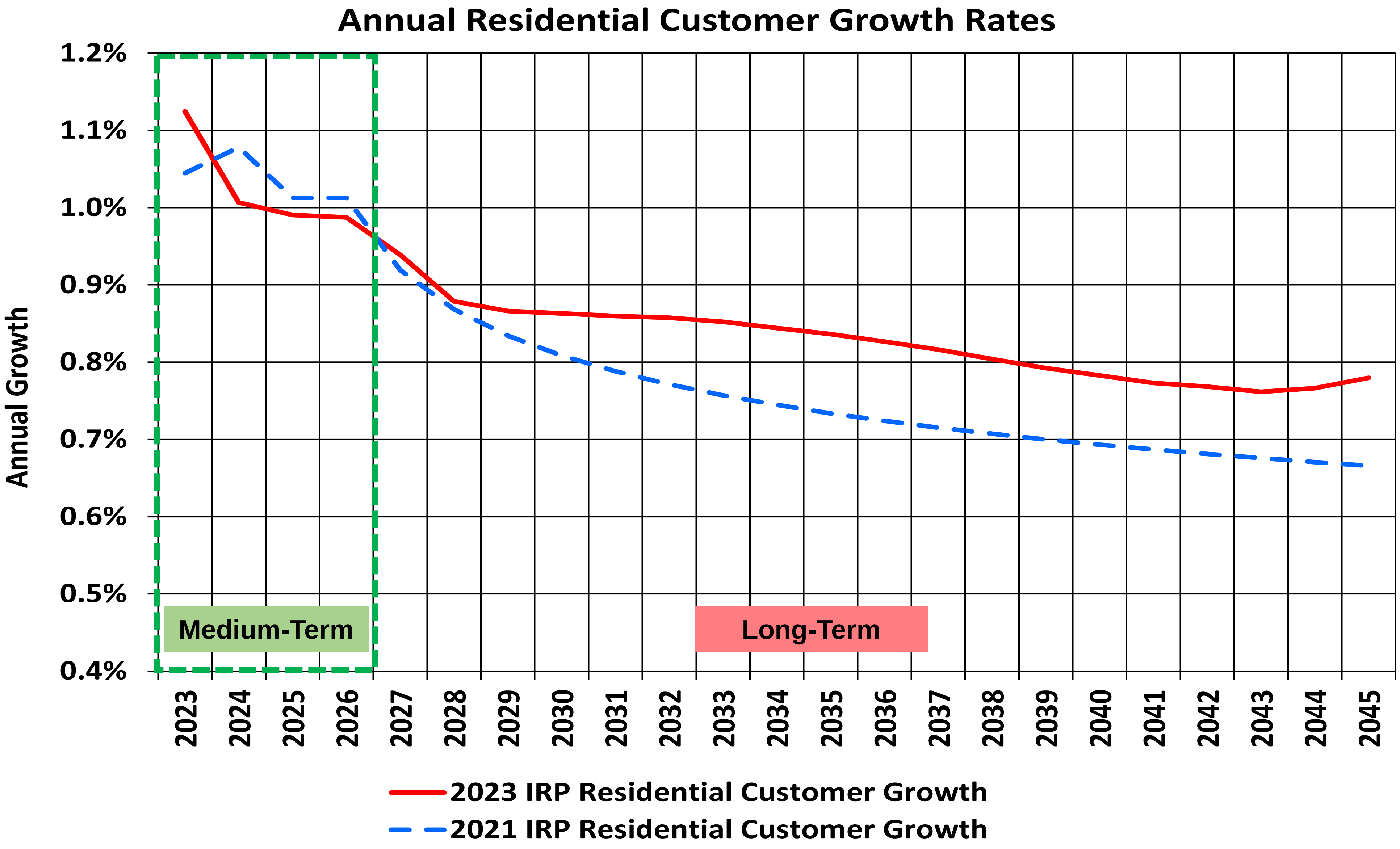
Load = Customers x Use Per Customer (UPC)

Load Growth ≈ Customer Growth + UPC Growth

Population growth is the primary driver of residential customer growth and residential growth is primary driver of commercial customer growth. Industrial customer growth reflects a long-run trend of declining customers.

Assumed to be a function of multiple factors; the major factors can be altered to see impacts.

Long-term Energy Forecast: Residential Customer Growth

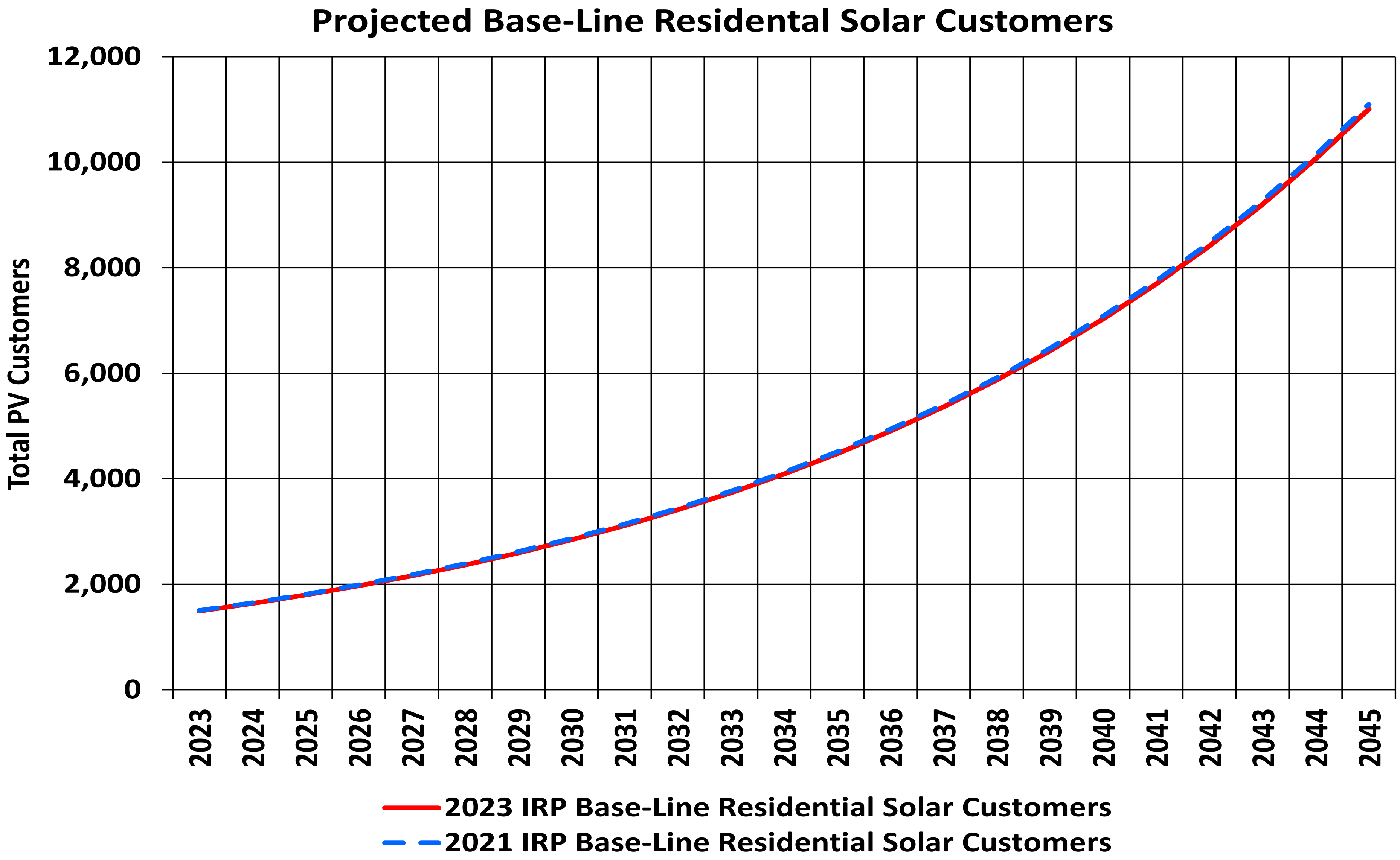


IRP	Avg. Annual Growth
2021 IRP	0.80%
2023 IRP	0.86%
2023 WA	0.69%
2023 ID	1.17%

Comments

- From 2027 on, the time-path reflects IHS population forecasts.
- The higher growth rate in this IRP reflects higher forecasted growth in ID.

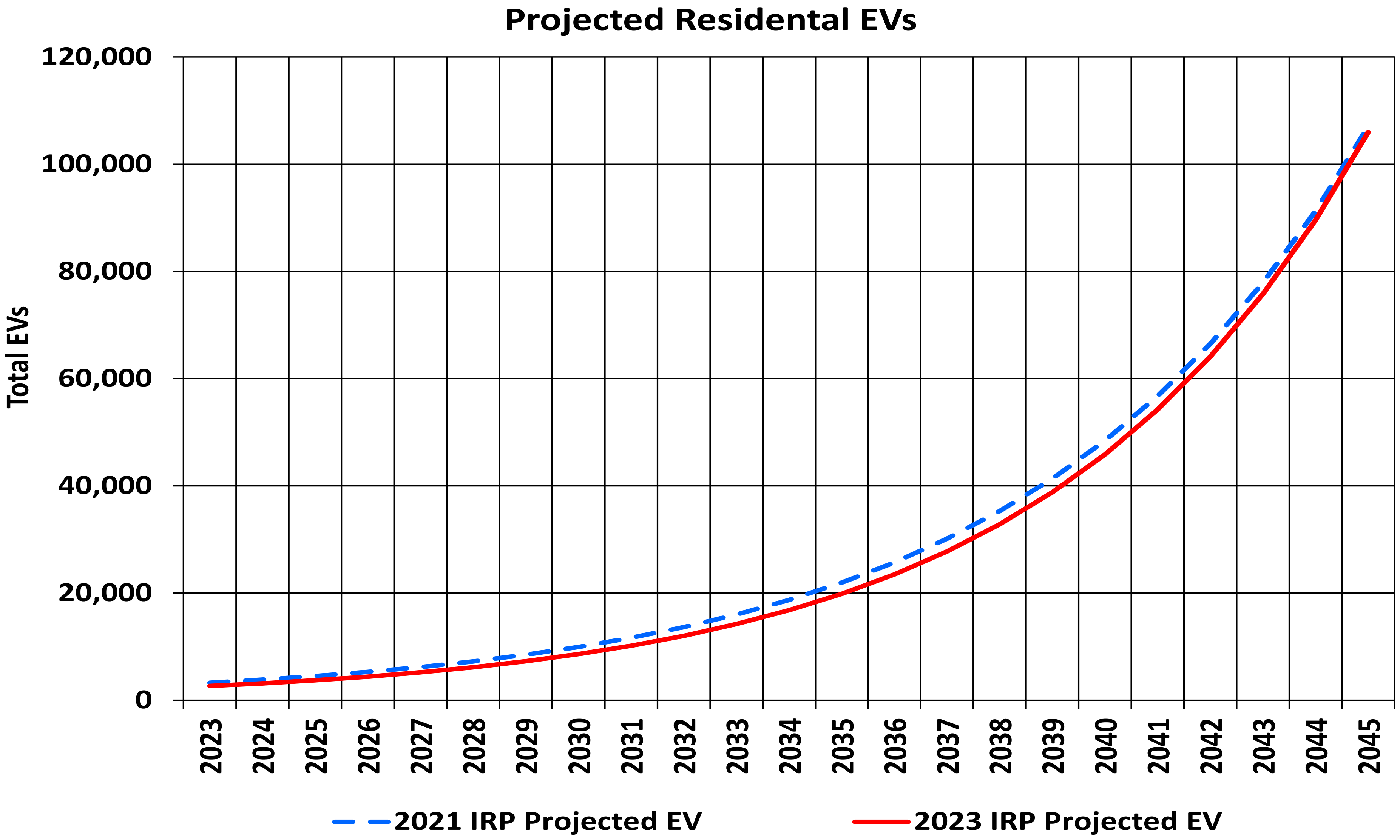
Long-term Energy Forecast: Residential Solar Penetration



Comments

- Solar penetration similar to 2021 IRP.
- Current penetration is 0.4% of residential customers. This is projected to grow to 2.5% by 2045.
- Current system size is around 7,000 watts, with the assumption of 8,900 watts by 2045
- This remains a highly uncertain projection given on-going changes to public policy.

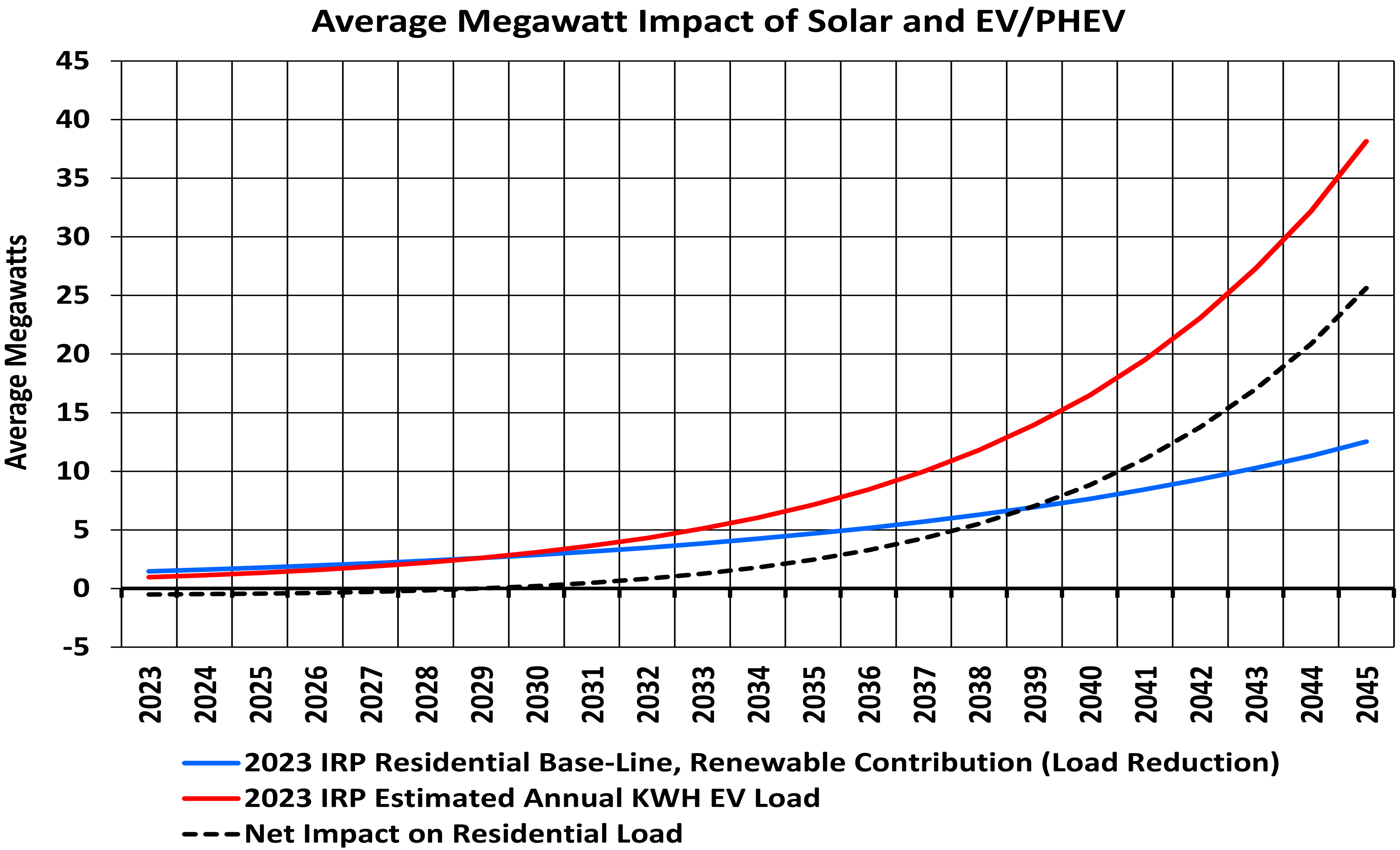
Long-term Energy Forecast: Light Duty EVs, 2023-2045



Comments

- Similar to 2021 IRP.
- Current light duty EVs are around 2,600. This is projected to grow to 106,000 by 2045.
- Current penetration is 0.3% of household vehicles. This is projected to grow to 13% by 2045.
- This remains a highly uncertain projection given on-going changes in the EV industry and public policy.

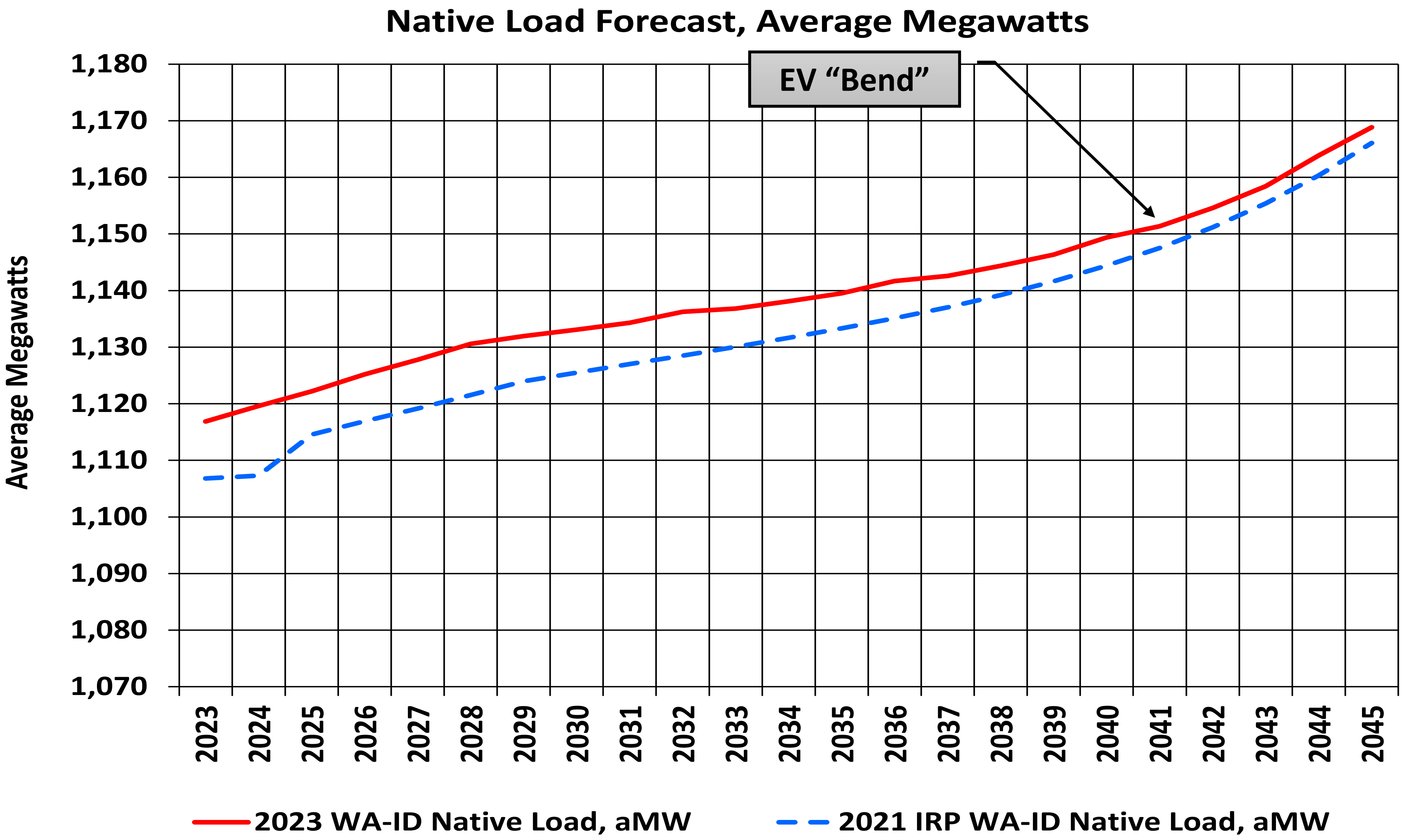
Long-term Energy Forecast: Net Solar and EV Impacts, 2023-2045



Comments

- EVs start to dominate load impacts in late 2030s.

Long-term Energy Forecast: Native Load

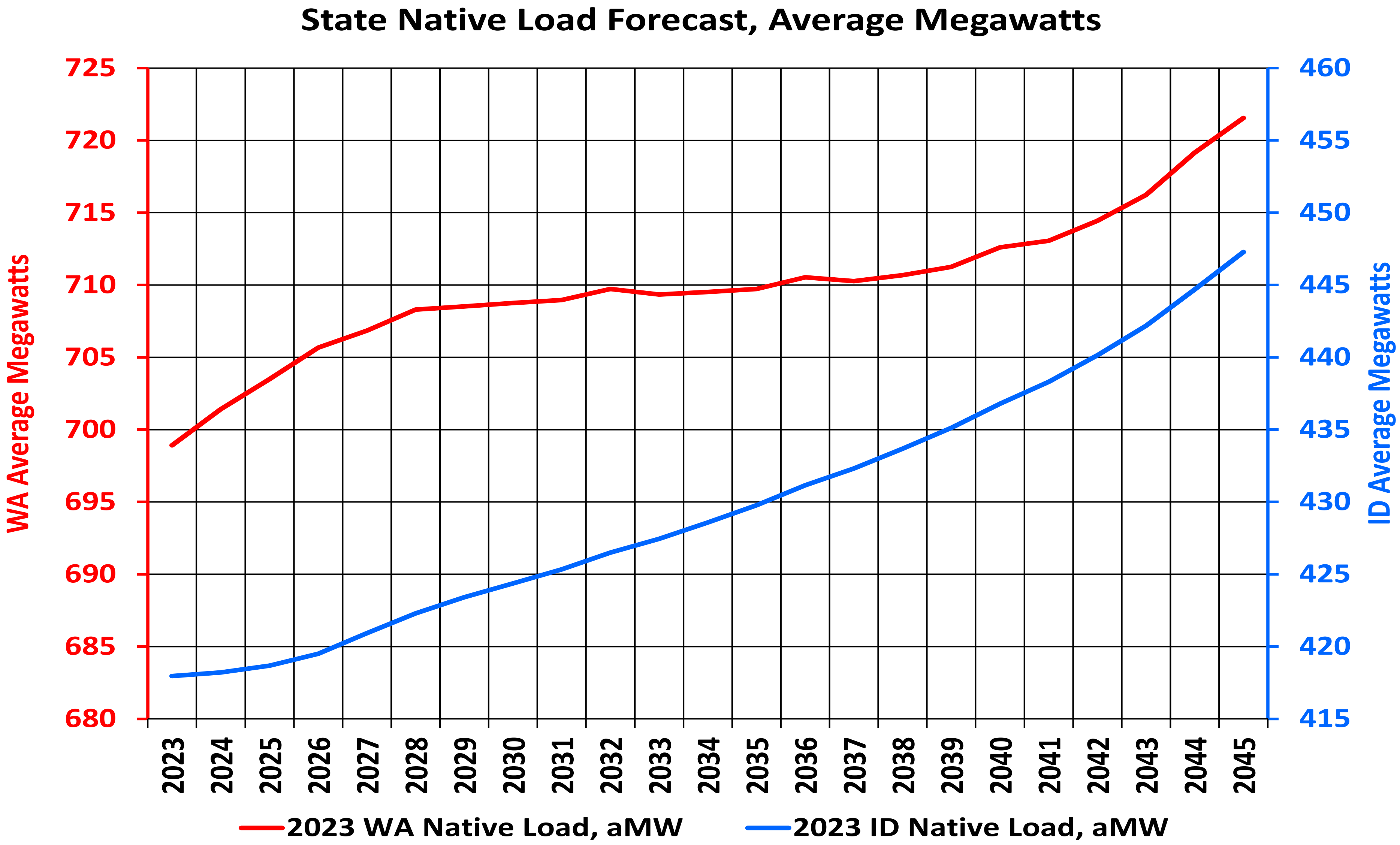


IRP	Avg. Annual Growth
2021 IRP	0.24%
2023 IRP	0.21%
2023 WA	0.15%
2023 ID	0.31%

Comments

- The load level is higher because the medium-term forecast in this IRP has stronger economic and population growth assumptions compared with the 2021 IRP.

Long-term Energy Forecast: State Native Load

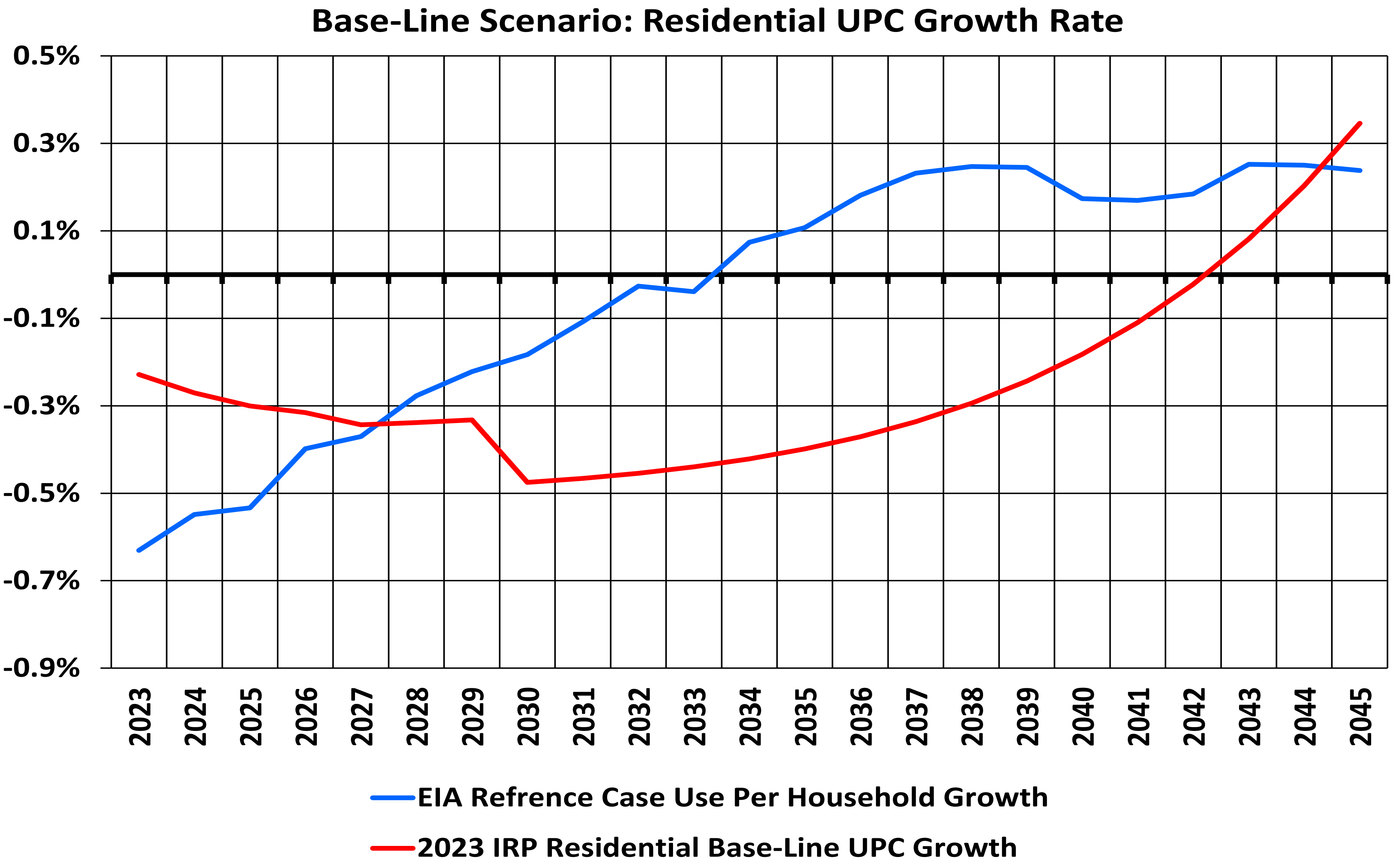


IRP	Avg. Annual Growth
2023 IRP	0.21%
2023 WA	0.15%
2023 ID	0.31%

Comments

- ID load growth is higher because (1) its population growth forecast is higher and (2) lower solar penetration compared to WA.
- WA long-term forecast assumes gas penetration (as a share of residential electric customers) is constant. In ID the model assumes a gradual increase.

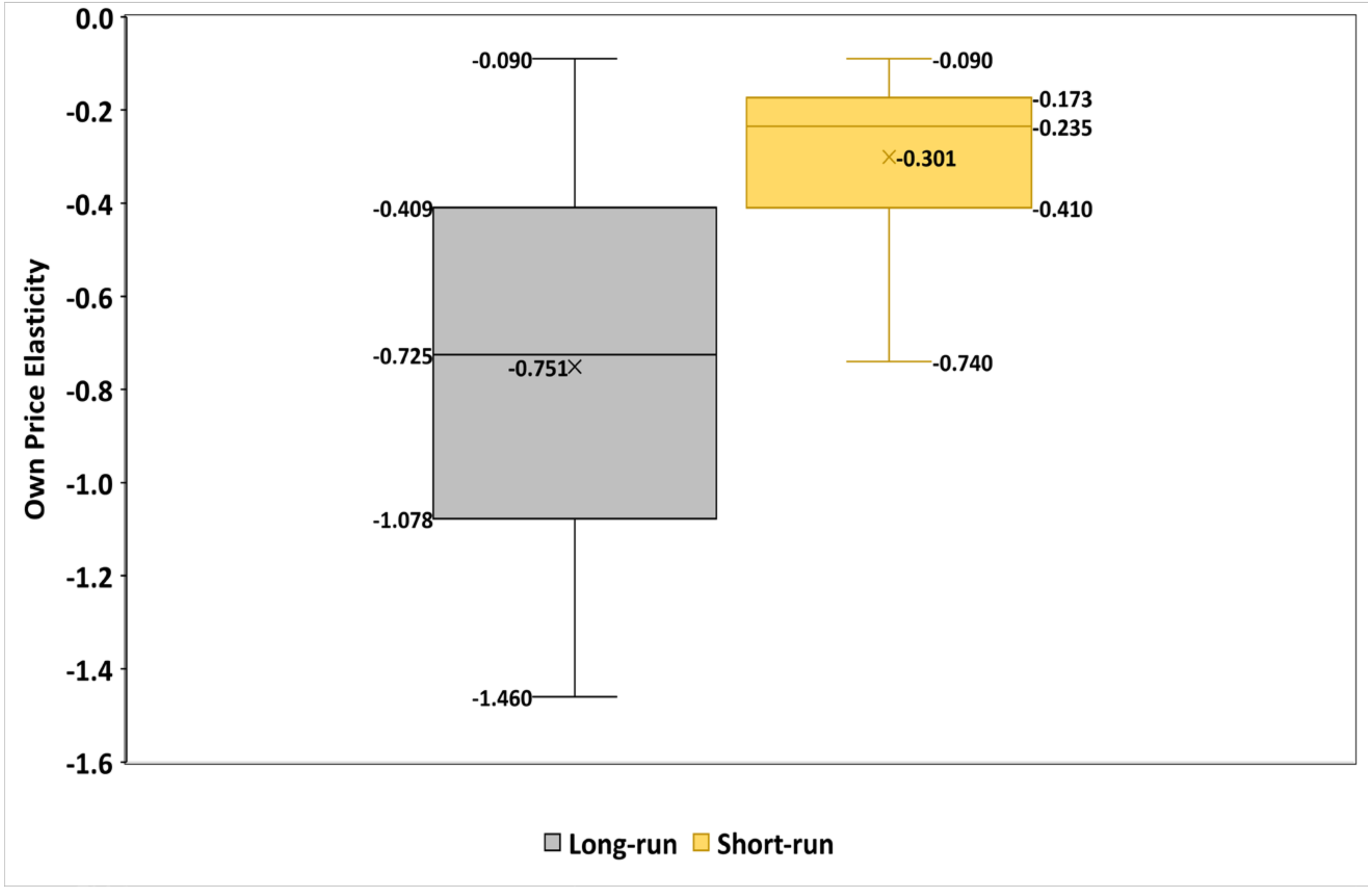
Long-term Energy Forecast: Annual Residential UPC Growth



Comments

- Avista and EIA UPC growth look different because of U.S. population shifts to warmer regions.
- Avista UPC dips in 2030 due to the assumption that the annual growth rate in real residential rate will accelerate from 1% growth from 2027 to 2029 to 1.5% until 2045.
- As noted, it's assumed WA's share of residential customers with gas is constant from 2026 to 2045.

Long-term Energy Forecast: Residential Own Price Elasticity

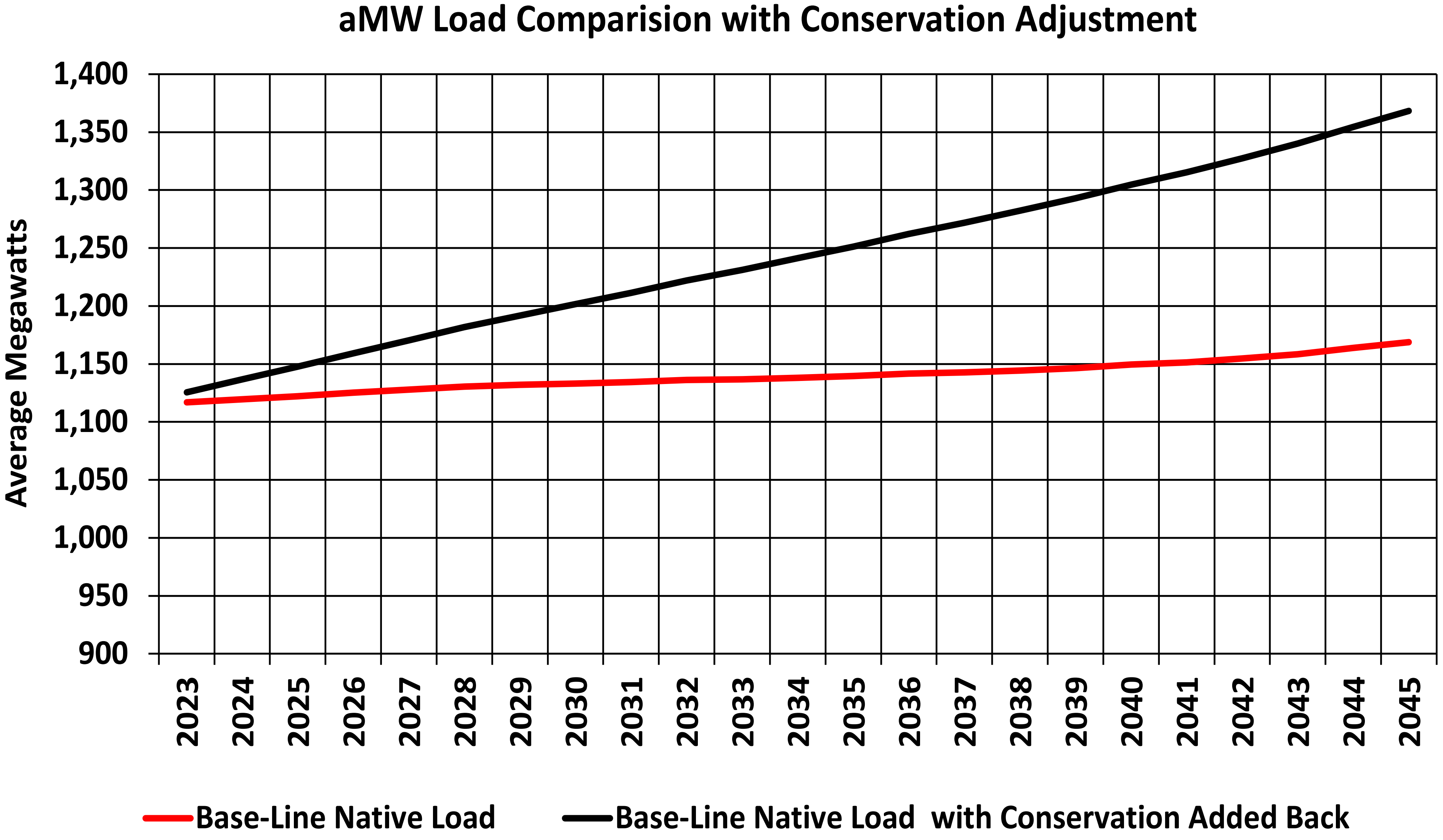


Source: Various sources and author's calculations.

Comments

- **Review of individual studies and surveys of studies to get a range of estimates.**
- **Long-term forecast assumes a residential elasticity of -0.3.**
- **Restrictions on natural gas and growth of EVs would likely put downward pressure on elasticity.**

Long-term Energy Forecast: Conservation Impacts



IRP	Avg. Annual Growth
2023 IRP No Conservation	0.89%
2023 IRP	0.21%

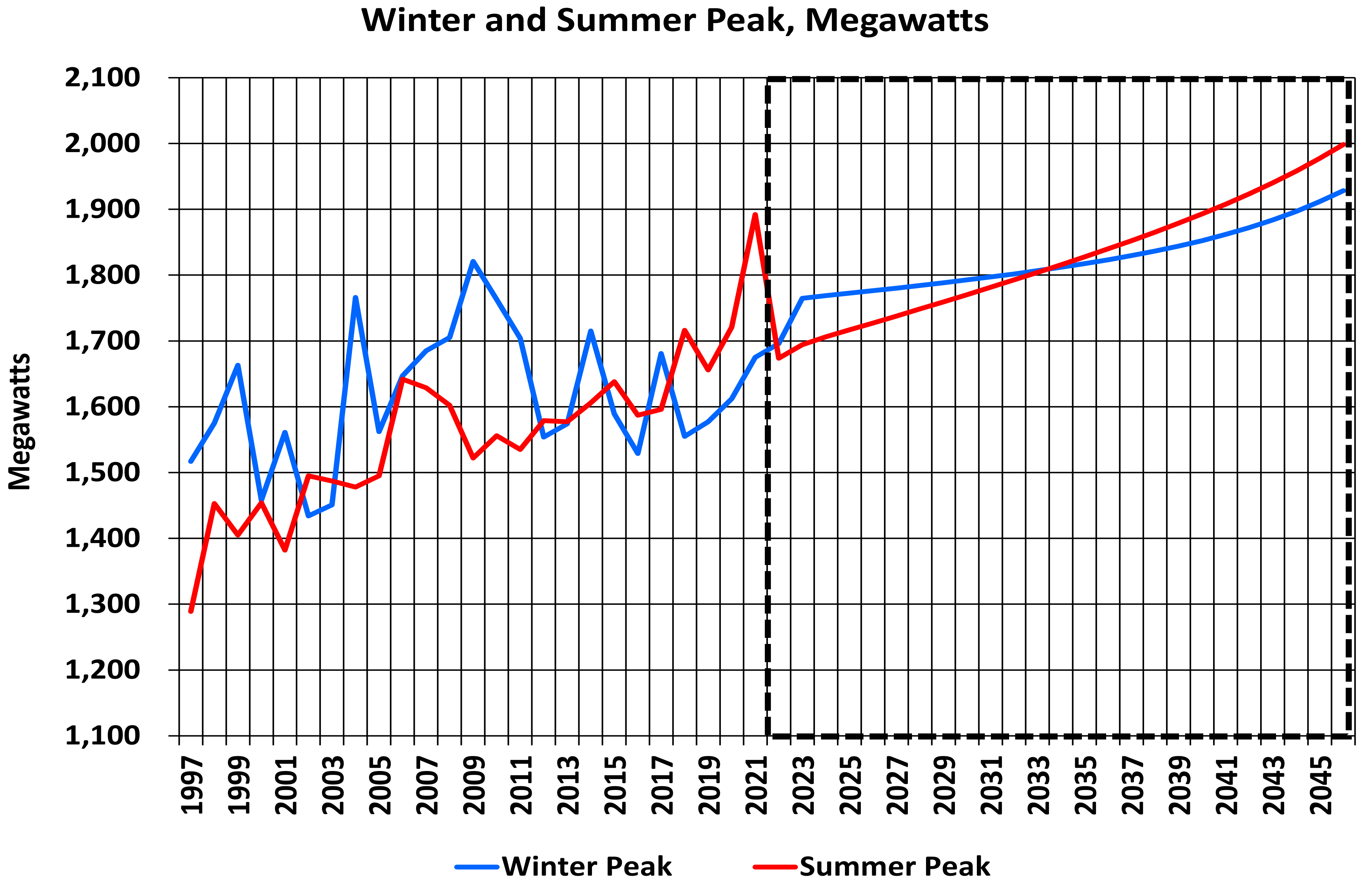
Comments

- Based on historical conservation behavior.

Peak Load Forecast: The Basic Model

- Based on monthly peak MW loads since 2004. The peak is pulled from hourly load data for each day for each month. The model used for this IRP underwent a major revision after the 2021 IRP.
- Monthly time-series regression model that initially excludes certain industrial loads, EVs, and solar. However, those are added back for the final forecast. As part of the model revision, the forecasted impact of EVs and solar were improved for this IRP.
- Explanatory variables include HDD-CDD and monthly and day-of-week dummy variables. The level of real U.S. GDP is the primary economic driver in the model—the higher GDP, the higher peak loads. The model allows GDP impact to differ between winter and summer. This separation was improved on in the revised model, and it significantly changes the results between winter and summer. The revised model shows Avista is a winter peaking utility until around 2030. This reflects a forecasted summer peak that is expected to grow notably faster than the winter peak.
- The coefficients of the model are used to generate a distribution of peak loads by month based on historical max/min temperatures since 1890, holding GDP constant. A starting expected peak load is then calculated using the average peak load simulated for that month going back to 1890. For the 2023 IRP, the starting winter peak average uses data back to 1890; the starting summer peak using a 30-year average.
- The long-run growth rate of peak loads for summer and winter are calculated using GDP growth under the "*all else constant*" assumption for all other factors in the model.

Peak Load Forecast: Winter and Summer Forecast

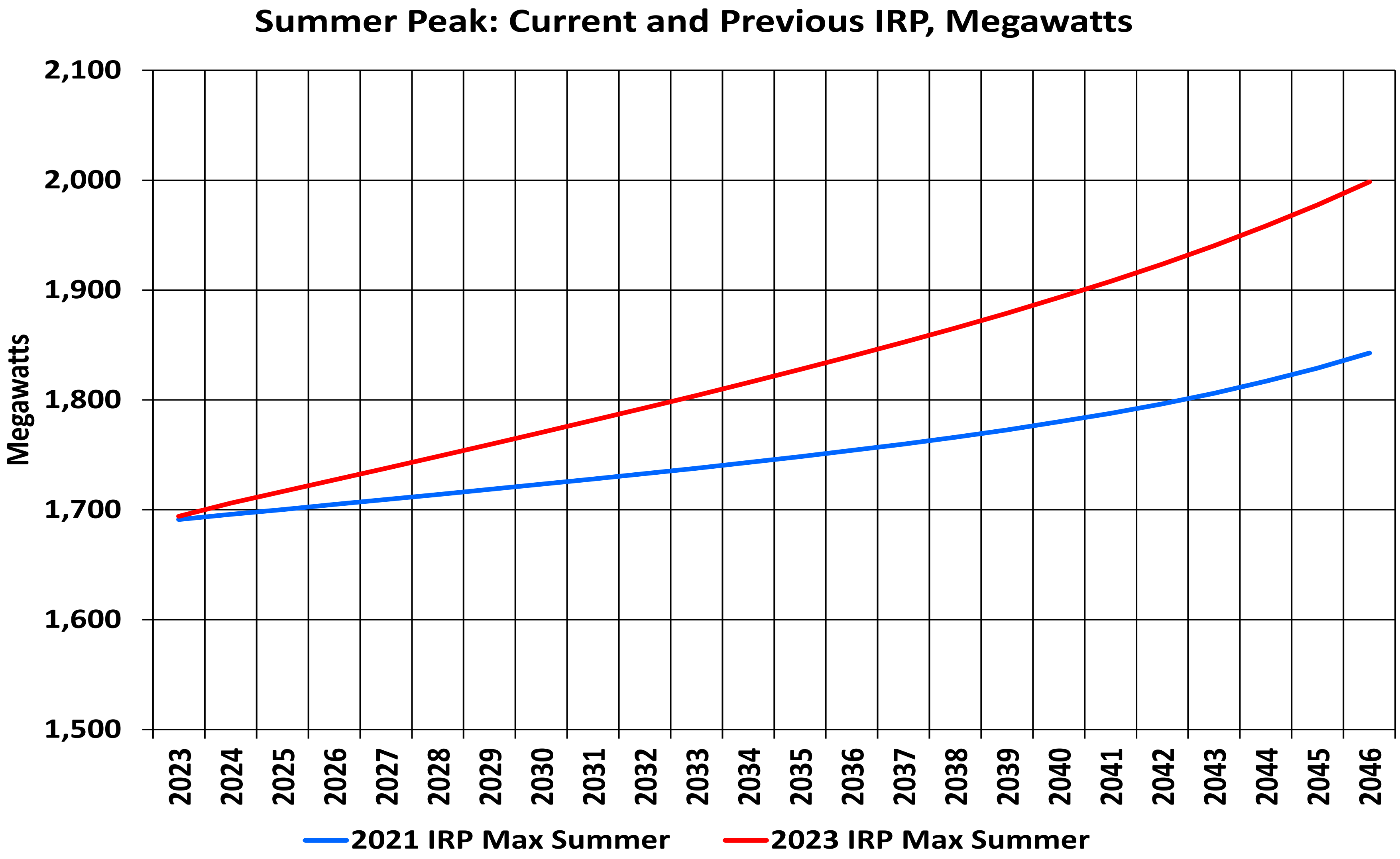


Peak	Avg. Growth 2023-45
Winter	0.37%
Summer	0.73%

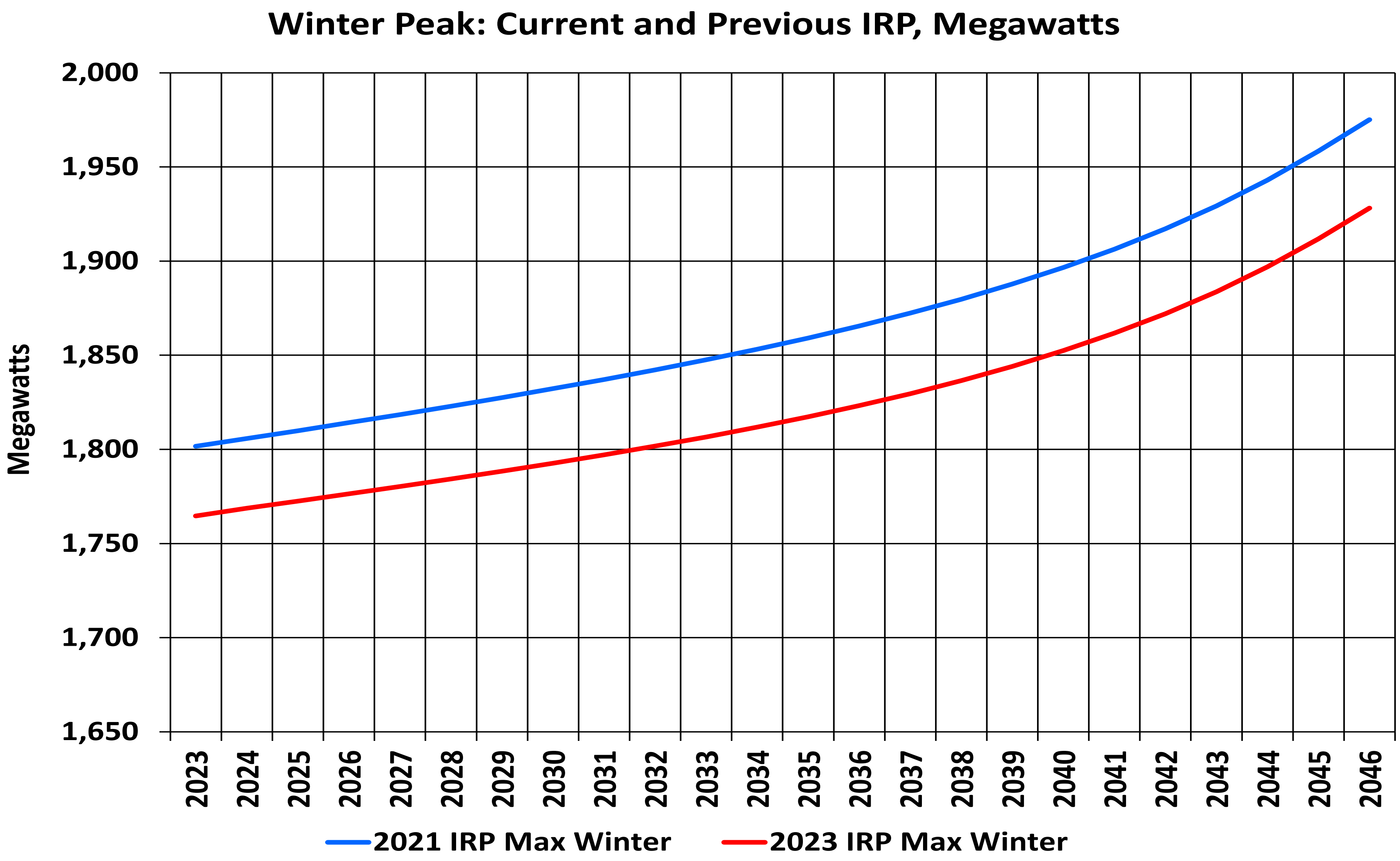
Comments

- Extreme value of analysis of winter and summer temperatures suggests cold is still a risk.
- Impacts of electrification policies still being evaluated.
- There is no trended climate in the current forecast.

Peak Load Forecast: Change in IRP Summer Peak



Peak Load Forecast: Change in IRP Winter Peak



Questions?

Load & Resource Balance Update

Avista, Electric Technical Advisory Committee

February 8th, 2022 – TAC 2

James Gall, Electric IRP Manager

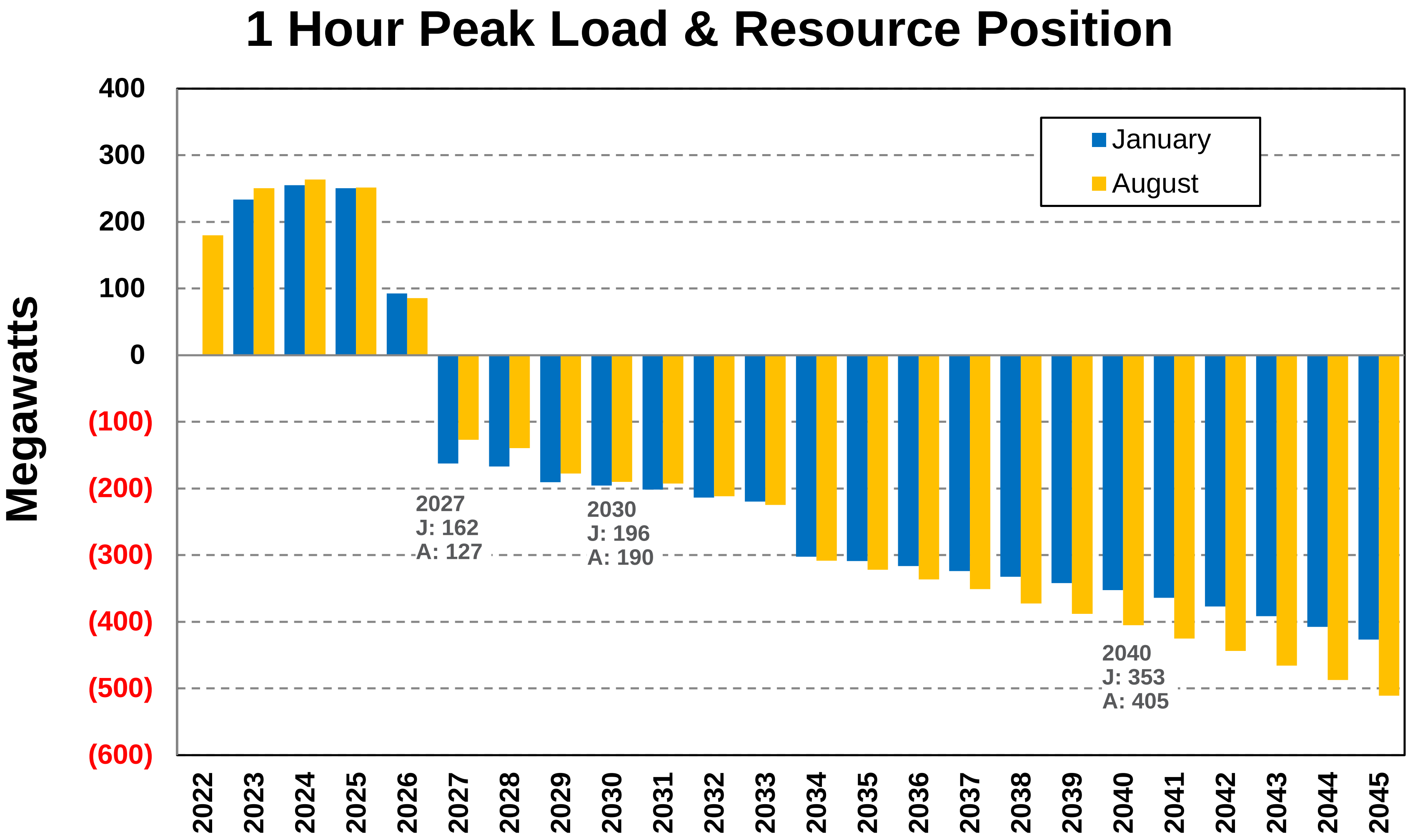
Major L&R Changes Since 2021 IRP

- Load forecast
- 30 MW industrial demand response (Washington Rate Case Settlement)
- Chelan County PUD purchase
  - ~88 MW or ~54 aMW equal to 5% of Rocky Reach and Rock Island projects

	2022	2023	2024	2025	2026-2030	2031-2033	2034-2045
Existing Slice	5%	5%	5%	5%	5%		
April 2021 Contract			5%	5%	5%	5%	
December 2021 Contract					5%	10%	10%

System Capacity Position

Western Resource Adequacy Program not included at this time



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7% summer PRM

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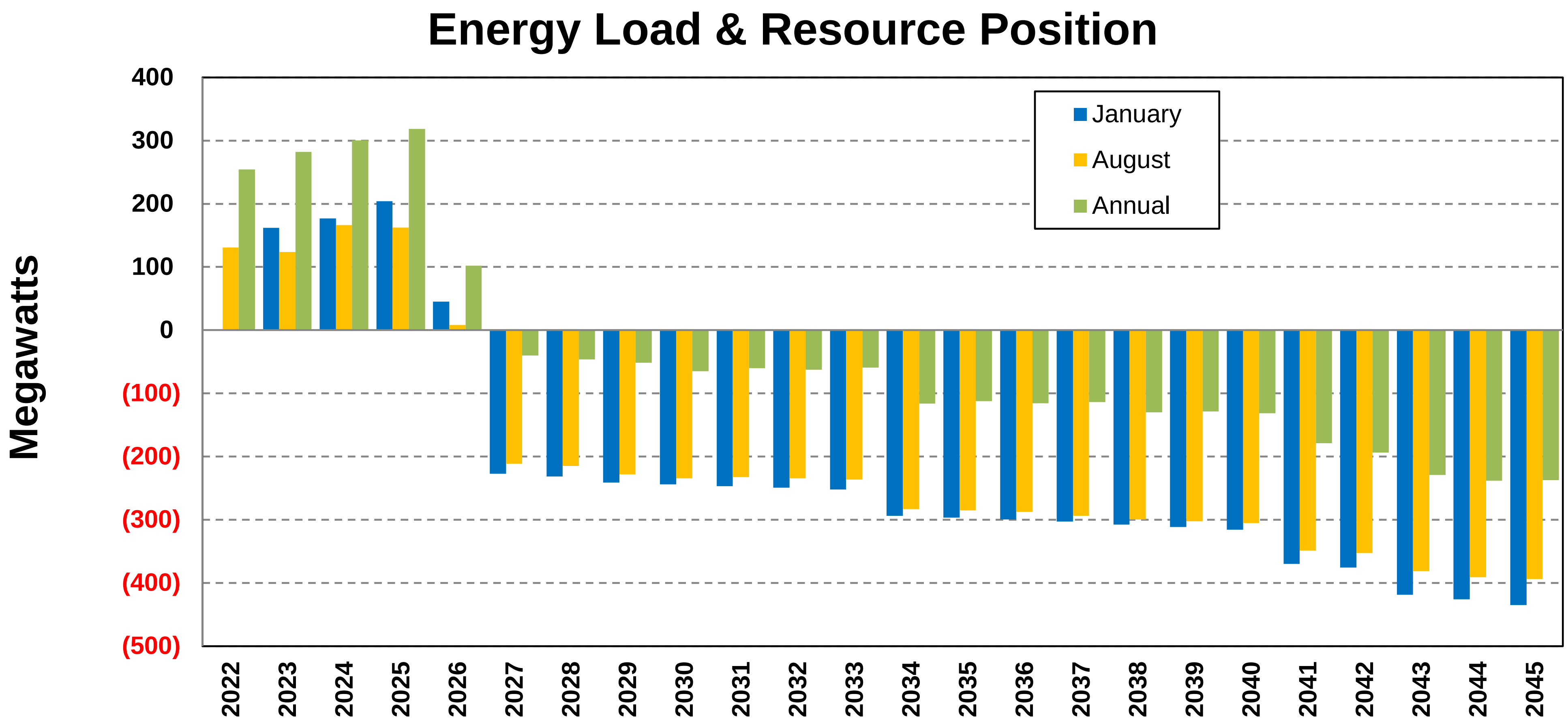
Regulation (16 MW)

Seasonal winter/summer peak not included at this time, short position begins in Nov 1, 2026

System Planning Energy Position



Energy Contingency Metrics

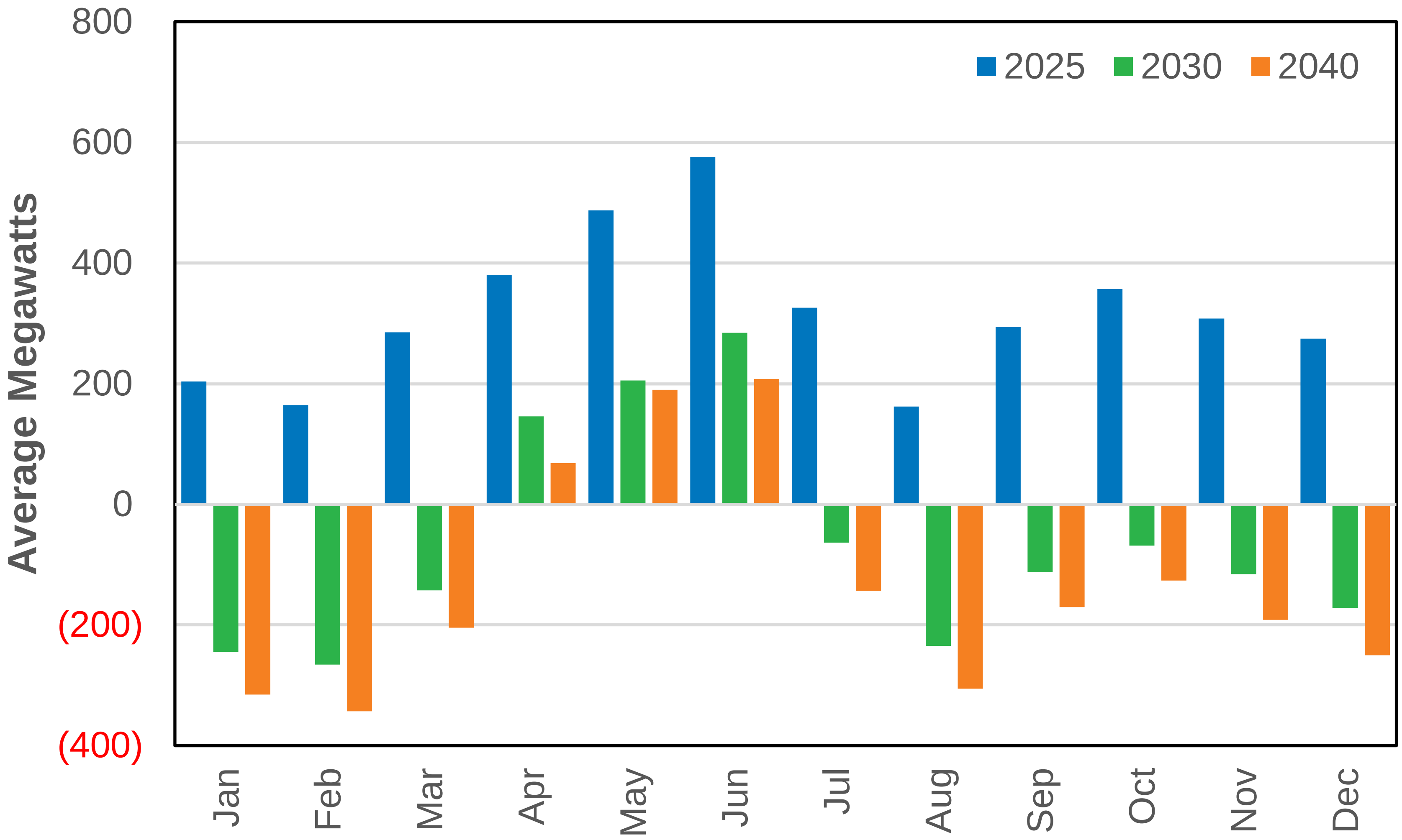
10th percentile hydro

90th percentile load

2023 IRP will update contingency metrics for wind/solar variability (TBD in future TAC meeting)

2023 IRP will energy planning constraint beyond annual

Monthly Planning Energy Position



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PT Ratio is ~65.5% Washington, and 34.5% Idaho

2030 Monthly Accounting Illustration (WA Only)

Illustration Purposes Only

				Washington Share							
Month	**Sales Forecast**	**WA PURPA**	**Net Retail Load**	**Hydro**	**Wind**	**Solar**	**Biomass**	**Energy Exchange from Idaho**	**Total Renewable Generation**	**Primary Compliance**	**Alternative Compliance**
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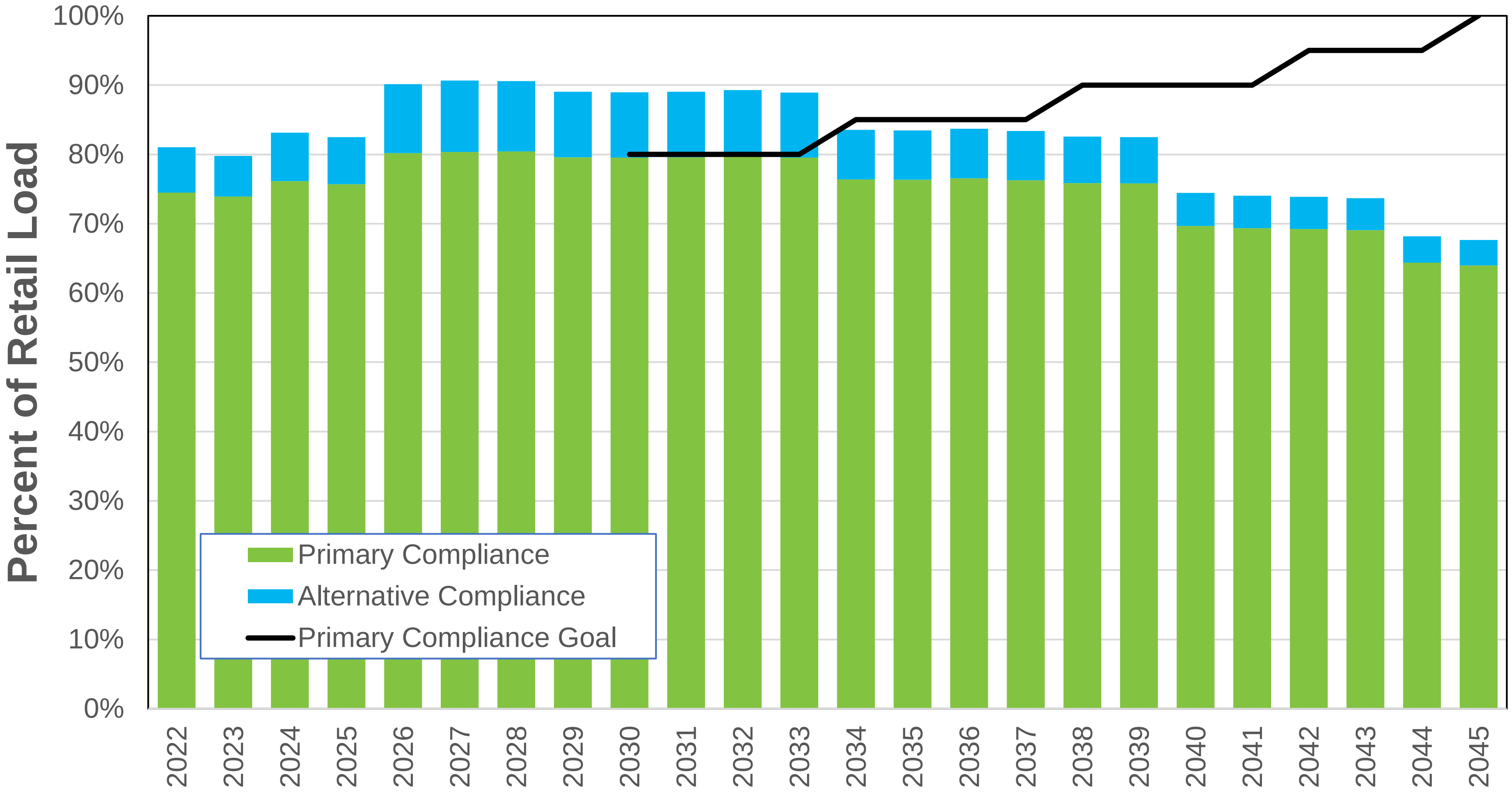
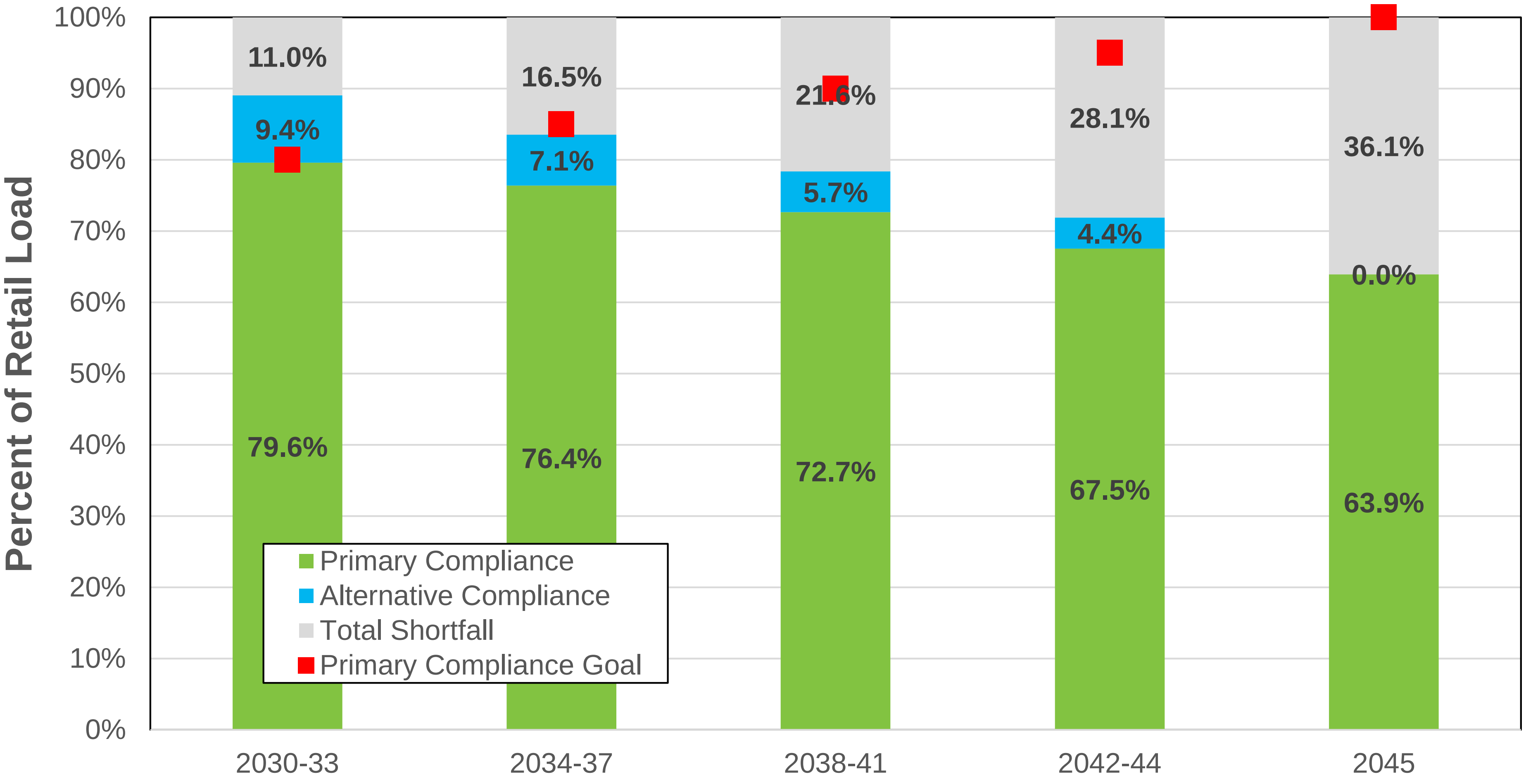
Current Annual CETA Energy Position



Does not include Idaho hydro used for Alternative Compliance

Compliance Window CETA Energy Position



Alternative Compliance Goal Limit	20%	15%	10%	5%	0%

2023 Electric Integrated Resource Plan

Technical Advisory Committee Meeting No. 3 Agenda

Wednesday, March 9, 2022
Virtual Meeting

Topic	**Time**	**Staff**
Introductions	8:30	John Lyons
Existing Resource Overview	8:35	Mike Hermanson
Resource Requirements	9:15	James Gall
Break		
Non-Energy Impact Study	10:00	DNV
Lunch	11:30	
Natural Gas Market Overview & Price Forecast	12:30	Tom Pardee
Wholesale Electric Price Forecast	1:15	Lori Hermanson
Adjourn	2:00	

2023 IRP Introduction

2023 Avista Electric IRP

TAC 3 – March 9, 2022

John Lyons, Ph.D. Senior Resource Policy Analyst

Meeting Guidelines

- IRP team is working remotely and is available for questions and comments
- Stakeholder feedback form
  - Responses shared with TAC at meetings, by email and in Appendix
  - Would a form and/or section on the web site be helpful?
- IRP data posted to web site – updated descriptions and navigation are in development
- Virtual IRP meetings on Microsoft Teams until able to hold large meetings again
- TAC presentations and meeting notes posted on IRP page
- This meeting is being recorded and an automated transcript made

Virtual TAC Meeting Reminders

- Please mute mics unless commenting or asking a question
- Raise hand or use the chat box for questions or comments
- Respect the pause
- Please try not to speak over the presenter or a speaker
- Please state your name before commenting
- Public advisory meeting – comments will be documented and recorded

Integrated Resource Planning

The Integrated Resource Plan (IRP):

- Required by Idaho and Washington* every other year
  - Washington requires IRP every four years and update at two years
- Guides resource strategy over the next twenty + years
- Current and projected load & resource position
- Resource strategies under different future policies
  - Generation resource choices
  - Conservation / demand response
  - Transmission and distribution integration
  - Avoided costs
- Market and portfolio scenarios for uncertain future events and issues

Technical Advisory Committee

- Public process of the IRP – input on what to study, how to study, and review of assumptions and results
- Wide range of participants involved in all or parts of the process
  - Please ask questions
  - Always soliciting new TAC members
- Open forum while balancing need to get through topics
- Welcome requests for new studies or different modeling assumptions.
- Available by email or phone for questions or comments between meetings
- Due date for study requests from TAC members – October 1, 2022
- External IRP draft released to TAC – March 17, 2023, public comments due – May 12, 2023
- Final 2023 IRP submission to Commissions and TAC – June 1, 2023

2023 IRP TAC Meeting Schedule

- TAC 4: August 2022
- TAC 5: Early September 2022
- TAC 6: End of September 2022
- TAC 7: October 2022
- Technical Modeling Workshop: October 2022
- TAC 8: February 2023
- Public Meeting Gas & Electric IRPs: February/March 2023
- TAC 9: March 2023

Today’s Agenda

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2:00	Adjourn

Existing Resource Overview

2023 Avista Electric IRP

TAC 3 – March 9, 2022

Mike Hermanson - Power Supply/CETA Analyst

Existing Resource Types

Avista-owned Hydro

Avista-owned Thermal

- Natural Gas
- Coal
- Biomass

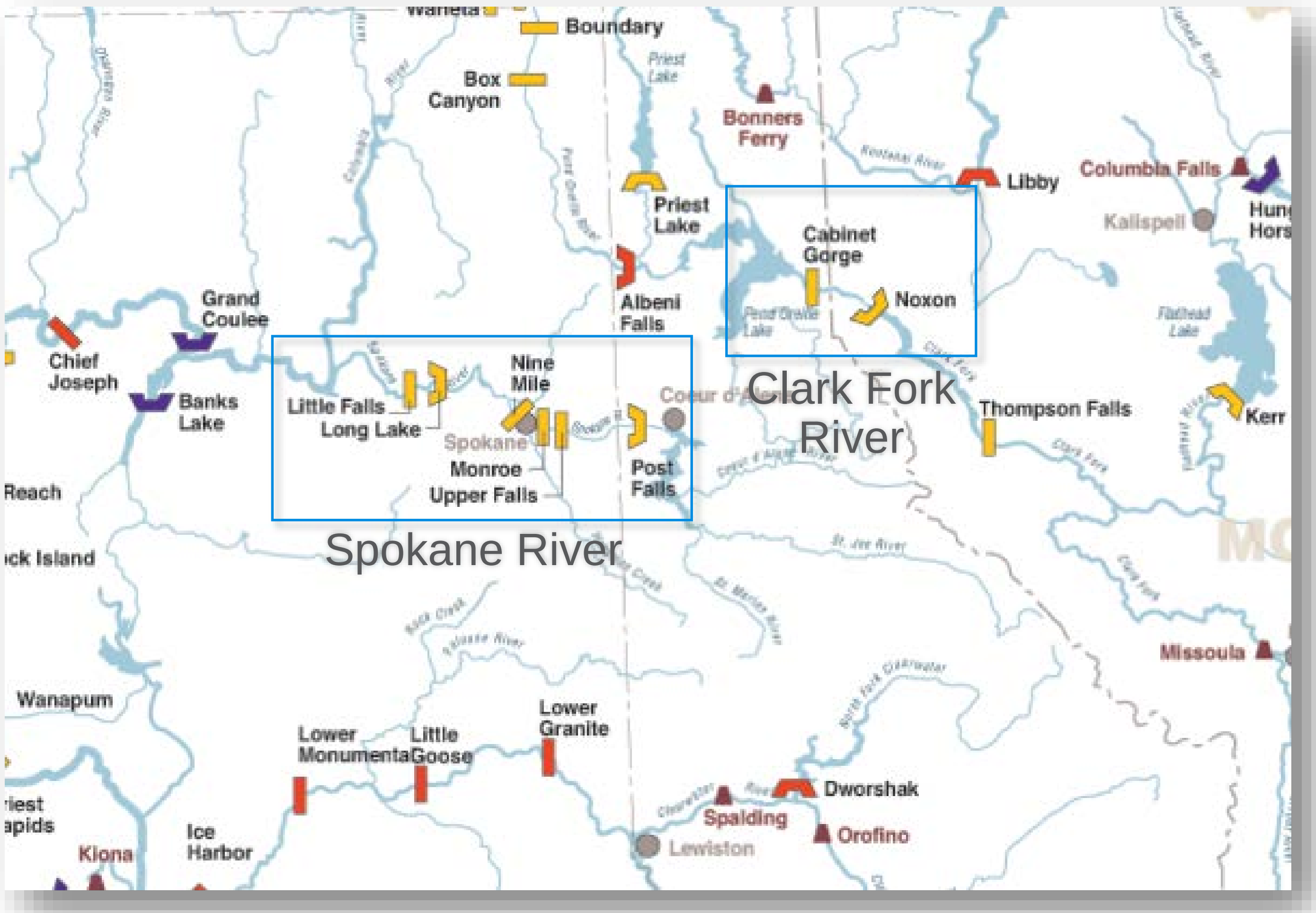
Contracted Resources

- Mid Columbia Hydro
- Natural Gas
- Wind
- Solar
- PURPA

Customer-Owned Resources

Avista Owned Hydro

- Spokane River
  - Post Falls (14.8 MW)
  - Upper Falls (10 MW)
  - Monroe St. (14.8 MW)
  - Nine Mile (36 MW)
  - Long Lake (81.6 MW)
  - Little Falls (32 MW)
- Clark Fork River
  - Noxon Rapids (518 MW)
  - Cabinet Gorge (265.2 MW)



Spokane River

Project	Nameplate Capacity (MW)	Maximum Capability (MW)	Expected Energy (aMW)*
Post Falls	14.8	18	11.2
Upper Falls	10	10.2	7.3
Monroe Street	14.8	15	11.2
Nine Mile	36	32	22.6
Long Lake	81.6	89	56
Little Falls	32	35.2	11.2
TOTAL	**189.2**	**199.4**	**119.5**

* based on 80-year hydrologic record


Long Lake

- Post Falls refurbishment – additional 3.8 MW incremental winter capacity and 4 aMW of incremental clean energy.

Clark Fork River

Project	**Nameplate Capacity (MW)**	**Maximum Capability (MW)**	**Expected Energy (aMW)***
Cabinet Gorge	265.2	270.5	123.6
Noxon Rapids	518	610	196.5
TOTAL	**783.2**	**880.5**	**320.1**

* based on 80-year hydrologic record


Cabinet Gorge

Avista Owned Thermal Resources

Project Name	Fuel Type	Winter Maximum Capacity (MW)	Summer Maximum Capacity (MW)	Nameplate Capacity (MW)
Colstrip	Coal	222	222	247
Coyote Springs 2	Gas	317.5	286	306.5
Rathdrum	Gas	176	130	166.2
Northeast	Gas	66	42	61.8
Boulder Park	Gas	24.6	24.6	24.6
Kettle Falls	Wood	47	47	50.7
Kettle Falls CT	Gas	11	8	7.2
	Total	**864.1**	**759.6**	**864.0**

Colstrip Units 3 & 4

- Located in eastern Montana

- Avista owns 15% of units 3 & 4

- After 2025 will not be used to serve Washington customers

- Max net capacity of 222 MW

Coyote Springs 2

- Natural gas-fired combined cycle combustion turbine (CCCT)

- A combined-cycle power plant **uses both a gas and a steam turbine together to produce up to 50% more electricity from the same fuel than a traditional simple-cycle plant**. The waste heat from the gas turbine is routed to the nearby steam turbine, which generates extra power.

- Max winter capacity of 317.5 MW, Max summer capacity of 286 MW


Coyote Springs 2

Rathdrum, Northeast, & Boulder Park

- Rathdrum
  - Simple cycle combustion turbine (CT) units
  - Winter max – 176 MW, Summer Max 126 MW
- Boulder Park
  - Six natural gas internal combustion reciprocating engines
  - Max – 24.6 MW
- Northeast
  - Two aero-derivative simple cycle CT units
  - Winter max 68 MW, Summer max 42 MW
  - Air permit allows 100 run hours per year

Kettle Falls Generating Station

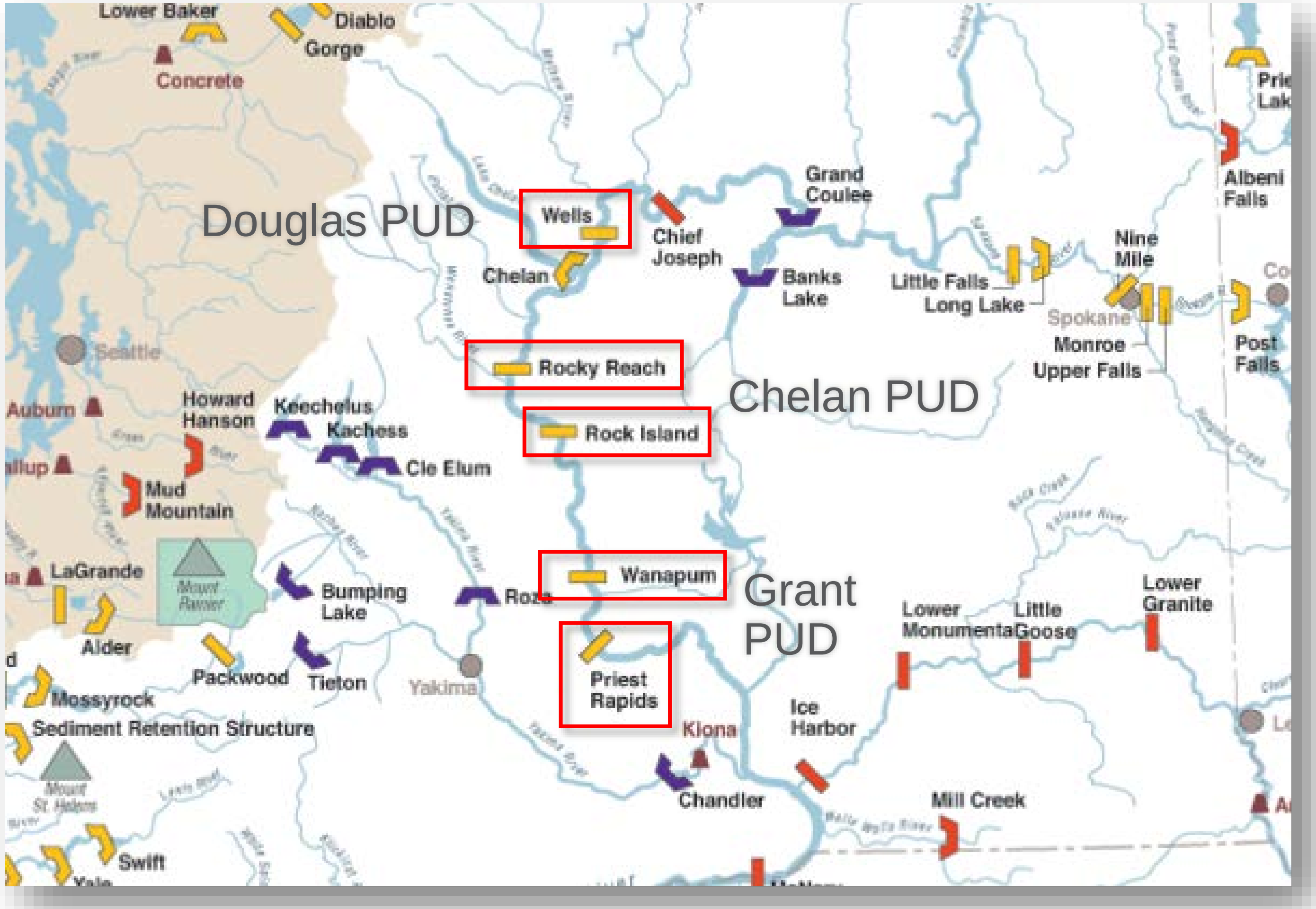
- Among the largest biomass generation plants in North America
- Open loop steam plant uses waste wood products (hog fuel) from area mills and forest slash.
- Max capacity of 50 MW
- Also has 7.5 MW gas combustion turbine increasing max capacity to 55-58 MW

Power Purchase and Sale Contracts

Contract	Type	Fuel Source	End Date	2021 Annual Energy (aMW)
Mid Columbia Hydro	Purchase	Hydro	varies	132.9
Lancaster	Purchase	Natural Gas	Oct-26	207.8
Palouse Wind	Purchase	Wind	2042	41.2
Rattlesnake Flats	Purchase	Wind	2040	48.3
Adams-Nielson	Purchase	Solar	2038	4.95
Nichols Pumping	Sale	System	2023	-6.4
Morgan Stanley	Sale	Clearwater Paper	2023	-48.4
Douglas PUD	Sale	System	2023	-47

Mid-Columbia Hydroelectric Contracts

- Douglas PUD
  - Wells – Total Capacity 840 MW
- Chelan PUD
  - Rocky Reach – Total Capacity 1254 MW
  - Rock Island – Total Capacity 503 MW
- Grant PUD
  - Priest Rapids – Total Capacity 953 MW
  - Wanapum – Total Capacity 1,220 MW



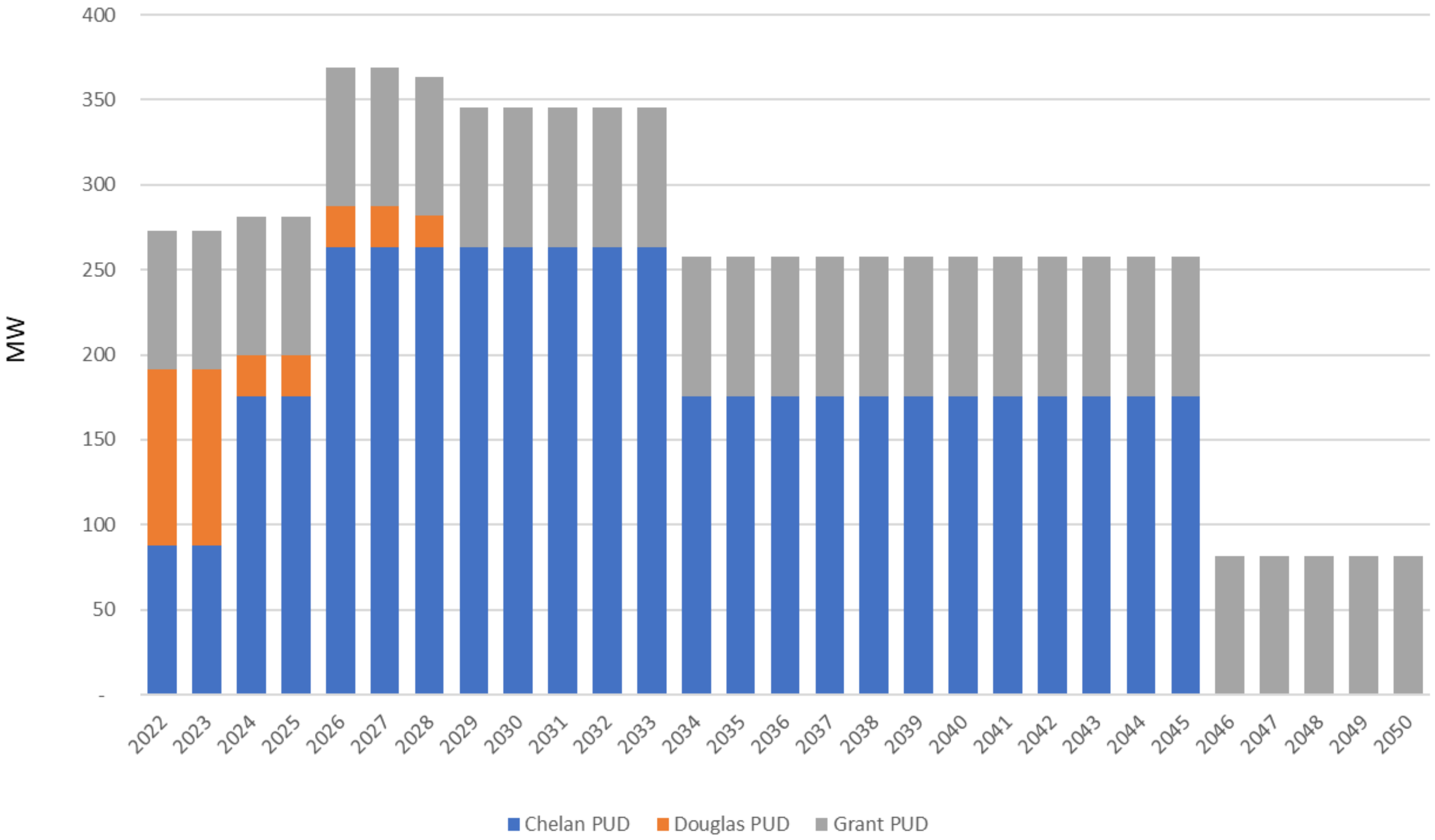
Note: Total capacity represents overall capacity of project, not total capacity of Avista's share.

Mid-Columbia Hydroelectric Contracts

Counter Party	Project(s)	Percent Share (%)	Start Date	End Date	2020 Estimated On-Peak Capability (MW)	2020 Annual Energy (aMW)
Grant PUD	Priest Rapids	3.79	Dec-2001	Dec-2052	30	19.5
Grant PUD	Wanapum	3.79	Dec-2001	Dec-2052	32	18.7
Chelan PUD	Rocky Reach	5	Jan-2016	Dec-2030	57	35.9
Chelan PUD	Rock Island	5	Jan-2016	Dec-2030	19	18.4
Douglas PUD	Wells	12.76*	Oct-2018	Dec-2028	107	57
Canadian Entitlement					-14	-5.6
2020 Total Net Contracted Capacity and Energy					231	143.90

* % share varies each year depending on Douglas PUD’s load growth

Mid Columbia Hydroelectric Contracts



Wind & Solar Resources

- Palouse PPA
  - Capability – 105 MW
  - 30-year power purchase agreement (PPA)
  - 2021 output – 41.2 aMW

- Rattlesnake Flat PPA
  - Capability - 160.6 MW
  - 20-year PPA
  - 2021 output of 48.3 aMW

- Adams-Nielson Solar PPA
  - Capability – 19.2 MW
  - 80,000 panel facility
  - 2021 output – 4.95 aMW


Palouse Wind

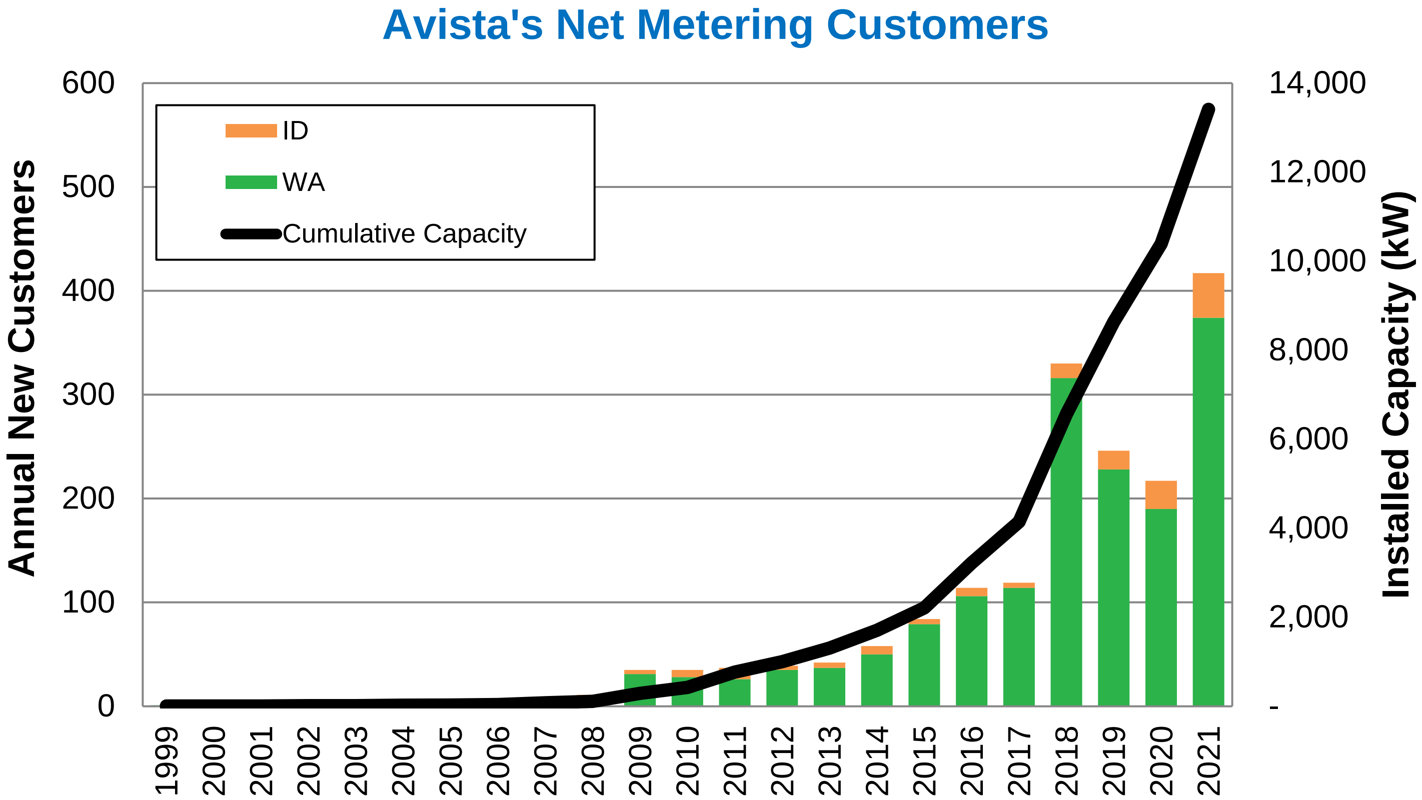
Public Utility Regulatory Policies Act (PURPA) Contracts

Owner	Fuel Source	Location	Contract End Date	Capability (MW)	Estimated Energy (aMW)
Sheep Creek Hydro Inc	Hydro	Northport, WA	12/31/2025	1.40	0.79
Hydro Technology Systems Inc.	Hydro	Kettle Falls, WA	12/31/2025	1.30	1.05
Deep Creek Energy	Hydro	Northport, WA	12/31/2022	0.41	0.23
Spokane County Water Reclamation*	Biomass	Spokane, WA	8/31/2030	0.26	0.14
Phillips Ranch	Hydro	Northport, WA	N/A	0.02	0.01
City of Spokane Upriver Dam*	Hydro	Spokane, WA	12/31/2024	17.60	6.17
City of Spokane Waste to Energy	Municipal Waste	Spokane, WA	12/30/2022	18.00	16.00
McKinstry*	Solar	Spokane, WA	5/3/2035	0.25	0.05
			WA Total	**39.24**	**24.44**
University of Idaho*	CHP Steam	Moscow, ID	2/15/2042	0.825	0.74
University of Idaho*	Solar	Moscow, ID	2/15/2042	0.1322	0.033
Ford Hydro LP	Hydro	Weippe, ID	6/30/2022	1.41	0.39
John Day Hydro	Hydro	Lucille, ID	9/21/2022	0.90	0.25
Clark Fork Hydro	Hydro	Clark Fork, ID	12/31/2037	0.22	0.12
Stimson Lumber	Wood Waste	Plummer, ID	12/31/2023	5.80	4.00
Clearwater Paper	Wood Waste	Lewiston, ID	12/31/2023	60.00	43.00
City of Cove	Hydro	Cove, OR	6/30/2038	0.80	0.29
			ID Total	**70.09**	**48.82**
			Total PURPA	**109.3**	**73.3**

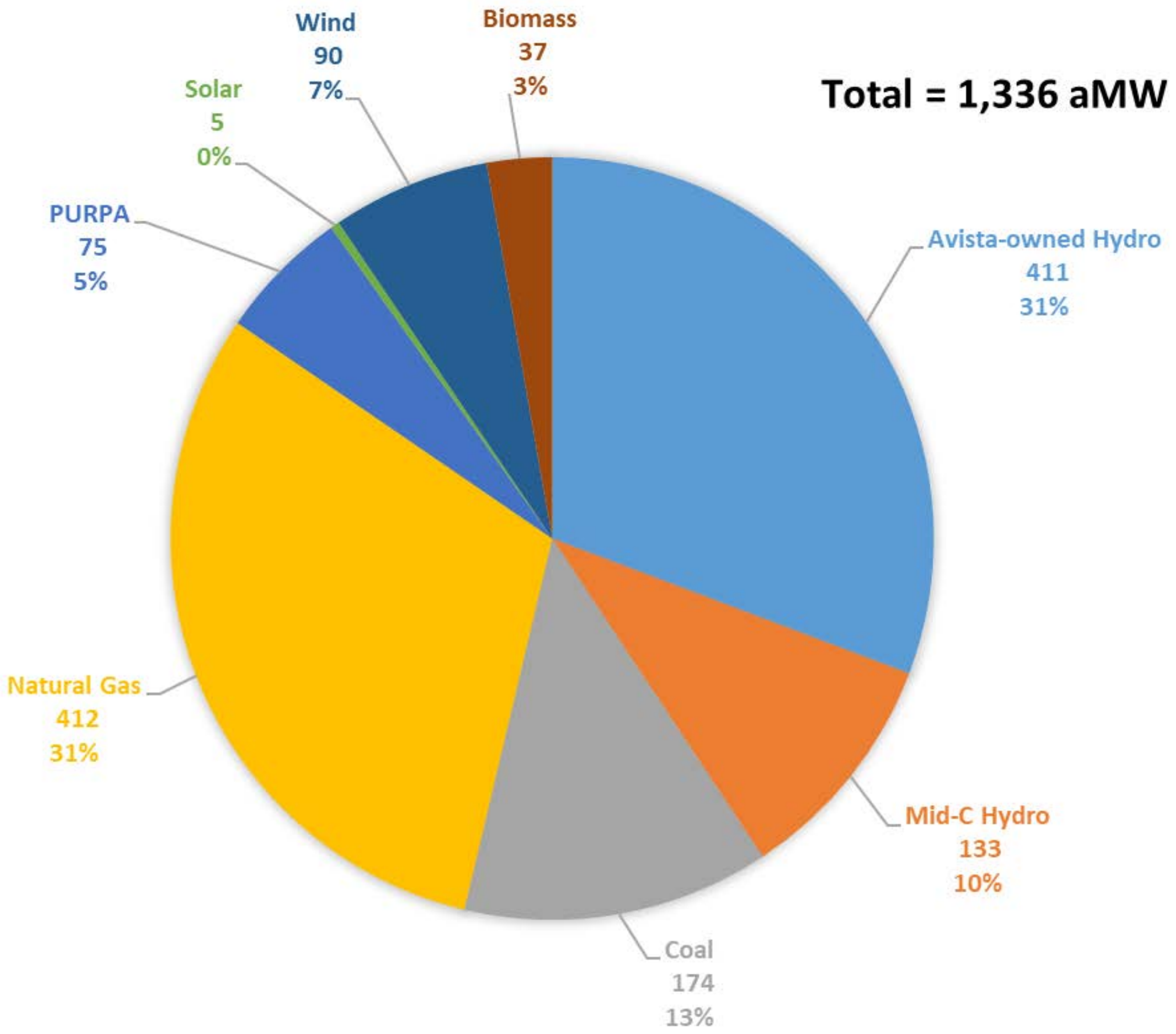
*connection is net metered and only contributes when generation exceeds load at facility

Customer Owned Generation

- 1,798 customer installed systems
- Technology
  - Primarily Solar
  - Some wind, combined solar & wind, and biogas
- Average system is 7.63 kW
- 93% of systems in Washington
- 2021 estimated 1.21 aMW

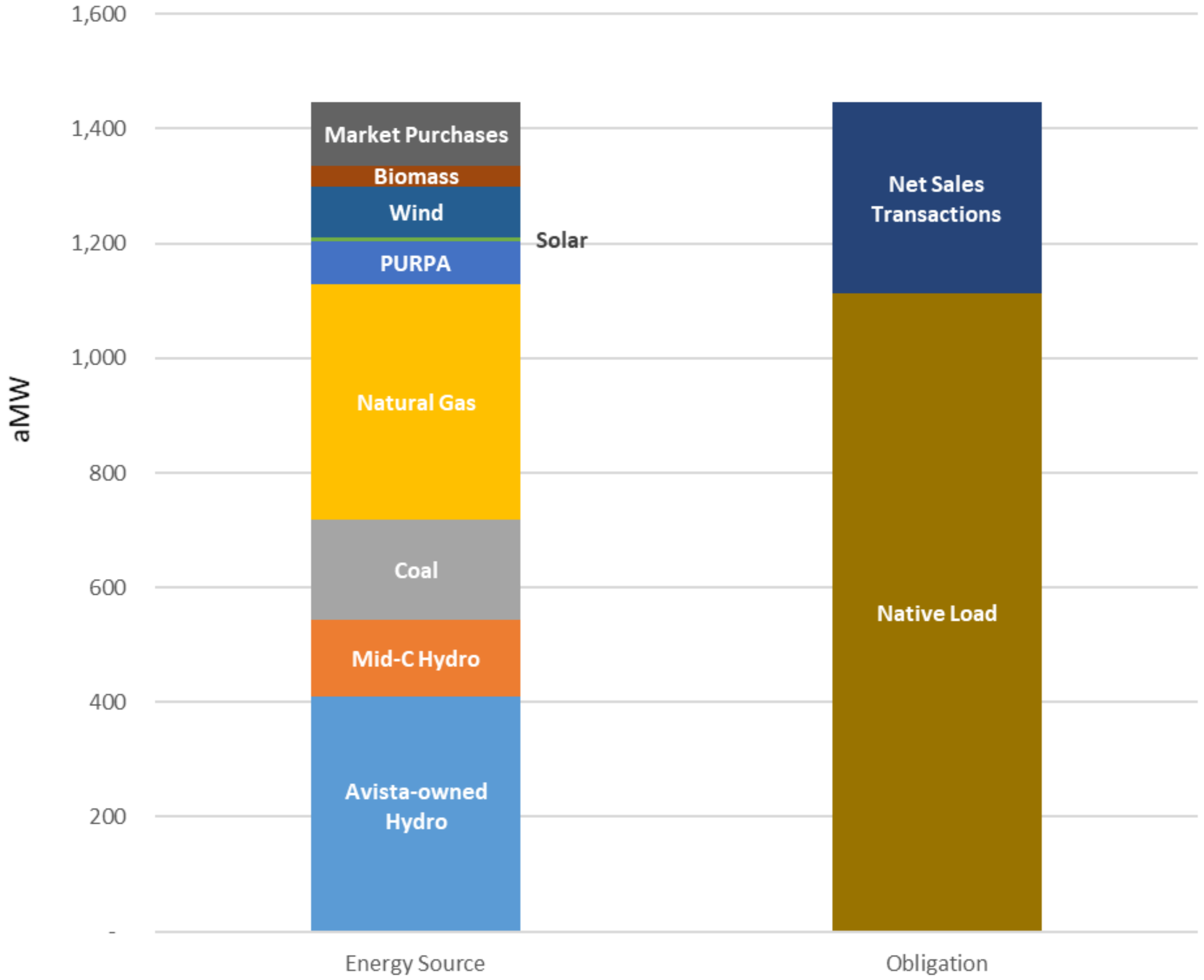


2021 System Generation by Resource Type (aMW)



Data is not adjusted for renewable energy credit sales or specified energy sales

2021 System Obligations & Energy Sources



Load & Resource Balance Update

Avista, Electric Technical Advisory Committee

March 9th, 2022 – TAC 3

James Gall, Electric IRP Manager

Major L&R Changes Since 2021 IRP

- Load forecast
- 30 MW industrial demand response (Washington Rate Case Settlement)
- Chelan County PUD purchase
  - ~88 MW or ~54 aMW equal to 5% of Rocky Reach and Rock Island projects

	2022	2023	2024	2025	2026-2030	2031-2033	2034-2045
Existing Slice	5%	5%	5%	5%	5%		
April 2021 Contract			5%	5%	5%	5%	
December 2021 Contract					5%	10%	10%

System Capacity Position

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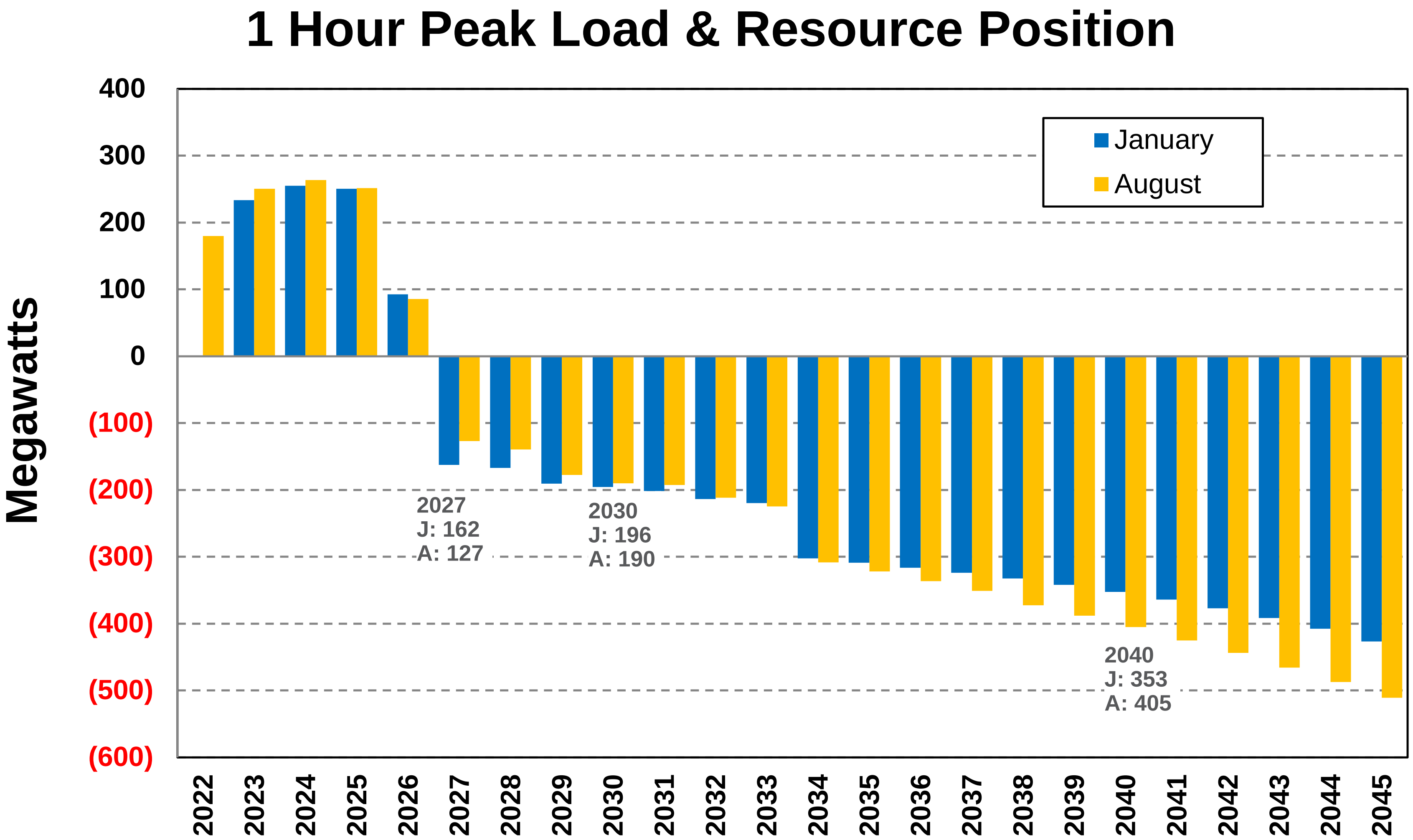

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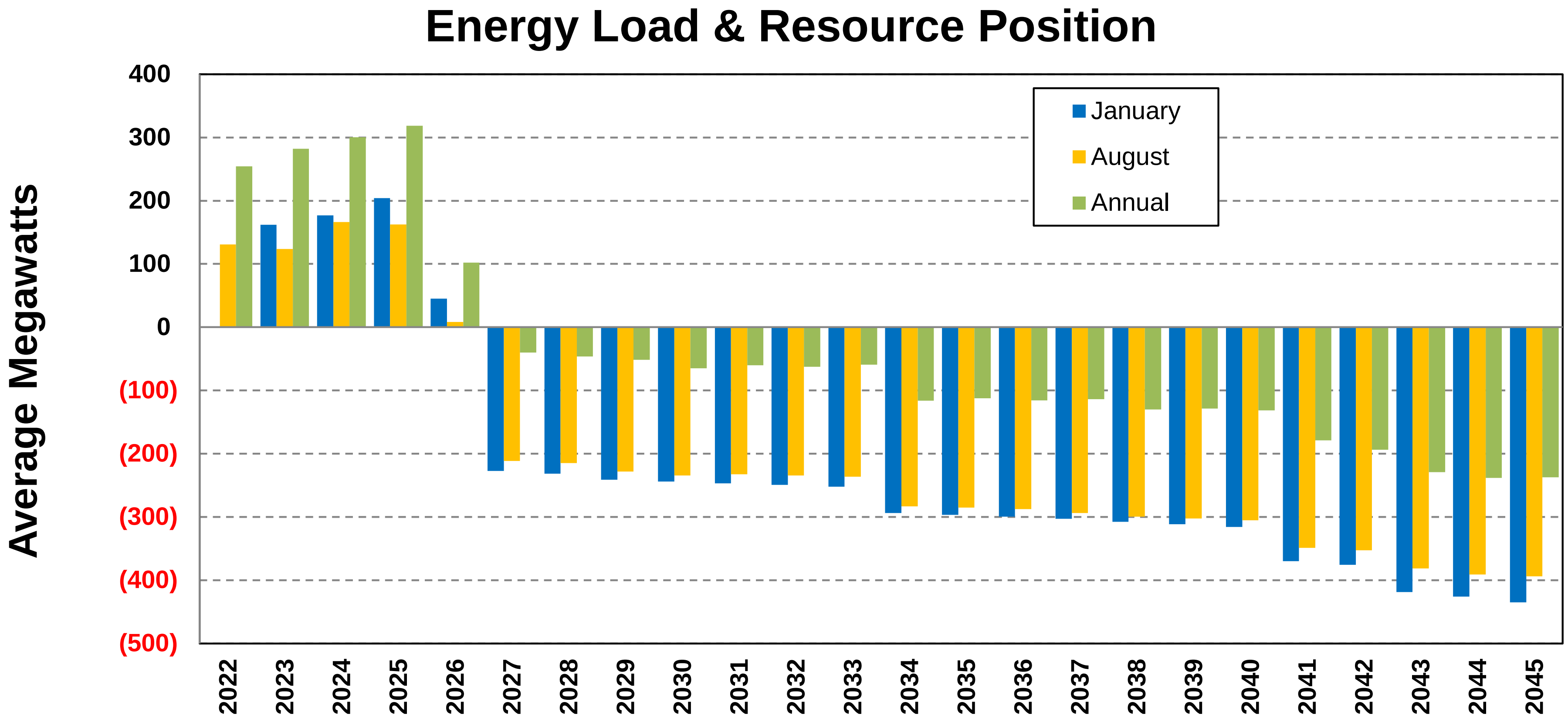

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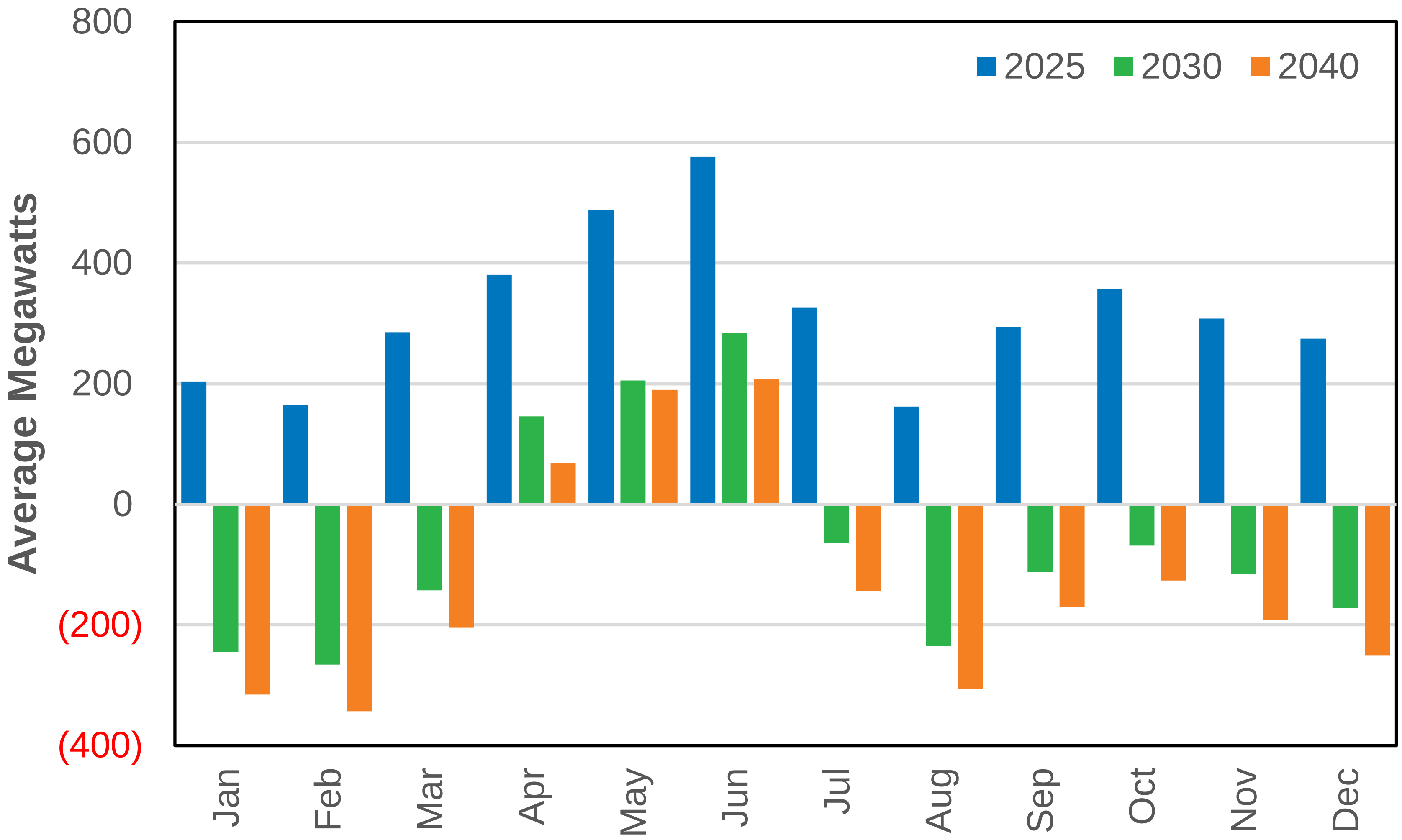

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Average Megawatts

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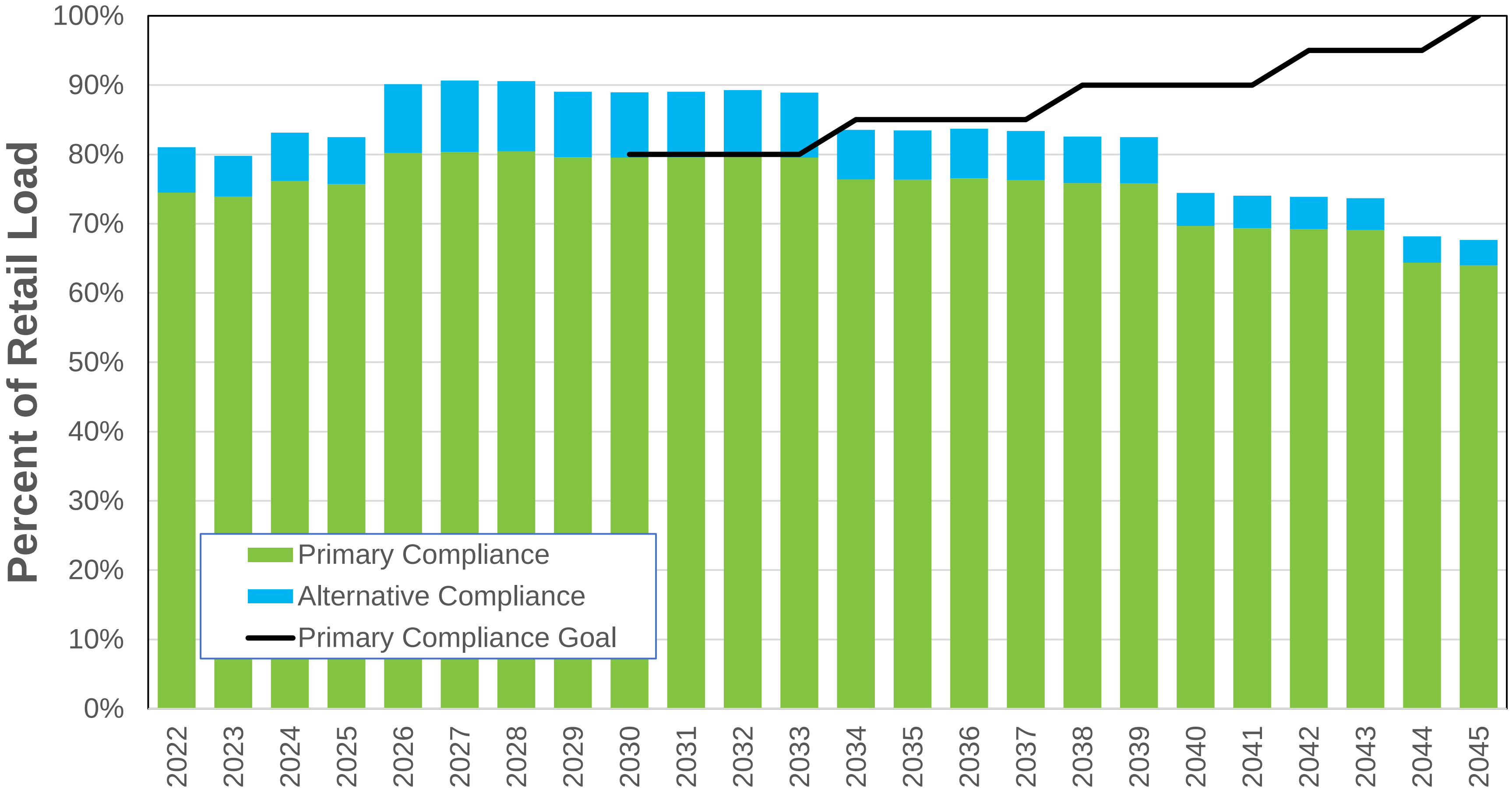

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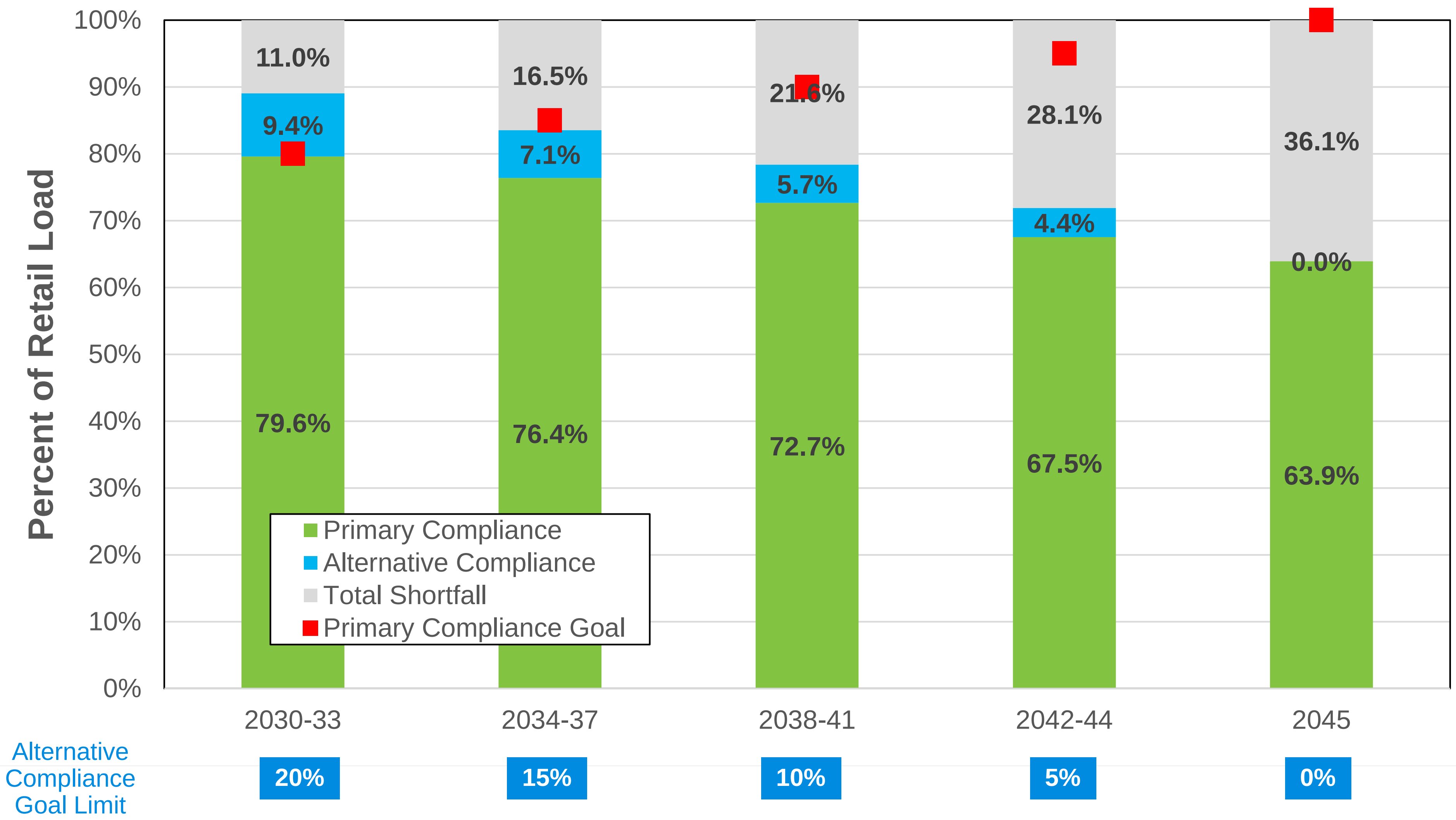
Compliance Window CETA Energy Position



WHEN TRUST MATTERS

Supply Side Non-Energy Impacts

09 March 2022

Agenda

01 Project Overview

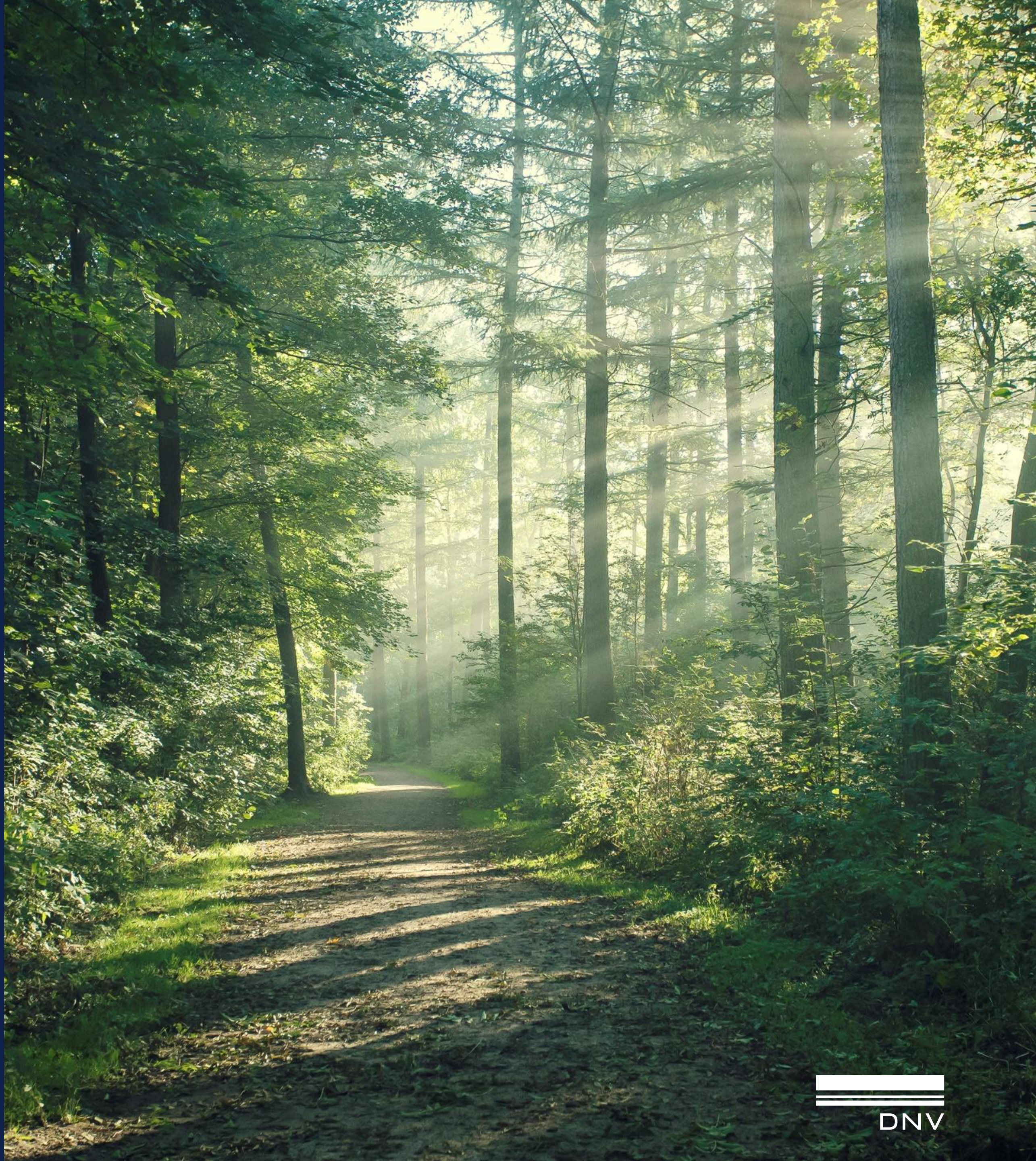
02 Approach

03 Results

04 Gap Analysis

05 Discussion

Project Overview



What is a Supply Side Non-Energy Impact (NEI)?

Cost of Energy

Impacts included in the cost of energy

Examples:

- Jobs and direct economic impacts
- Fuel costs
- Water use

NEI (Externality)

Impacts **not** accounted for in the cost of energy

Examples:

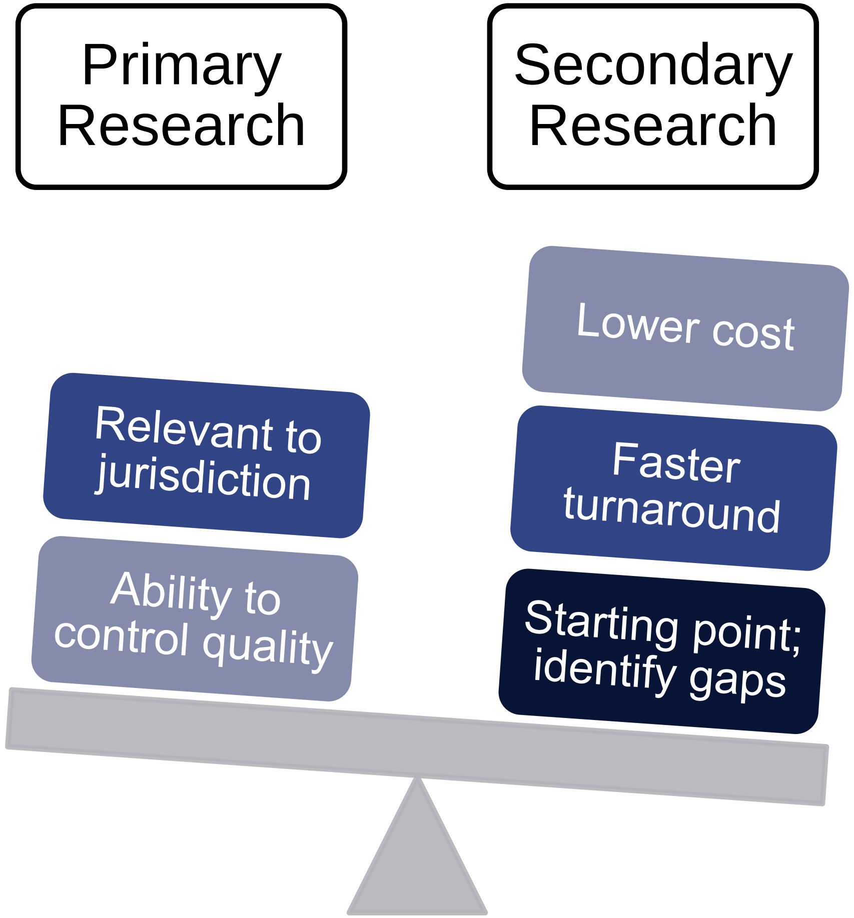
- Health impacts due to emissions
- Fatalities
- Water use

Project Overview

- Jurisdictional Scan
- NEI Database Development
- Database Application
- Gap Analysis

Approach

Potential NEI Approaches



Primary Research

Secondary Research

Relevant to jurisdiction

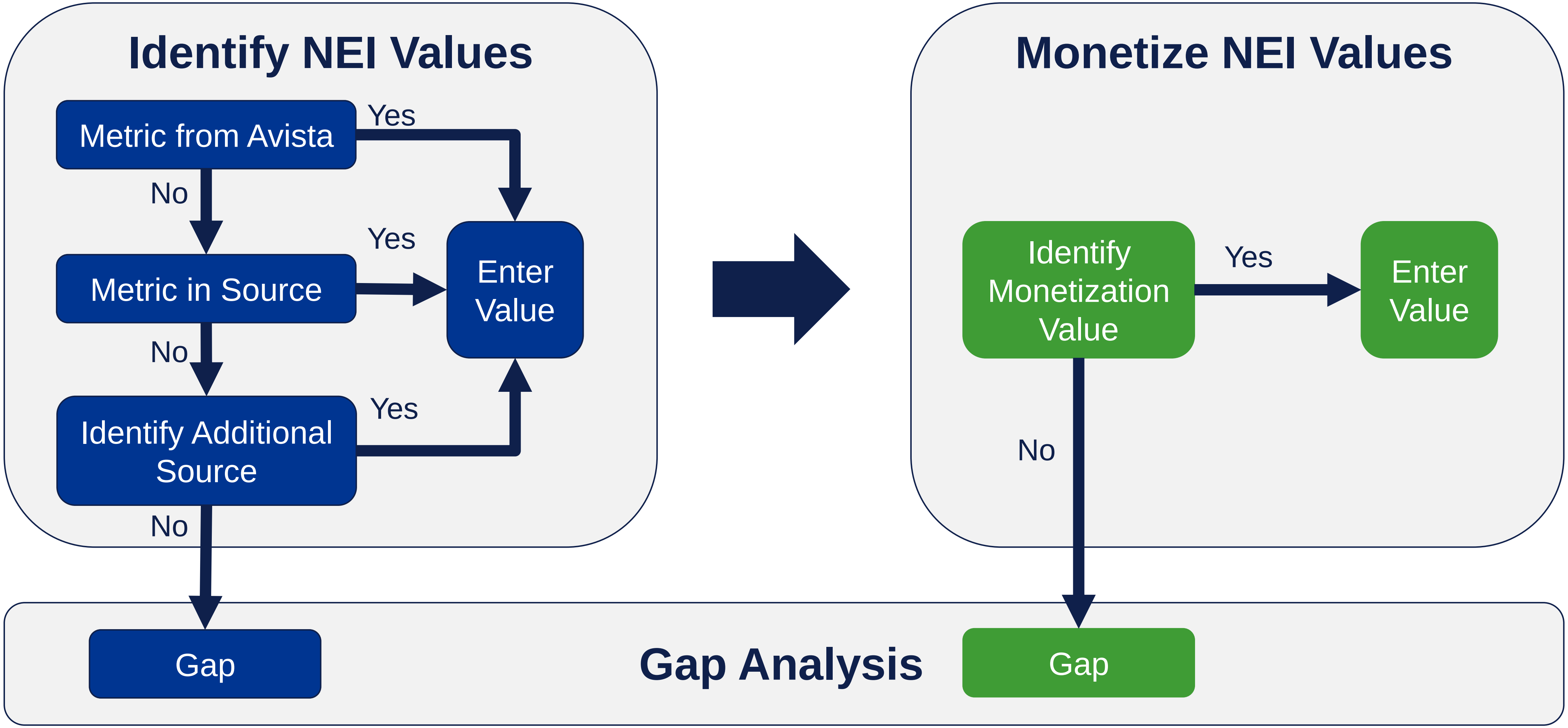
Ability to control quality

Lower cost

Faster turnaround

Starting point; identify gaps

Database Compilation: Generalized Approach



Identify NEI Values

Metric from Avista

Yes

No

Metric in Source

Yes

Enter Value

No

Identify Additional Source

Yes

No

Monetize NEI Values

Identify Monetization Value

Yes

Enter Value

No

Gap

Gap Analysis

Gap

Approach Limitations

- NEI values are not always comparable across regions
- Potential limitations:
  - Outdated studies
  - Issues with methodology
  - Lack of documentation for some values
- Gaps in secondary research, particularly for monetization

NEI Metrics

Public Health

- $PM_{2.5}$ health impacts
- SO_2 health impacts
- NO_x health impacts

Safety

- Direct fatalities from construction & operations
- Indirect fatalities from supply chain

Energy Security (Customer)

- Energy Burden

Environment

- Land Use
- Water Use
- Wildlife
- Wildfire

Economic

- Induced Jobs
- Induced value add

Summary of Compiled Data

Group	Generator Types	Public Health	Safety	Environment			Economic
				Land Use	Water Use	Wildlife	
Biomass	Biomass	✓	✓	✓	✓		✓
Coal	Coal	✓	✓	✓	✓	✓	✓
	Coal CCS		✓	✓	✓	✓	≈
Hydro	Hydro-PB	✓					✓
	Hydro-GF	✓					✓
	Hydro-Res	✓	✓	✓	✓		✓
	Hydro-RR	✓					✓
	Hydro-RRS	✓					✓
Hydrogen Electrolyzer	HE-LG			✓			
	HE-SM			✓			
Lithium-ion Storage	Batt-LG						
	Batt-SM						
Natural gas	NG-Aero	✓	✓	✓		✓	✓
	NG-CCCT	✓	✓	✓	✓	✓	✓
	NG-CT	✓	✓	✓	✓	✓	✓
	NG-ICE	✓	✓	✓	✓	✓	✓

Group	Generator Types	Public Health	Safety	Environment			Economic
				Land Use	Water Use	Wildlife	
Non-natural gas	NNG-Bio		✓				
	NNG-CF						≈
	NNG-Hyd			✓			
	NNG-LAir						
	NNG-Ren			✓			
Nuclear	Nuclear	✓	✓	✓	✓	✓	
Solar	Solar-Com	✓	✓	✓			≈
	Solar-Rft	✓	✓	✓	✓		≈
	Solar-Utl	✓	✓	✓	✓		≈
Wind	Wind-LG	✓	✓	✓	✓	✓	✓
	Wind-Off	✓	✓	✓	✓		≈
	Wind-SM	✓	✓	✓	✓	✓	✓

Results

Public Health: Approach

Emissions Values

- Values: $PM_{2.5}$, SO_2, and NO_x tons/MWh
- Sources: Avista, eGRID

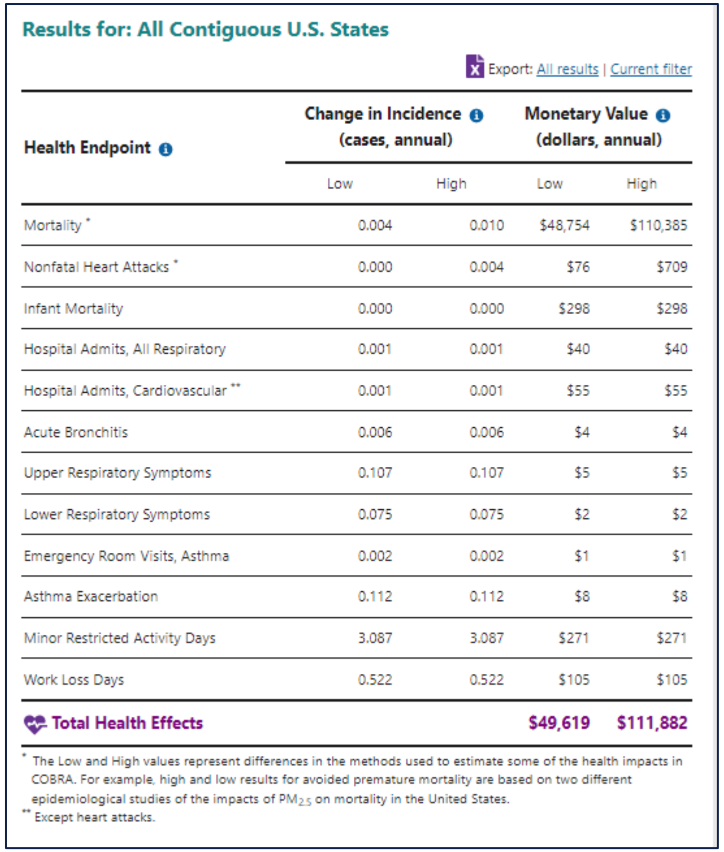
Public Health Costs

- Values: \$/ton of $PM_{2.5}$, SO_2, or NO_x
- Source: COBRA model by county

Monetized Impacts (\$/MWh)

$$Monetized\ Health\ impacts\left[\frac{\$}{MWh}\right]$$

$$= Emissions\left[\frac{tons}{MWh}\right] \times Health\ Impacts\ from\ pollutant\left[\frac{\$}{ton}\right]$$



Results for: All Contiguous U.S. States

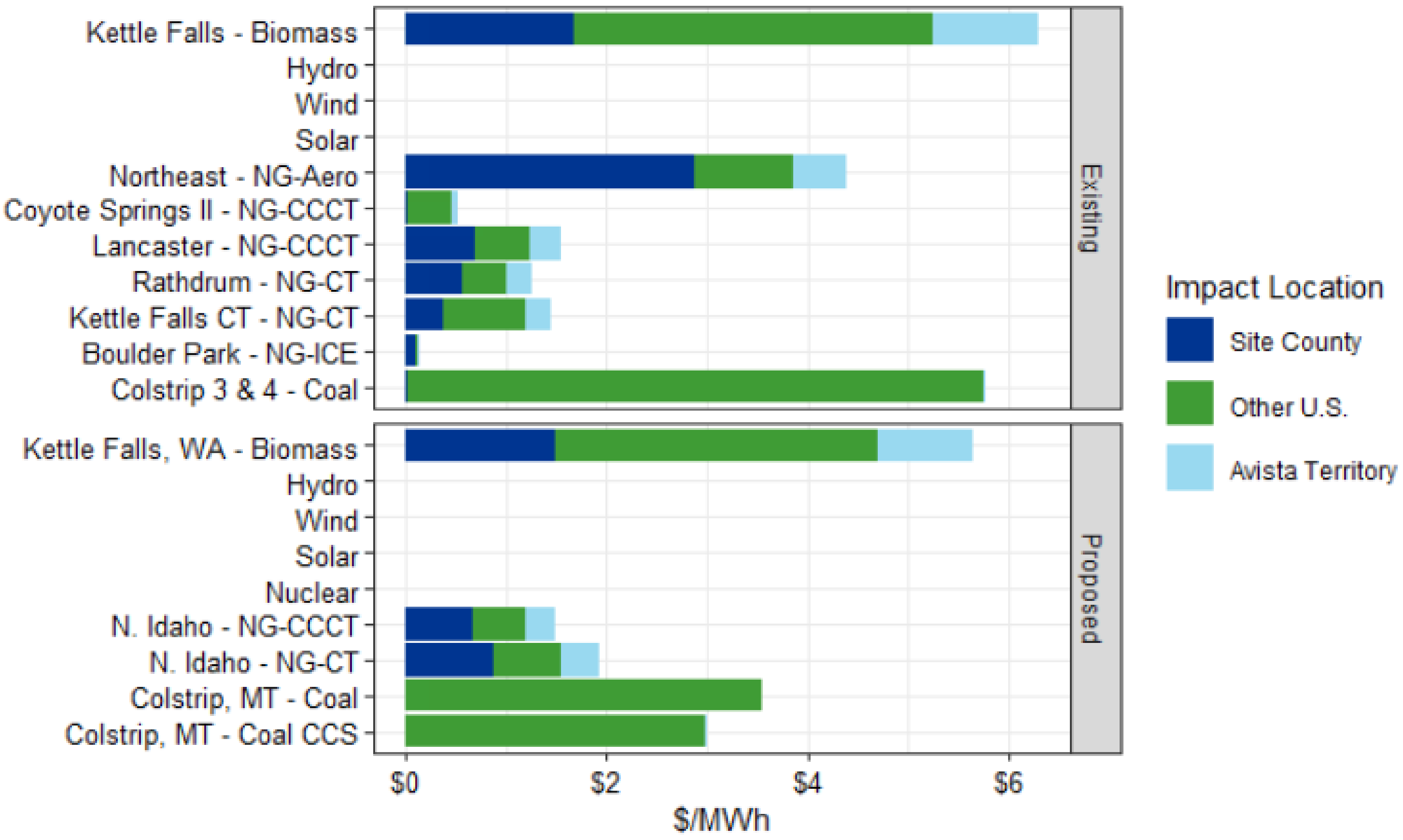
Export: All results | Current filter

Health Endpoint	Change in Incidence (cases, annual)		Monetary Value (dollars, annual)	
	Low	High	Low	High
Mortality *	0.004	0.010	\$48,754	\$110,385
Nonfatal Heart Attacks *	0.000	0.004	\$76	\$709
Infant Mortality	0.000	0.000	\$298	\$298
Hospital Admits, All Respiratory	0.001	0.001	\$40	\$40
Hospital Admits, Cardiovascular **	0.001	0.001	\$55	\$55
Acute Bronchitis	0.006	0.006	\$4	\$4
Upper Respiratory Symptoms	0.107	0.107	\$5	\$5
Lower Respiratory Symptoms	0.075	0.075	\$2	\$2
Emergency Room Visits, Asthma	0.002	0.002	\$1	\$1
Asthma Exacerbation	0.112	0.112	\$8	\$8
Minor Restricted Activity Days	3.087	3.087	\$271	\$271
Work Loss Days	0.522	0.522	\$105	\$105
Total Health Effects			**\$49,619**	**\$111,882**

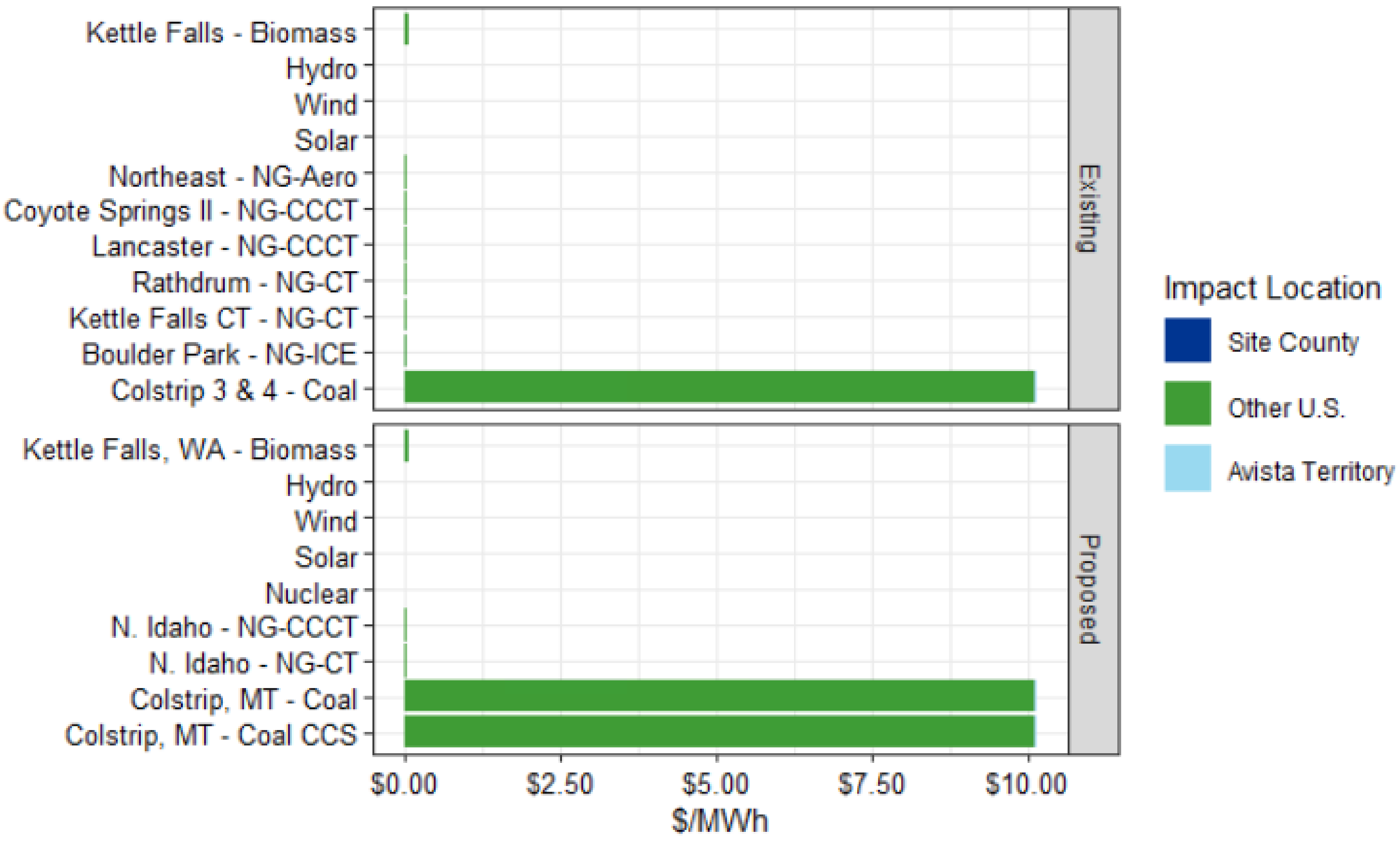
* The Low and High values represent differences in the methods used to estimate some of the health impacts in COBRA. For example, high and low results for avoided premature mortality are based on two different epidemiological studies of the impacts of $PM_{2.5}$ on mortality in the United States.

** Except heart attacks.

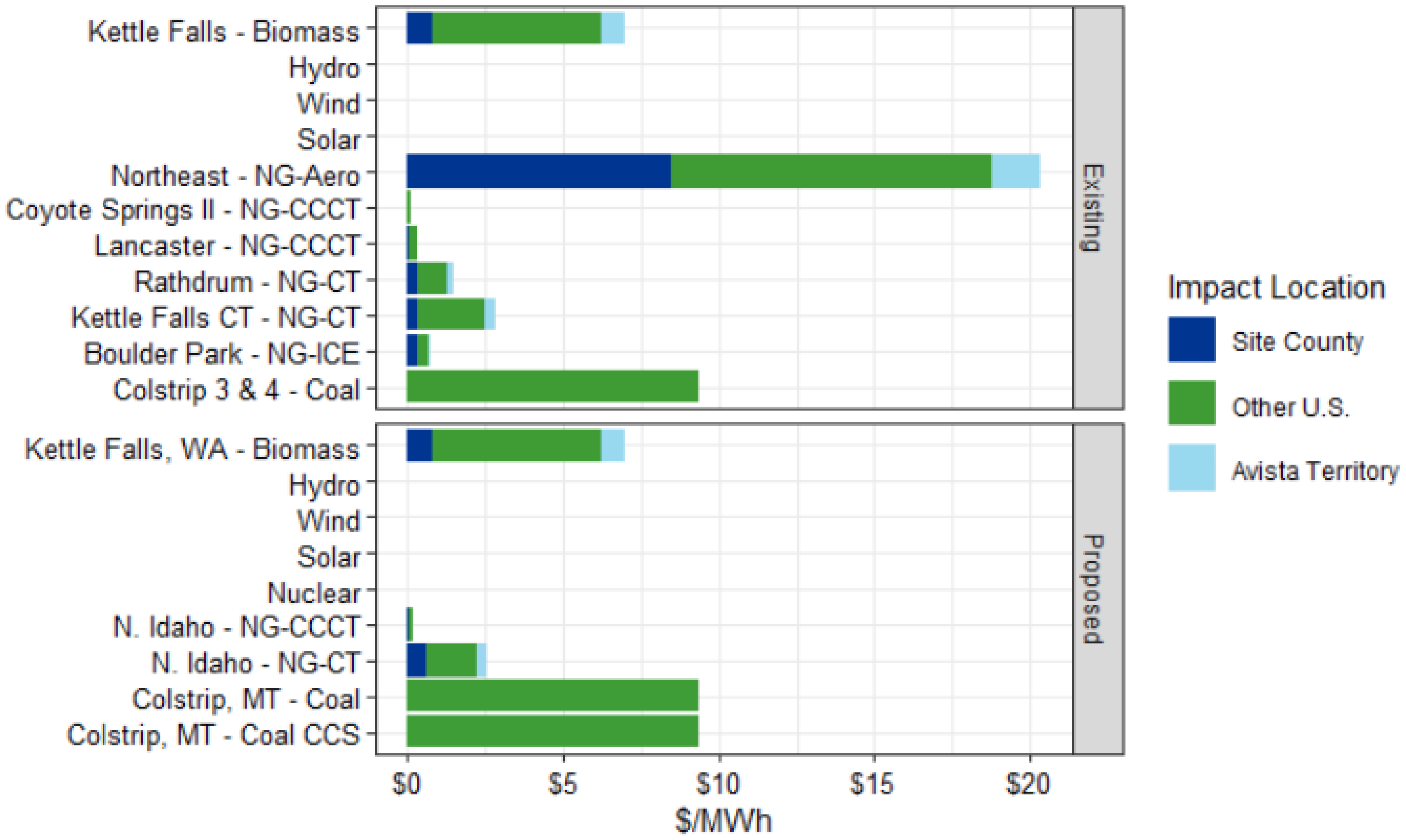
Public Health: $PM_{2.5}$



Public Health: SO_2



Public Health: NO_x



Safety: Approach

Fatality Values

- Values: direct fatalities, indirect fatalities
- Sources: BLS, BTS, MSHA, CDC, DOT

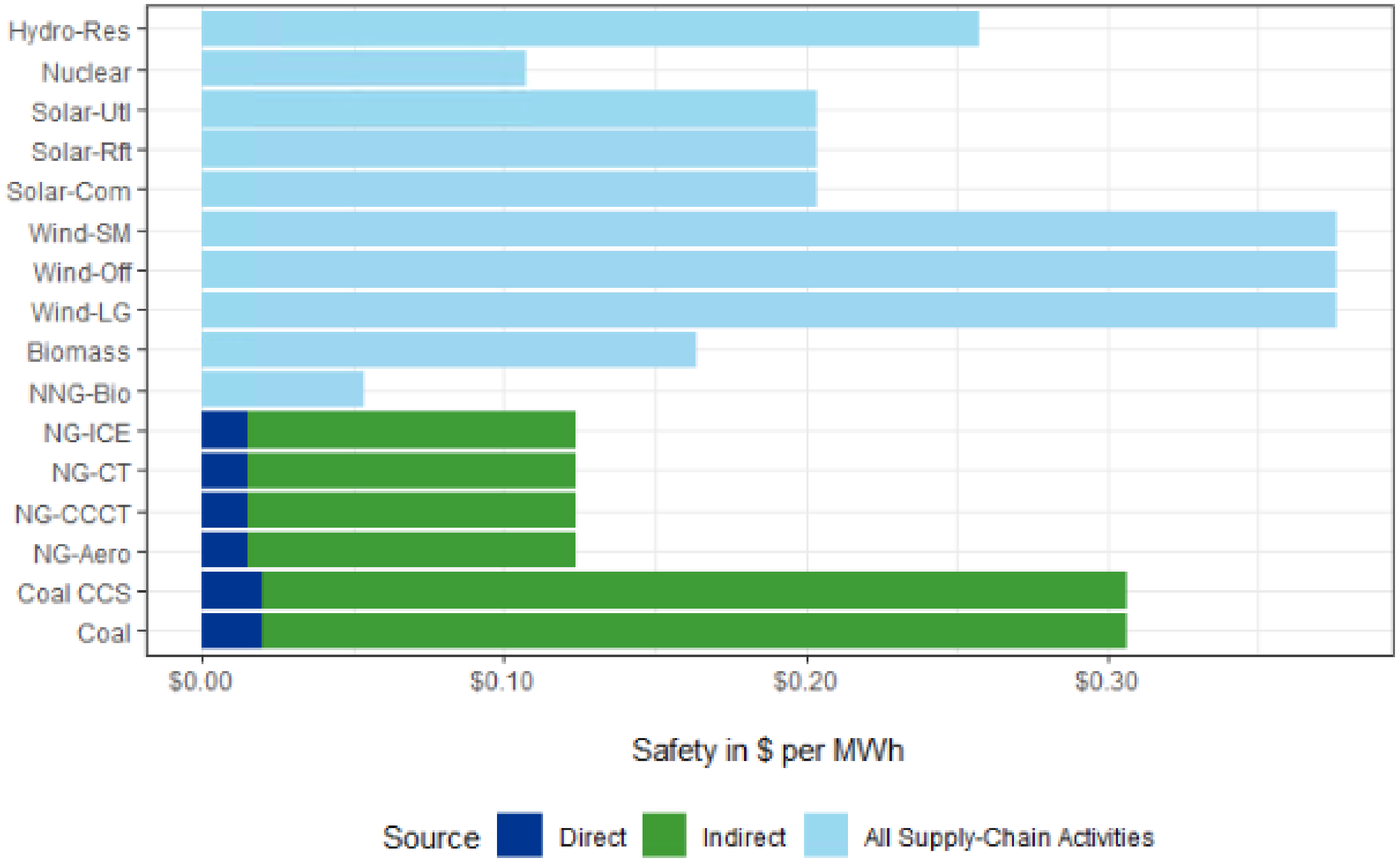
Safety Costs

- Values: value of statistical life, $/MWh
- Source: EPA

Monetized Impacts ($/MWh)

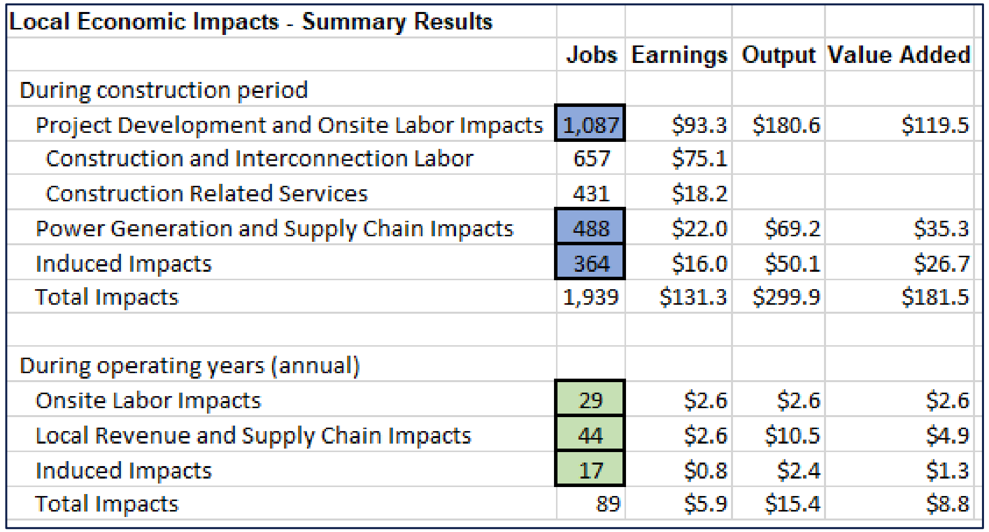
$$Monetized\ \text{safety}\left[\frac{\$}{MWh}\right] = Safety\left[\frac{Fatalities}{MWh}\right] \times Value\ of\ a\ Statistical\ Life\left[\frac{\$10{,}742{,}916.67}{Fatality}\right]$$

Safety: Fatalities



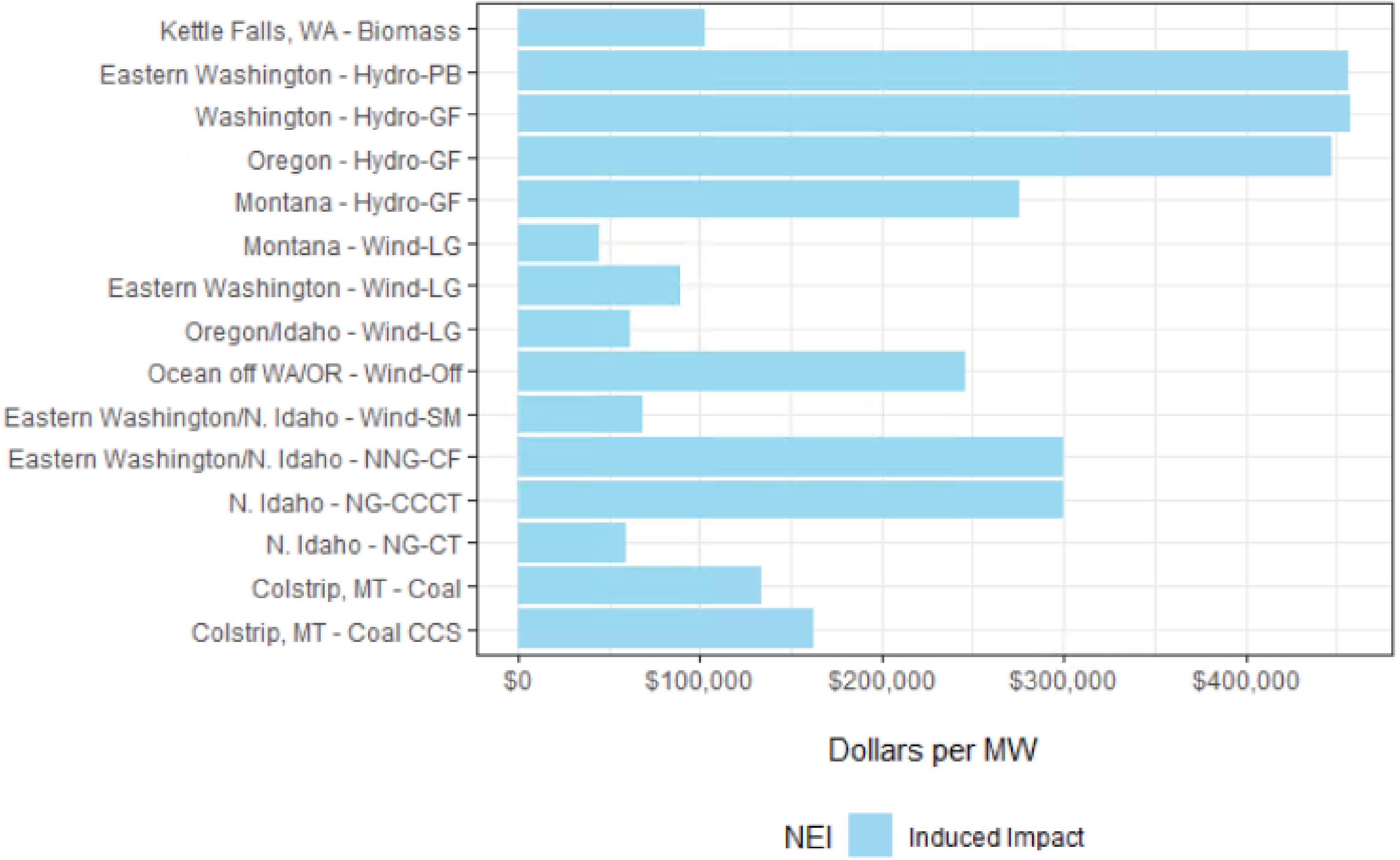
Economic: Approach

- NREL JEDI models
  - 6 different models
  - Specified location, year of construction, & MW
- Types of impacts:
  - **Direct**: Labor directly related to onsite development, construction, and operations
  - **Indirect**: Supporting industry impacts
  - **Induced**: Impacts due to reinvestment and spending driven by the direct and indirect impacts
- **Value added**: The difference between total gross output and the cost of intermediate inputs. Equivalent to gross domestic product.



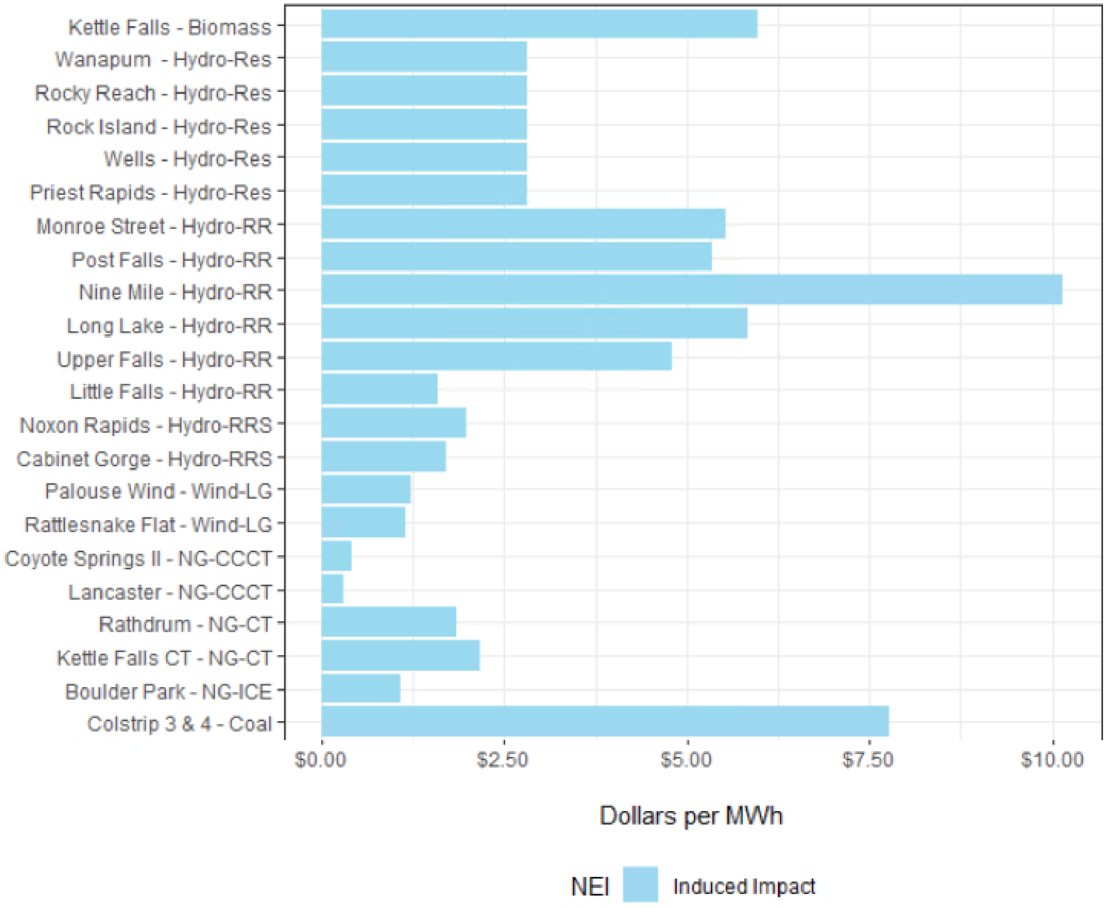
Local Economic Impacts - Summary Results				
	Jobs	**Earnings**	**Output**	**Value Added**
During construction period				
Project Development and Onsite Labor Impacts	1,087	$93.3	$180.6	$119.5
Construction and Interconnection Labor	657	$75.1		
Construction Related Services	431	$18.2		
Power Generation and Supply Chain Impacts	488	$22.0	$69.2	$35.3
Induced Impacts	364	$16.0	$50.1	$26.7
Total Impacts	1,939	$131.3	$299.9	$181.5
During operating years (annual)				
Onsite Labor Impacts	29	$2.6	$2.6	$2.6
Local Revenue and Supply Chain Impacts	44	$2.6	$10.5	$4.9
Induced Impacts	17	$0.8	$2.4	$1.3
Total Impacts	89	$5.9	$15.4	$8.8

Economic: Construction Impacts (proposed)

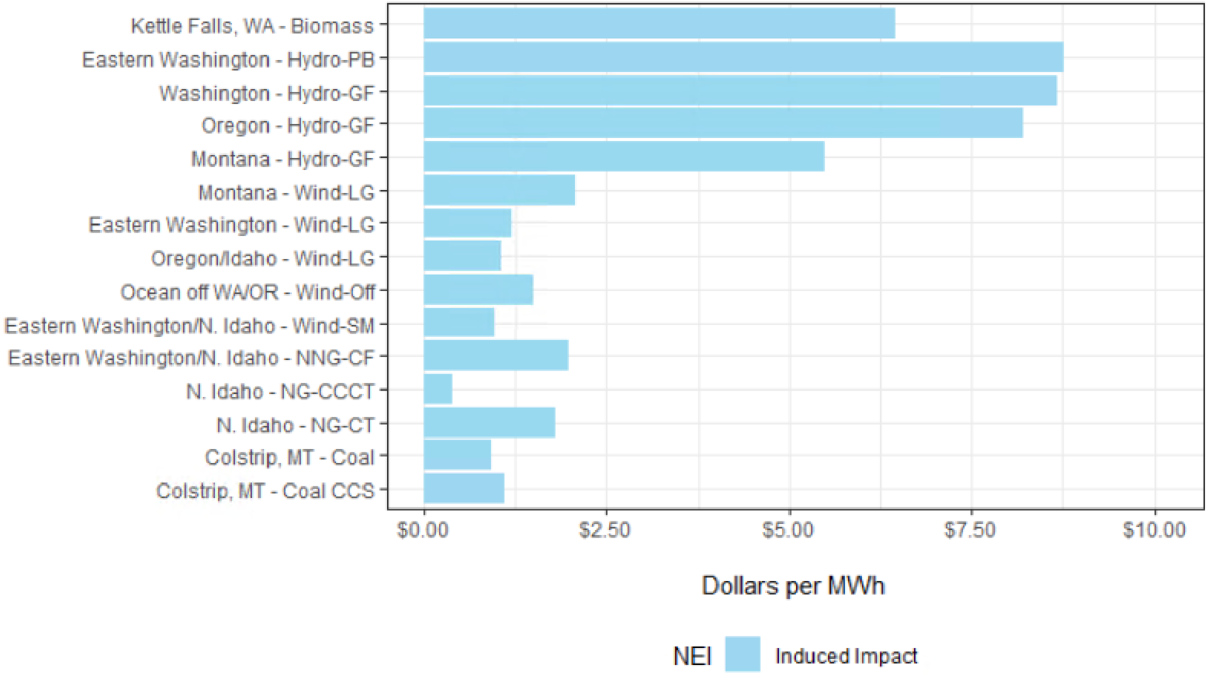


Economic: Operations Impacts

Existing



Proposed



Database Application Example: Proposed Eastern Washington Large Wind Farm

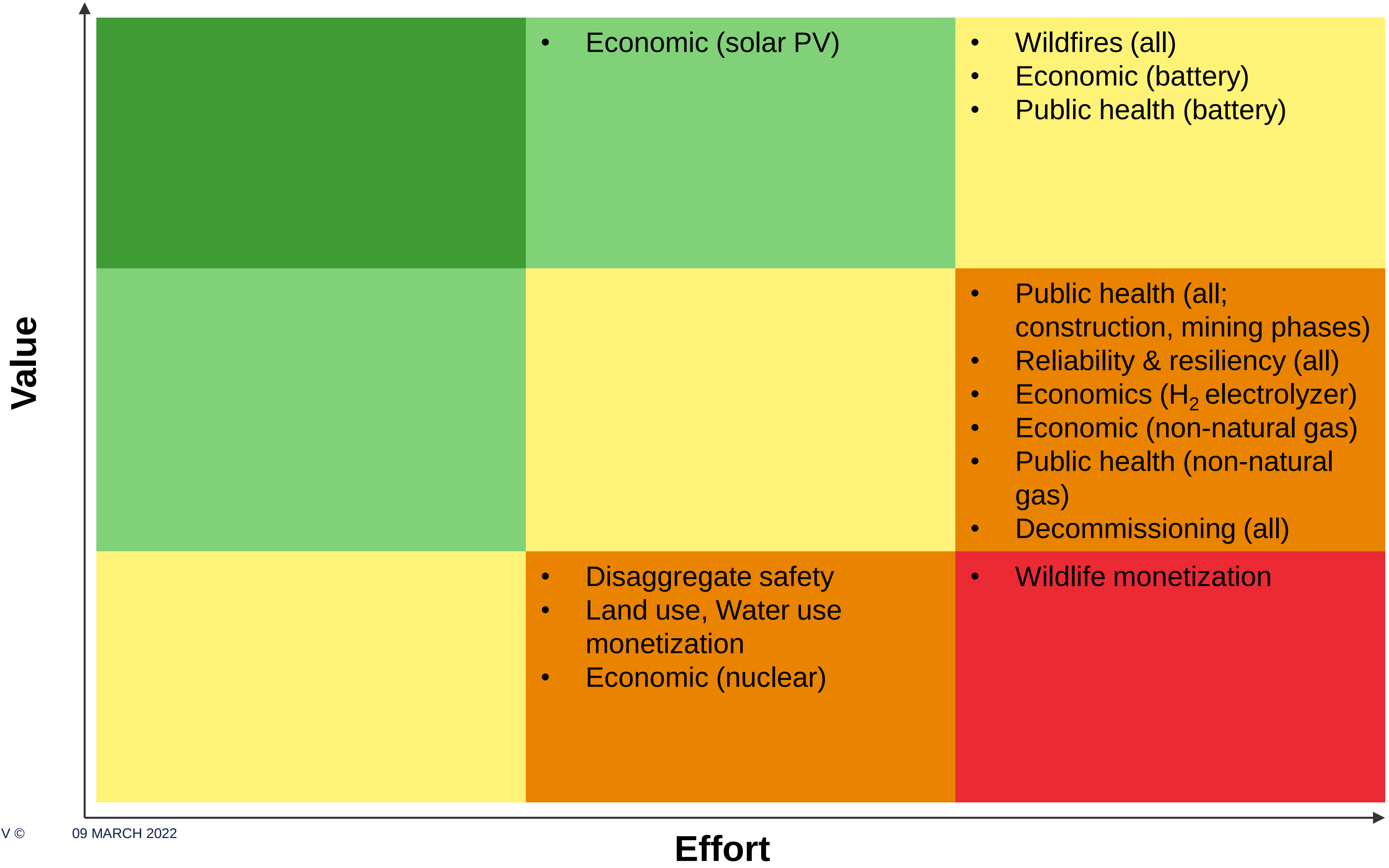
Impacts per MWh

Impacts per MW

NEI	Impact ($/MW)
Economic - Construction	$89,600

Gap Analysis

Gap analysis



	• Economic (solar PV)	• Wildfires (all) • Economic (battery) • Public health (battery)
		• Public health (all; construction, mining phases) • Reliability & resiliency (all) • Economics (H_2 electrolyzer) • Economic (non-natural gas) • Public health (non-natural gas) • Decommissioning (all)
	• Disaggregate safety • Land use, Water use monetization • Economic (nuclear)	• Wildlife monetization

Discussion

WHEN TRUST MATTERS

www.dnv.com

Database Compilation: Resource Types

Group	Technology	
	Abbreviation	Generator Types
Biomass	Biomass	Biomass
Coal	Coal	Coal
	Coal CCS	Coal with Carbon Capture
Hydro	Hydro-PB	Pumped hydro - brownfield
	Hydro-GF	Pumped hydro - greenfield
	Hydro-Res	Reservoir hydro
	Hydro-RR	Run-of-river hydro
	Hydro-RRS	Run-of-river hydro with storage
Hydrogen electrolyzer	HE-LG	Hydrogen electrolyzer - large
	HE-SM	Hydrogen electrolyzer - small
Lithium-ion storage	Batt-LG	Lithium-ion Storage - Large
	Batt-SM	Lithium-ion Storage - Small
Natural gas	NG-Aero	Natural gas Aero Turbine
	NG-CCCT	Natural gas CCCT
	NG-CT	Natural gas CT
	NG-ICE	Natural gas internal combustion engine
Non-natural gas	NNG-Bio	Non-natural gas (Bio-fuel)
	NNG-CF	Clean Fuel Turbine
	NNG-Hyd	Non-natural gas (Hydrogen)
	NNG-LAir	Non-natural gas (Liquid air)
	NNG-Ren	Renewable natural gas storage tank
Nuclear	Nuclear	Nuclear
Solar	Solar-Com	Community solar
	Solar-Rft	Rooftop solar
	Solar-Utl	Utility-scale solar
Wind	Wind-LG	Large wind
	Wind-Off	Off-shore wind
	Wind-SM	Small Wind

Natural Gas Price Forecast

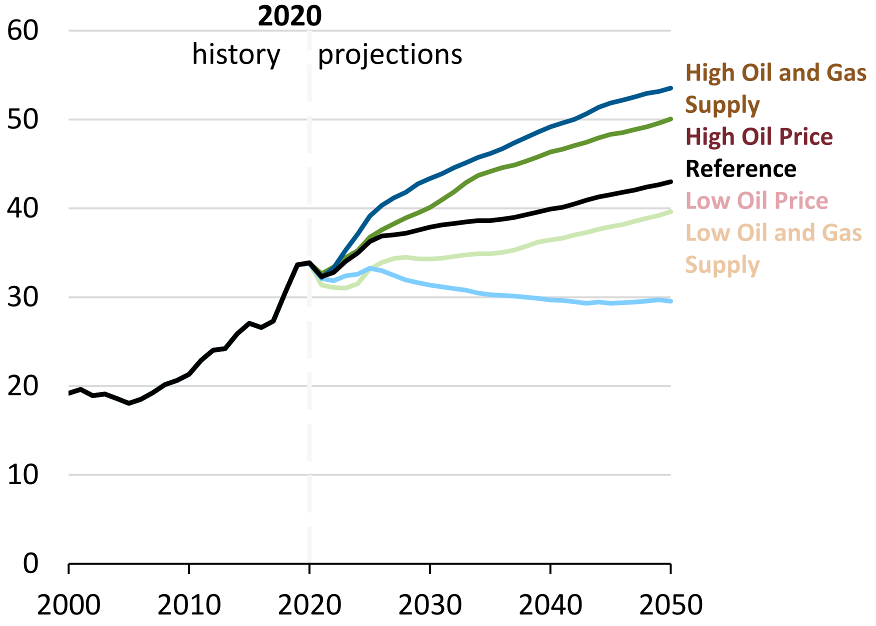
Avista, Electric Technical Advisory Committee

March 9th, 2022 – TAC 3

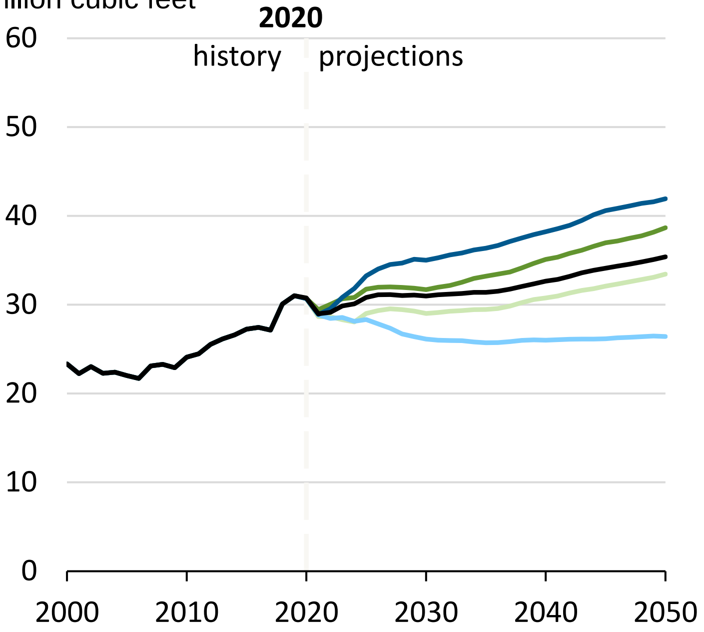
Tom Pardee, Natural Gas IRP Manager

U.S. dry natural gas production and consumption

U.S. dry natural gas production
AEO2021 side cases
trillion cubic feet

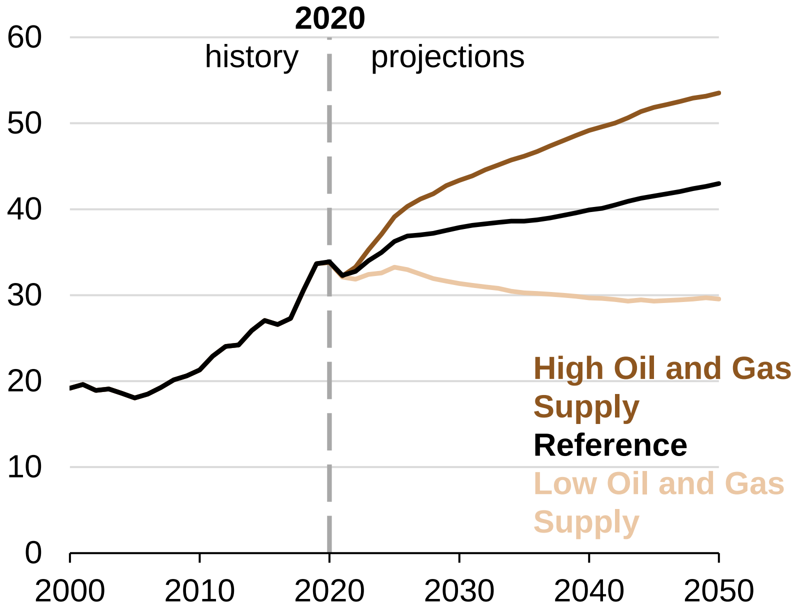


U.S. natural gas consumption
AEO2021 side cases
trillion cubic feet

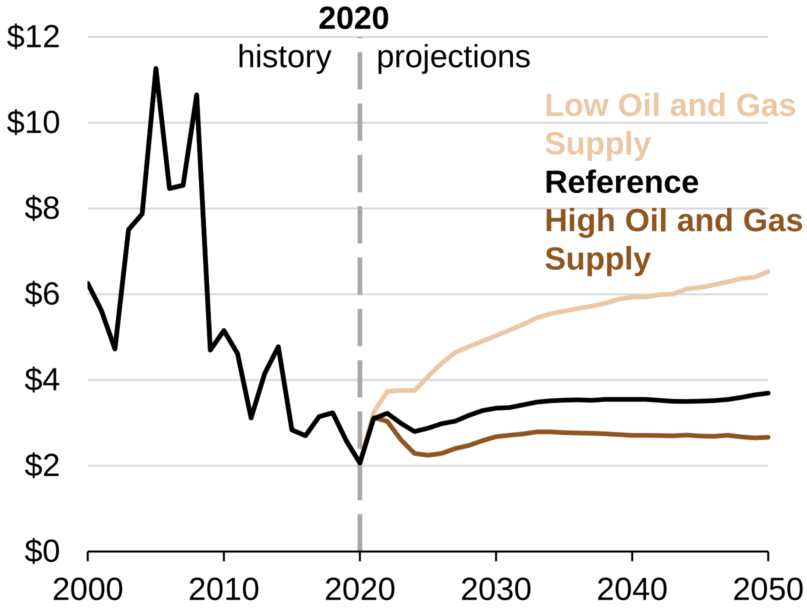


Natural gas production and prices

U.S. dry natural gas production
AEO2021 oil and gas supply cases
trillion cubic feet

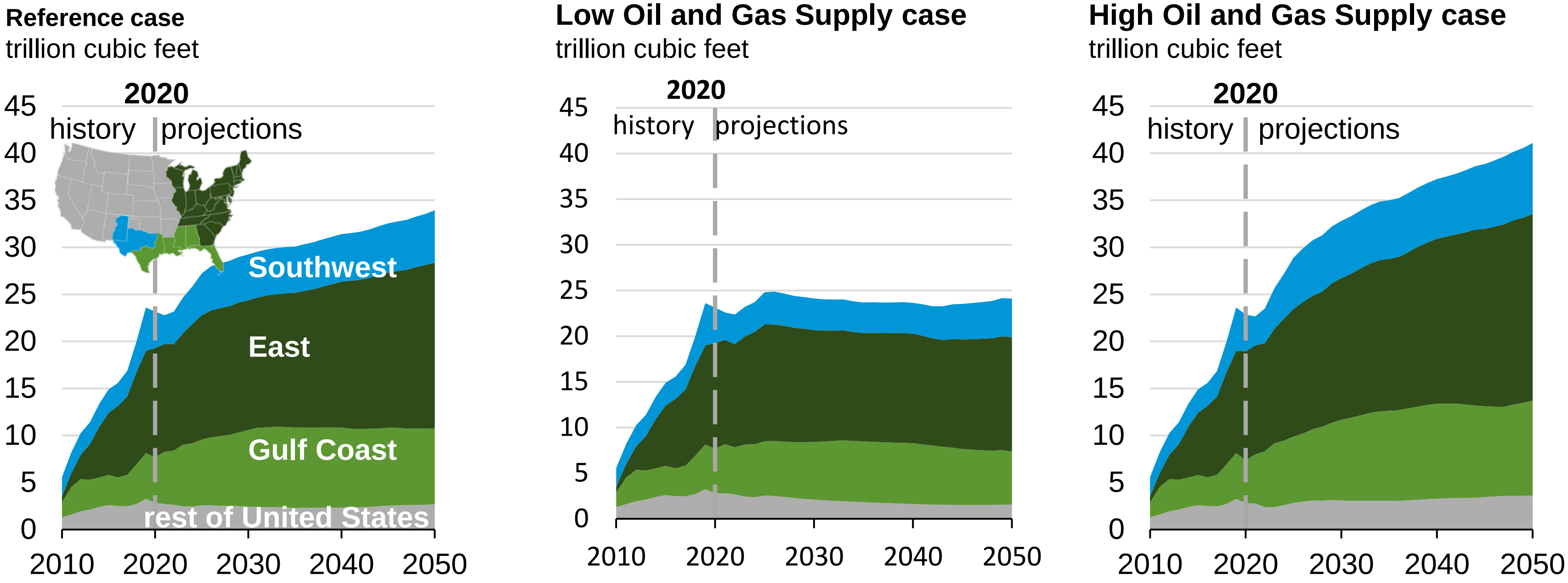


Natural gas spot price at Henry Hub
AEO2021 oil and gas supply cases
2020 dollars per million British thermal units



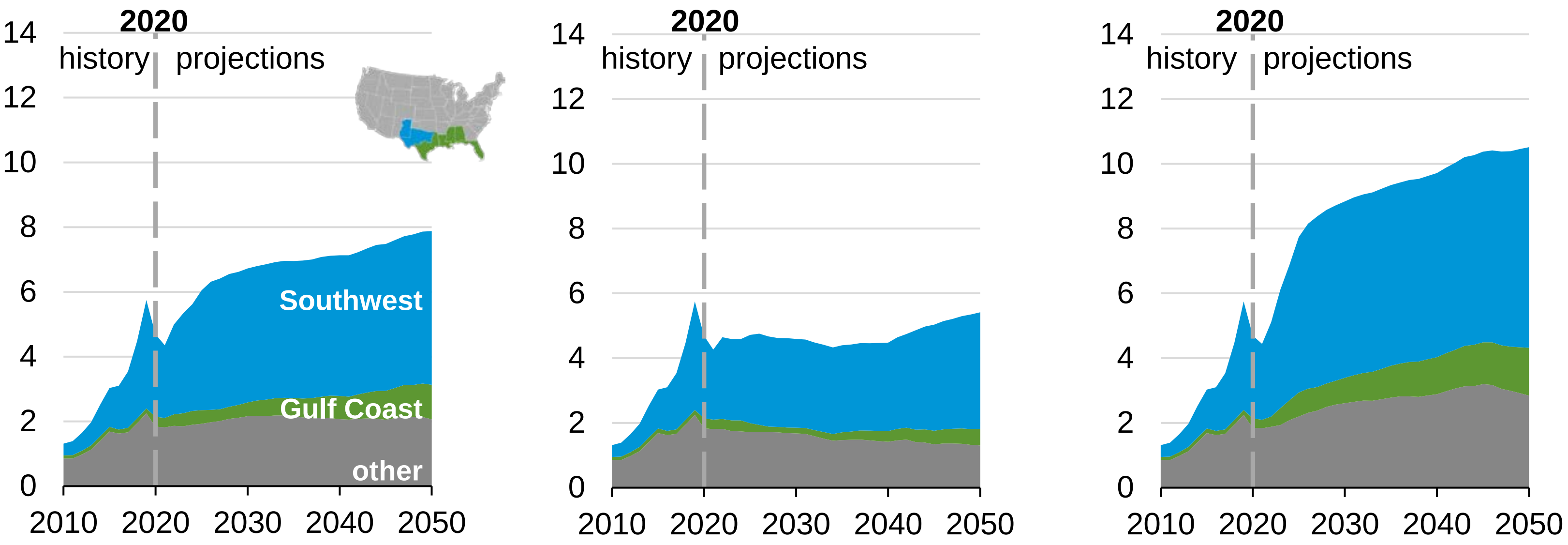
U.S. production of natural gas from shale resources

U.S. dry natural gas production from shale resources by region, AEO2021 oil and gas supply cases



U.S. production of natural gas from oil formations

U.S. dry natural gas production from oil formations by region, AEO2021 oil and gas supply cases

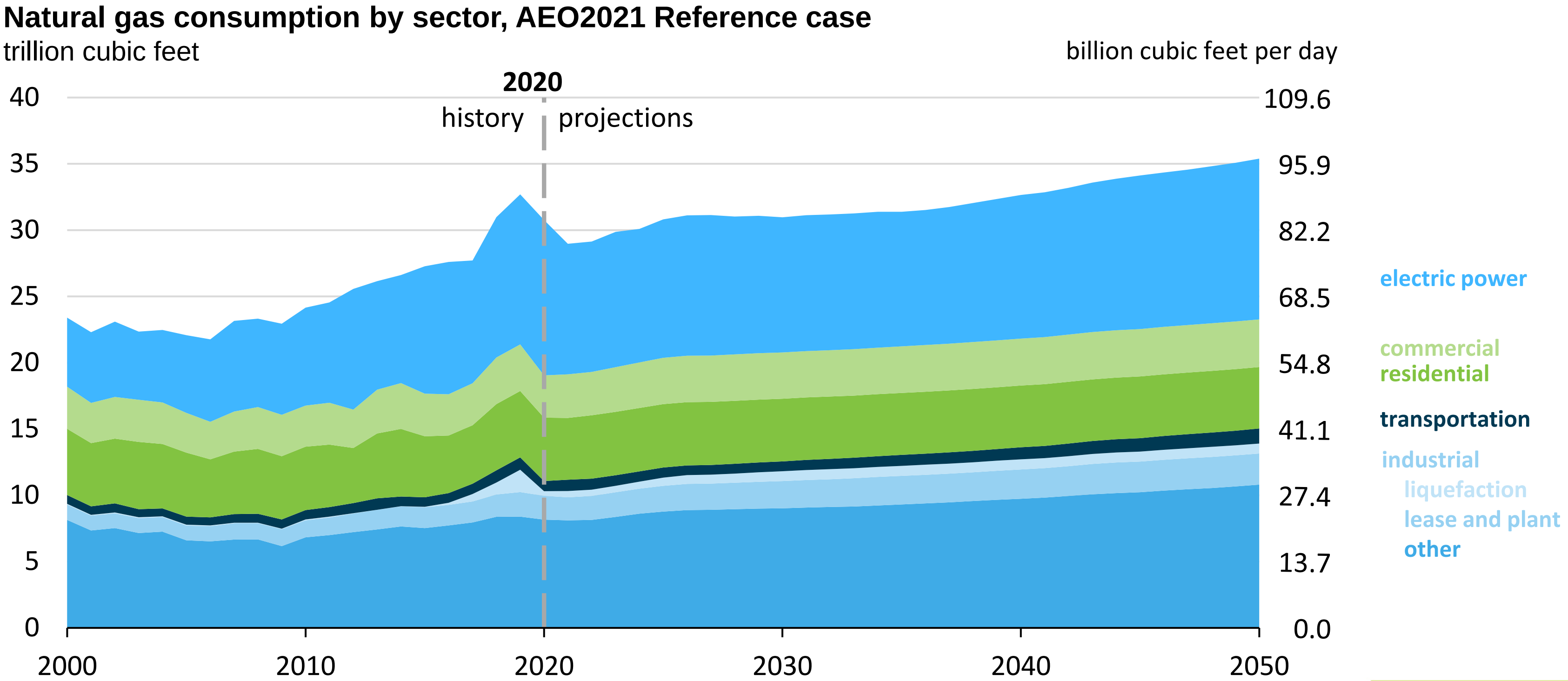


Reference case
trillion cubic feet

Low Oil and Gas Supply case
trillion cubic feet

High Oil and Gas Supply case
trillion cubic feet

U.S. natural gas consumption by sector

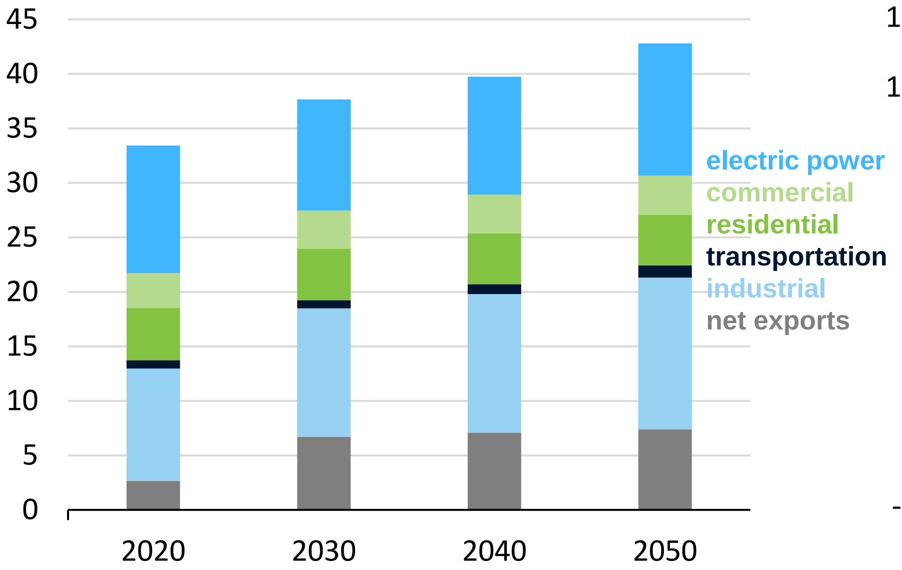


Change in natural gas disposition by sector and net exports

Natural gas disposition by sector and net exports

AEO2021 Reference case

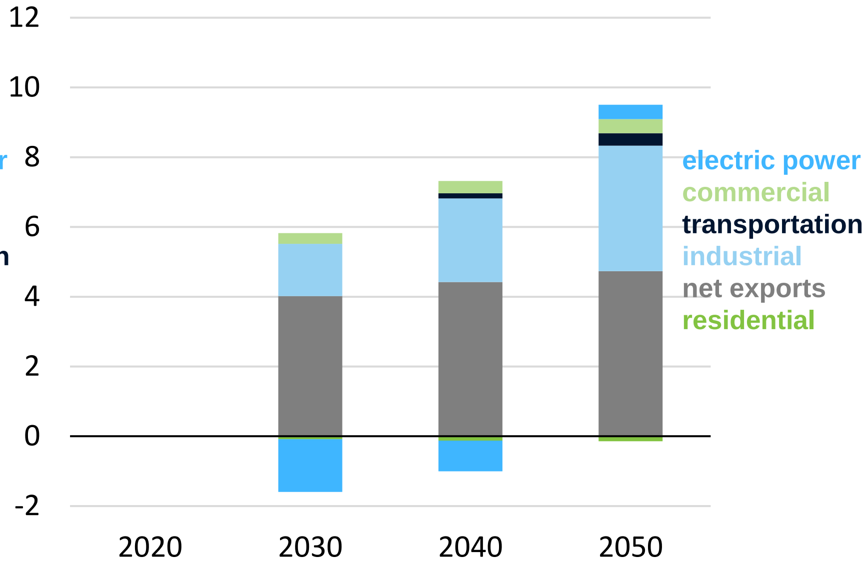
trillion cubic feet



Change in natural gas disposition and net exports

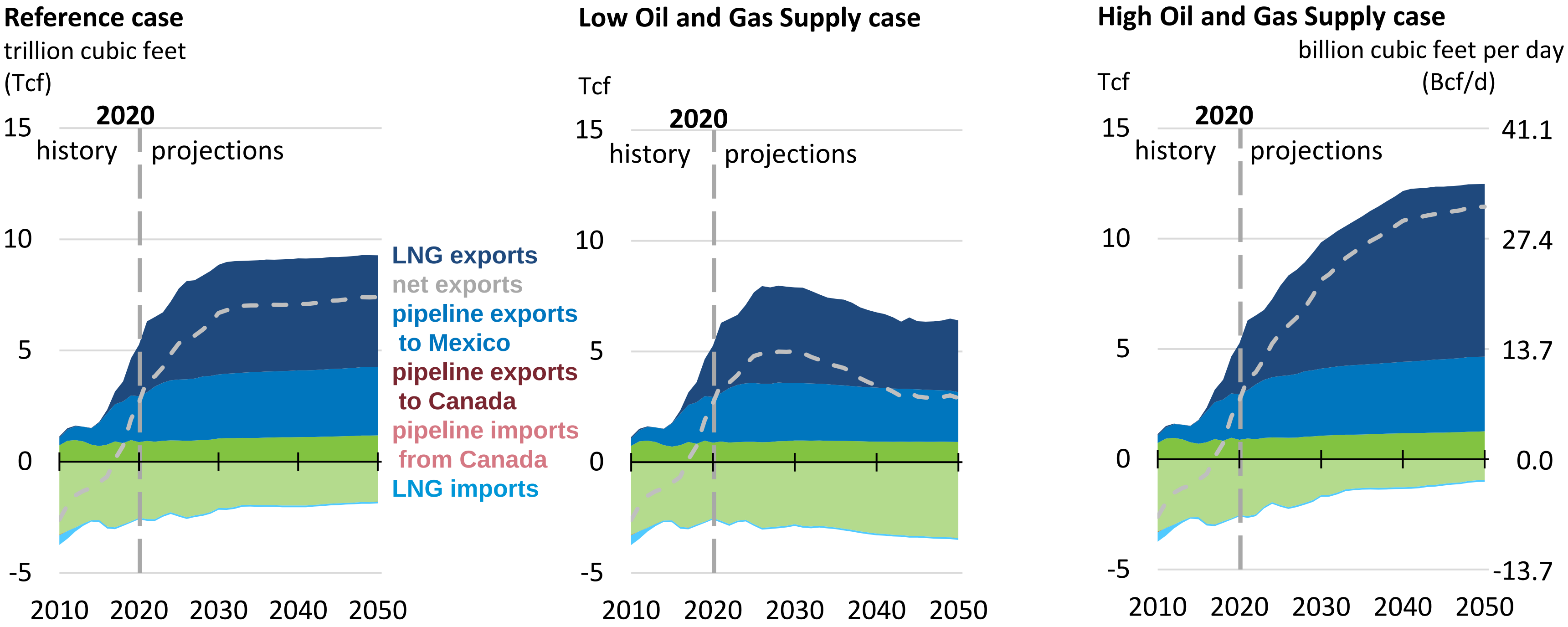
AEO2021 Reference case

relative to 2020 in trillion cubic feet



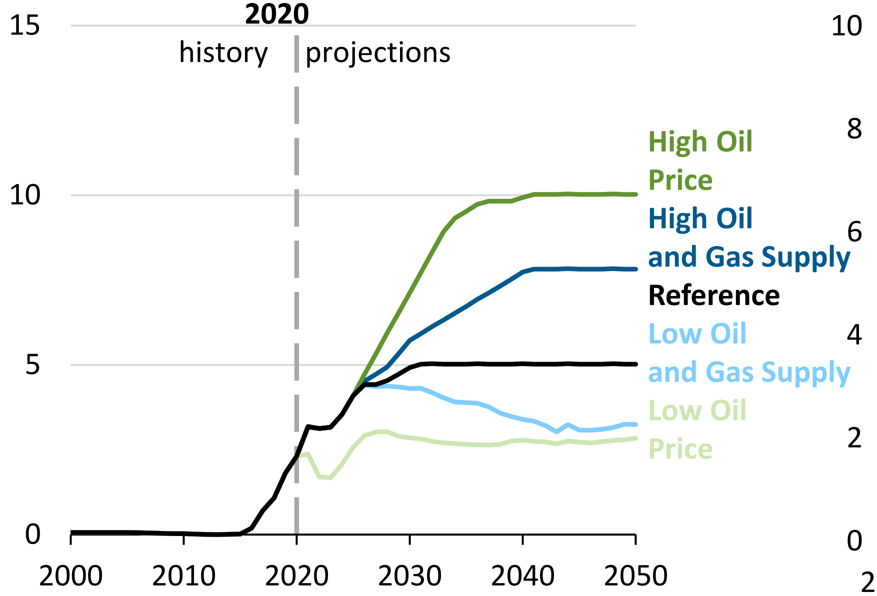
U.S. natural gas and liquefied natural gas (LNG) trade

U.S. natural gas and LNG trade, AEO2021 oil and gas supply cases

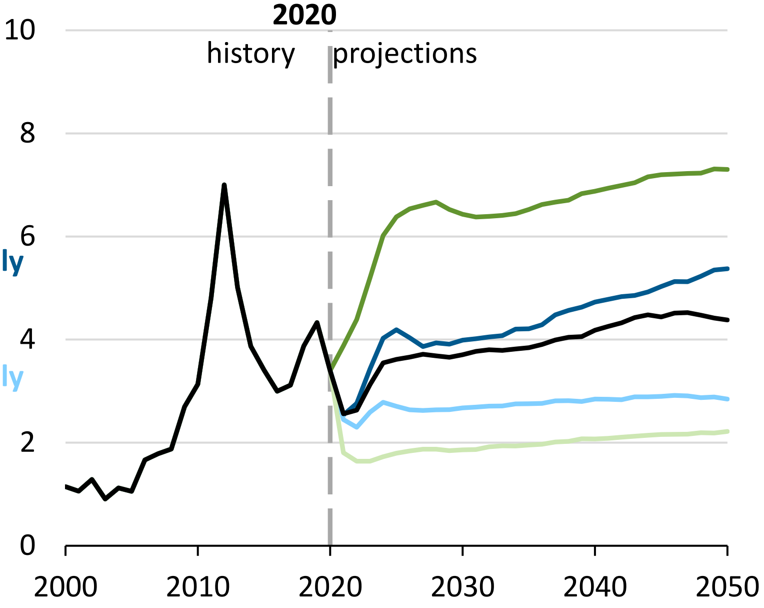


U.S. liquefied natural gas (LNG) exports and oil and natural gas prices

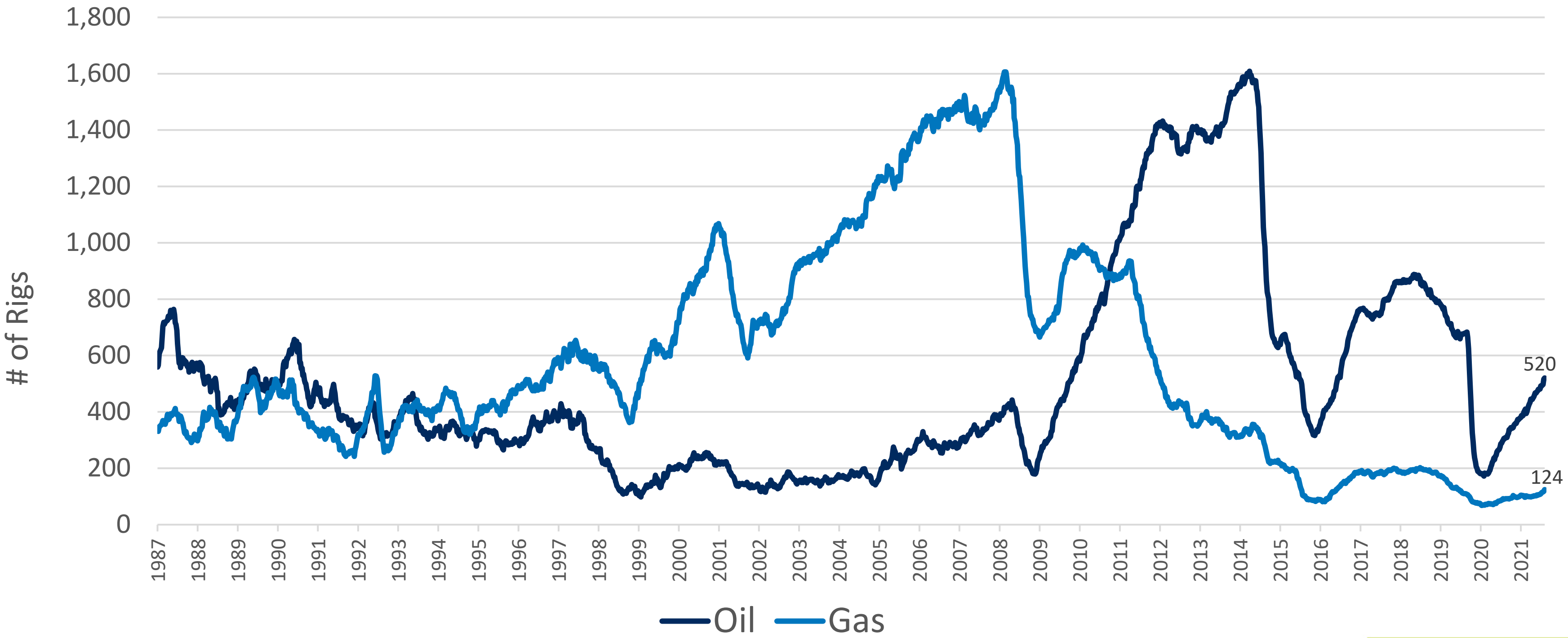
U.S. liquefied natural gas exports AEO2021 supply and price cases
trillion cubic feet



Ratio of Brent crude oil price to natural gas price at Henry Hub, AEO2021 supply and price cases
energy-equivalent terms



Rig Count



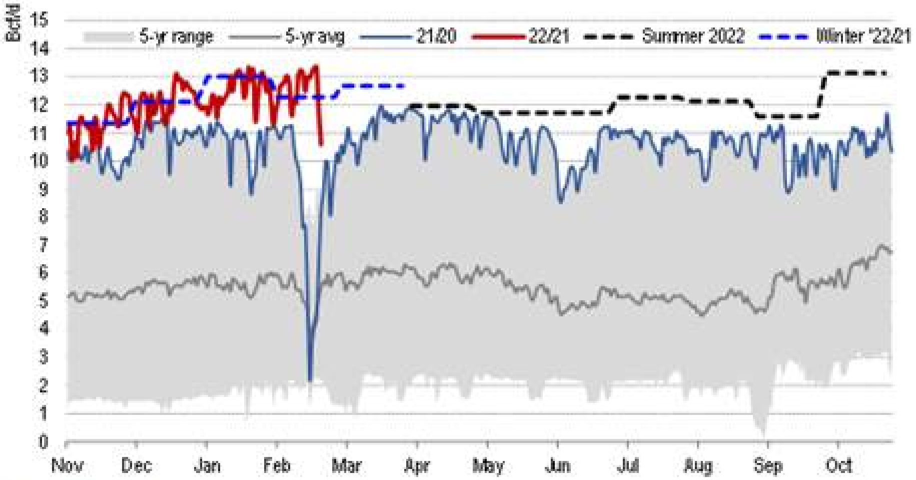
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
# of Rigs
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
520
124
Oil
Gas

Production

Seasonal US Production with Forecast

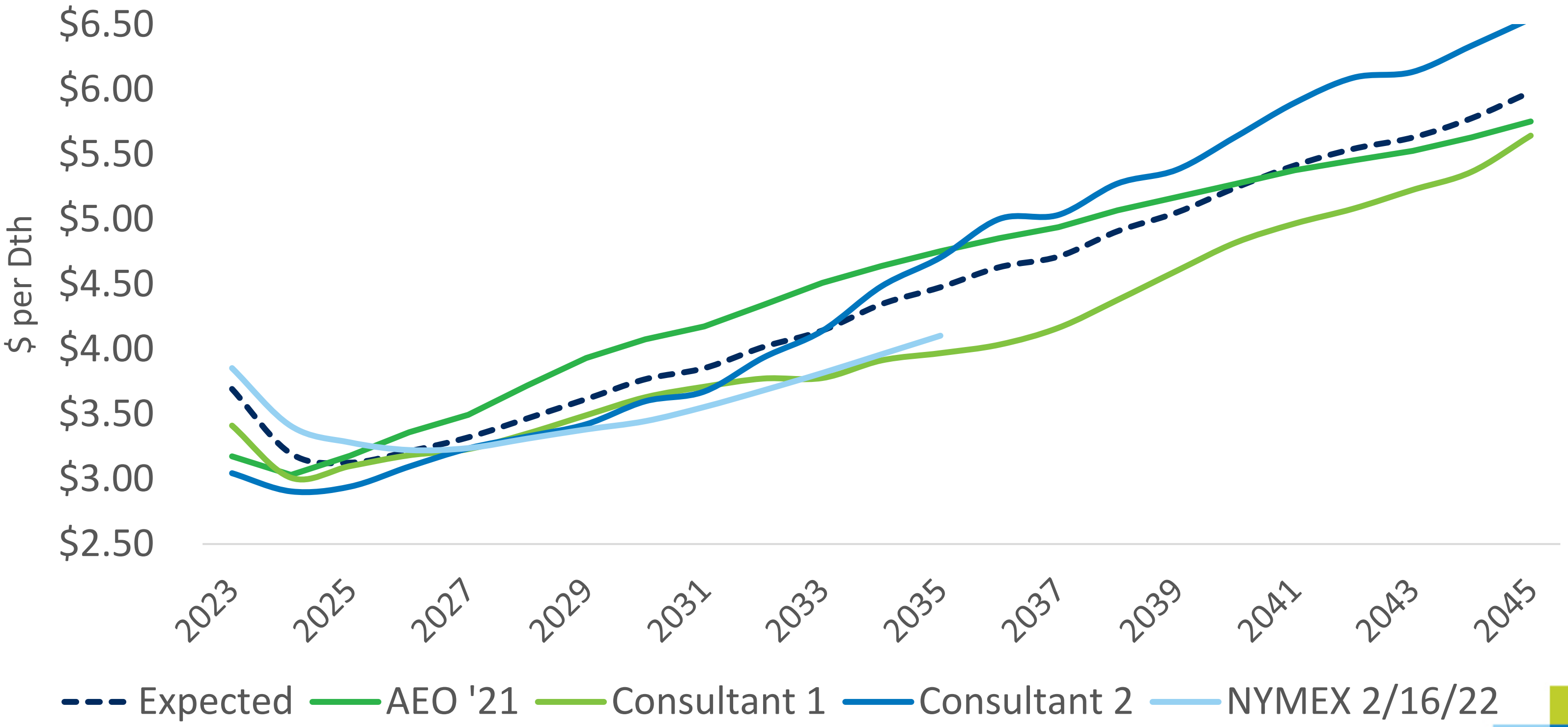
Source: S&P Global, NBC

Seasonal US LNG Export with Forecast

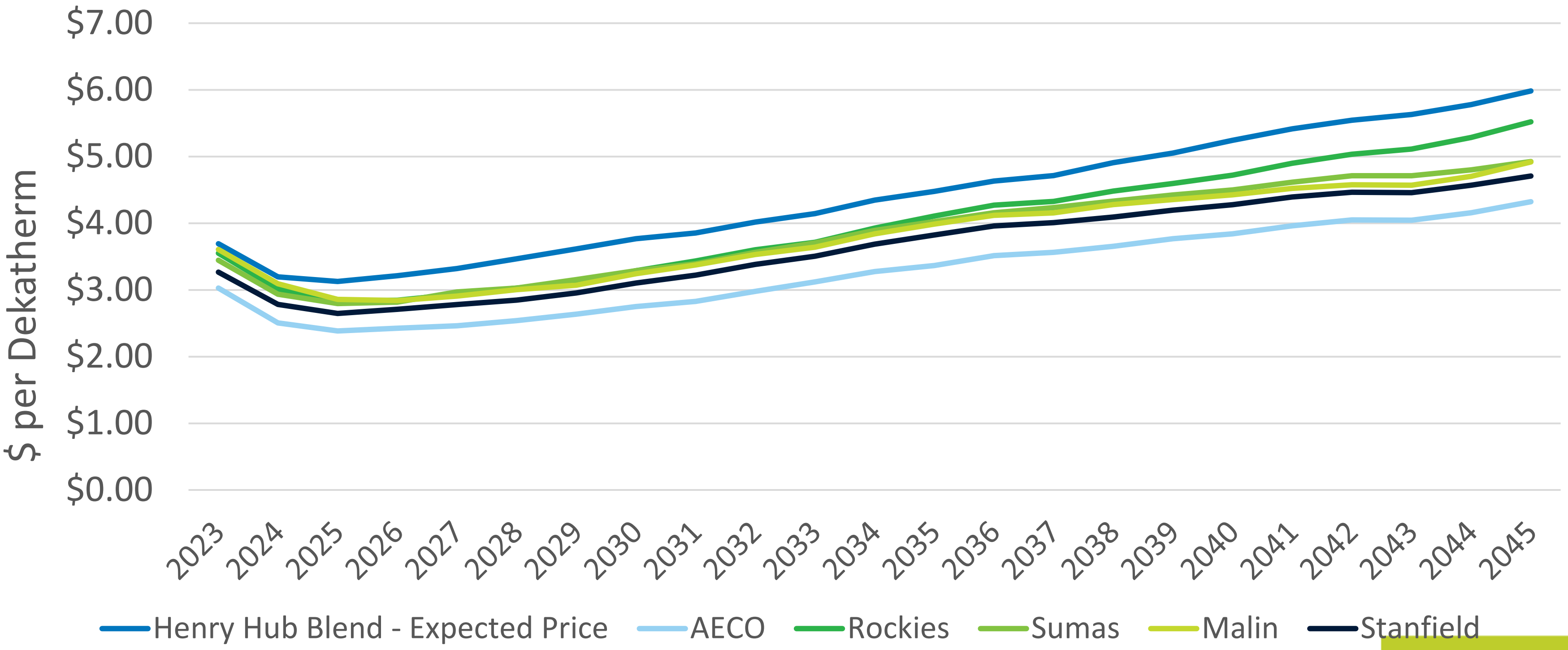


Source: S&P Global, NBC

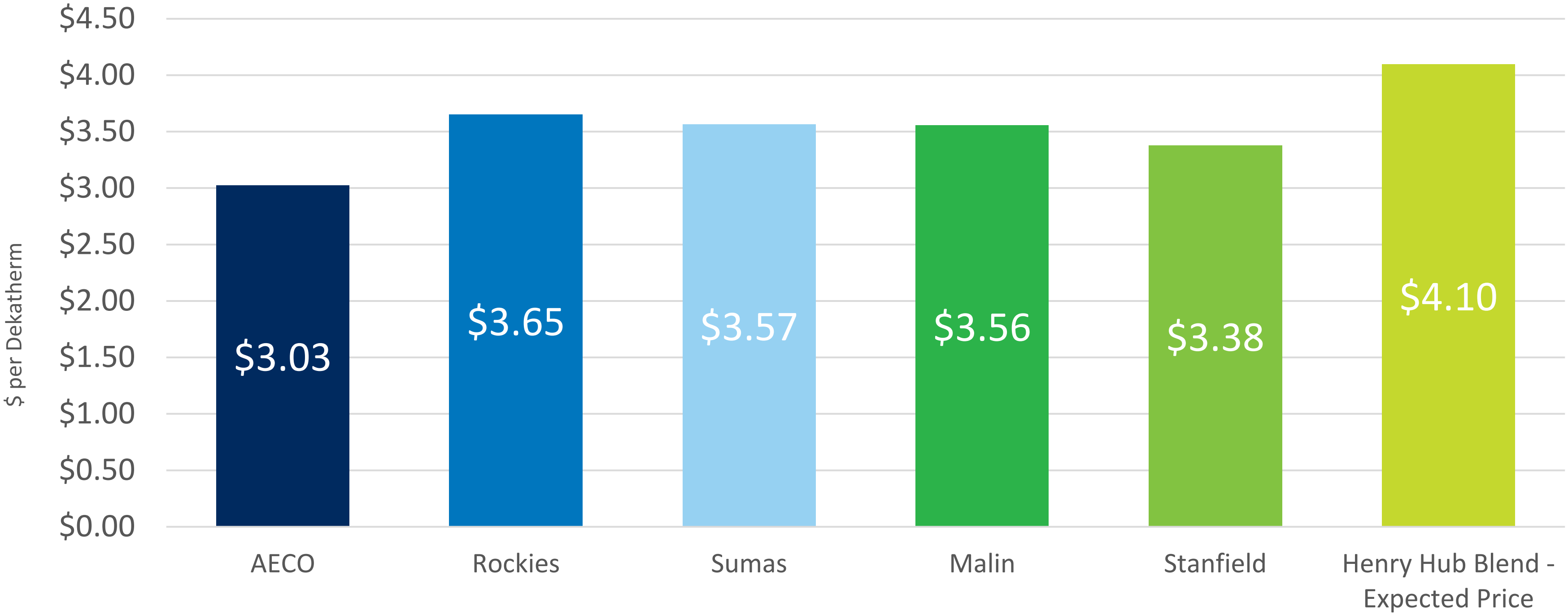
Expected Prices



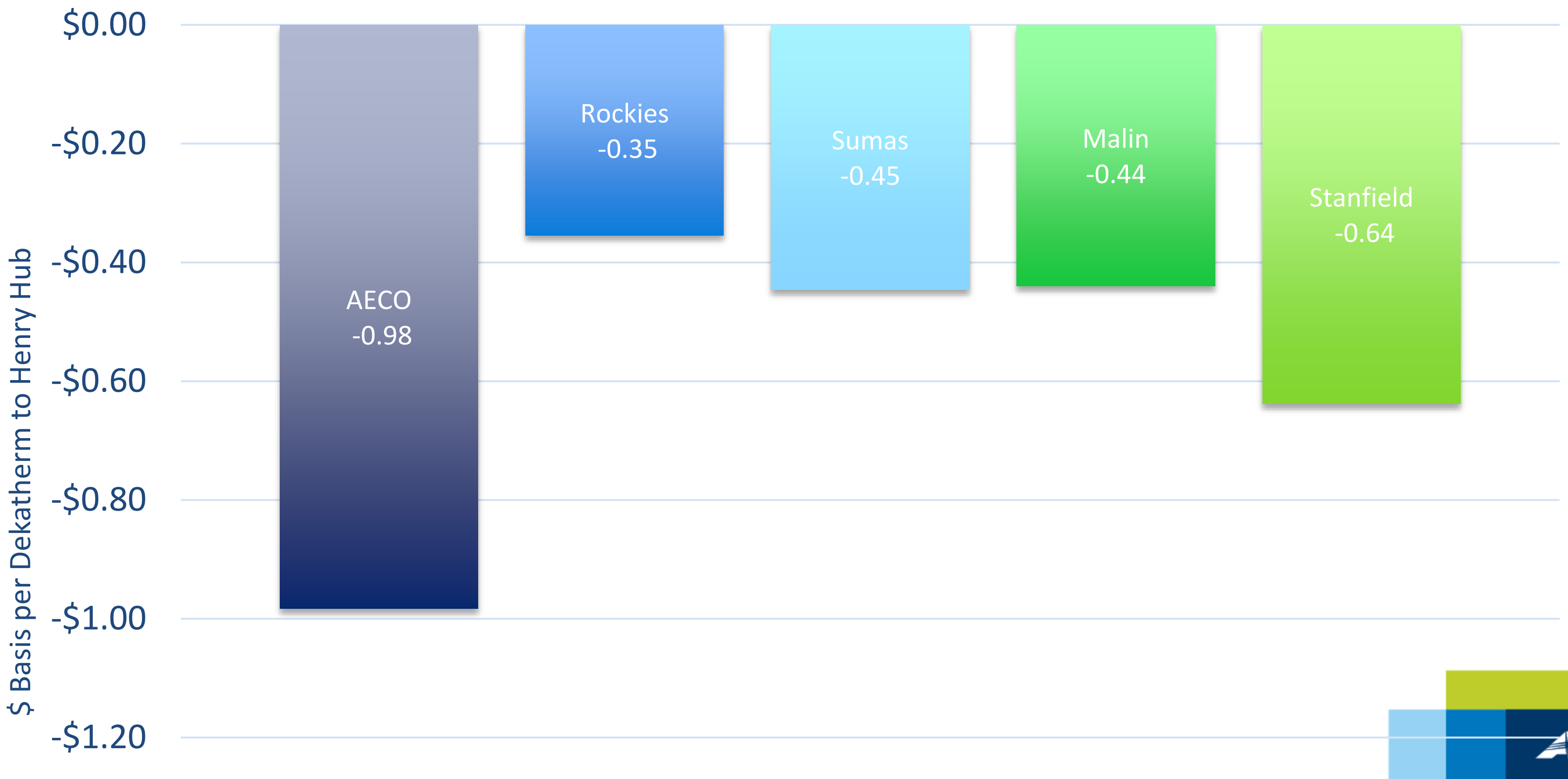
Expected Prices - Levelized



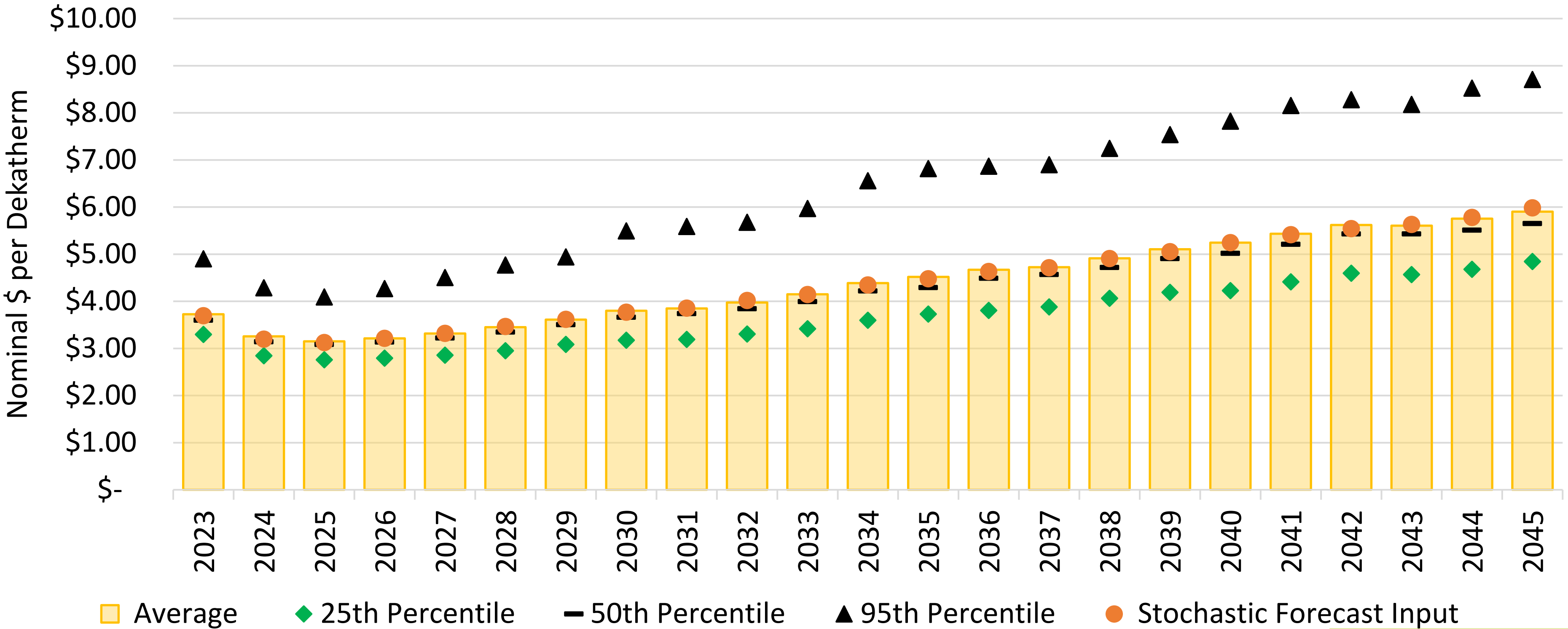
Levelized Costs
(2023 – 2045)



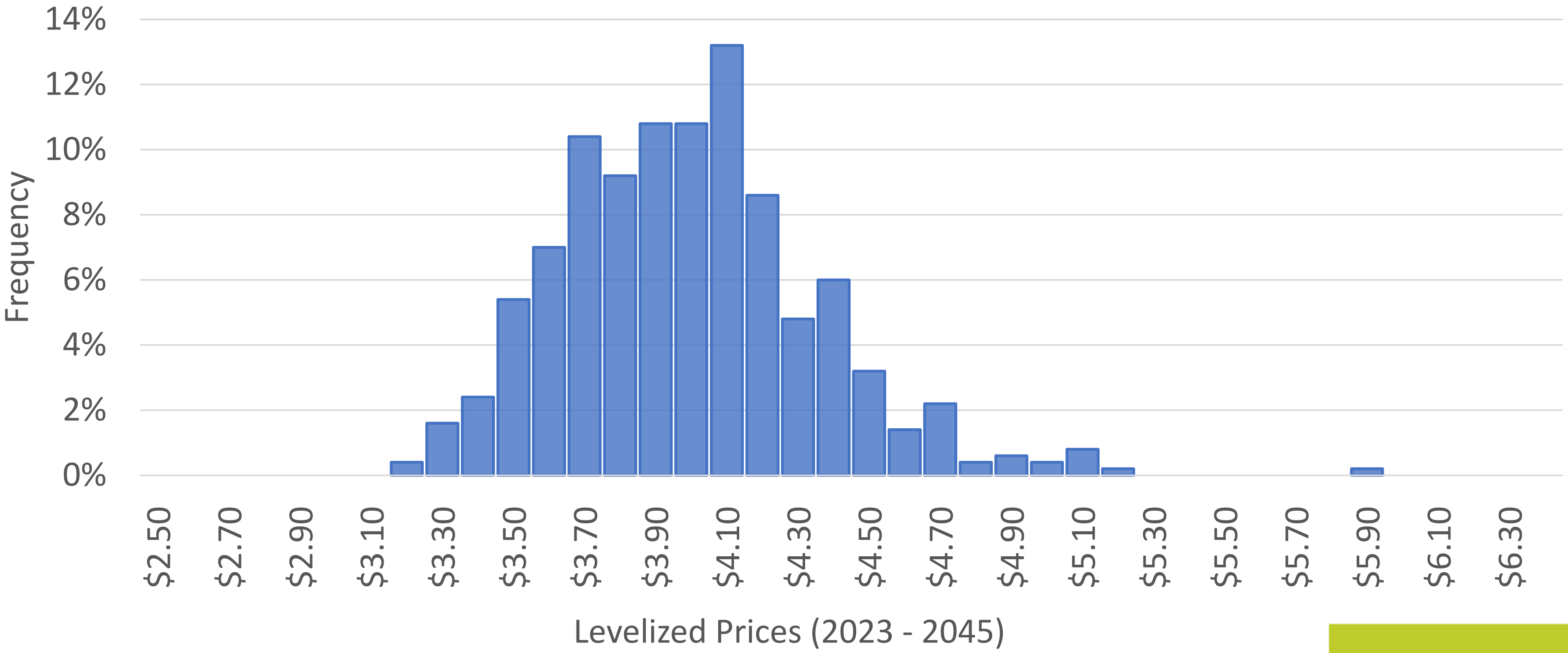
Basis to Henry Hub - Levelized



Henry Hub Stochastic Results (500 Draws)



Henry Hub Stochastic Results (500 Draws)



Electric Wholesale Market Price Forecast

Lori Hermanson, Senior Resource Analyst
Electric IRP, Third Technical Advisory Committee Meeting
March 9, 2022

Overview

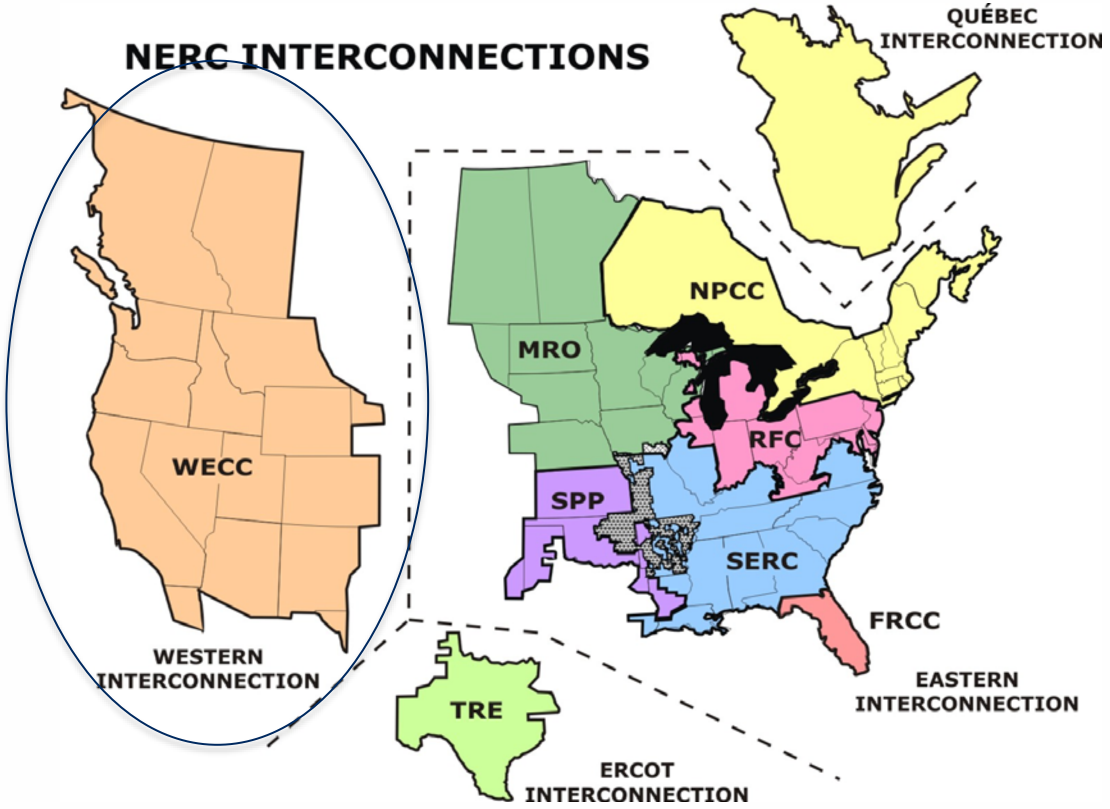
- Draft market price forecast based on preliminary analysis
  - To be used for RFP response comparison

- IRP will use this market price forecast with updated natural gas price and other assumptions (late summer)

- Stochastics pricing results will be discussed at a future TAC meeting

Market Price Forecast – Purpose

- Estimate “market value” of resources options for the IRP
- Estimate dispatch of “dispatchable” resources
- Informs avoided costs
- May change resource selection if resource production is counter to needs of the wholesale market

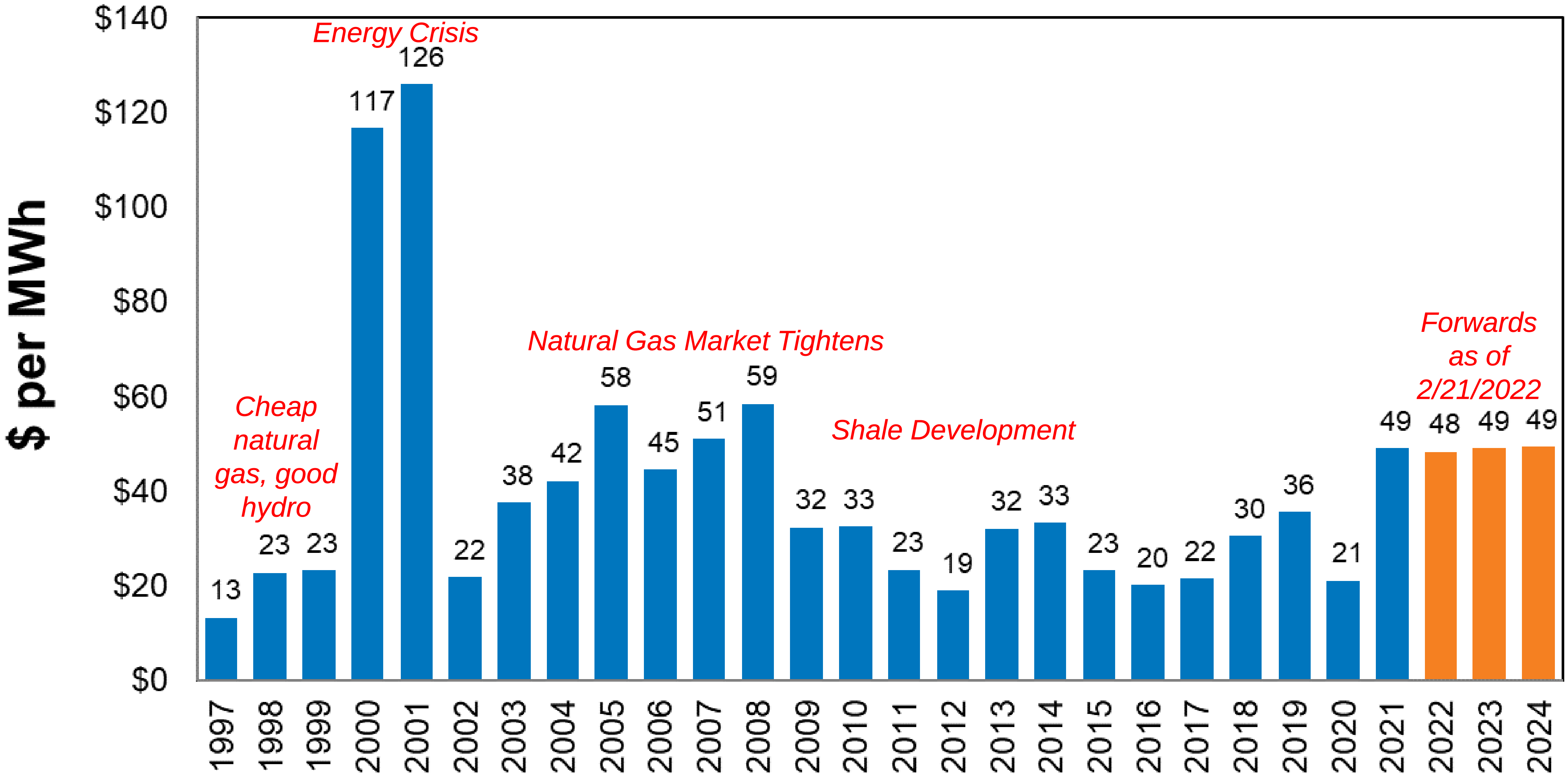


Source: NERC

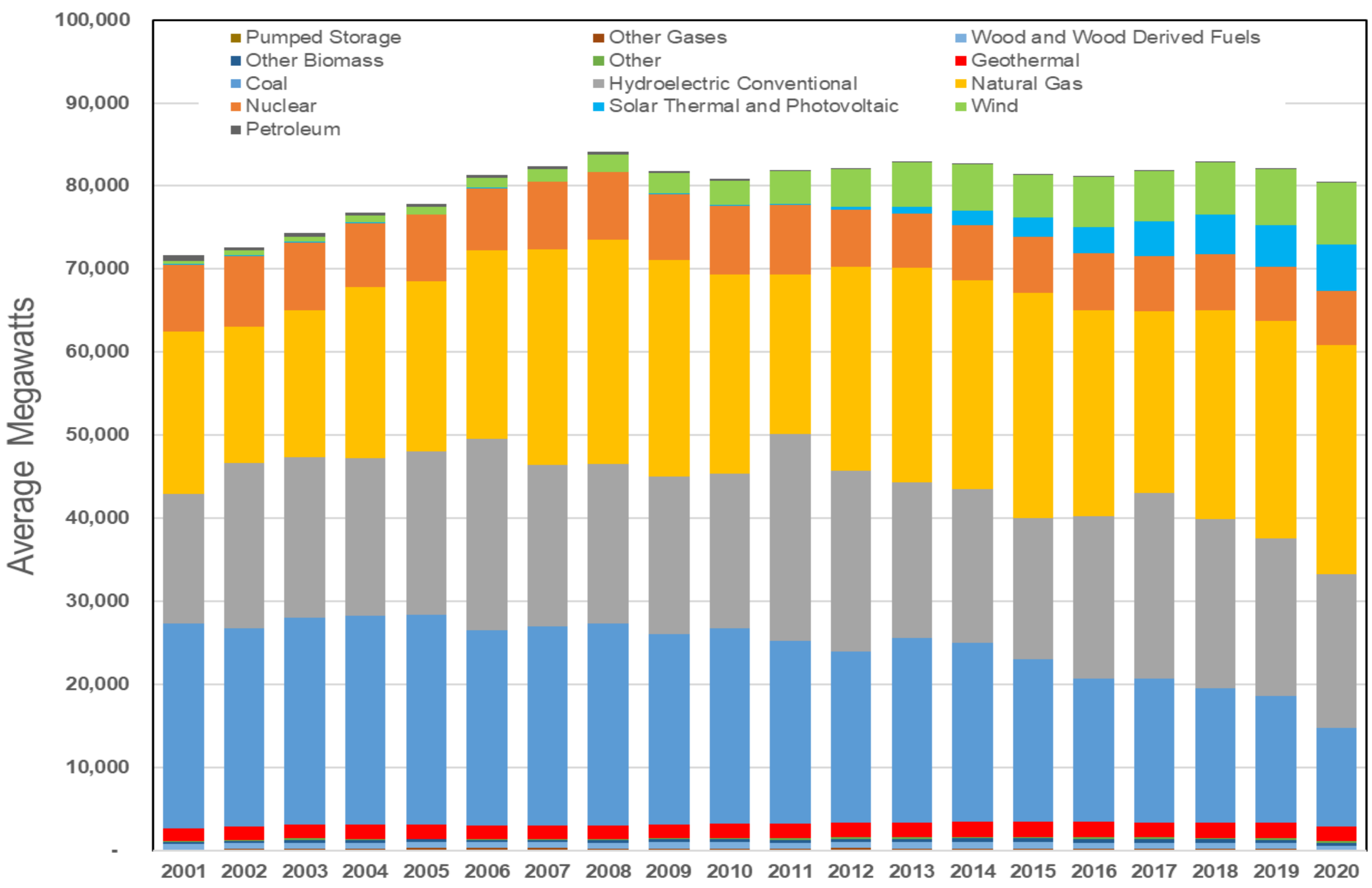
Methodology

- 3rd party software - Aurora by Energy Exemplar
- Electric market fundamentals - production cost model
- Simulates generation dispatch to meet regional load
- Outputs:
  - Market prices (electric & emission)
  - Regional energy mix
  - Transmission usage
  - Greenhouse gas emissions
  - Power plant margins, generation levels, fuel costs
  - Avista’s variable power supply costs

Wholesale Mid-C Electric Market Price History



U.S. Western Interconnect Historical Generation Mix



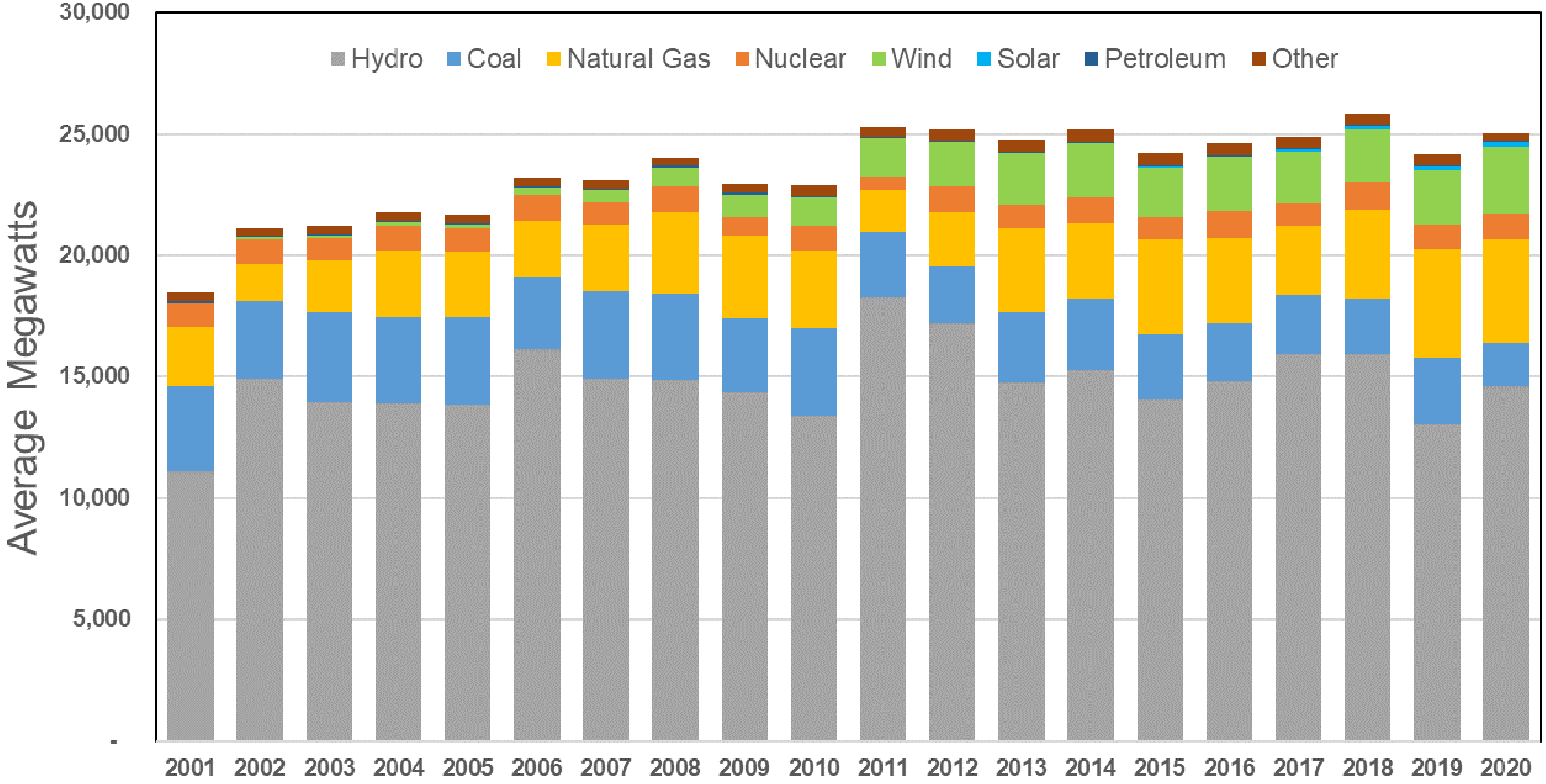
Source: EIA

Significant changes (aGW)

Solar: + 5.6
Wind: + 7.0
Nat Gas: + 7.9
Coal: - 12.8
Total: + 9.5

Hydro: -4.1 / +5.3

Northwest Generation Mix (ID, MT, OR and WA)



Source: EIA

Significant changes (aGW)

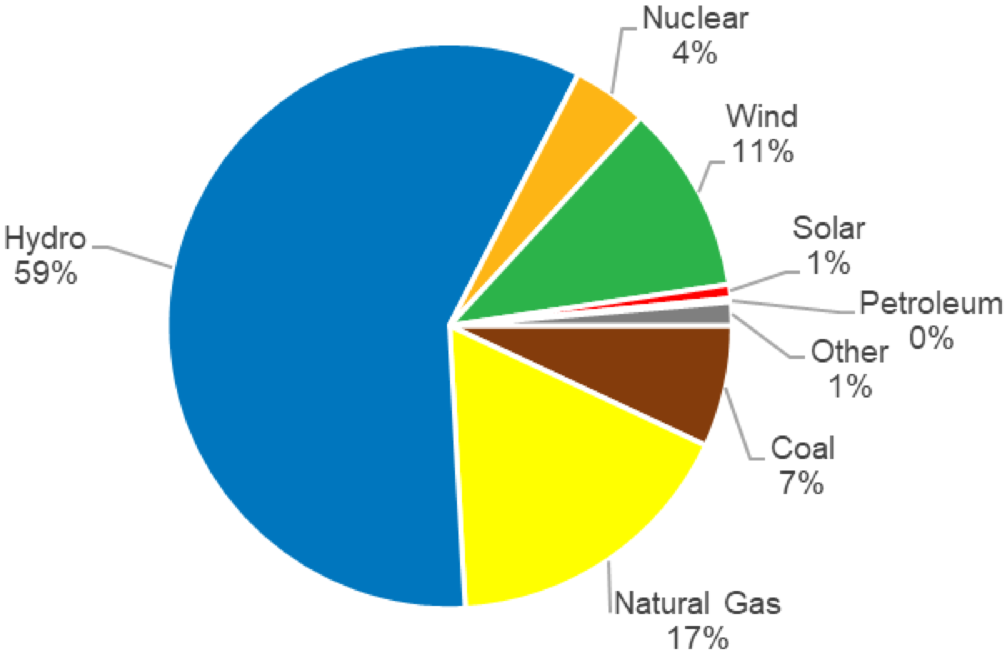
Solar: + 0.2
Wind: + 2.7
Nat Gas: + 1.8
Coal: - 1.8
Total: + 6.6

Hydro: -3.5 / +3.7

2020 Fuel Mix

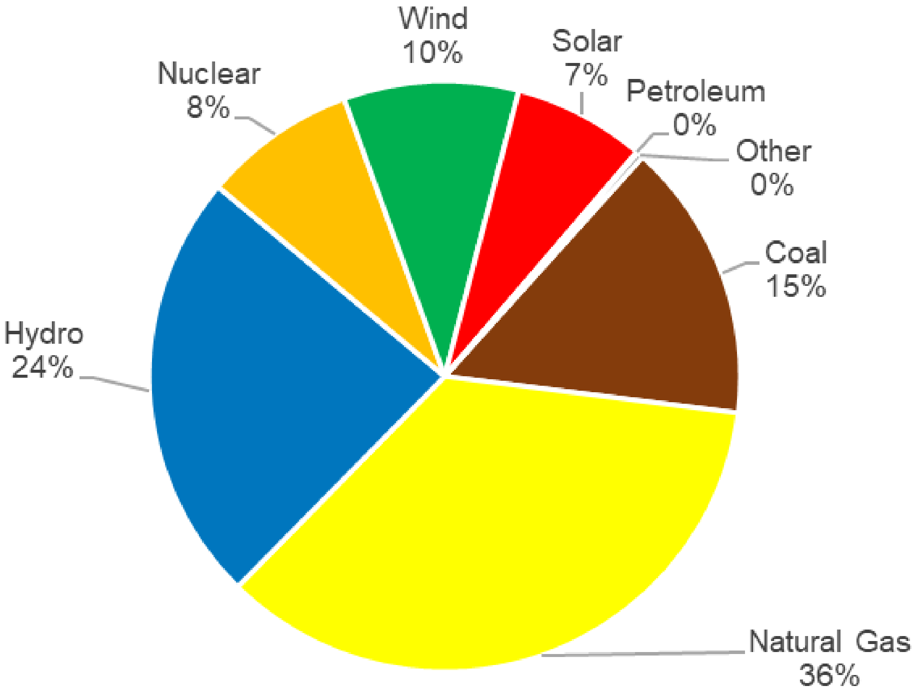
Northwest

75% GHG Emission Free



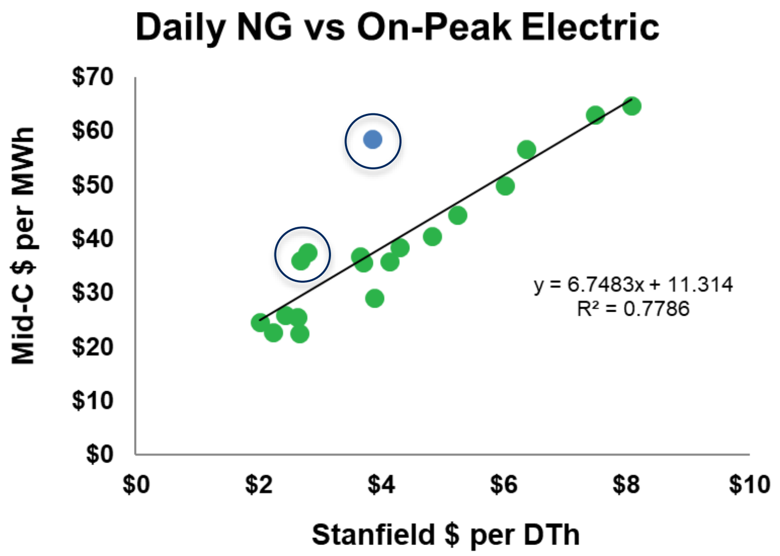
U.S. Western Interconnect

49% GHG Emission Free

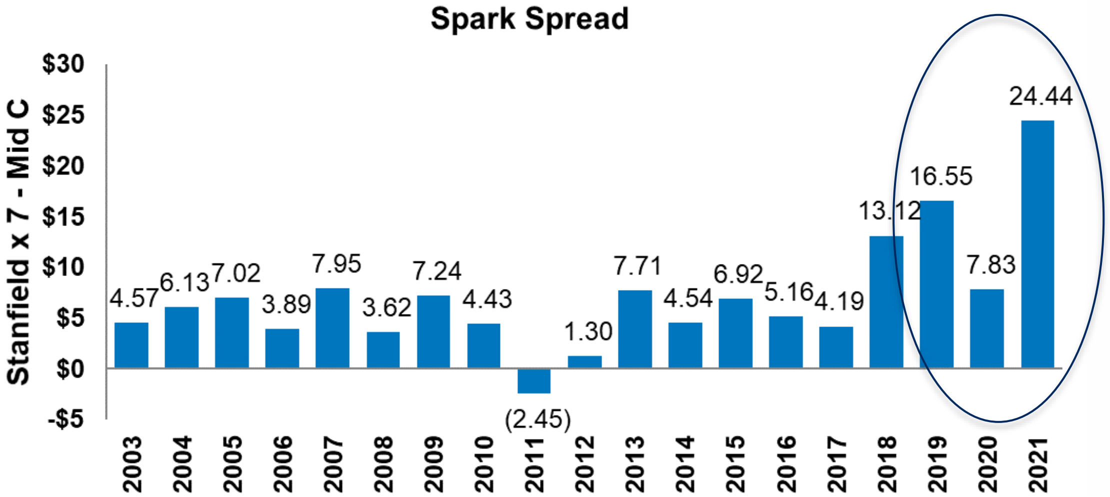


Source: EIA

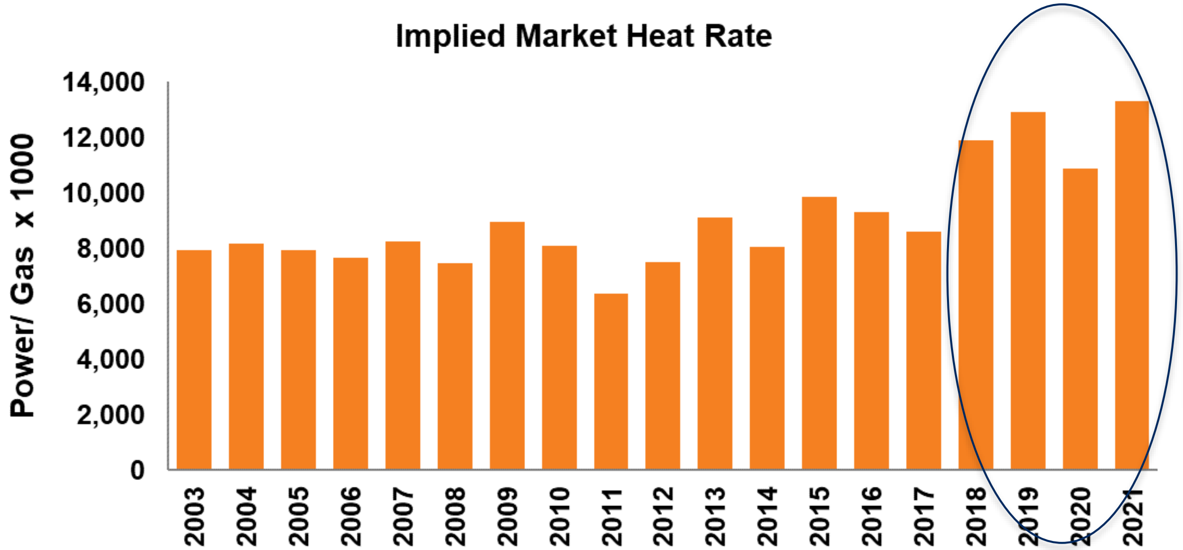
Market Indicators- Market is Tightening



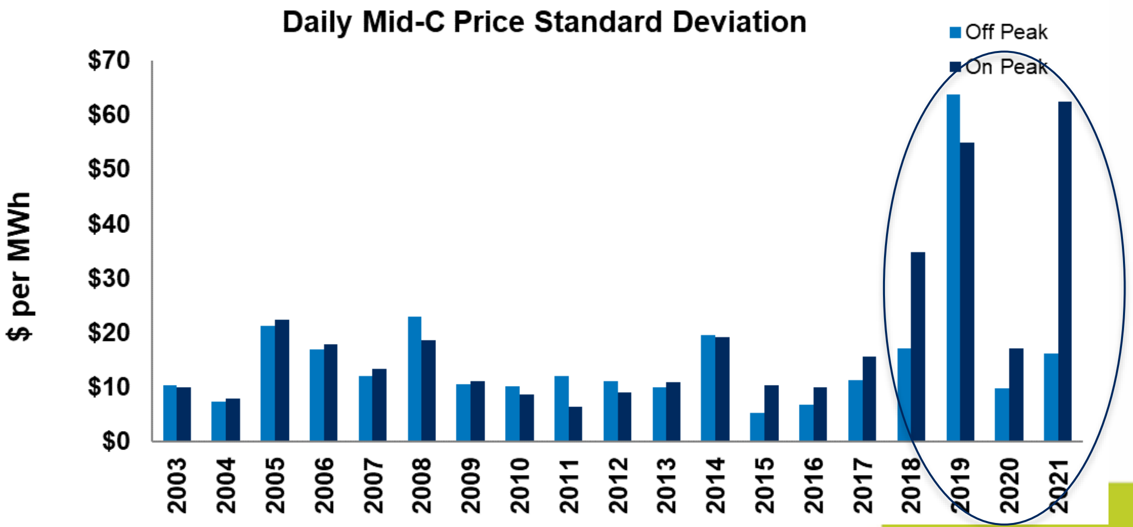
Daily NG vs On-Peak Electric



Spark Spread

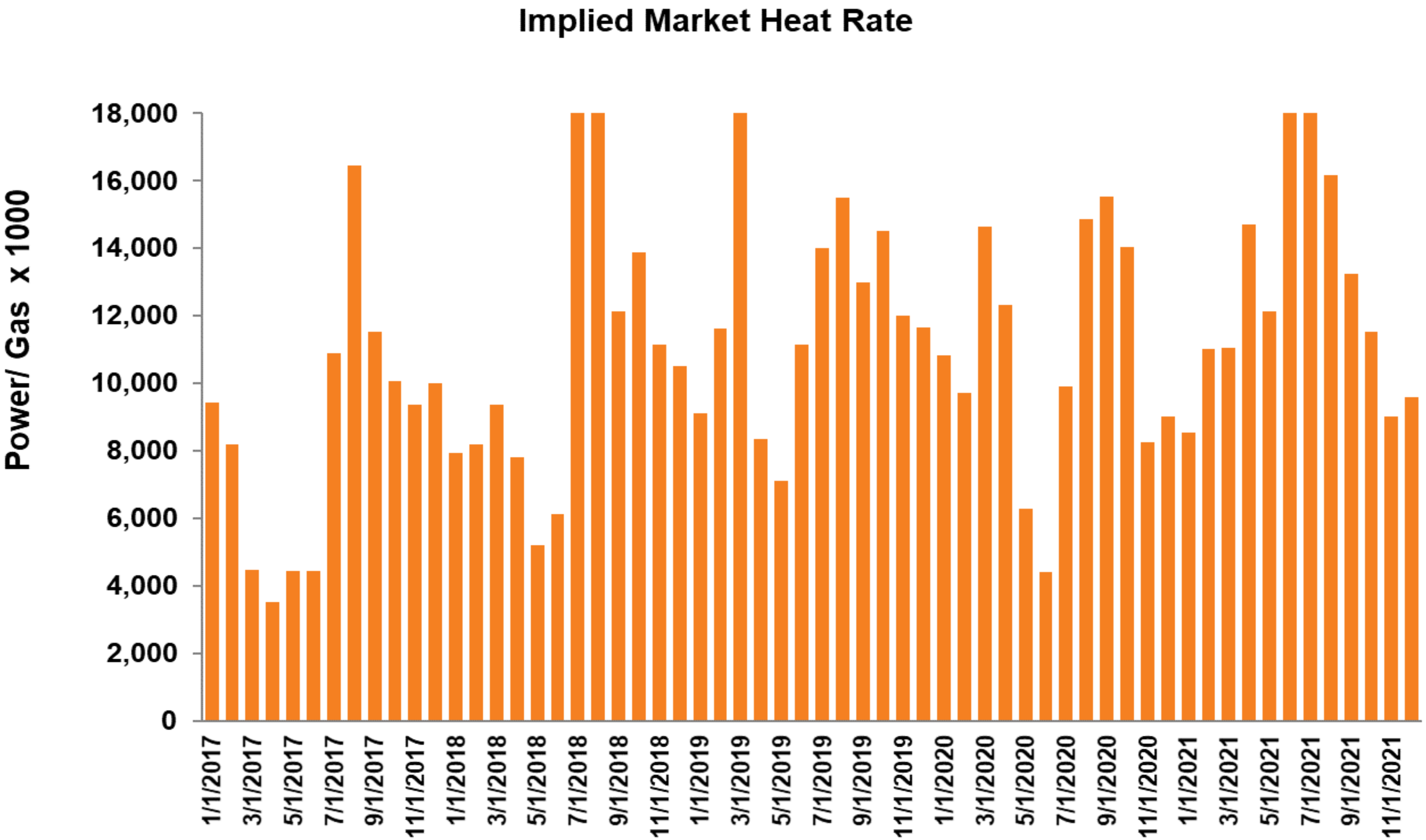


Implied Market Heat Rate

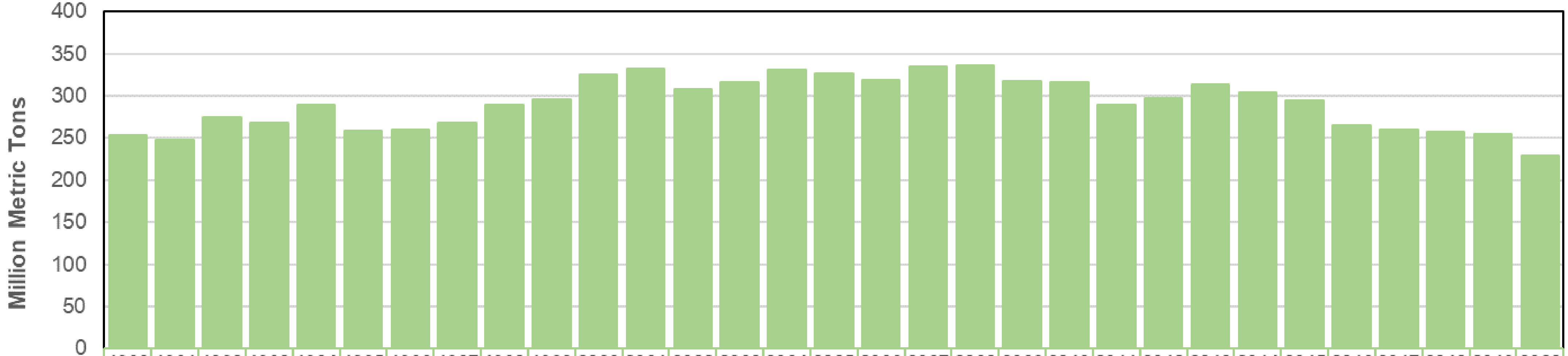


Daily Mid-C Price Standard Deviation

Monthly Implied Market Heat Rate (2017-2021)



Electric Greenhouse Gas Emissions
U.S. Western Interconnect



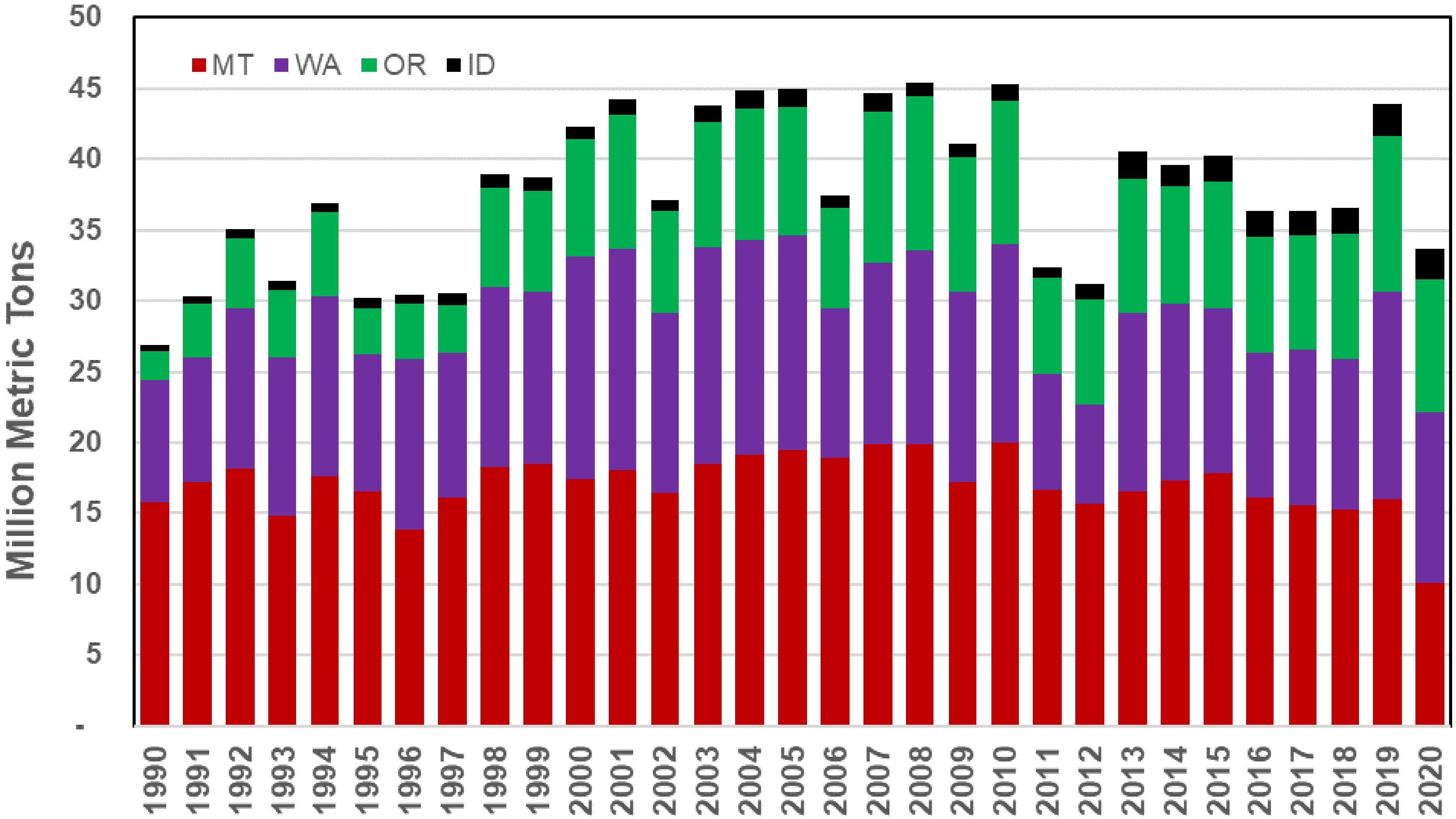
Change		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
-3.8	WY	36	35	38	36	39	36	37	36	40	38	40	40	39	39	40	39	39	40	40	38	39	38	40	43	41	40	37	37	37	33	32
+3.5	WA	9	9	11	11	13	10	12	10	13	12	16	16	13	15	15	15	10	13	14	14	14	8	7	13	12	12	10	11	11	15	12
-2.9	UT	29	28	30	31	32	30	30	31	32	33	33	33	34	35	36	36	37	39	39	37	36	34	32	36	35	34	28	28	29	28	26
7.3	OR	2	4	5	5	6	3	4	3	7	7	8	9	7	9	9	9	7	11	11	9	10	7	7	9	8	9	8	8	9	11	9
-11.3	NM	27	23	26	27	28	28	28	29	30	30	31	31	29	31	31	32	32	31	30	31	27	29	27	27	23	23	21	21	16	18	16
-3.2	NV	17	18	19	18	20	18	19	19	21	21	25	24	21	23	25	26	17	17	18	18	17	15	15	16	16	15	15	13	14	14	13
-5.7	MT	16	17	18	15	18	17	14	16	18	18	17	18	16	19	19	19	19	20	20	17	20	17	16	17	17	18	16	16	15	16	10
+1.7	ID	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	2	2	2	2	2
-2.4	CO	32	31	32	32	34	33	35	35	36	36	40	42	42	41	41	41	42	44	42	39	40	40	40	39	38	37	36	36	35	34	29
-9.2	CA	53	50	58	54	62	50	47	50	53	58	68	72	60	56	60	55	60	63	63	59	55	48	59	57	58	55	47	44	44	41	43
2.6	AZ	33	33	36	38	39	33	33	36	39	41	46	47	46	47	53	52	54	56	59	54	56	54	52	55	54	50	45	44	47	44	36

Source: EIA

Emissions are adjusted for generation within the Western Interconnect

2020 estimates are subject to adjustment

Northwest Greenhouse Gas Emissions



Source: EIA

Modeling Process

Vendor Database
(2020 North American)

Input Changes
80 yr hydro
NG prices
Regional Loads
Avista Resources/Loads
Operational Detail

Capacity Expansion
Add new resource forecast
(Capacity/RPS)
Include known retirements
Model adds resources to meet planning targets

Test Year Stochastic Study
Test Resource Adequacy

Re-Run Capacity Expansion
Increase/Decrease Planning Margin Targets

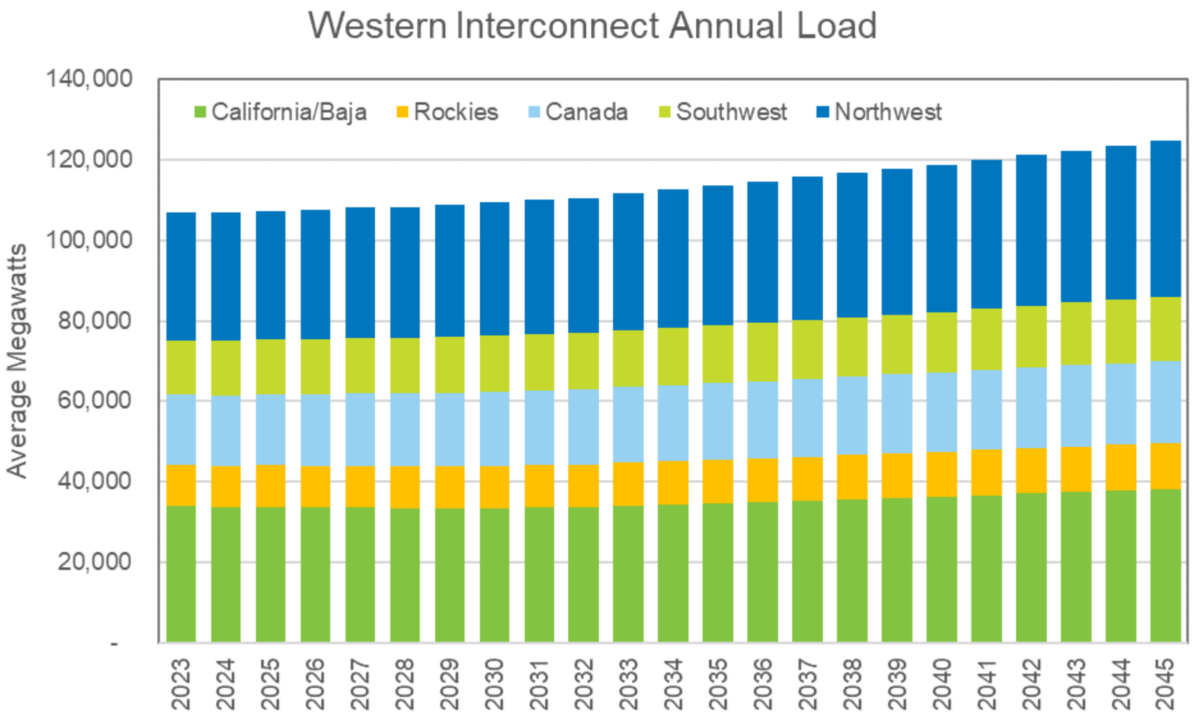
Run Full Forecast
Stochastic & Deterministic

Run Scenarios
Deterministic
Stochastic (if necessary)

Draft Forecast

Load Forecast

- Regional load forecast from IHS
  - Forecast includes energy efficiency
- Add net meter resource forecast
  - Input annually with hourly shape
- Add electric vehicle forecast
  - Input annual with hourly shape
- Future load shape differs from today’s load shape

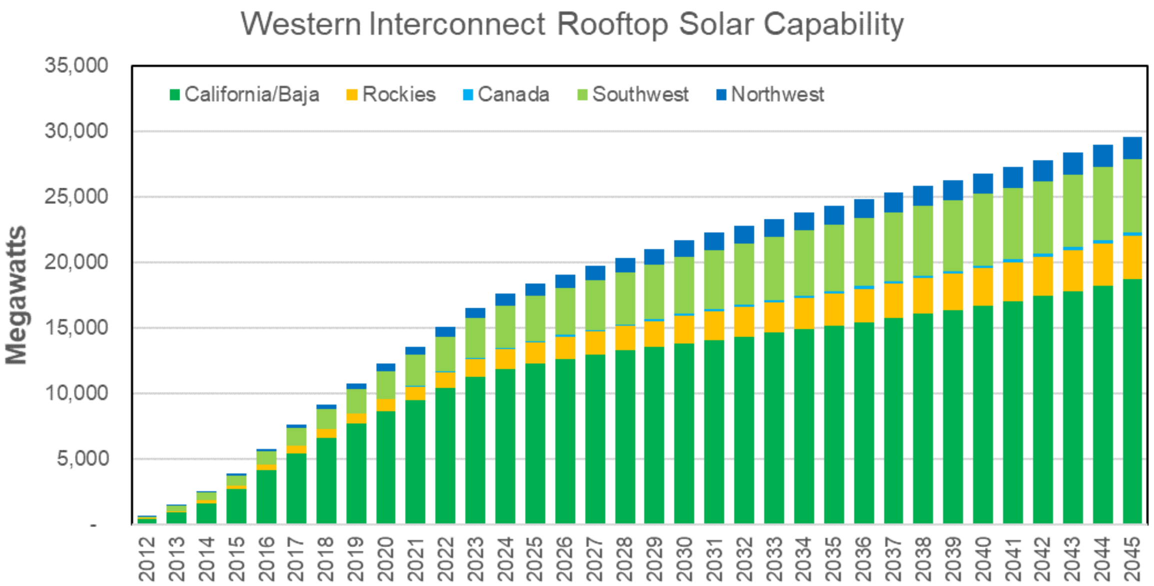


Draft Forecast

Electric Vehicle and Solar Adjustments

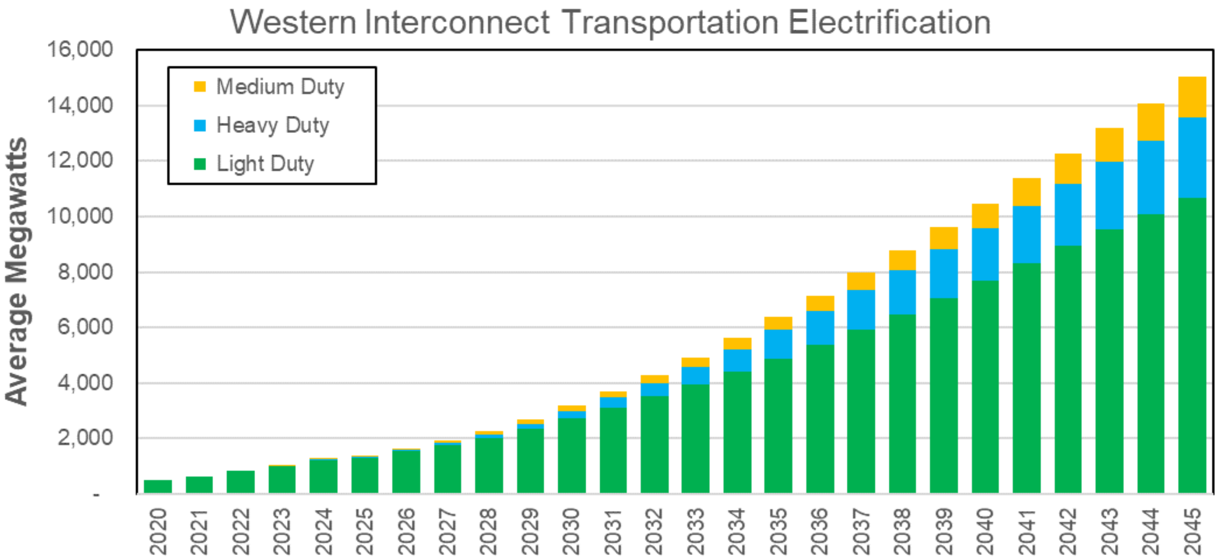
Roof Top Solar

- EIA existing estimates for history
- IHS regional growth rates



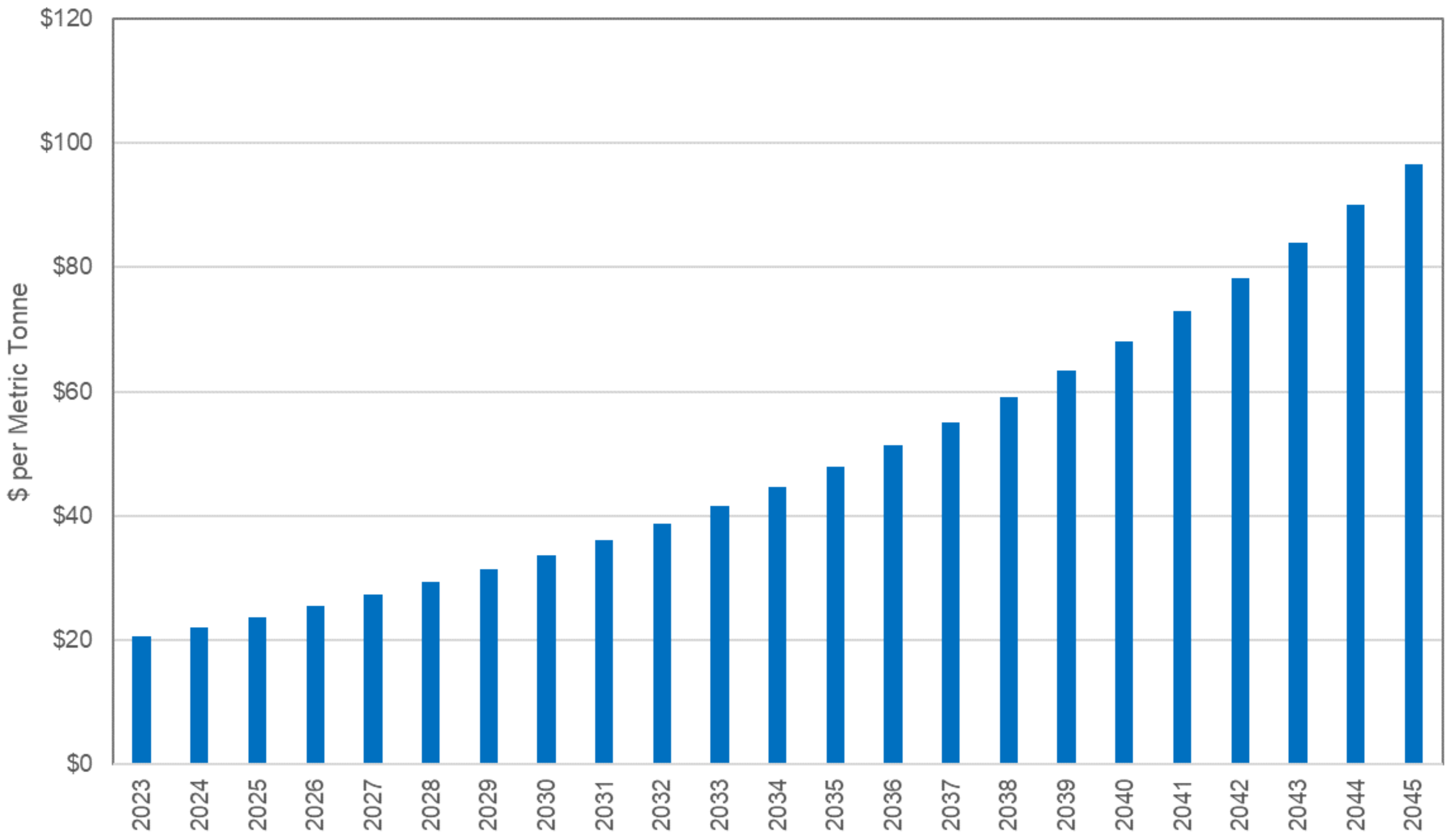
Electric Vehicles

- Penetration rates increase each year
- 15-65% light duty (2040)
- 12-15% medium duty (2040)
- 5% heavy duty (2040)



Draft Forecast

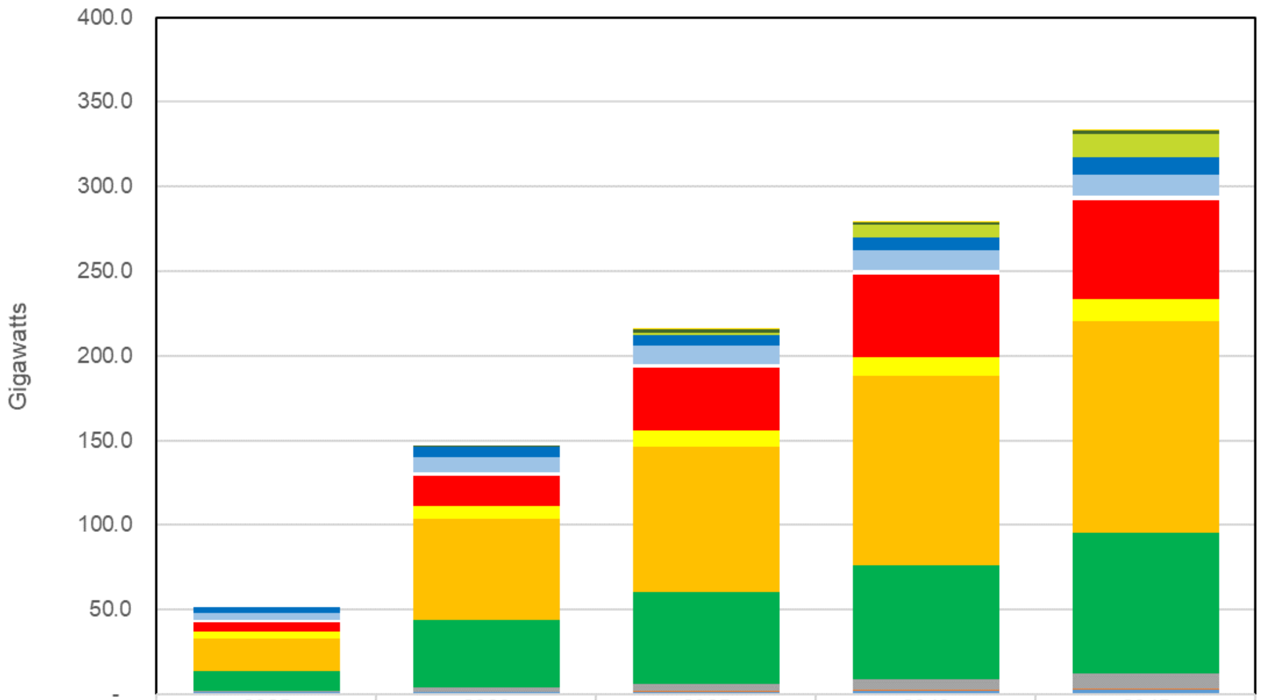
Northwest GHG Emission Prices



- $41.47 levelized
- Assumes California Emission Prices for the Northwest from the Revised 2019 IEPR Carbon Price Projections as placeholder for WA Climate Commitment Act and OR Climate Protection Program
- To address imports, exporting region includes a carbon price adder to transfer power

New Resource Forecast (Western Interconnect)

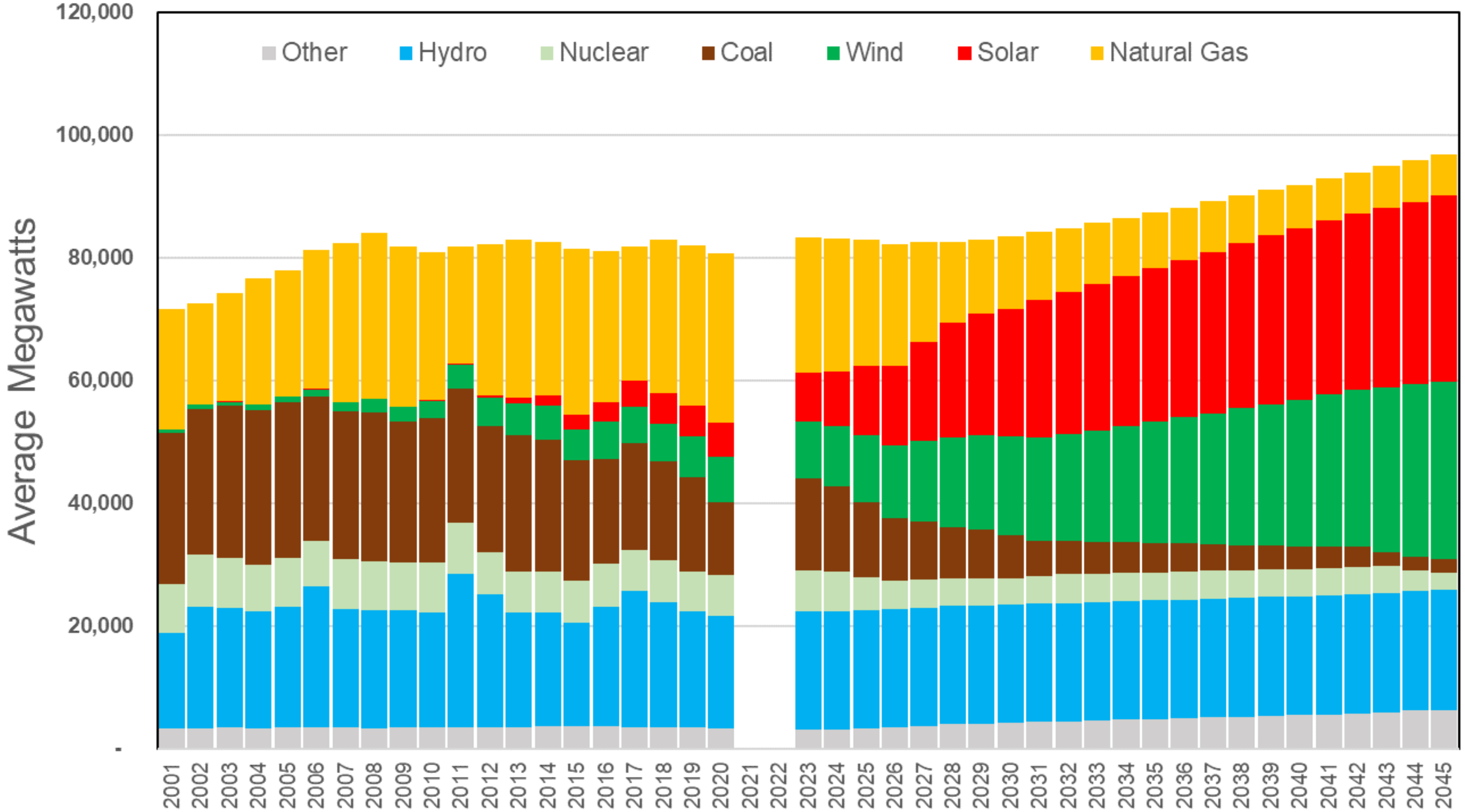
Draft Forecast



	2025	2030	2035	2040	2045
Nuclear	-	-	0.5	0.5	0.5
H2CT	-	0.5	1.4	1.7	2.4
OSWind	-	-	1.5	7.1	13.7
CCCT	3.8	6.2	6.2	7.9	10.0
SCCT	3.6	8.9	11.1	11.8	12.8
DR	1.5	2.1	2.3	2.5	2.8
Storage	5.2	18.3	37.0	48.7	58.1
Net-Meter	4.5	7.6	9.5	11.1	12.8
Solar	19.0	59.4	85.8	111.5	125.4
Wind	11.9	39.8	54.2	67.5	83.2
Geothermal	0.7	2.5	4.1	6.2	8.9
Biomass	0.1	0.3	0.5	0.7	0.8
Hydro	1.3	1.5	1.8	2.1	2.5

Draft Forecast

U.S. West Resource Type Forecast

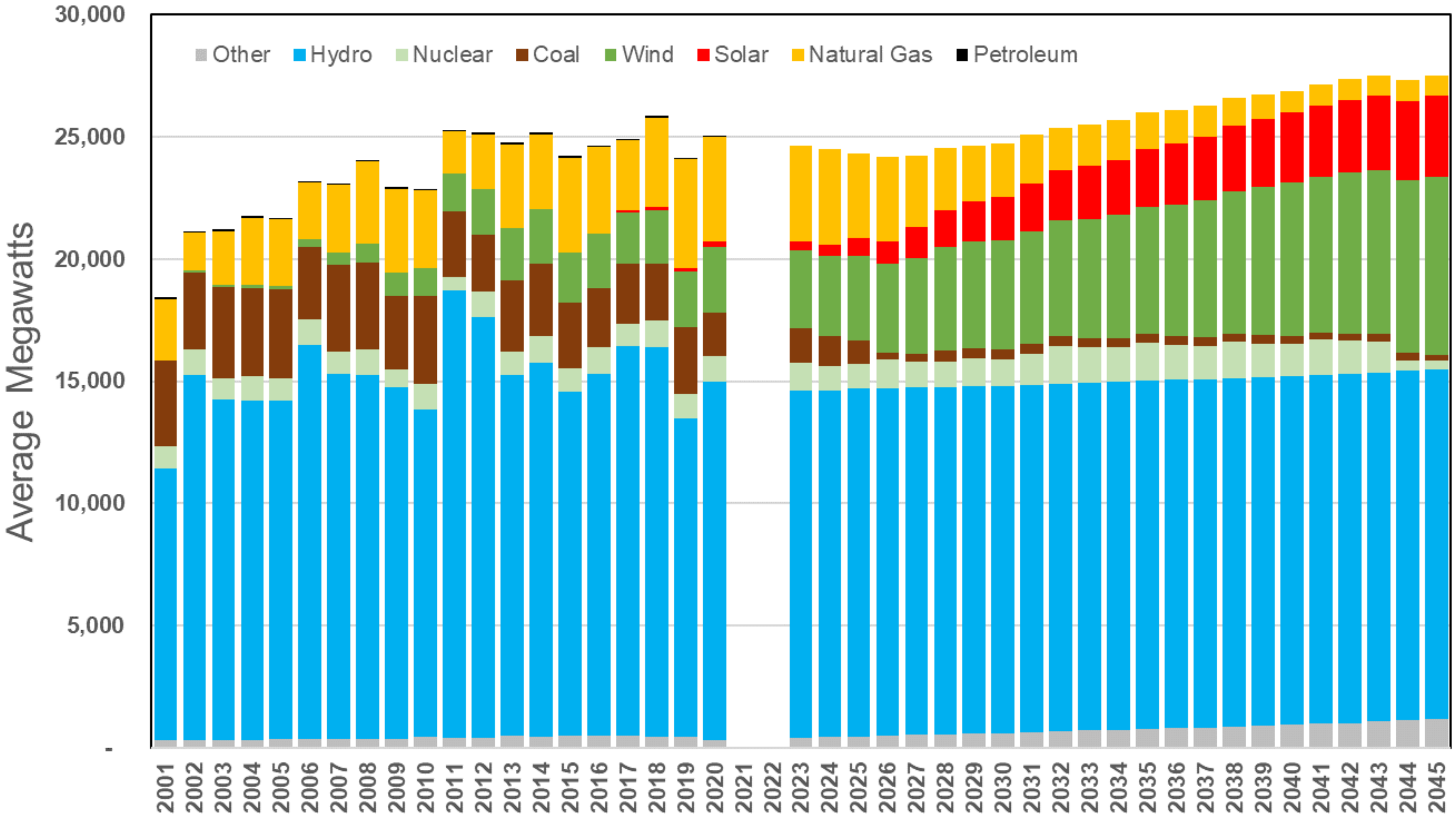


Significant changes 2045 to 2023 (aGW)

Solar:	+ 22.5
Wind:	+ 20.2
Nat Gas:	- 15.6
Coal:	- 13.4
Nuclear:	- 4.0
Other:	+ 3.3
Total:	+ 13.4

Draft Forecast

Northwest Resource Type Forecast

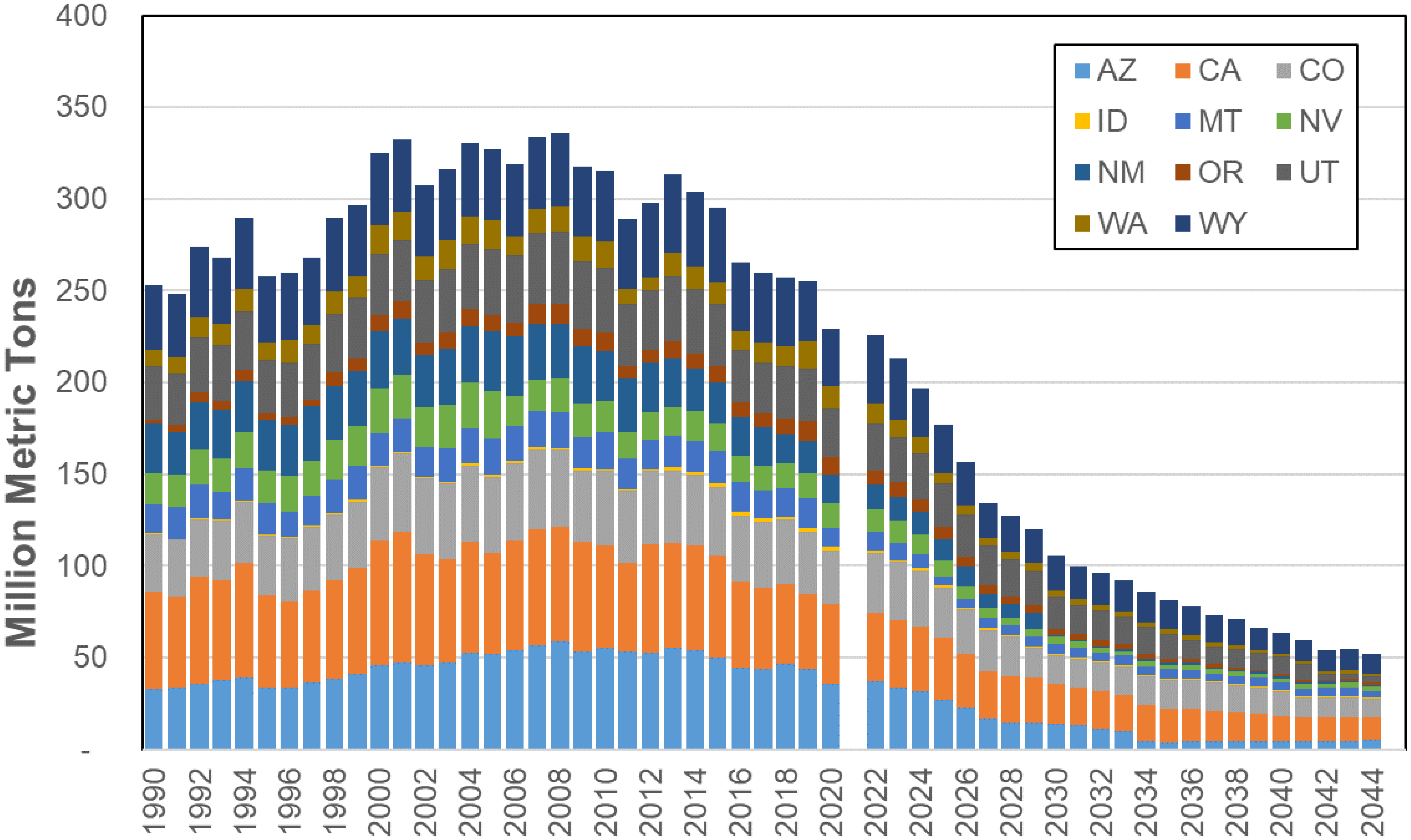


Significant changes (aGW)
2045 to 2023

Solar: + 2.9
Wind: + 4.0
Nat Gas: - 3.1
Coal: - 1.1
Other: + 0.8
Nuclear: - 0.8
Total: + 2.9

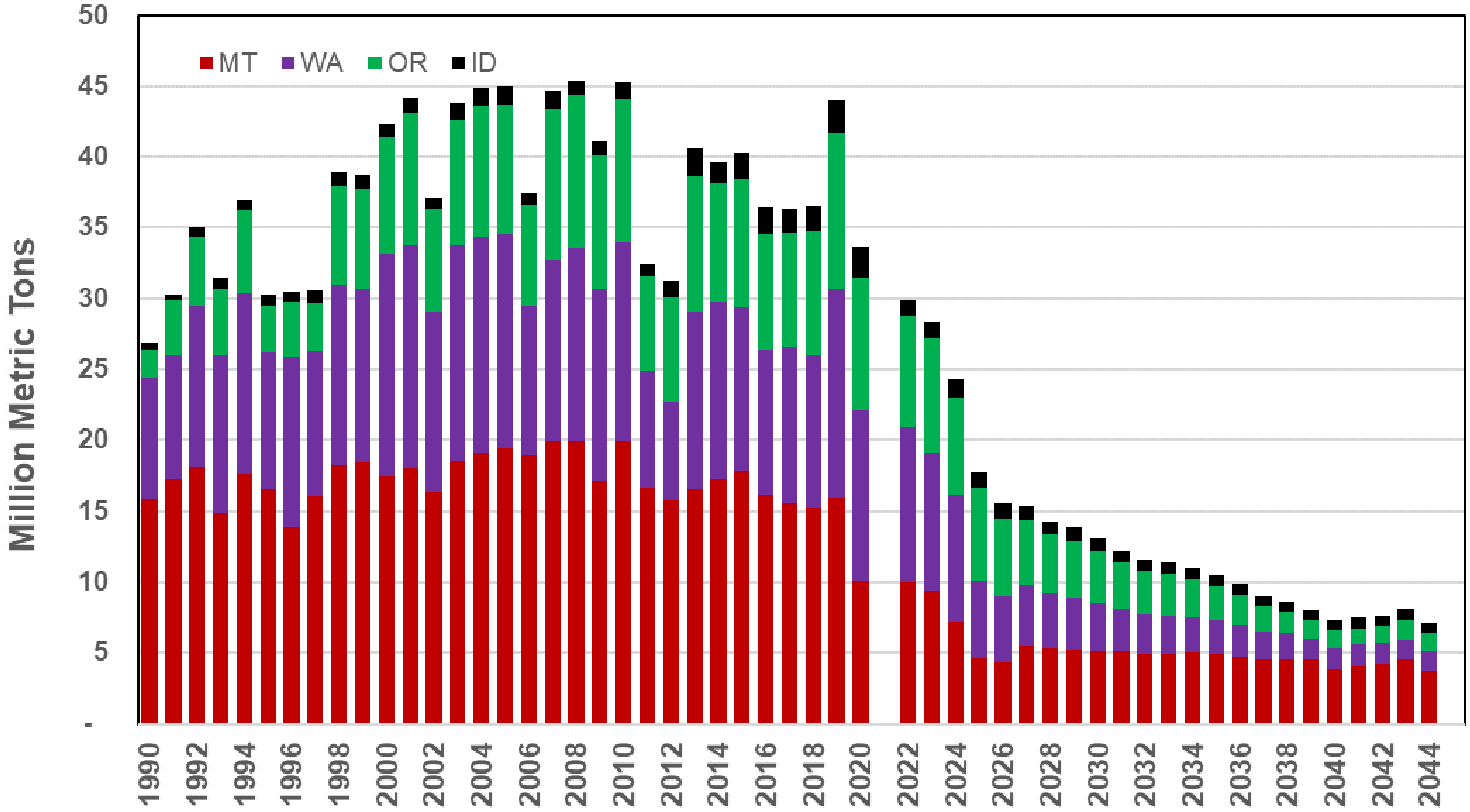
Greenhouse Gas Forecast
U.S. Western Interconnect

Draft Forecast



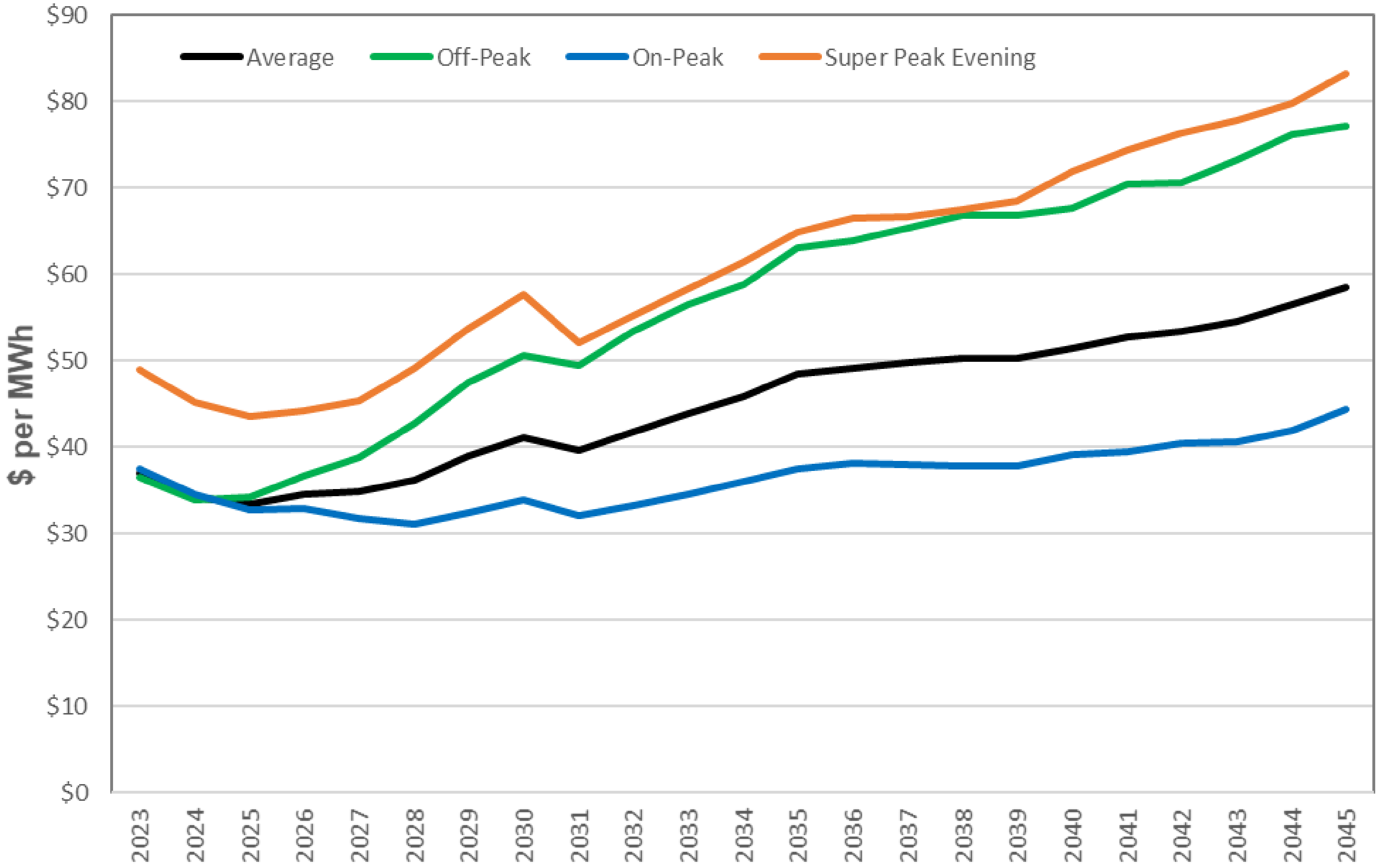
Greenhouse Gas Forecast
Northwest States

Draft Forecast



draft

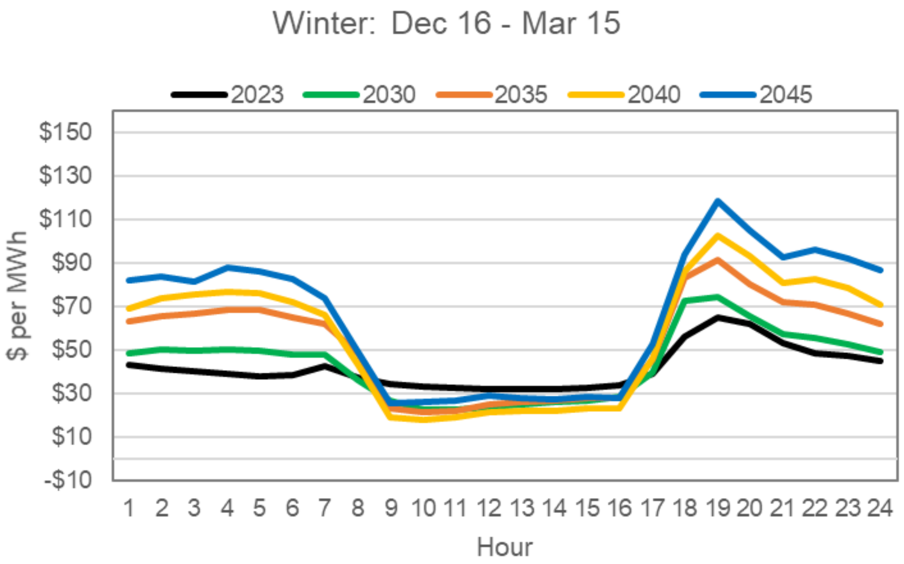
Mid-C Electric Price Forecast

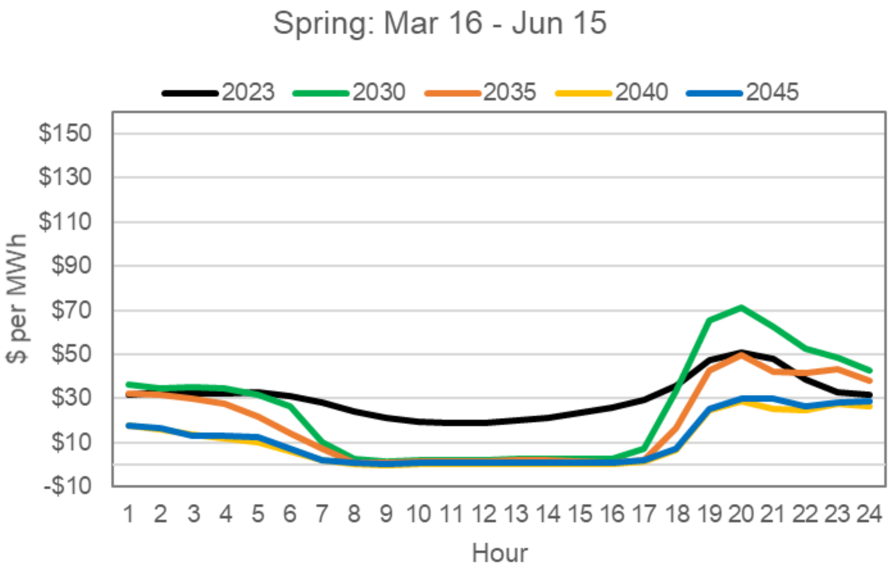


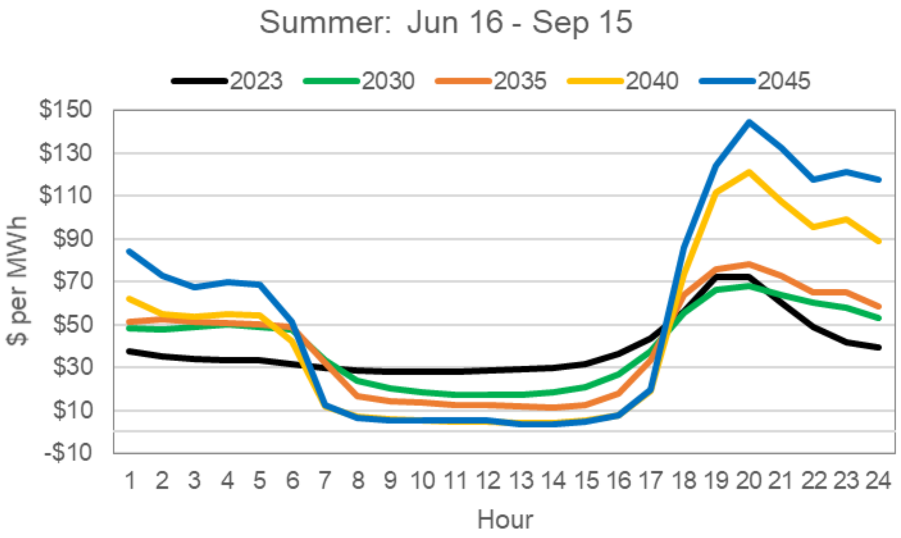
- Levelized Prices:
  - 2023-45: $41.76/MWh
- Off-peak prices overtake on-peak in 2023 on an annual basis
- Evening peak (4pm-10pm) and off-peak prices remain high

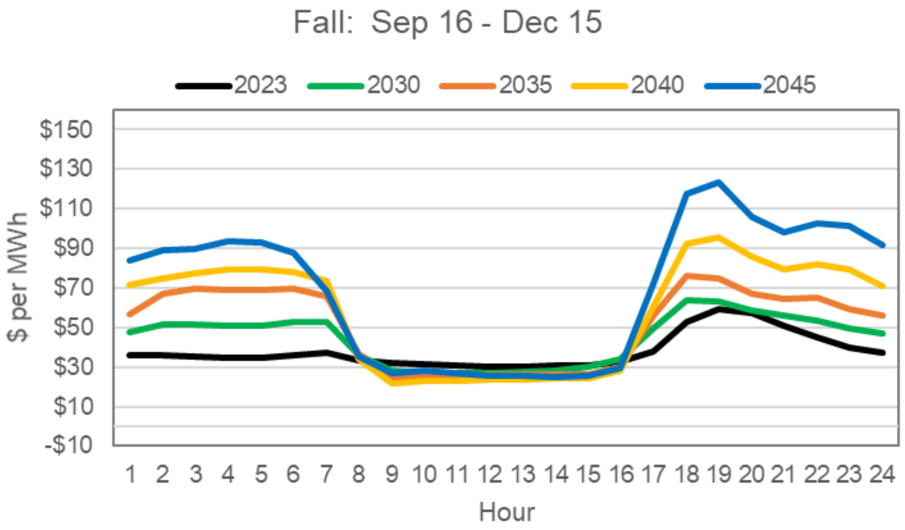
Draft Forecast

Hourly Wholesale Mid-C Electric Price Shapes



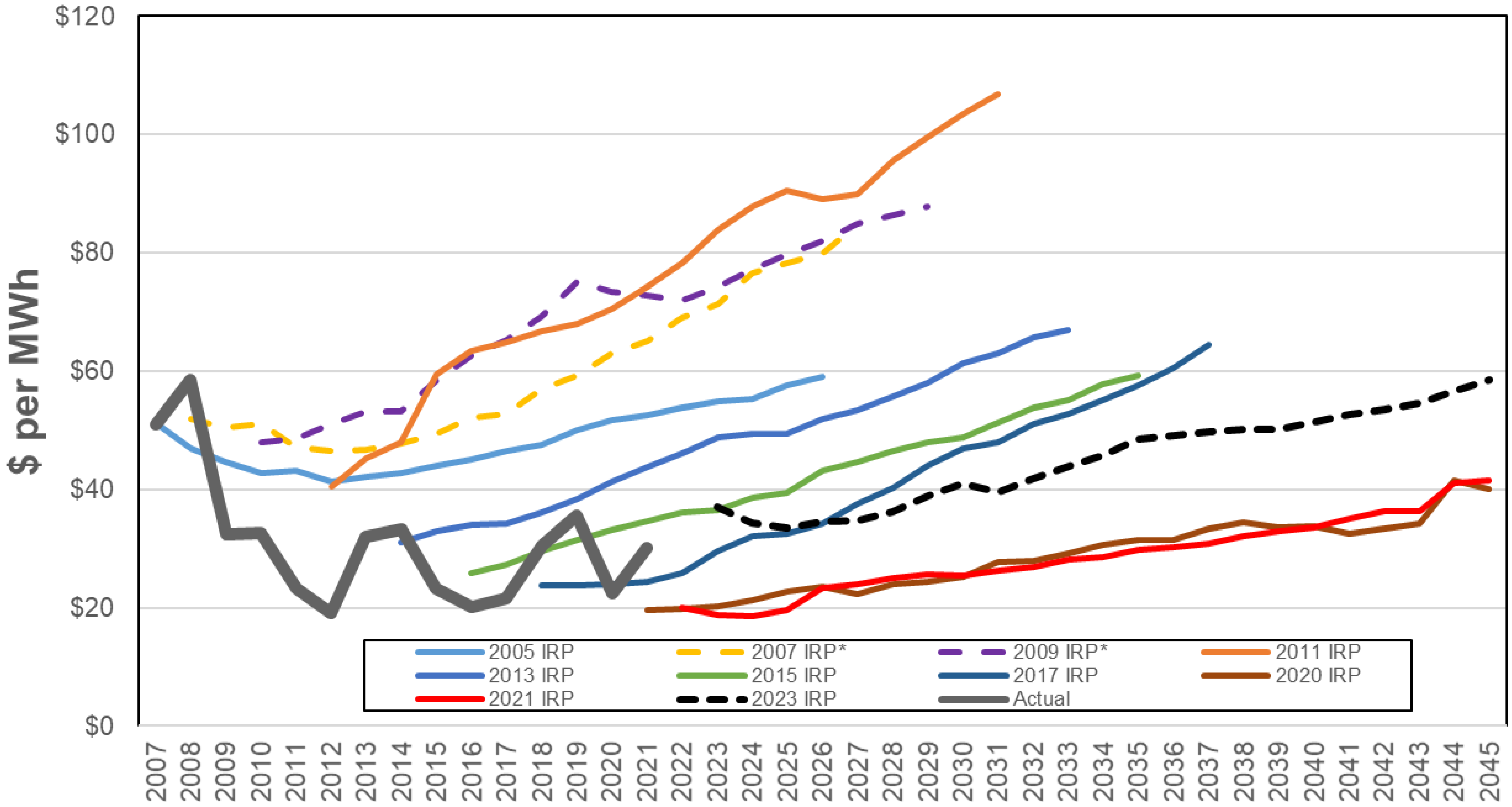






Draft Forecast

Mid-C Electric Price Comparison vs. Previous IRPs



* These forecasts use price scenarios without GHG “taxes” to make all forecasts consistent

Next Steps

- Conduct stochastic studies and verify resource adequacy

- Update price forecast this summer for final IRP analysis
  - Update gas prices (including stochastics),
  - Western Resource Adequacy Program (WRAP)
  - New IHS Markit forecast (load forecast and new regional resource forecast), if available
  - WA and OR carbon pricing update, if available

Data Availability

Outputs

- Expected Case: annual Mid-C prices by iteration
- Expected Case: hourly Mid-C prices
- Regional resource dispatch
- Regional GHG emissions

2023 Electric Integrated Resource Plan
Technical Advisory Committee Meeting No. 4 Agenda
Wednesday, August 10, 2022
Microsoft Teams Virtual Meeting

Topic	Time	Staff
Introductions	9:00	John Lyons
Electric Conservation Potential Assessment	9:05	AEG
Break		
Electric Demand Response Study	10:35	AEG
Lunch	11:30	
Clean Energy Survey	12:30	Mary Tyrie
Adjourn	2:00	

Microsoft Teams meeting

Join on your computer or mobile app

Click here to join the meeting

Or call in (audio only)

+1 509-931-1514,,184108690#   United States, Spokane

Phone Conference ID: 184 108 690#

Find a local number | Reset PIN

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2023 IRP Introduction

2023 Avista Electric IRP

TAC 4 – August 10, 2022

John Lyons, Ph.D. Senior Resource Policy Analyst

Meeting Guidelines

- IRP team is working remotely and is available for questions and comments
- Stakeholder feedback form
    - Responses shared with TAC at meetings, by email and in Appendix
    - Would a form and/or section on the web site be helpful?
- IRP data posted to web site – updated descriptions and navigation are in development
- Virtual IRP meetings on Microsoft Teams until able to hold large meetings again
- TAC presentations and meeting notes posted on IRP page
- This meeting is being recorded and an automated transcript made

Virtual TAC Meeting Reminders

- Please mute mics unless commenting or asking a question
- Raise hand or use the chat box for questions or comments
- Respect the pause
- Please try not to speak over the presenter or a speaker
- Please state your name before commenting
- Public advisory meeting – comments will be documented and recorded

Integrated Resource Planning

The Integrated Resource Plan (IRP):

- Required by Idaho and Washington* every other year
  - Washington requires IRP every four years and update at two years
- Guides resource strategy over the next twenty + years
- Current and projected load & resource position
- Resource strategies under different future policies
  - Generation resource choices
  - Conservation / demand response
  - Transmission and distribution integration
  - Avoided costs
- Market and portfolio scenarios for uncertain future events and issues

Technical Advisory Committee

- Public process of the IRP – input on what to study, how to study, and review of assumptions and results
- Wide range of participants involved in all or parts of the process
  - Please ask questions
  - Always soliciting new TAC members
- Open forum while balancing need to get through topics
- Welcome requests for new studies or different modeling assumptions.
- Available by email or phone for questions or comments between meetings
- Due date for study requests from TAC members – October 1, 2022
- External IRP draft released to TAC – March 17, 2023, public comments due – May 12, 2023
- Final 2023 IRP submission to Commissions and TAC – June 1, 2023

2023 IRP Progress Update

- Please provide any feedback on Washington and Regional Carbon Pricing Assumptions by August 15th

- Schedule changes:
  - Oct 12th TAC moved to Oct 11th
  - Move Global Climate Change Studies from Oct 11th meeting to Sept 28th meeting
  - Move L&R and load forecast from September 28th meeting to Oct 11th meeting

- Public Participation Partner’s (P3) reach out opportunity (Date TBD)

2023 IRP TAC Meeting Schedule

- TAC 4: August 10, 2022
- TAC 5: September 7, 2022
- TAC 6: September 28, 2022
- TAC 7: October 11, 2022
- Technical Modeling Workshop: October 20, 2022
- Washington Progress Report Workshop: December 14, 2022
- TAC 8: February 16, 2023
- Public Meeting Gas & Electric IRPs: March 8, 2023
- TAC 9: March 22, 2023

Today’s Agenda

9:00	Introductions, John Lyons
9:05	Electric Conservation Potential Assessment, AEG
	Break
10:35	Electric Demand Response Study, AEG
11:30	Lunch
12:30	Clean Energy Survey, Mary Tyrie
2:00	Adjourn Electric IRP

APPLIED ENERGY GROUP

Avista 2022 Electric Conservation Potential Assessment

Date: 8/10/2022
Prepared for: Avista Technical Advisory Committee

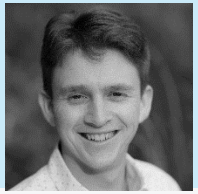
Agenda

- ✓ AEG Introduction
- ✓ Study Objectives
- ✓ AEG's CPA Methodology
- ✓ Electric CPA Draft Results Summary
- ✓ Electric DR Analysis Summary

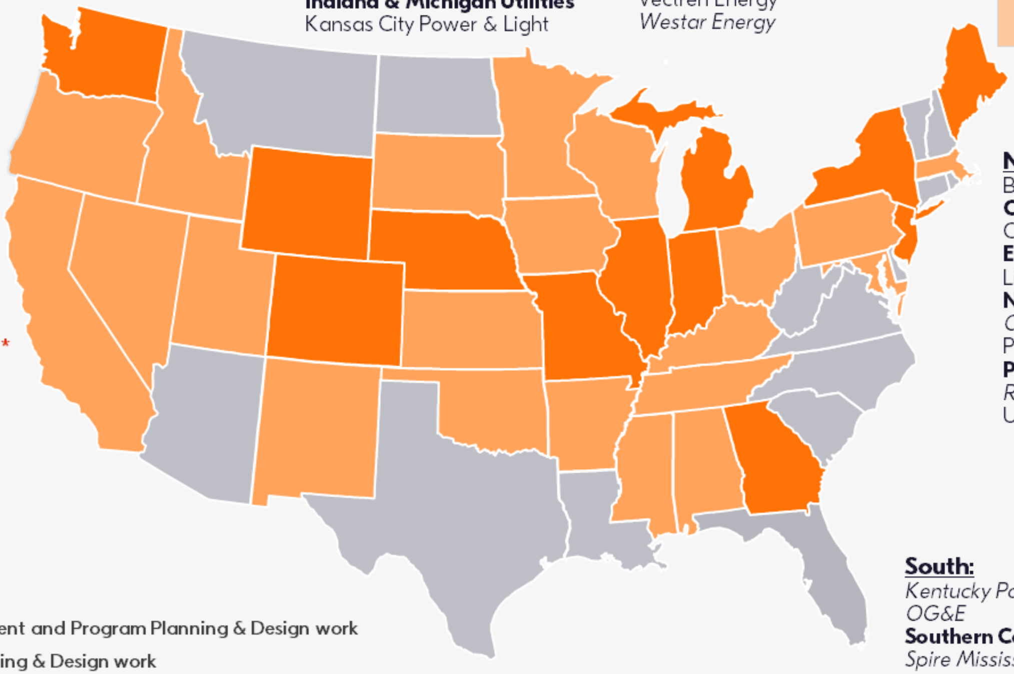
AEG Introduction


Eli Morris
Project Director


Kelly Marrin
Demand
Response Lead


Max McBride
Energy Efficiency
Lead Analyst


Andy Hudson
Project Manager



West:
Avista Energy *
BPA *
Cascade Natural Gas *
Chelan PUD
Cheyenne LFP *
Colorado Electric *
Cowlitz PUD *
HECO
Idaho Power *
Inland P&L *
LADWP
NV Energy
Oregon Trail EC
PacifiCorp *
PNGC
PG&E *
Portland General Electric
Public Service New Mexico *
Seattle City Light *
State of Hawaii *
State of New Mexico
Tacoma Power *
Xcel/SPS

Midwest:
Ameren Illinois *
Ameren Missouri *
Black Hills Power *
Citizens Energy
Empire District Electric *
Indianapolis P&L*
Indiana & Michigan Utilities
Kansas City Power & Light
MERC
NIPSCO *
Omaha Public Power District *
Peoples' Gas/ North Shore Gas *
Spire Missouri
State of Michigan
Sunflower Electric
Vectren Energy *
Westar Energy

Regional & National:
Midcontinent ISO *
EEI/IEE *
EPRI
FERC

Northeast:
Berkshire Gas
Central Hudson G&E *
Con Edison of NY *
Efficiency Maine *
Liberty Utilities *
New Jersey BPU
Orange & Rockland *
PECO Energy
PSEG Long Island
Rockland Electric
Unitil

South:
Kentucky Power *
OG&E
Southern Company / Georgia Power
Spire Mississippi
State of Maryland – EmPOWER *
TVA

Key

*Two or more studies

Bold = Both Market Assessment and Program Planning & Design work

Italics = Only Program Planning & Design work

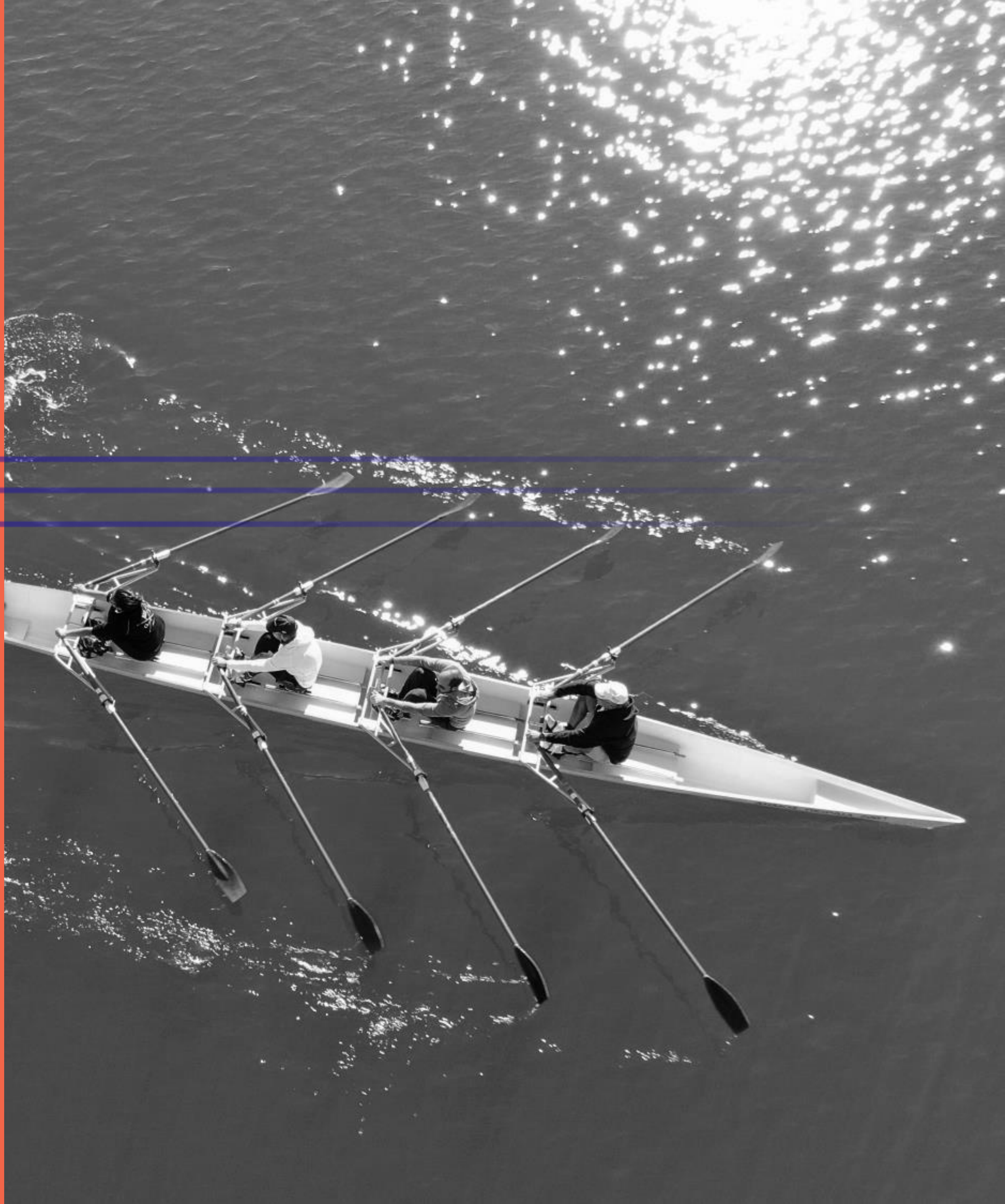
As of January 2022

✓ 60 potential studies in last 5 years, many of these in the Pacific Northwest

CPA Objectives

- ✓ Assess a broad set of technologies to identify long-term energy efficiency and demand response potential in Avista's Washington and Idaho service territories to support:
  - Integrated Resource Planning
  - Portfolio target-setting
  - Program development
- ✓ Provide information on costs and seasonal impacts of conservation to compare to supply-side alternatives
- ✓ Understand differences in energy consumption and energy efficiency opportunities by income level
- ✓ Ensure transparency into methods, assumptions, and results

AEG CPA Methodology



AEG's Modeling Approach

Market Characterization

- Baseline studies
- Utility data
- Secondary data

Identify Demand-Side Resources

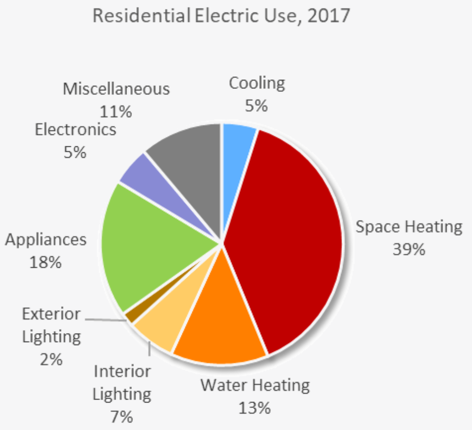
- EE equipment
- EE measures
- Emerging tech.

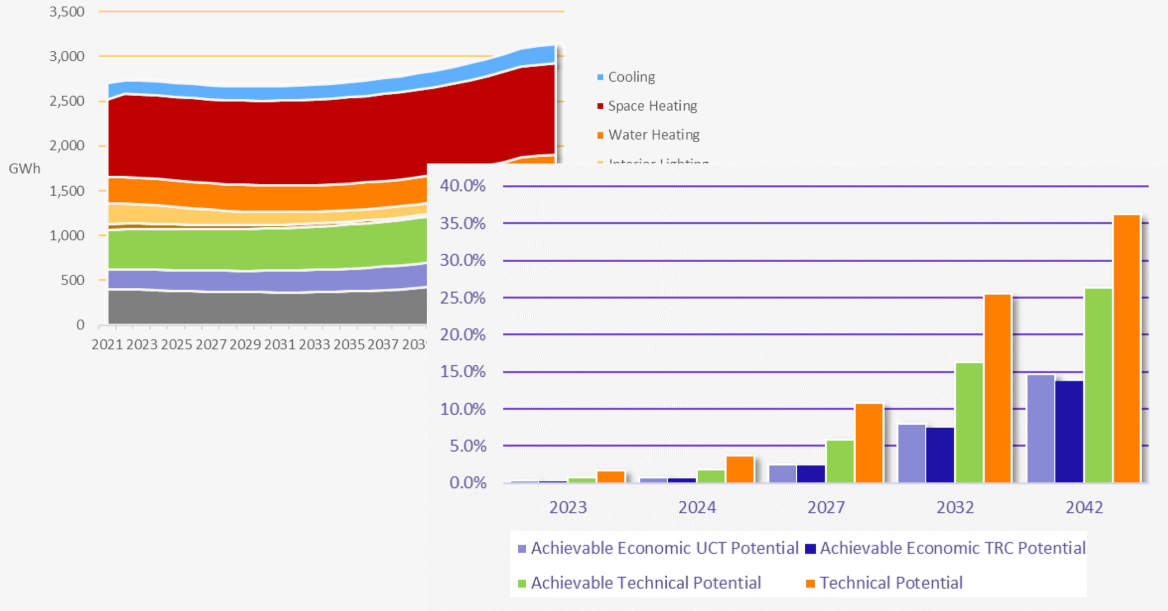
Baseline Projection

- Utility forecasts
- Standards and building codes

Potential Estimation

- Technical
- Achievable Tech.
- Economic screen in IRP





Key Sources of Data

Data from Avista is prioritized when available, followed by regional data, and finally well-vetted national data.

Avista data sources:

- ✓ 2013 Residential GenPop Survey
- ✓ Historical energy, peak loads, and customer counts
  - CPA Base Period: Sept 2020 – Aug 2021
- ✓ Forecast data and load research
- ✓ Recent-year program accomplishments and plans

Regional data sources:

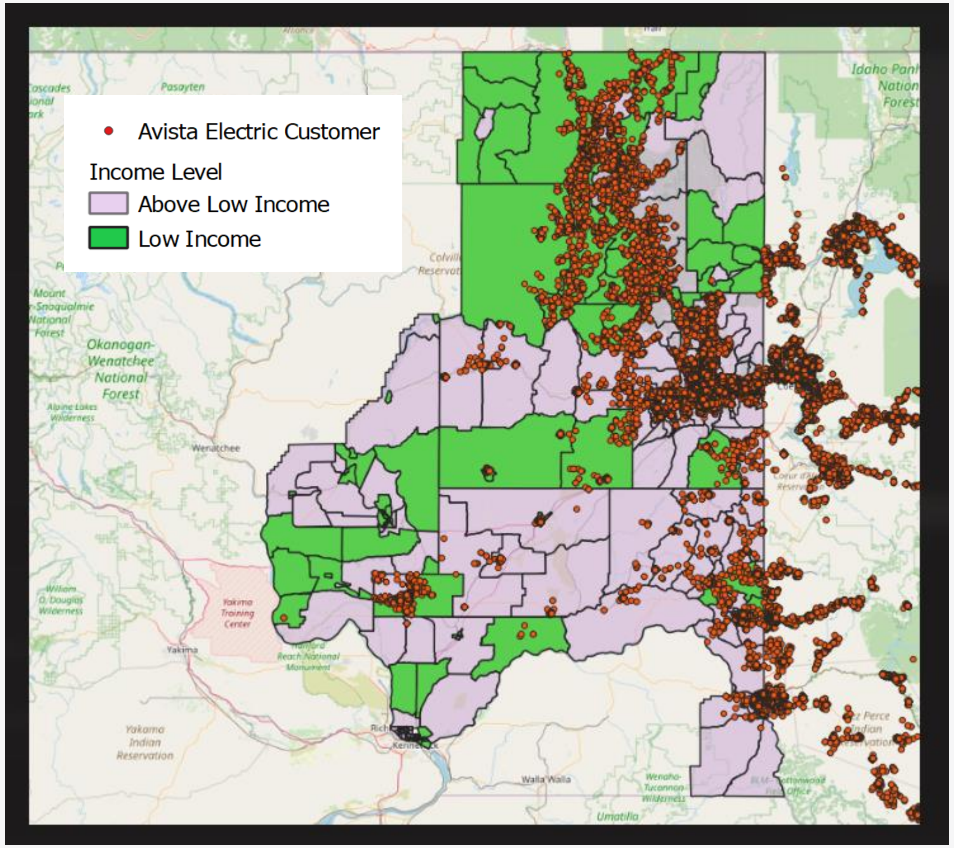
- ✓ NEEA studies (RBSA 2016, CBSA 2019, IFSA)
- ✓ Regional Technical Forum and NW Power and Conservation Council methodologies, ramp rates, and measure assumptions

Additional sources:

- ✓ U.S. DOE's Annual Energy Outlook
- ✓ U.S. DOE's projections on solid state lighting technology improvements
- ✓ Technical Reference Manuals and California DEER
- ✓ AEG Research

Residential Customer Segmentation

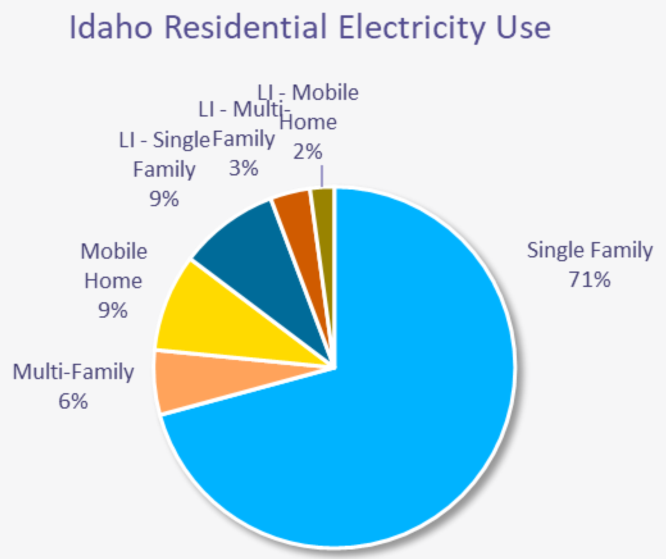
- This CPA enhances the residential segmentation to distinguish low-income households within each housing type rather than a single grouped "low income" segment.
- AEG cross referenced geographic data from Avista's customer database with data from the US Census American Community Survey to estimate the presence of low-income households within Avista's service territory (WA Census blocks shown at right).
  - "Low Income" was defined by household size. In Washington the threshold is 80% of Area Median Income, and in Idaho it is 200% of the Federal Poverty Level.
- Data from NEEA's Residential Building Stock Assessment (RBSA II, 2016) was used to differentiate energy characteristics of low-income households, including differences in building shells, energy use per customer, and presence of energy-using equipment



Market Profiles

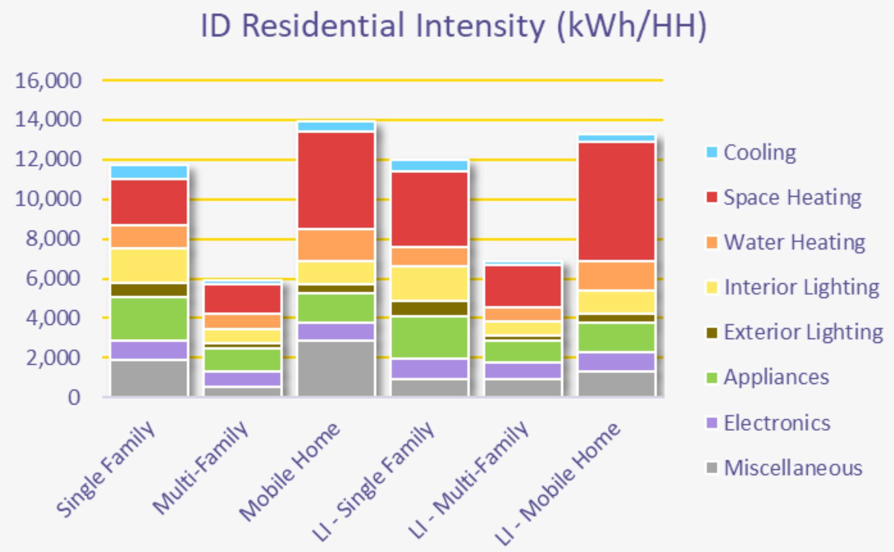
Example – Idaho Residential

- Always calibrated to Avista's use-per-customer at the household level
- Breaks down energy consumption to the end use and technology level
- Defines the **saturation** (presence of equipment) and the annual consumption of a given technology where it is present **(Unit Energy Consumption – UEC)**
- Refer to data sources slide



Single Family Reg. Income Profile (excerpt)

End Use	Technology	Saturation	UEC (kWh)	Intensity (kWh/HH)	Usage (MWh)
Cooling	Central AC	33%	1,432	471	37,616
	Room AC	11%	487	52	4,127
	Air-Source Heat Pump	14%	1,476	207	16,539
	Geothermal Heat Pump	1%	1,300	11	855
	Ductless Mini Split Heat Pump	1%	517	6	450
Space Heating	Electric Furnace	5%	16,251	830	66,273
	Electric Room Heat	9%	1,616	139	11,100
	Air-Source Heat Pump	12%	9,954	1,230	98,255
	Geothermal Heat Pump	1%	8,539	62	4,946
	Ductless Mini Split Heat Pump	1%	4,977	54	4,328
Water Heating	Water Heater (<= 55 Gal)	46%	2,364	1,096	87,540
	Water Heater (> 55 Gal)	3%	2,144	71	5,669



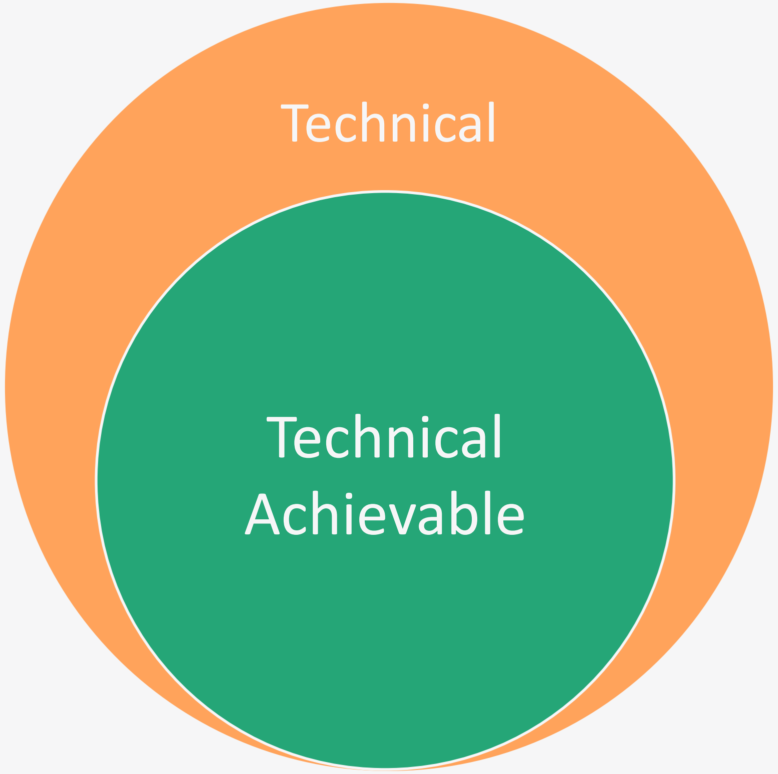
Two Levels of Savings Estimates

NW Power Council Methodology

This study develops two sets of estimates:

- **Technical potential (TP)**: upper bound on potential, assuming all of the most energy efficiency opportunities are adopted without consideration of cost or customer willingness to participate.
  - This may include emerging or very expensive ultra-high efficiency technologies
- **Technical Achievable Potential (TAP)** is a subset of TP that accounts for customer preference and likelihood to adopt through **both** utility- and non-utility driven mechanisms, but does not consider cost-effectiveness

In addition to these estimates, the study produces cost data for the Total Resource Cost (TRC) and Utility Cost Test (UC)T perspectives that can be used by Avista's IRP process to select energy efficiency measures in competition with other resources (see next slide)



Levelized Costs

Two Cost-Effectiveness Tests

AEG provided a levelized cost of conserved energy ($/kWh) for each measure within the technical achievable potential within Avista's Washington and Idaho territories from two perspectives.

- ✓ Utility Cost Test (UCT): Assesses cost-effectiveness from a utility or program administrator's perspective.
- ✓ Total Resource Cost Test (TRC): Assesses cost-effectiveness from the perspective of the utility and its customers. Includes quantifiable and monetizable non-energy impacts if they can be quantified and monetized.

Component	UCT	TRC
Measure Incremental Cost		Cost
Incentive	Cost	
Administrative Cost	Cost	Cost
Non-Energy Benefits*		Benefit
Non-Energy Costs* (e.g. O&M)		Cost

*Council methodology includes monetized impacts on other fuels within these categories

Both values are provided to Avista for all measure level potential, so that the IRP can use the appropriate evaluation for each state: TRC for WA and UCT for ID.

Potential Estimates

Achievability

All potential "ramps up" over time – all ramp rates are based on those found within the NWPCC's 2021 Power Plan

- ✓ Max Achievability
  - NWPCC 2021 Plan allows some measures max achievability to reach up to 100% of technical potential
  - Previous Power Plans assumed a maximum achievability of 85%
  - AEG has aligned assumptions with the 2021 Plan and measures such as lighting reach greater than 85%
- ✓ Note that Council ramp rates are agnostic to delivery to acquisition mechanism and include potential that may be realized through utility DSM programs, regional initiatives and market transformation, or enhanced codes and standards

Measures examples over 85% Achievability:

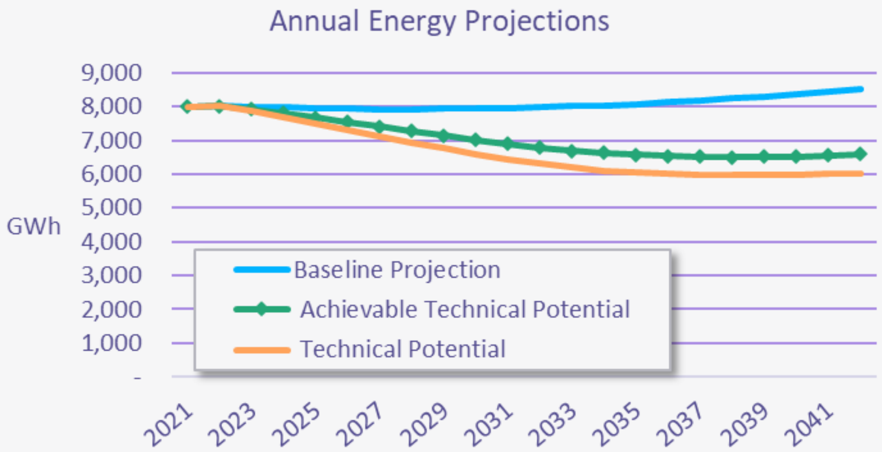
- All Lighting
- Washers/Dryers
- Dishwashers
- Refrigerators/Freezers
- Circulation Pumps
- Thermostats
- C&I Fans

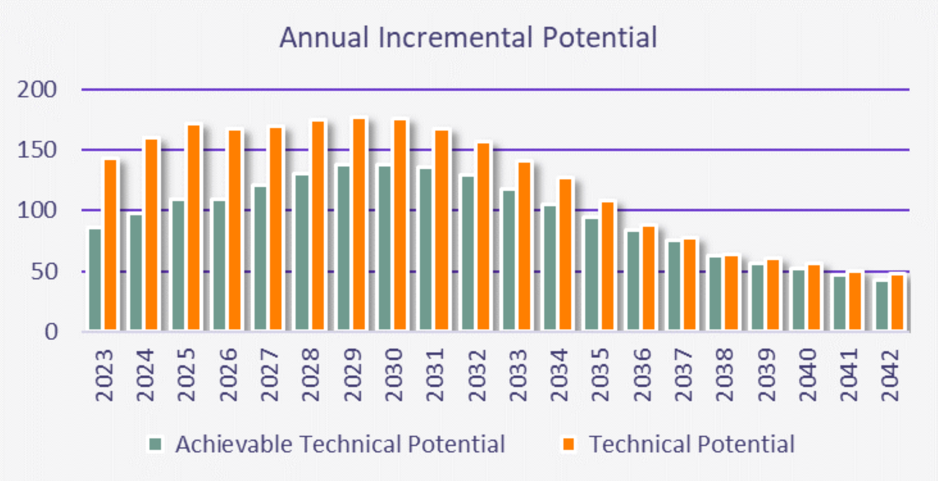
Electric CPA Draft Results

Energy Efficiency Potential (WA & ID, All Sectors)

Draft results indicate energy savings of ~1.1% of baseline consumption per year are Technically Achievable.

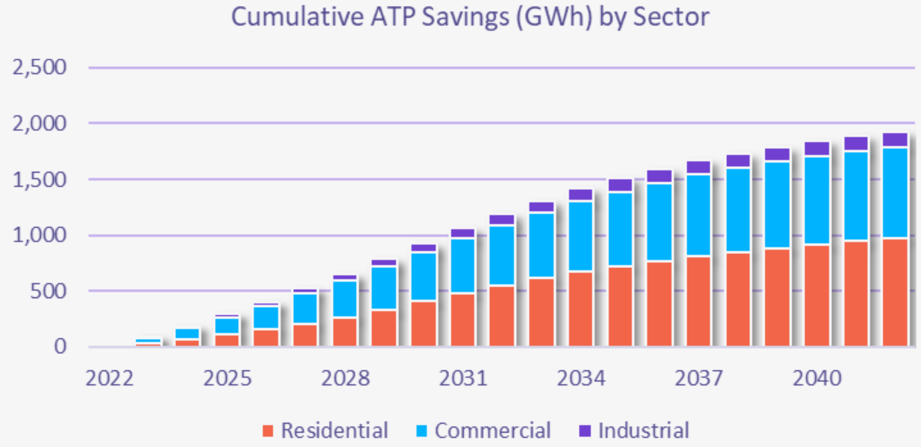
- 183 GWh (20.9 aMW) in next biennial period (2023-2024)
- 1,193 GWh (136.2 aMW) by 2032
- 1,929 GWh (220.2 aMW) by 2042

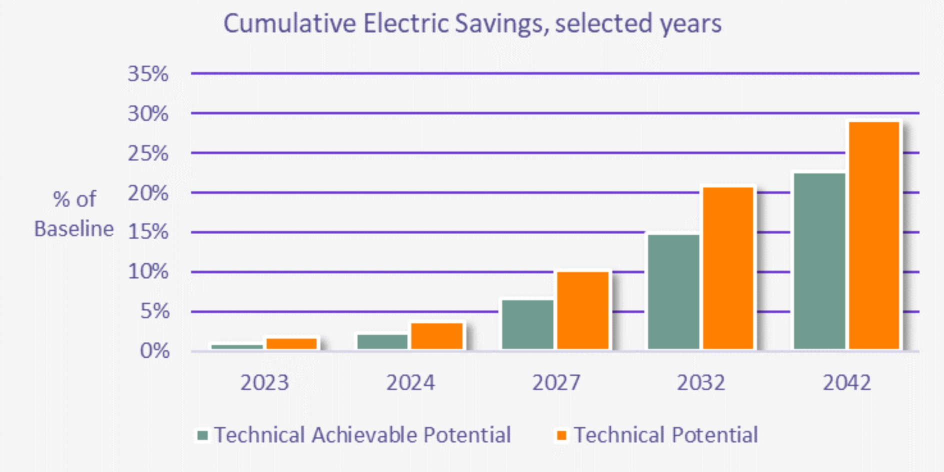

Annual Energy Projections


Annual Incremental Potential

Energy Efficiency Potential, Continued

Potential Summary – WA & ID, All Sectors

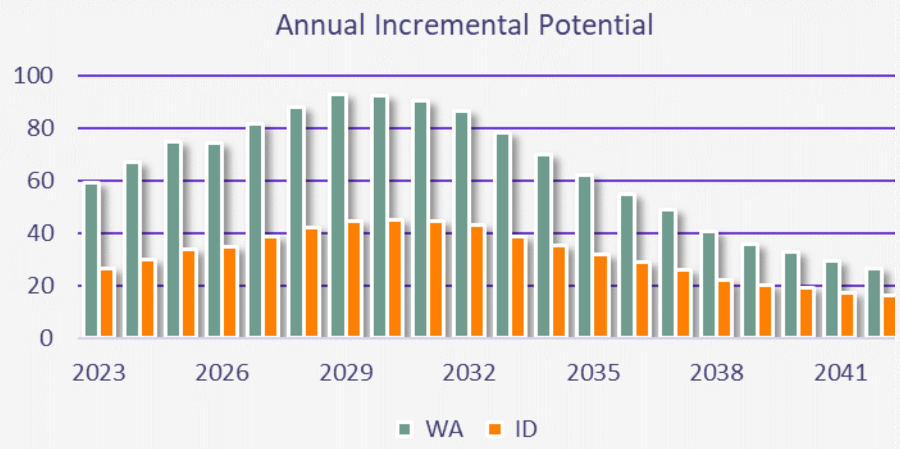


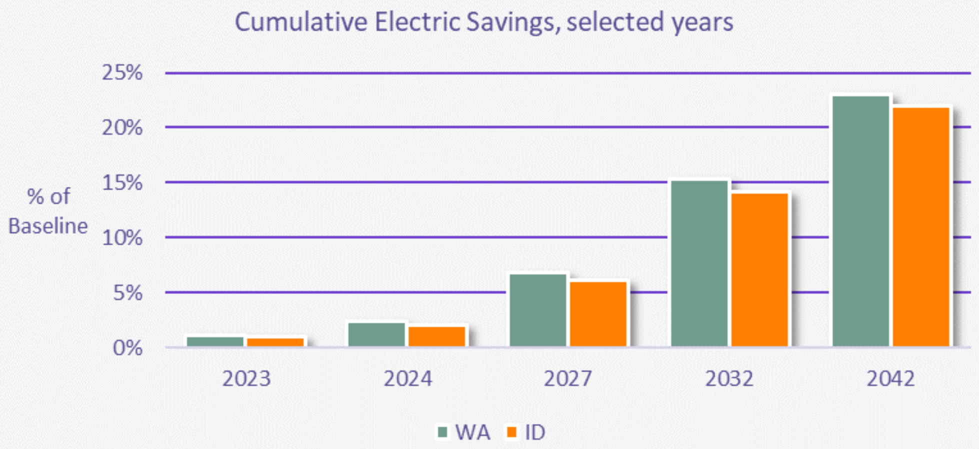


Summary of Energy Savings (GWh), Selected Years	2023	2024	2027	2032	2042
Reference Baseline	8,009	7,996	7,933	7,982	8,520
Cumulative Savings (GWh)					
Technical Achievable Potential	86	183	522	1,193	1,929
Technical Potential	144	304	813	1,665	2,486
Energy Savings (% of Baseline)					
Technical Achievable Potential	1.1%	2.3%	6.6%	15.0%	22.6%
Technical Potential	1.8%	3.8%	10.3%	20.9%	29.2%
Incremental Savings (GWh)					
Technical Achievable Potential	86	97	121	130	43
Technical Potential	144	160	170	157	48

EE Potential, Continued

Potential Summary – State Comparison





Summary of Energy Savings (GWh), Selected Years	2023	2024	2027	2032	2042
Reference Baseline					
Washington	5,309	5,301	5,256	5,277	5,608
Idaho	2,700	2,695	2,678	2,705	2,912
Cumulative Savings (GWh)					
Washington	59	127	358	809	1,289
Idaho	26	57	165	384	640
Energy Savings (% of Baseline)					
Washington	1.1%	2.4%	6.8%	15.3%	23.0%
Idaho	1.0%	2.1%	6.1%	14.2%	22.0%
Incremental Savings (GWh)					
Washington	59	67	82	87	27
Idaho	26	30	39	43	16

EE Potential - Top Measures

Cumulative Potential Summary – WA

Top Measure Notes

- Some expensive or emerging measures have significant technical achievable potential, but may not be selected by the IRP due to costs
- Heat Pump measures, including DHPs and HPWHs, have significant annual energy benefits, however since heat pumps revert to electric resistance heating during extreme cold, they may not have a corresponding winter peak benefit
- In addition to being expensive, some emerging tech measures are included in Technical Achievable which may not prove feasible for programs at this time, but can be kept in mind for future programs

Rank	Measure / Technology	2032 Achievable Technical Potential (MWh)	% of Total	TRC Levelized $/kWh
1	Residential - Connected Thermostat - ENERGY STAR (1.0)	66,516	8.2%	$0.25
2	Commercial - Linear Lighting	56,757	7.0%	$0.00
3	Commercial - Ductless Mini Split Heat Pump	46,099	5.7%	$0.89
4	Residential - Windows - Low-e Storm Addition	42,942	5.3%	$0.21
5	Residential - Water Heater (<= 55 Gal)	38,857	4.8%	$0.12
6	Residential - Home Energy Management System (HEMS)	26,551	3.3%	$0.35
7	Commercial - HVAC - Dedicated Outdoor Air System (DOAS)	18,215	2.3%	$1.30
8	Residential - Windows - Cellular Shades	16,852	2.1%	$0.62
9	Commercial - Retrocommissioning	13,583	1.7%	$0.01
10	Commercial - Strategic Energy Management	11,198	1.4%	$0.18
11	Commercial - HVAC - Energy Recovery Ventilator	10,374	1.3%	$0.13
12	Commercial - Server	9,551	1.2%	$0.01
13	Commercial - Refrigeration - High Efficiency Compressor	9,429	1.2%	$0.40
14	Residential - Windows - High Efficiency (Class 22)	9,328	1.2%	$0.54
15	Commercial - High-Bay Lighting	9,066	1.1%	$0.00
16	Commercial - Insulation - Wall Cavity	8,551	1.1%	$0.03
17	Residential - Windows - High Efficiency (Class 30)	8,417	1.0%	$0.42
18	Commercial - Ventilation - Demand Controlled	8,267	1.0%	$2.15
19	Residential - Insulation - Floor Installation	8,249	1.0%	$0.17
20	Commercial - Desktop Computer	7,884	1.0%	$0.11
	Total of Top 20 Measures	**426,685**	**52.7%**	
	Total Cumulative Savings	**809,194**	**100.0%**	

EE Potential - Top Measures

Cumulative Potential Summary – ID

Top Measure Notes

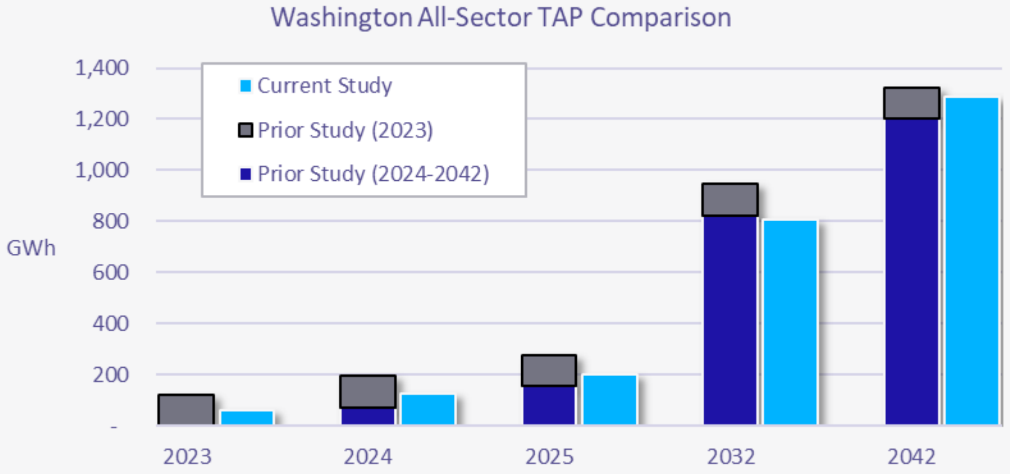
- Some expensive or emerging measures have significant technical achievable potential, but may not be selected by the IRP due to costs
- Heat Pump measures, including DHPs and HPWHs, have significant annual energy benefits, however since heat pumps revert to electric resistance heating during extreme cold, they may not have a corresponding winter peak benefit
- In addition to being expensive, some emerging tech measures are included in Technical Achievable which may not prove feasible for programs at this time, but can be kept in mind for future programs

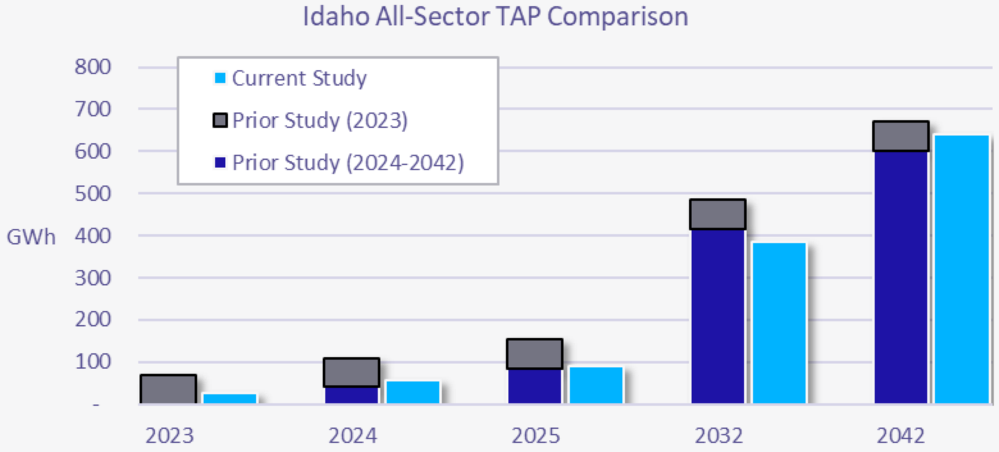
Rank	Measure / Technology	2032 Achievable Technical Potential (MWh)	% of Total	UCT Levelized $/kWh
1	Commercial - Linear Lighting	27,909	7.3%	$0.00
2	Commercial - Ductless Mini Split Heat Pump	17,184	4.5%	$0.59
3	Residential - Water Heater (<= 55 Gal)	16,791	4.4%	$0.09
4	Residential - Windows - Low-e Storm Addition	13,713	3.6%	$0.17
5	Residential - Connected Thermostat - ENERGY STAR (1.0)	11,260	2.9%	$0.20
6	Residential - Home Energy Management System (HEMS)	10,512	2.7%	$0.27
7	Residential - Windows - Cellular Shades	8,363	2.2%	$0.49
8	Commercial - HVAC - Dedicated Outdoor Air System (DOAS)	7,942	2.1%	$0.86
9	Residential - Insulation - Floor Installation	7,934	2.1%	$0.13
10	Commercial - Engine Block Heater Controls	7,437	1.9%	$0.01
11	Commercial - Refrigeration - High Efficiency Compressor	6,570	1.7%	$0.16
12	Commercial - Retrocommissioning	6,391	1.7%	$0.01
13	Commercial - Refrigeration - Floating Head Pressure	6,079	1.6%	$0.06
14	Residential - Advanced New Construction Design - Zero Net Energy	5,436	1.4%	$0.10
15	Industrial - Linear Lighting	5,385	1.4%	$0.01
16	Residential - Insulation - Ceiling Installation	5,247	1.4%	$0.16
17	Commercial - Strategic Energy Management	5,164	1.3%	$0.12
18	Commercial - Server	4,976	1.3%	$0.01
19	Commercial - Insulation - Wall Cavity	4,457	1.2%	$0.02
20	Residential - TVs	4,225	1.1%	$0.00
	Total of Top 20 Measures	**182,975**	**47.6%**	
	Total Cumulative Savings	**384,102**	**100.0%**	

Comparison with 2020 Electric CPA

Achievable Potential Comparison

Comparison with Prior Potential Study (2022-2042 **TAP**)

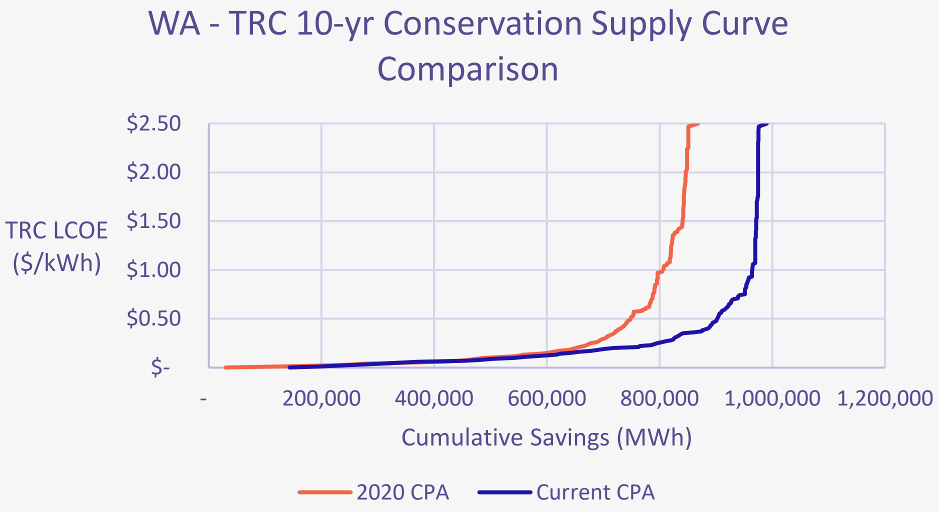


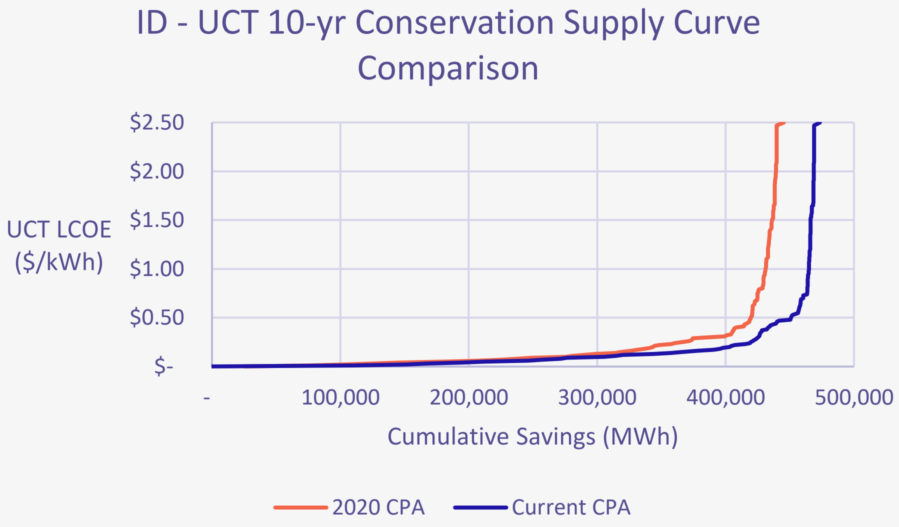


Sector (All States)	End Use	Prior CPA 2042 MWh	Current Study 2042 MWh	Diff.
Residential	Cooling	112,802	75,404	-37,398
	Heating	403,894	453,969	50,075
	Water Heating	220,393	227,303	6,910
	Interior Lighting	18,040	29,624	11,584
	Exterior Lighting	1,320	10,922	9,601
	Appliances	85,150	96,145	10,995
	Electronics	56,747	59,310	2,563
	Miscellaneous	46,509	20,171	-26,339
Commercial	Cooling	130,699	127,447	-3,252
	Heating	89,773	113,699	23,925
	Ventilation	100,043	119,087	19,045
	Water Heating	21,941	25,733	3,791
	Interior Lighting	195,773	192,109	-3,663
	Exterior Lighting	52,777	48,740	-4,037
	Refrigeration	107,229	105,453	-1,776
	Food Preparation	7,662	26,932	19,270
	Office Equipment	13,101	45,382	32,282
	Miscellaneous	9,240	14,077	4,837
Industrial	Cooling	4,218	11,895	7,677
	Heating	461	6,912	6,451
	Ventilation	12,137	5,346	-6,791
	Interior Lighting	42,345	22,883	-19,462
	Exterior Lighting	4,745	18,386	13,641
	Motors	60,407	62,550	2,142
	Process	6,055	8,346	2,291
	Miscellaneous	678	1,511	833
Grand Total		**1,804,139**	**1,929,335**	**125,196**

Supply Curves – Compare to Prior CPA

WA & ID Technical Achievable Potential





Sector-Level Notes

Comparison with Prior Potential Study – Technical Achievable

Residential:

- ✓ Updates to RTF Workbooks and latest Avista TRM are driving increase in potential across weatherization measures.
  - Low-E Storm Addition, Floor Insulation and Cellular Shades are the largest increases.
- ✓ Ductless Mini Split Heat Pump measures showing less potential driven by RTF savings update.

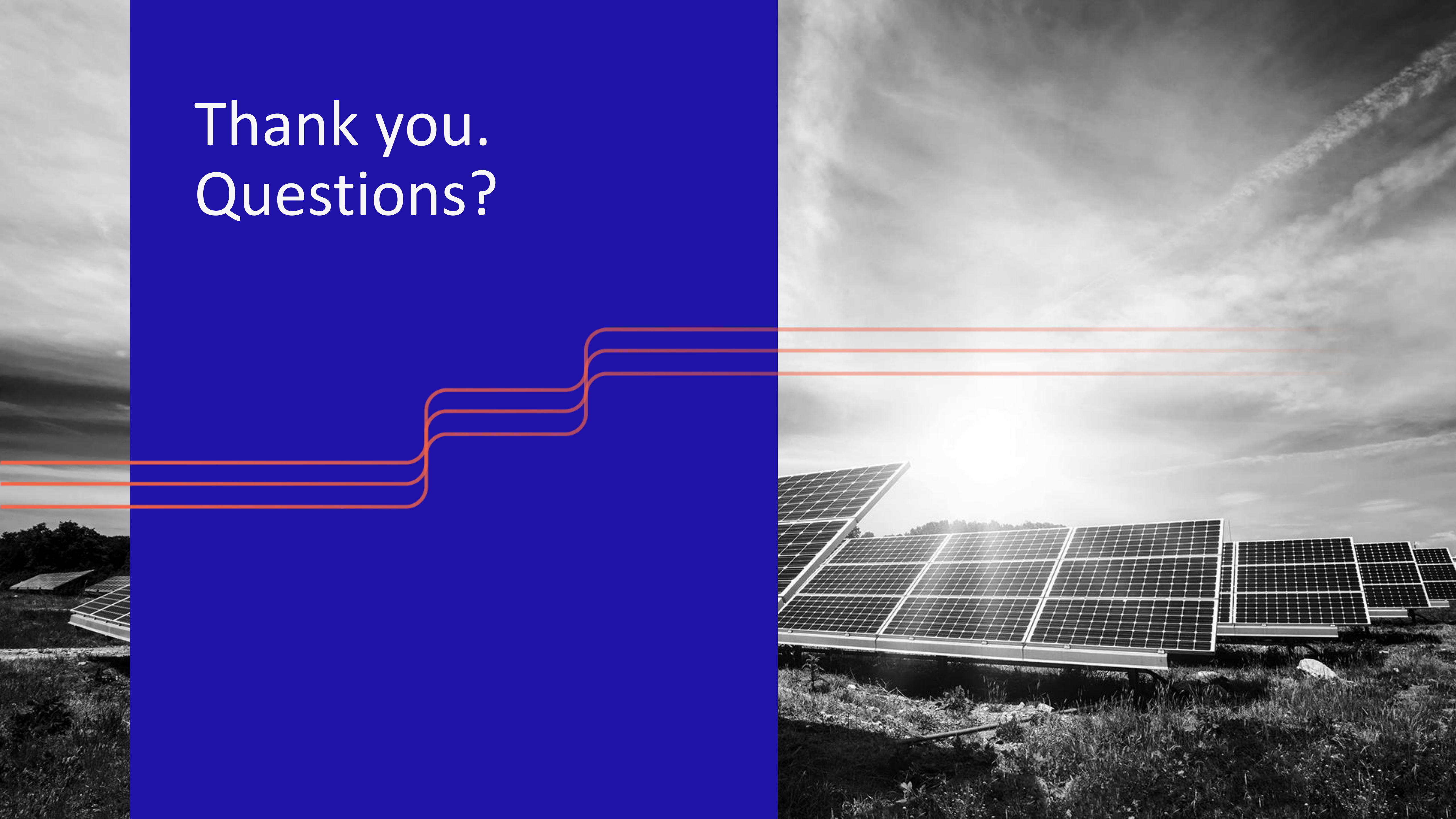
Commercial:

- ✓ Similar lighting potential. New LED replacement with Controls measure offsets increase in LED saturation.
- ✓ Increase in potential across Food Preparation and Office Equipment end uses driven by updates to ENERGY STAR specifications and market data.
- ✓ Updated savings characterizations across HVAC and water heating measures leading to lower potential estimates in those end uses.

Industrial:

- ✓ Industrial measure data was revised to reflect the newest iteration of the 2021 Industrial Tool (v8), updating savings and costs for many measures.
- ✓ Pumping measures showing increased potential due to explicit accounting for Avista pumping rate schedule and the new Pumping measures from the V8 Industrial Tool update.
- ✓ Fan controls also have greater savings as a result of the measure data update

Thank you.
Questions?



Demand Response

Approach to the Study

Data Collection

Characterize the Market

Develop list of DR Options

Characterize the Options

Estimate Potential

Align with EE Potential Study

- Market Profiles

Secondary Sources

- Industry or regional reports
- Previous studies

Segmentation by Customer Class

- Residential
- General Service
- Large General Service
- Extra-Large General Service

Program Categories

- Conventional DLC
- Smart/Interactive DLC
- Curtailment
- Energy Storage
- Time-Varying Rates/Behavioral
- Ancillary Services

Develop Program Assumptions

- Impacts
- Participation
- Technology
- Costs
- Incentives

Technical Achievable Potential

- Potential for all programs regardless of cost and without consideration of dual participation

Achievable Potential

- Integrated program options without participant overlap

All Program Options

Conventional DLC	Central AC Water Heating Electric Vehicle Charging
Smart/Interactive DLC	Grid-Interactive Water Heating Smart Thermostats (Cooling/Heating) Smart Appliances
Third Party Curtailment	Capacity Bidding Emergency Curtailment
Energy Storage	Battery Storage Thermal Storage
Time-Varying Rates/Behavioral	Behavioral Time-of-Use Electric Vehicle Time-of-Use Variable Peak Pricing

Avista Pilot Program Scenario

Avista plans to run the following DR Pilot Programs in Washington:

- ✓ CTA-2045 HPWH
- ✓ CTA-2045 ERWH
- ✓ Time-of-Use Opt-in
- ✓ Peak Time Rebate

All Pilot Programs will run for a three-year period starting in 2024

The TOU Opt-in Pilot will have an optional two-year extension pending results

Advanced Metering Infrastructure (AMI) Assumptions

Some of the options require AMI

- ✓ DLC Options- No AMI Metering Required
- ✓ Dynamic Rates- require AMI for billing

Washington

- ✓ Assume 100% throughout study for all sectors

Idaho starting AMI rollout in 2024

- ✓ 36-month deployment schedule

Assumptions and Updates

Smart Thermostat - Heating Program will piggyback off Cooling Program

- ✓ Shared Admin, Development, and O&M Costs

Grid-Interactive Water Heaters

- ✓ Split results across water heater type- ER and HP
  - Lowered CTA-2045 impacts to reflect "BPA 2018" peak mitigation strategies

Dynamic Rates

- ✓ PTR for Residential and General Service
- ✓ VPP for Large and Extra-Large General Service
- ✓ Added EV TOU

Program Impact and Cost assumptions mainly based on NWPCC 2021 Power Plan assumptions

- ✓ Diverged from these where appropriate
  - Customization for Avista's service territory
  - Where NWPCC program information wasn't available

Program Impact Calculation

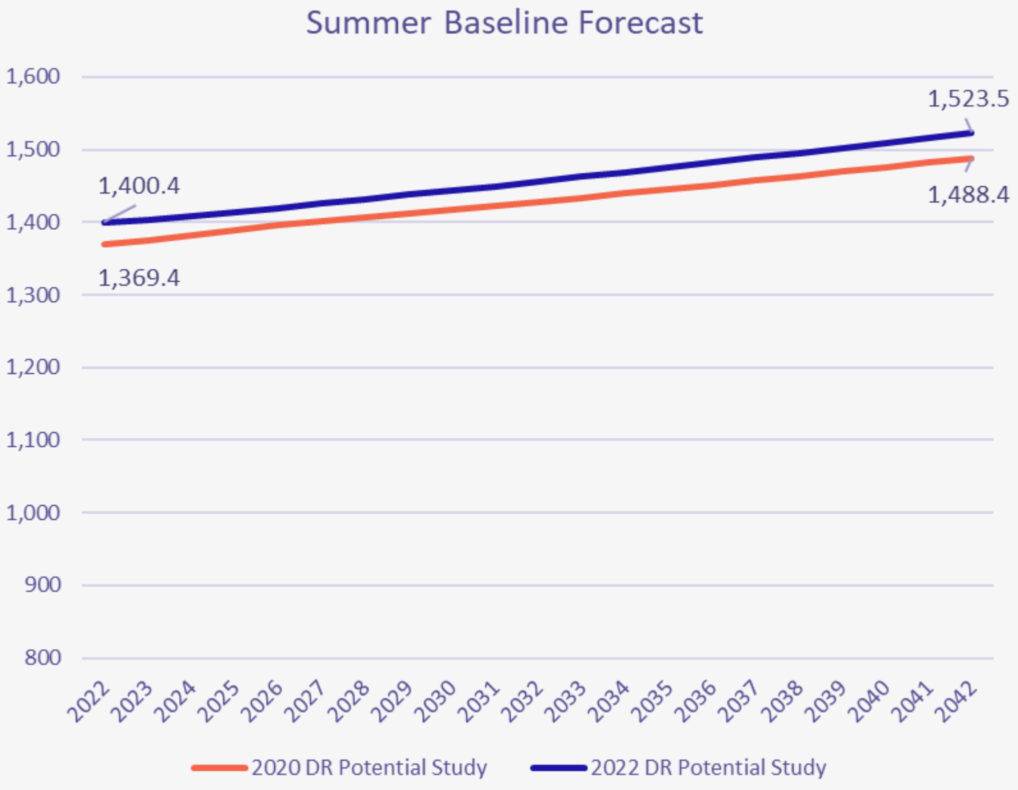
$$\mathit{Program\ Impact}_{year,program}$$

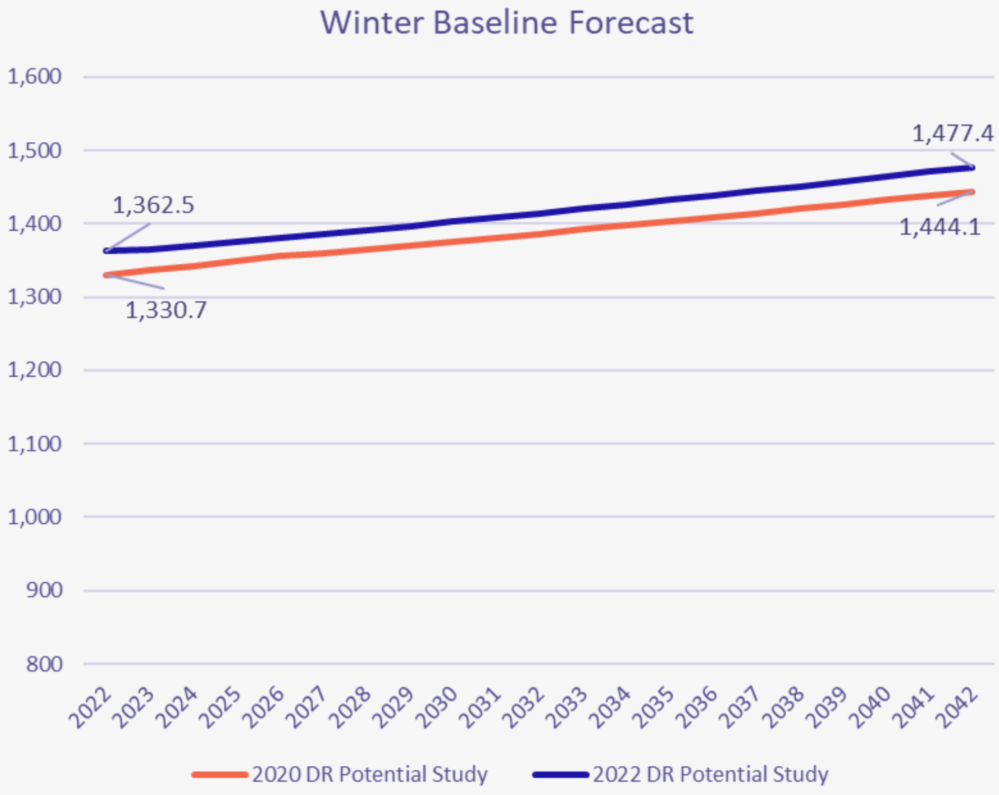
$$= \mathit{Per\ Customer\ Peak\ Impact}_{y,p} * \mathit{Eligible\ Participants}_{y,p} * \mathit{Participation\ Rate}_{y,p}$$

$$* \mathit{Equipment\ Saturation\ Rate}\ _{y,p}$$

Baseline Characterization

Baseline Comparisons to 2020 Study

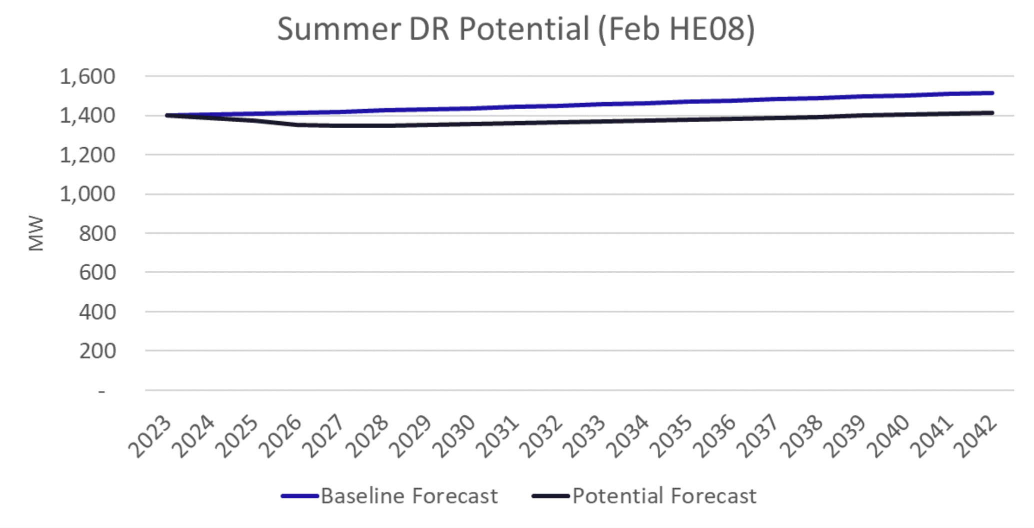


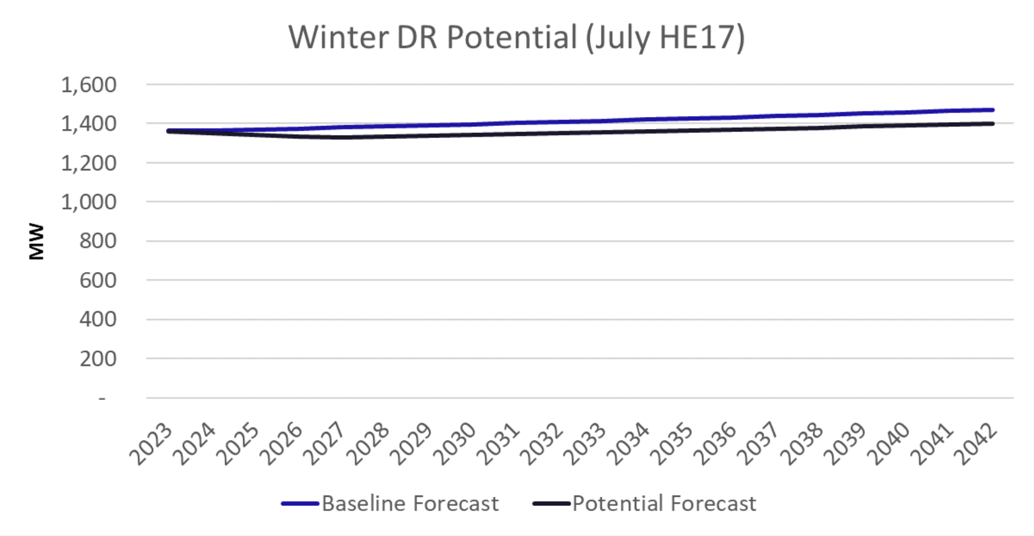


Achievable Potential

All Program Options

Potential by Season

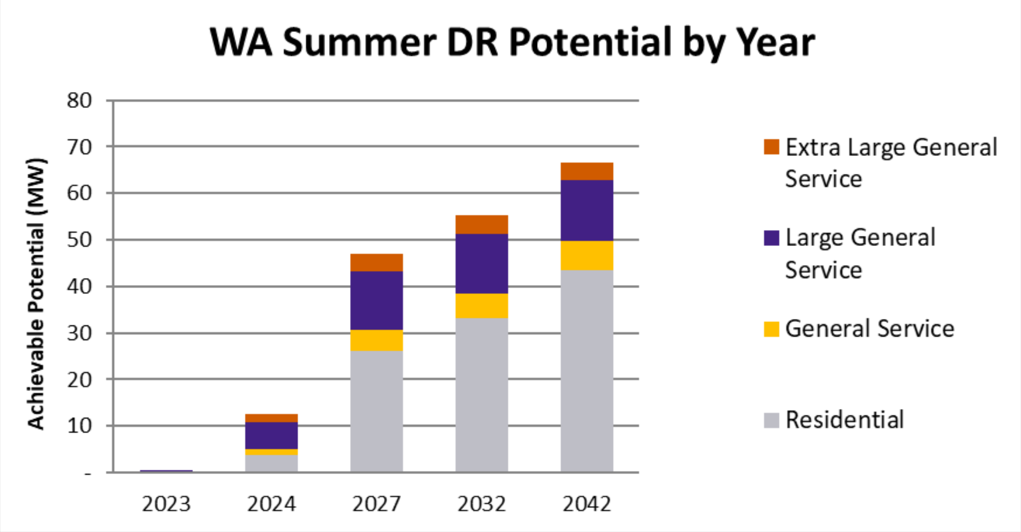

Summer DR Potential (Feb HE08)

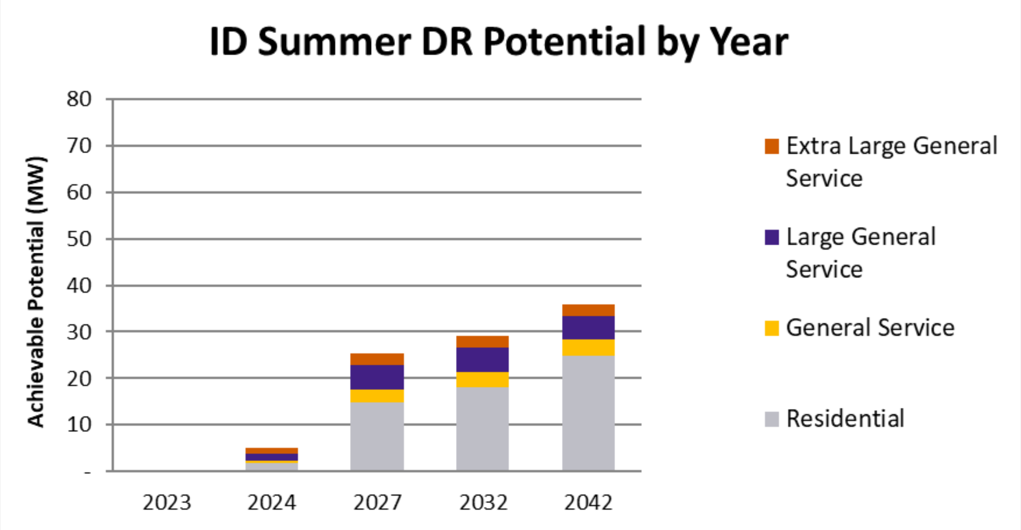

Winter DR Potential (July HE17)

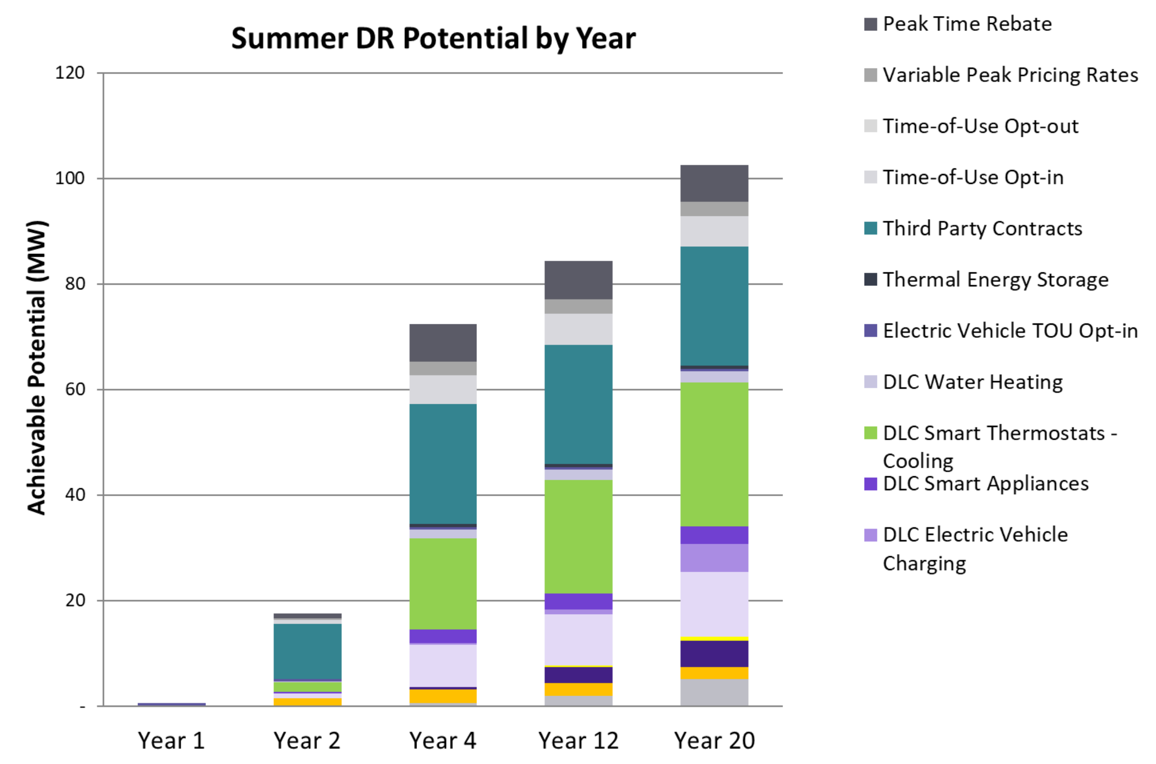
Summer Potential	2023	2024	2027	2032	2042
Baseline Forecast	1,400	1,404	1,420	1,450	1,516
Achievable Potential	0.5	17.5	72.3	84.3	102.6
% of Baseline	0.0%	1.2%	5.1%	5.8%	6.8%
Potential Forecast	1,400	1,386	1,348	1,365	1,414

Winter Potential	2023	2024	2027	2032	2042
Baseline Forecast	1,363	1,366	1,381	1,408	1,471
Achievable Potential	0.5	14.8	49.4	57.6	69.3
% of Baseline	0.0%	1.1%	3.6%	4.1%	4.7%
Potential Forecast	1,362	1,351	1,331	1,351	1,401

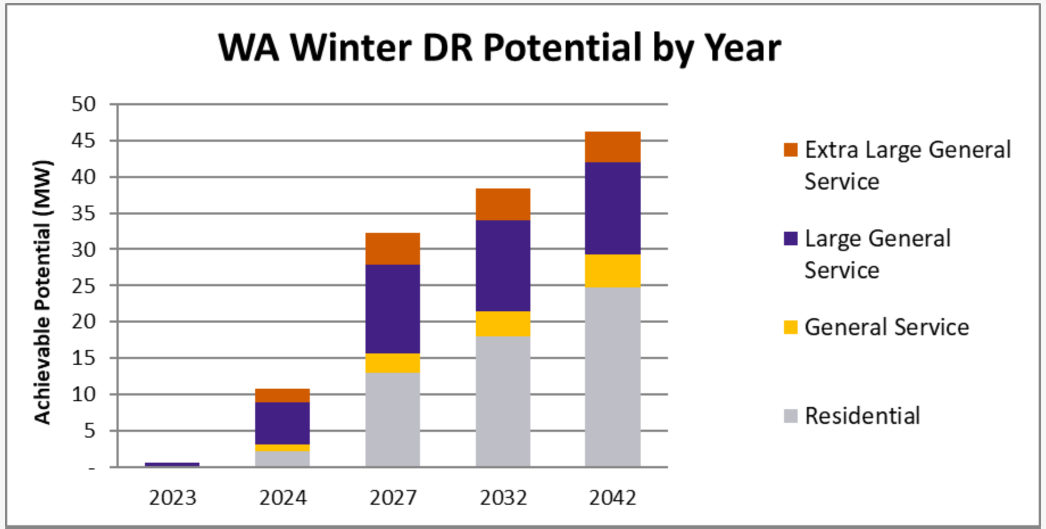
Summer DR Potential

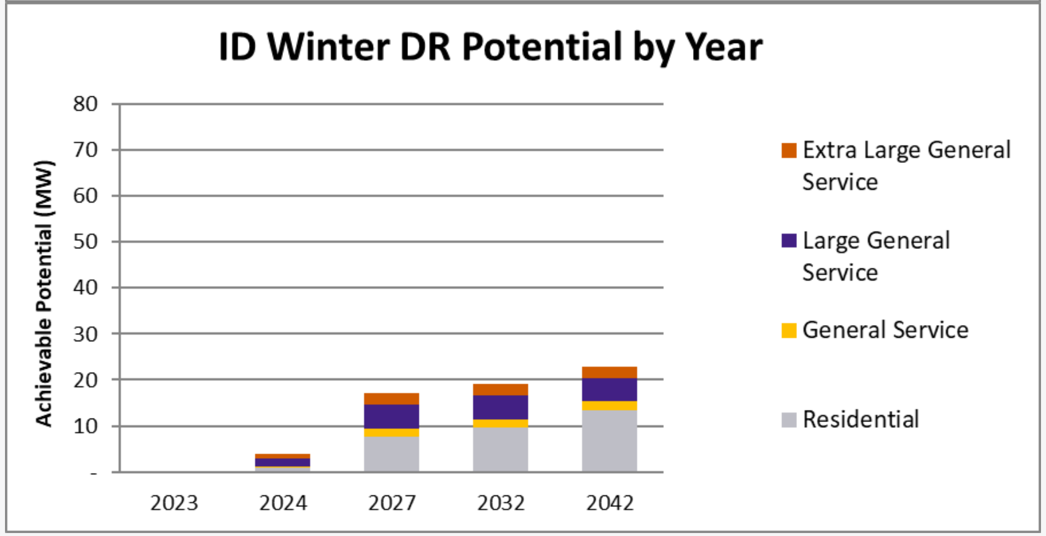


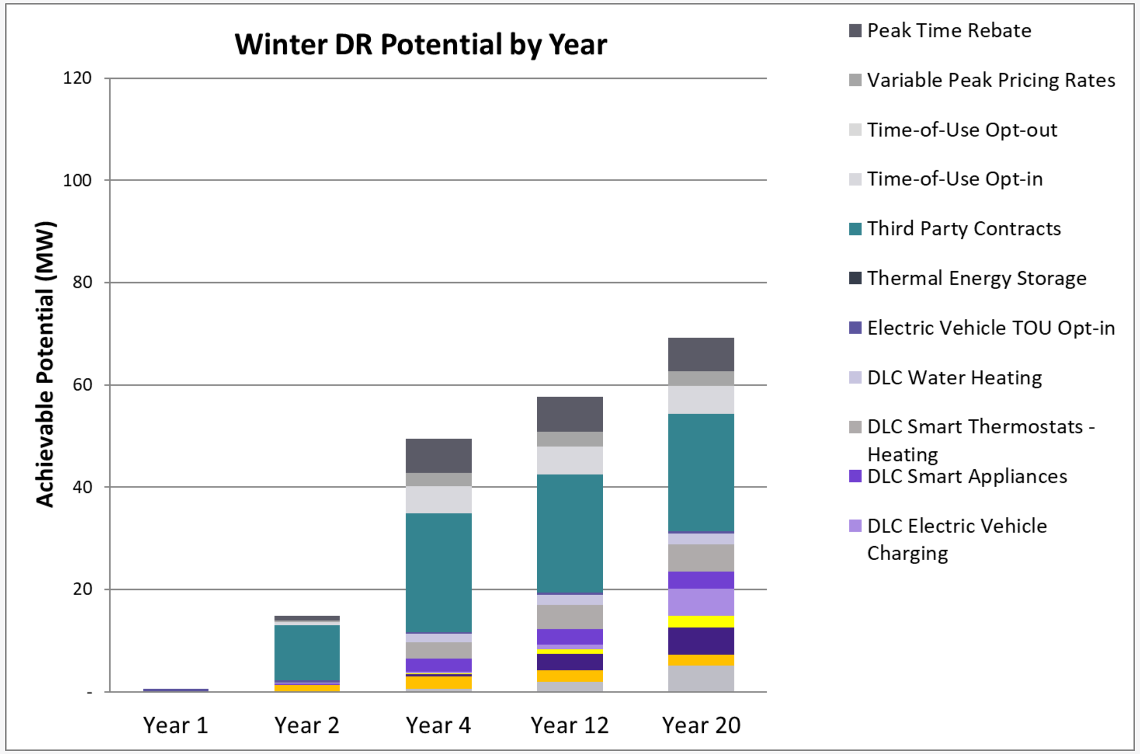




Winter DR Potential



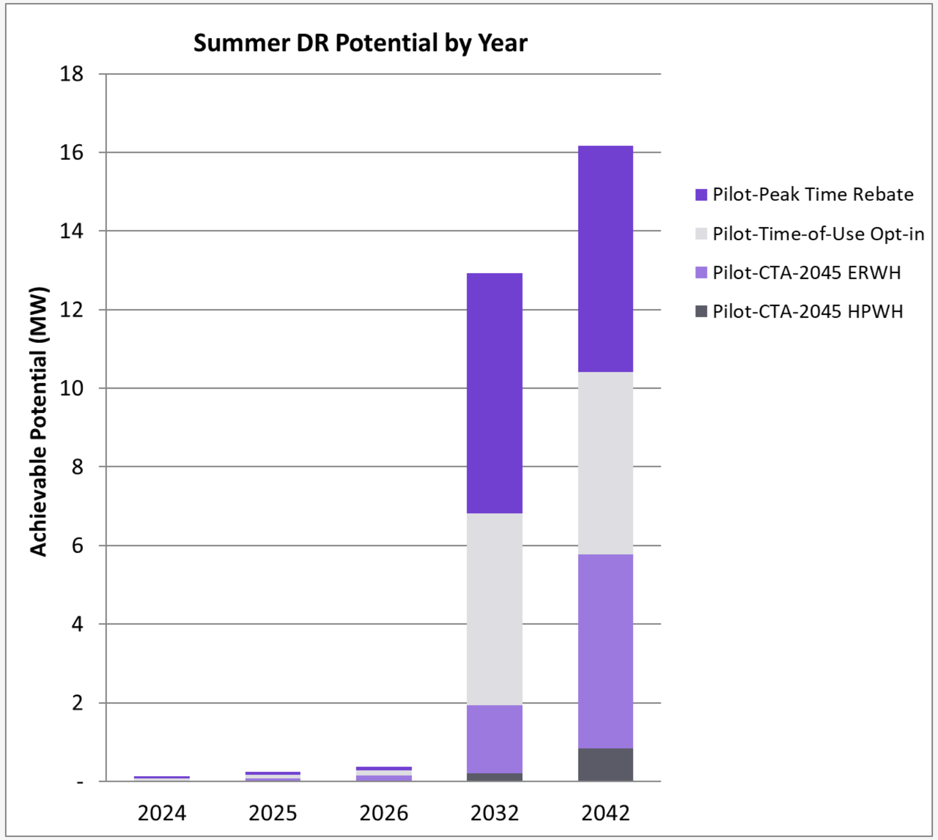




Pilot Program
Scenario WA

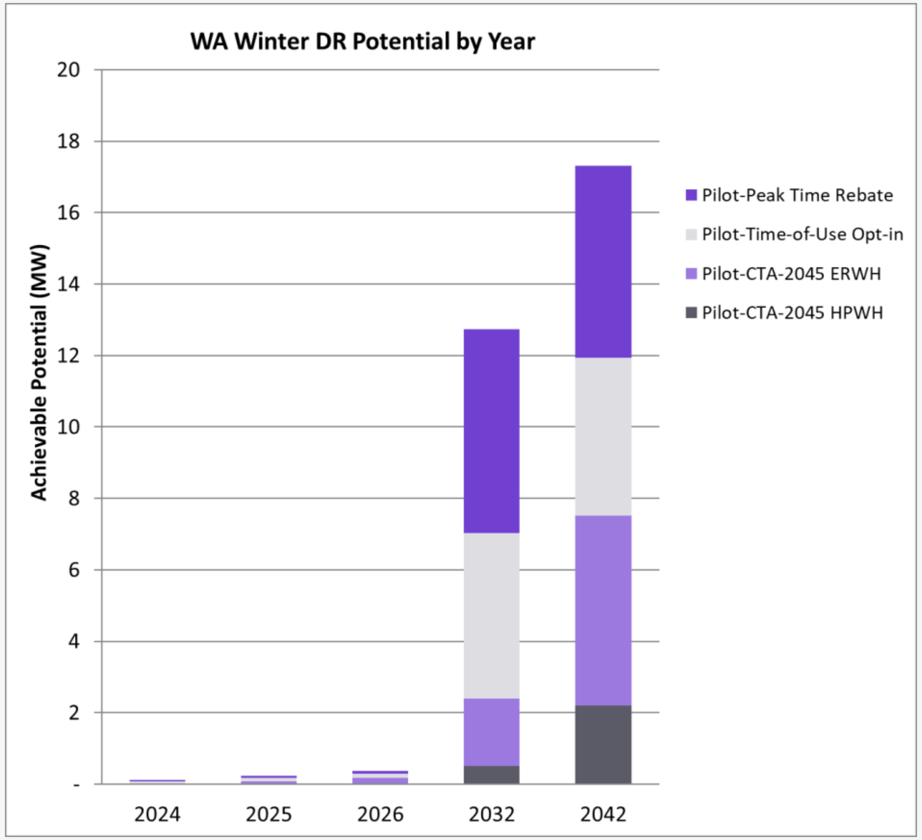
Pilot Programs Summer DR Potential

Pilot Summer Potential	2024	2025	2026	2032	2042
Baseline Forecast (MW)	**941**	**944**	**948**	**975**	**1,024**
Achievable Potential (MW)	**0.1**	**0.2**	**0.4**	**12.9**	**16.2**
Pilot-CTA-2045 HPWH	0.0	0.0	0.0	0.2	0.8
Pilot-CTA-2045 ERWH	0.0	0.1	0.1	1.7	4.9
Pilot-Time-of-Use Opt-in	0.1	0.1	0.1	4.9	4.7
Pilot-Peak Time Rebate	0.0	0.1	0.1	6.1	5.7



Pilot Programs Winter DR Potential

Pilot Winter Potential	2024	2025	2026	2032	2042
Baseline Forecast (MW)	**910**	**914**	**917**	**942**	**988**
Achievable Potential (MW)	**0.1**	**0.2**	**0.4**	**12.7**	**17.3**
Pilot-CTA-2045 HPWH	0.0	0.0	0.0	0.5	2.2
Pilot-CTA-2045 ERWH	0.0	0.1	0.2	1.9	5.3
Pilot-Time-of-Use Opt-in	0.1	0.1	0.1	4.6	4.4
Pilot-Peak Time Rebate	0.0	0.1	0.1	5.7	5.4



Demand Response Program Costs

Developing Demand Response Resource Costs

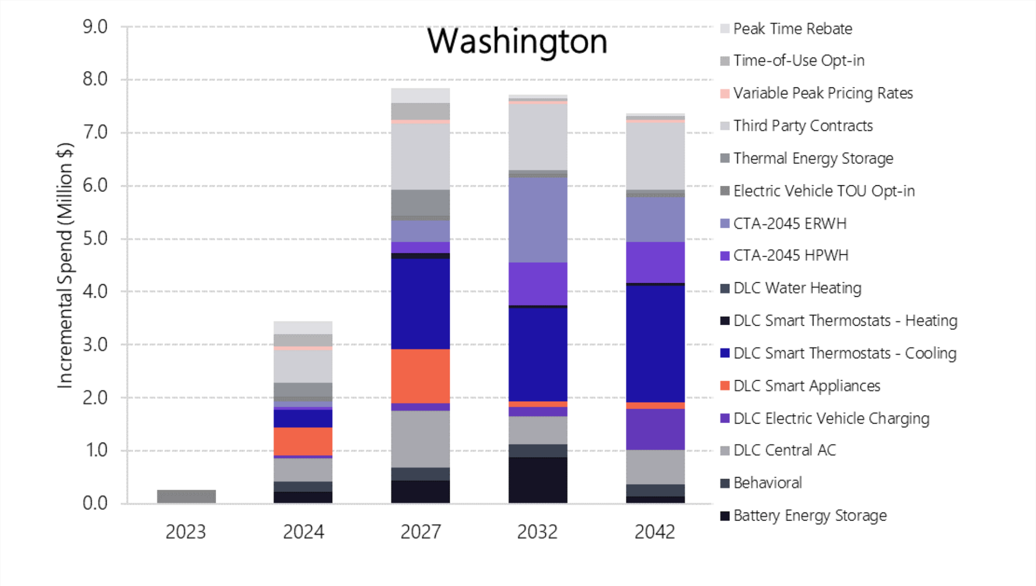
- ✓ DR Programs have both upfront and ongoing costs according to the table below
- ✓ DR costs are amortized over 10 years to allow programs time to fully ramp up
- ✓ Levelized costs are presented in $/kW-year

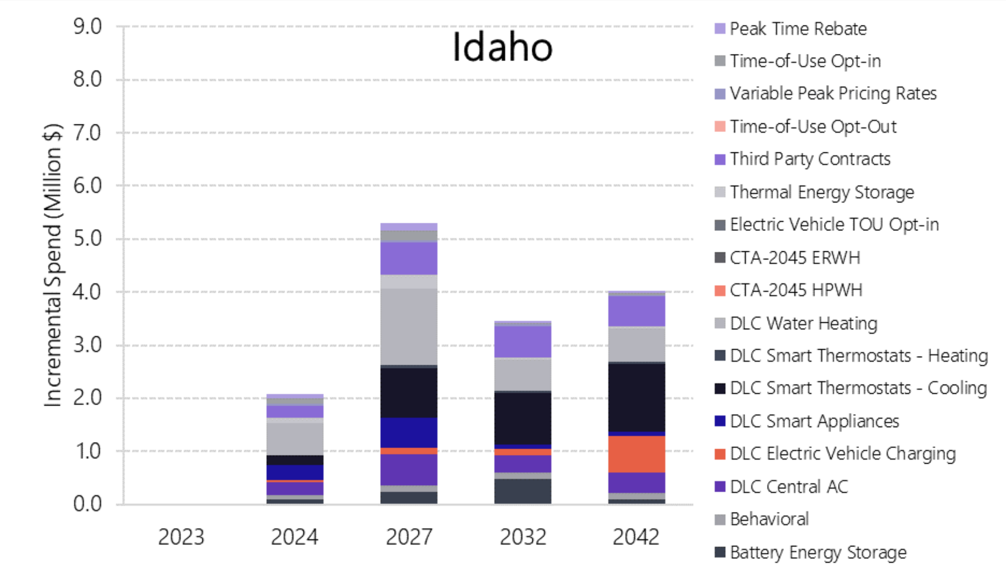
One-Time Fixed Costs	One-Time Variable Costs	Ongoing Costs
Program Development Costs ($/program)	Equipment Costs ($/participant)	Administrative Costs (shared costs)
	Marketing Costs ($/participant)	O&M Costs ($/participant)
		Incentives ($/participant or $/kW)

Example: Residential Grid-Interactive Electric Resistance Water Heaters

Cost Type	Unit	Cost
Development	$/program	$34,000
Administrative	$/program/yr	$40,800
O&M	$/participant/yr	$0
Marketing	$/new participant	$60
Equipment	$/new participant	$170
Incentive	$/program/yr	$24

Program Costs





Thank You.

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APPLIED ENERGY GROUP

Appendix

Baseline Projection

- ✓ "How much energy would customers use in the future if Avista stopped running conservation programs now and in the absence of naturally occurring efficiency?"
  - The baseline projection answers this question
- ✓ The baseline projection is an independent end-use forecast of electric or natural gas consumption at the same level of detail as the market profile

The baseline projection:

Includes

- To the extent possible, the same forecast drivers used in the official load forecast, particularly customer growth, natural gas prices, normal weather, income growth, etc.
- Trends in appliance saturations, including distinctions for new construction.
- Efficiency options available for each technology , with share of purchases reflecting codes and standards (current and finalized future standards)
- Expected impact of appliance standards that are "on the books"
- Expected impact of building codes, as reflected in market profiles for new construction
- Market baselines when present in regional planning assumptions

Excludes

- Expected impact of naturally occurring efficiency (except market baselines)
  - **Exception:** RTF workbooks have a market baseline for lighting, which AEG's models also use.
- Impacts of current and future demand-side management programs
- Potential future codes and standards not yet enacted

Conventional DLC Assumptions

Conventional DLC Assumptions		Program Option	Residential	General Service	Large General Service	Extra Large General Service	Source
	Peak Impacts	Central AC	0.5 kW	1.25 kW			NWPCC DLC Switch Cooling
		Water Heating	0.5 kW	1.26 kW			Best Estimate based on Industry Exp.
		Electric Vehicle Charging	0.5 kW				Avista Background and Research
	Steady-State Participation	Central AC	10%	10%			NWPCC DLC Switch Cooling
		Water Heating	15%	5%			Best Estimate based on Industry Exp.
		Electric Vehicle Charging	25%				NWPCC Electric Resistance Grid-Ready

Smart/Interactive DLC Assumptions

		Program Option	Residential	General Service	Large General Service	Extra Large General Service	Source
Smart/Interactive DLC Assumptions	Peak Impacts	Smart Thermostats - Cooling	0.5 kW	1.25 kW			NWPCC Smart Thermostat- Cooling (Adjusted for proposed cycling strategy)
		Smart Thermostats - Heating	1.09 kW	1.35 kW			NWPCC Smart Thermostat- Heating
		Grid-Interactive WH (ER)	0.35-0.37 kW	0.87 kW			BPA 2018 Peak Mitigation (ER)
		Grid-Interactive WH (HP)	0.09-0.22 kW	0.21 kW			BPA 2018 Peak Mitigation (HP)
		Smart Appliances	0.14 kW	0.14 kW			Ghatikar, Rish. Demand Response Automation in Appliance and Equipment. Lawrence Berkley National Laboratory, 2015
		Third Party Curtailment		10%	21%	21%	2019 Statewide Load Impact Evaluation of California Aggregator Demand Response Programs
	Steady-State Participation	Smart Thermostats - Cooling	20%	20%			NWPCC Smart Thermostat Cooling
		Smart Thermostats - Heating	5%	3%			Piggybacks off of cooling- Adjusted down to reflect realistic participation for space heating in Avista's territory
		Grid-Interactive WH (ER)	50%	50%			Reflects Rollout→ Ten-Year Ramp Rate
		Grid-Interactive WH (HP)	50%	50%			Reflects Rollout→ Ten-Year Ramp Rate
		Smart Appliances	5%	5%			2015 ISACA IT Risk Reward Barometer - US Consumer Results. October 2015
		Third Party Contracts		15%	21%	22%	Best Estimate based on Industry Exp.

Time-Varying Rates/Behavioral Assumptions

Time-Varying Rates/Behavioral Assumptions		Program Option	Residential	General Service	Large General Service	Extra Large General Service	Source
	Peak Impacts	Behavioral	2%				Opower documentation for Behavioral DR with Consumers and DTE
		Time-of-Use Opt-In	2.9%-5.7%	0.1%-0.2%	1.3%-2.6%	1.6%-3.1%	Brattle Analysis and Estimate - PacifiCorp 2019 opt-in scenario
		Time-of-Use Opt-Out	1.7%-3.4%	0.1%-0.2%	1.3%-2.6%	1.6%-3.1%	Brattle Analysis and Estimate - PacifiCorp 2019 opt-out scenario
		Time-of-Use Electric Vehicles		0.1%-0.2%	1.3%-2.6%		Brattle Analysis and Estimate - PacifiCorp 2019 opt-in scenario
		Variable Peak Pricing	8%-10%	3%-4%	3%-4%	3%-4%	OG&E 2020 Smart Hours Study
	Steady-State Participation	Behavioral	20%				PG&E rollout with six waves
		Time-of-Use Opt-In	13%	13%	13%	13%	Best estimate based on industry experience; Brattle Analysis and Estimate
		Time-of-Use Opt-Out	74%	74%	74%	74%	Best estimate based on industry experience; Brattle Analysis and Estimate
		Time-of-Use Electric Vehicles		13%	13%		Best estimate based on industry experience; Brattle Analysis and Estimate
		Variable Peak Pricing	25%	25%	25%	25%	OG&E 2020 Smart Hours Study

Energy Storage Assumptions

		Program Option	Residential	General Service	Large General Service	Extra Large General Service	Source
Energy Storage Assumptions	Peak Impacts	Battery	2 kW	2 kW	15 kW	15 kW	Typical Battery Size Per Segment
		Thermal	0.5 kW	1.26 kW			2016 Ice Bear Tech Specifications
	Steady-State Participation	Battery	0.5%	0.5%	0.5%	0.5%	Best Estimate Based on Industry Exp.
		Thermal		0.5%	1.5%	1.5%	Best Estimate Based on Industry Exp.

MDC Research
Your Trusted Insights Partner Since 1978

Avista IRP Clean Energy Research

April 2022

Research Overview

Objectives

Determine willingness to pay for the implementation of clean energy among Avista customers

- Establish baseline of environmental concerns; perceived responsibility of individuals, businesses, and Avista specifically
- Understand customer tradeoffs between bill increases and carbon emission goals
- Explore perceptions associated with Avista should they invest in carbon-neutral or carbon-free emissions
- Gauge perceptions specific to natural gas preferences and tradeoffs
- Quantify differences by state, customer type, green perceptions, and demographic factors

Methodology

Web survey with Avista customers.

- Customers from Washington, Idaho, and Oregon sourced randomly by email
- Survey optimized for both desktop and mobile
- Conducted in April 2022
- Final sample size of n=1,100

Proportional representation of state and service type.

WA	ID	OR
52%	29%	20%

G	GE	E
25%	47%	29%

Respondents screened to ensure appropriate target

- Avista customer age 18+
- Has or shares household finance and utility bill responsibility
- Not employed by a utility company, or in media, advertising, or market research firm

Report Interpretation

- All significant differences are reported at the 95% confidence level or higher. The total sample size of n=1,100 has a maximum sampling variability of +/-3.0% at the 95% level.
- Some percentages may not add to 100% due to rounding

Analysis Approach

This study incorporates a conjoint exercise to force tradeoffs between various green initiatives and customer willingness to pay.

Respondents review various combinations of **energy goals**, **timeframes for that goal**, **energy sources**, and **potential bill increases**, and select their “most preferred” from a series of options (including an option for “none” each time).

Subsequent analysis produces utility scores for each individual attribute, allowing us to calculate which combination has the broadest appeal.

Energy Goal	Investing in renewables to achieve carbon neutrality Providing 100% carbon-free power by only generating energy through clean energy sources
Goal Timeframe	In the next year In the next 5 years (by 2027) In the next 10 years (by 2032) In the next 25 years (by 2047)
Bill Increase	2% monthly increase 5% monthly increase 10% monthly increase 20% monthly increase 50% monthly increase 100% monthly increase
Energy Source	Sourced locally Sourced regionally Sourced from anywhere

Key Takeaways

Price is Important.

When faced with tradeoffs, price is the prevailing factor. While the majority of customers find importance in sourcing green or local energy, they are only willing to pay so much. Anything beyond a 10% monthly bill increase shows significant declines in popularity.

If bill increases to invest in carbon-free or carbon-neutral options are kept below 10%, the specific energy goal, timeframe, local vs. regional source are less important.

Some customers see beyond price

Increases beyond 10% monthly still appeal to a certain subset of customers, particularly those who place great importance on “green,” and/or when the goal can be achieved within the next 10 years.

Any increase to invest in “green” energy will alienate some customers

Overall, roughly one in five do not find importance in being “green”

When evaluating various green investment options, 17% reject all, including more ambitious outcomes for just a 2% increase

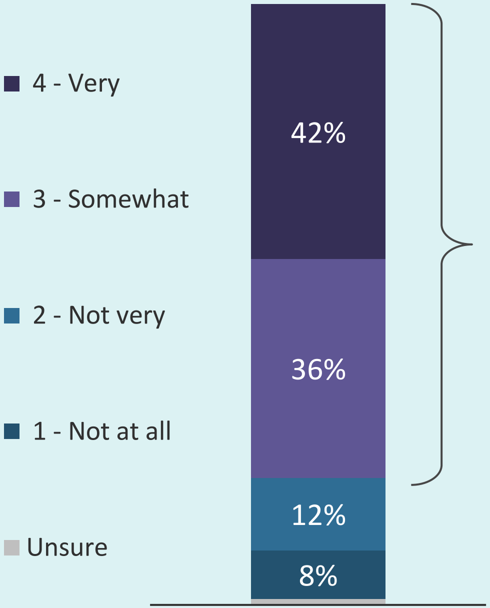
Three in ten say they would be likely to seek bill assistance or consider moving to another state if bill were to increase due to Avista investing in carbon-free or carbon-neutral energy

Detailed Findings: **Green Insights**

At a personal level, the concept of being environmentally friendly or "green" is important to nearly eight in ten customers

Personal Importance of "Green"

(n=1,100)



78%

find the concept of being "green" important

Key Differences and Insights

Green importance differs by state.

Customers in **Oregon** and **Washington** are significantly more likely than those in Idaho to find the concept of "green" to be important.

83% 80% 71%

Green importance differs by area.

Customers in **urban** areas are significantly more likely than those in rural areas to find the concept important.

urban 84%

suburban 80%

rural 75%

Green importance differs by gender.

Women are significantly more likely than men to find it important.

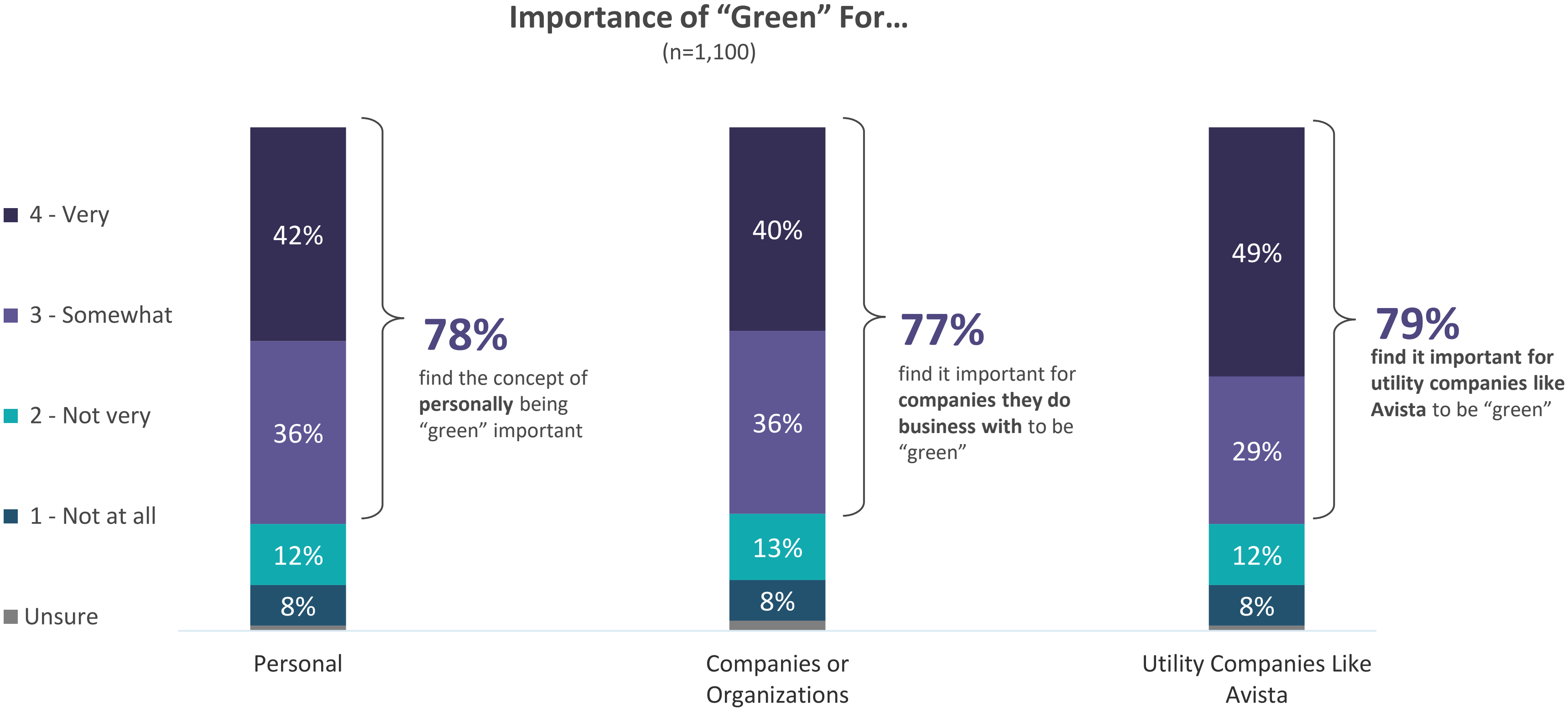
♀ 85%

♂ 73%

Green importance is <u>consistent across age and income categories</u>.

Q1. How important is the concept of being environmentally friendly or "green" to you personally?

Customers place similar importance on the "green" responsibility of themselves, businesses, and utility companies



78% find the concept of **personally** being "green" important

77% find it important for **companies they do business with** to be "green"

79% **find it important for utility companies like Avista** to be "green"

Q1. How important is the concept of being environmentally friendly or "green" to you personally?
Q3. How important is it for general companies or organizations you do business with to be environmentally friendly or "green?"
Q4. How important is it specifically for utility companies like Avista to be environmentally friendly or "green?"

Personal importance to be "green" is driven by responsibility to protect the planet; for those believing it is not important to personally be green, cost is the main reason

Why is it Important?

(n=860)

- To protect our planet/environment (38%)
- Good for the future/future generations (24%)
- Responsibility/right thing to do/stewardship (16%)
- To address climate change/global warming (13%)

"If we take care of our planet, it will in turn last for generations to come. If we take care of it, it will always take care of us."

"Every person has to take responsibility for the environment. We are stewards of the Earth after all. That responsibility cannot, and should, not be abrogated. If we don't stand up and insist on choices that protect that for which we are responsible then no one will and we necessarily choose a very dark alternative for an uncertain and unjust future."

Why is it NOT Important?

(n=224)

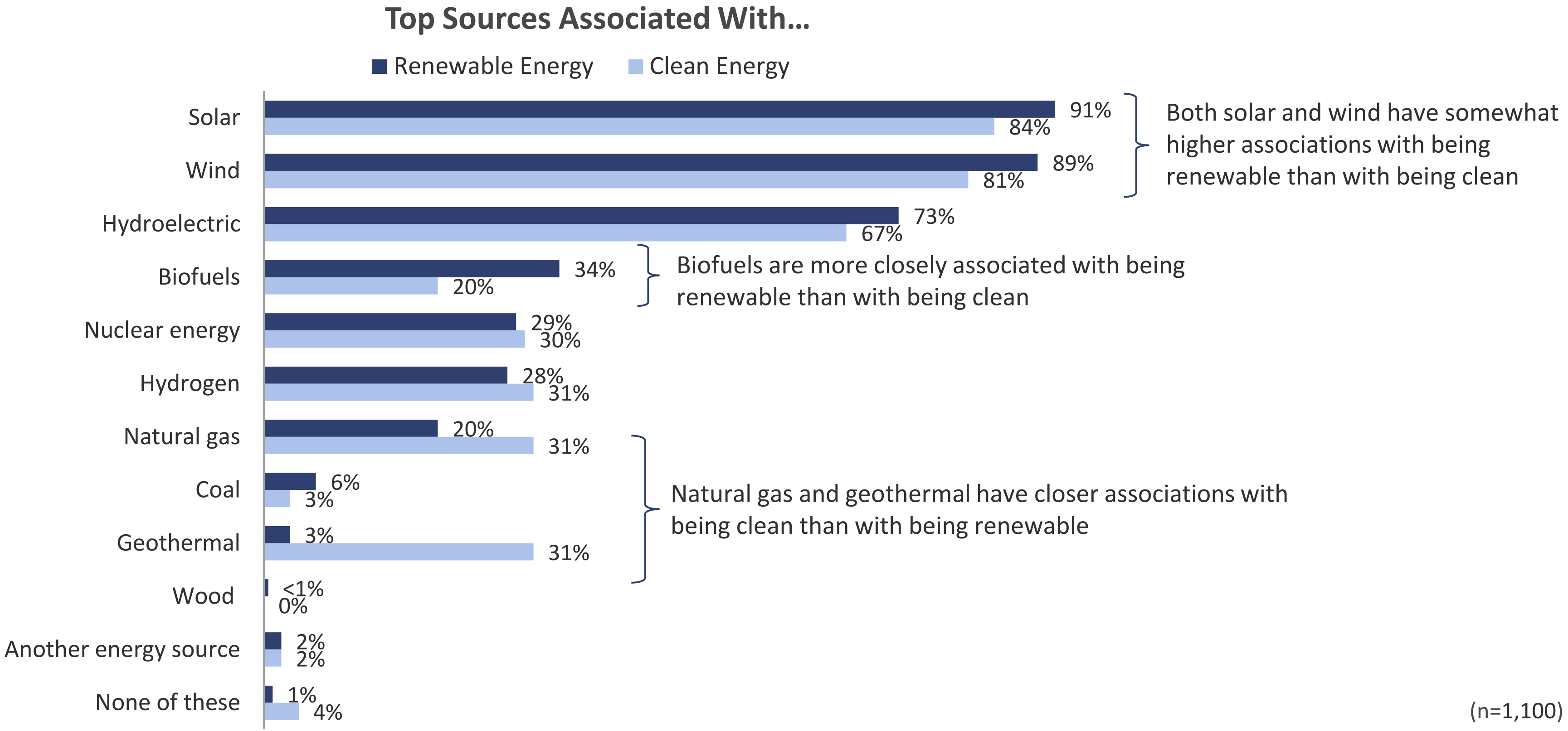
- Cost/it's expensive (29%)
- Not real/hoax/misinformation (25%)
- "Green" is worse for the environment, not better (20%)
- Politics/Political Agenda (17%)

"In the 60+ years I've been around, the air land and waters have markedly improved. As the current crop of 'renewables' are unreliable and expensive, good ol' fossil fuels are the best bang for bucks."

"Because the terms 'environmentally friendly' and 'green' have been distorted to the point where they have little relevance to actually protecting the environment."

Q2A. Why is it [very/somewhat important] to personally be environmentally friendly or "green?"
Q2B. Why is it [not very/not at all important] to personally be environmentally friendly or "green?"

Solar and wind are commonly associated with both renewable and clean energy



Both solar and wind have somewhat higher associations with being renewable than with being clean

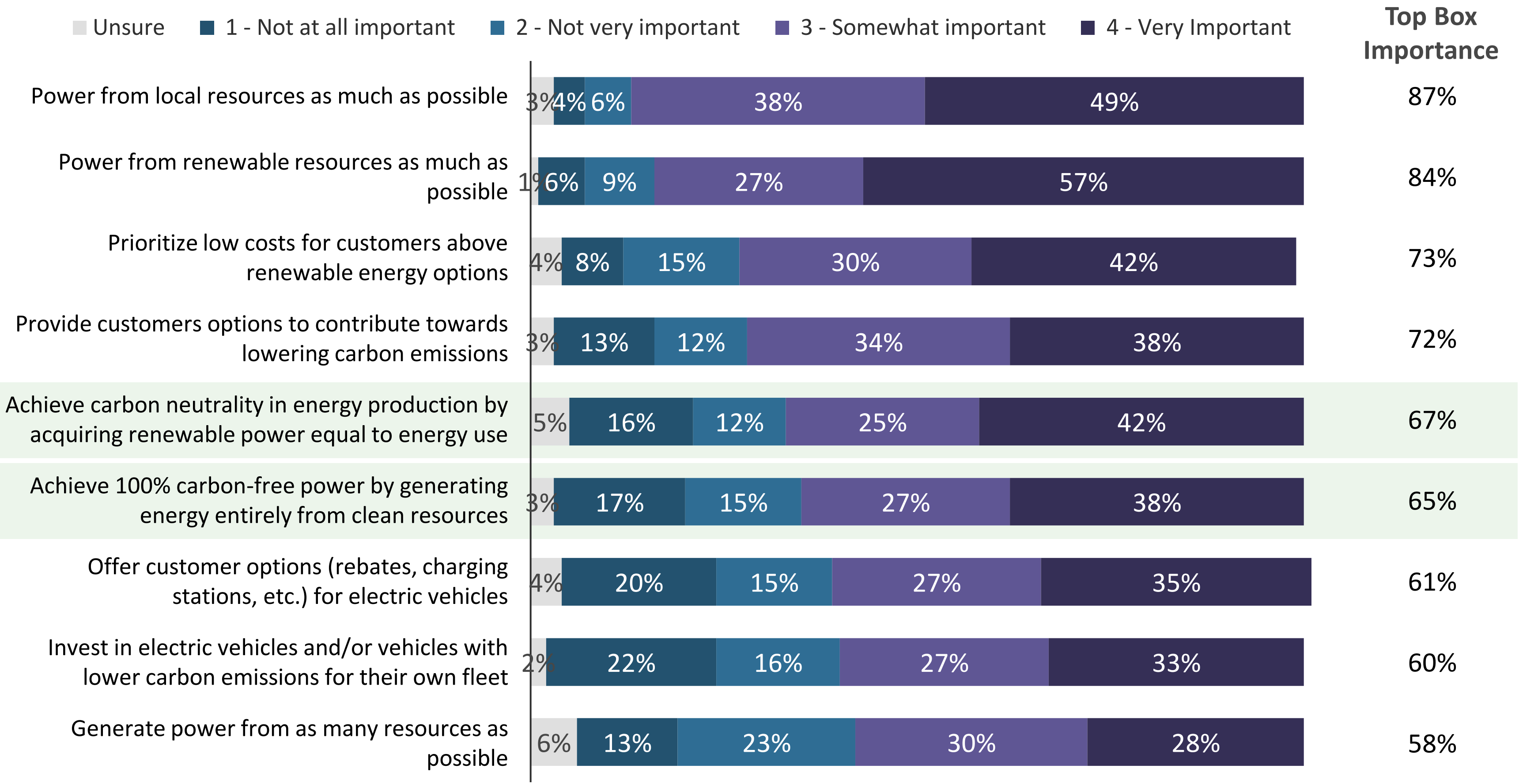
Biofuels are more closely associated with being renewable than with being clean

Natural gas and geothermal have closer associations with being clean than with being renewable

(n=1,100)

Q6. When you hear the words "renewable energy," what sources come to mind?
Q7. When you hear the words "clean energy," what sources come to mind?

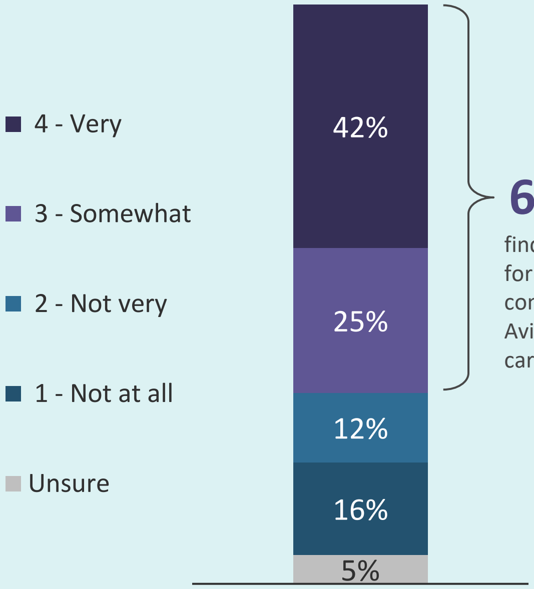
When considering potential utility company initiatives, customers place highest importance on generating power from local and renewable resources



Q5. How important is it for utility companies like Avista to do each of the following?

Customers place near equal importance on Avista achieving carbon neutrality and on achieving 100% carbon-free power

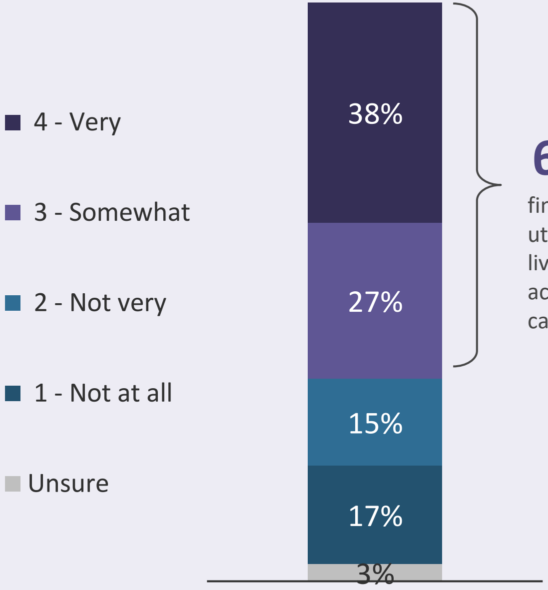
Importance For Avista to
Achieve Carbon Neutrality
(n=1,100)



67%

find it important for utility companies like Avista to achieve carbon neutrality

Importance of Avista Achieving
100% Carbon-Free Power
(n=1,100)



65%

find it important for utility companies live Avista to achieve 100% carbon-free power

Q5. How important is it for utility companies like Avista to do each of the following?

Achieve carbon neutrality in energy production by acquiring renewable power equal to energy use.

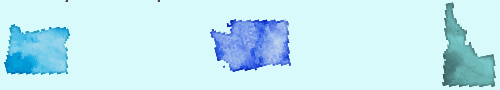
Achieve 100% carbon-free power by generating energy entirely from clean resources.

The importance of Avista achieving these goals differs by certain key audiences

Key Differences and Insights: Carbon Neutrality

Carbon neutrality importance differs by state.

Customers in **Oregon** are significantly more likely than those in Idaho to say it is important for to achieve carbon neutrality.



73% 67% 61%

Carbon neutrality importance differs by area.

Customers in **urban** areas are significantly more likely than those in rural areas to find the achievement important.

urban	suburban	rural
72%	69%	63%

Carbon neutrality importance differs by gender.

Women are significantly more likely than men to find it important.

♀ 75% ♂ 60%

Importance of carbon neutrality differs by income.

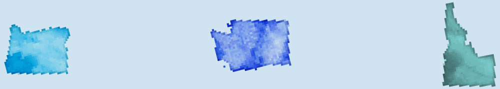
Those making **$150K+ in household income** are significantly more likely than those making less than $60K to say it is important.

<$60K	$150K+
62%	72%

Key Differences and Insights: 100% Carbon-Free

Carbon-free power importance differs by state.

Customers in **Oregon** are significantly more likely than those in Idaho to find an achievement of 100% carbon-free to be important.



69% 66% 60%

Carbon-free power importance differs by area.

Customers in **urban** and **suburban** areas are significantly more likely than those in rural areas to find the achievement important.

urban	suburban	rural
74%	67%	59%

Importance of 100% carbon-free power differs by gender.

Women are significantly more likely than men to find it important.

♀ 73% ♂ 59%

Importance is consistent across age and income categories.

Q5H. How important is it for utility companies like Avista to do each of the following? *Achieve carbon neutrality in energy production by acquiring renewable power equal to energy use. | Achieve 100% carbon-free power by generating energy entirely from clean resources.*

Detailed Findings:
Green Investment

Conjoint Results Summary: Overall Feature Scoring

Category	Attribute	Result	Meaning
Energy Goal	Investing in renewables to achieve carbon neutrality	0.55	If all other factors are held consistent, providing 100% carbon-free energy vs. investing in carbon neutrality has almost no impact
	Providing 100% carbon-free power by only generating energy through clean energy sources	0.59	
Goal Timeframe	In the next year	0.60	There is a drop-off in utility at the 25-year level; however, there is little differentiation between *in the next year*, *five years*, or *ten years* when all other factors are held consistent
	In the next 5 years (by 2027)	0.59	
	In the next 10 years (by 2032)	0.59	
	In the next 25 years (by 2047)	0.52	
Bill Increase	2% monthly increase	0.83	If all other factors are held consistent, the monthly bill increase has the biggest impact; utility drops off considerably with more than a 10% increase
	5% monthly increase	0.78	
	10% monthly increase	0.69	
	20% monthly increase	0.53	It should be noted, however, that those placing high importance on being green demonstrate a willingness to pay beyond the 10% mark
	50% monthly increase	0.36	
	100% monthly increase	0.25	
Energy Source	Sourced locally	0.59	Though 87% find sourcing power locally to be important, ultimately there is little differentiation between *local*, *regional*, and *anywhere*, when considering other factors along with locality
	Sourced regionally	0.58	
	Sourced from anywhere	0.55	
None		0.39	Overall, 17% of respondents said no to all options presented, indicating no willingness to pay for green investments

(n=1,100)

C2. Now, we will present you with a series of 12 screens, each with a set of options for an energy package that could be made available in the future for your home. For each set, please indicate the one you would be most likely to choose. You can always select "none" if you would not select any of the options.

Conjoint Results Summary: Feature Scores by Personal Green Importance

Category	Attribute	Feature Score by Green Importance		
		Very (n=445)	Somewhat (n=399)	Not (n=331)
Energy Goal	Investing in renewables to achieve carbon neutrality	0.67	0.53	0.38
	Providing 100% carbon-free power by only generating energy through clean energy sources	0.76	0.54	0.35
Goal Timeframe	In the next year	0.79	0.54	0.33
	In the next 5 years (by 2027)	0.76	0.54	0.35
	In the next 10 years (by 2032)	0.72	0.55	0.38
	In the next 25 years (by 2047)	0.59	0.52	0.39
Bill Increase	2% monthly increase	0.87	0.86	0.71
	5% monthly increase	0.88	0.78	0.60
	10% monthly increase	0.85	0.65	0.45
	20% monthly increase	0.74	0.46	0.24
	50% monthly increase	0.53	0.30	0.13
	100% monthly increase	0.42	0.17	0.04
Energy Source	Sourced locally	0.72	0.55	0.39
	Sourced regionally	0.73	0.55	0.37
	Sourced from anywhere	0.69	0.51	0.34
None		0.14	0.43	0.80

C2. Now, we will present you with a series of 12 screens, each with a set of options for an energy package that could be made available in the future for your home. For each set, please indicate the one you would be most likely to choose. You can always select “none” if you would not select any of the options.

Conjoint Results Summary: Feature Scores by Service Type

Category	Attribute	Feature Score by Service Type		
		Gas Only (n=271)	**Dual** (n=513)	**Electric Only** (n=316)
Energy Goal	Investing in renewables to achieve carbon neutrality	0.57	0.56	0.54
	Providing 100% carbon-free power by only generating energy through clean energy sources	0.61	0.60	0.58
Goal Timeframe	In the next year	0.63	0.60	0.58
	In the next 5 years (by 2027)	0.62	0.59	0.57
	In the next 10 years (by 2032)	0.61	0.59	0.57
	In the next 25 years (by 2047)	0.52	0.52	0.51
Bill Increase	2% monthly increase	0.83	0.84	0.82
	5% monthly increase	0.79	0.79	0.76
	10% monthly increase	0.71	0.70	0.66
	20% monthly increase	0.56	0.53	0.50
	50% monthly increase	0.39	0.35	0.35
	100% monthly increase	0.28	0.24	0.24
Energy Source	Sourced locally	0.61	0.59	0.57
	Sourced regionally	0.60	0.59	0.56
	Sourced from anywhere	0.57	0.55	0.53
None		0.36	0.38	0.42

C2. Now, we will present you with a series of 12 screens, each with a set of options for an energy package that could be made available in the future for your home. For each set, please indicate the one you would be most likely to choose. You can always select “none” if you would not select any of the options.

Conjoint Results Summary: Optimal Feature Combination

Unsurprisingly, the optimal utility results from customers achieving the most for the lowest cost. While this is not a realistic scenario, it provides a baseline for any changes made to move toward carbon-free or carbon-neutral energy in the future. Subsequent slides show change from optimal should other factors be considered.

Category	Attribute
Energy Goal	Investing in renewables to achieve carbon neutrality
Goal Timeframe	In the next year
Bill Increase	2% monthly increase
Energy Source	Sourced locally

(n=1,100)

C2. Now, we will present you with a series of 12 screens, each with a set of options for an energy package that could be made available in the future for your home. For each set, please indicate the one you would be most likely to choose. You can always select “none” if you would not select any of the options.

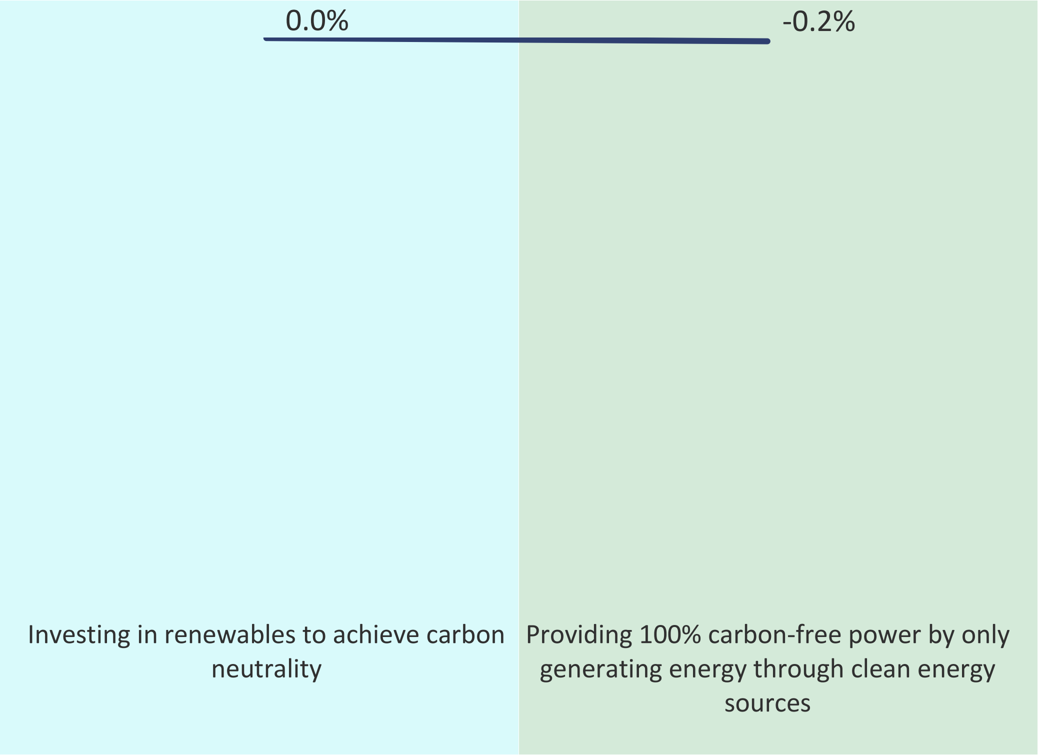
Conjoint Summary: Difference from Optimal Combination (Based on Goal)

Optimal Feature Combination

Energy Goal	Investing in renewables to achieve carbon neutrality
Goal Timeframe	In the next year
Bill Increase	2% monthly increase
Energy Source	Sourced locally

If all other factors are held consistent, providing 100% carbon-free energy vs. investing in carbon neutrality has almost no impact

Change from Optimal Based on **Goal**



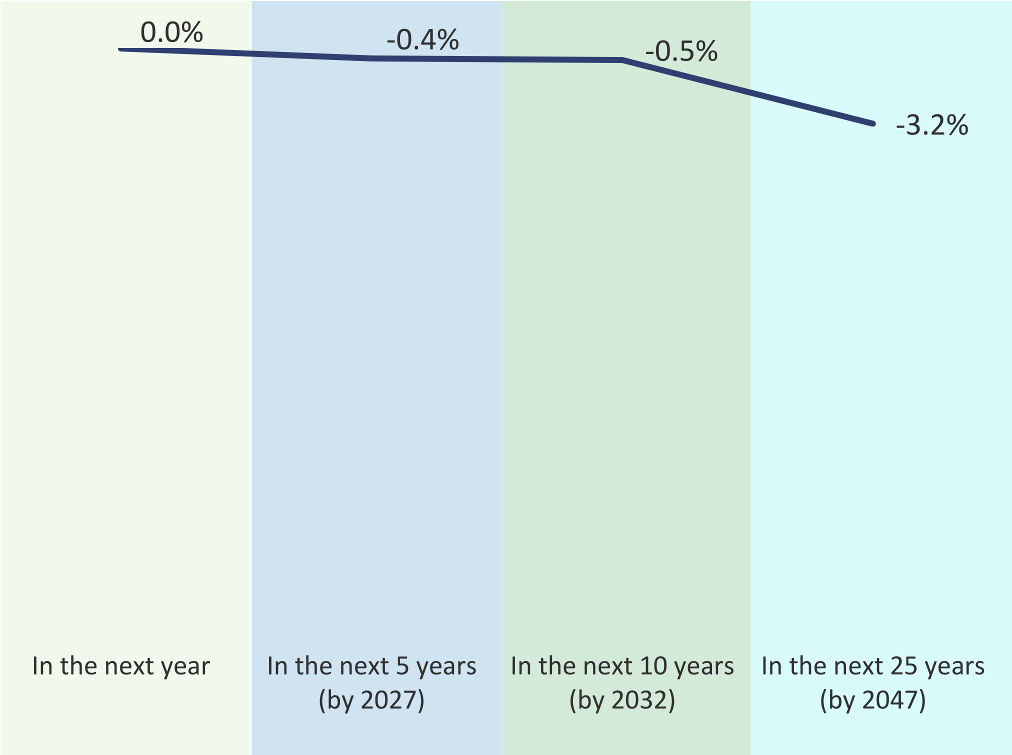
Conjoint Summary: Difference from Optimal Combination (Based on Timeframe)

Optimal Feature Combination

Energy Goal	Investing in renewables to achieve carbon neutrality
Goal Timeframe	In the next year
Bill Increase	2% monthly increase
Energy Source	Sourced locally

If all other factors are held consistent, a shorter timeline has minimal impact; utility drops off after 10 years

Change from Optimal Based on **Timeframe**



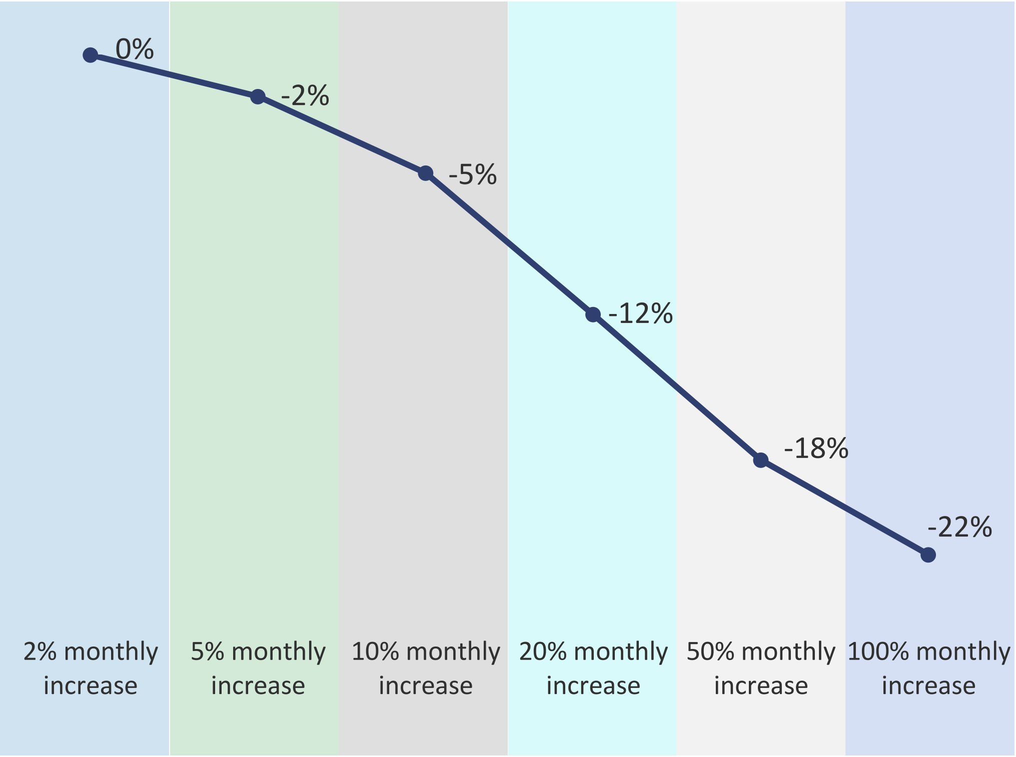
Conjoint Summary: Difference from Optimal Combination (Based on Bill Increase)

Optimal Feature Combination

Energy Goal	Investing in renewables to achieve carbon neutrality
Goal Timeframe	In the next year
Bill Increase	2% monthly increase
Energy Source	Sourced locally

If all other factors are held consistent, the monthly bill increase has the biggest impact; utility drops off considerably with more than a 10% increase

Change from Optimal Based on **Monthly Bill Increase**



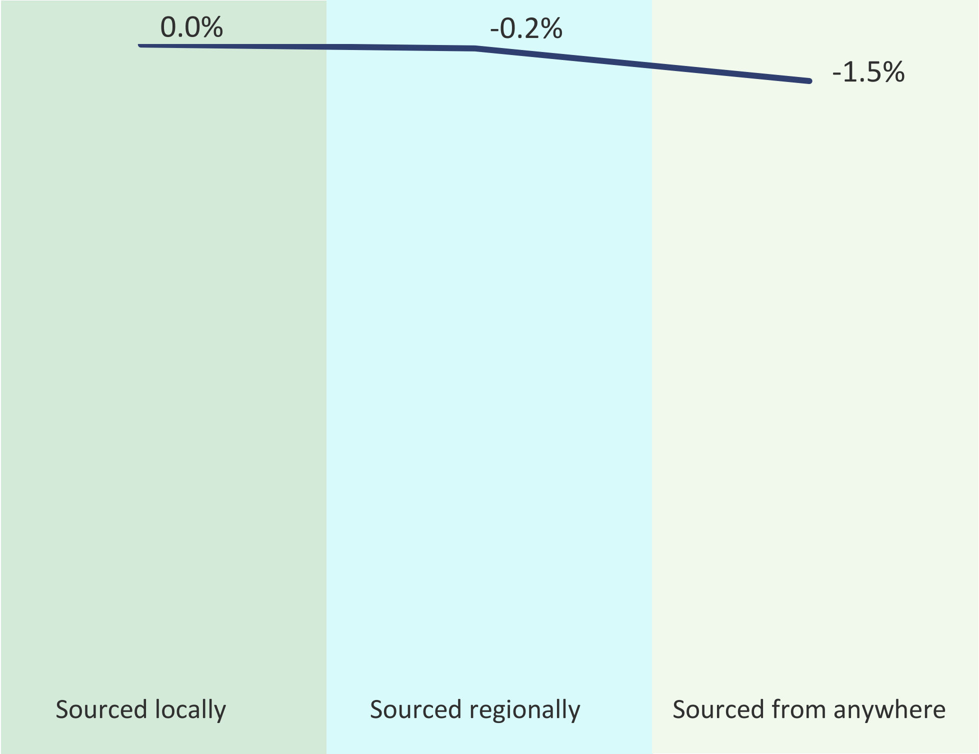
Conjoint Summary: Difference from Optimal Combination (Based on Source)

Optimal Feature Combination

Energy Goal	Investing in renewables to achieve carbon neutrality
Goal Timeframe	In the next year
Bill Increase	2% monthly increase
Energy Source	Sourced locally

If all other factors are held consistent, the source of energy has almost no impact; energy sourced locally or regionally is only slightly more preferred

Change from Optimal Based on **Source**

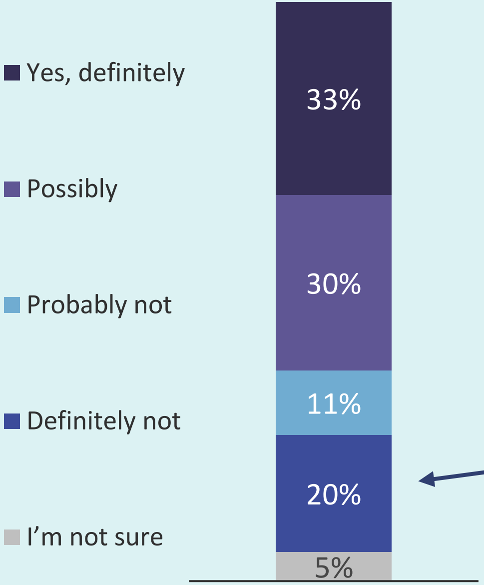


Detailed Findings:
Investment Support

Three in five customers say Avista should invest in carbon-neutral energy even if it involves a rate increase for customers

Should Avista invest in carbon-neutral or carbon-free energy, even if it involves a rate increase for customers?

(n=1,100)



Key Differences and Insights

Investment sentiment differs by income.

Those with **higher household incomes** are significantly more likely than those making $60K or less to agree Avista definitely should invest, even if it involves a rate increase.

<$60K	$60K+
28%	**42%**

Investment sentiment differs by area.

Customers in **urban** areas are significantly more likely than those in rural areas to believe Avista should definitely invest.

urban	suburban	rural
40%	**36%**	**29%**

Lack of investment support differs by gender.

While those **supporting** investment is consistent across gender**, men** are significantly more likely than women to **definitely not** support investment.

♀	♂
15%	**23%**

Support is consistent across age and state.

C3. Should Avista invest in carbon-neutral or carbon-free energy, even if it involves a rate increase for customers?

Supporters say the main reason Avista should invest in carbon-neutral energy is to “save the planet,” while the main reason to not invest among detractors is “consumer cost”

What is the main reason to invest?

(n=697)

- To save the planet (21%)
- For a cleaner environment (19%)
- For cleaner air (16%)
- To fight climate change (16%)
- Depends on cost effectiveness (16%)
- It’s the right thing to do (16%)

“Finite resources are finite. It doesn't matter that you save money today but have fewer or no energy sources later.”

What is the main reason to NOT invest?

(n=345)

- Consumer costs/expensive (57%)
- Don’t believe in it/hoax/impossible (17%)
- Unnecessary/will not change anything (16%)
- Politics/political agenda (10%)

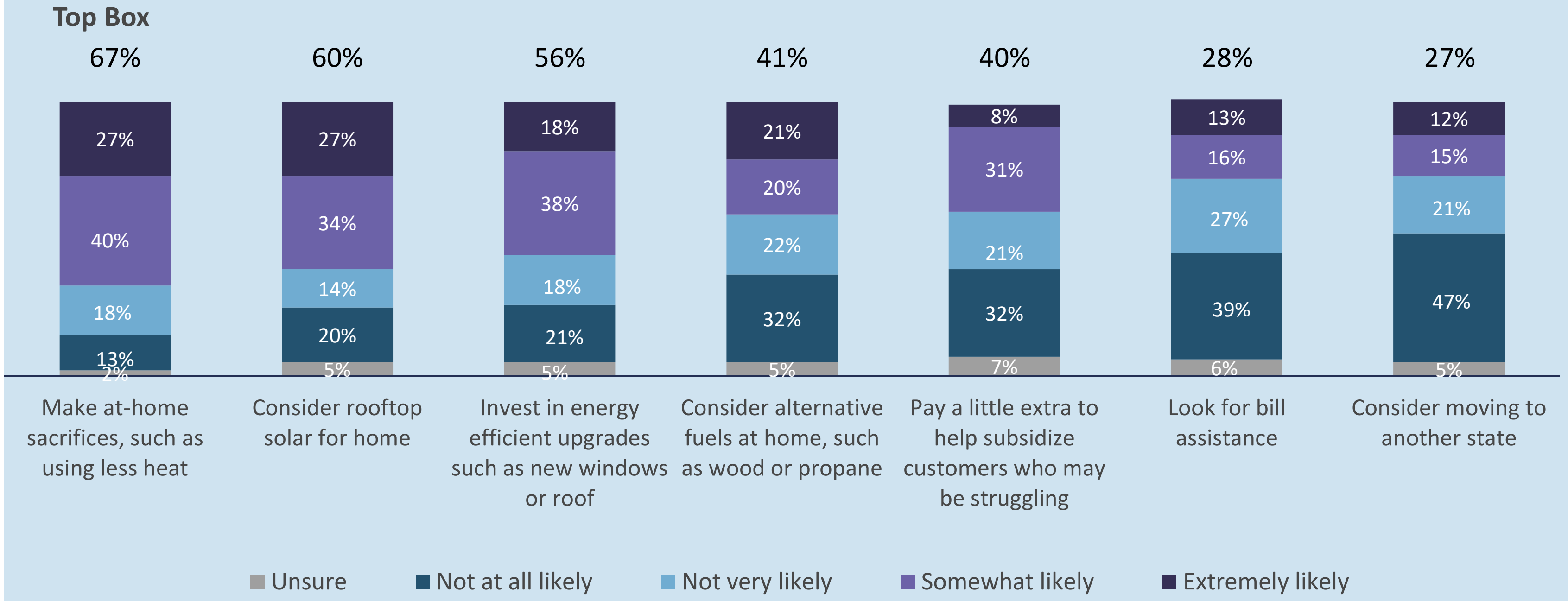
“Carbon neutral and carbon free energy are ridiculous ideas that only increase the cost of energy for everyone.”

C3A. In your opinion, what is the main reason Avista should invest in carbon-neutral or carbon-free energy, even if it involves a rate increase for customers?
C3B. In your opinion, what is the main reason or reasons Avista should not invest in carbon-neutral or carbon-free energy?

Nearly seven in ten customers would be likely to "make at home-sacrifices" if their bill increased due to Avista's investment in carbon-neutral energy

If Avista did go that route, and your bill increased, how likely would you be to take each of the following actions?

(n=1,100)

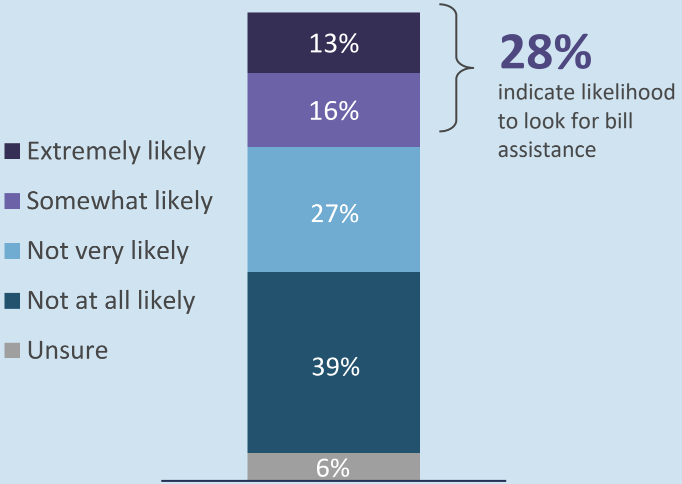


C4. If Avista did go that route, and your bill increased, how likely would you be to take each of the following actions?

Just over a quarter indicate they'd seek bill assistance should rates rise due to Avista pursuing carbon-neutral or carbon-free options; for over half, this would take a 10% increase or more

Likelihood to Seek Bill Assistance if Bill Increased

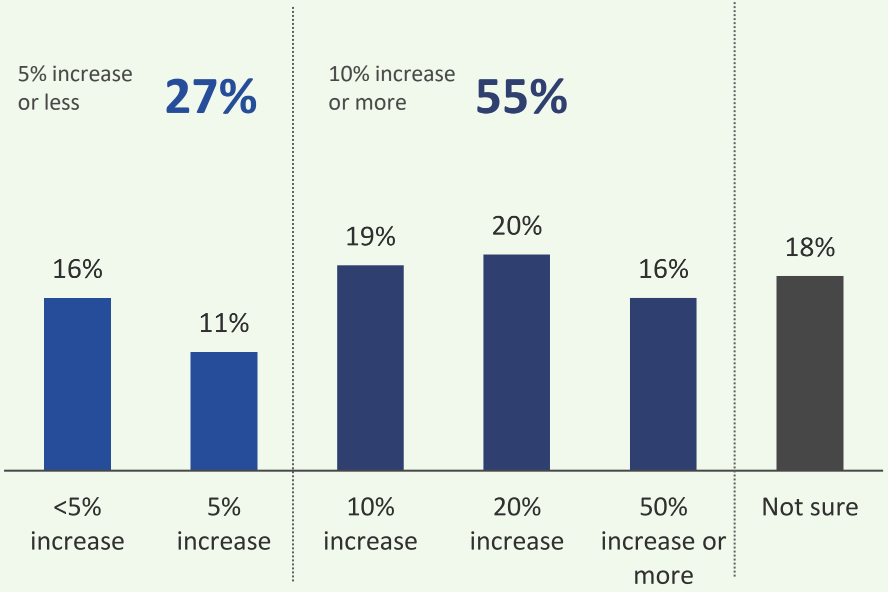
(n=1,100)



28% indicate likelihood to look for bill assistance

Level of Bill Increase That Would Drive Seeking Assistance

(Among Those Likely to Seek Assistance; n=313)



5% increase or less **27%**

10% increase or more **55%**

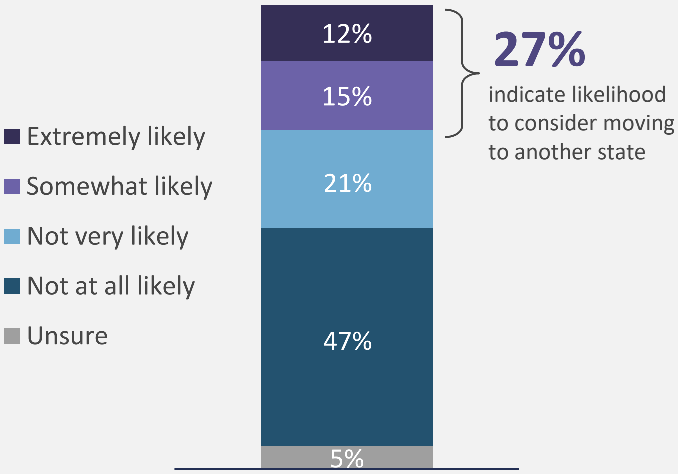
C4. If Avista did go that route, and your bill increased, how likely would you be to take each of the following actions? *Look for bill assistance*

C5. What level of bill increase would you envision driving you to seek bill assistance?

Roughly a third indicate they'd consider moving to another state should rates rise; however, there is uncertainty around what threshold of increase would drive this decision

Likelihood to Move Out of State if Bill Increased

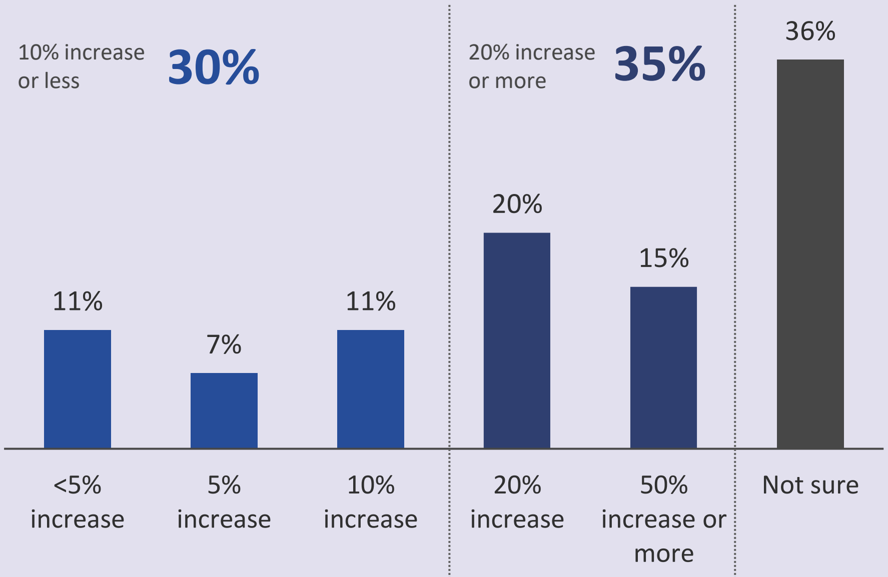
(n=1,100)



27% indicate likelihood to consider moving to another state

Level of Bill Increase That Would Drive Moving Out of State

(Among Those Likely to Consider Moving; n=299)



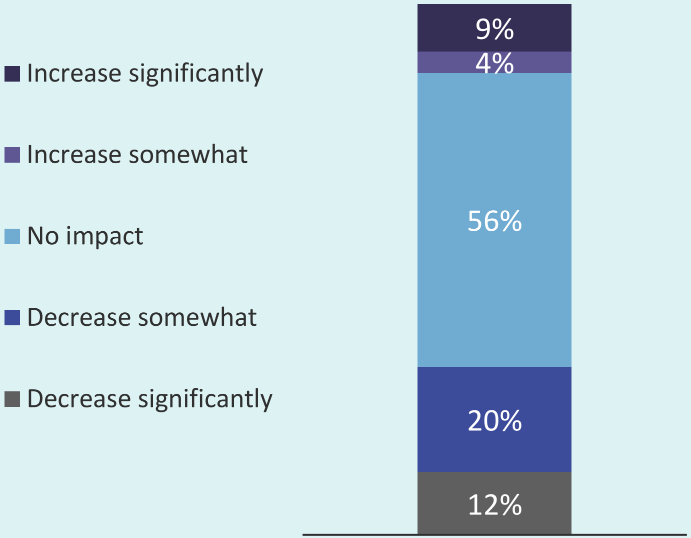
10% increase or less **30%**

20% increase or more **35%**

C4. If Avista did go that route, and your bill increased, how likely would you be to take each of the following actions? *Consider moving to another state*

C6. What level of bill increase would you envision driving you to consider moving to another state?

Over half of customers say their favorability would not be impacted if Avista does not achieve carbon neutrality by 2027



Favorability of the Company if Avista is not able to Achieve Carbon Neutrality by 2027

(n=1,100)

Potential decreased favorability differs by age.

Younger participants are significantly more likely than older participants to say their favorability of Avista would decrease significantly if Avista is not able to achieve carbon neutrality by 2027.

18-54	55+
15%	**10%**

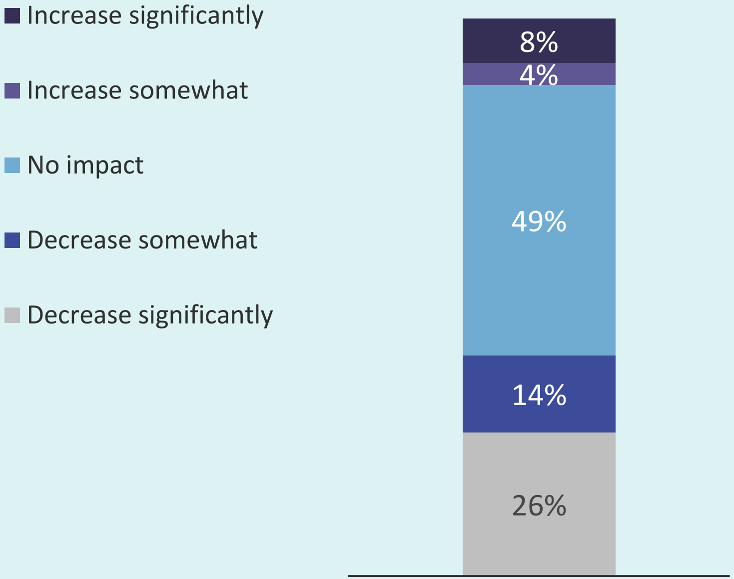
Potential decreased favorability is <u>consistent across state, gender, area of residence, and income categories</u>.

C7. If Avista is not able to achieve carbon neutrality by 2027, how would this affect your favorability of the company?

Nearly half say their favorability would not change if Avista does not achieve carbon free by 2045

Favorability of the Company if Avista is not able to Provide 100% Carbon-Free Power by 2045

(n=1,100)



Potential favorability differs by state.

Customers in **Oregon** and **Washington** are significantly more likely than those in Idaho say their favorability of Avista would decrease significantly.

29%	27%	21%

Potential favorability differs by area.

Customers in **urban** and **suburban** areas are significantly more likely than those in rural areas to decrease favorability.

urban	suburban	rural
32%	28%	21%

Potential favorability differs by household income

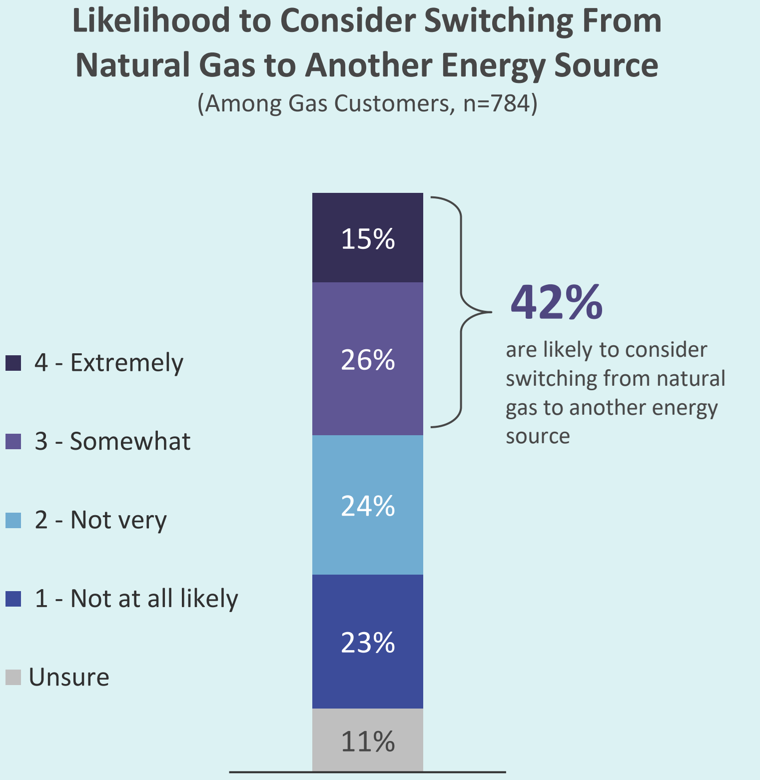
Those with **higher household incomes** are significantly more likely than those making $80K or less to decrease favorability.

<$80K	$80K+
23%	33%

C8. If Avista is not able to provide 100% carbon-free power by 2045, how would this affect your favorability of the company?

Detailed Findings:
Natural Gas Insights

Nearly half of customers would **not** consider switching from natural gas to help reduce carbon emissions

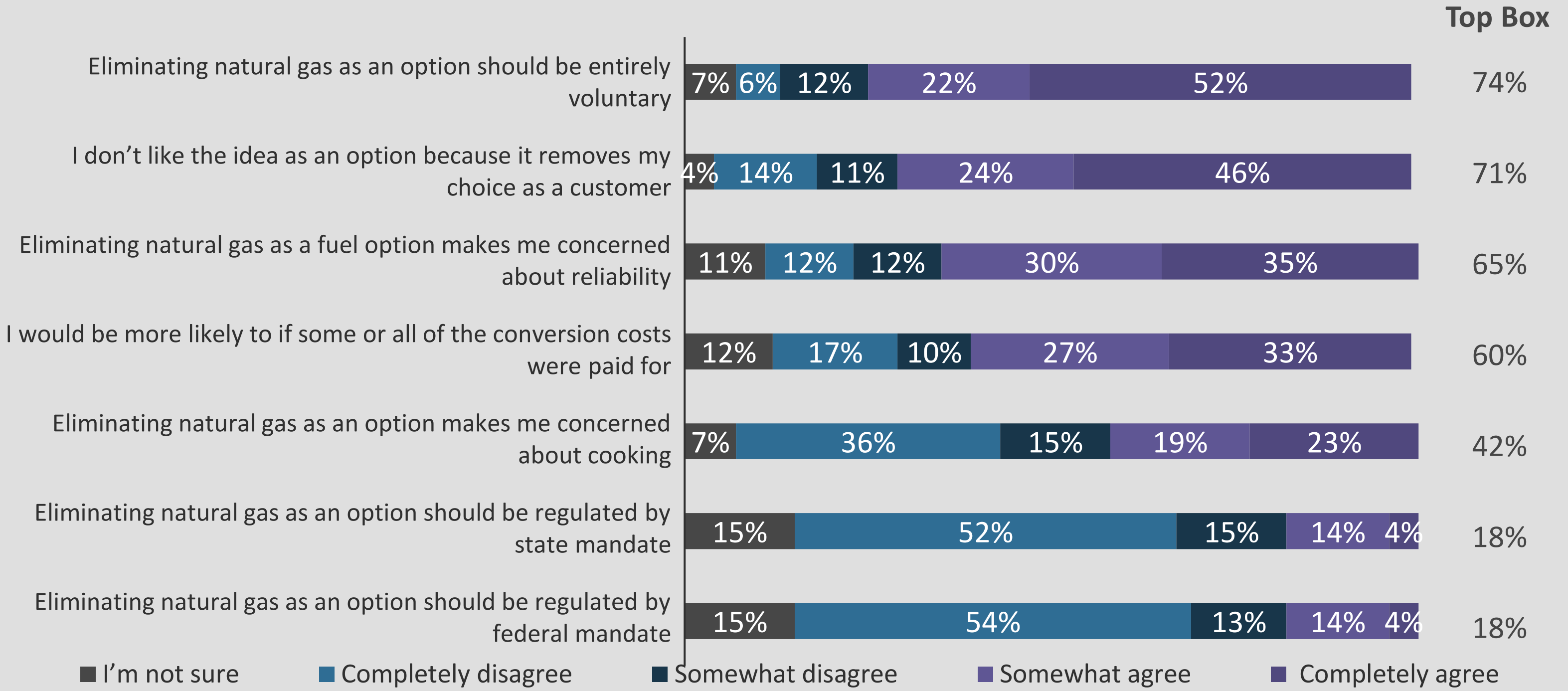


N1. How likely would you be to consider switching from natural gas to another energy source to help reduce carbon emissions?

Three-quarters gas customers agree eliminating natural gas should be entirely voluntary

Agreement Concerning Eliminating Natural Gas In Home

(Among Gas Customers; n=784)

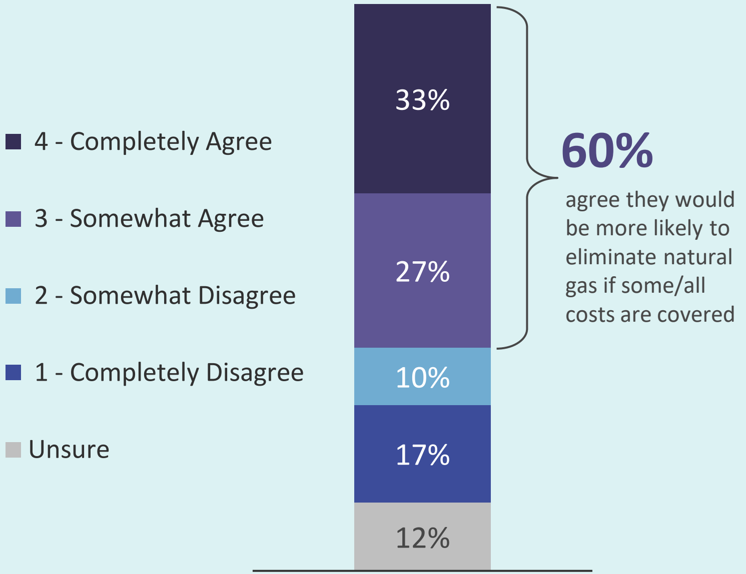


N2. How much do you agree or disagree with the following statements concerning natural gas in your home?

Six in ten would be more likely to convert from natural gas if some or all conversion costs were covered; of these, 59% would be willing to pay under $1000

Would be More Likely to Convert if Some or All Conversion Costs are Covered

(Among Gas Customers, n=784)



Maximum Personal Contribution

(Among Gas Customers More Likely to Convert If Some/All Costs Are Covered; n=473)

N2. How much do you agree or disagree with the following statements concerning natural gas in your home?

I would be more likely to eliminate natural gas as an option in my home if some or all of the conversion costs were paid for by the electric utility and/or government incentives

N3. If you did have to contribute some costs towards converting from natural gas in your home, how much would you consider your max level of contribution?

Customer Demographics

Demographics

Education	Total (n=1,100)	WA (n=569)	ID (n=316)	OR (n=215)
High school or less	7%	5%	10%	7%
Trade or Technical School	6%	6%	9%	4%
Some college	20%	20%	20%	21%
Graduated college	36%	37%	35%	33%
Graduate/professional school	26%	28%	22%	30%
Age				
18-24	1%	<1%	2%	--
25-34	5%	4%	9%	4%
35-44	13%	15%	14%	9%
45-54	14%	14%	14%	12%
55-64	23%	21%	26%	22%
65-74	25%	24%	24%	31%
75+	12%	16%	4%	16%
Refused	6%	5%	7%	7%

Home Type	Total (n=1,100)	WA (n=569)	ID (n=316)	OR (n=215)
Single family dwelling	83%	92%	64%	87%
A duplex or triplex	4%	2%	7%	3%
In a building with 4 or more units	6%	2%	16%	2%
Income				
Median	~$70K	~$78K	~$62K	~$66K
Household				
Mean # of people	2.4	2.5	2.2	2.2
Gender				
Women	46%	44%	47%	53%
Men	46%	49%	45%	40%
Non-binary or Other	<1%	1%	1%	--
Prefer not to say	7%	7%	7%	8%

2023 Electric Integrated Resource Plan

Technical Advisory Committee Meeting No. 5 Agenda

Wednesday, September 7, 2022
Microsoft Teams Virtual Meeting

Topic	**Time**	**Staff**
Introductions	12:30	John Lyons
IRP Generation Option Transmission Planning Studies	12:40	Dean Spratt
Distribution System Planning within the IRP	1:45	Damon Fisher
Break		
Social Cost of Greenhouse Gas for Energy Efficiency (WA only)	3:00	James Gall
Avoided Cost Rate Methodology	3:15	Clint Kalich
Adjourn	4:00	

2023 IRP Introduction

2023 Avista Electric IRP

TAC 5 – September 7, 2022

John Lyons, Ph.D. Senior Resource Policy Analyst

Meeting Guidelines

- IRP team is working remotely and is available for questions and comments
- Stakeholder feedback form
  - Responses shared with TAC at meetings, by email and in Appendix
  - Would a form and/or section on the web site be helpful?
- IRP data posted to web site – updated descriptions and navigation are in development
- Virtual IRP meetings on Microsoft Teams until able to hold large meetings again
- TAC presentations and meeting notes posted on IRP page
- This meeting is being recorded and an automated transcript made

Virtual TAC Meeting Reminders

- Please mute mics unless commenting or asking a question
- Raise hand or use the chat box for questions or comments
- Respect the pause
- Please try not to speak over the presenter or a speaker
- Please state your name before commenting
- Public advisory meeting – comments will be documented and recorded

Integrated Resource Planning

The Integrated Resource Plan (IRP):

- Required by Idaho and Washington* every other year
  - Washington requires IRP every four years and update at two years
- Guides resource strategy over the next twenty + years
- Current and projected load & resource position
- Resource strategies under different future policies
  - Generation resource choices
  - Conservation / demand response
  - Transmission and distribution integration
  - Avoided costs
- Market and portfolio scenarios for uncertain future events and issues

Technical Advisory Committee

- Public process of the IRP – input on what to study, how to study, and review of assumptions and results
- Wide range of participants involved in all or parts of the process
  - Please ask questions
  - Always soliciting new TAC members
- Open forum while balancing need to get through topics
- Welcome requests for new studies or different modeling assumptions.
- Available by email or phone for questions or comments between meetings
- Due date for study requests from TAC members – October 1, 2022
- External IRP draft released to TAC – March 17, 2023, public comments due – May 12, 2023
- Final 2023 IRP submission to Commissions and TAC – June 1, 2023

Remaining 2023 IRP TAC Meeting Schedule

- TAC 5: September 7, 2022
- TAC 6: September 28, 2022, 12:30 – 4:00 pm
- Public Participation Partners opportunity to comment on Avista's advisory groups
    - September 12, 2022, 11:00 am to 12:00 pm or September 13, 2022, 9:00 am to 10:00 am
- TAC 7: October 11, 2022, 9 am – 3:30 pm
- Technical Modeling Workshop: October 20, 2022
- Washington Progress Report Workshop: December 14, 2022
- TAC 8: February 16, 2023
- Public Meeting Gas & Electric IRPs: March 8, 2023
- TAC 9: March 22, 2023

Today’s Agenda

12:30	Introductions, John Lyons
12:40	IRP Generation Option Transmission Planning Studies, Dean Spratt
1:45	Distribution System Planning within the IRP, Damon Fisher
	Break
3:00	Social Cost of Greenhouse Gas for Energy Efficiency (WA Only), James Gall
3:15	Avoided Cost Rate Methodology, Clint Kalich
4:00	Adjourn

Integrated Resource Plan (IRP) Transmission Planning Studies

Dean Spratt, Transmission Planning

Technical Advisory Committee Meeting

September 07, 2022

FERC Standards of Conduct

Summary of requirements

- Non-public transmission information can not be shared with Avista Merchant Function employees.
- There are Avista Merchant Function employees attending today.
- We will not be sharing any non-public transmission information. Avista's OASIS is where this information is made public.

Agenda

- Introduction to Avista System Planning
  - Useful information about Transmission Planning
  - Overview of recent Avista projects

- Generation Interconnection Study Process
  - Integrated Resource Plan (IRP) Requests
  - Large Generation Interconnection Queue
  - Transition to Cluster Study Process

Introduction to Avista System Planning

Avista’s System Planning Group includes:

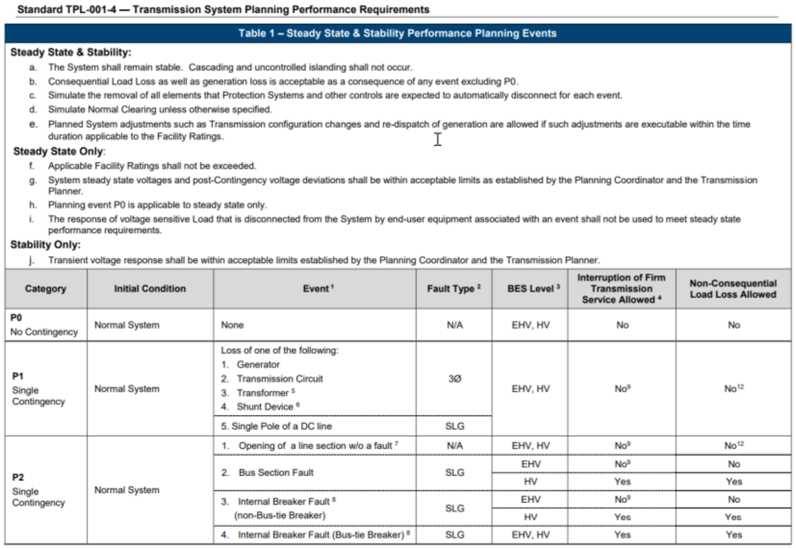
- Distribution Planning
- Transmission Planning
  - Focus on reliable electric service
    - Federal, regional, and state compliance
    - Regional system coordination
  - Provide transmission service and system analysis
    - Planned load growth and changing generation mix/dispatch
    - Interconnection of any type of generation or load
      - We are ambivalent about type (must perform though)

Information About Transmission Planning

- Our focus is the Bulk Electric System (BES)
  - Avista’s 115 kV and 230 kV facilities (>100 kV)
- We identify issues where Avista’s BES won’t reliably deliver power to our customers
- Then we develop plans to fix it
  - “Corrective Action Plans”
  - Mandated and described in NERC TPL-001-4
- We live in the world of NERC Mandatory Standards
  - Energy Policy Act of 2005

NERC Standard TPL-001-4

- Describes outage conditions we must study
  - P0: everything online and working
  - P1: single facility outages, like a transformer
  - P2, P4, P5 & P7: multiple facility outages
  - P3 & P6: overlapping combination of two facilities



Standard TPL-001-4 — Transmission System Planning Performance Requirements

Table 1 – Steady State & Stability Performance Planning Events

Steady State & Stability:

a. The System shall remain stable. Cascading and uncontrolled islanding shall not occur.
b. Consequential Load Loss as well as generation loss is acceptable as a consequence of any event excluding P0.
c. Simulate the removal of all elements that Protection Systems and other controls are expected to automatically disconnect for each event.
d. Simulate Normal Clearing unless otherwise specified.
e. Planned System adjustments such as Transmission configuration changes and re-dispatch of generation are allowed if such adjustments are executable within the time duration applicable to the Facility Ratings.

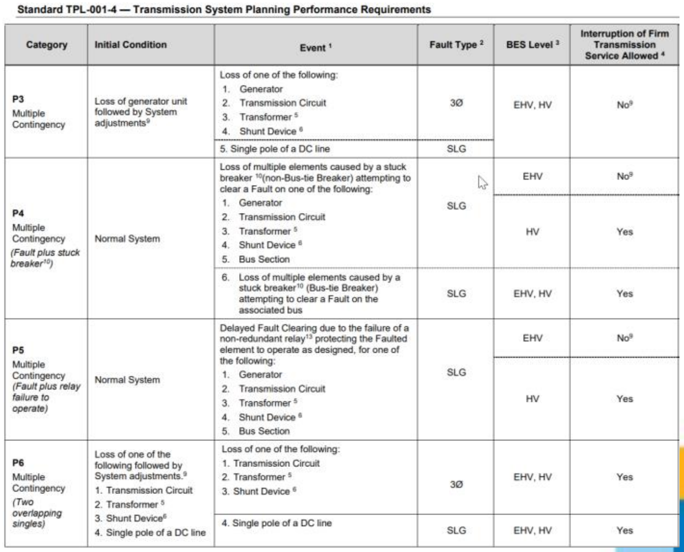
Steady State Only:

f. Applicable Facility Ratings shall not be exceeded.
g. System steady state voltages and post-Contingency voltage deviations shall be within acceptable limits as established by the Planning Coordinator and the Transmission Planner.
h. Planning event P0 is applicable to steady state only.
i. The response of voltage sensitive Load that is disconnected from the System by end-user equipment associated with an event shall not be used to meet steady state performance requirements.

Stability Only:

j. Transient voltage response shall be within acceptable limits established by the Planning Coordinator and the Transmission Planner.

Category	Initial Condition	Event[1]	Fault Type[2]	BES Level[3]	Interruption of Firm Transmission Service Allowed[4]	Non-Consequential Load Loss Allowed
P0 No Contingency	Normal System	None	N/A	EHV, HV	No	No
P1 Single Contingency	Normal System	Loss of one of the following: 1. Generator 2. Transmission Circuit 3. Transformer[5] 4. Shunt Device[6]	3Ø	EHV, HV	No[9]	No[12]
		5. Single Pole of a DC line	SLG			
P2 Single Contingency	Normal System	1. Opening of a line section w/o a fault[7]	N/A	EHV, HV	No[9]	No[12]
		2. Bus Section Fault	SLG	EHV	No[9]	No
				HV	Yes	Yes
		3. Internal Breaker Fault[8] (non-Bus-tie Breaker)	SLG	EHV	No[9]	No
				HV	Yes	Yes
		4. Internal Breaker Fault (Bus-tie Breaker)[8]	SLG	EHV, HV	Yes	Yes



Standard TPL-001-4 — Transmission System Planning Performance Requirements

Category	Initial Condition	Event[1]	Fault Type[2]	BES Level[3]	Interruption of Firm Transmission Service Allowed[4]
P3 Multiple Contingency	Loss of generator unit followed by System adjustments[9]	Loss of one of the following: 1. Generator 2. Transmission Circuit 3. Transformer[5] 4. Shunt Device[6]	3Ø	EHV, HV	No[9]
		5. Single pole of a DC line	SLG		
P4 Multiple Contingency *(Fault plus stuck breaker[10])*	Normal System	Loss of multiple elements caused by a stuck breaker[10](non-Bus-tie Breaker) attempting to clear a Fault on one of the following: 1. Generator 2. Transmission Circuit 3. Transformer[5] 4. Shunt Device[6] 5. Bus Section	SLG	EHV	No[9]
				HV	Yes
		6. Loss of multiple elements caused by a stuck breaker[10] (Bus-tie Breaker) attempting to clear a Fault on the associated bus	SLG	EHV, HV	Yes
P5 Multiple Contingency *(Fault plus relay failure to operate)*	Normal System	Delayed Fault Clearing due to the failure of a non-redundant relay[13] protecting the Faulted element to operate as designed, for one of the following: 1. Generator 2. Transmission Circuit 3. Transformer[5] 4. Shunt Device[6] 5. Bus Section	SLG	EHV	No[9]
				HV	Yes
P6 Multiple Contingency *(Two overlapping singles)*	Loss of one of the following followed by System adjustments.[9] 1. Transmission Circuit 2. Transformer[5] 3. Shunt Device[6] 4. Single pole of a DC line	Loss of one of the following: 1. Transmission Circuit 2. Transformer[5] 3. Shunt Device[6]	3Ø	EHV, HV	Yes
		4. Single pole of a DC line	SLG	EHV, HV	Yes

TPL-001-4, cont.

- A couple of NERC directives for the above faults
  - “The System shall remain stable”
    - Cascading and uncontrolled islanding shall not occur
  - “Applicable Facility Ratings shall not be exceeded”
    - Equipment ratings, voltage, fault duty, etc
  - “An objective of the planning process is to minimize the likelihood and magnitude of Non-Consequential Load Loss following planning events”

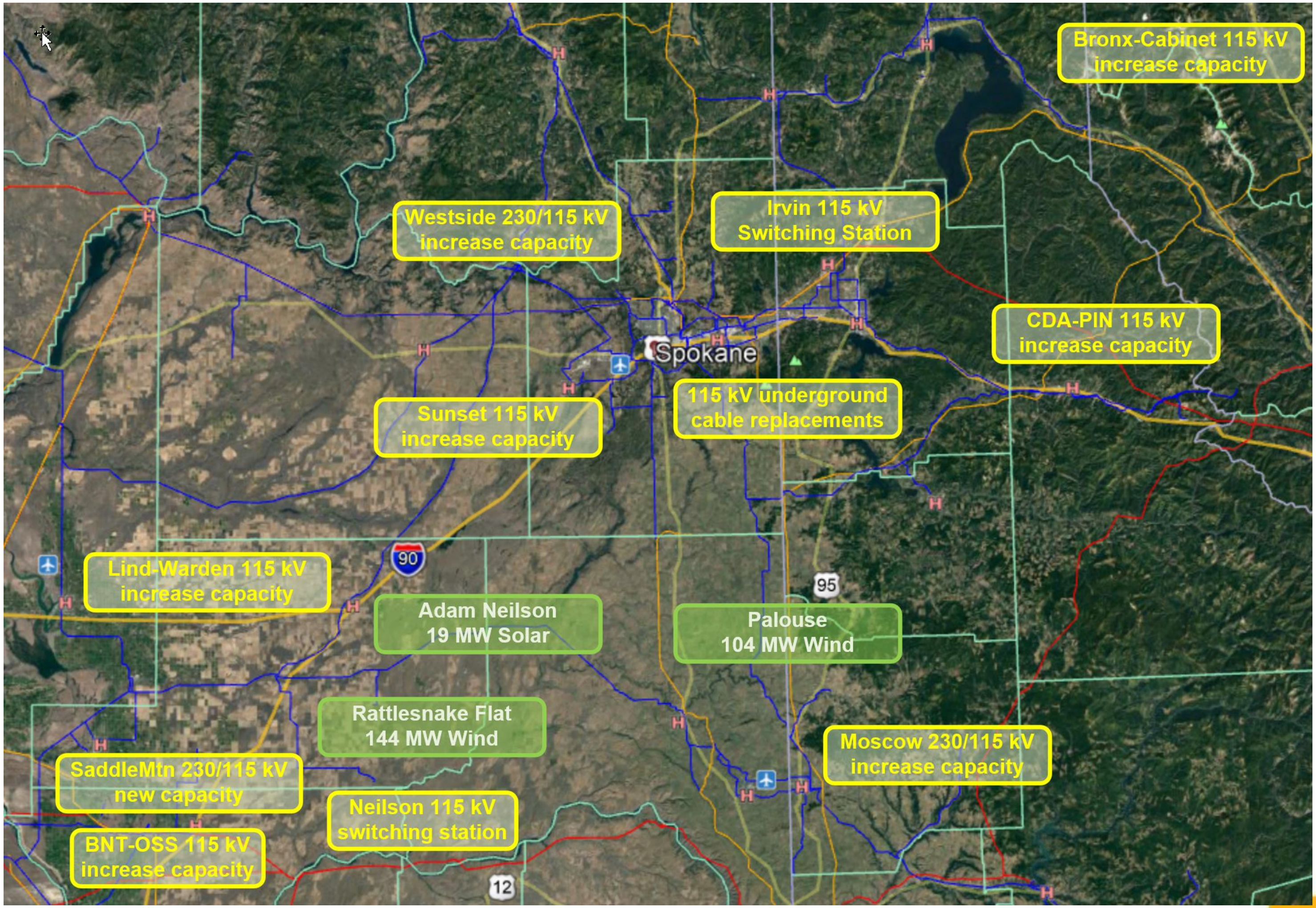
Two Approaches to Reliability Issues

- Transmission Operations (TO) are guided by *significantly* different standards than Transmission Planning (TP).
- TO standards provide *flexibility* that TP standards do not allow
  - – Operators can push system limits to ***SAVE*** the interconnected system
    - Shed load, overload equipment, etc – all short term
    - The planned system should give them the tools to do this
    - The standards continue to define this balance

Standards are a Roadmap

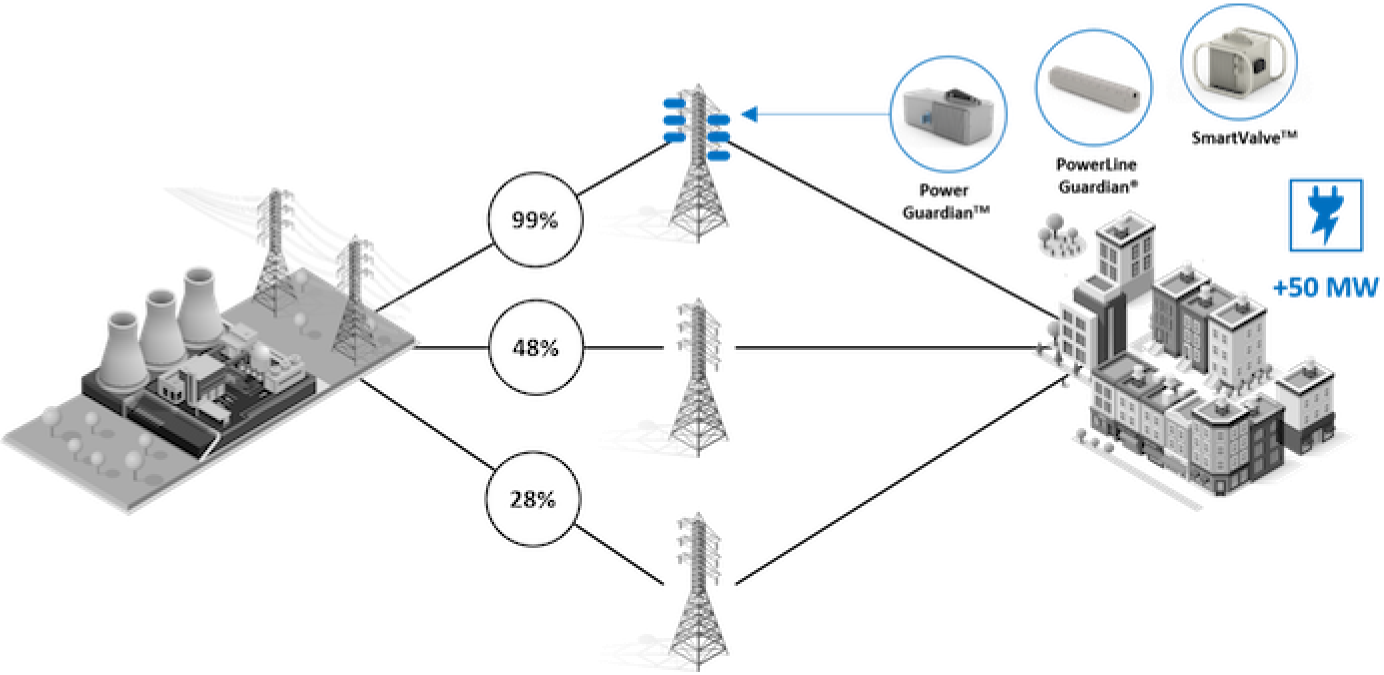
- Western Systems Coordinating Council (WSCC)
  - – Ensure that disturbances in one system do not spread to other systems.
    - Operating agreement with 40 electric power systems established in 1967
- Western Electricity Coordinating Council (WECC)
  - – Responsible for coordinating and promoting electric system reliability established in 2002
- North American Electric Reliability Council (NERC)
  - – Ensure the reliability of the North American bulk power system reformed in 2006; Corporation in 2007
    - Established as a voluntary organization in 1968

Recent Transmission Projects



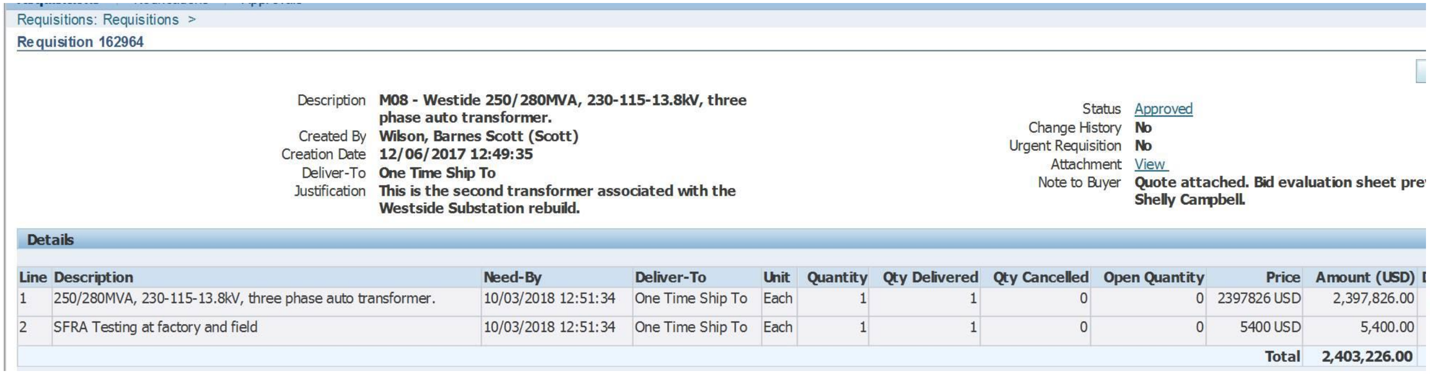
Non-Wire Alternatives are Considered

- We are documenting this with more clarity
- Non-wire options require robust wires to perform
  - – Avista is working on the transmission fundamentals



Evaluated Batteries for T-1-1

- TPL-001-4 ~ T-1-1 for long lead equipment
  - Double transformer outages
    - Shawnee 230/115 kV outage followed by a concurrent outage of Moscow 230/115 kV transformer.
  - Could we mitigate performance issues with storage?
    - Yes…but… We would need a 125 MW battery
      - Typical charge is 8 hours, discharge for 12 to 16 hours
      - Transformer outage is weeks to months
    - A third transformer is a better solution
      - Robust performance and much less $$$$



Requisitions: Requisitions >

Requisition 162964

Description **M08 - Westide 250/280MVA, 230-115-13.8kV, three phase auto transformer.**
Created By **Wilson, Barnes Scott (Scott)**
Creation Date **12/06/2017 12:49:35**
Deliver-To **One Time Ship To**
Justification **This is the second transformer associated with the Westside Substation rebuild.**

Status Approved
Change History **No**
Urgent Requisition **No**
Attachment View
Note to Buyer **Quote attached. Bid evaluation sheet pre Shelly Campbell.**

Details

Line	Description	Need-By	Deliver-To	Unit	Quantity	Qty Delivered	Qty Cancelled	Open Quantity	Price	Amount (USD)
1	250/280MVA, 230-115-13.8kV, three phase auto transformer.	10/03/2018 12:51:34	One Time Ship To	Each	1	1	0	0	2397826 USD	2,397,826.00
2	SFRA Testing at factory and field	10/03/2018 12:51:34	One Time Ship To	Each	1	1	0	0	5400 USD	5,400.00
									Total	**2,403,226.00**

Generation Interconnection Study Process

Process for Generation Requests

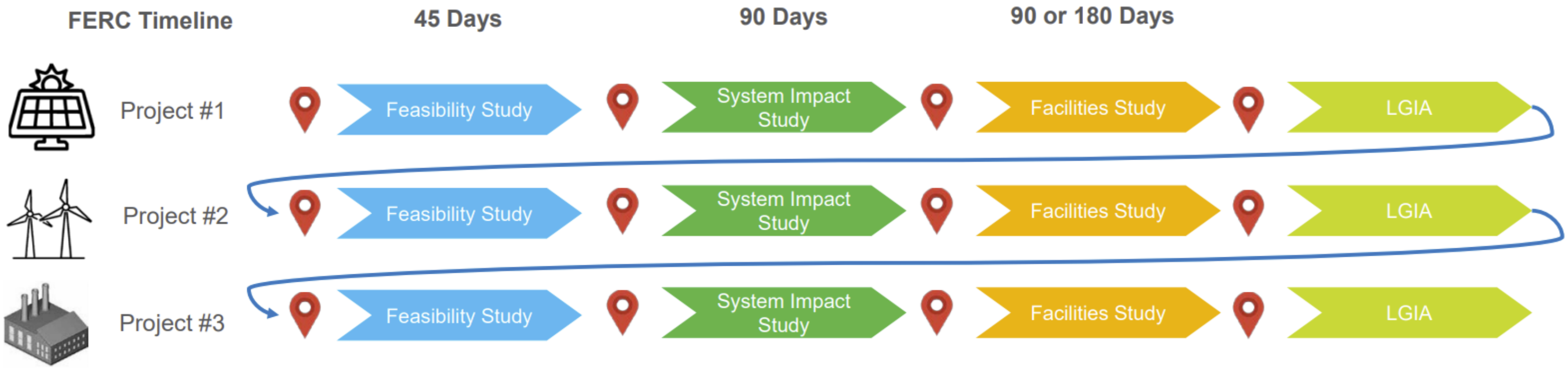
- Two sources:
  - External developers
    - Enter via the OATT
  - Internal IRP requests
    - Feasibility Light Study…then OATT
      - AVA Merchant MUST follow the OATT just like external parties
- Typical process:
  - Hold a scoping meeting to discuss particulars
  - Outline a study plan
  - Augment WECC approved cases for our studies
  - Analyze the system against the standards
  - Publish our findings and recommendations

Transition - Serial to Cluster Study Process

Challenges with Serial Interconnections

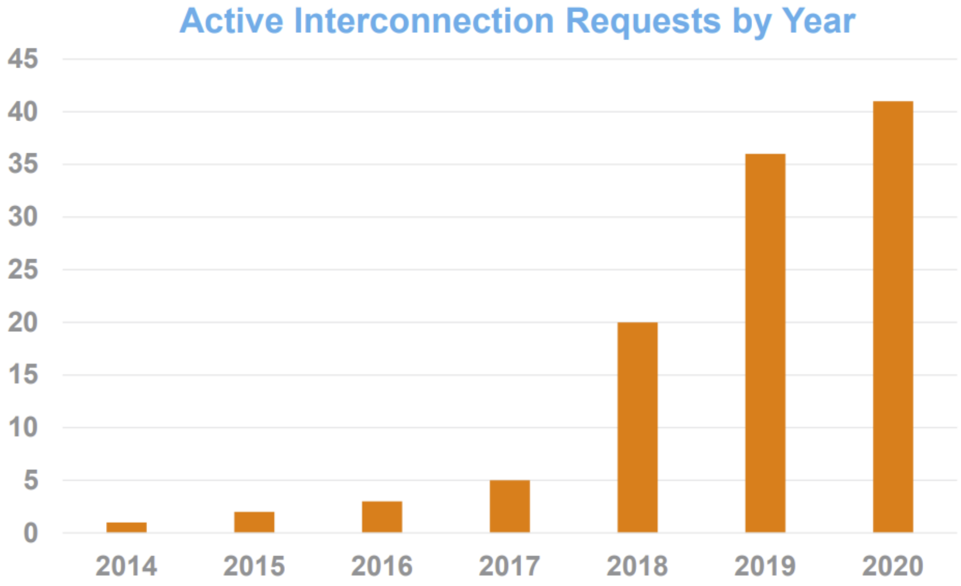
- Large serial queues become difficult to process efficiently
- Interdependency of projects becomes complicated
  - Studying single projects is inefficient compared to studying projects in a group
  - Projects that do not reach commercial operation may cause re-studies
  - System Upgrade allocation
- The serial process is difficult for the developers and the utility

Serial Process was Complex and Slow



FERC Timeline	45 Days	90 Days	90 or 180 Days	
Project #1	Feasibility Study	System Impact Study	Facilities Study	LGIA
Project #2	Feasibility Study	System Impact Study	Facilities Study	LGIA
Project #3	Feasibility Study	System Impact Study	Facilities Study	LGIA

Interconnection Requests necessitated a better Process



Active Interconnection Requests by Year

Two-Phase Cluster Study Process

Benefits and Objectives

- Create a more efficient process
- Design a process with definitive timelines that can be consistently met
- Allocate System Upgrades proportionally
- Ensure commercially viable projects have a clear path for development
- Alleviate the backlog in the queue

Phase One Study

Phase Two Study

Individual Facilities Studies

LGIA's

Current Interconnection Queue

Serial or Cluster Number	Project Name	Former Queue Number	Max MW Output	Type	County	State
LGIA	Saddle Mountain	46	126	Wind	Adams	WA
LGIA	Taunton	52	100	Solar	Adams	WA
LGIA	Asotin	60	150	Solar	Asotin	WA
LGIA	Kettle Falls	66	71	Wood Burner/ CT	Stevens	WA
Senior	Aurora	59	116	Solar/Storage	Adams	WA
Senior	Post Falls	63	26	Hydro	Kootenai	ID
Senior	Elf II	79	2.1	Solar	Spokane	WA
Senior	Elf I	80	19	Solar	Spokane	WA
Senior	Acadia	84	5	Solar	Stevens	WA
Senior	Lolo Solar	97	100	Solar/Storage	Nez Perce	ID
TCS-02	Rattlesnake II	62	123.2	Wind	Adams	WA
TCS-03	Old Milwaukee	67	80	Solar/Storage	Adams	WA
TCS-04	Sprague	73	94	Solar/Storage	Adams	WA
TCS-05	Royal City	76	114.12	Solar	Grant	WA
TCS-06	Ralston	81	94	Solar/Storage	Adams	WA
TCS-07	Rainier	85	5	Solar	Adams	WA
TCS-08	Wahatis	99	200	Solar/Storage	Franklin	WA
TCS-09	Stringtown	100	100	Solar/Storage	Spokane	WA
TCS-10	Harrington	103	40	Solar	Lincoln	WA
TCS-11	Latah	104	120	Wind	Spokane	WA
TCS-12	Orin	105	5	Solar	Stevens	WA
TCS-14	Cloudwalker	110	375	Wind/Solar/Storage	Garfield	WA
TCS-16	Daydreamer	112	125	Solar/Storage	Lincoln	WA
TCS-18	Dry Falls	119	200	Solar/Storage	Grant	WA

Transmission Integration Cost Estimates

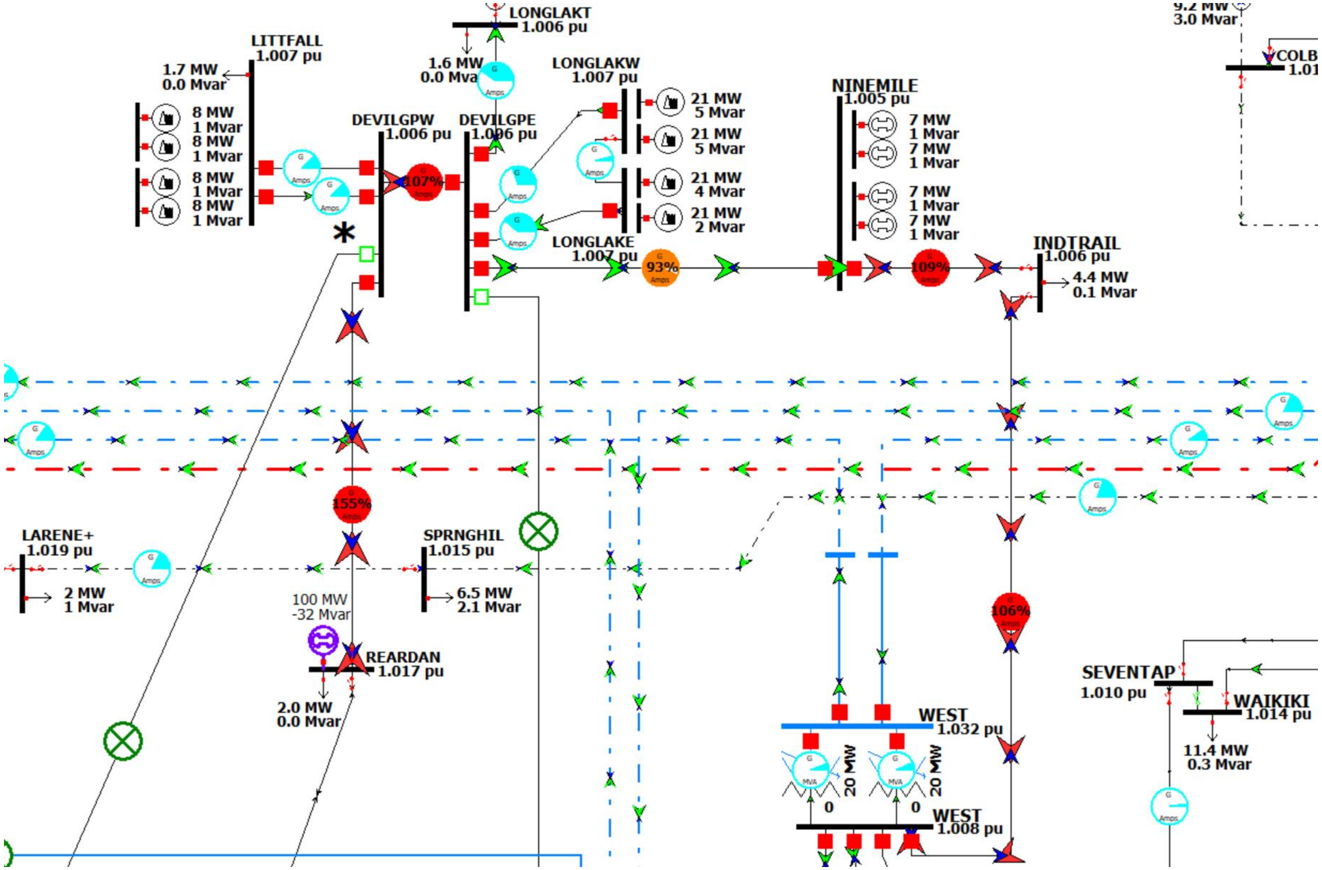
POI Station or Area	Requested (MW)	POI Voltage	Cost Estimate ($ million)
Big Bend area near Lind (Tokio)	100/200	230kV	138.2
Big Bend area near Odessa	100	230kV	167.1
Big Bend area near Odessa	200/300	230kV	168.0
Big Bend area near Othello	100/200	230kV	222.2
Big Bend area near Othello	300	230kV	262.4
Big Bend area near Reardan	50	230kV	9.7
Big Bend area near Reardan	100	230kV	10.3
Clarkston/Lewiston area	100/200/300	230kV	1.9
Kettle Falls substation, existing POI	12/50	115kV	1.8
Kettle Falls substation, existing POI	100	115kV	24.9
Lower Granite area	100/200/300	230kV	2.9
Northeast substation, existing POI	10	115kV	1.6
Northeast substation, existing POI	100	115kV	6.7
Palouse area, near Benewah (Tekoa)	100/200	230kV	2.4
Rathdrum substation, existing POI	25/50	115kV	11.5
Rathdrum substation, existing POI	100	230kV	16.7
Rathdrum substation, existing POI	200	230kV	27.0
Rathdrum Prairie, north Greensferry Rd	100	230kV	32.7
Rathdrum Prairie, north Greensferry Rd	200	230kV	43.0
Rathdrum Prairie, north Greensferry Rd	300	230kV	54.4
Rathdrum Prairie, north Greensferry Rd	400	230kV	91.5
Thornton substation, existing POI	10/50	230kV	1.9
West Plains area north of Airway Heights	100	115kV	2.4
West Plains area north of Airway Heights	200/300	115kV	4.7

Assume anti-islanding scheme is in place, but no remedial Action Scheme (RAS)

Preliminary estimates are given as -25% to +75%

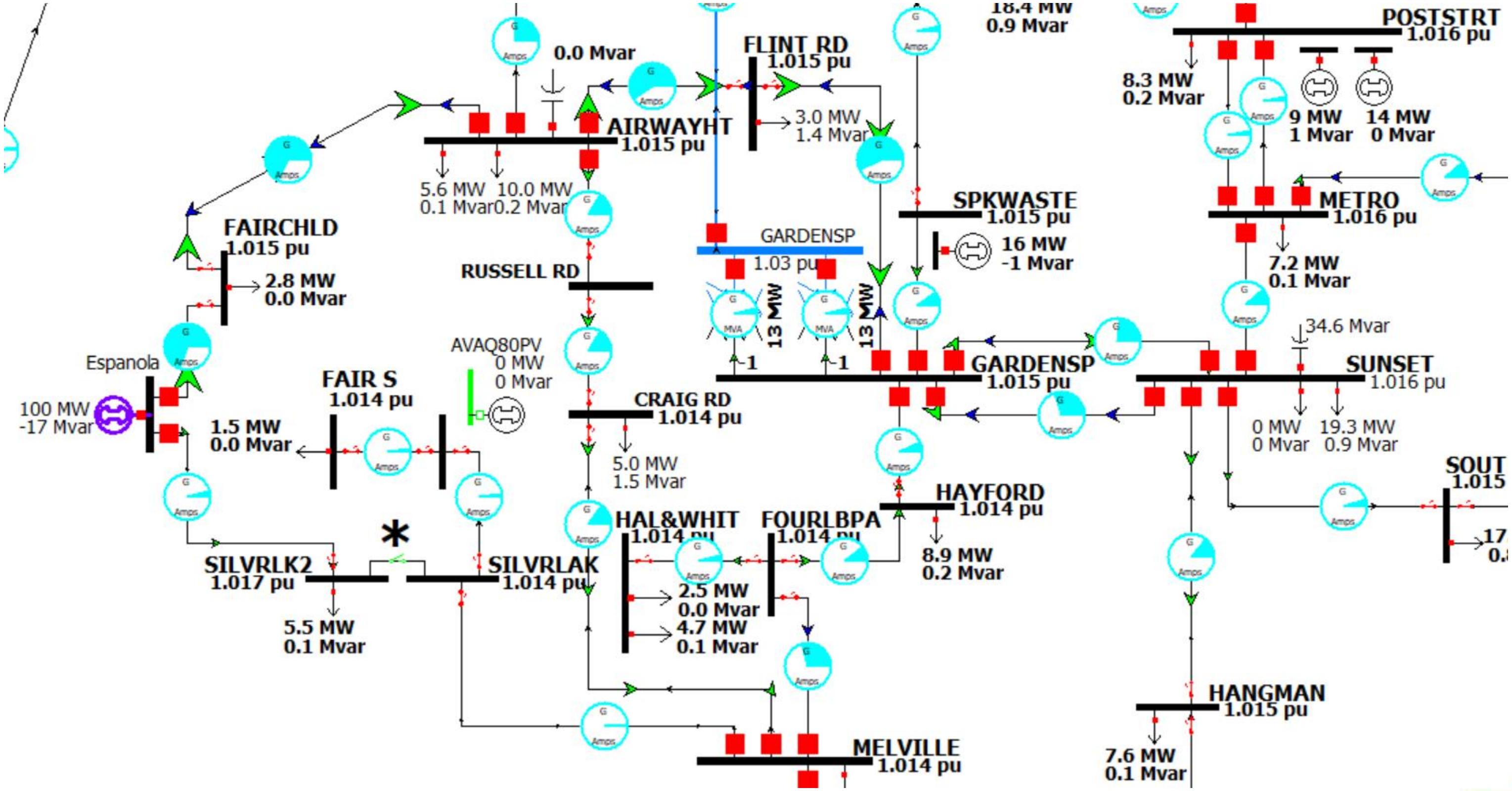
Reardan: 100 MW

Choice of interconnection point may result in extensive system reinforcements



Espanola: 100 MW

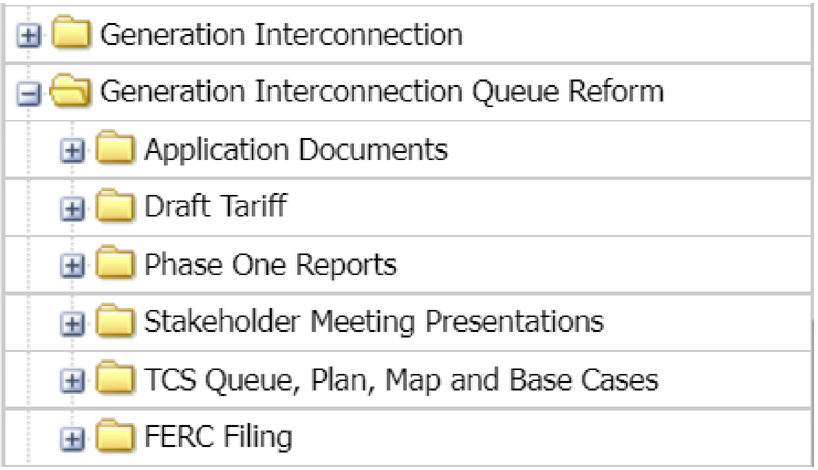
Optimizing the interconnection point is a key benefit of the Cluster Study process



Questions?

Refer to Avista's OASIS link for information regarding System Planning and the Interconnection Process:

http://www.oasis.oati.com/avat/index.html



- Generation Interconnection
- Generation Interconnection Queue Reform
  - Application Documents
  - Draft Tariff
  - Phase One Reports
  - Stakeholder Meeting Presentations
  - TCS Queue, Plan, Map and Base Cases
  - FERC Filing

Distribution Resource Planning

Damon Fisher, System Planning
Fifth Technical Advisory Committee Meeting
September 7, 2022

Goals of Electric Distribution Planning

- Ensure electric distribution infrastructure to serve customers now and in the future with a focus on:
  - Safety
  - Reliability
  - Capacity
  - Efficiency
  - Level of service
  - Operational flexibility
  - Corporate/Regulatory goals
  - Affordability

Primary Goal of Distribution Resource Plan

- Where possible, solve distribution grid deficiencies using distributed energy resources (DER) that also contribute to system resource needs as identified in the Integrated Resource Plan.

Can IRP resource needs and distribution "fixes" be aligned? Certainly.

- Not without challenges.
  - Temporal need
  - Grid operation and flexibility
  - Resource adequacy- a new distribution definition?
  - System Protection

Typical Distribution System Deficiencies

- Low Voltage
- Capacity (Substation/Feeder)
- Asset Condition
- Contingency Switching Limits

What are DER’s? – Distribution’s Perspective

- Anything that can reduce demand or support voltage

Real

Targeted Energy Efficiency

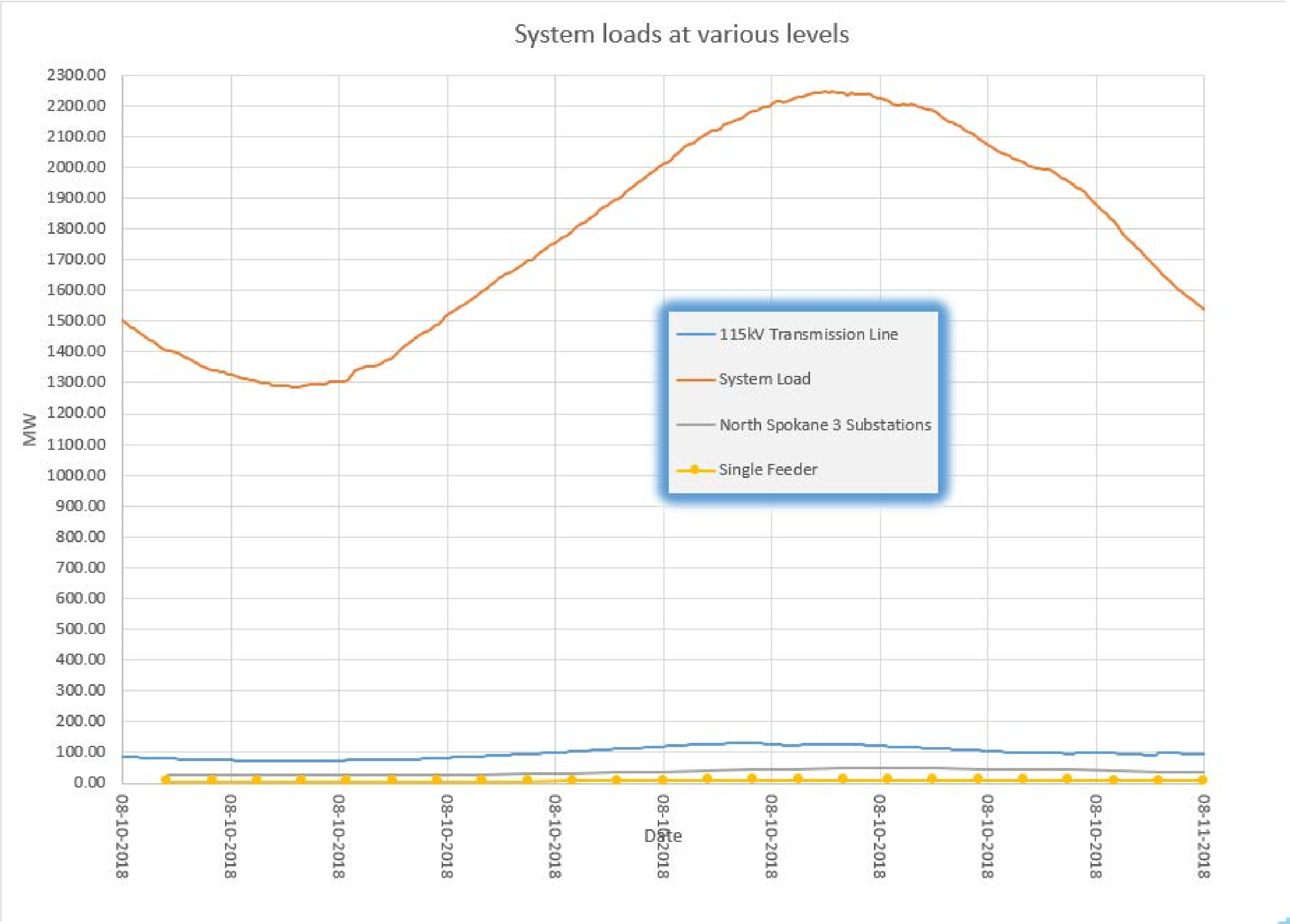
Targeted Demand Response

Apparent

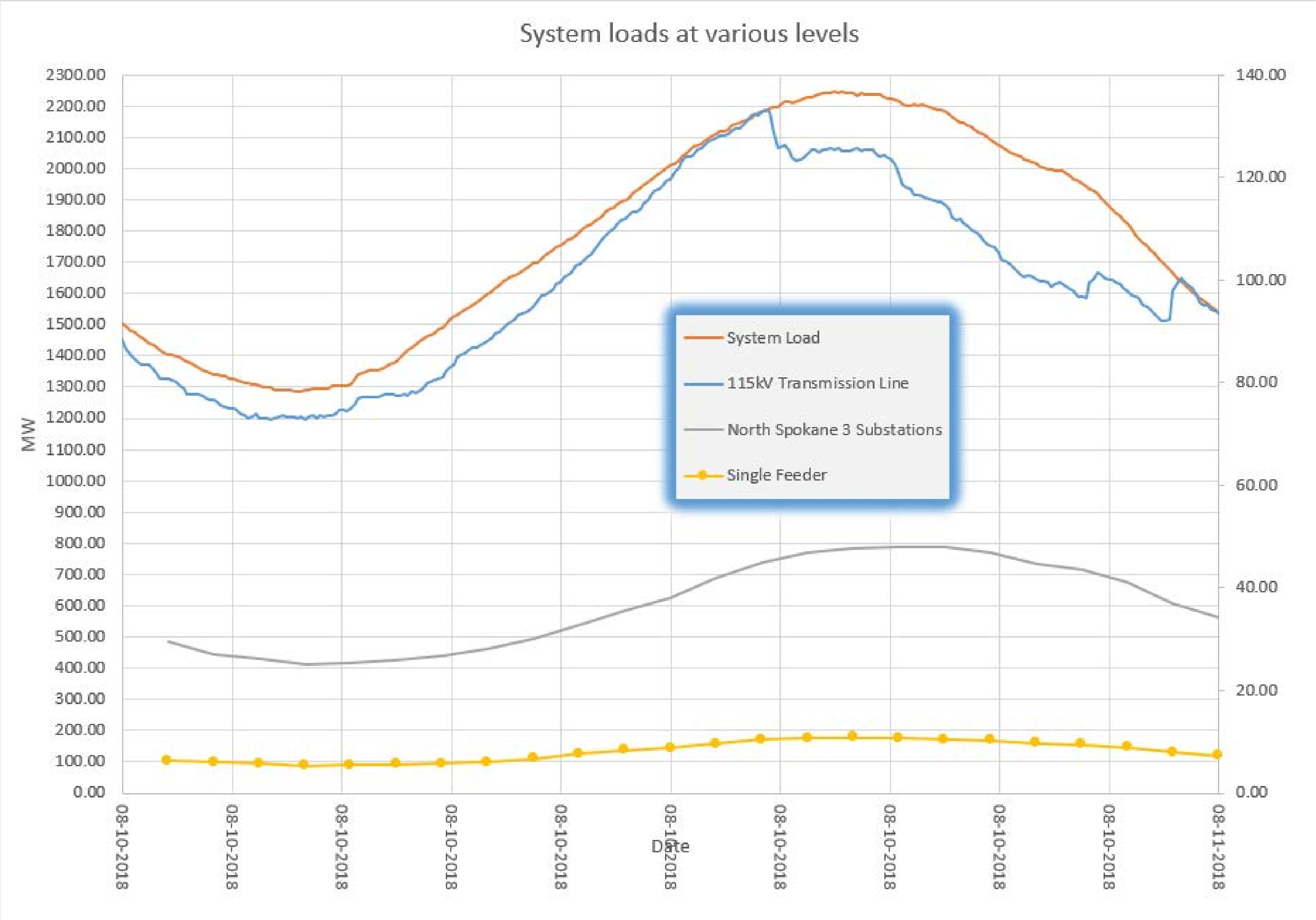
Storage (Load shifting)

Generation (Load service)

System Resources vs. Feeder Demand

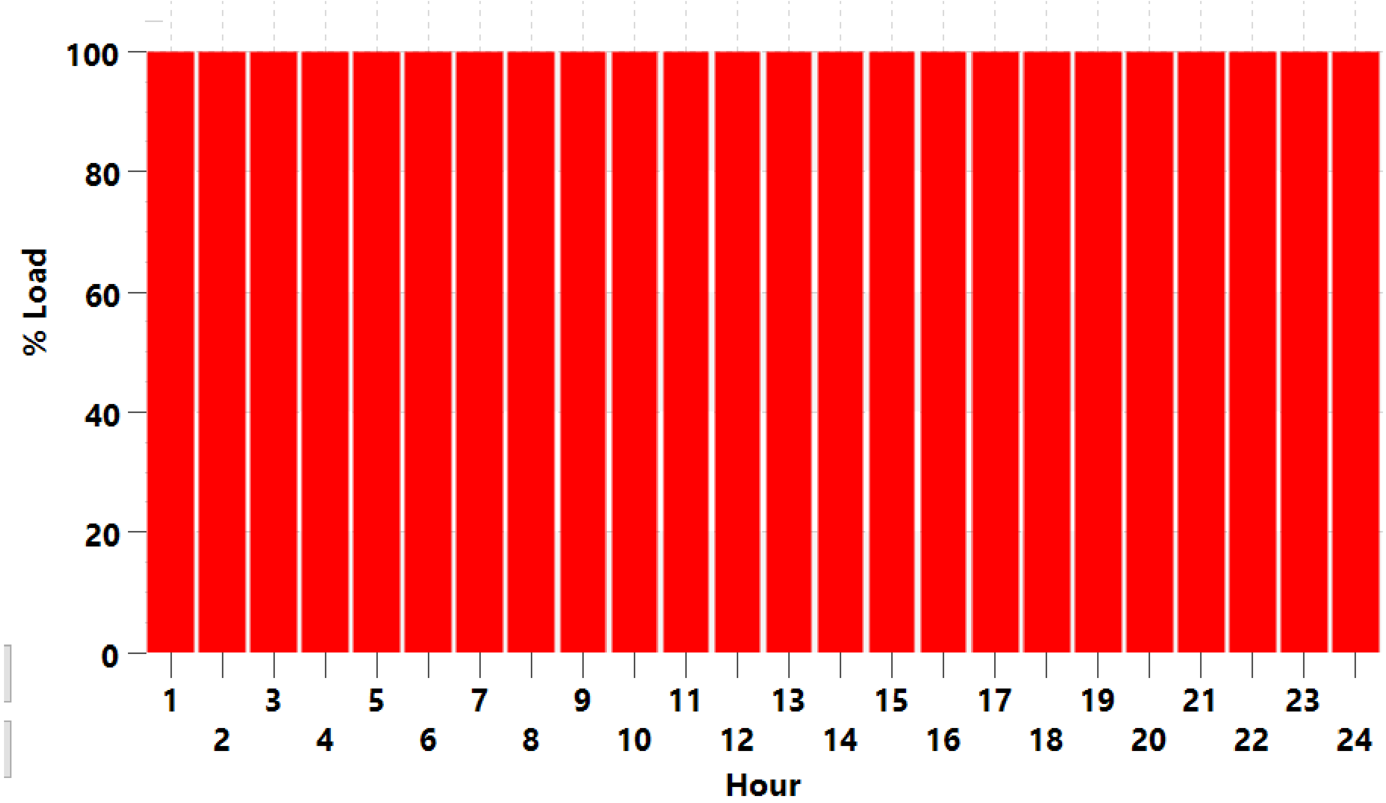


System Resources vs. Feeder Demand



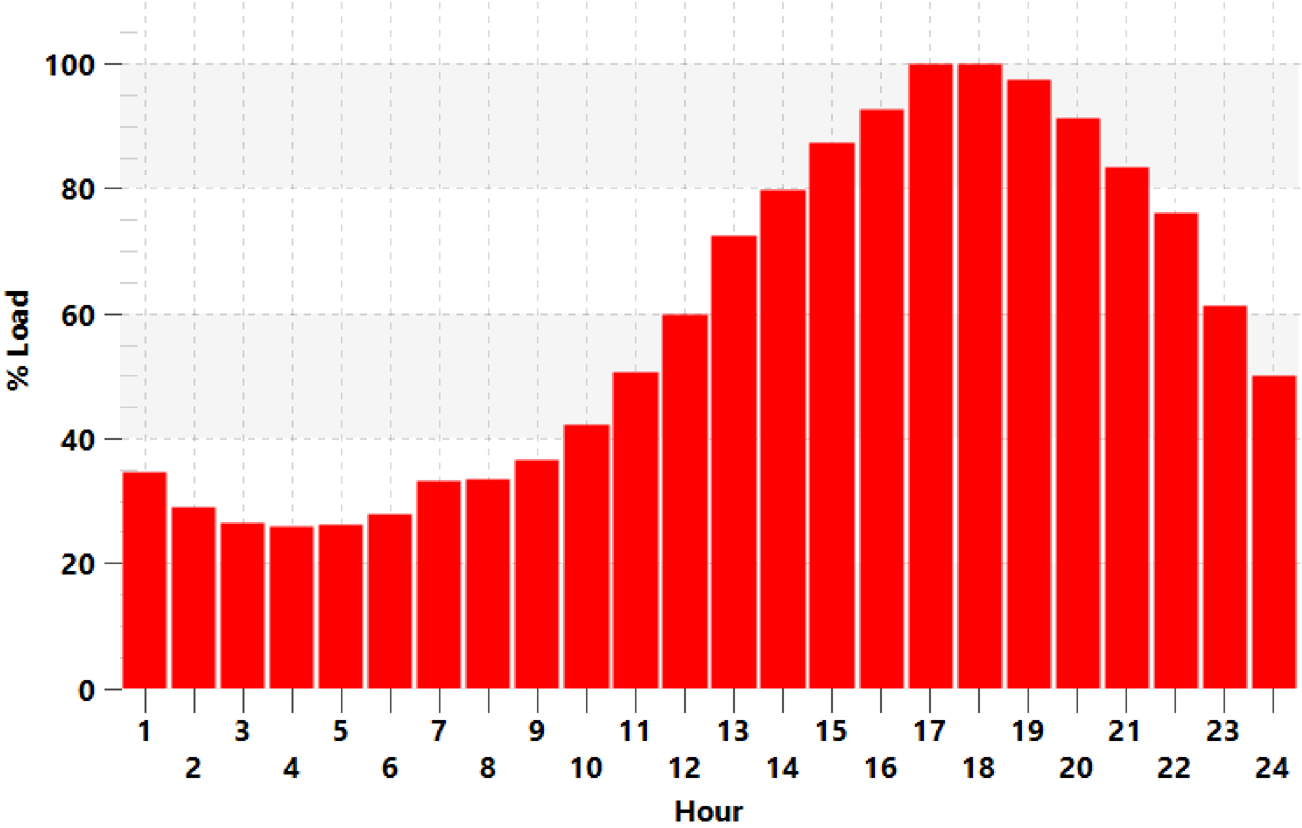
It Is All About Curves

- The ideal curve-

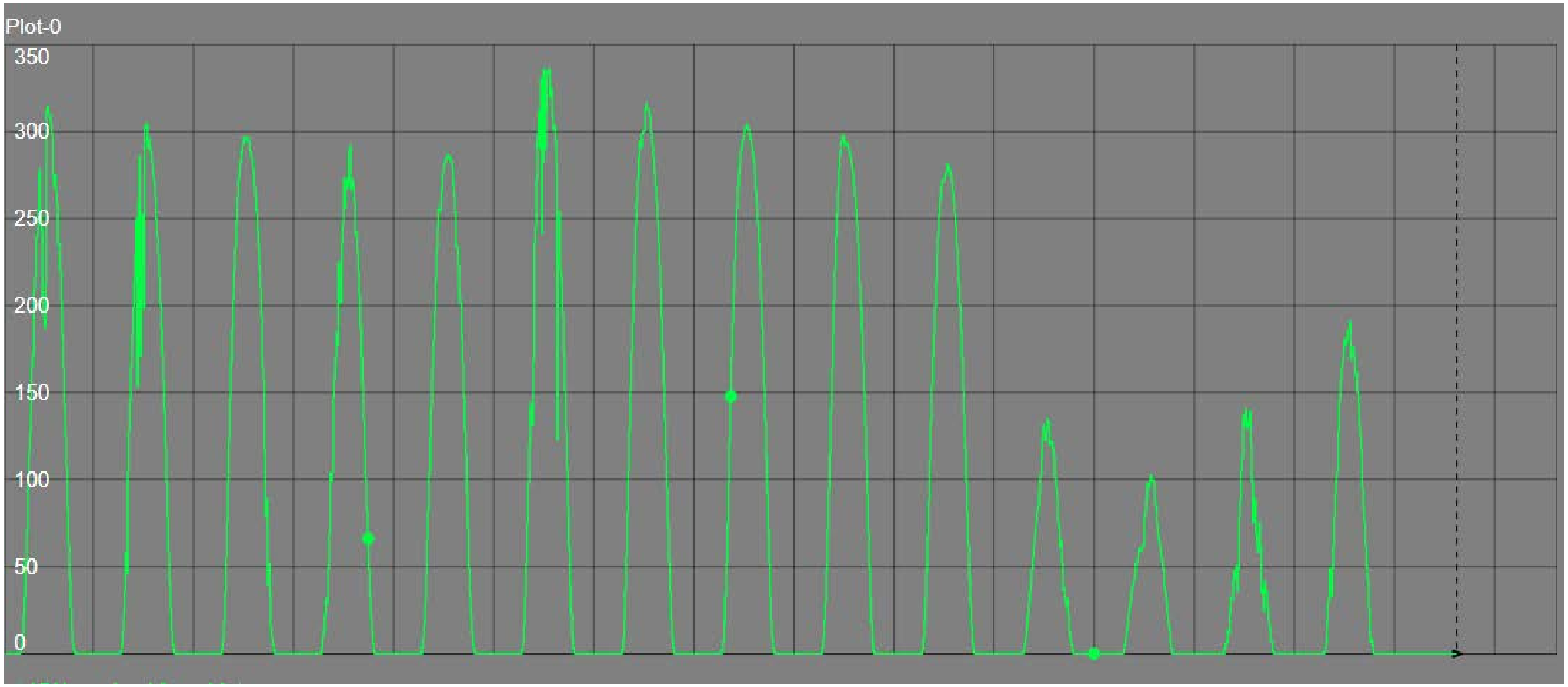


It is all about curves

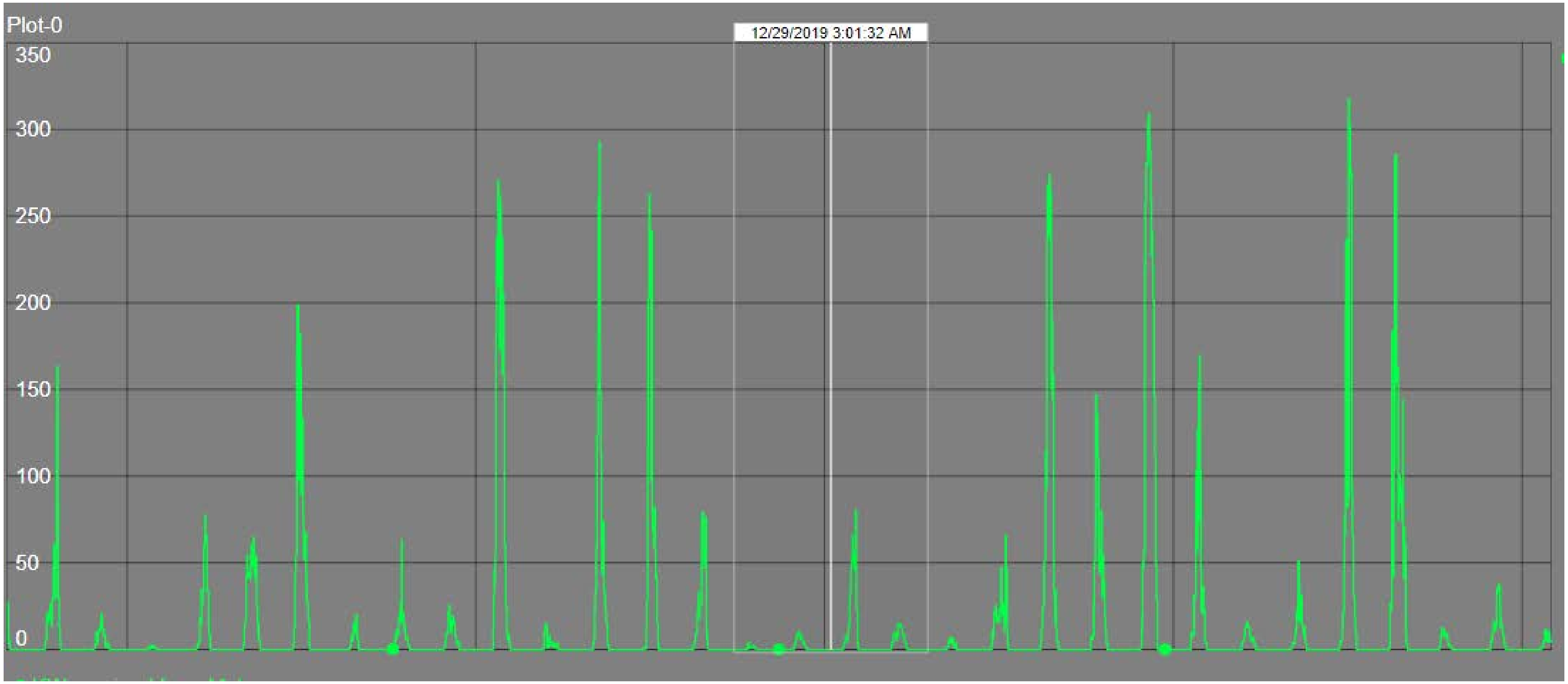
- A real curve (not ideal)-



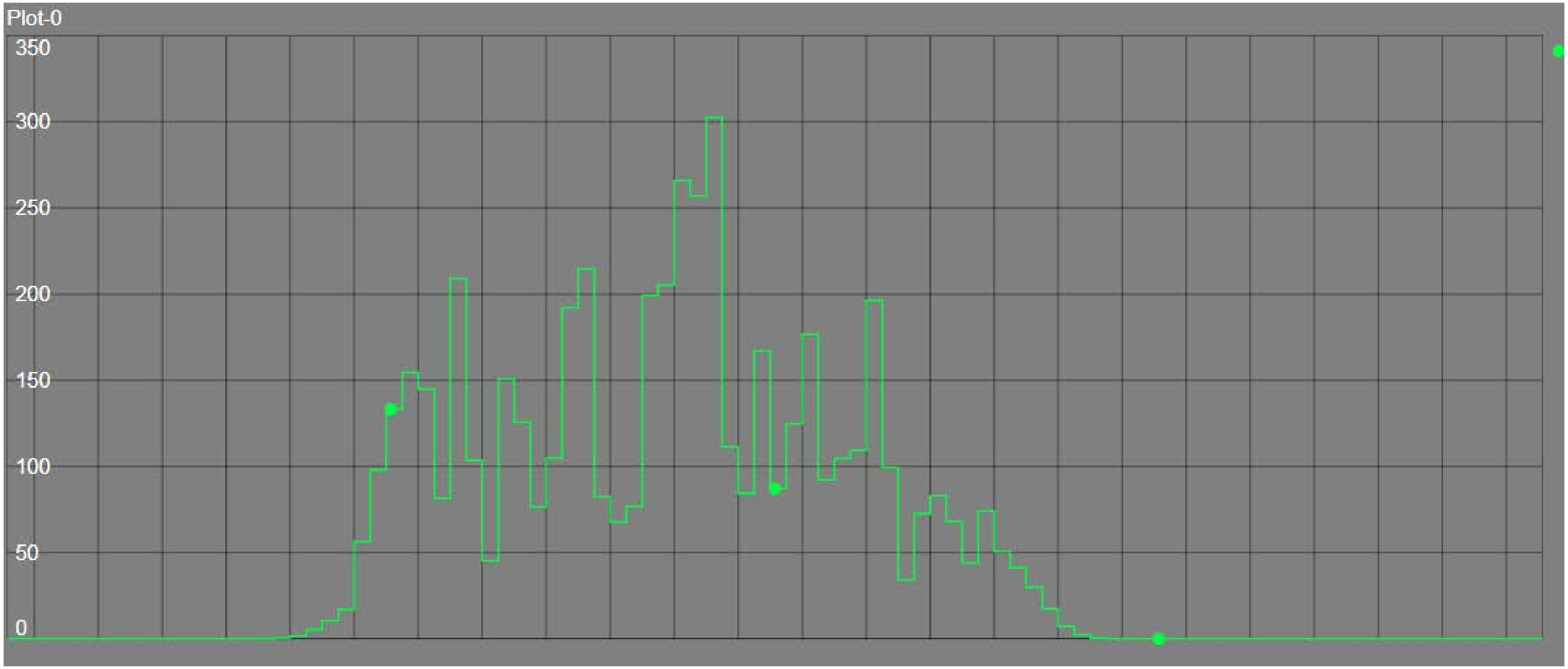
Can We Fix Curves with PV? Community Solar – Summer



Can We Fix Curves with PV?
Community Solar – Winter



Can We Fix Curves with Just PV? Community Solar – Cloudy Day, Battery



DRP Implementation-

- Spatial Load Forecasting
- Spatial DER Forecasting (gap)
- System Performance Criteria
- DER Acquisition and Implementation Processes (in process)
- Engineering/Operational Expertise (in process)
- Time series analysis
- Hosting capacity maps (in process)
- Non-Wired and Wired Playbook (in process)

	Reliability					Safety		Capacity					Power Quality	
	Outages							Load Growth		Peak Support				
	Prevent (SAIFI)	Shorten (SAIDI)	Shorten (CAIDI)	Reduce (CEMI3)	Vulnerable Customer	Mitigate Wildfire	Short Circuit	Transportation Electronification	Electrification (replace gas)	Summer	Winter	8,760 Hours	Voltage	Flicker & Harmonics
Non-Wires Alternatives														
Transmission Connected														
Remedial action schemes												◑		
Dynamic line rating										◑	◑	◑		
Series compensation										◑	◑			
Hydrogen fuel-cell														
Storage														
Short-duration (<=8hrs.) - lithium (NMC, LFP, LTO)														
Medium-duration (>8hrs.& <=72hrs.)								◑	◑	◑	◑			
Long-duration (>72hrs.)								◑	◑	◑	◑			
Distribution Connected														
Natural gas generation		◑	◑		◕					◑	◑			
Distribution automation FDIB (FLISB)	●		[illegible]											
Resource aggregation - virtual power plant										◕	◕	◔		
Automatic feeder reconfiguration (load shifting)										◑	◑			
Load balancing										◕	◕		●	◕
Demand response								◕	◕	◕	◕			
Energy efficiency												◕		
Remedial action schemes							◑							
Wind													◑	
Solar										◕		◔	◕	
Hydrogen fuel-cell					◕			◑	◑	◑	◑	◑		
Storage														
Short-duration (<=8hrs.) - lithium (NMC, LFP, LTO)		◑	◑		◕			◕	◑	●	●		◕	
Medium-duration (>8hrs.& <=72hrs.)		◑	◑		◕									
Long-duration (>72hrs.)		◑	◑		◕									
Portable storage					◑					◑	◑			
Immediate response storage (e.g., fly-wheel)					◑								◕	◑
Behind the Meter														
Wind													◑	
Solar										◑		◕	◕	
Natural gas generator					●	◑		◑		◑	◑			
Demand response								◕						
Hydrogen fuel-cell					◕			◑	◑	◑	◑			
Storage														
Short-duration (<=8hrs.) - lithium (NMC, LFP, LTO)		◑	◑		◕			◕		◕	◕		◕	
Medium-duration (>8hrs.& <=72hrs.)		◑	◑							◔	◔			
Long-duration (>72hrs.)		◑	◑											
Microgrid														
Eco-district								◕	●	◕	◕	◕		
Fossil generation					●	◕				◑	◑			
Renewable generation										◑			◑	
Stand-alone Storage					◕					◕	◕		◕	
Fossil generation w/ storage	◑	◑	◑	◑	●	◕				◕	◕		◕	
Renewable generation w/ storage	◑	◑	◑	◑	●	◕		◕	◕	◕	◕	◕	◕	

Generation Integration Costs

- 5MW – assuming dedicated feeder bay and SCADA comms required - $975,000 to $1,350,000

- 1MW – assuming a feeder tap, viper, and SCADA comms required - $170,000 to $254,000

- 500kW - assuming tap the feeder with some upgrades - $24,000 to $36,000

- 100kW - assuming tap the feeder, not a net-metered project - $8,000 to $12,000

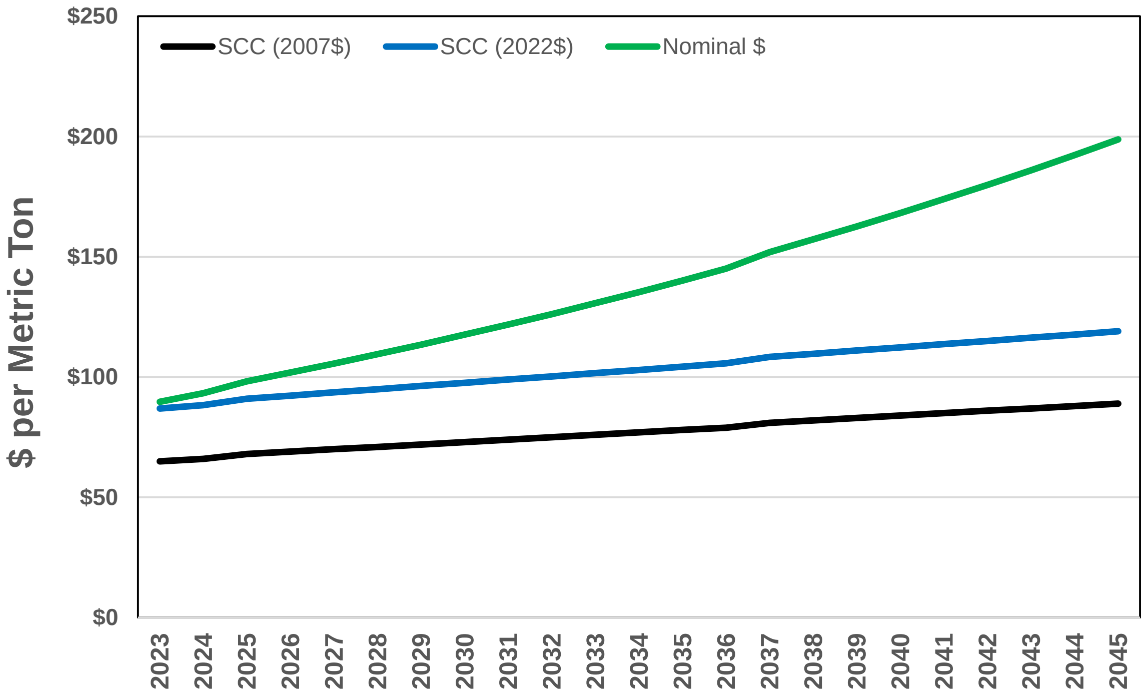
Questions?

Social Cost of Greenhouse Gas for Energy Efficiency (Washington State Methodology)

James Gall, Integrated Resource Planning Manager
Electric IRP, Fifth Technical Advisory Committee Meeting
September 7, 2022

Requesting TAC Input

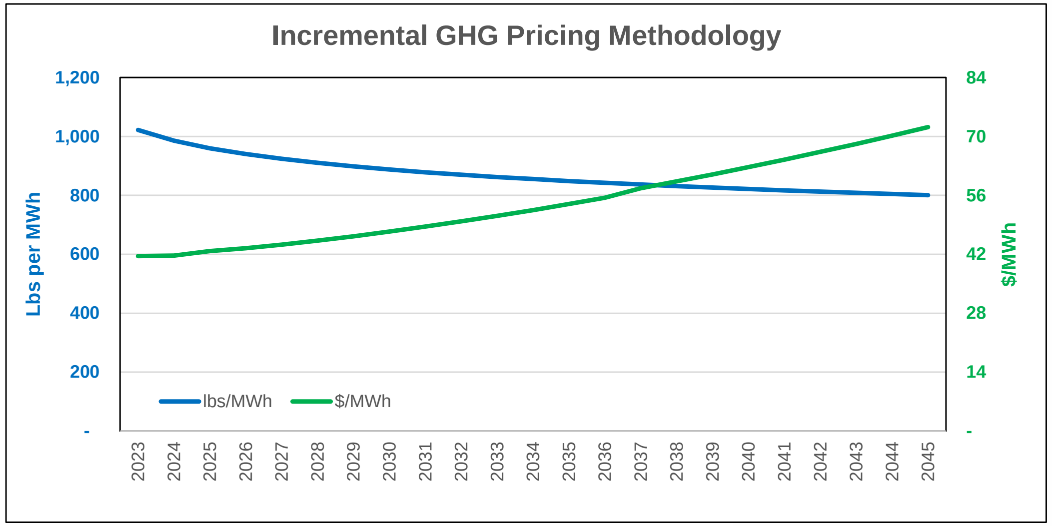
- Avista must include the Social Cost of GHG for Energy Efficiency selected
  - Per Clean Energy Transformation Act (CETA) for Washington customers.
- There are three proposed options to incorporate the non-energy impact into resource planning.
- Levelized SCGHG is estimated at $125.84 per metric ton.
  - Awaiting WUTC’s official pricing.



Methods Studied in the 2021 IRP

1) Incremental Method

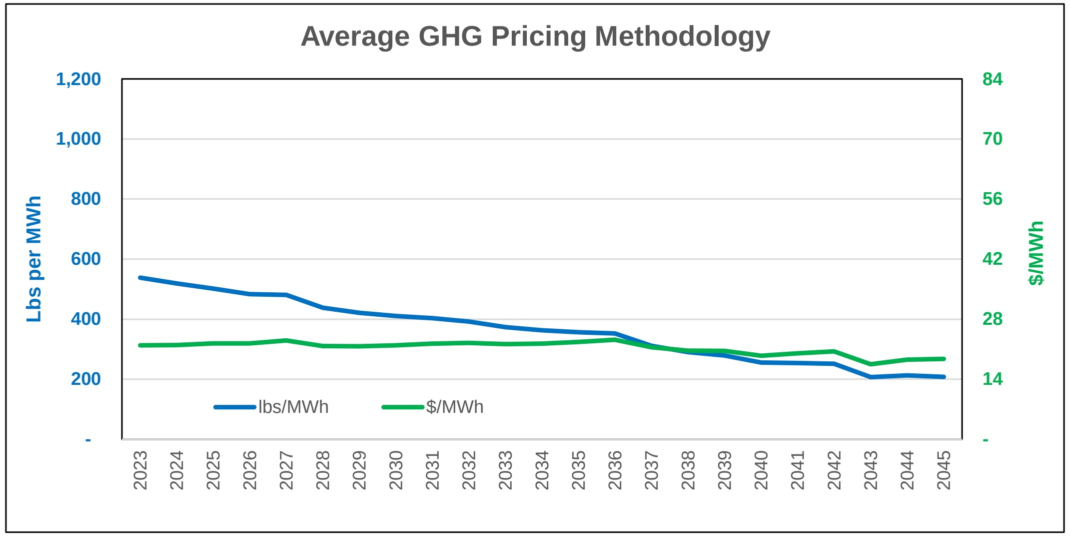
- Uses regional GHG incremental emissions rate for the Northwest



- Each MWh of energy efficiency receives a credit toward avoided cost for savings priced at the SCGHG.
- Results in $50.32/MWh credit

2) Average Method

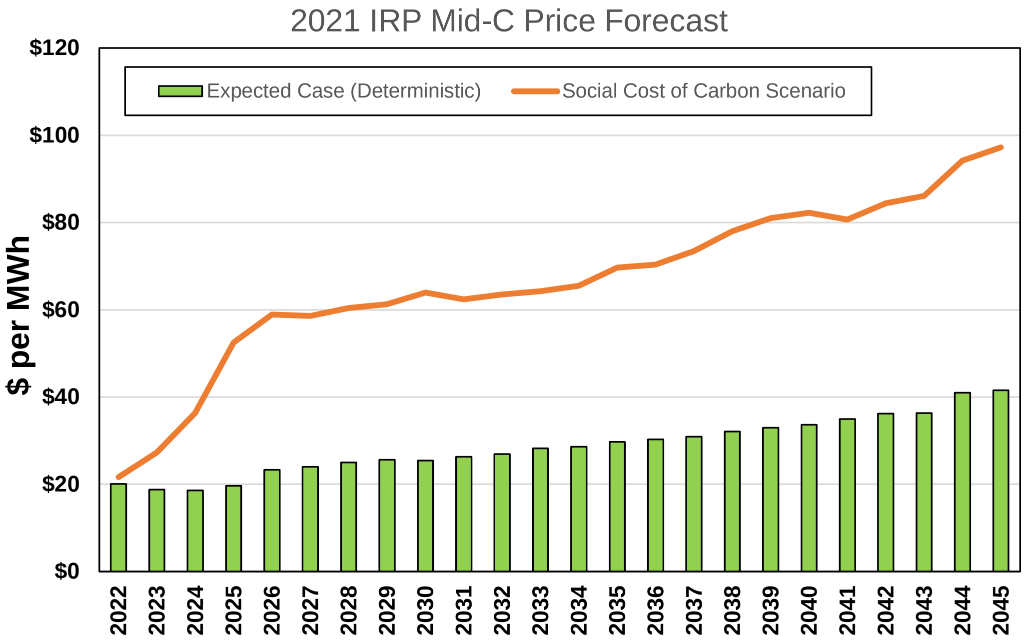
- Uses regional GHG average emissions rate for the Northwest



- Each MWh of energy efficiency receives a credit toward avoided cost for savings priced at the SCGHG.
- Results in $21.70/MWh credit

3) Wholesale Price Method

- Apply SCGHG to all resources in the dispatch within Aurora model.
- Creates new wholesale price forecast for energy efficiency avoided cost.
- Caution: some wholesale price forecasts with SCGHG have an overbuild of renewables creating lower wholesale marginal prices.



Results from 2021 Electric IRP Washington only savings (GWh)

GWh Savings	Incremental Method	Average Method	Wholesale Price Method	No SCGHG
10-year savings	507.8	452.4	506.6	370.8
20-year savings	772.4	671.5	769.4	557.9

Options for 2023 IRP

- Incremental Method
  - – SCGHG adder will be reduced to account for CCA price already included in dispatch.
- Average Method
  - – SCGHG adder will be reduced to account for CCA price already included in dispatch.
- Market Dispatch Method
  - – All regional resources dispatched with SCGHG.

Valuing QF Resources (Avoided Costs)

Fifth Electric Technical Advisory Committee

September 7, 2022

Clint Kalich, Senior Manager—Resource Analysis

clint.kalich@avistacorp.com

Agenda

- Define qualifying facility or QF
- Detail sizes in Federal, Idaho and Washington
- Describe Washington QF methodologies (published vs. IRP method)
- Define Idaho QF Rate methodologies (published SAR vs. IRP method)

PURPA Regulations

For Avista, defined by federal government and two states

- Federal Rules (Public Utilities Regulatory Policy Act of 1978)
  - Buy all cogeneration, and non-cogeneration up to 80 MW, at rates defined by state rules
  - Qualifying non-cogeneration, with a couple of exceptions, defined as renewable resources
  - Rates based on utility-avoided energy and capacity values

- Idaho Implementation
  - Small QF uses “Published SAR Method” rate for up to 10 aMW (100 kW wind/solar)
  - Negotiated rate for larger QFs based on “IRP Methodology”

- Washington Implementation
  - Published rate for QFs up to 5 MW based on IRP Methodology
  - Negotiated rate for larger QFs based on IRP Methodology

QF Published Rate Eligibility
Washington

- Projects up to 5 MW receive payments using a published rate schedule
- Projects over 5 MW receive a negotiated rate
    - Based on conceptual methodologies of published rates
    - Adjustments (up/down) can be applicable to the extent the larger resource differs from the value streams reflected in the published rate schedule

Washington State Avoided Costs

(IRP-Based Methodology)

Washington QF Value Streams

Payment consists of value streams dependent on resource/products offered

- Commodity Energy
- Peaking Capacity Value
- Clean Energy Premium
- Transmission
- Contingency Reserves
- Integration Charge for variable generation resources (wind/solar)
- Others

Commodity Energy – Washington

The most basic value associated with electricity provided to the grid

- Latest-approved IRP energy price forecast
- Priced in two blocks of on- and off-peak periods each month
  - Hours 0700-2200 defined as on-peak
  - Hours 0000-0700 and 2200-2400 are off-peak
- Payment is monthly for each MWh of facility production delivered to grid during that month

Transmission Credits and Charges – Washington

Portfolio savings or costs associated with transporting energy to/from market

- Credit paid in addition to others in hours IRP shows imported market power

- Charge in addition to others in hours IRP shows imported market power

- Rate equals BPA hourly Point-To-Point transmission tariff rate

- Credits and charges billed monthly for each MWh of forecast facility production delivered to grid during a month
  - Not a real-time credit/charge but is determined based on IRP data at the time of contracting
  - Rate escalates with IRP inflation forecast

- For published rates, billed as adjustment to Commodity Energy rate equal to:
  - Delivered energy (MWh) * Transmission credit/charge

Variable Energy Resource Integration Charge – Washington

Cost of incremental capacity services necessary to support grid reliability

- Avista applies variable energy resource (VER) integration charge to all such resources, whether owned or contracted for
- Covers various incremental ancillary services
  - Regulation, load following, forecast error
- Priced at VER integration study rate * QF nameplate capacity
- Discount will not apply until VER study is complete
- For published rates, billed as reduction to Commodity Energy rate equal to:
  - Delivered energy (MWh) * VER integration charge

Peaking Capacity Value – Washington

The value of providing electricity to the grid during times of system peak demands

- Fixed costs from one of two utility options:
  - Fixed costs associated with the last-approved- IRP’s first capacity addition fixed cost
  - Fixed costs associated with bids in most recent WAC 480-107 compliant RFP

- Paid based on Qualifying Capacity Contribution (QCC) factor
  - Will update QCC for 2023 IRP to Western Power Pool figures once available

- For published rates, value is paid monthly as a per-MWh rate:
  - Total annual value (TAV) = Nameplate Capacity * QCC * Price
  - Rate equals total annual value divided by annual energy output in MWh

Defining Qualifying Capacity Credit (QCC)

2021 IRP Data will be updated with WPP values once approved (WA & ID IRP Method)

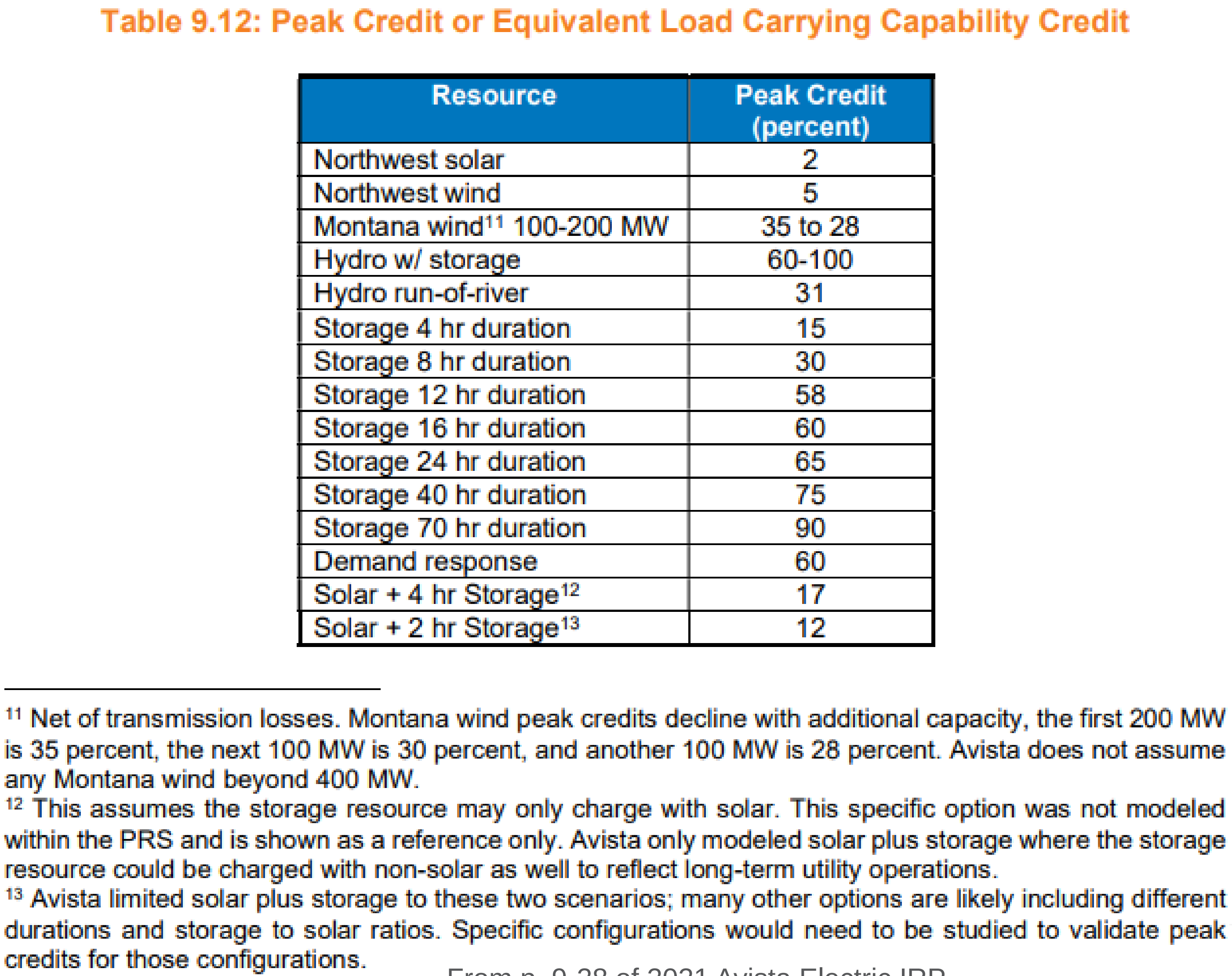


Table 9.12: Peak Credit or Equivalent Load Carrying Capability Credit

Resource	Peak Credit (percent)
Northwest solar	2
Northwest wind	5
Montana wind[11] 100-200 MW	35 to 28
Hydro w/ storage	60-100
Hydro run-of-river	31
Storage 4 hr duration	15
Storage 8 hr duration	30
Storage 12 hr duration	58
Storage 16 hr duration	60
Storage 24 hr duration	65
Storage 40 hr duration	75
Storage 70 hr duration	90
Demand response	60
Solar + 4 hr Storage[12]	17
Solar + 2 hr Storage[13]	12

---

[11] Net of transmission losses. Montana wind peak credits decline with additional capacity, the first 200 MW is 35 percent, the next 100 MW is 30 percent, and another 100 MW is 28 percent. Avista does not assume any Montana wind beyond 400 MW.

[12] This assumes the storage resource may only charge with solar. This specific option was not modeled within the PRS and is shown as a reference only. Avista only modeled solar plus storage where the storage resource could be charged with non-solar as well to reflect long-term utility operations.

[13] Avista limited solar plus storage to these two scenarios; many other options are likely including different durations and storage to solar ratios. Specific configurations would need to be studied to validate peak credits for those configurations.

From p. 9-28 of 2021 Avista Electric IRP

Contingency Reserves – Washington

Cost of regional obligation to hold capacity in the case of generation outages

- Avista holds 3% of all generation on its grid, irrespective of technology type or ownership

- Charge compensates for this cost

- For published rates, a reduction equal to:
  - Peaking Capacity Value * QF nameplate capacity

- For published rates, billed as a reduction to Peak Capacity Value equal to:
    - Delivered energy (MWh) * Contingency Reserve charge

Clean Energy Premium Value – Washington

Value of providing electricity to the grid that does not contain CO2e

- Latest-approved IRP total resource value less Energy less Peaking Capacity Values

- For published rates, value is added to the commodity energy schedule

Other Value Streams

Washington

- QF payments are based on generic resource type
- Some resources might have values above the generic assumptions
  - e.g., dispatch flexibility, storage, interruption rights, local distribution benefits
  - It is not expected these values will be large for most resources, especially if small in size (i.e., < 5 MW)
- Avista must be able to confirm additional values before a payment is defined

Idaho State Avoided Costs

(SAR-Based Methodology)

Surrogate Avoided Rates (SAR)

Idaho

- Published rate based on IPUC-managed model
  - Based on the fixed and variable costs of a combined-cycle gas turbine
  - Natural gas fuel price updated annually using an EIA gas price forecast
- Different pricing by resource type
  - Wind, solar, hydro, non-seasonal hydro, and other
- On- and off-peak production rates for two seasons of the year
  - Energy and capacity value combined into one figure
  - VER discount per 2007 wind integration study (to be updated with new study)

Surrogate Avoided Rates (SAR), Continued

Idaho

- Note on capacity payments
  - Renewed contracts receive full capacity payment as part of production rate
  - New contracts receive capacity payment starting with first year the utility is capacity deficit
- Renewable energy credits are kept by the QF

Idaho State Avoided Costs

(IRP-Based Methodology)

Differences between Idaho and Washington QF Rates

- Idaho has its own and varying size limits for published QF rates
  - Wind and solar projects <= 100 kW
  - Non-wind, non-solar <= 10 aMW

- Projects ineligible for published rates receive IRP-Methodology rates
  - Same methodology as described for Washington, EXCEPT
  - Peaking capacity value based on portfolio capacity cost rather than a single peaking resource technology
    - Calculated as the difference between PRS and PRS absent the energy and capacity constraints
  - Peaking capacity value is paid on a per-MW rather than per-MWh basis
  - VER charge is billed on a nameplate per-MW basis
  - Large QFs retain 50% of renewable energy credits

Thank You

2023 Electric Integrated Resource Plan

Technical Advisory Committee Meeting No. 6 Agenda

Wednesday, September 28, 2022
Microsoft Teams Virtual Meeting

Topic	Time	Staff
Introductions	12:30	John Lyons
Supply Side Resource Cost Assumptions, including DER	12:40	IRP Team
Variable Energy Resource Integration Study Update,	1:45	Lori Hermanson
Break		
All-Source RFP Update	2:30	Chris Drake
Global Climate Change Studies, Impacts to Avista Loads & Resources	2:45	Mike Hermanson
Adjourn	4:00	

IRP Introduction

2023 Avista Electric IRP

TAC 6 – September 28, 2022

John Lyons, Ph.D. Senior Resource Policy Analyst

Meeting Guidelines

- IRP team is working remotely and is available for questions and comments
- Stakeholder feedback form
  - Responses shared with TAC at meetings, by email and in Appendix
  - Would a form and/or section on the web site be helpful?
- IRP data posted to web site – updated descriptions and navigation are in development
- Virtual IRP meetings on Microsoft Teams until able to hold large meetings again
- TAC presentations and meeting notes posted on IRP page
- This meeting is being recorded and an automated transcript made

Virtual TAC Meeting Reminders

- Please mute mics unless commenting or asking a question
- Raise hand or use the chat box for questions or comments
- Respect the pause
- Please try not to speak over the presenter or a speaker
- Please state your name before commenting
- Public advisory meeting – comments will be documented and recorded

Integrated Resource Planning

The Integrated Resource Plan (IRP):

- Required by Idaho and Washington* every other year
  - Washington requires IRP every four years and update at two years
- Guides resource strategy over the next twenty + years
- Current and projected load & resource position
- Resource strategies under different future policies
  - Generation resource choices
  - Conservation / demand response
  - Transmission and distribution integration
  - Avoided costs
- Market and portfolio scenarios for uncertain future events and issues

Technical Advisory Committee

- Public process of the IRP – input on what to study, how to study, and review of assumptions and results
- Wide range of participants involved in all or parts of the process
  - Please ask questions
  - Always soliciting new TAC members
- Open forum while balancing need to get through topics
- Welcome requests for new studies or different modeling assumptions.
- Available by email or phone for questions or comments between meetings
- Due date for study requests from TAC members – October 1, 2022
- External IRP draft released to TAC – March 17, 2023, public comments due – May 12, 2023
- Final 2023 IRP submission to Commissions and TAC – June 1, 2023

Remaining 2023 Electric IRP TAC Meeting Schedule

- TAC 7: October 11, 2022, 9 am – 3:30 pm
- Technical Modeling Workshop: October 20, 2022
- Washington Progress Report Workshop: December 14, 2022
- TAC 8: February 16, 2023
- Public Meeting Gas & Electric IRPs: March 8, 2023
- TAC 9: March 22, 2023

Today’s Agenda

12:30	Introductions, John Lyons
12:40	Supply Side Resource Cost Assumptions, Avista IRP Team
1:45	Variable Energy Resource Integration Study Update, Lori Hermanson
	Break
2:30	All-Source RFP Update, Chris Drake
2:45	Global Climate Change Studies, Impacts to Avista Loads & Resources, Mike Hermanson
4:00	Adjourn

Supply Side Resource Options

Resources Considered

Avista IRP Team
Electric IRP, 6th Technical Advisory Committee Meeting
September 28, 2022

Inflation Reduction Act

Tom Pardee, Natural Gas Planning Manager
Electric IRP, 6th Technical Advisory Committee Meeting
September 28, 2022

IRA Overview

- Signed August 16, 2022, and became Public Law No: 117-169
- New “technology-neutral” clean electricity production and investment credits
- Extension and expansion of the renewable electricity production tax credit (PTC) and energy tax credit (ETC)
- Zero-emissions nuclear power production credit
- Clean hydrogen production credit
- Expansion of the credit for carbon capture and storage
- Energy manufacturing credits

IRA Details

- $14,000 in direct consumer rebates for heat pumps or other energy efficient home appliances ($2,000 annual credit against tax liability)

- Up to $7,500 in tax credits for new electric vehicles and $4,000 for used electric vehicles

- Production Tax Credits
  - (Geothermal, Wind and Biomass)
  - $0.026 per kWh tax credit
  - Nuclear
  - $0.015 per kWh tax credit plus $0.003 base credit ($0.018 total per kWh credit)

- Investment Tax Credit (Battery Storage, Pumped Hydro, Solar)
  - Costs incurred in 2022 and 2032 qualify for a 30% tax credit
  - Credit falls to 26% in 2033, 22% in 2034, 10% in 2035/2036, and 0% in 2037
  - Extends to battery storage
  - Additional 10% low-income tax credit
  - Domestic production at 10%

https://www.congress.gov/bill/117th-congress/house-bill/5376/text

Not Modeled

- Renewable Natural Gas (RNG)
- Carbon Capture
- Synthetic Methane
- Biodiesel
- Non-Commercial Technologies

Modeled But Covered in TAC 7

- Ammonia
- Hydrogen

Supply Side Resource Options

Resources Considered

Michael Brutocao, Natural Gas Analyst
Electric IRP, 6th Technical Advisory Committee Meeting
September 28, 2022

Overview & Considerations

- The assumptions discussed are “today’s” estimates – likely to be periodically revised.
- IRP supply-side resources are commercially available technologies with potential for development within or near Avista service territory.
- Resource costs vary depending on location, equipment, fuel prices and ownership; while IRPs use point estimates, actual costs will be different.
- Certain resources will be modeled as purchase power agreements (PPA) while others will be modeled as Avista “owned”. These assumptions do not mean they are the only means of resource acquisition.
- No transmission or interconnection costs are included at this time.
  - Interconnect included for off-system resources.
- An Excel file has been distributed with all resources, assumptions and cost calculations for TAC members to review and provide feedback.

Proposed Natural Gas Resource Options

Peakers

- Simple Cycle Combustion Turbine (CT)
  - CT Frame
  - 180 MW

- Reciprocating Engines
  - 185 MW

Baseload

- Combined Cycle CT (CCCT)
  - 312 MW (1x1 w/DF)

Natural gas turbines are modeled using a 30-year life with Avista ownership

Renewable Resource Options - Solar

All Purchase Power Agreement (PPA) Options

Solar

- Residential (6 kW AC)
  - New & existing
  - With & without battery
- Commercial (1 MW AC)
  - With & without battery
- Fixed PV Array (5 MW AC)
  - With & without battery
- On-System Single Axis Tracking Array (100 MW AC)
  - With & without 100 MW 4-hour lithium-ion battery
  - With 100 MW 2-hour lithium-ion battery
  - With 50 MW 4-hour lithium-ion battery
- Off-system Single Axis Tracking Array (100 MW AC) located in southern PNW

Renewable Resource Options - Wind

All Purchase Power Agreement (PPA) Options

Wind

- On-system wind (100 MW)
- Off-system wind (100 MW)
- Montana wind (100 MW)
- Offshore wind (100 MW)
  - Share of a larger project

Other “Clean” Resource Options

- Geothermal PPA (20 MW)
  - Off-system PPA
- Biomass (58 MW)
  - i.e. Kettle Falls 3 or other
- Nuclear PPA (100 MW)
  - Off-system PPA share of a mid-size facility
- Renewable Hydrogen
  - Fuel Cell (25 MW)
- Ammonia (74 MW)
  - Natural Gas Turbine

Storage Technologies

Lithium-Ion

- Assumes: 86% round trip efficiency (RTE), 15-year operating life
- Assumes Avista ownership
- 5 MW Distribution Level
  - 4 hours (20 MWh)
  - 8 hours (40 MWh)
- 25 MW Transmission Level
  - 4 hours (100 MWh)
  - 8 hours (200 MWh)
  - 16 hours (400 MWh)

Other Storage Options

- Assumes Avista ownership
- 25 MW Vanadium Flow (70% RTE)
  - 4 hours (100 MWh)
- 25 MW Zinc Bromide Flow (67% RTE)
  - 4 hours (100 MWh)
- 25 MW Liquid Air (65% RTE)
  - 8 hours (400 MWh)
- 100 MW Iron Oxide (65% RTE)
  - 100 hours
- 100 MW Pumped Hydro
  - 16/24 hours (1,600/2,400 MWh)
- 400 MW Pumped Hydro
  - 8.5 hours (3,400 MWh)

Resource Upgrades

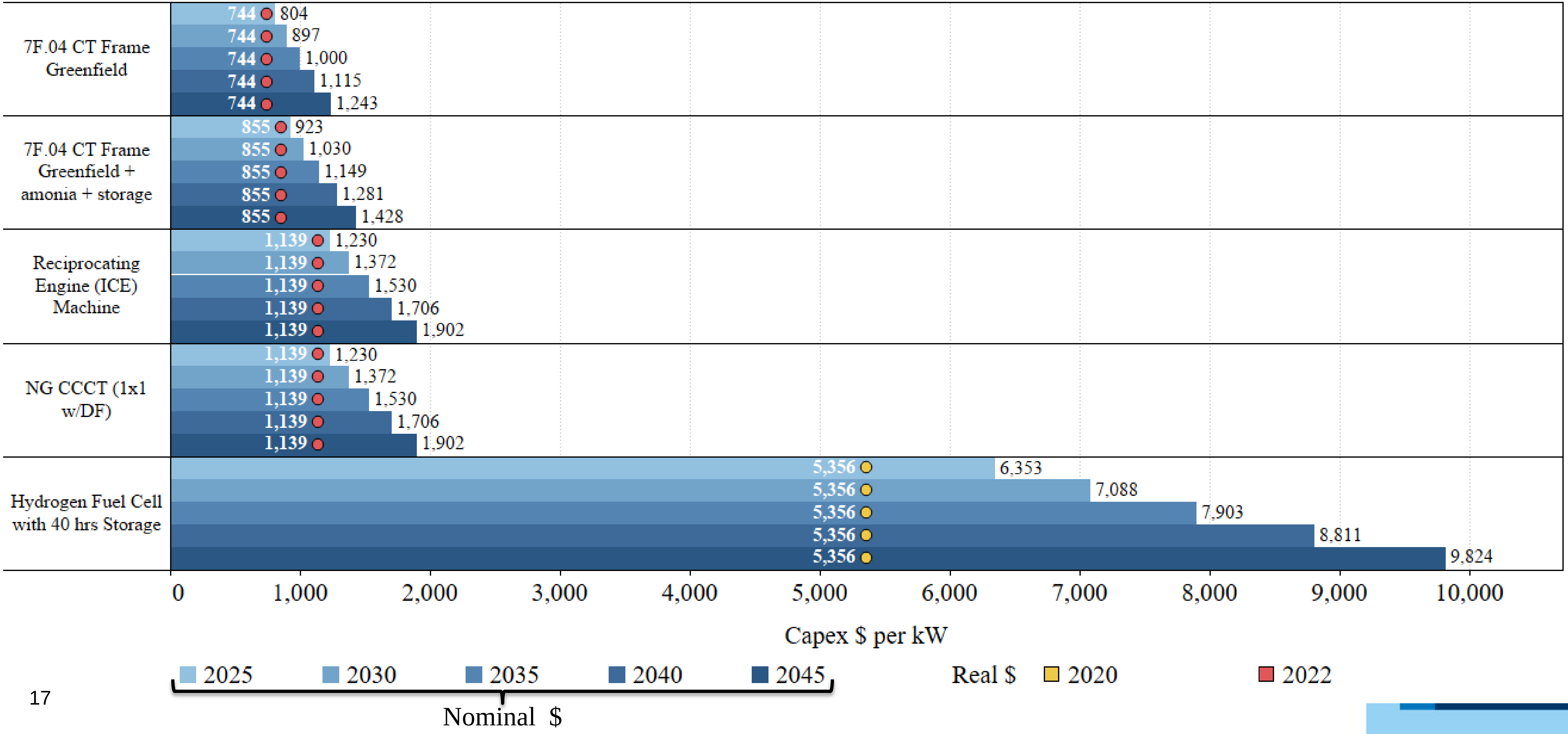
- **Rathdrum CT** *[natural gas peaker]*
  - 5 MW by 2055 uprates
  - 10 MW Inlet Evaporation

Supply Side Resource Options

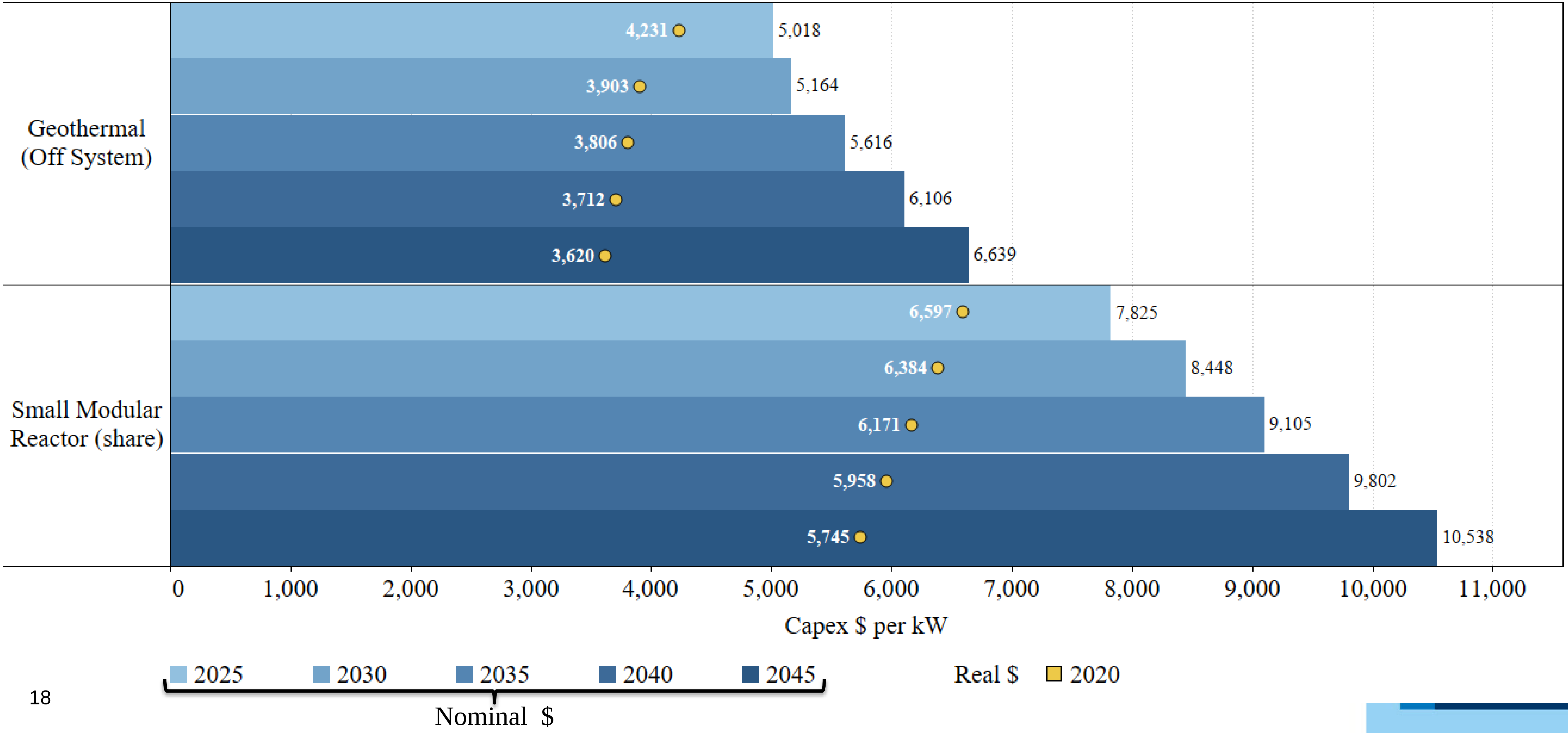
Capital Costs

Michael Brutocao, Natural Gas Analyst
Electric IRP, 6th Technical Advisory Committee Meeting
September 28, 2022

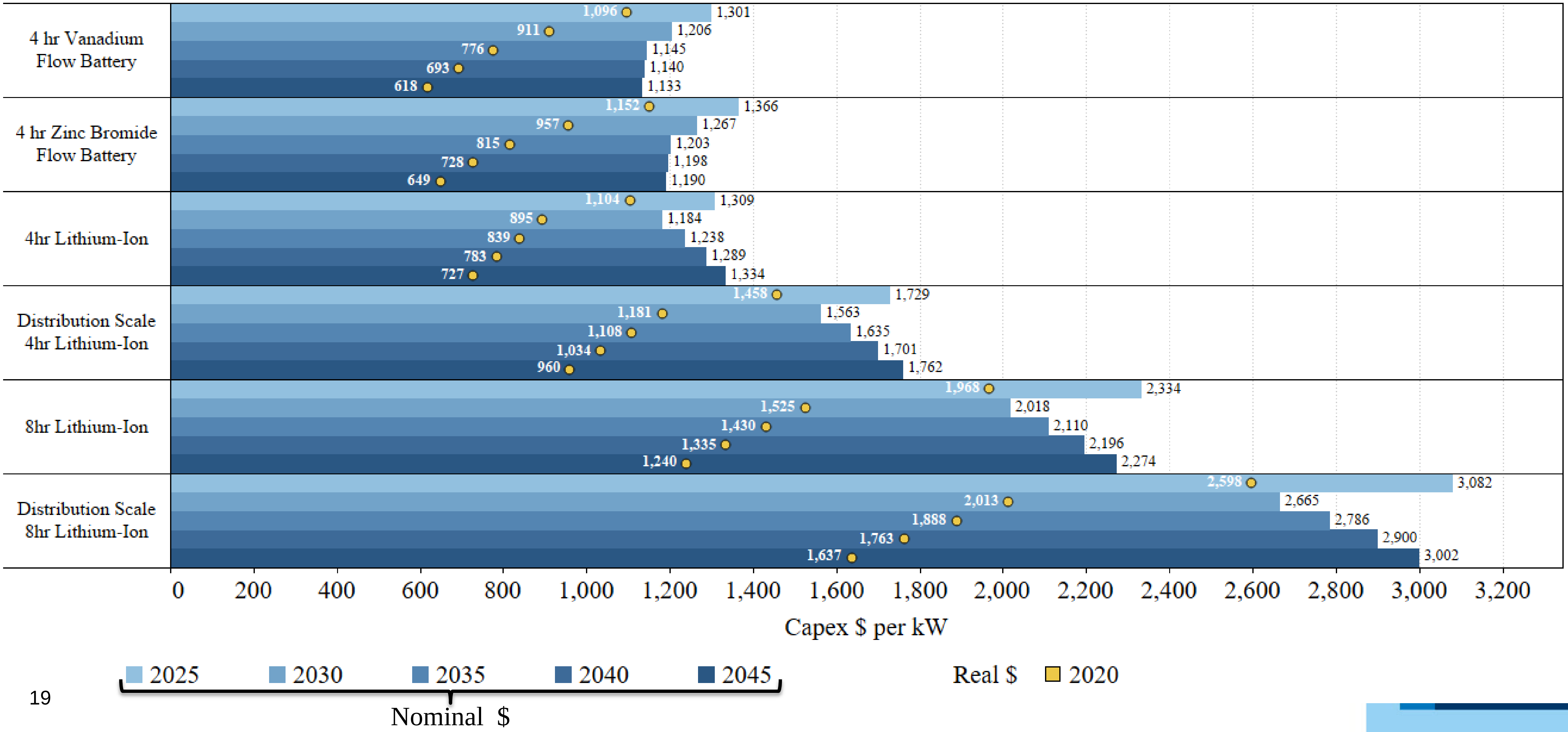
Fueled Generation



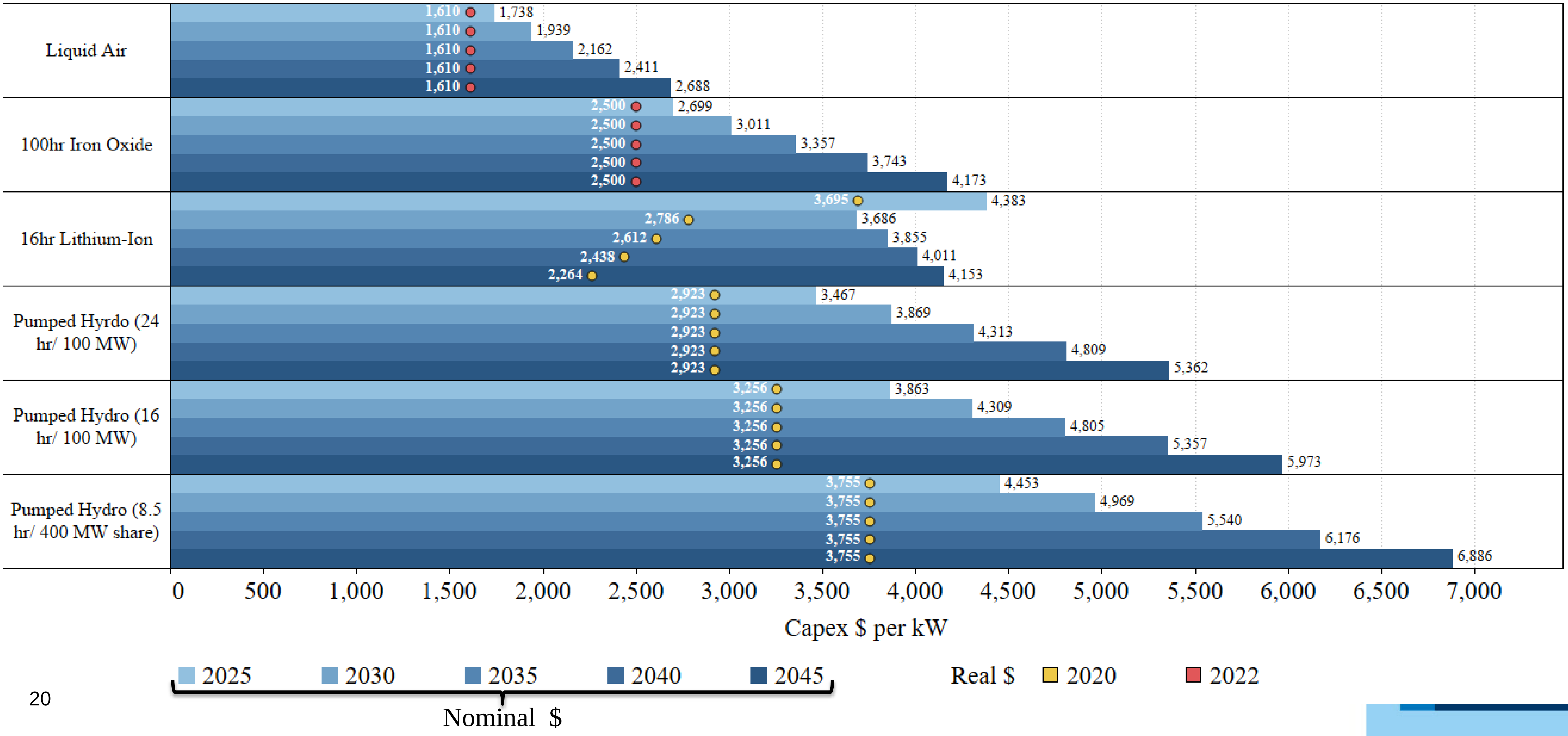
Geothermal & Nuclear



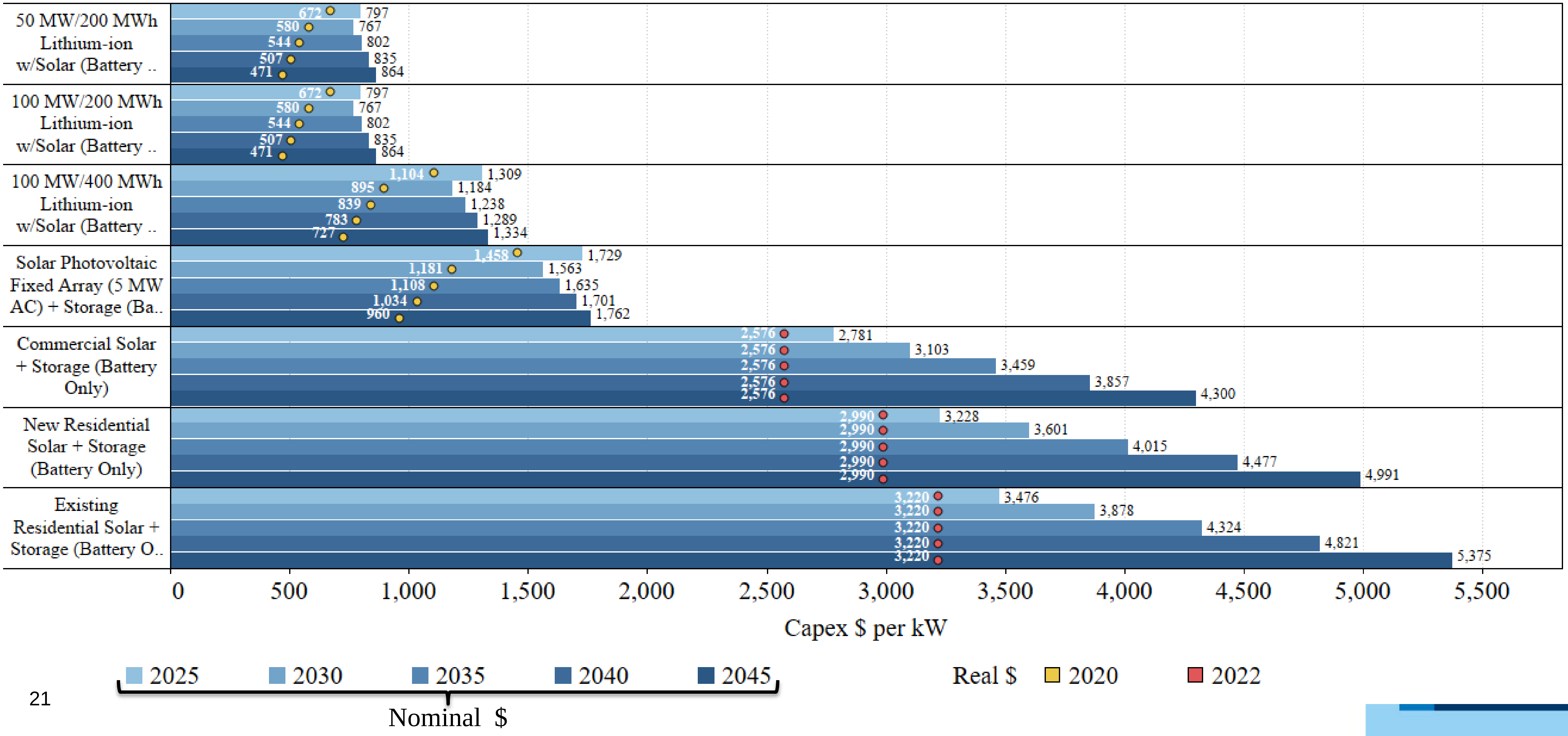
Storage


4 hr Vanadium Flow Battery
1,096
1,301
911
1,206
776
1,145
693
1,140
618
1,133
4 hr Zinc Bromide Flow Battery
1,152
1,366
957
1,267
815
1,203
728
1,198
649
1,190
4hr Lithium-Ion
1,104
1,309
895
1,184
839
1,238
783
1,289
727
1,334
Distribution Scale 4hr Lithium-Ion
1,458
1,729
1,181
1,563
1,108
1,635
1,034
1,701
960
1,762
8hr Lithium-Ion
1,968
2,334
1,525
2,018
1,430
2,110
1,335
2,196
1,240
2,274
Distribution Scale 8hr Lithium-Ion
2,598
3,082
2,013
2,665
1,888
2,786
1,763
2,900
1,637
3,002
0
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
2,200
2,400
2,600
2,800
3,000
3,200
Capex $ per kW
2025
2030
2035
2040
2045
Nominal $
Real $
2020

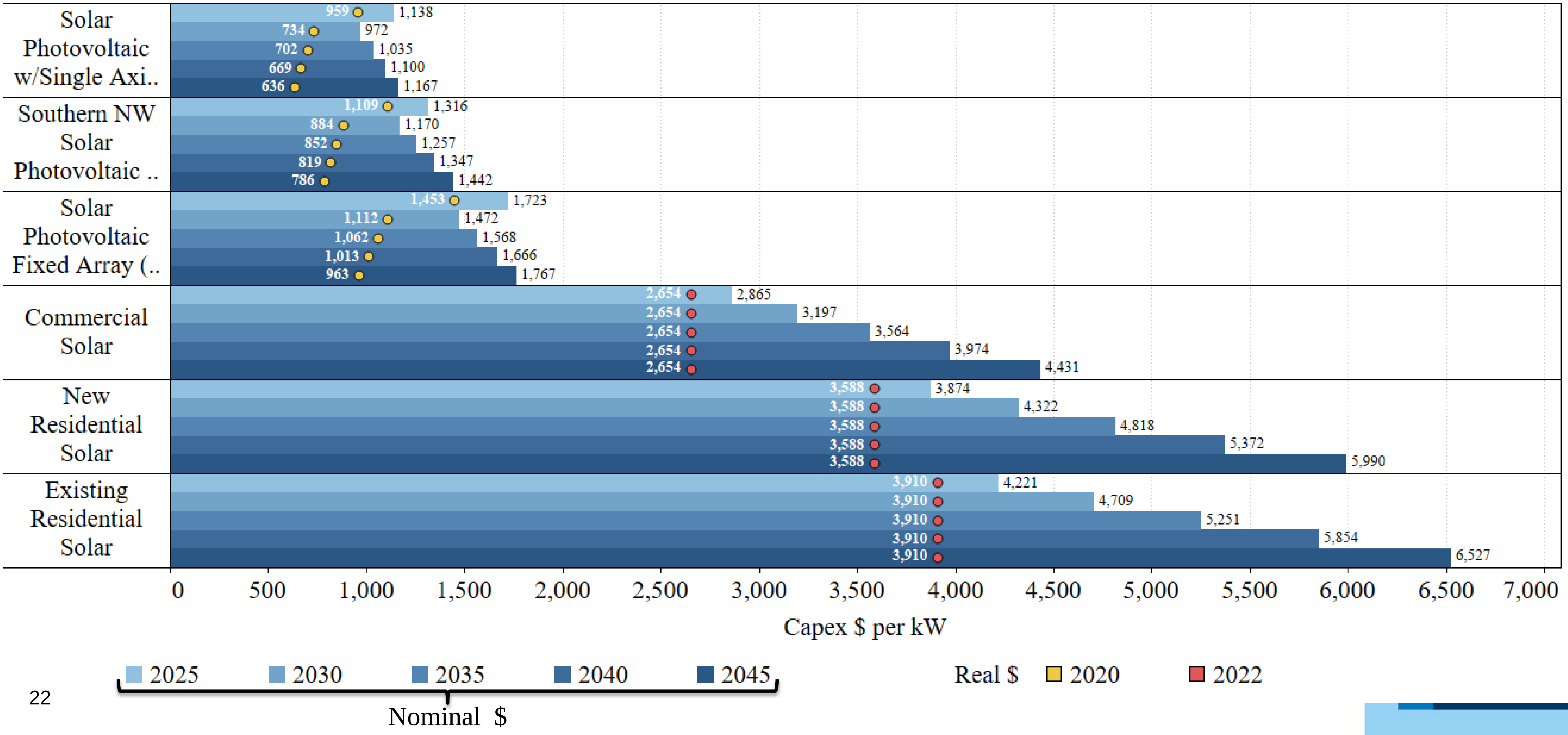
Storage Continued



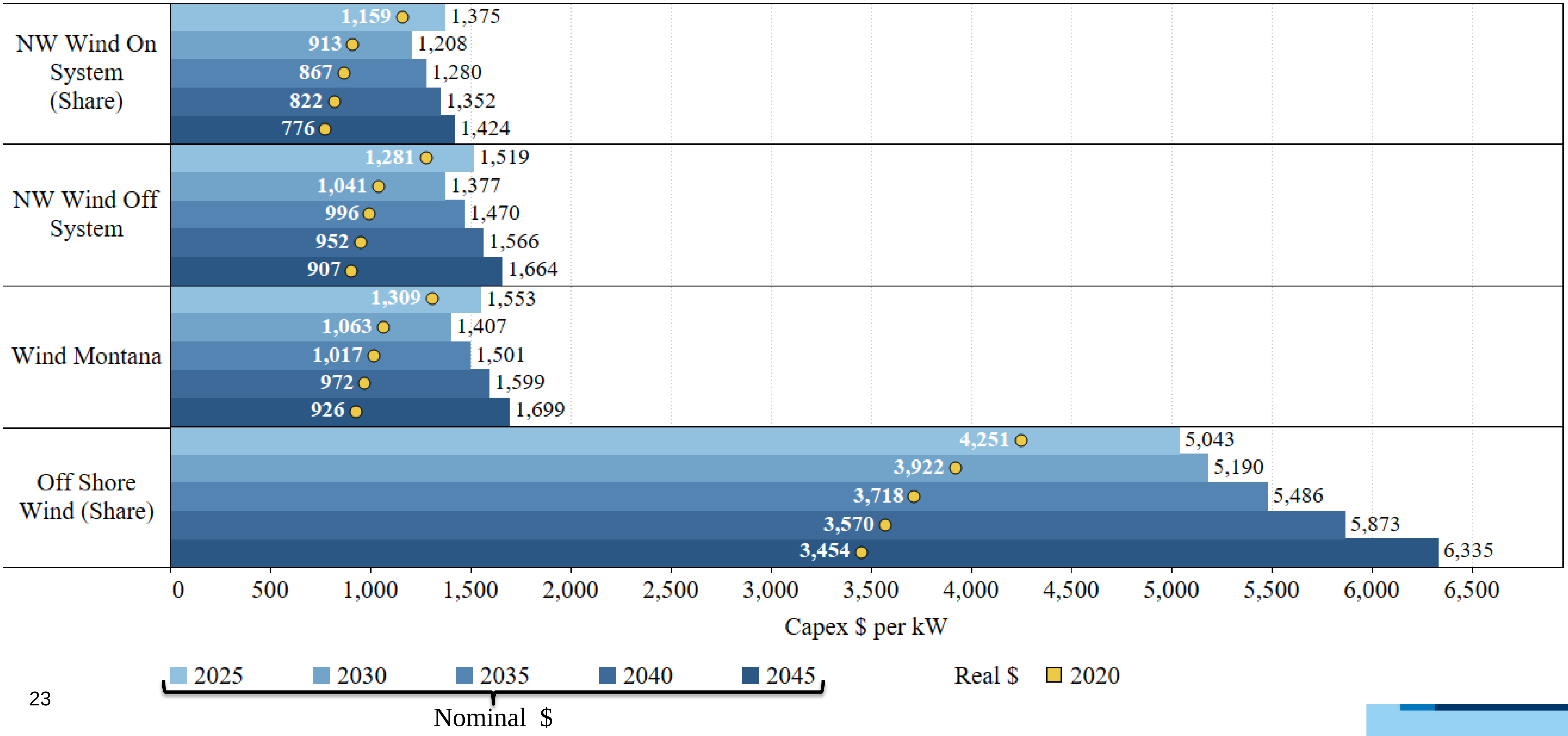
Solar + Storage



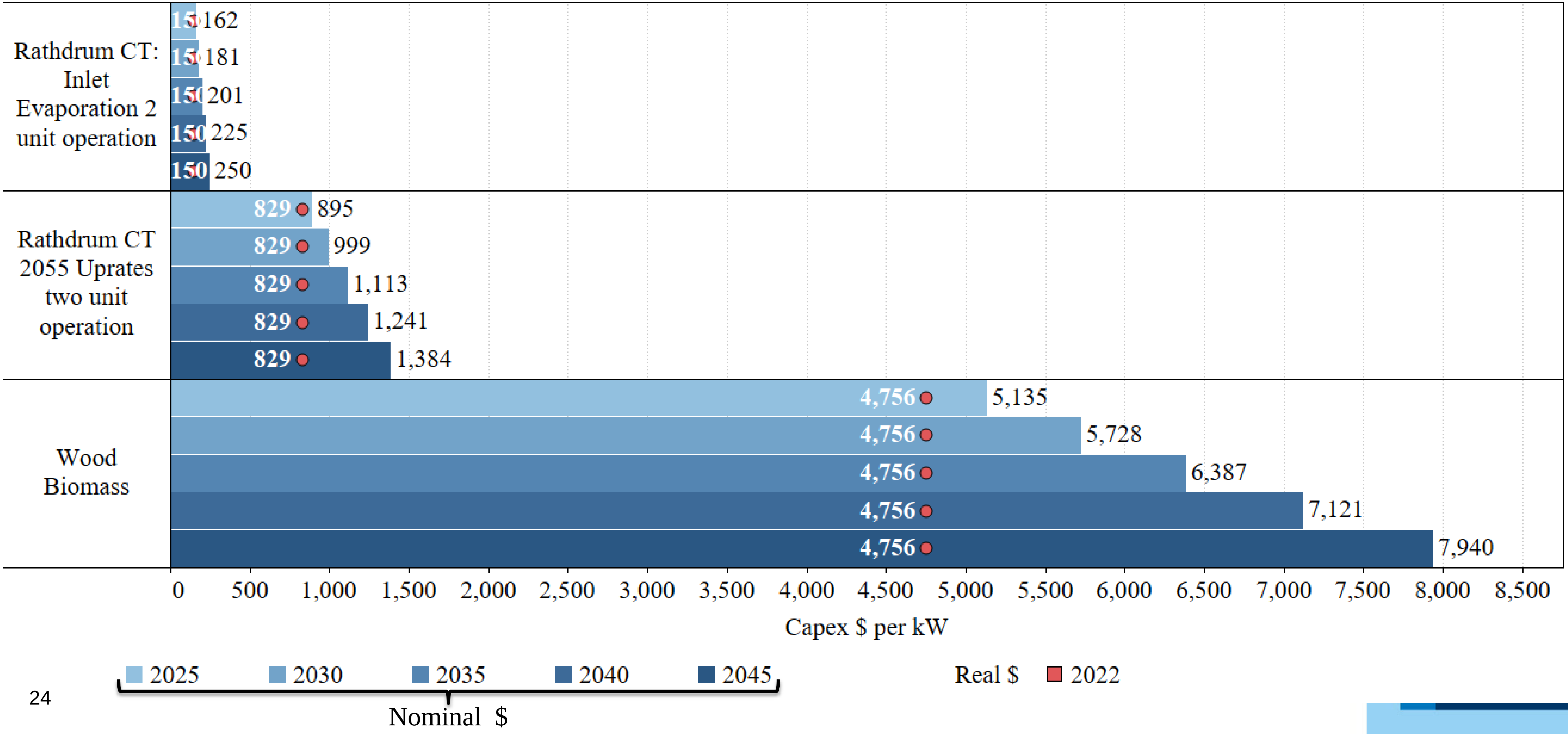
Solar PPA


Solar Photovoltaic w/Single Axi..
959 1,138
734 972
702 1,035
669 1,100
636 1,167
Southern NW Solar Photovoltaic ..
1,109 1,316
884 1,170
852 1,257
819 1,347
786 1,442
Solar Photovoltaic Fixed Array (..
1,453 1,723
1,112 1,472
1,062 1,568
1,013 1,666
963 1,767
Commercial Solar
2,654 2,865
2,654 3,197
2,654 3,564
2,654 3,974
2,654 4,431
New Residential Solar
3,588 3,874
3,588 4,322
3,588 4,818
3,588 5,372
3,588 5,990
Existing Residential Solar
3,910 4,221
3,910 4,709
3,910 5,251
3,910 5,854
3,910 6,527
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
5,500
6,000
6,500
7,000
Capex $ per kW
2025
2030
2035
2040
2045
Nominal $
Real $
2020
2022

Wind PPA


NW Wind On System (Share)
1,159
1,375
913
1,208
867
1,280
822
1,352
776
1,424
NW Wind Off System
1,281
1,519
1,041
1,377
996
1,470
952
1,566
907
1,664
Wind Montana
1,309
1,553
1,063
1,407
1,017
1,501
972
1,599
926
1,699
Off Shore Wind (Share)
4,251
5,043
3,922
5,190
3,718
5,486
3,570
5,873
3,454
6,335
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
5,500
6,000
6,500
Capex $ per kW
2025
2030
2035
2040
2045
Nominal $
Real $
2020

Upgrades & Biomass

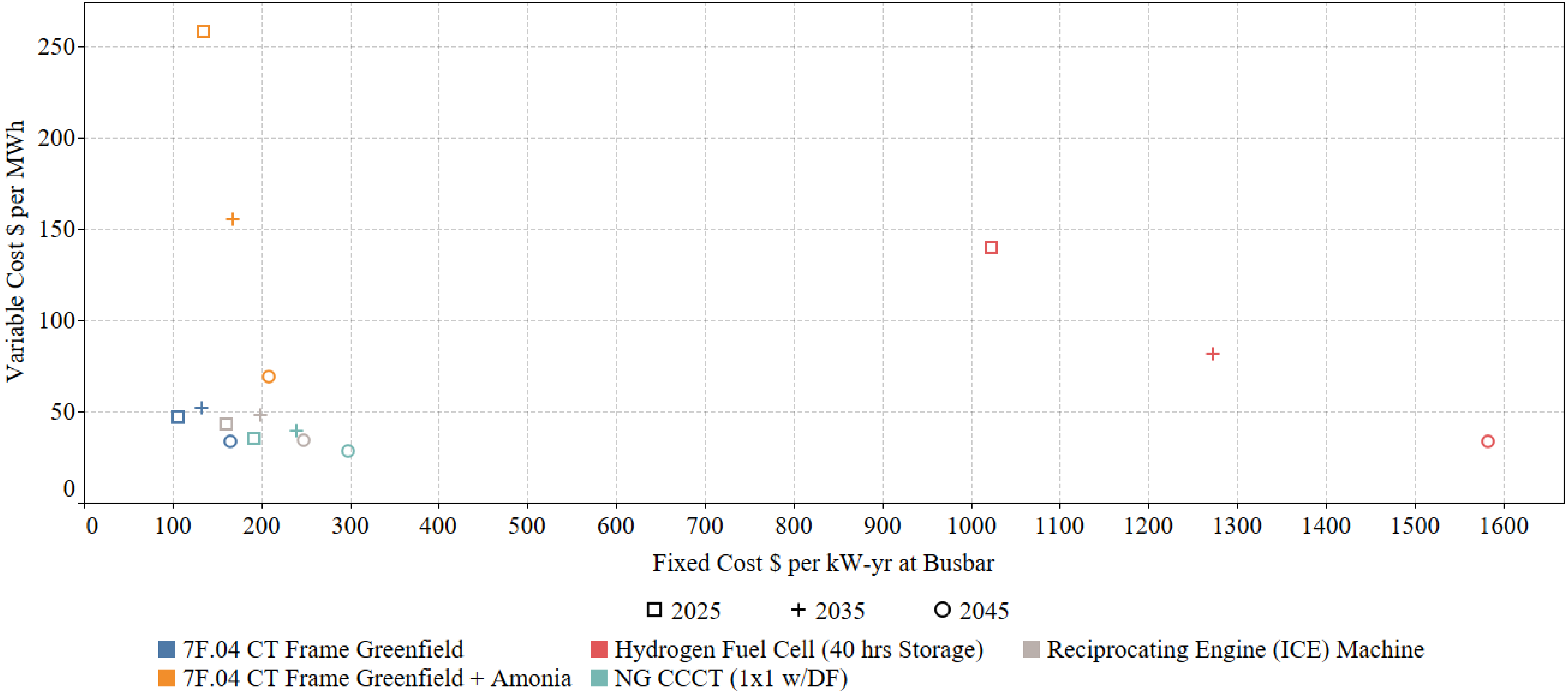


Supply Side Resource Options

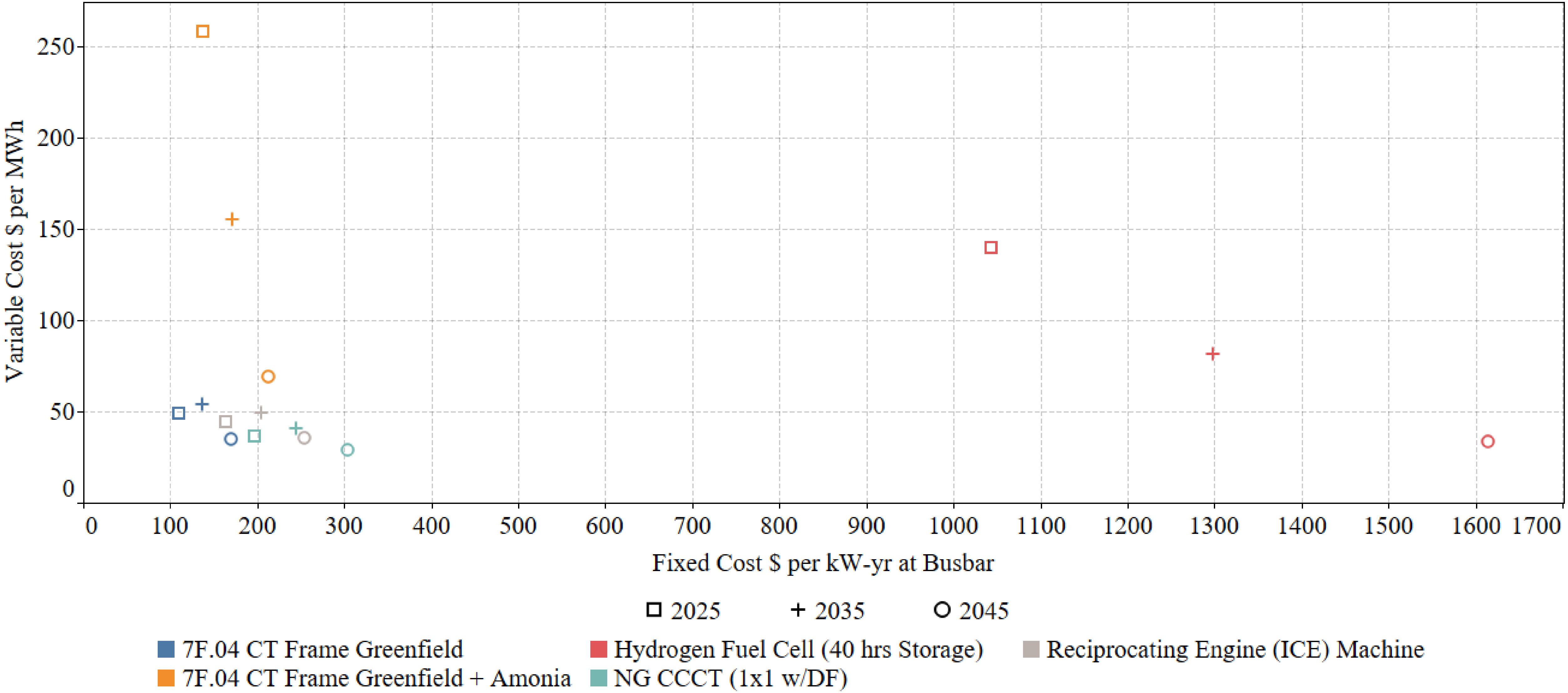
Levelized Costs

Michael Brutocao, Natural Gas Analyst
Electric IRP, 6th Technical Advisory Committee Meeting
September 28, 2022

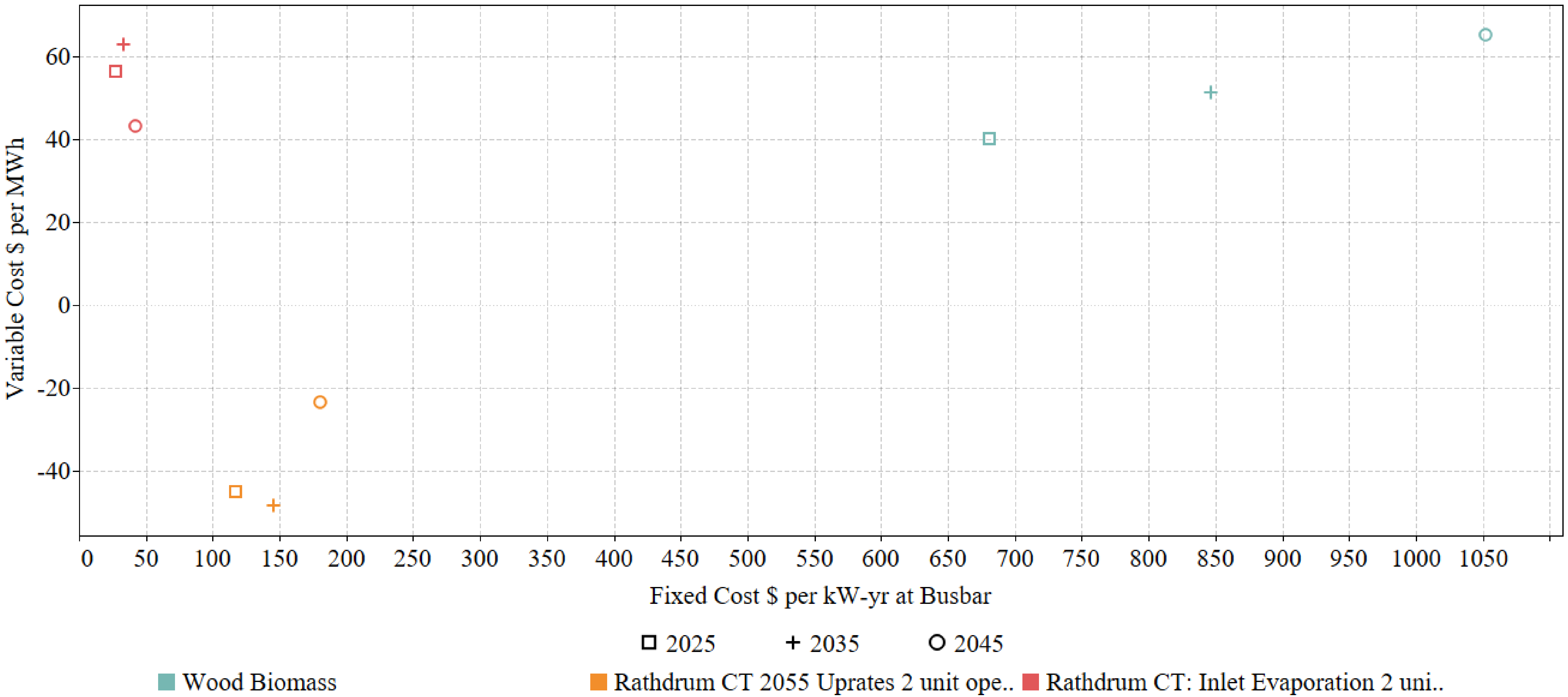
Natural Gas Fixed & Variable Costs – nominal $ (Idaho)



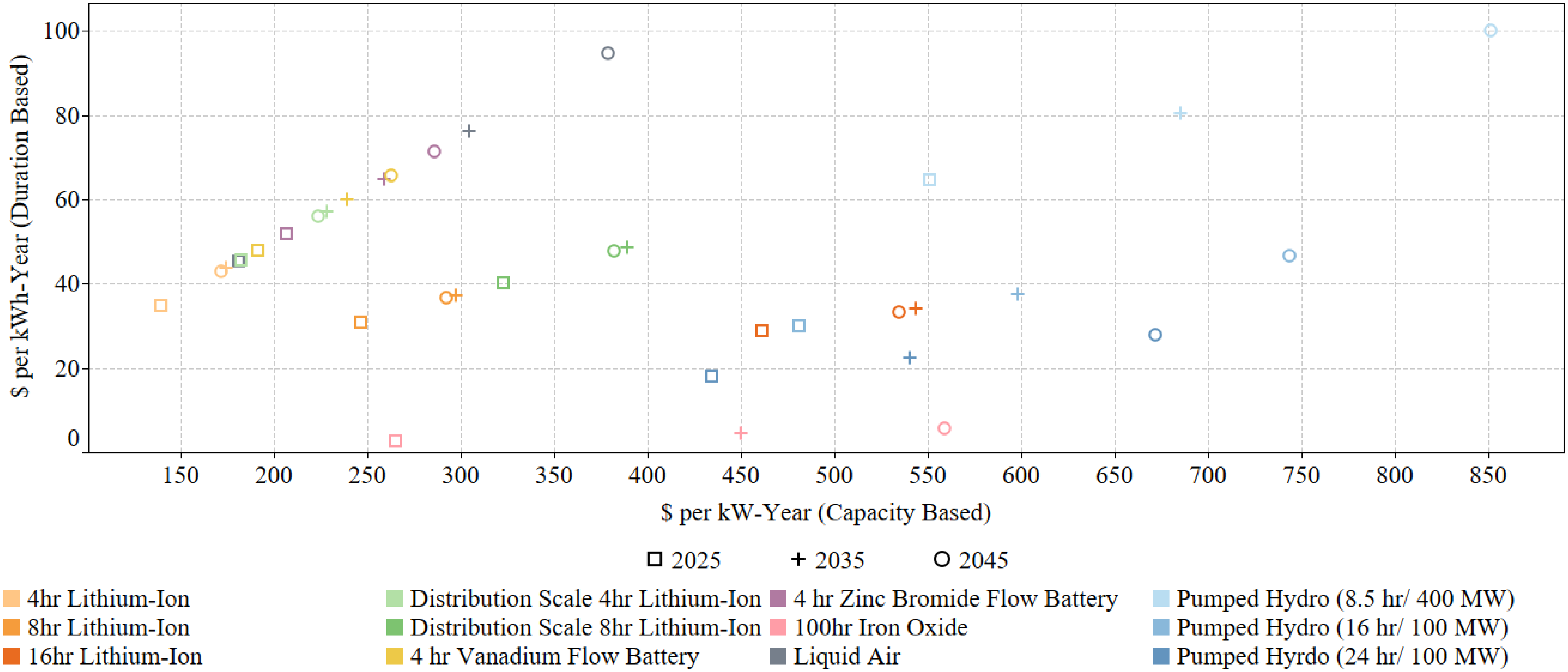
Natural Gas Fixed & Variable Costs – nominal $ (Washington)



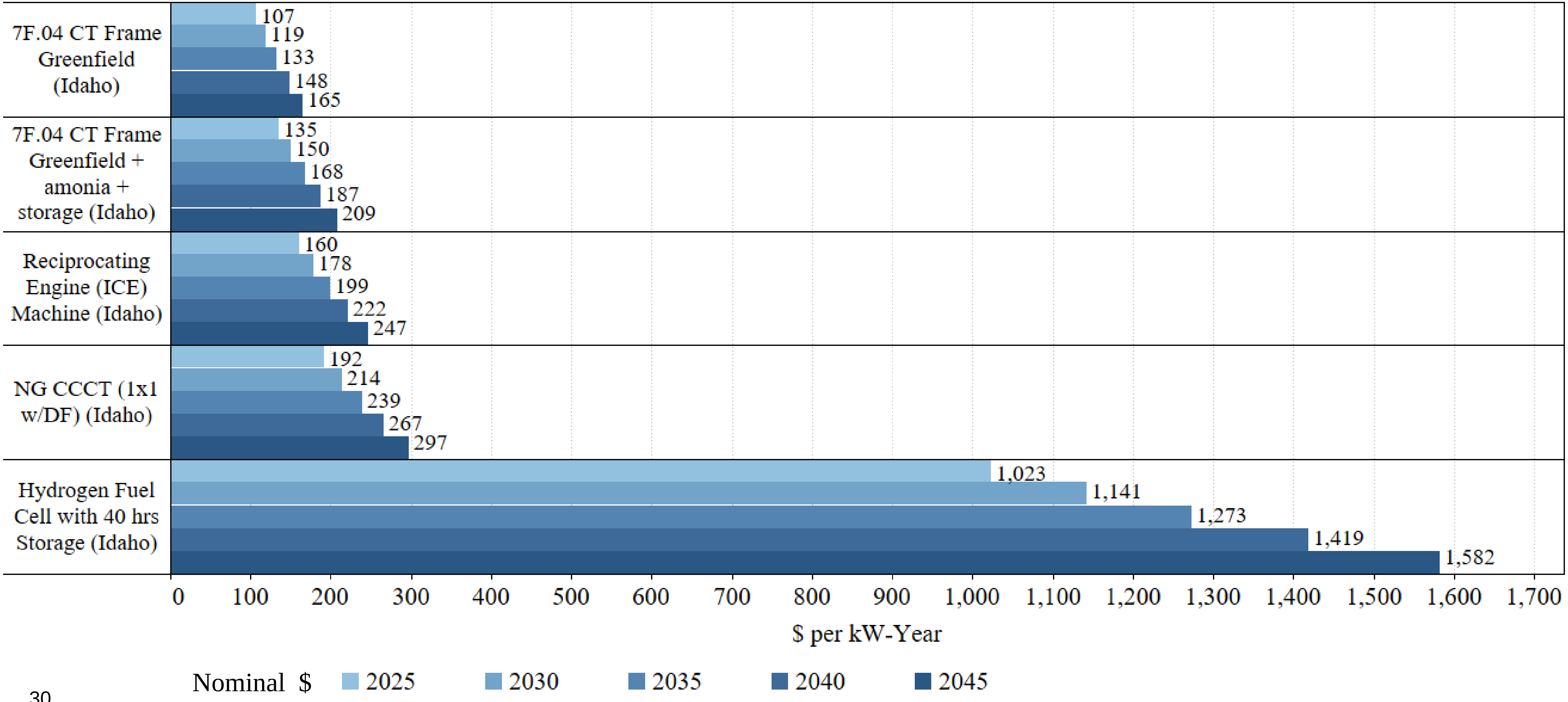
Facility Upgrade Cost Analysis – nominal $



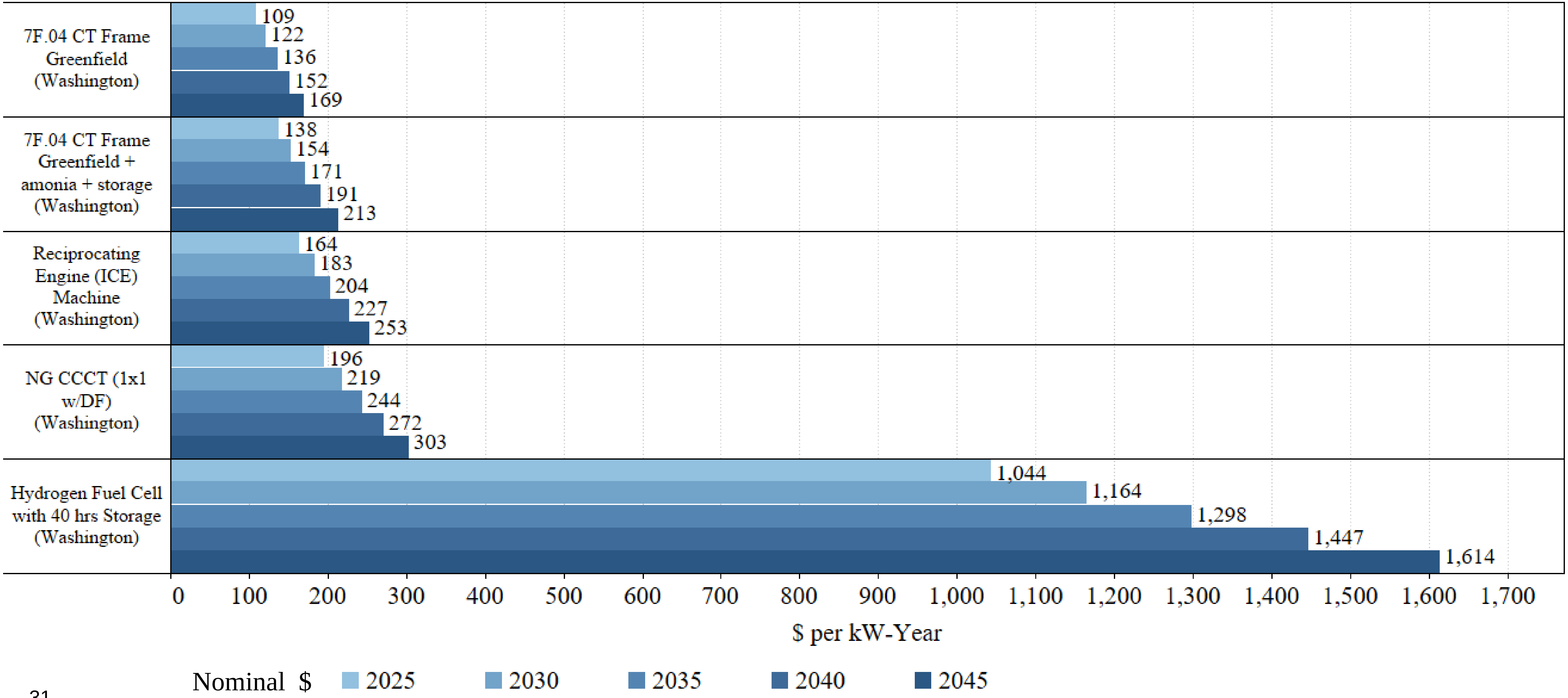
Storage Cost Analysis – nominal $



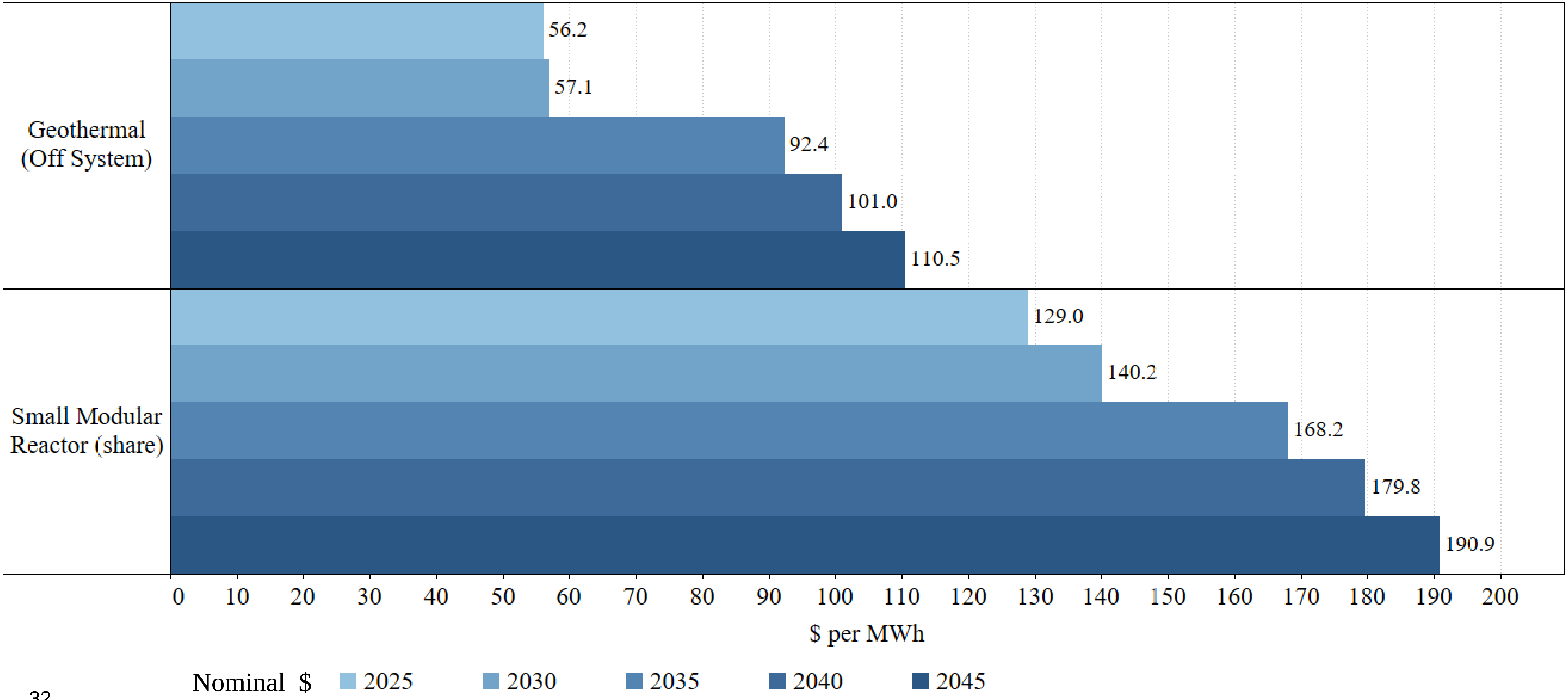
Fueled Generation Fixed Cost (Levelized) - Idaho



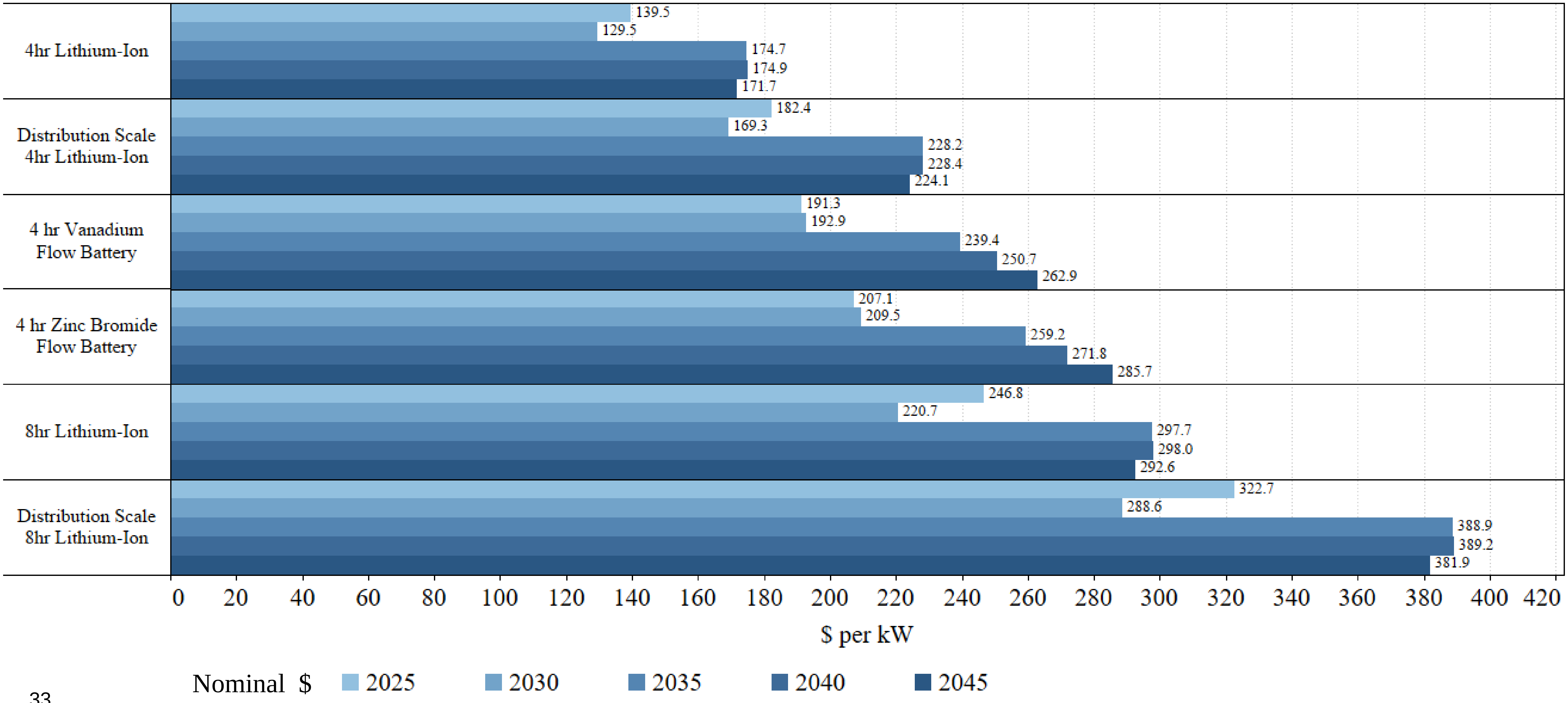
Fueled Generation Fixed Cost (Levelized) - Washington



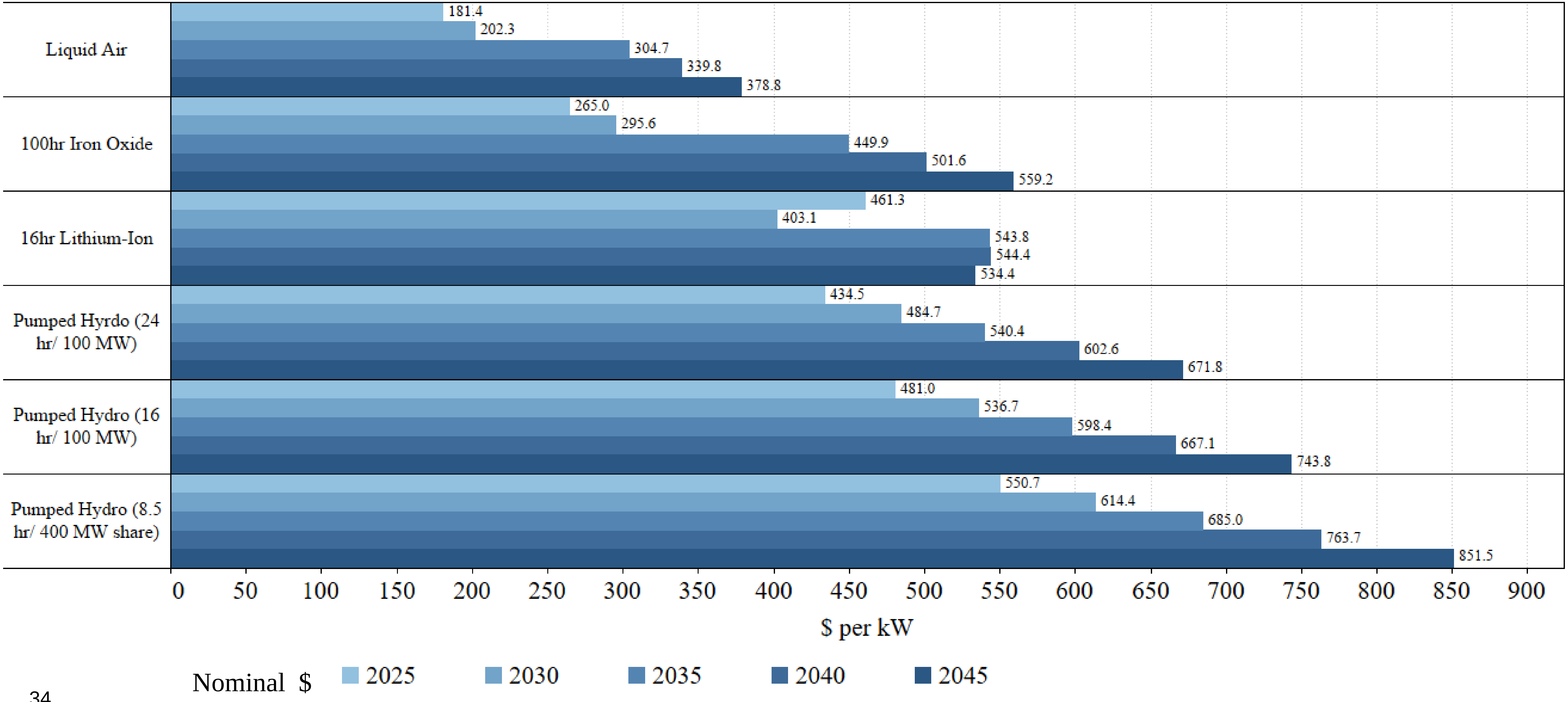
Geothermal/Nuclear Implied Energy Payment (Levelized)



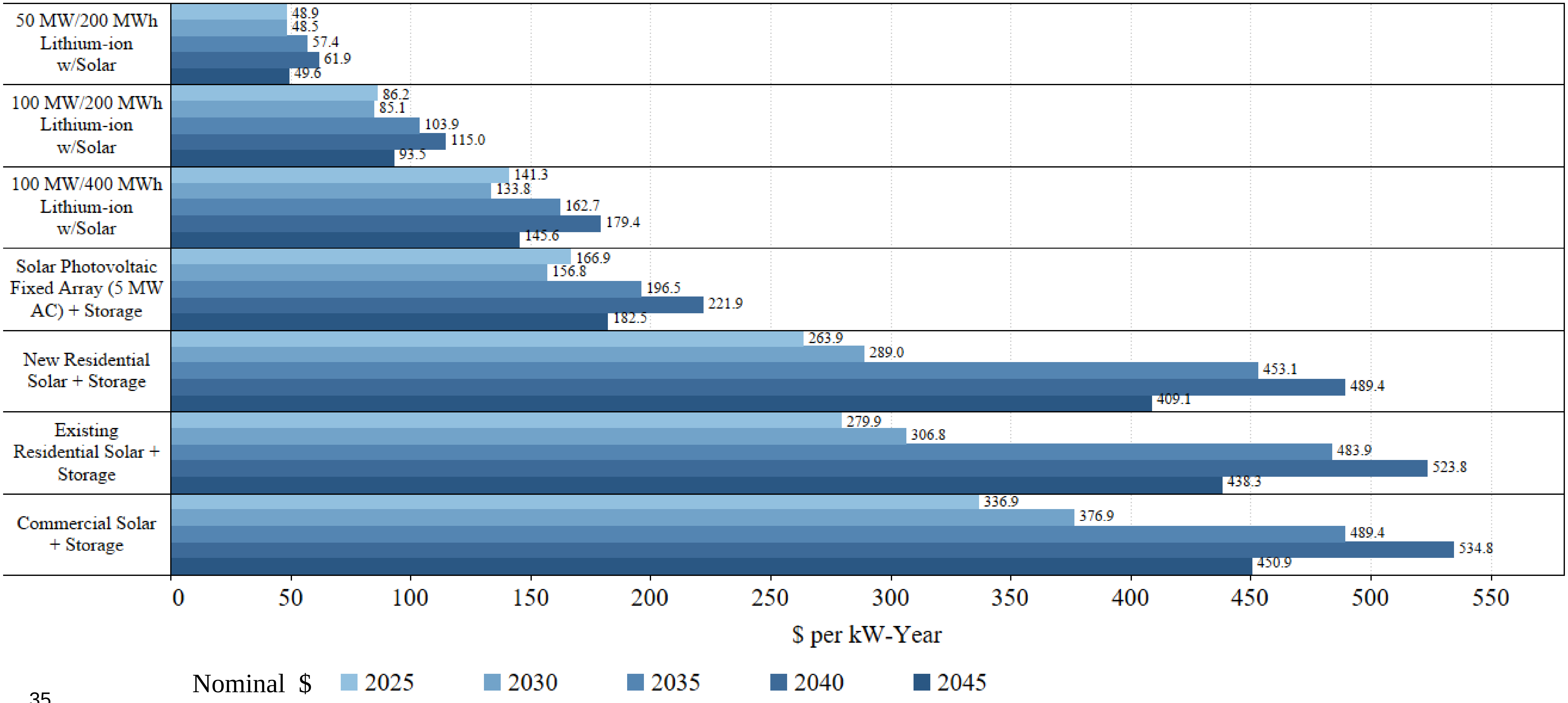
Storage Fixed Cost (Levelized)



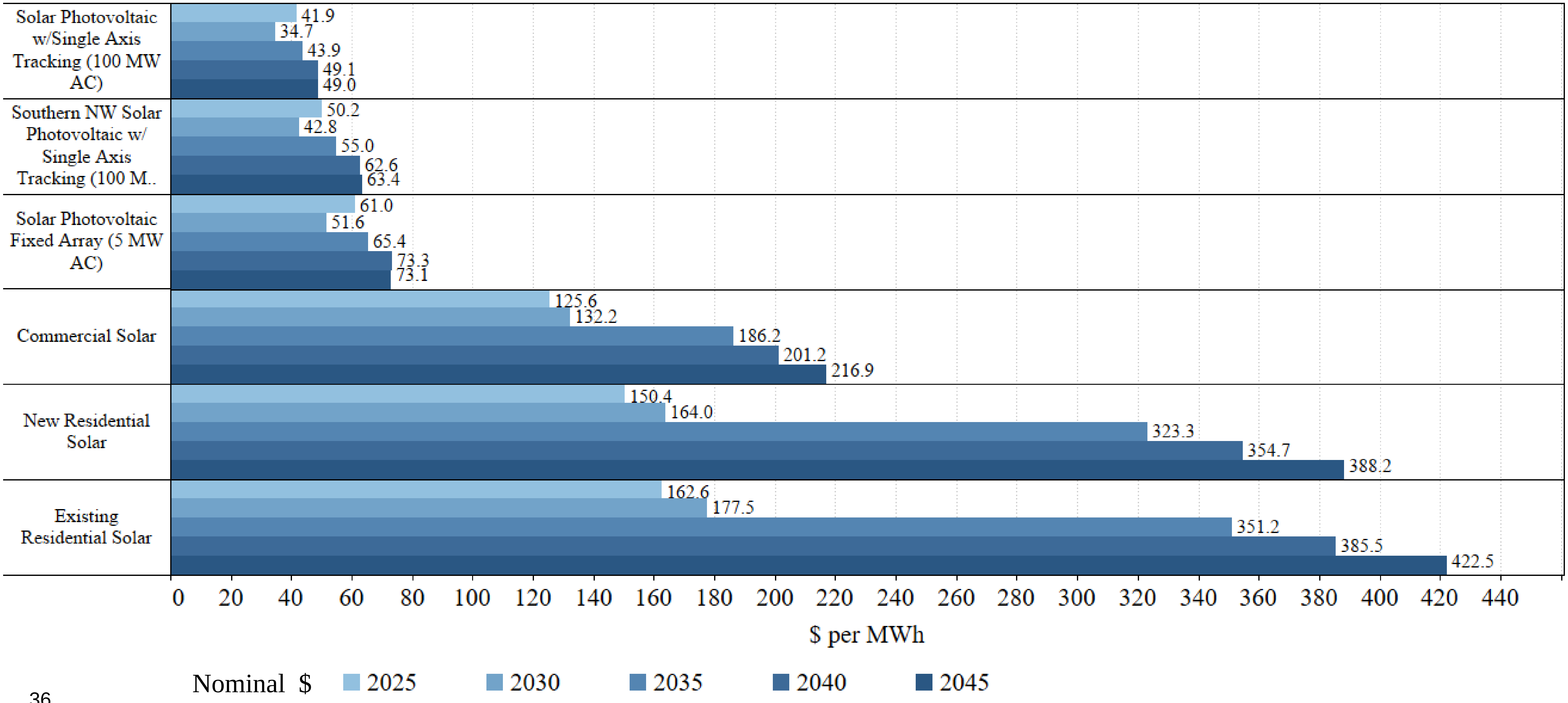
Storage Fixed Cost (Levelized) Continued…



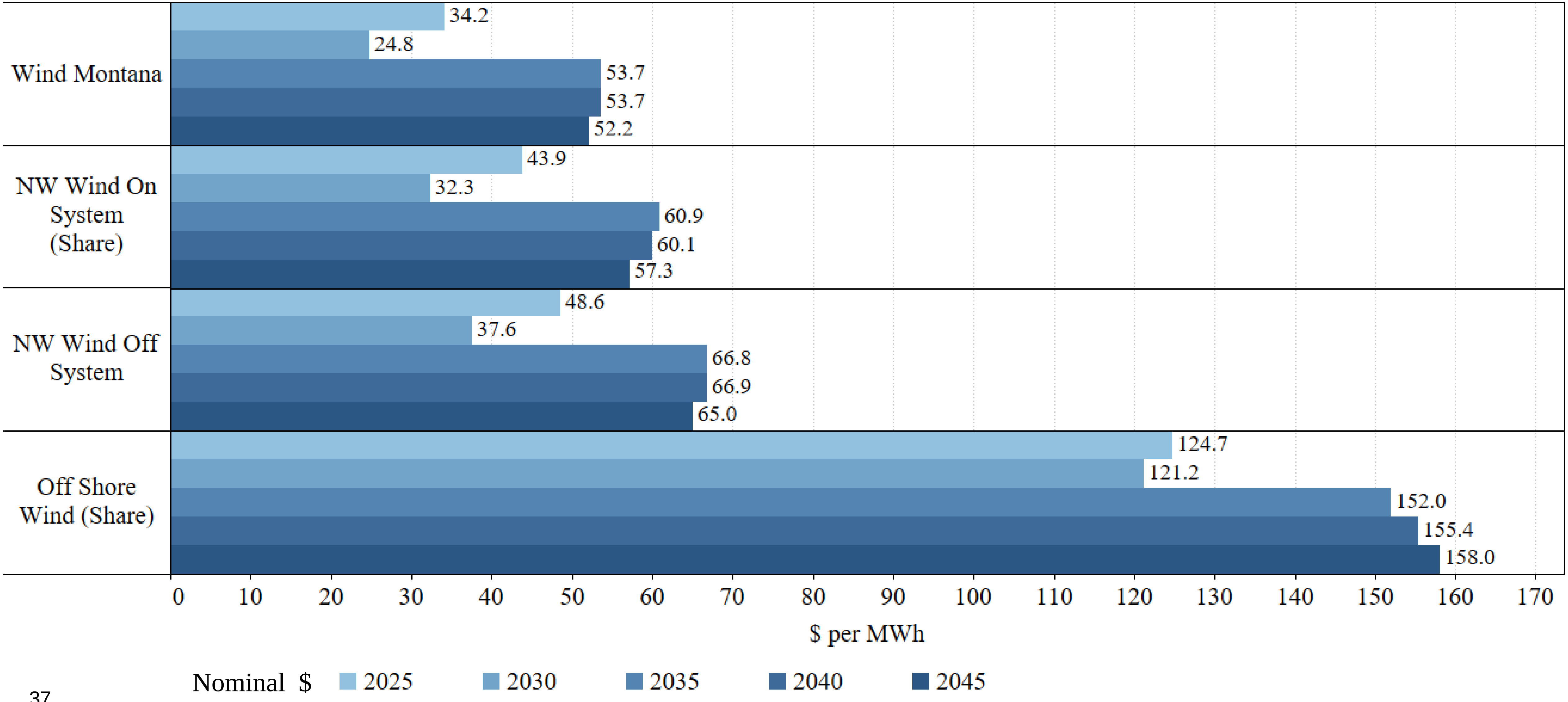
Storage Implied Capacity Payment (Levelized)



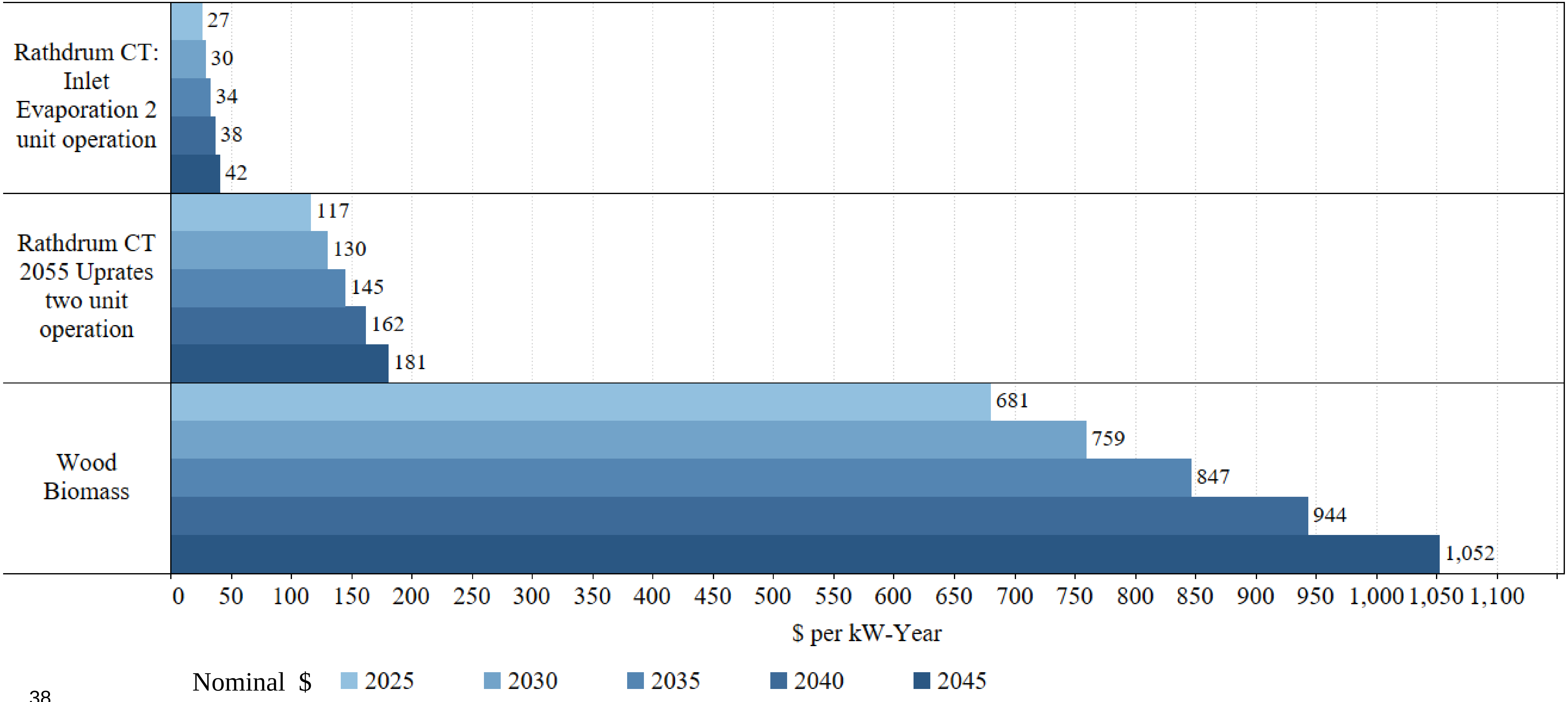
Solar PPA Price/Implied Energy Payment (Levelized)



Wind PPA Price/Implied Energy Payment (Levelized)



Upgrades & Biomass Fixed Cost (Levelized)



Supply Side Resource Options

Excel Workbook – Methodology and Navigation

Michael Brutocao, Natural Gas Analyst
Electric IRP, 6th Technical Advisory Committee Meeting
September 28, 2022

Variable Energy Resources Integration Study Update

2023 Avista Electric IRP

TAC 6 – September 28, 2022

Lori Hermanson, Senior Power Supply Analyst

VER Integration Study – Purpose and Overview

- Consistent application supporting varying analyses
  - Integrated Resource Planning
  - Resource acquisition processes (e.g., RFP)
  - Transmission tariff rates
  - PURPA avoided cost calculations

- Define “Consumptive Capacity” (CC) associated with incremental variable energy resources

- Determine Costs
  - Current costs under varying scenarios
  - Projected future costs under IRP Preferred Resource Strategy

VER Integration Study Scope

- Included
  - Consumptive capacity and its costs
  - Impacts of EIM (”fast”) markets
  - Potential future portfolio VER buildouts
  - Sensitivity scenarios

- Not included
  - Alternative capacity resources (e.g. batteries)
  - New utility-controlled storage
  - VER-driven investments in existing infrastructure
  - Distributed generation or response beyond what’s in IRP

Assumptions for ADSS Modeling

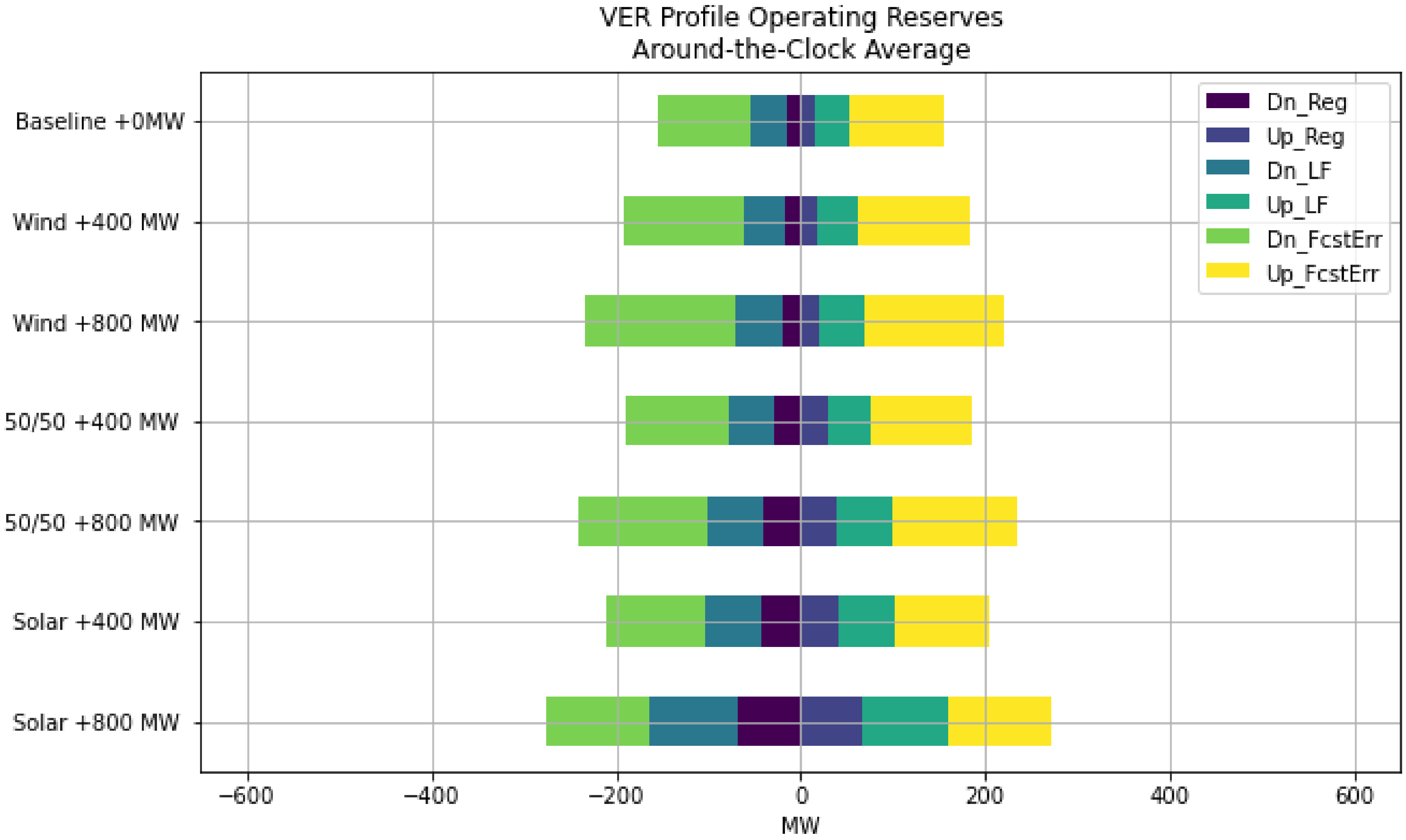
- Base case assumptions for all portfolio mixes (2-4 hours per run)
  - 13 VER portfolios (base + 12)
  - Include EIM regional diversity
  - Include carbon costs (CCA)

- Modeling sensitivities for 400 MW wind case
  - Addresses next 10+ years of PRS
  - Hydro (low/base/high)
  - Market prices (low/base/high)

VER Study Workplan Overview

- Phase I Results – Energy Strategies
  - VER scenarios and profiles – *completed*
  - VER reserve analysis – *completed*
  - VER Work group presentation– *completed*
  - Slides and recording of presentation on IRP website
- Production Cost Modeling (Avista ADSS) – 1Q23
- Phase II Deliverables (ES) – 2Q23
  - Finalize calculation of integration costs
  - Presentation and report with full analysis and results
  - Tool to calculate reserves for future scenarios/mixes

Phase I Results – Reserves



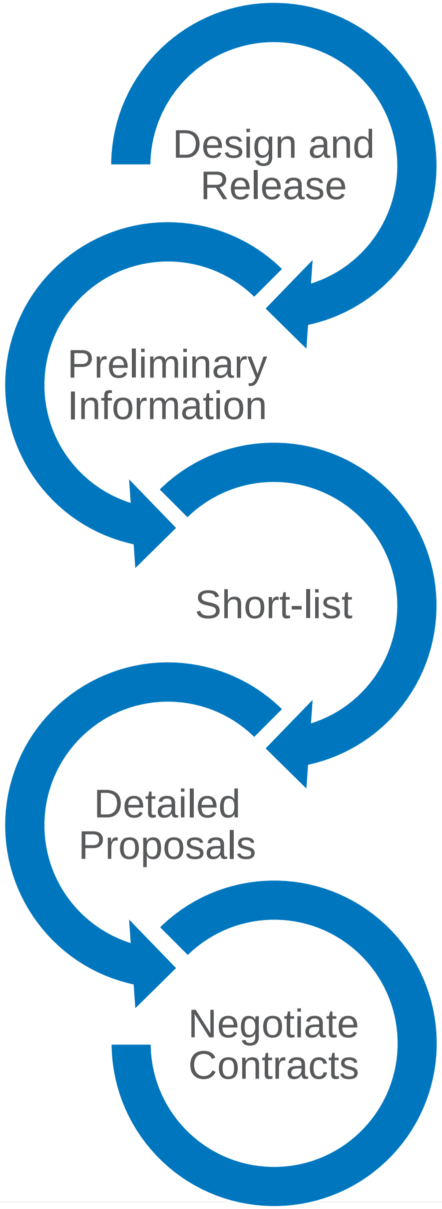
Avista Utilities
IRP TAC - RFP Update

2023 Electric IRP
6th Technical Advisory Committee Meeting
September 28, 2022

Chris Drake, Wholesale Marketing Manager

2022 All Source RFP Target Timeline

- February 18, 2022 – Avista releases All Source RFP
- February 28, 2022 – Bidders’ conference
- March 25, 2022 – RFP bids due
- April 25, 2022 – Summary of Proposals posted
- June 10, 2022 – Short-listed Bid selection/notification
- July 18, 2022 – Detailed proposals due from Short-listed Bidders
- Sep 2, 2022 – Final price refresh request from Short-listed Bidders
- *Oct 2022 – Proposal(s) selected for negotiations*
- *Nov/Dec 2022 – IE report to commission*



Design and Release

Preliminary Information

Short-list

Detailed Proposals

Negotiate Contracts

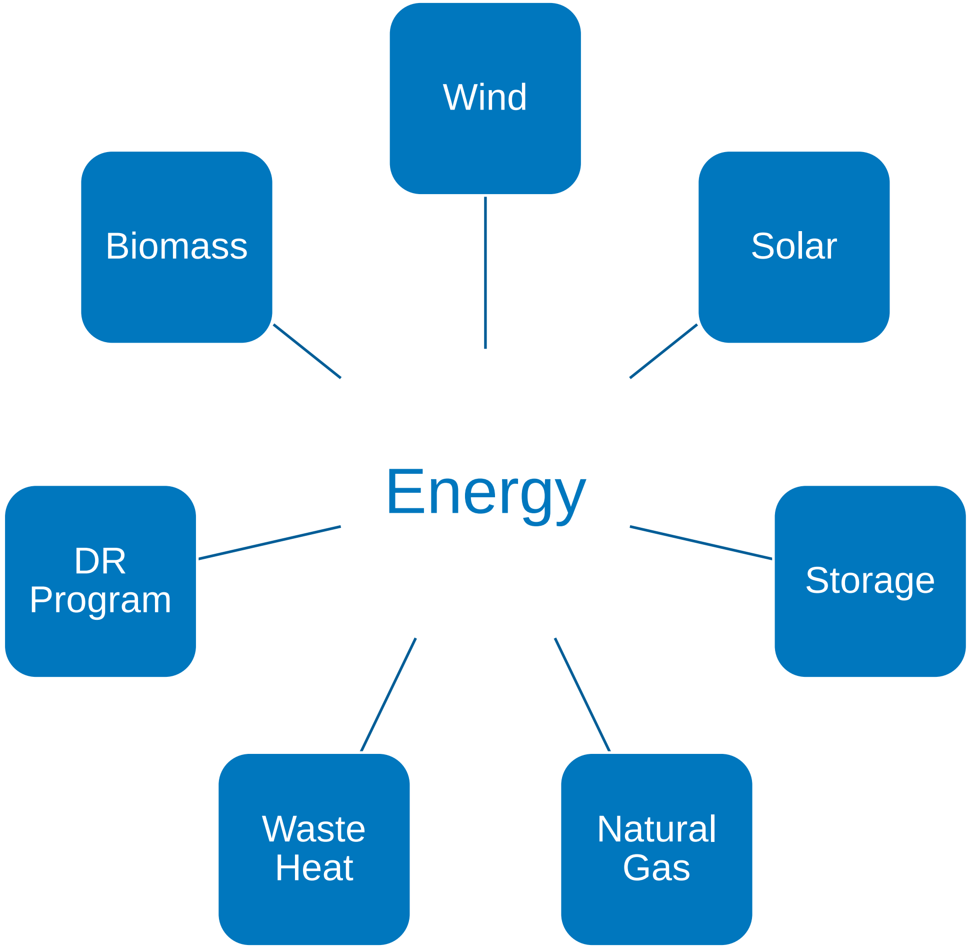
2022 All Source RFP and Proposal Highlights

Request for Proposals

- Shortfalls in 2026 (flexible CODs)
- 162 MW winter capacity
- 127 MW summer capacity
- Renewable and monthly energy resources also required

Responses

- 21 developers
- 11 technology types
- 32 proposals with options
- 56 total projects to analyze
- Avista and Sapere analysis completed mid-June to identify short list



2022 RFP Responses

Number of Proposals and Capacity by Type

Resource	Type	# of Proposals	Total Capacity (MW)[1]
Wind	Wind	12	1804.7
	Wind + Storage	6	856.2
	Wind + Solar	1	404
	Wind + Solar + Storage	4	2159.8
Solar	Solar	6	749.9
	Solar + Storage	7	660
Storage	Battery	6	643
	Pumped Storage Hydro	3	393.3
Other	Biomass	2	226
	Waste Heat	1	9.9
	Geothermal	1	8
	Hydro	1	38.7
	Demand Response	3	25.84
	Natural Gas	3	280

[1] Some bidders provided multiple bids or capacity options. Within each type only the initial capacity is included. Posted at www.myavista.com/AllSourceRFP.

Independent Evaluator (IE) – Sapere Consulting

- IE's role includes, but not limited to, the following:
  - Professional assistance in design and evaluation
  - Ensure RFP is conducted in accordance with Idaho and Washington resource acquisition rules
  - Ensure process is fair and transparent
  - Assess Avista's process of scoring bids and selection of shortlists is reasonable
  - Review all third party and Avista proposals
    - Non-Financial Scoring
    - Financial Modeling and Scoring

Evaluation Process – Short List Selection

Initial Screen Evaluation Scoring Matrix

Weighting						
20%	**40%**	**5%**	**20%**	**10%**	**5%**	**100%**
Risk Management	**Financial Energy Impact[1,2]**	**Price Risk**	**Electric Factors**	**Environmental[2]**	**Non-Energy Impact[2]**	**Total Score**
Developer Experience, Proven Technology, etc.	Financial Analysis of Price to include PPA/Ownership, capacity costs/value, transmission, cost of carbon, etc.	Potential for change in costs, fixed vs variable pricing, variable energy, etc.	Interconnection status and transmission plan	Permitting such as Conditional Use Permit, SEPA, Studies, etc.	Energy security, benefit to service territory, named communities, DEI, etc.	

---

[1] *Financial evaluation based on highest score of Capacity or Energy.*

[2] *Clean Energy Implementation Plan Customer Benefit Indicators (where applicable) are included in Non-Energy Impact as well as Financial Energy Impact and Environmental criteria.*

Equity Considerations

Develop, strengthen, and support policies and procedures that distribute and prioritize resources to historically and currently marginalized customers, including tribes.

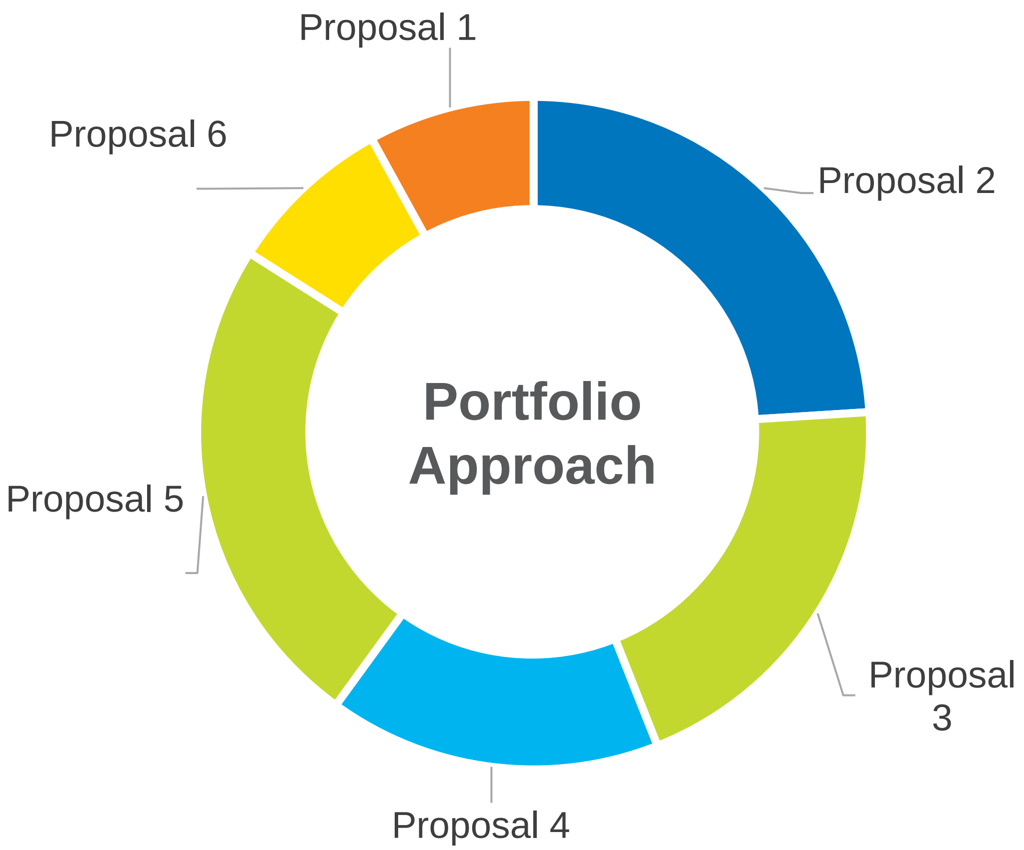
- RFP Stakeholder Input
  - Draft RFP filed with Washington Utilities and Transportation Commission (UTC) and shared with Idaho Public Utilities Commission (PUC), Avista's IRP TAC and Equity Advisory Group among others
  - RFP document including preliminary information requested from bidders, evaluation methodology and scoring incorporated stakeholder feedback
  - Final RFP approved by UTC
- Scoring matric included Customer Benefit Indicators (CBI)
  - Non-Energy Impacts – Energy resiliency, security, diversity, labor and location in named community
  - Financial Impacts – consideration for quantifiable cost impacts of economic, public health and safety
  - Environmental Factors – such as air quality impacts

Stakeholder Participation

Named Community

Customer Benefit Indicators

Evaluation Process – Detailed Proposals



- Short list identified based on natural break points in scoring matrix
  - June 10, 2022
- Detailed proposals due from Short-listed Bidders
  - July 18, 2022
- Price refresh after Inflation Reduction Act
  - September 2, 2022
- Financial modeling
  - Portfolio approach (one or many resources selected)
  - Several scenarios to be modeled

Thank you…

IRP Climate Change Analysis

Impact of forecasted streamflow and temperature changes on hydrogeneration and load

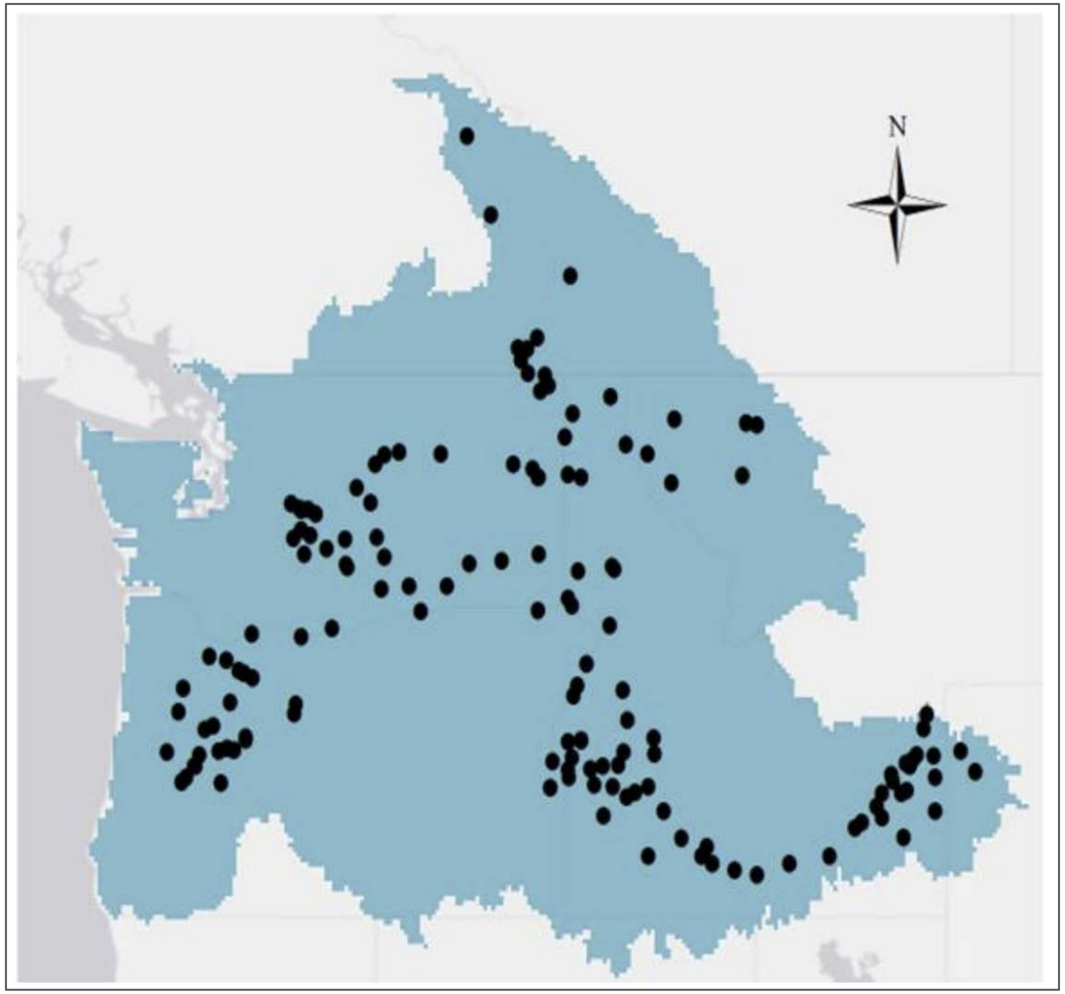
Mike Hermanson, Senior Power Supply Analyst
Electric IRP, 6th Technical Advisory Committee Meeting
September 28, 2022

Overview

- Data sources and methodology
- Hydrogeneration
- Load forecast
- Peak load forecast
- Use in IRP Modeling

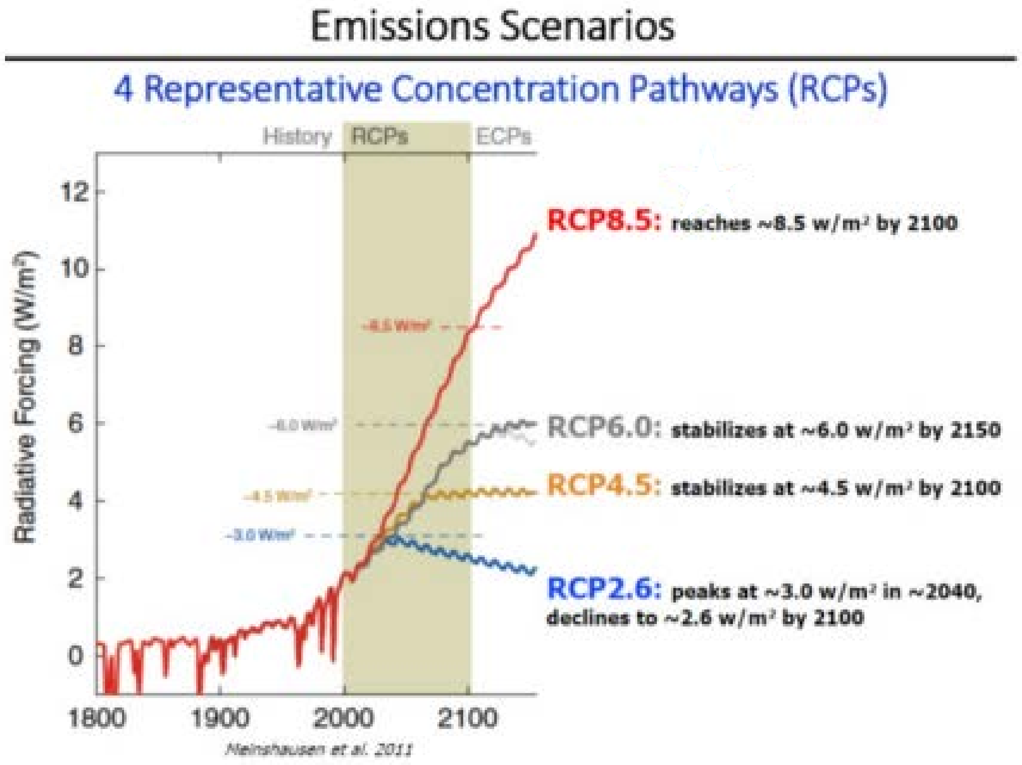
Data Sources

- Climate and Hydrology Datasets for RMJOC Long-Term Planning Studies: Second Edition
    - River Management Joint Operating Committee (RMJOC)
        - BPA, US Army Corps of Engineers, US Bureau of Reclamation
    - Research Team
        - University of Washington, Oregon State University
- Part I – Unregulated stream flows
- Part II – Reservoir Regulation and Operations



Global Climate Models

- Global Climate Models (GCMs)
  - Coarse resolution ranging from 75 to 300 km grid size
  - Provides projections of temperature and precipitation
  - Multiple Representative Concentration Pathways (RCP 4.5, RCP 6, RCP 8.5)
  - 10 GCM models used in study
    - CanESM2 (Canada)
    - CCSM4 (US)
    - CNRM-CM5 (France)
    - CSIRO-Mk3-6-0 (Australia)
    - GFDL-ESM2M (US)
    - HadGEM2-CC (UK)
    - HadGEM2-ES (UK)
    - inmcm4 (Russia)
    - IPSL-CM5-MR (France)
    - MIROC5 (Japan)



Meinshausen et al. 2011

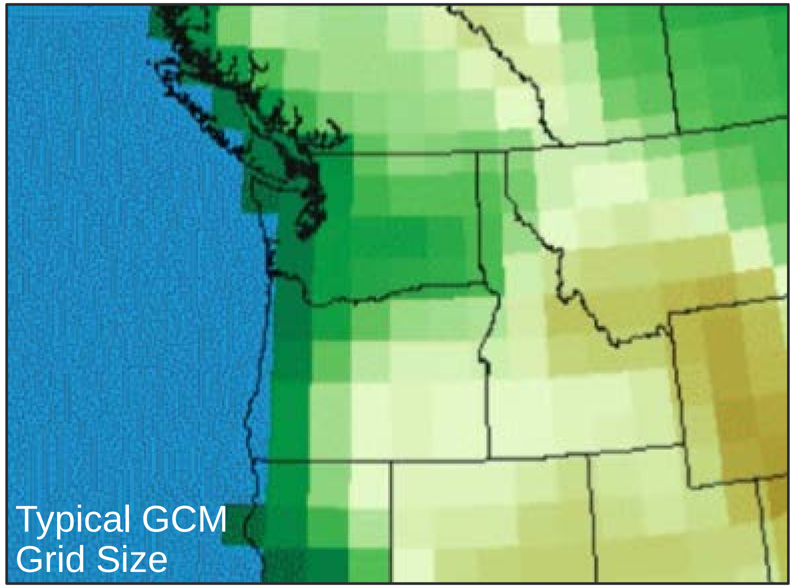
Representative Concentration Pathways

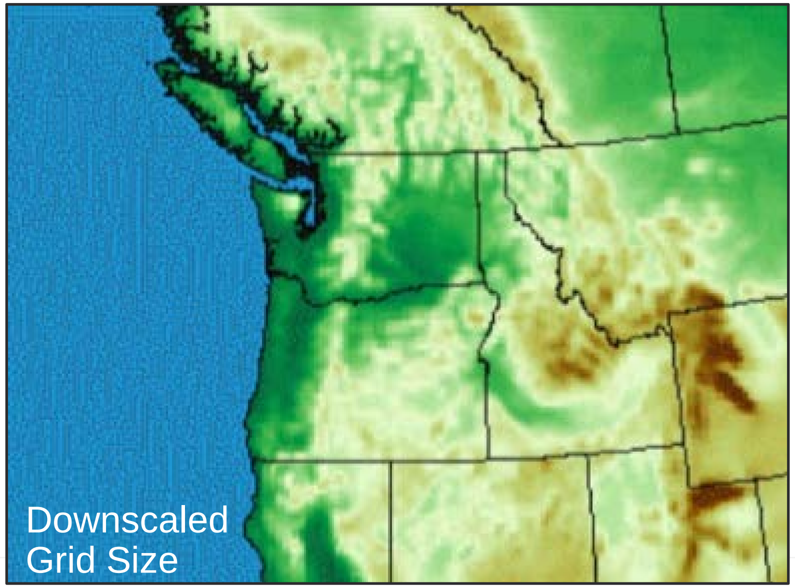
- Description by Intergovernmental Panel on Climate Change (IPCC)
    - RCP2.6 – stringent mitigation scenario
    - RCP4.5 & RCP6.0 – intermediate scenarios
    - RCP8.5 – very high GHG emissions
- RMJOCII Study evaluated RCP4.5 and RCP8.5
- RCP4.5 and RCP6.0 similar within the IRP planning horizon

	Scenario	**2046-2065**		**2081-2100**	
		Mean	Likely range	Mean	Likely range
Global Mean Surface Temperature Change (C°)	RCP2.6	1.0	0.4 to 1.6	1.0	0.3 to 1.7
	RCP4.5	**1.4**	**0.9 to 2.0**	**1.8**	**1.1 to 2.6**
	RCP6.0	**1.3**	**0.8 to 1.8**	**2.2**	**1.4 to 3.1**
	RCP8.5	2.0	1.4 to 2.6	3.7	2.6 to 4.8

Downscaling Techniques

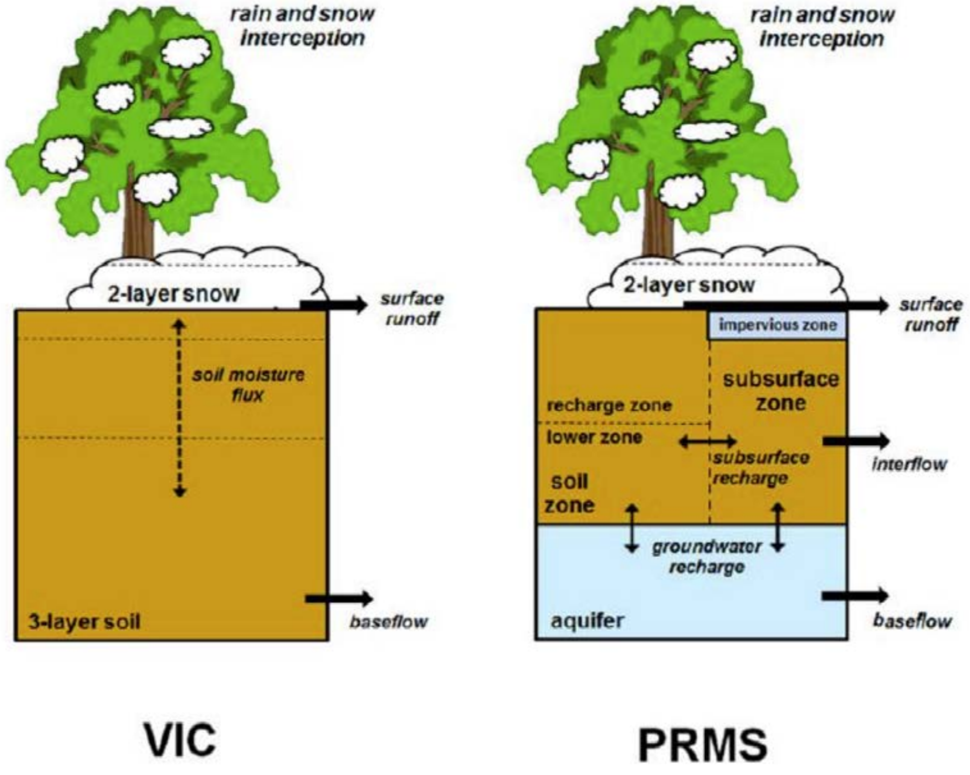
- Downscale GCM data to finer resolution necessary to model hydrology
  - Statistical methods to represent variation within large grid size
  - Two methods used (BCSD, MACA)
    - Bias Corrected Spatial Disaggregation
    - Multivariate Adaptive Constructed Analog



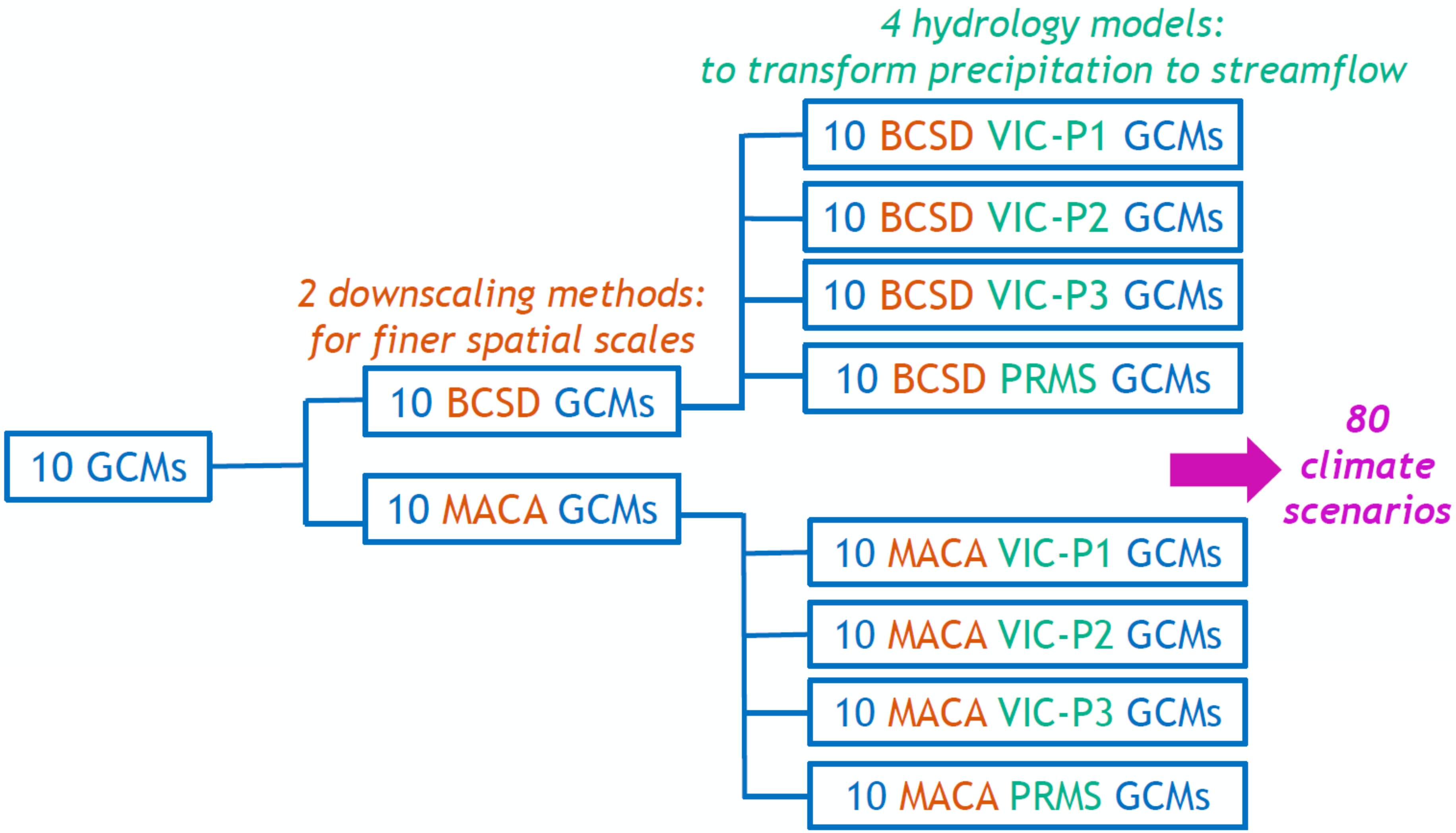


Modeling Climate Change Impacts on Hydrogeneration

- Hydrologic models
  - Downscaled temperature and precipitation is input to hydrologic models.
  - Hydrologic models use soil, geology, slope, vegetation, aspect, snow cover, etc. to model how precipitation translates into runoff and streamflow.
  - 2 different hydrology models used.
    - 1 version of PRMS model
    - 3 versions of VIC model
- Hydro regulation models
  - Unregulated streamflow is input to reservoir models of Columbia River system to generate regulated flows.



Modeling Climate Change Impacts on Hydrogeneration



4 hydrology models:
to transform precipitation to streamflow

2 downscaling methods:
for finer spatial scales

10 GCMs

10 BCSD GCMs

10 MACA GCMs

10 BCSD VIC-P1 GCMs

10 BCSD VIC-P2 GCMs

10 BCSD VIC-P3 GCMs

10 BCSD PRMS GCMs

10 MACA VIC-P1 GCMs

10 MACA VIC-P2 GCMs

10 MACA VIC-P3 GCMs

10 MACA PRMS GCMs

80 climate scenarios

Modeling Climate Change Impacts on Hydrogeneration

- Comparison of hydrogeneration used for previous IRP to estimated hydrogeneration based on stream flows from climate change modeling.
- Previous IRP utilized modeled regulated flows for water years 1929-2008 provided by BPA.
- BPA selected 19 of the 80 scenarios that encompass a sufficient range of uncertainty.
- Streamflows for 19 scenarios for the period of 2019-2049 were used to develop estimates of generation.
- Regression models based on relationship of baseline flows to generation for Avista projects.
- Mid-C generation from BPA Hydsim model of climate change scenarios.

Modeling Recent 30-Year Hydrogeneration

- BPA is moving to using recent 30-year period for planning purposes.

- BPA is finalizing 90-year (1928-2018) regulated flow data set and is not yet available.

- Utilized actual river flow data for 2009-2021in regression models utilized for climate change modeling to add to the current 80-year record and create a recent 30-year dataset.

- Used actual 2009-2021 Mid-C generation.

Results

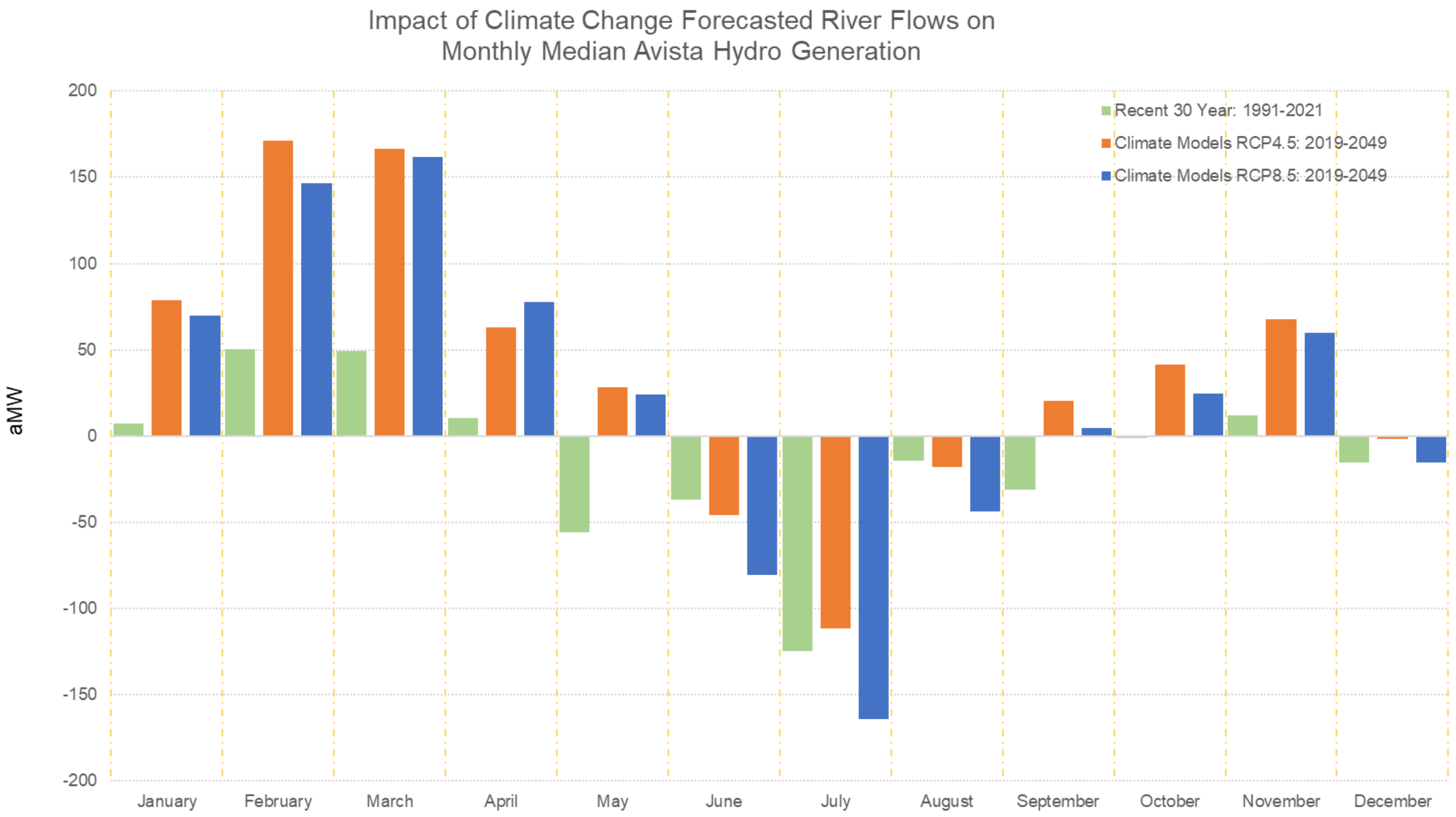
Comparison of Annual (aMW)

	80-Year Hydro (1929-2008)	Recent 30-Year (1991-2021)	Climate Change RCP8.5 (2019-2049)	Climate Change RCP4.5 (2019-2049)
Mean	598	595	628	645
Median	597	585	620	636
Standard Deviation	142	137	149	169
10th Percentile	424	437	454	447

- Recent 30-year shows slight decrease in annual energy
- Climate change scenarios show an increase in annual energy consistent with the projection of overall increase in precipitation in the Northwest

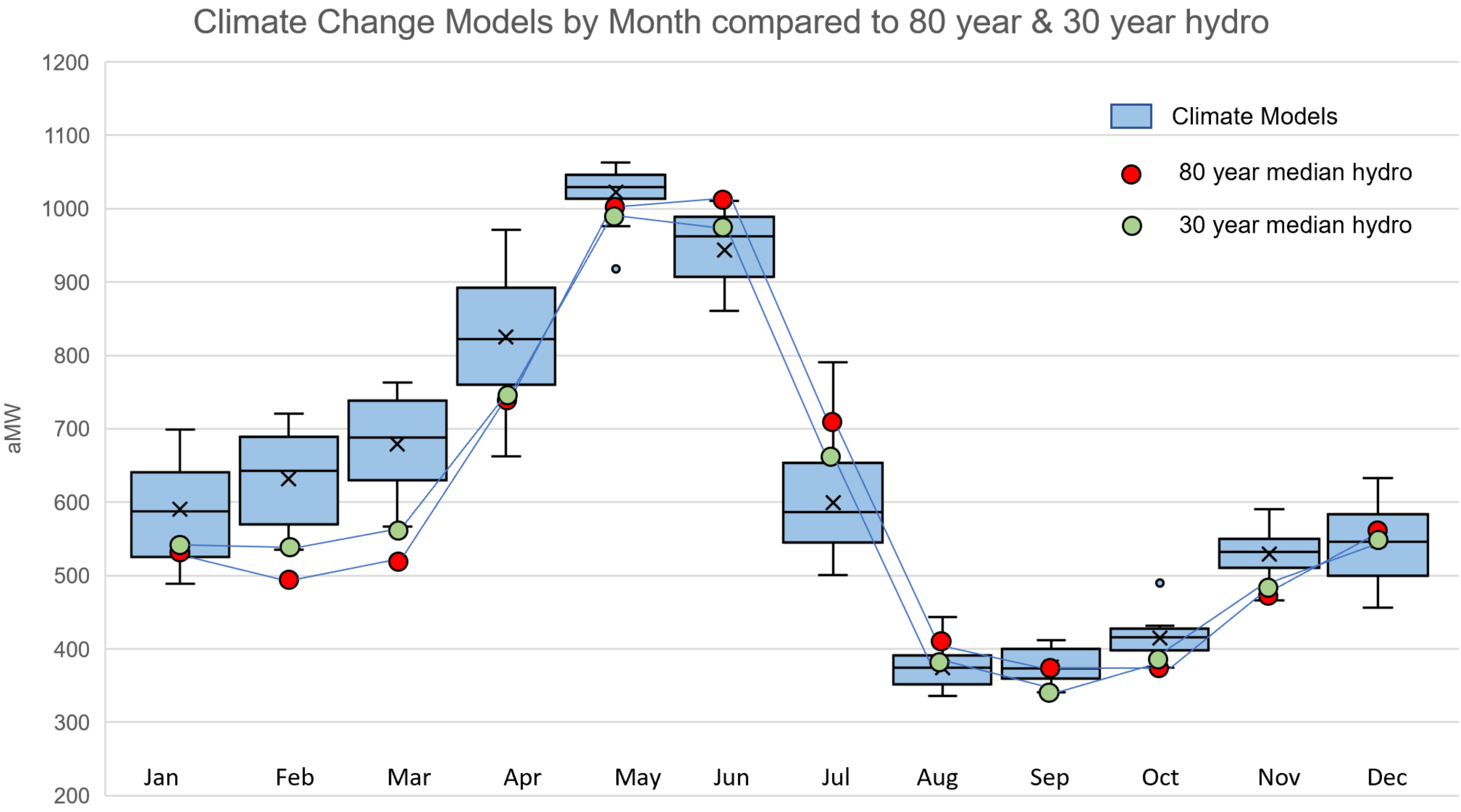
Results

Comparison of Monthly (aMW)



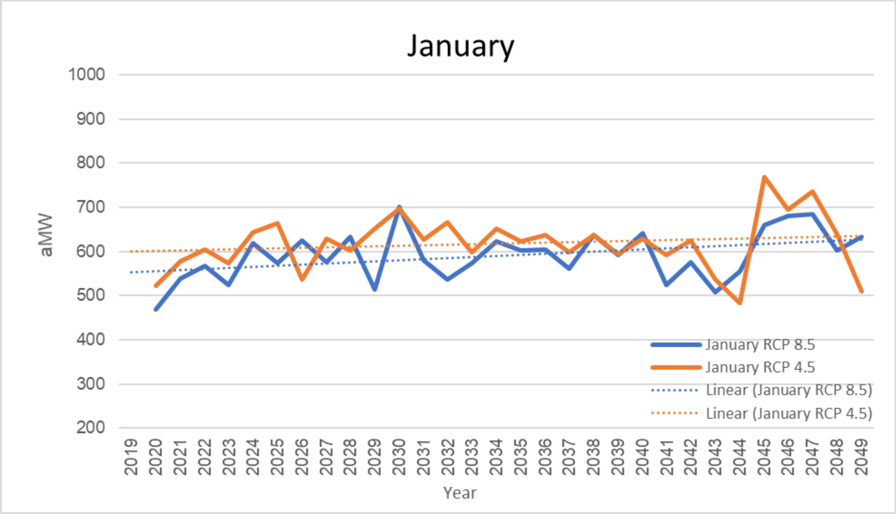
Results

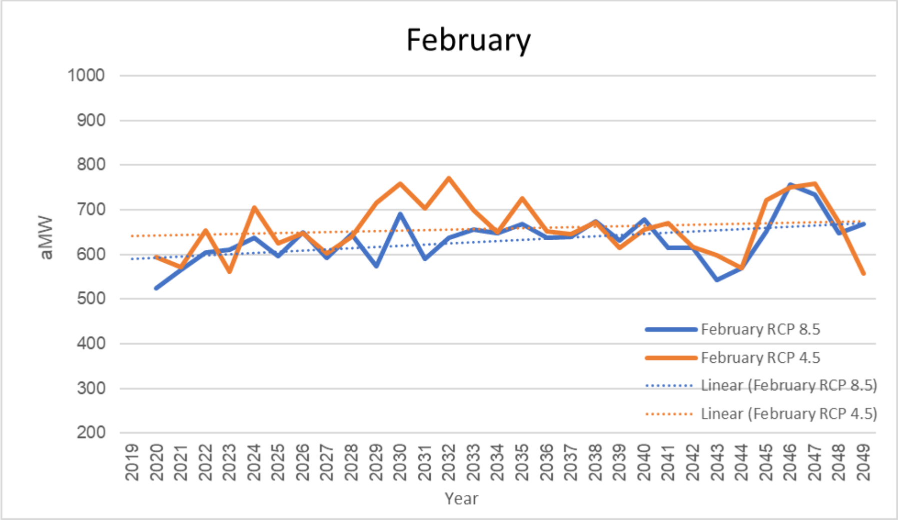
Variability of Climate Models

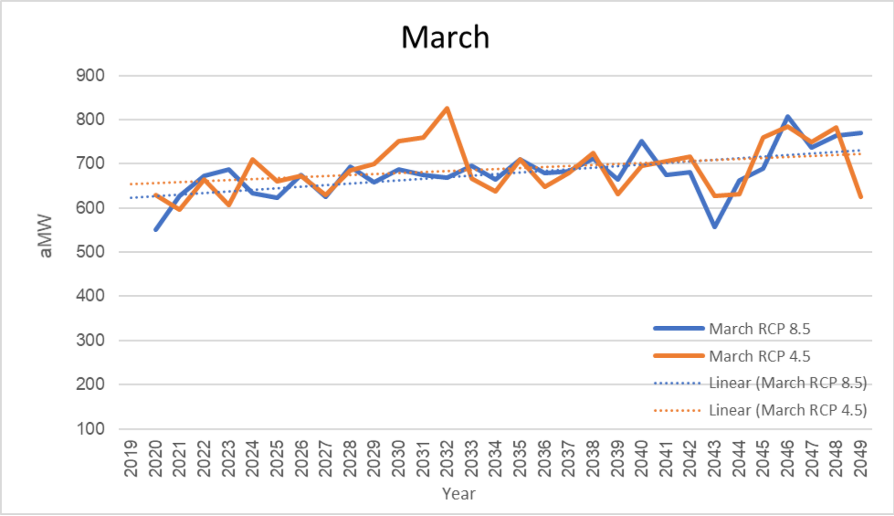


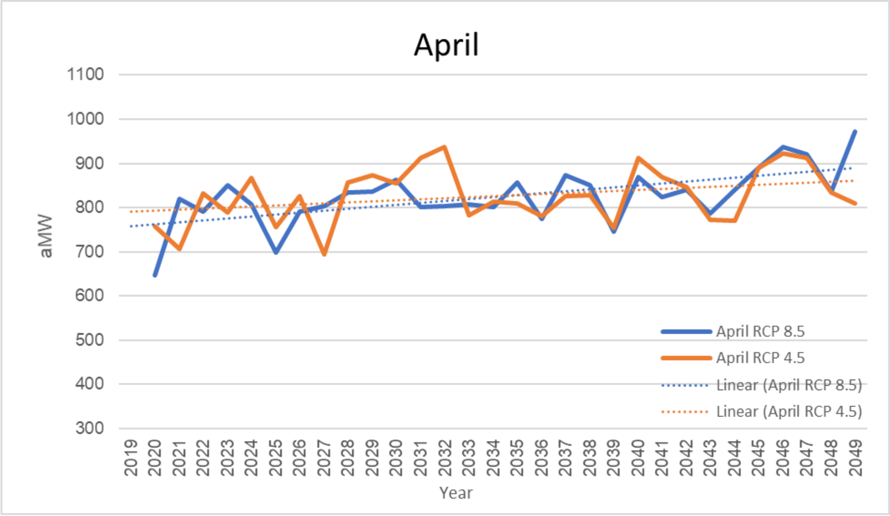
Results

2019-2049 Trend


January

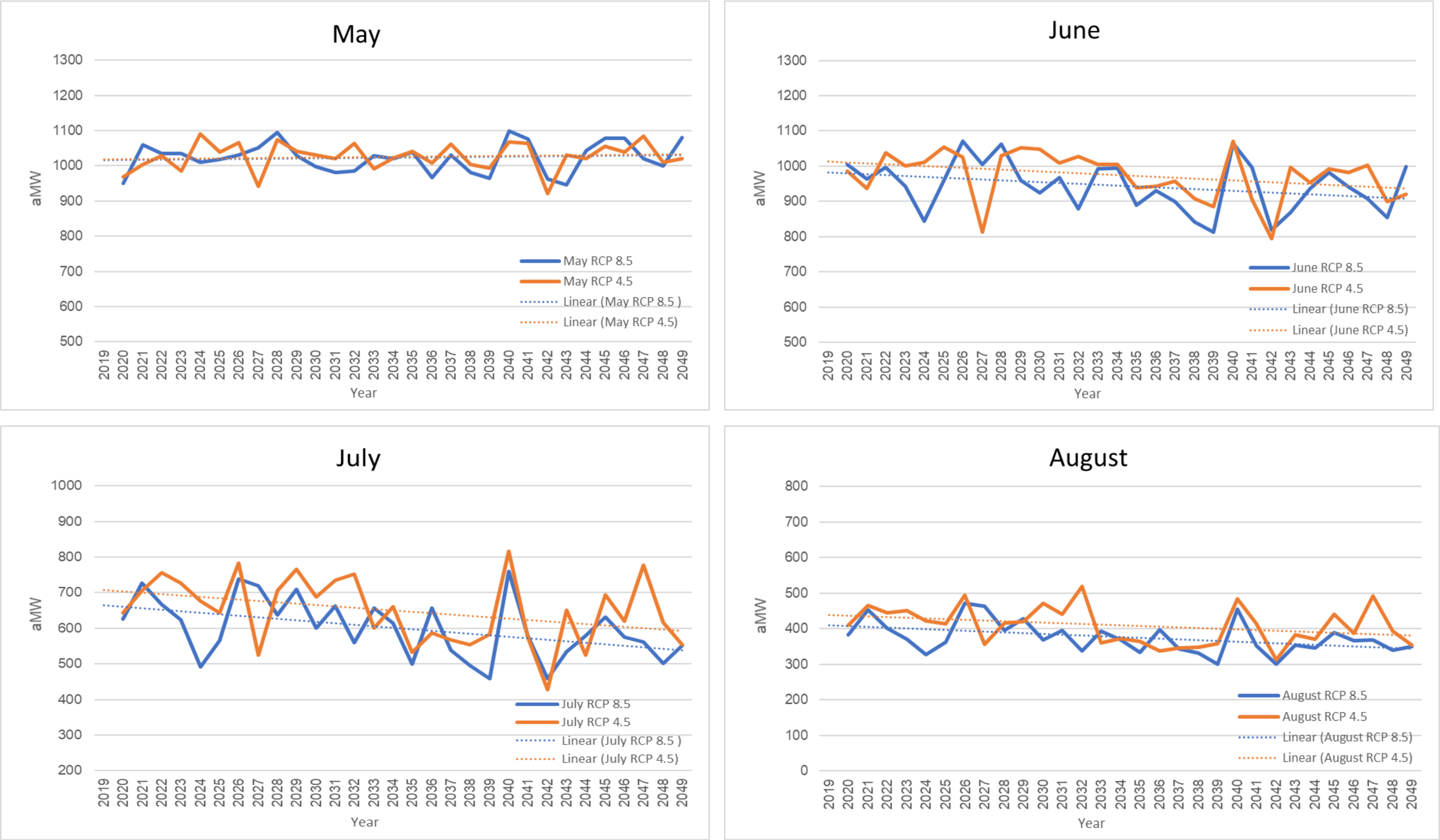

February


March


April

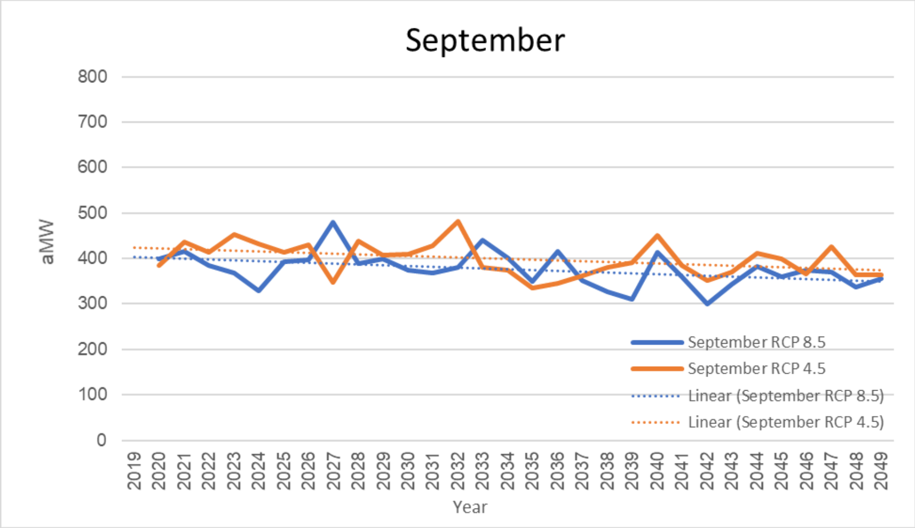
Results

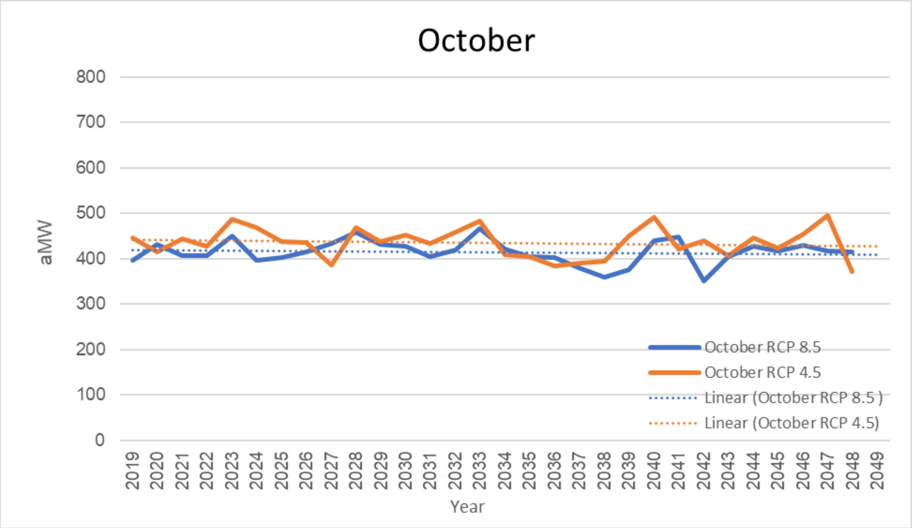
2019-2049 Trend

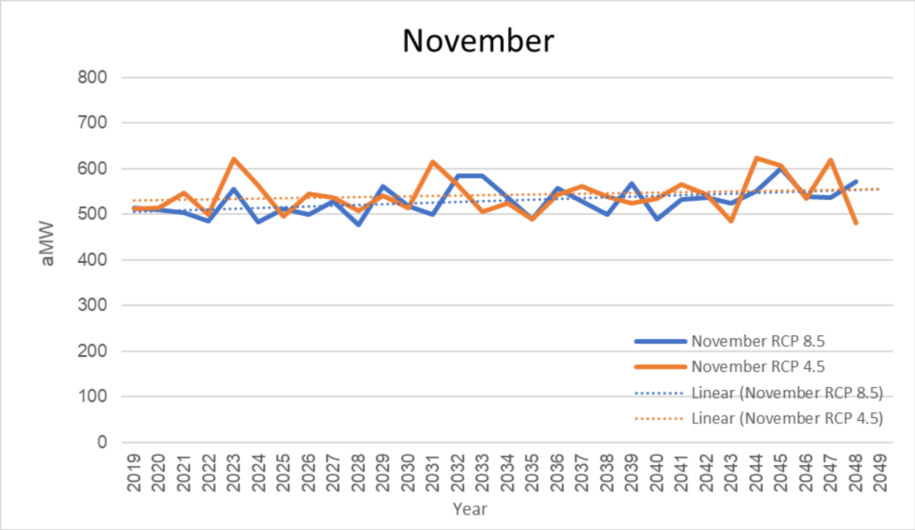


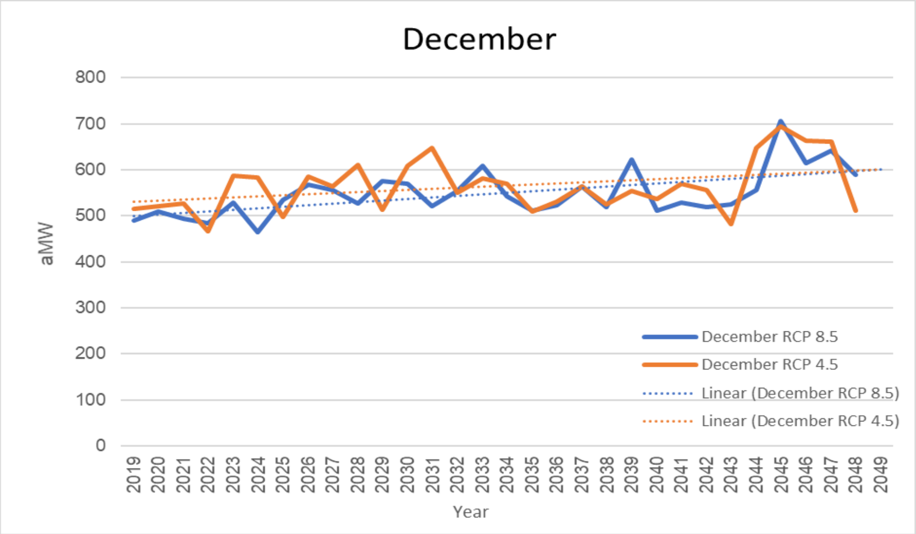
Results

2019-2049 Trend



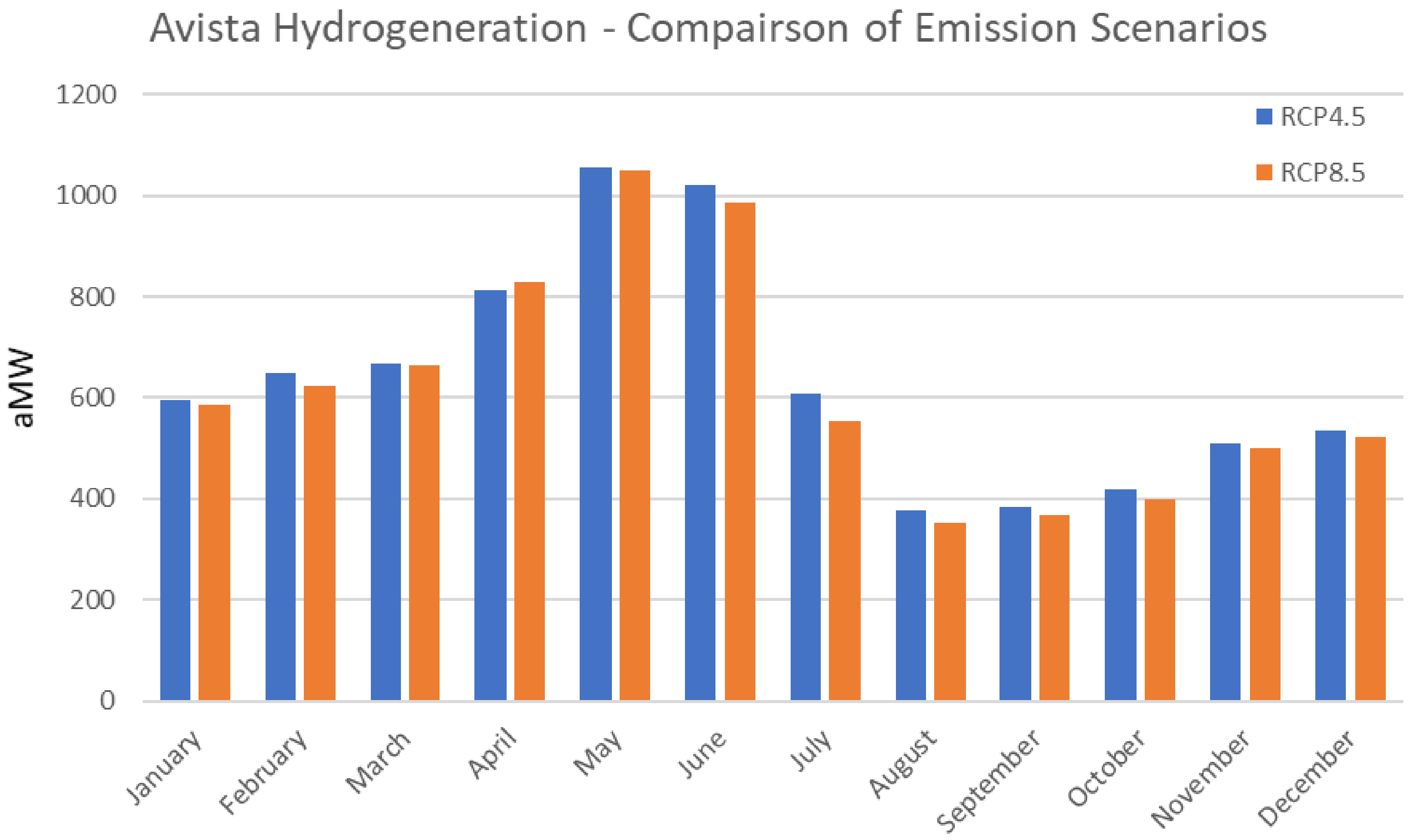






Results

Comparison of RCP4.5 and RCP8.5 for 2019-2049



Climate Change Impacts to Load

- Daily max and min temperature for Spokane airport through 2049 that correspond to the 19 BPA scenarios.

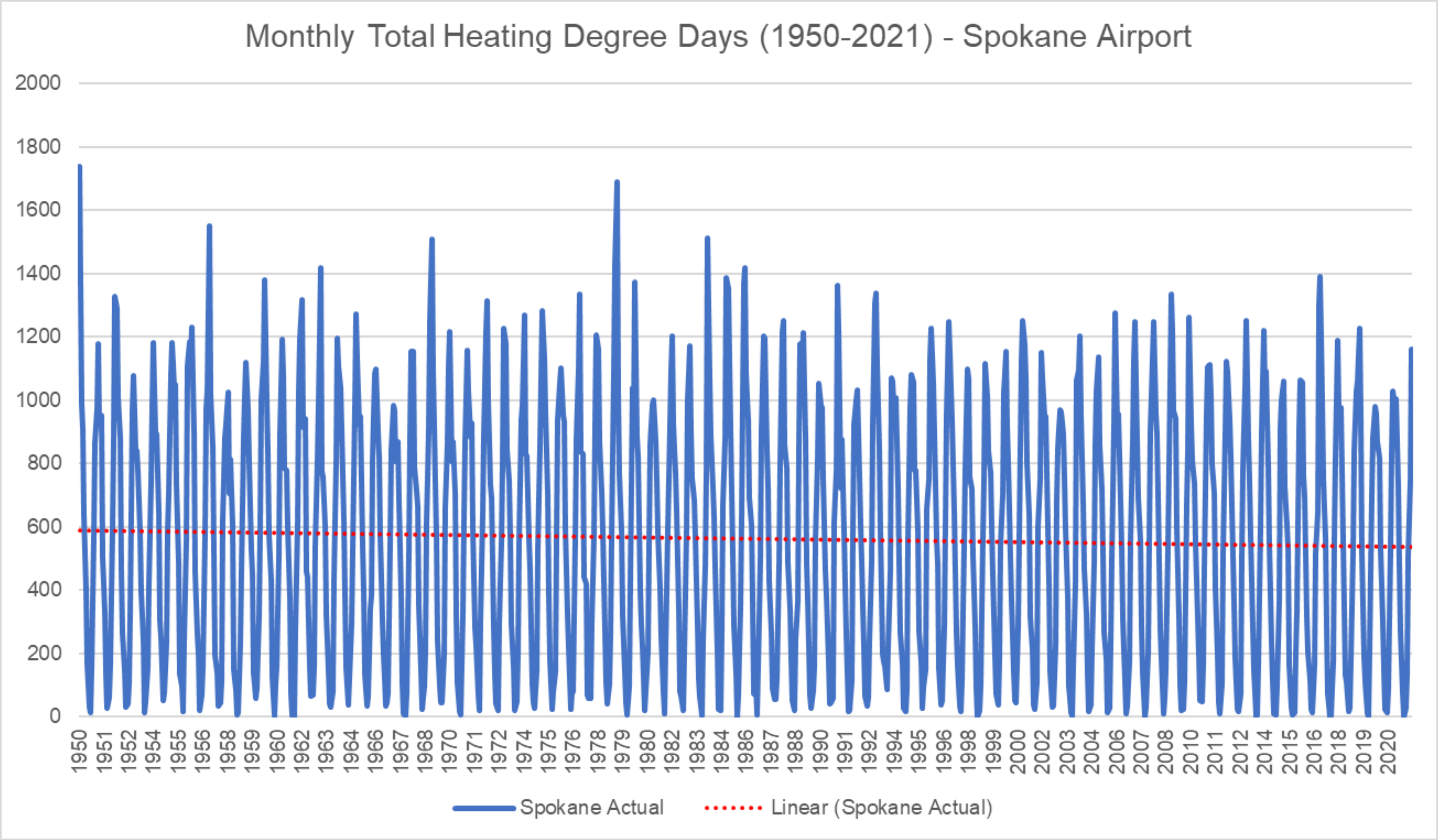
- Load forecasting model utilizes monthly heating degree days (HDDs) and cooling degree days (CDDs) as inputs to econometric model.

- Utilized the median average daily temperature of the climate models to calculate daily HDDs and CDDs and then summed monthly.

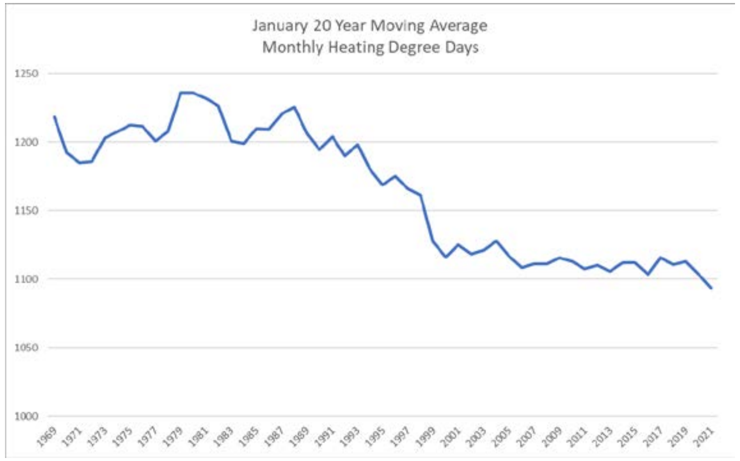
- Load forecast utilizes a 20-year moving average.

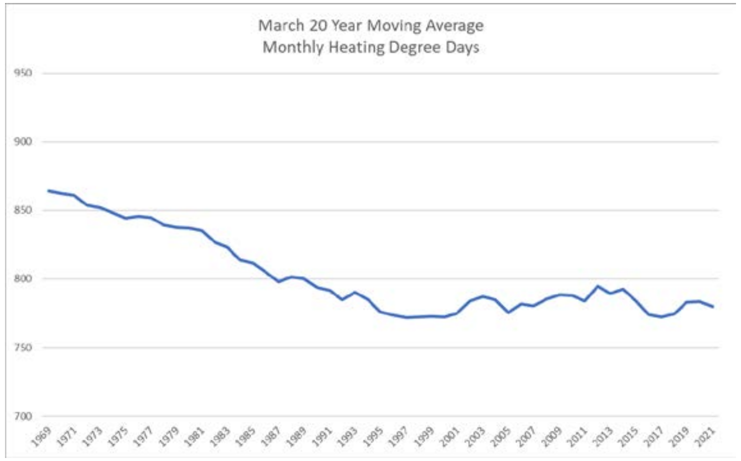
Climate Change Impacts to Load

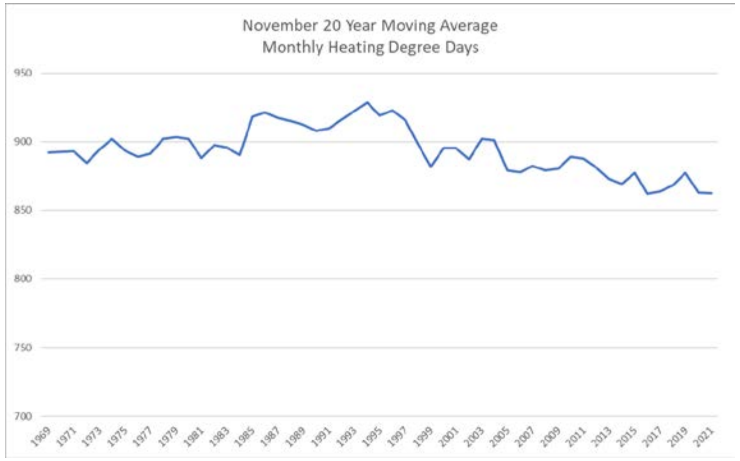
- Heating Degree Days Baseline Data

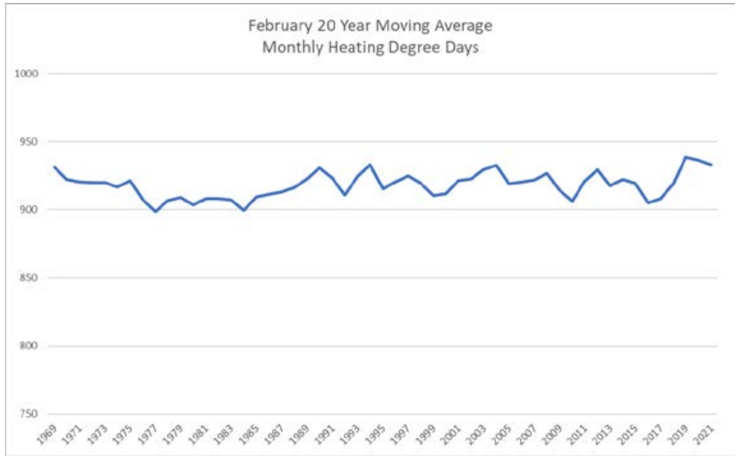


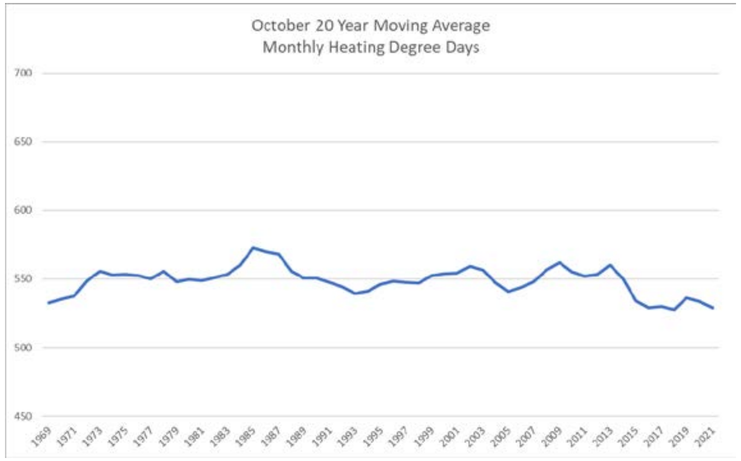
Climate Change Impacts to Load

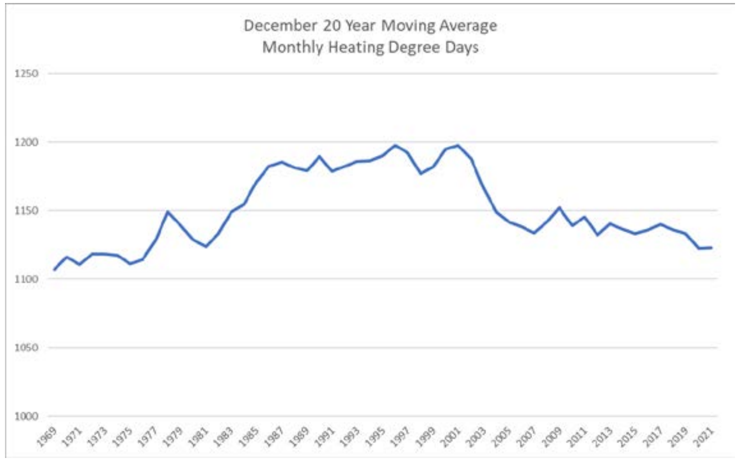

January 20 Year Moving Average
Monthly Heating Degree Days


March 20 Year Moving Average
Monthly Heating Degree Days

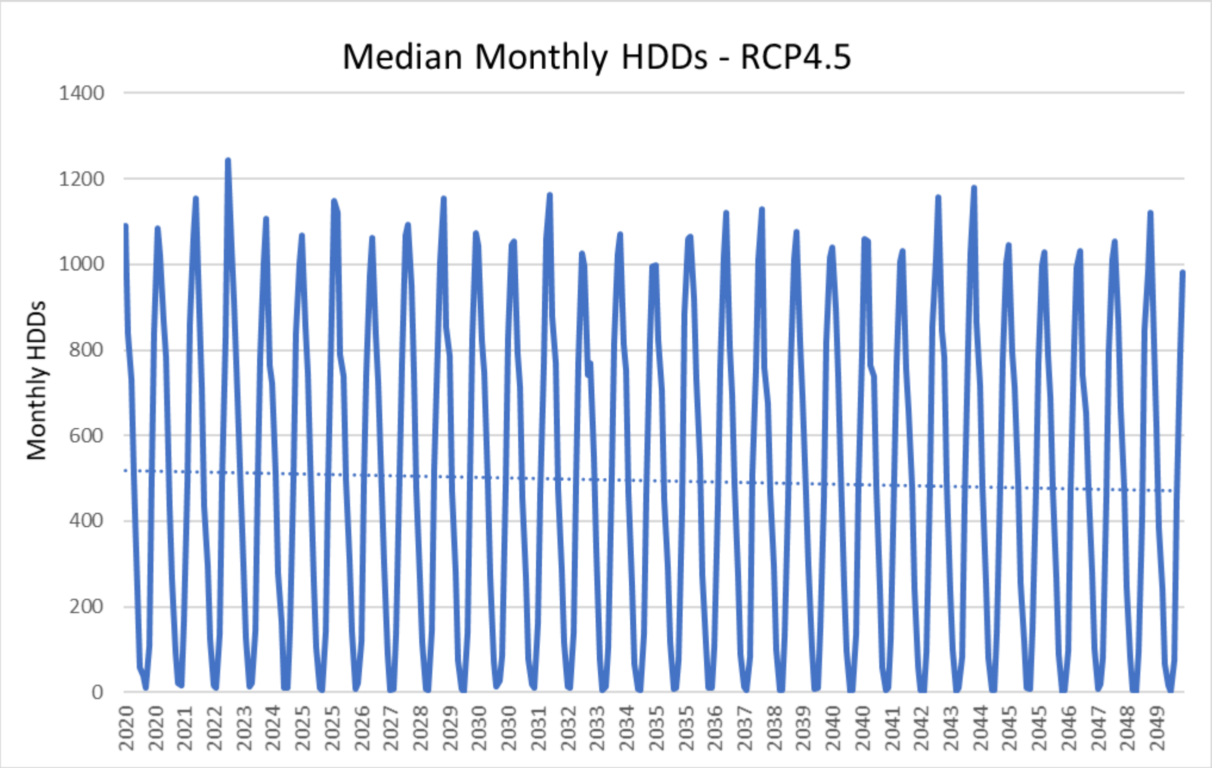

November 20 Year Moving Average
Monthly Heating Degree Days

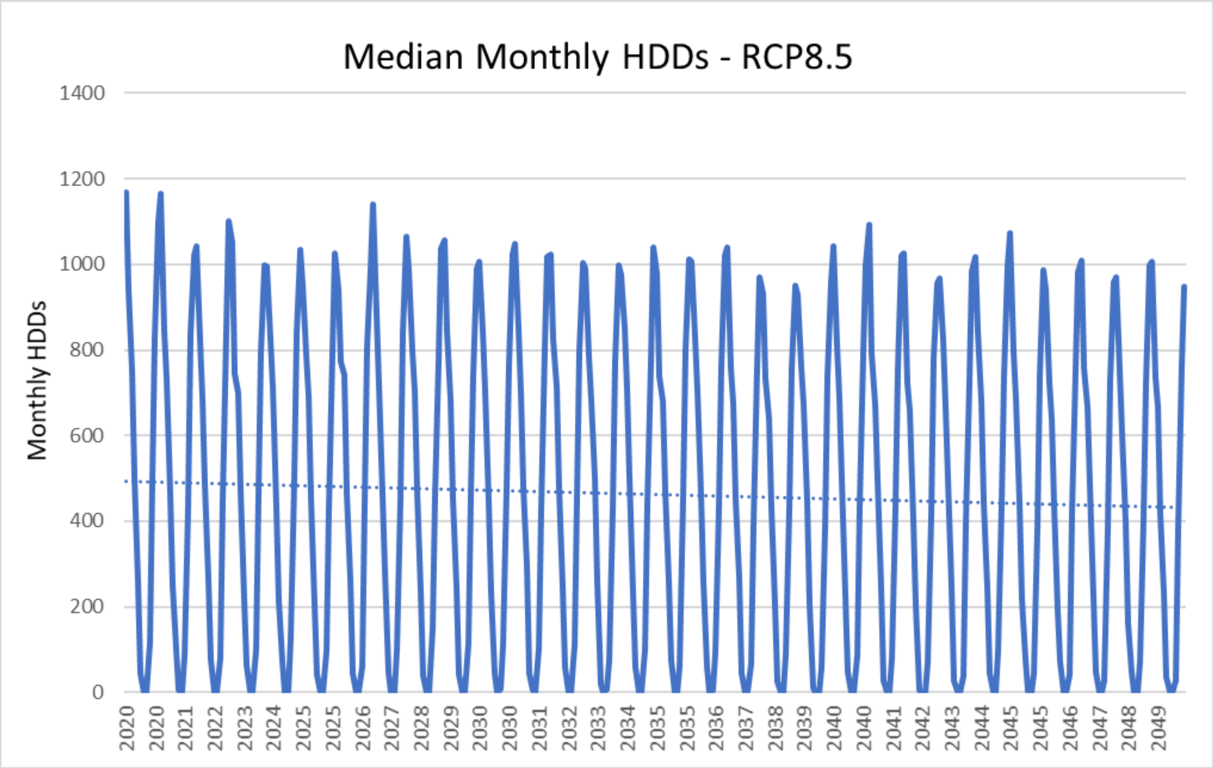

February 20 Year Moving Average
Monthly Heating Degree Days


October 20 Year Moving Average
Monthly Heating Degree Days


December 20 Year Moving Average
Monthly Heating Degree Days

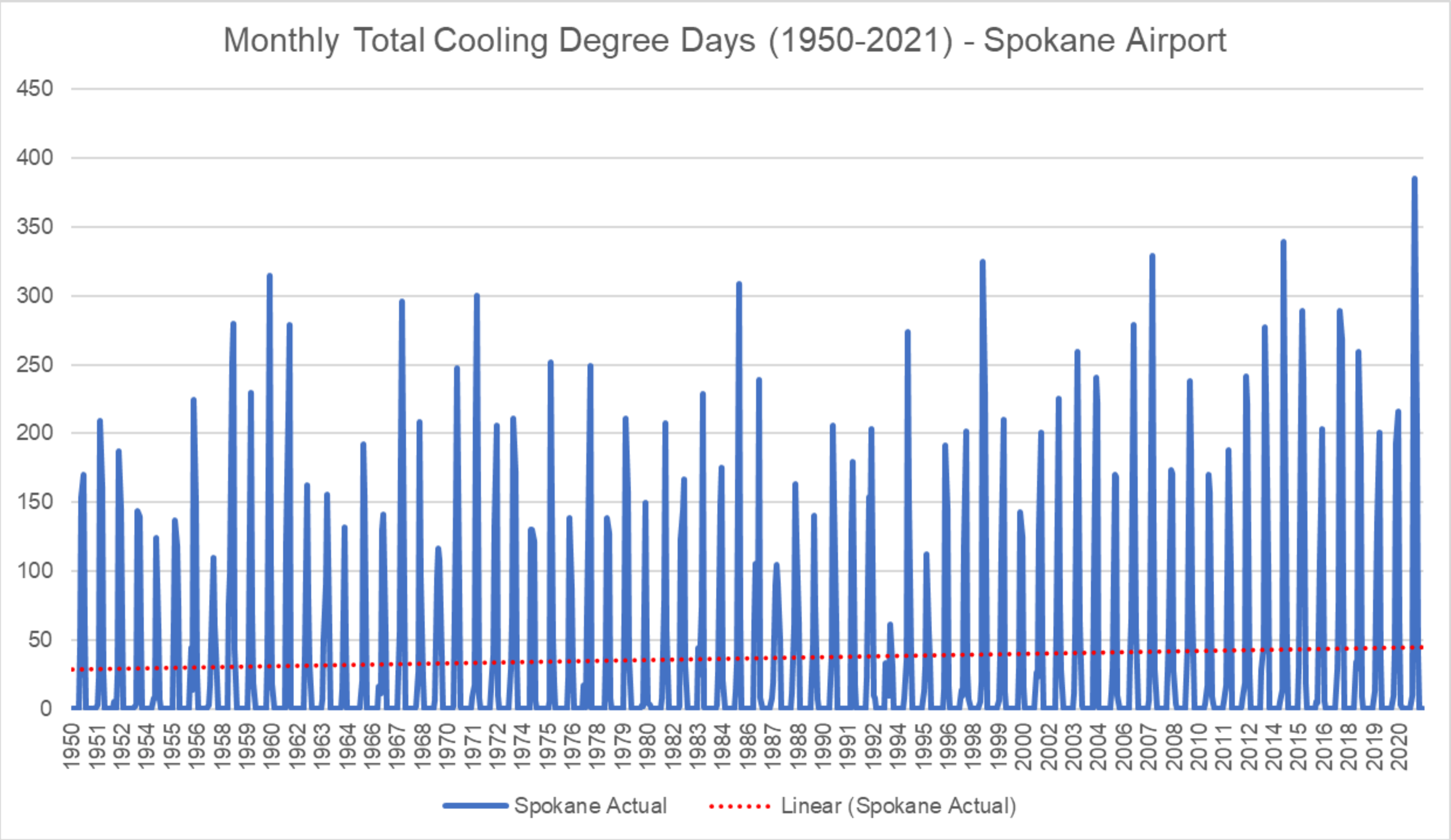
Climate Change Impacts to Load



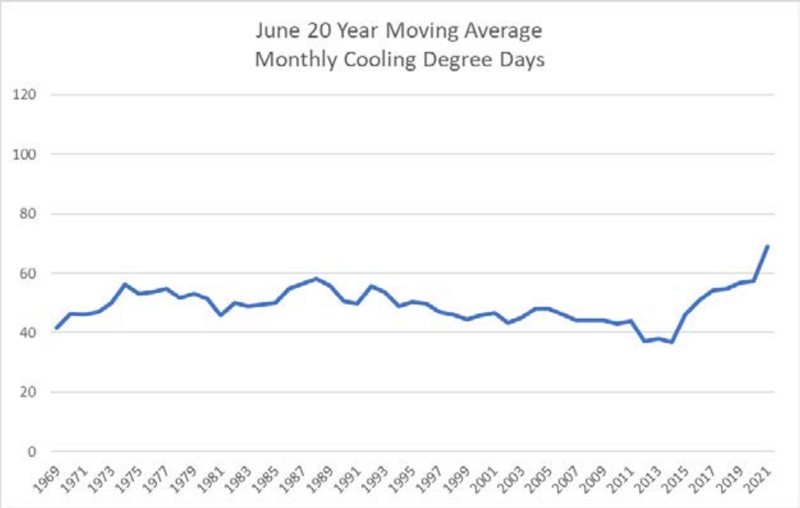


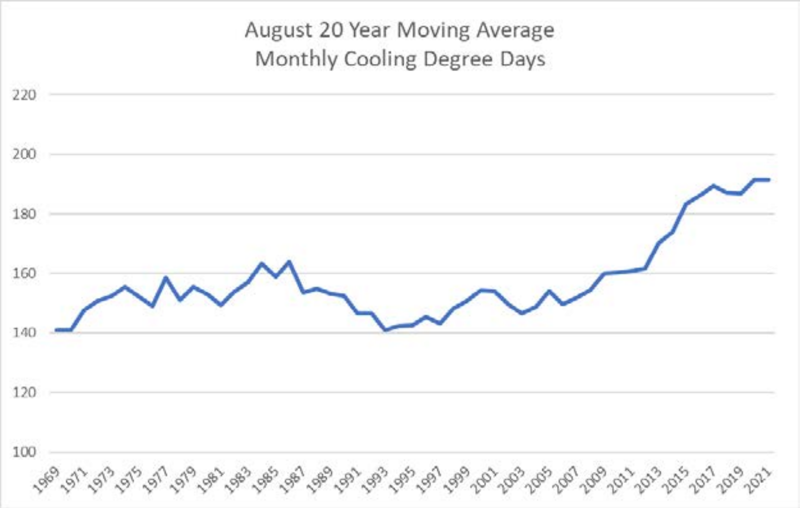
Climate Change Impacts to Load

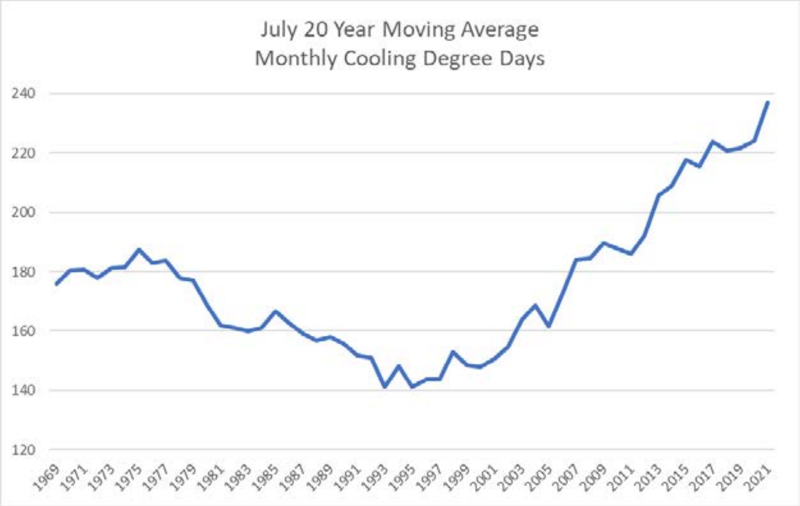
- Cooling Degree Days Baseline Data

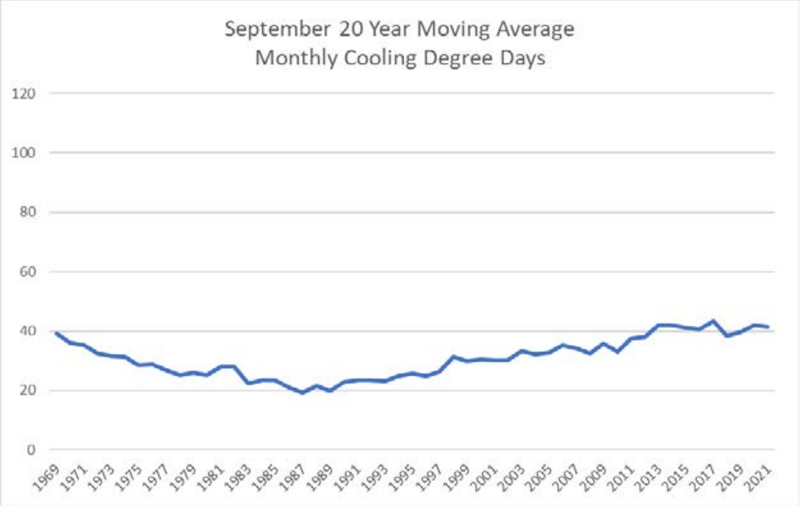


Climate Change Impacts to Load

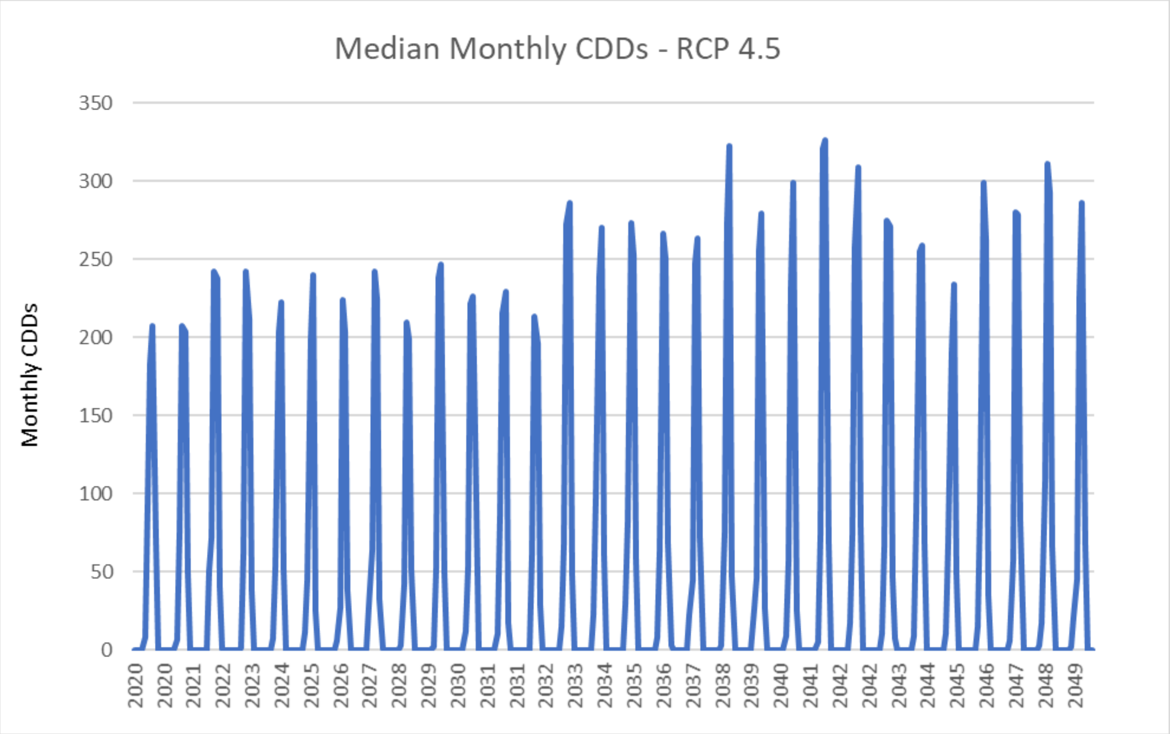


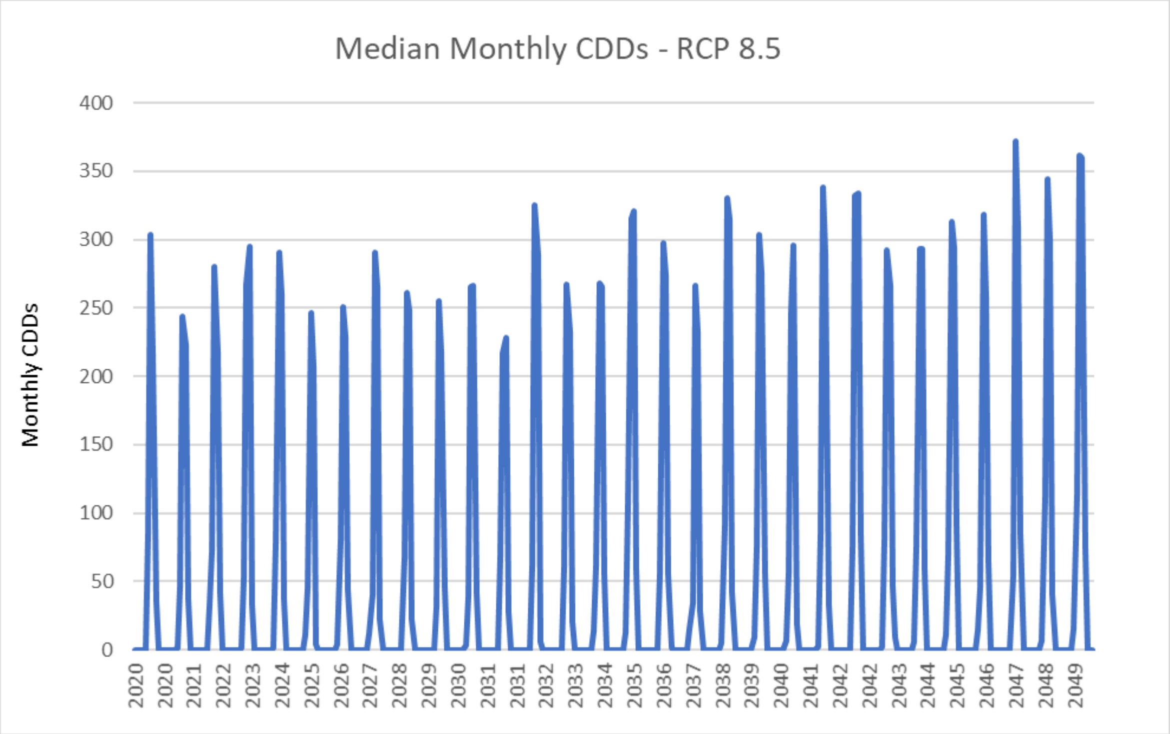






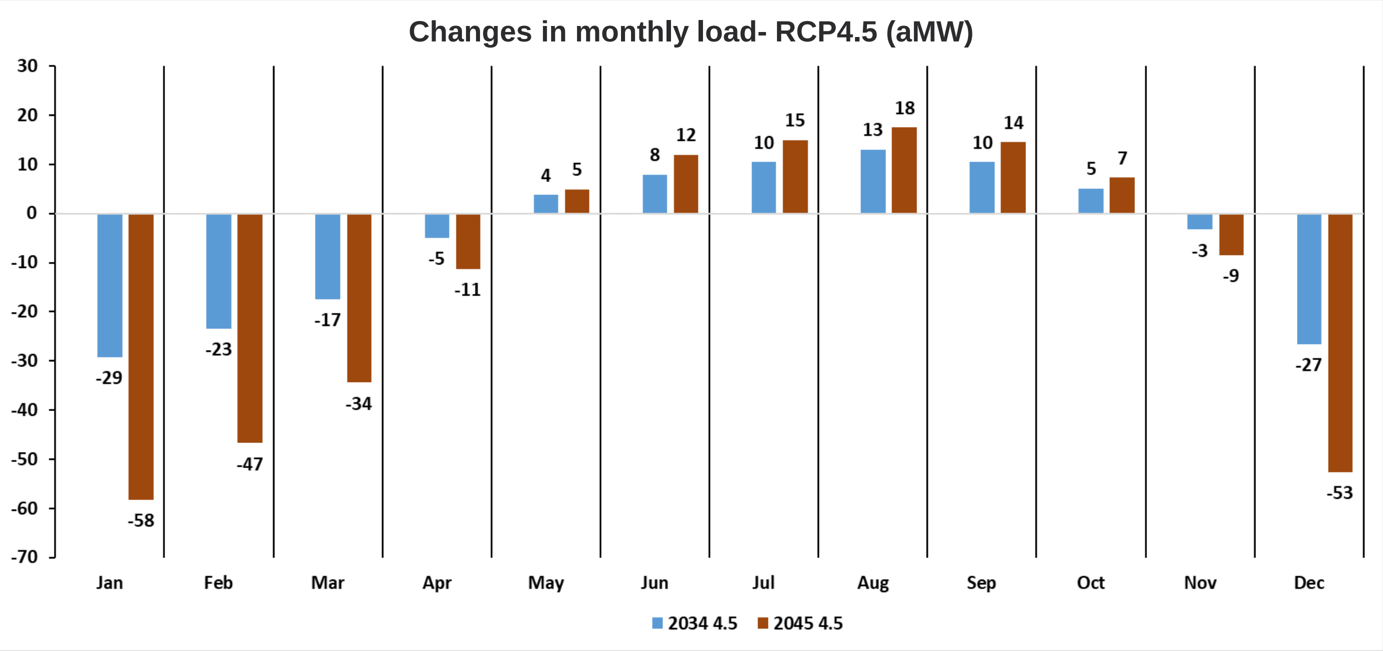
Climate Change Impacts to Load

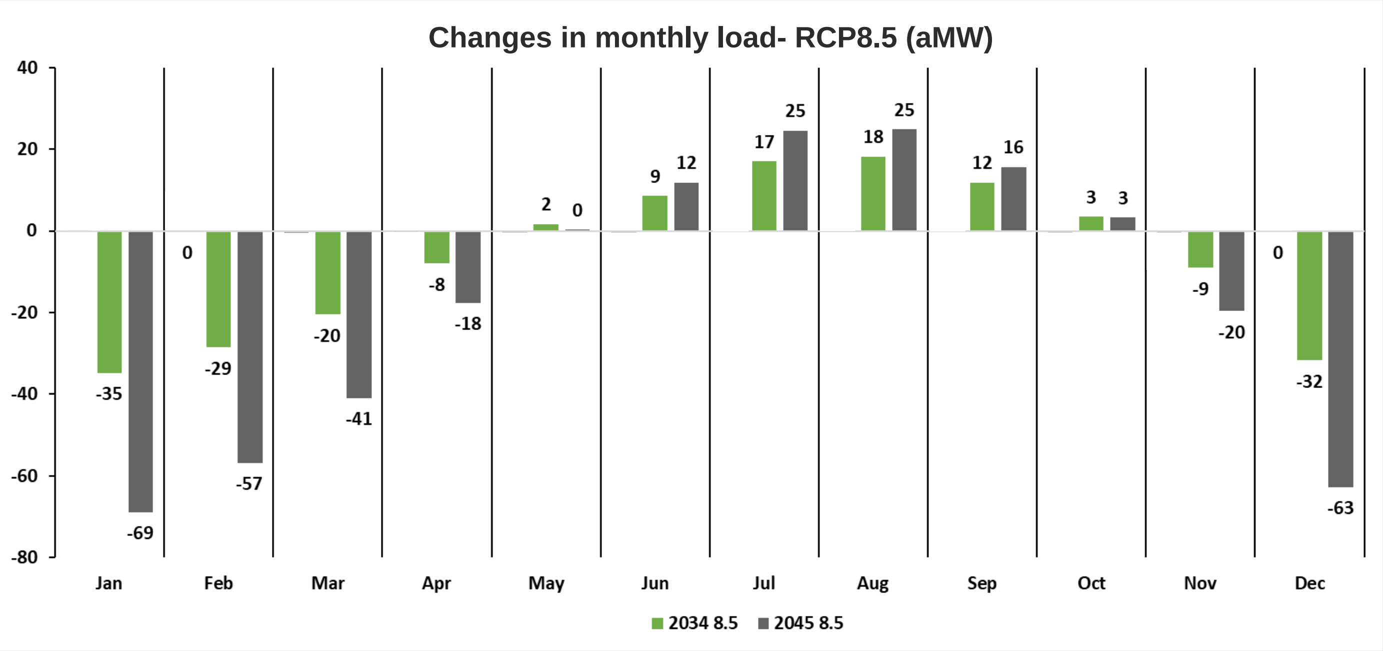

Median Monthly CDDs - RCP 4.5


Median Monthly CDDs - RCP 8.5

Impacts to Load

- Load forecast utilizes 20-year rolling average which phases into the climate change forecast.





Climate Change Impacts to Peak Load

- Peak load model utilizes minimum/maximum daily average temperature for each month.
- Median of minimum/maximum average daily temperature for each month of all models.
- Summer and winter peak is the highest/lowest for each time period.
- Winter peak is based on a 76-year* moving average, summer peak is based on a 20-year moving average.

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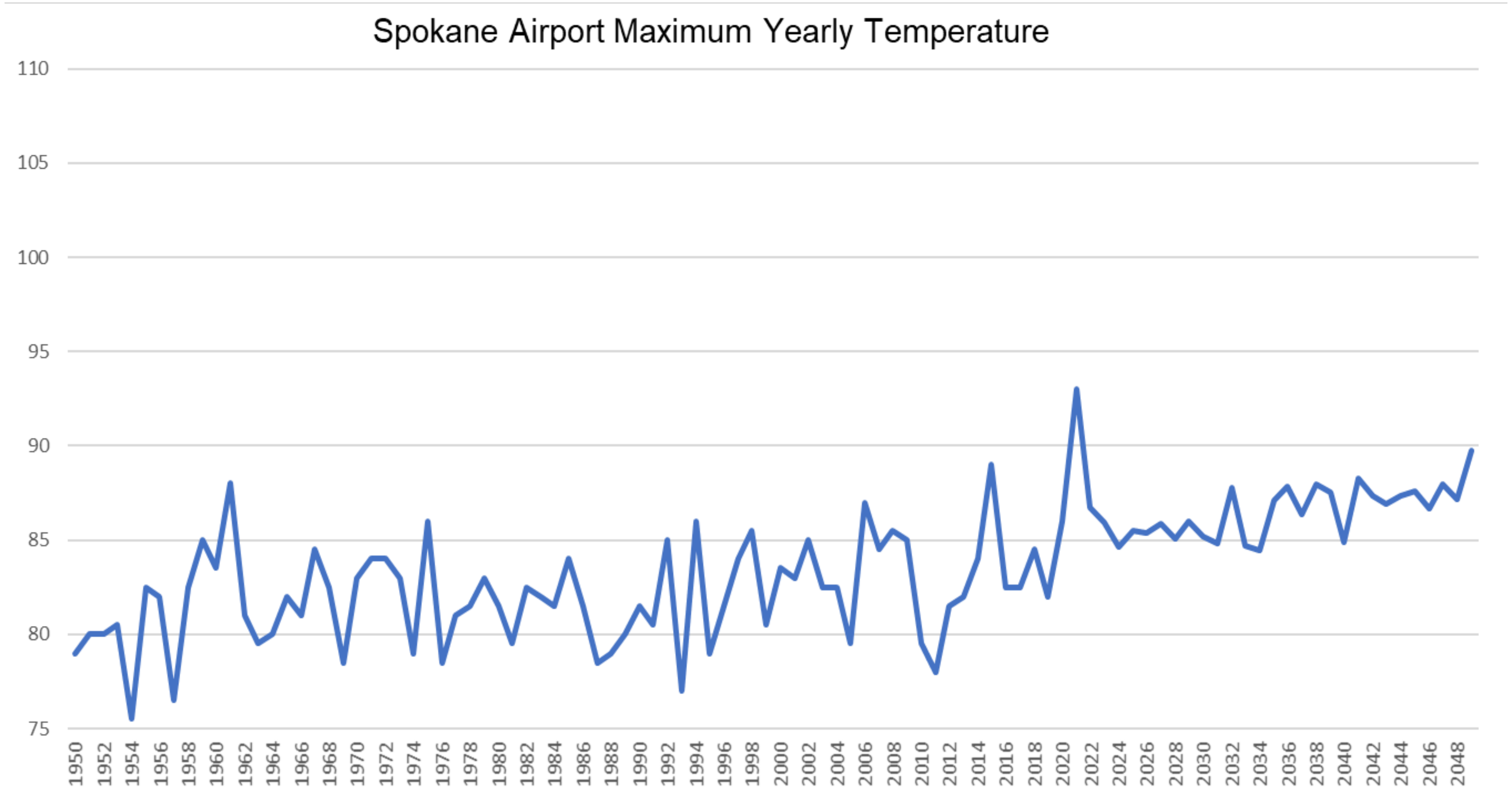
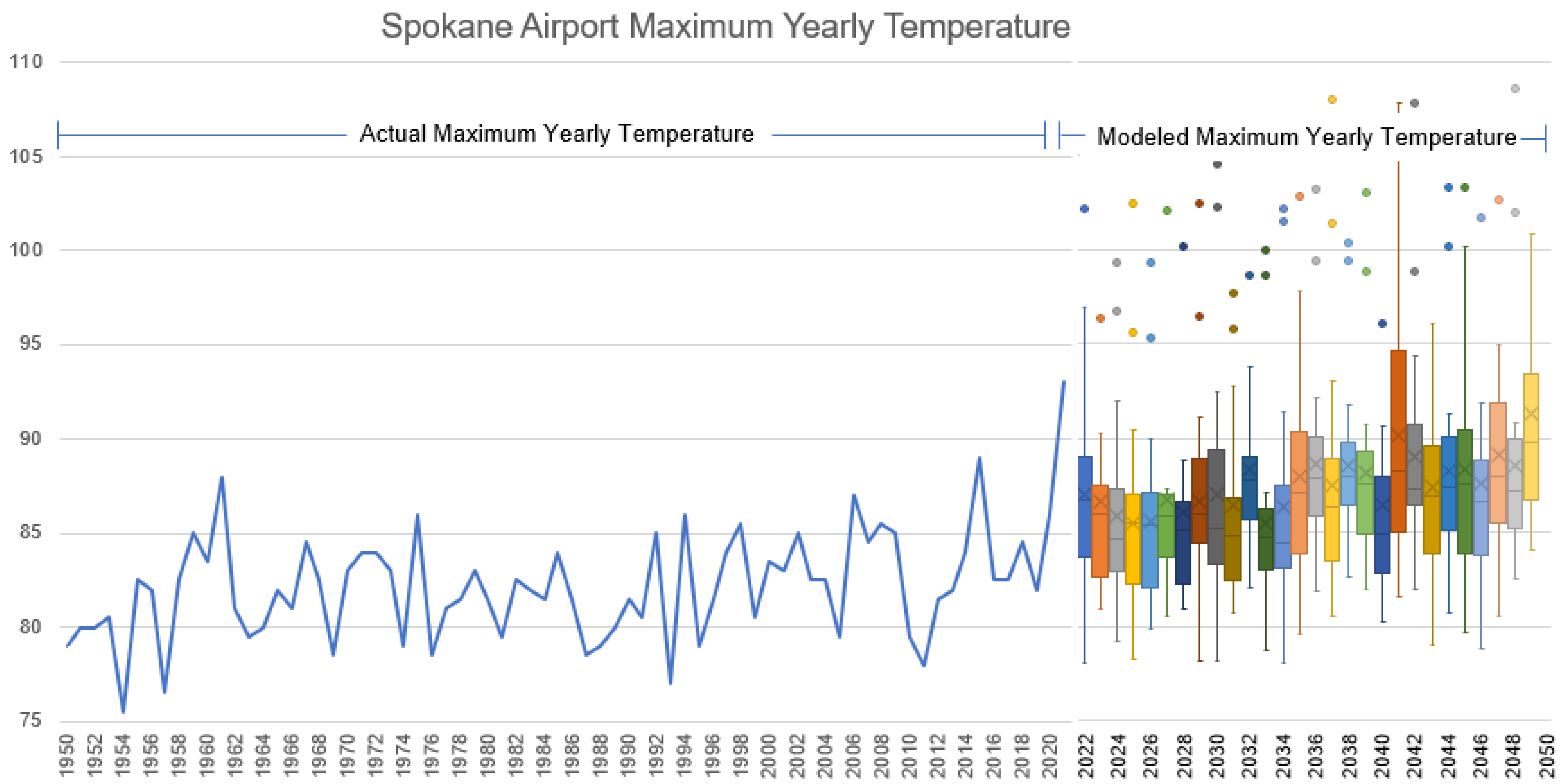
* Spokane temperature data changed in 1947.

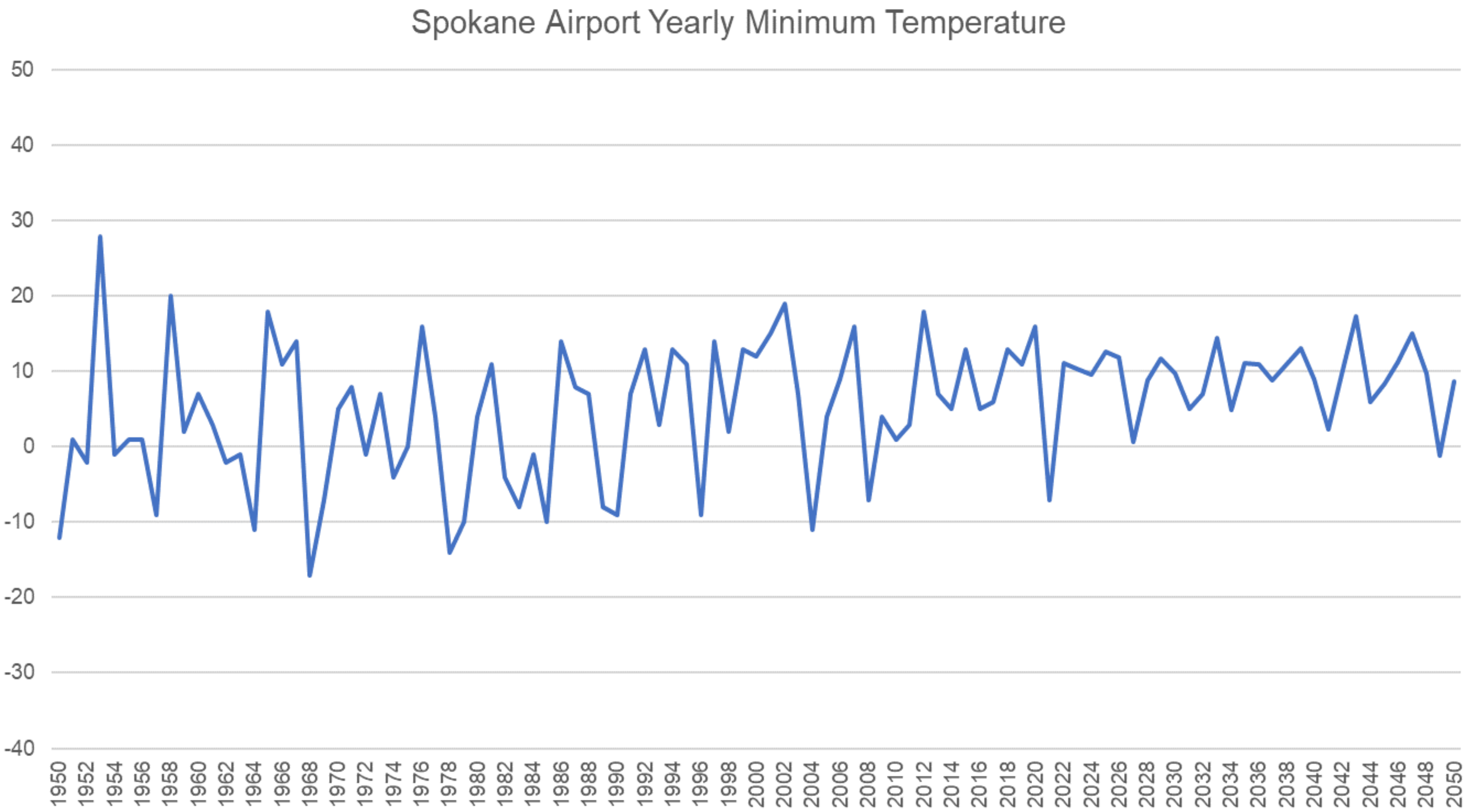
Climate Change Impacts to Peak Load



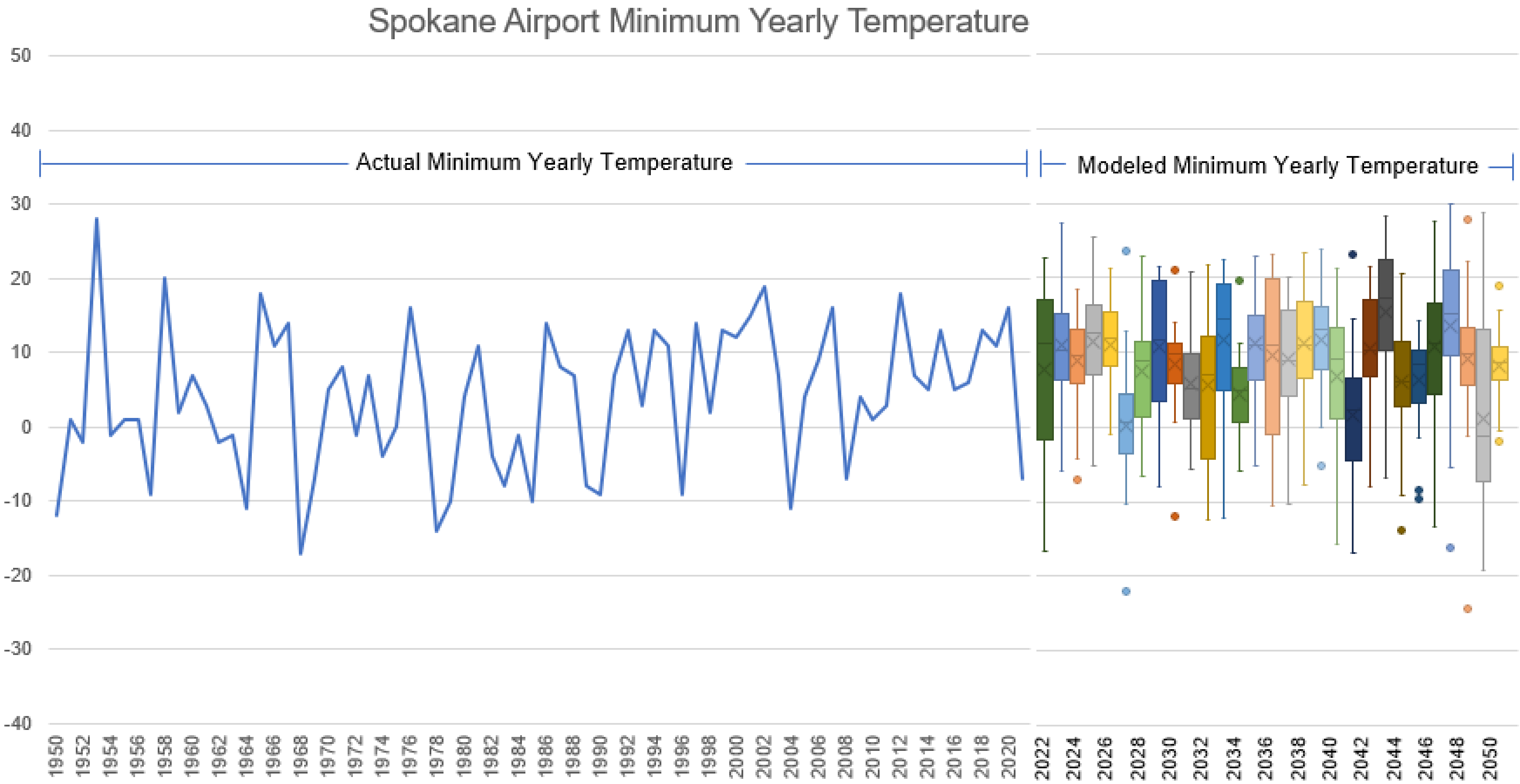
Climate Change Impacts to Peak Load



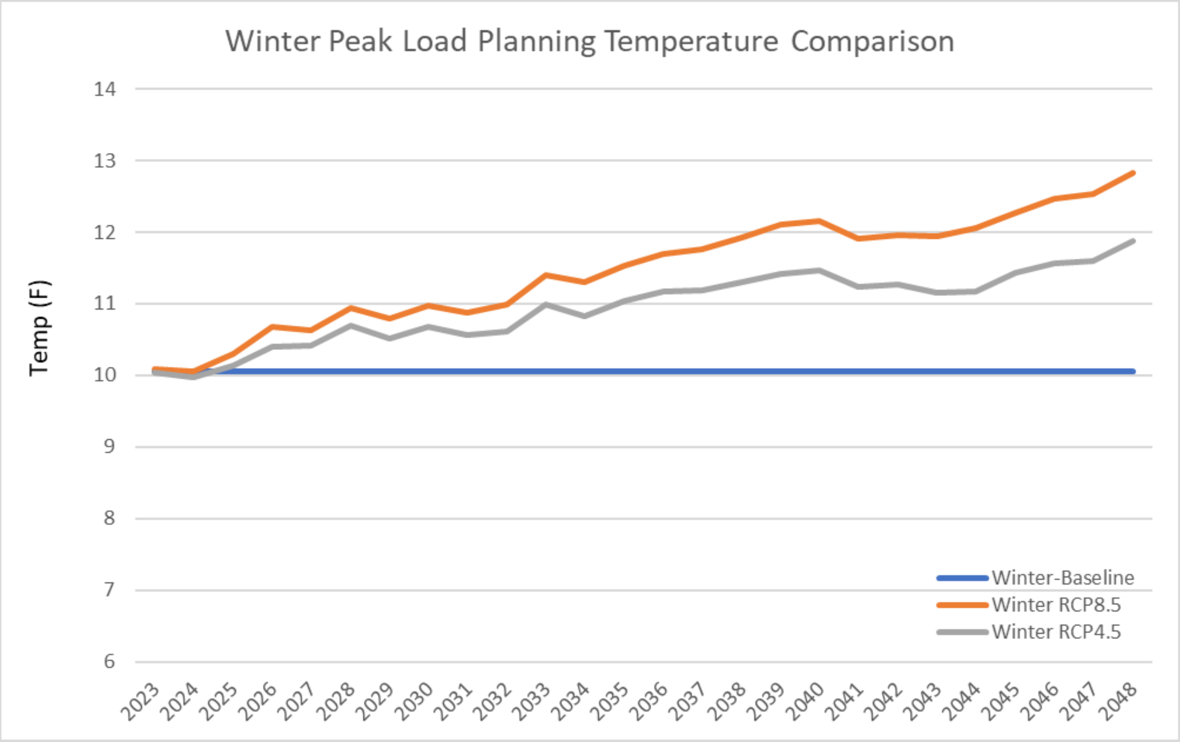
Climate Change Impacts to Peak Load

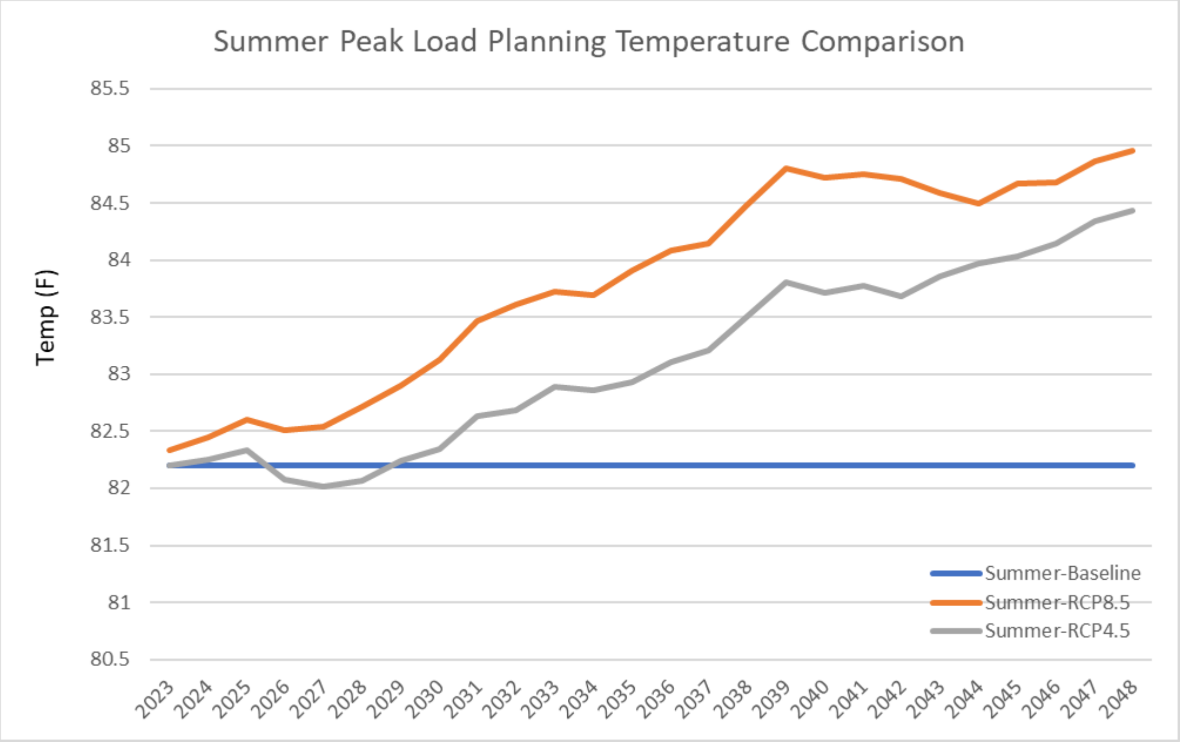


Climate Change Impacts to Peak Load

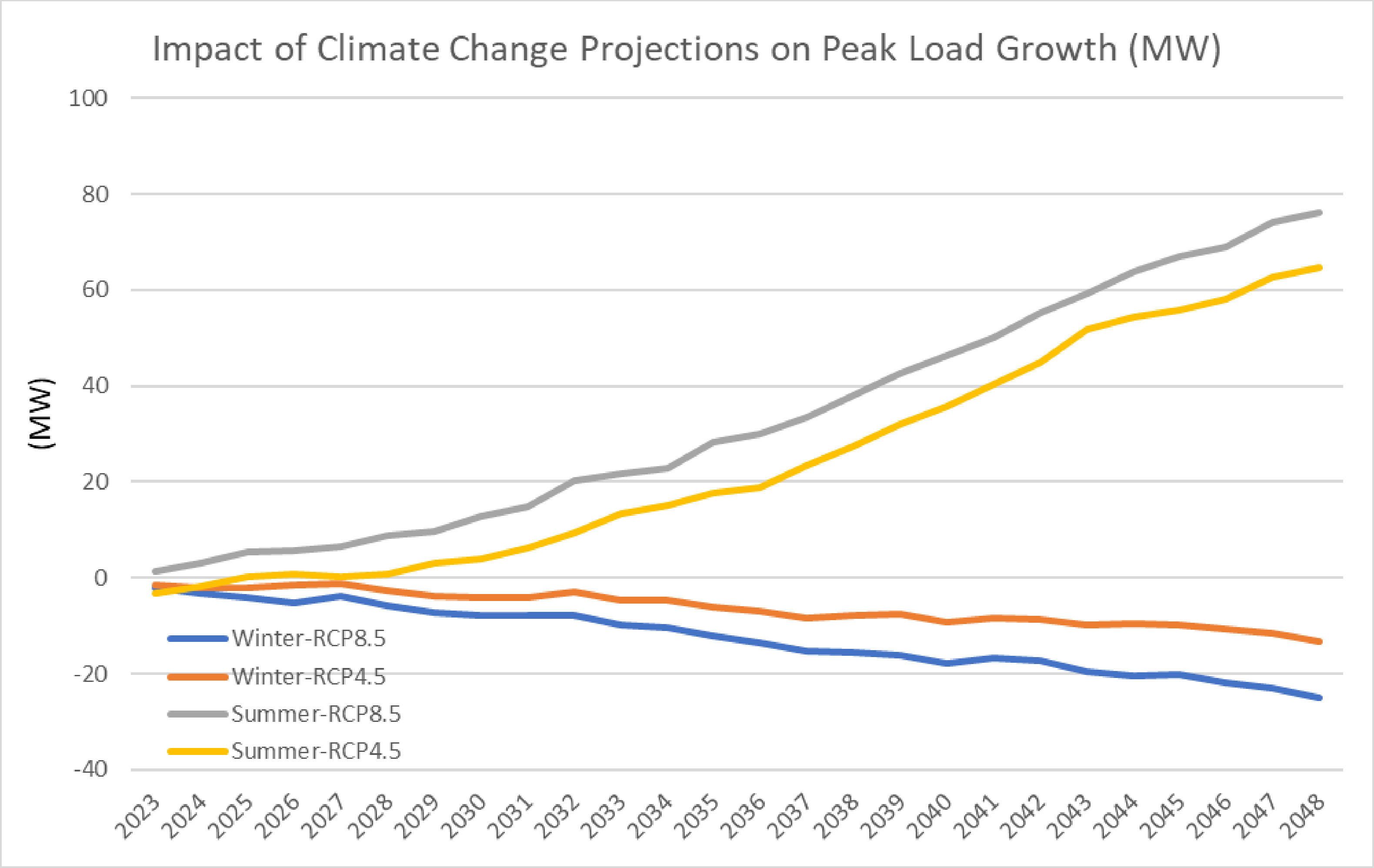


Climate Change Impacts to Peak Load

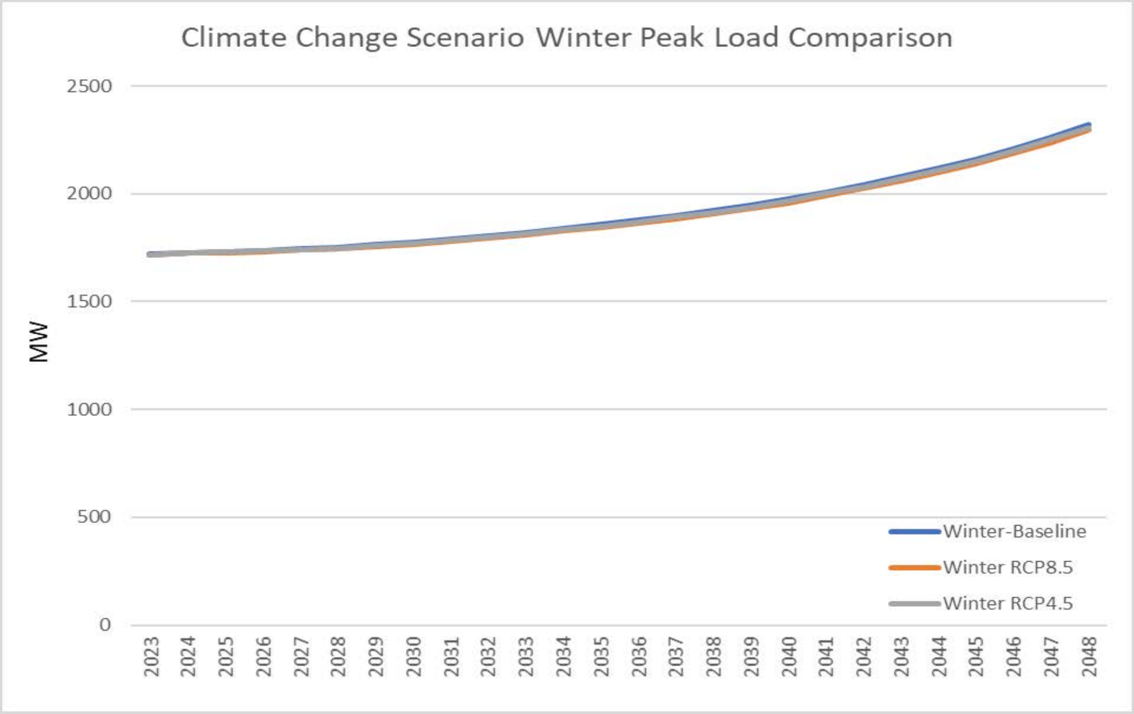


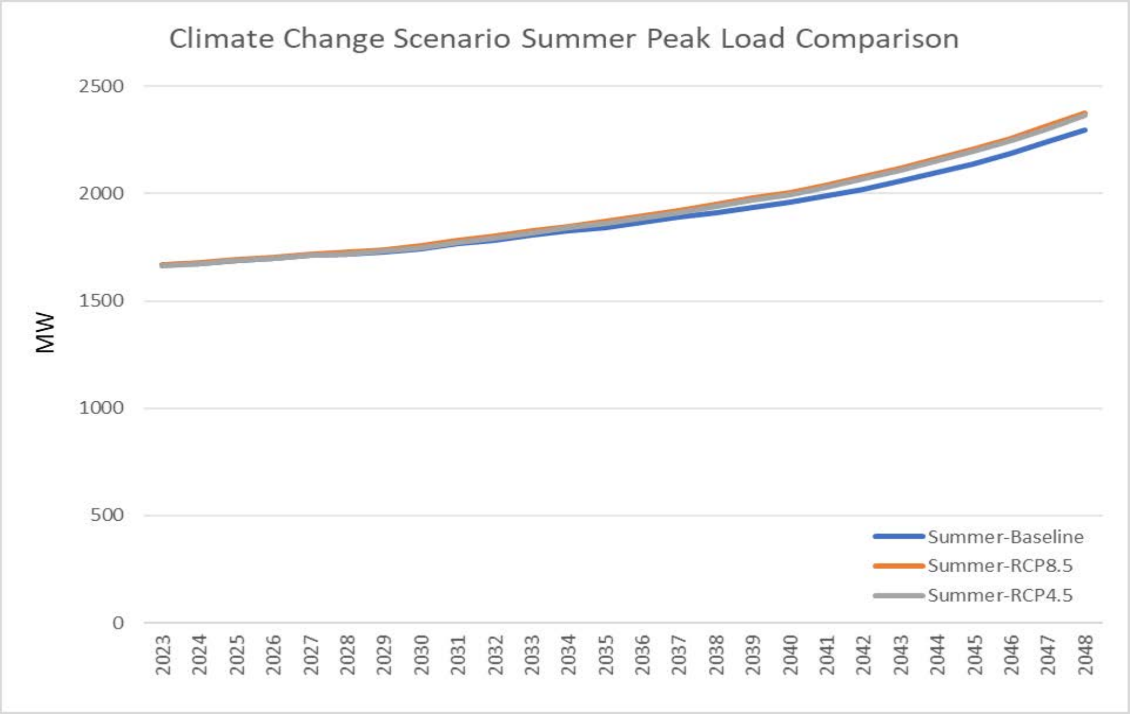


Climate Change Impacts to Peak Load



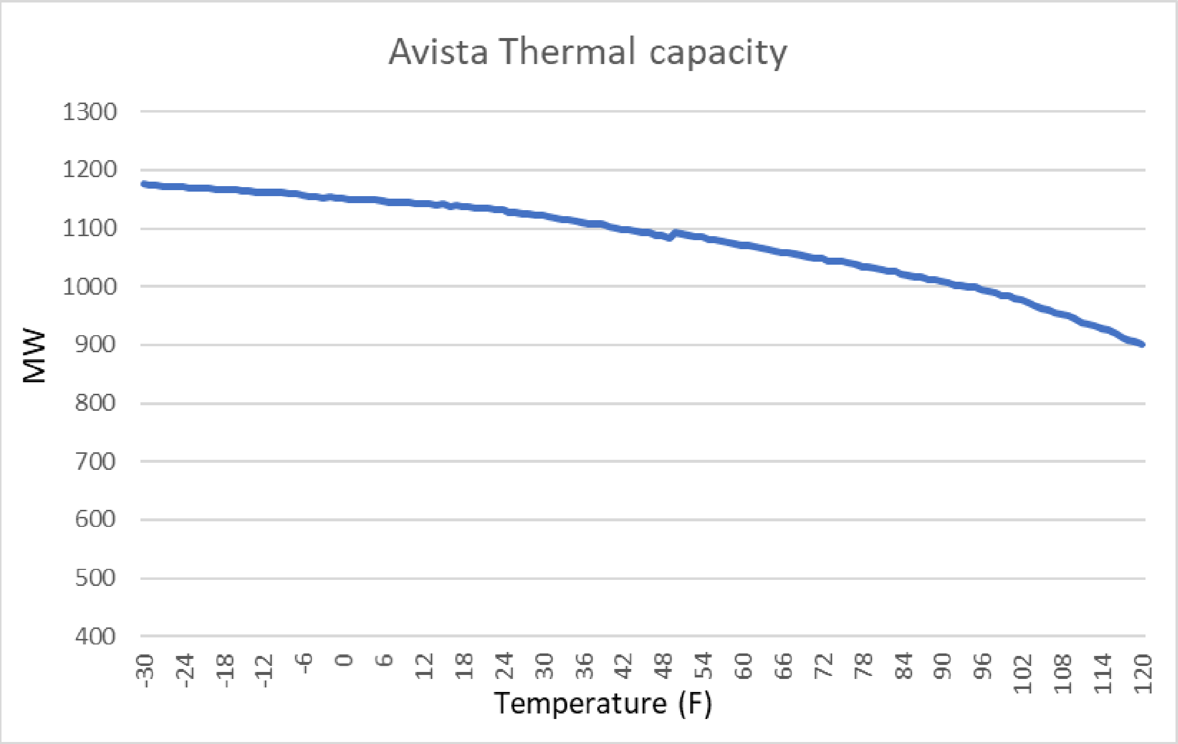
Climate Change Impacts to Peak Load





Climate Change Impacts to Peak Load

- Capacity of gas turbines decreases as temperature increases.

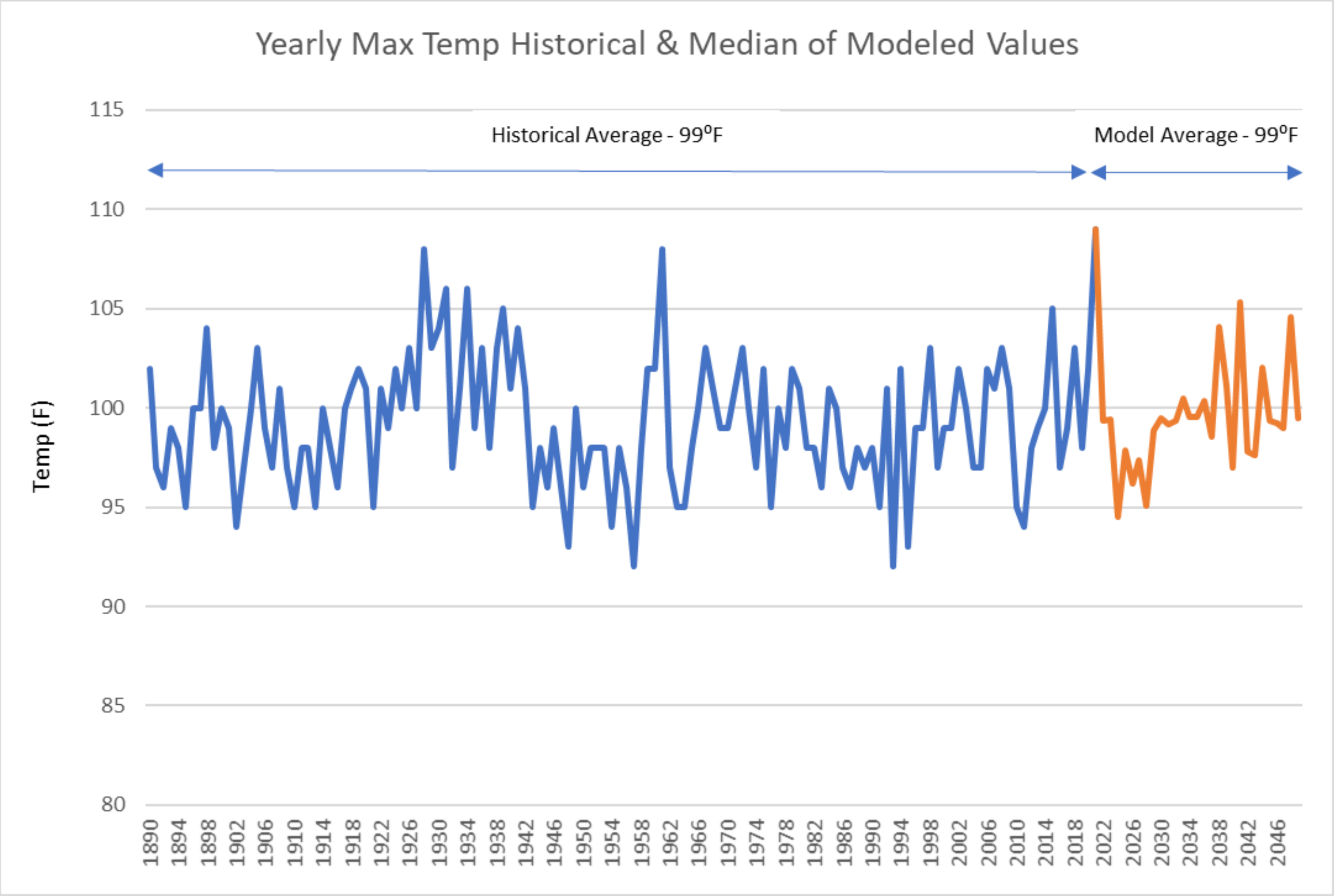


- Will increased maximum temperatures reduce capacity during extreme heat events?

Climate Change Impacts to Peak Load

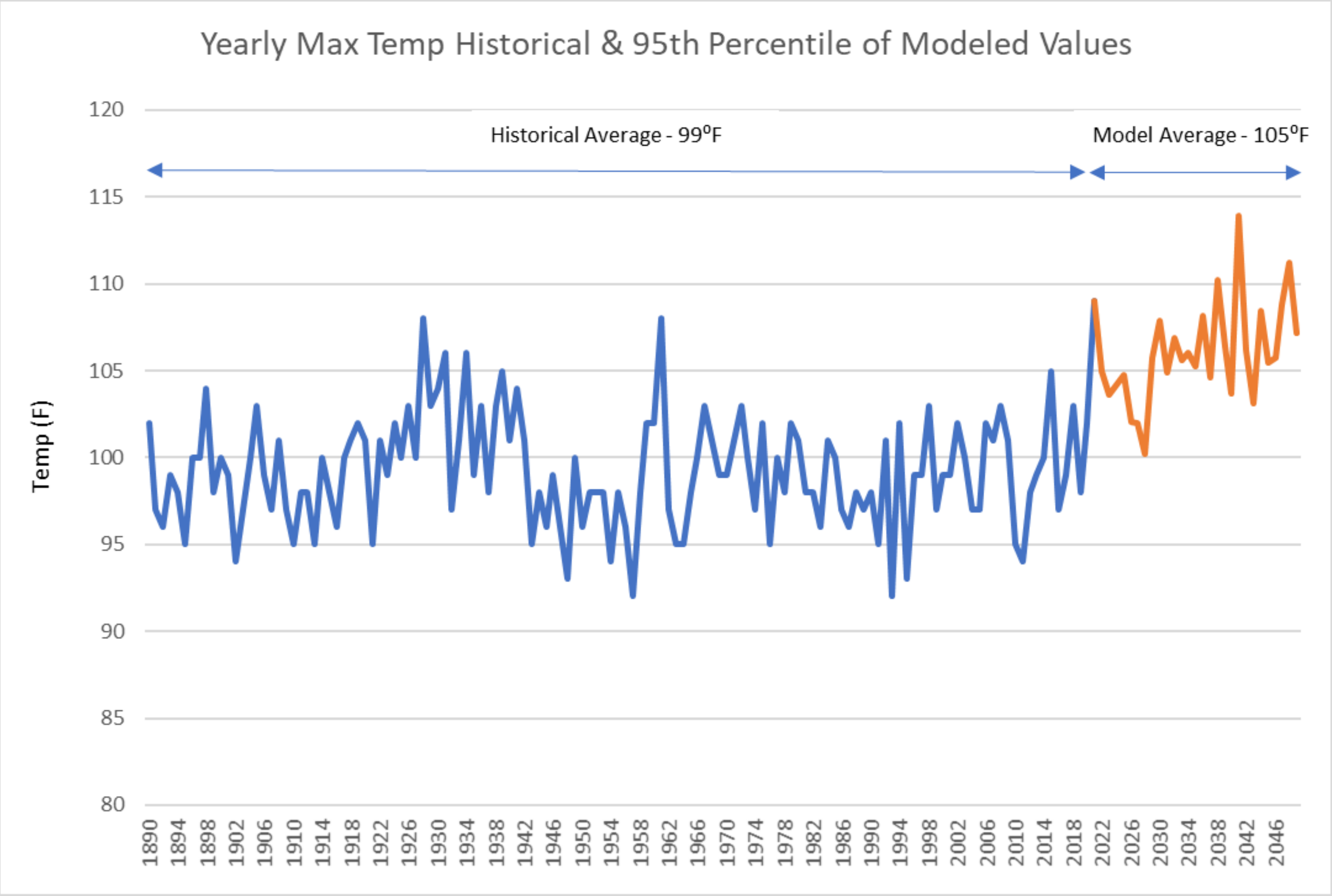
- Historical yearly maximum temperatures similar to median yearly maximum modeled temperatures

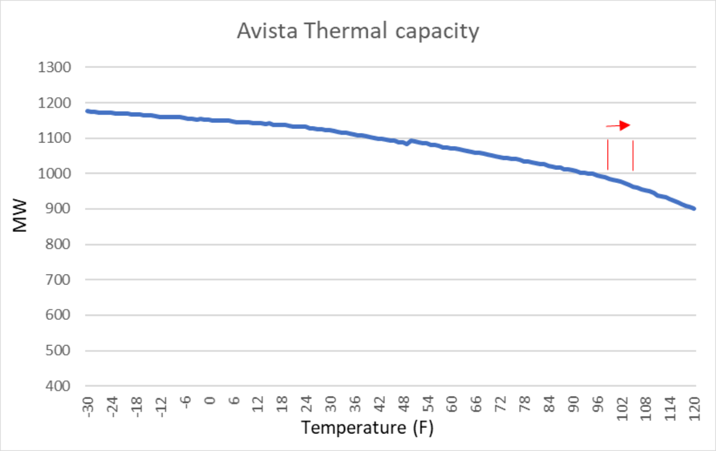
- No difference in thermal capacity when comparing historical data to median of climate models



Climate Change Impacts to Peak Load

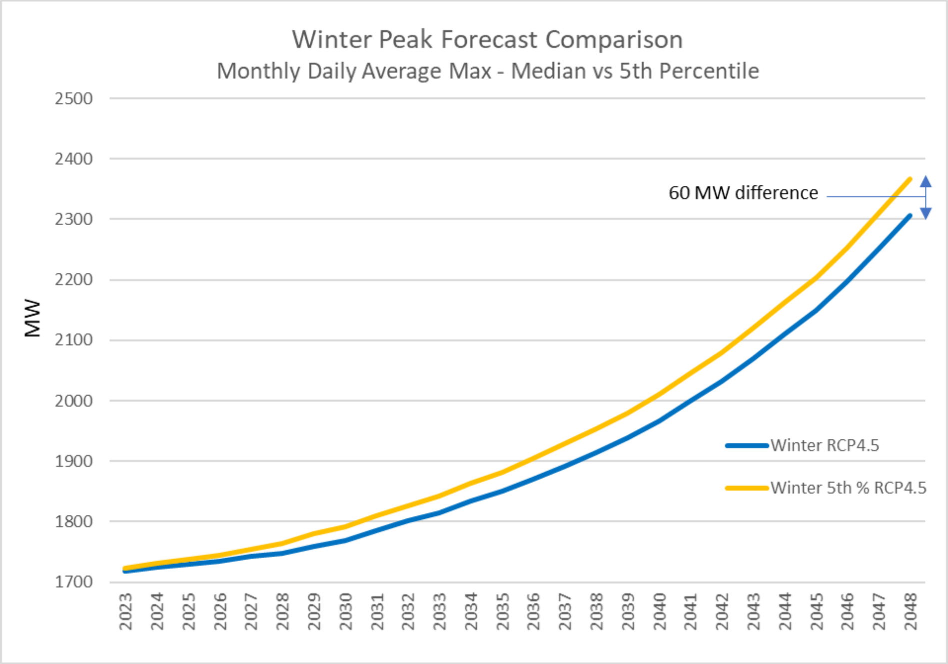
- Thermal capacity is reduced by 22 MW at the 95th percentile of yearly maximum, maximum temperatures

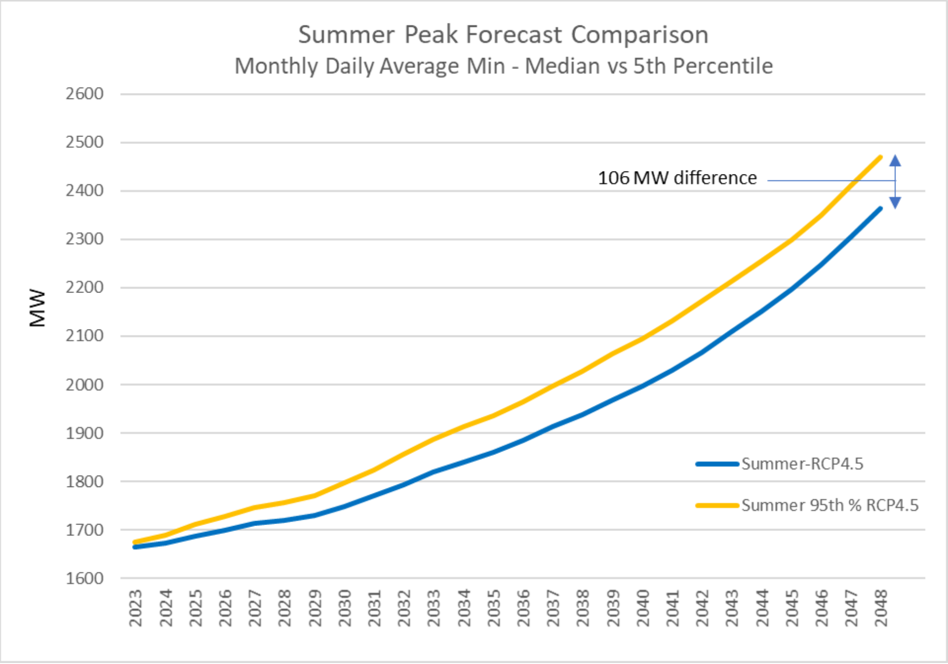




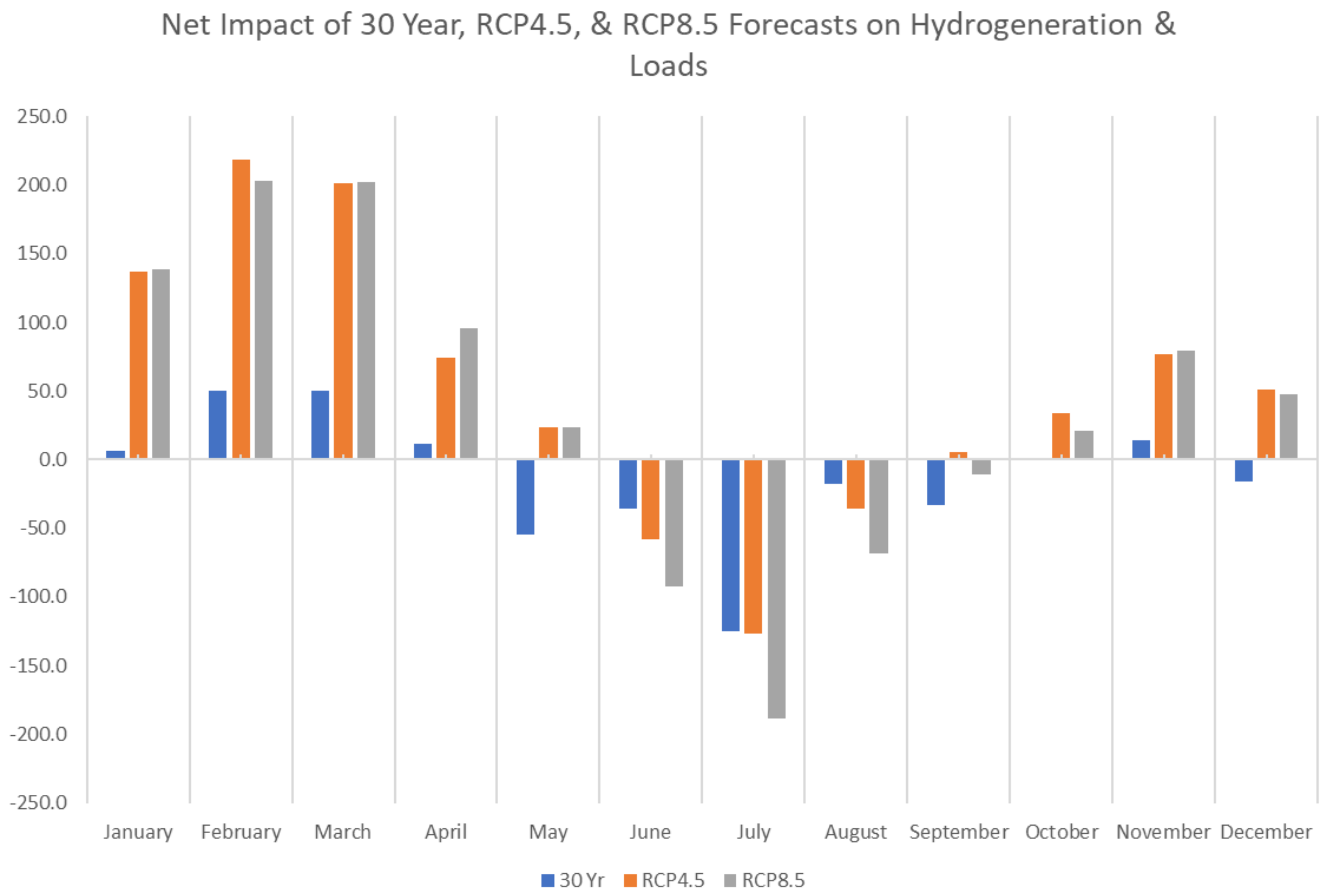
Climate Modeling and Peak Load Risk

- Capacity risk is addressed with the planning reserve margin.
- Given the variance of the climate change models, what is the risk associated with climate change at the extremes of the modeling, and does that risk increase over the planning horizon?





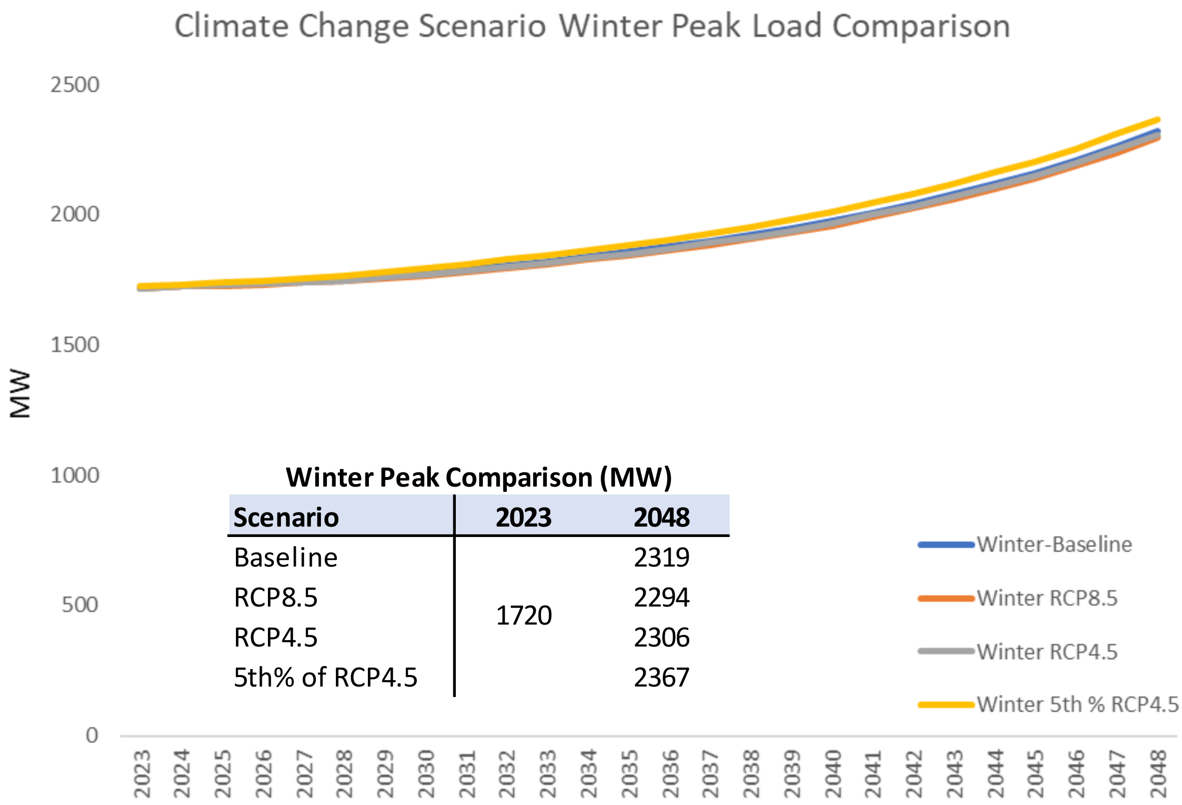
Climate Change – Net Impact



Difference from current 80 year hydro record

Month	30 Yr	RCP4.5	RCP8.5
January	6	137	139
February	50	218	203
March	50	201	202
April	11	74	96
May	-54	23	24
June	-36	-58	-92
July	-125	-127	-189
August	-17	-36	-69
September	-33	6	-11
October	0	34	21
November	14	76	80
December	-16	51	48

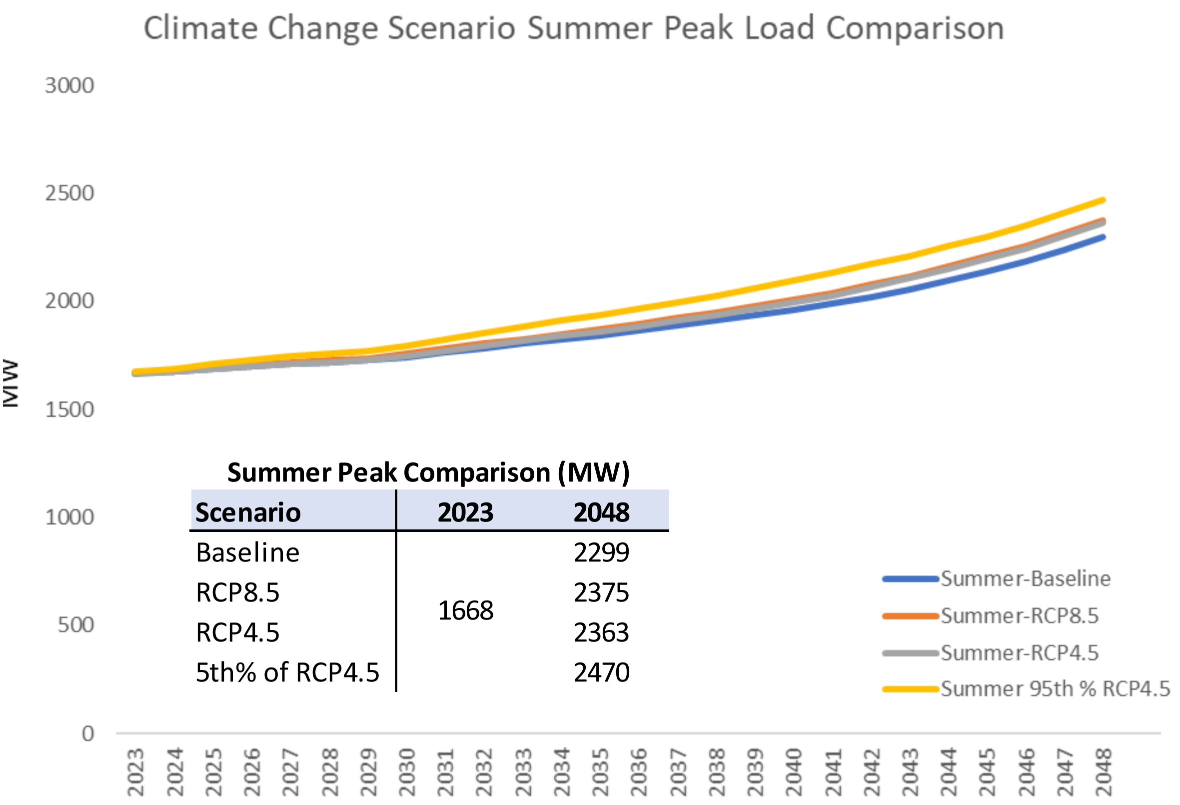
Climate Change – Net Impact



Climate Change Scenario Winter Peak Load Comparison

Winter Peak Comparison (MW)

Scenario	2023	2048
Baseline	1720	2319
RCP8.5		2294
RCP4.5		2306
5th% of RCP4.5		2367



Climate Change Scenario Summer Peak Load Comparison

Summer Peak Comparison (MW)

Scenario	2023	2048
Baseline	1668	2299
RCP8.5		2375
RCP4.5		2363
5th% of RCP4.5		2470

IRP Climate Change Approach

- Use RCP4.5 Scenario
  - Description by Intergovernmental Panel on Climate Change (IPCC)
    - RCP2.6 – stringent mitigation scenario
    - RCP4.5 & RCP6.0 – intermediate scenarios
    - RCP8.5 – very high GHG emissions
  - RCP4.5 & RCP6.0 are similar in IRP planning horizon
- Hydrogeneration – Move from median of 80-year (1929-2008) to median of previous 30 years throughout planning horizon
- Energy Load Forecast – move from static assumed temperature to moving average of previous 20 years throughout planning horizon
- Peak Load Forecast – move from static assumed temperature to moving average of previous 20 years (summer peak) and 76 years (winter peak)

2023 Electric Integrated Resource Plan

Technical Advisory Committee Meeting No. 7 Agenda

Tuesday, October 11, 2022
Microsoft Teams Virtual Meeting
With an in-Person Option

Topic	**Time**	**Staff**
Introductions	9:00	John Lyons
DER Potential Study Scope	9:15	James Gall
Load Forecast Update	9:45	Grant Forsyth
Break	10:30	
Load & Resource Balance (Resource Need)	10:40	Lori Hermanson
Natural Gas Market Dynamics	11:00	Tom Pardee/ Michael Brutocao
Lunch	11:30	
Wholesale Electric Price Forecast	12:30	Lori Hermanson
WRAP Update	1:00	James Gall
Clean Energy Implementation Plan (CEIP) Update & Customer Benefit Indicator's (CBI) use in the IRP	1:30	Annette Brandon
Break	2:30	
Portfolio & Market Scenario Options	2:40	James Gall
Adjourn	3:30	

IRP Introduction

2023 Avista Electric IRP

TAC 7 – October 11, 2022

John Lyons, Ph.D. Senior Resource Policy Analyst

Meeting Guidelines

- IRP team is working remotely and is available for questions and comments
- Stakeholder feedback form
  - Responses shared with TAC at meetings, by email and in Appendix
  - Would a form and/or section on the web site be helpful?
- IRP data posted to web site – updated descriptions and navigation are in development
- Virtual IRP meetings on Microsoft Teams until able to hold large meetings again
- TAC presentations and meeting notes posted on IRP page
- This meeting is being recorded and an automated transcript made

Virtual TAC Meeting Reminders

- Please mute mics unless commenting or asking a question
- Raise hand or use the chat box for questions or comments
- Respect the pause
- Please try not to speak over the presenter or a speaker
- Please state your name before commenting
- Public advisory meeting – comments will be documented and recorded

Integrated Resource Planning

The Integrated Resource Plan (IRP):

- Required by Idaho and Washington* every other year
  - Washington requires IRP every four years and update at two years
- Guides resource strategy over the next twenty + years
- Current and projected load & resource position
- Resource strategies under different future policies
  - Generation resource choices
  - Conservation / demand response
  - Transmission and distribution integration
  - Avoided costs
- Market and portfolio scenarios for uncertain future events and issues

Technical Advisory Committee

- Public process of the IRP – input on what to study, how to study, and review of assumptions and results
- Wide range of participants involved in all or parts of the process
  - Please ask questions
  - Always soliciting new TAC members
- Open forum while balancing need to get through topics
- Welcome requests for new studies or different modeling assumptions.
- Available by email or phone for questions or comments between meetings
- Due date for study requests from TAC members – October 1, 2022
- External IRP draft released to TAC – March 17, 2023, public comments due – May 12, 2023
- Final 2023 IRP submission to Commissions and TAC – June 1, 2023

Remaining 2023 Electric IRP TAC Meeting Schedule

- Technical Modeling Workshop: October 20, 2022 (9 am to 12 pm PST)
- Washington Progress Report Workshop: December 14, 2022 (9 am to 10:30 am PST)
- TAC 8: February 16, 2023 (9 am to 4 pm PST)
- Virtual Public Meeting Gas & Electric IRPs: March 8, 2023 (12 to 1 pm and 5:30 to 6:30 pm PST)
- TAC 9: March 22, 2023 (9 am to 4 pm PST)

Today’s Agenda

9:00	Introductions, John Lyons
9:15	DER Potential Study Scope, James Gall
9:45	Load forecast Update, Grant Forsyth
10:30	Break
10:40	Load & Resource Balance (Resource Need), Lori Hermanson
11:00	Wholesale Price Forecast Natural Gas & Electric, Avista IRP Team
11:30	Lunch
12:30	Wholesale Price Forecast Natural Gas & Electric (continued)
1:00	WRAP Update
1:30	Clean Energy Implementation Plan Update & Customer Benefit Indicator’s Use in the IRP, Annette Brandon
2:30	Break
2:40	Portfolio & Market Scenario Options, James Gall
3:30	Adjourn

Distributed Energy Resource Potential Study

James Gall, Integrated Resource Planning Manager
Electric IRP, Seventh Technical Advisory Committee Meeting
October 11, 2022

CEIP Commitment #14

- Avista will include a Distributed Energy Resources (DERs) potential assessment for each distribution feeder no later than its 2025 electric IRP.
- Avista will develop a scope of work for this project no later than the end of 2022, including input from the IRP TAC, EEAG, and DPAG.
- The assessment will include a low-income DER potential assessment.
- Avista will document its DER potential assessment work in the Company's 2023 IRP Progress Report in the form of a project plan, including project schedule, interim milestones, and explanations of how these efforts address WAC 480-100-620(3)(b)(iii) and (iv).

WAC 480-100-620(3)(b)(iii) and (iv).

> (iii) Energy assistance potential assessment – The IRP must include distributed energy programs and mechanisms identified pursuant to RCW 19.405.120, which pertains to energy assistance and progress toward meeting energy assistance need; and
>
> (iv) Other distributed energy resource potential assessments – The IRP must assess other distributed energy resources that may be installed by the utility or the utility's customers including, but not limited to, energy storage, electric vehicles, and photovoltaics. Any such assessment must include the effect of distributed energy resources on the utility's load and operations.

Distributed Energy Resource

- Forecast for each distribution feeder (361 originating in Washington)
- Washington only study
- New Generation & Storage
  - Residential and Commercial Solar
  - Residential and Commercial Storage
  - Other Renewables (i.e. wind, small hydro, fuel cell, ICE)
- Load Management
  - Energy Efficiency
  - Demand Response
    - Includes electric vehicles
    - Should we conduct a study future locations for electric vehicles (MDV, HDV, LDV)?

New Generation & Storage

- Potential assessment for each option for each year between 2025 and 2045
  - Forecast should consider existing policies and cost/pricing outlooks for the customer demographics and building potential.
  - A scenario for future customer electrification impacting its demand should be included to the extent it could affect generation.

– The analysis shall include a scenario for feeders within Highly Impacted or Vulnerable Population area identifying the upper bound limits excluding financial limitations of the customer.

Load Management

- Uses current potential assessment for energy efficiency and demand response.
  - Low-income efficiency is addressed in the energy efficiency CPAs.
- Requirement is a geographic dispersion assessment by feeder for each calendar year for each load management resource type.
- Building space and water heating electrification scenario.

Schedule and Tasks

Task 1: July 2023

- A survey of other utility or other entity efforts to conduct similar DER potential studies. The study shall include comparison of the other utility's size, rates, climate, and customer demographics.
- A summary of best practices for development of future adoption of new DER technologies.
- An overview of Avista's current DER resources (i.e., 2022 baseline).

Task 2: September 2023

- A description of the methodology used to develop the estimates for each DER and related scenarios.

Task 3: Draft March 2024 and Final May 2024

- Matrix including each feeder and the amount of DER resources in kW and/or kWh for each resource type by year and customer class.

Task 4: 2024 Q2

- Present draft results of study to Electric and Natural Gas Integrated Resource Planning Technical Advisory Committee, Energy Efficiency Advisory Group, and the Distribution Planning Advisory Group.

Task 5: Draft April 2024, Final Report June 2024

- Final report including tasks 1 through 4.
- Summary of comments and suggestions from non-Avista parties and how they are addressed in the final report.
- Recommendations for future studies.
- Documentation of methods and procedures to transition Avista to be able to update these forecasts for future use.

TAC Meeting
October 11, 2022

2023 IRP: Updated Energy and Peak Forecasts

Grant Forsyth, Ph.D.
Chief Economist
Grant.Forsyth@avistacorp.com

Outline

- Significant Model Updates
- Long-run Energy Forecast Update
- Peak Load Forecast Update

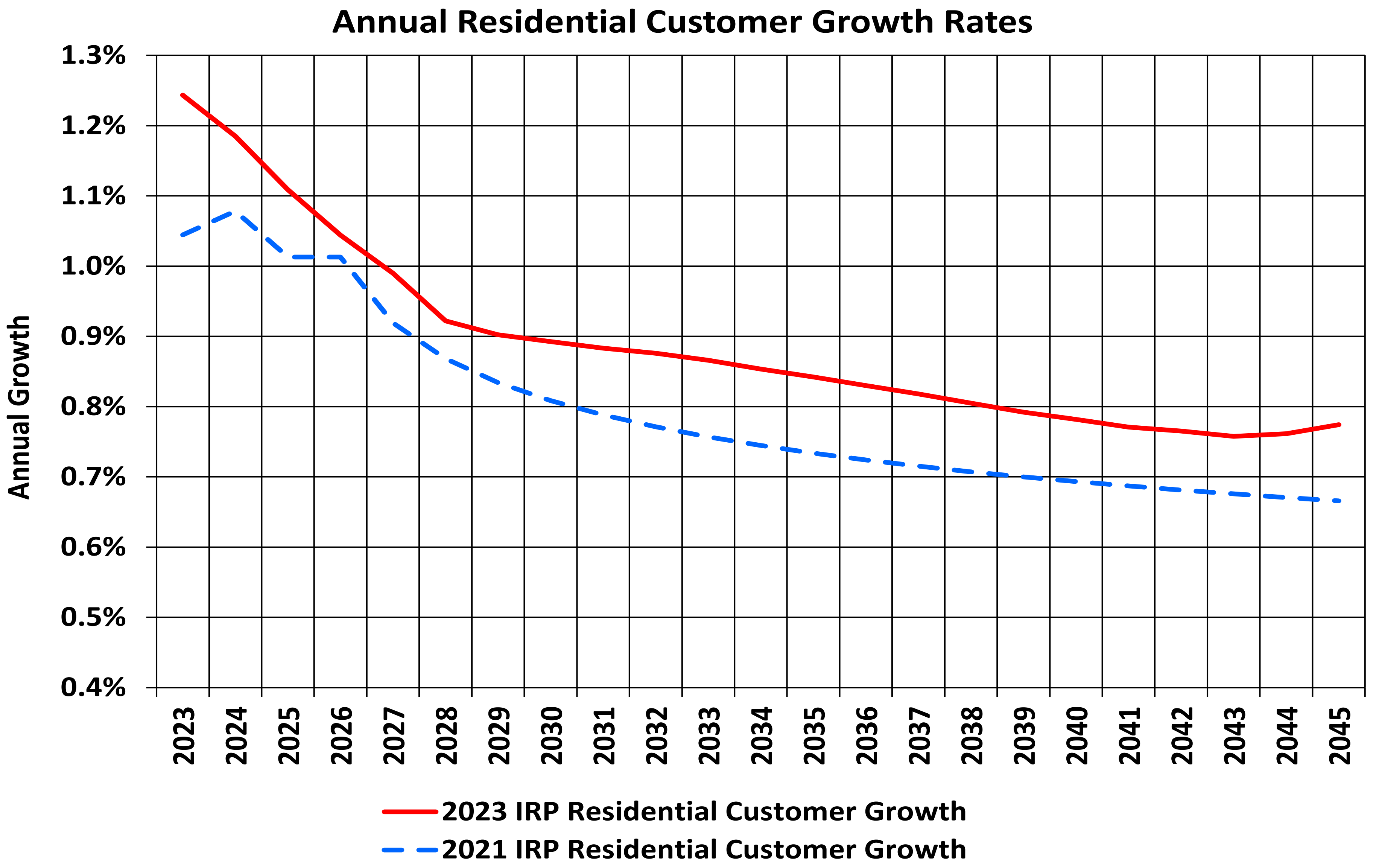
The world since February 2020:

> “…all are punish’d.”
>
> \- The Prince, Romeo and Juliet, Act 5, Scene 3

Significant Model Updates

- More aggressive EV forecast with an explicit separation between residential and commercial schedules.
- LDV EV forecast out to 2030/31 lines up with Avista's EV transportation plan in terms of forecasted percent of sales. Assumes WA-ID combined reaches 15% of sales by 2030/31 and 38% by 2045.
- MDV forecast for commercial assumes WA-ID combined reaches 25% of sales by 2045.
- More aggressive solar forecast with an explicit separation of residential and commercial solar customers.
- Climate change is in the base-line energy and peak forecasts using RCP 4.5.
- Energy and peak adjustments for WA's newly announced restrictions on commercial gas connects.
- Long-term GDP growth is an explicit choice variable after 2026.
- Improved treatment of energy load profiles for climate, solar, EVs, and gas restriction impacts.
- Higher residential customer growth for the 2023-2028 period.

Long-term Energy Forecast: Residential Customer Growth

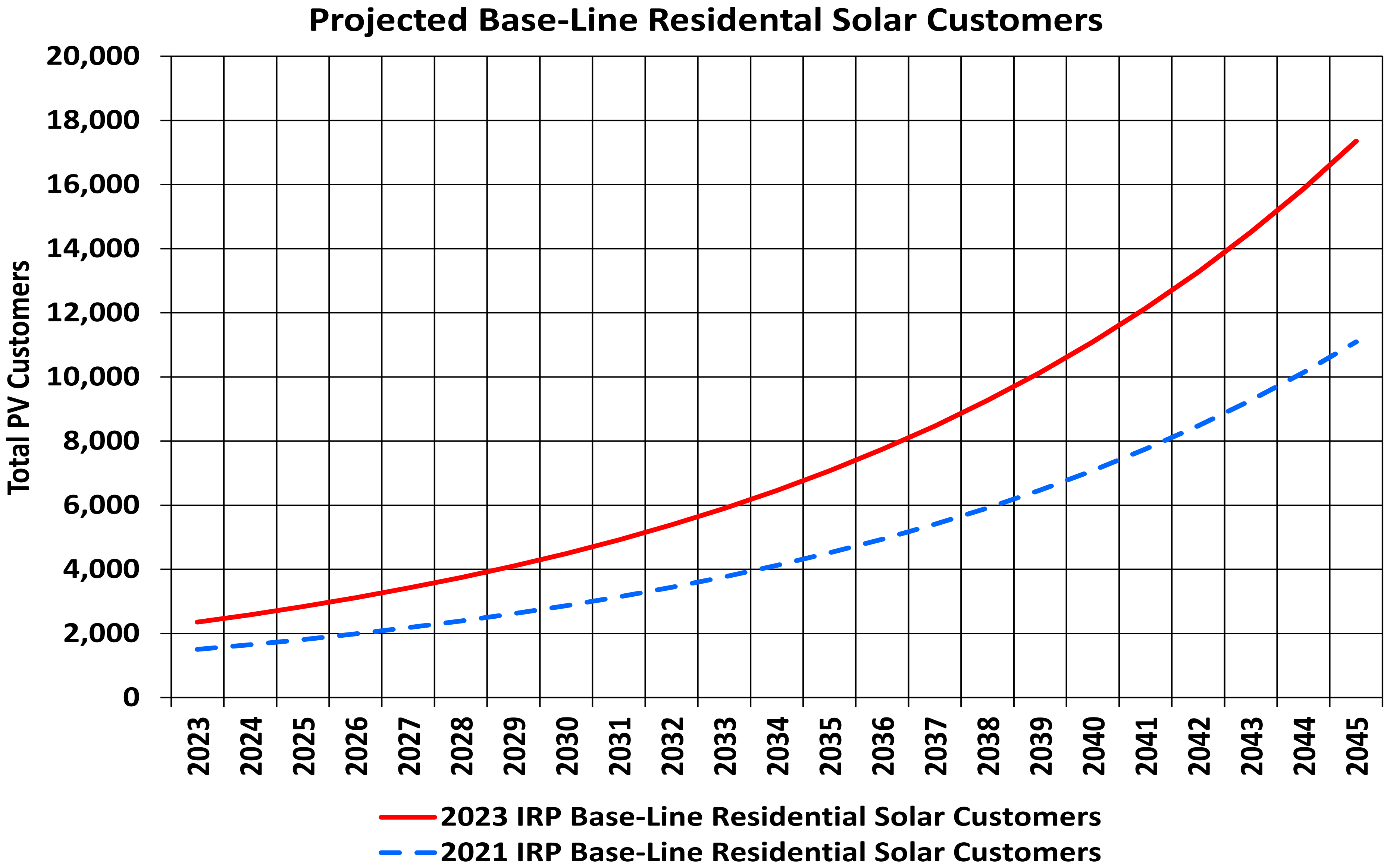


IRP	Avg. Annual Growth
2021 IRP	0.80%
2023 IRP	0.89%
2023 WA	0.69%
2023 ID	1.25%

Comments

- From 2027 on, the time-path reflects IHS population forecasts.
- The higher growth rate in this IRP reflects higher forecasted growth in ID.

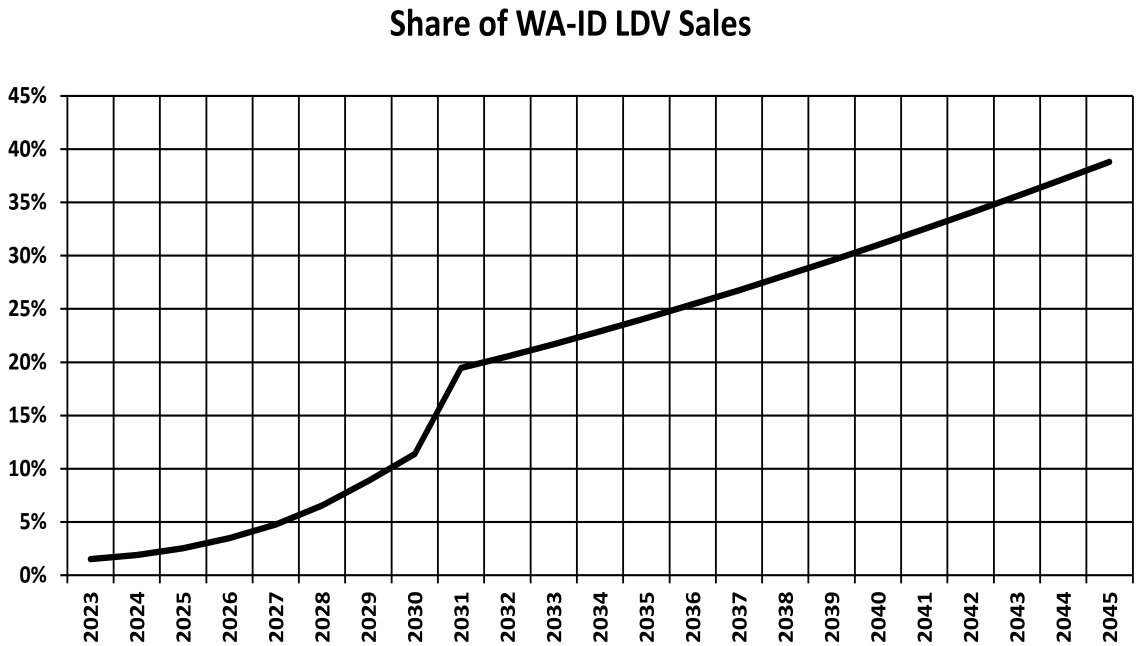
Long-term Energy Forecast: Residential Solar Penetration

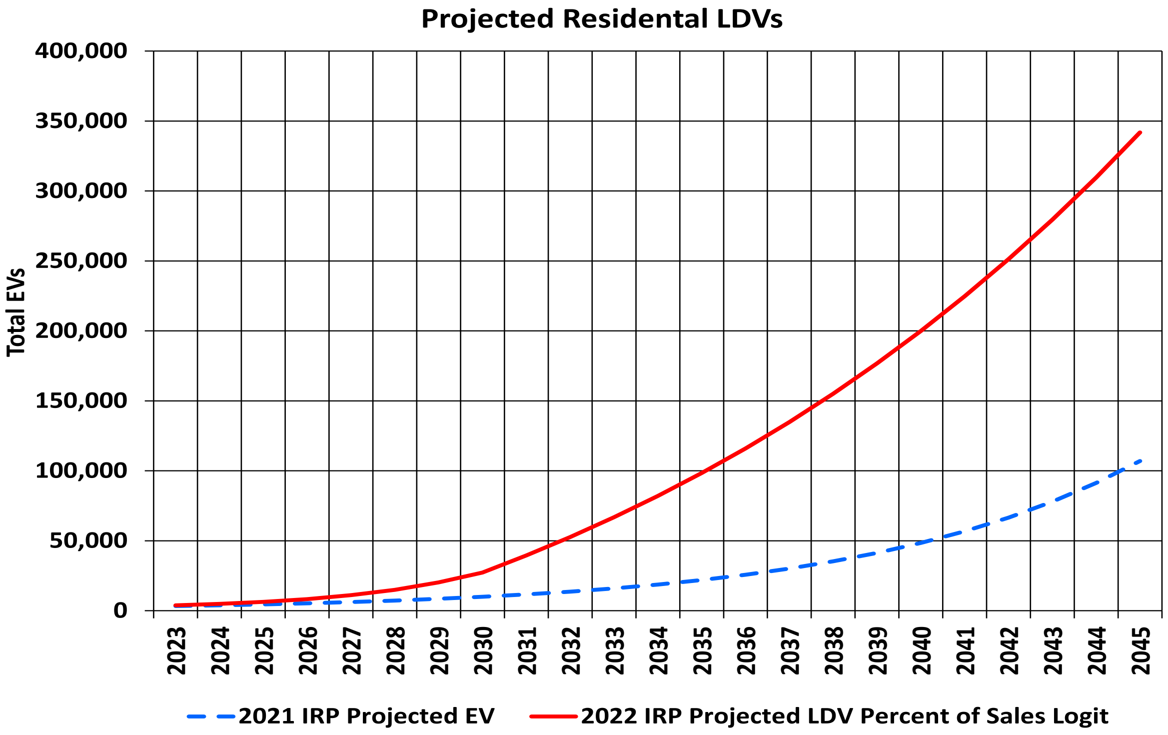


Comments

- Solar penetration now higher than 2021 IRP.
- Current penetration is 0.6% of residential customers. This is projected to grow to 4% by 2045.
- Current system size is around 7,000 watts, with the assumption of 8,900 watts by 2045
- This remains a highly uncertain projection given on-going changes to public policy.

Long-term Energy Forecast: Light Duty EVs, 2023-2045

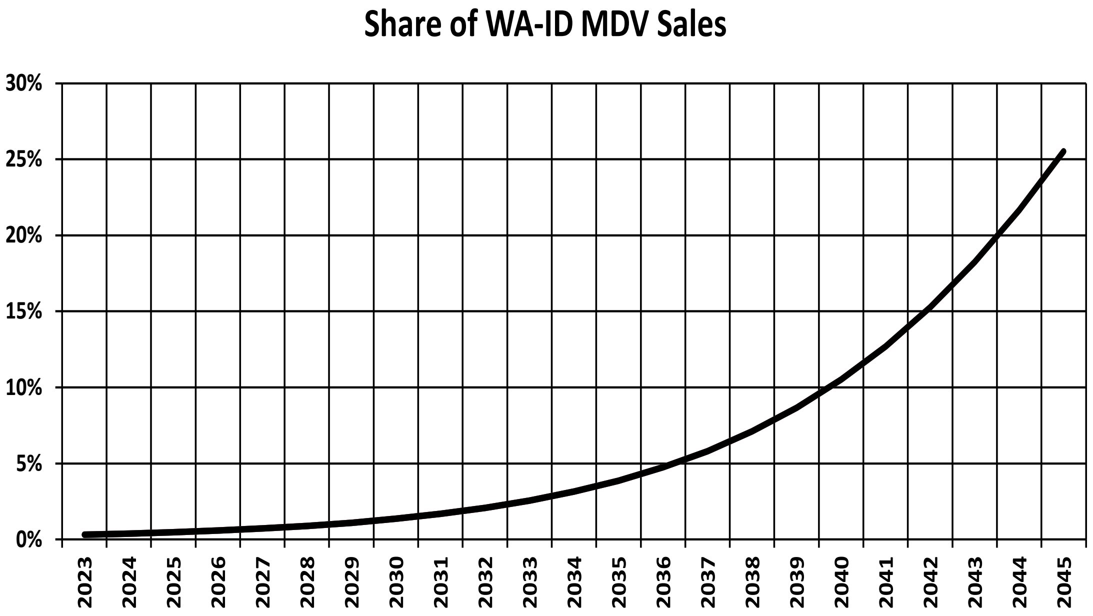


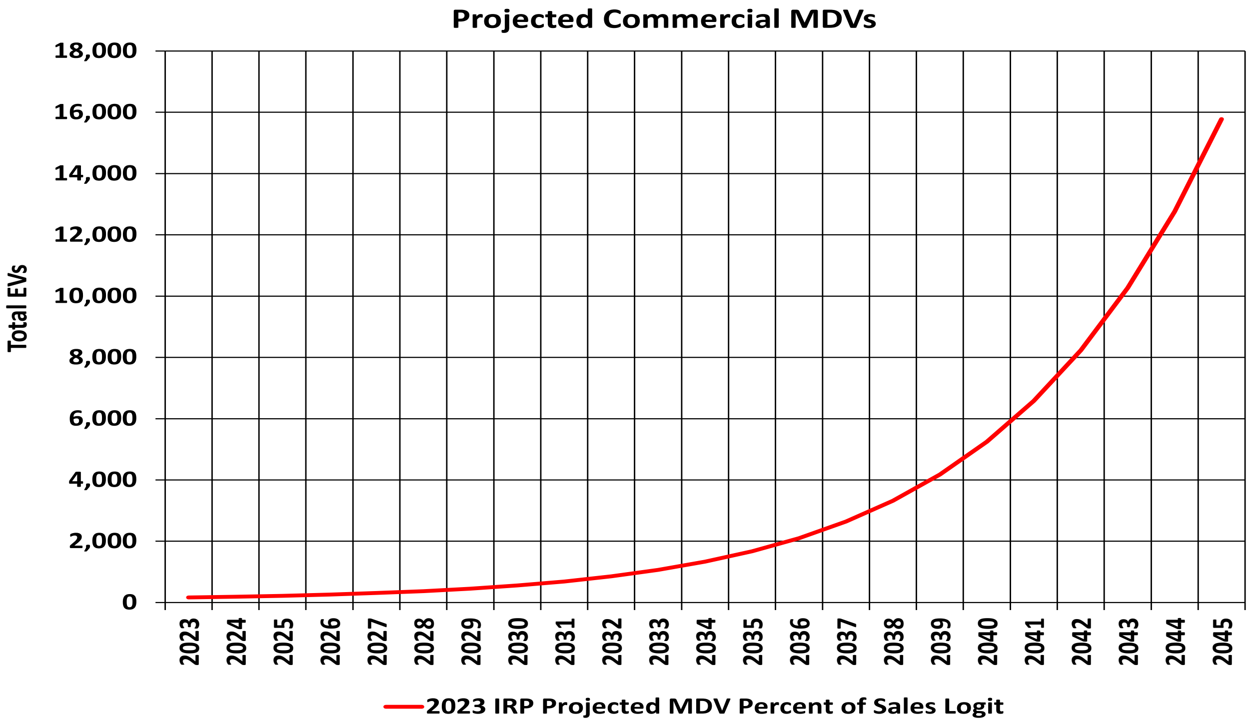


Comments

- **Current light duty EVs are around 3,900. This is projected to grow to 342,000 by 2045—nearly 40% of all LDV sales.**
- **Current penetration is 0.5% of household vehicles. This is projected to grow to 27% by 2045.**
- **This remains a highly uncertain forecast given on-going changes in the EV industry and public policy.**

Long-term Energy Forecast: Medium Duty EVs, 2023-2045

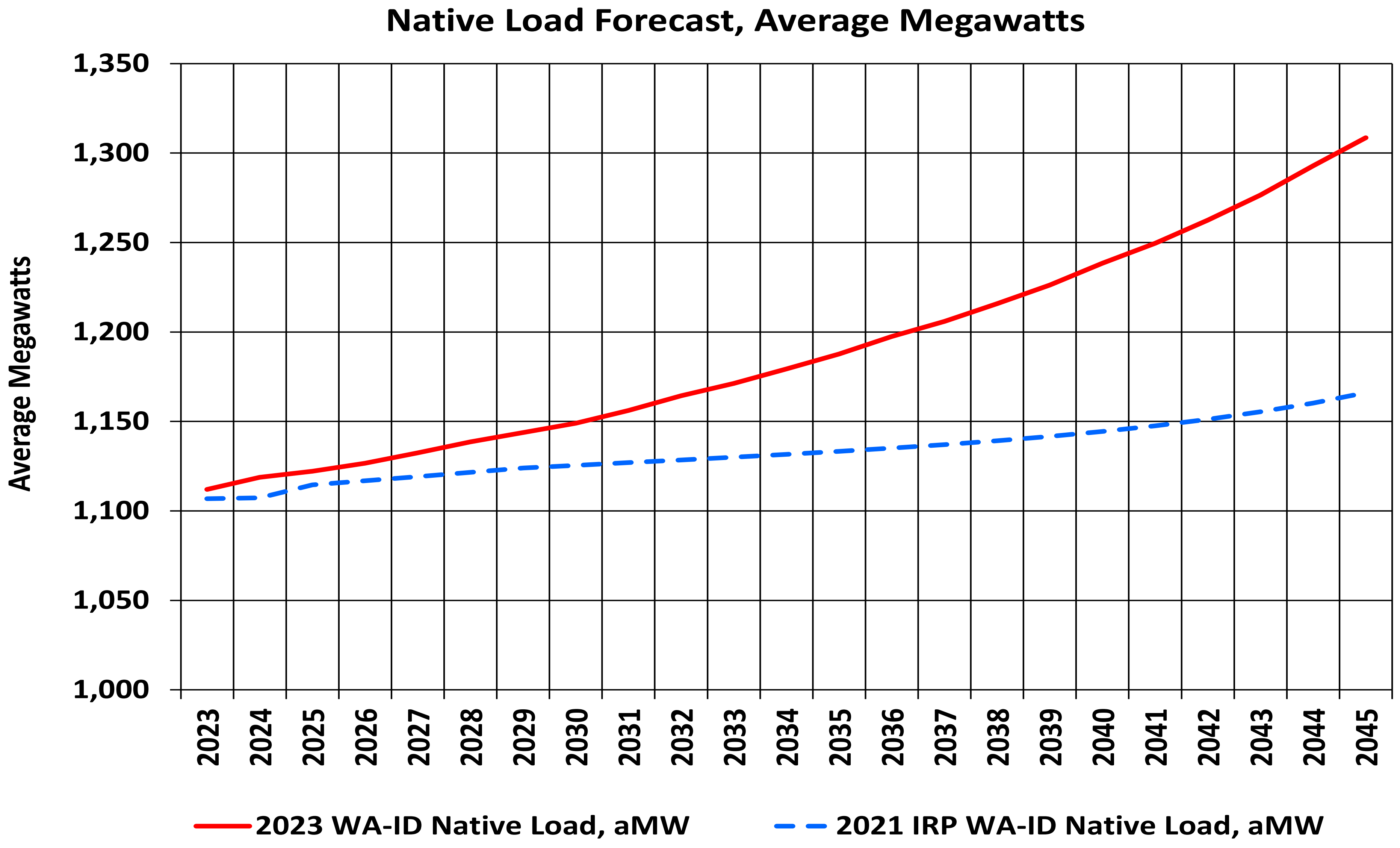




Comments

- **Current medium EVs are approximately 170 (very rough estimate). This is projected to grow to over 15,000 by 2045—just over 25% of all MDV sales.**
- **Current penetration is 0.25% of all commercial vehicles (very rough estimate). This is projected to grow to 13% by 2045.**
- **Even more so than LDV, the MDV forecast is highly uncertain given on-going changes in the EV industry and public policy.**

Long-term Energy Forecast: Native Load

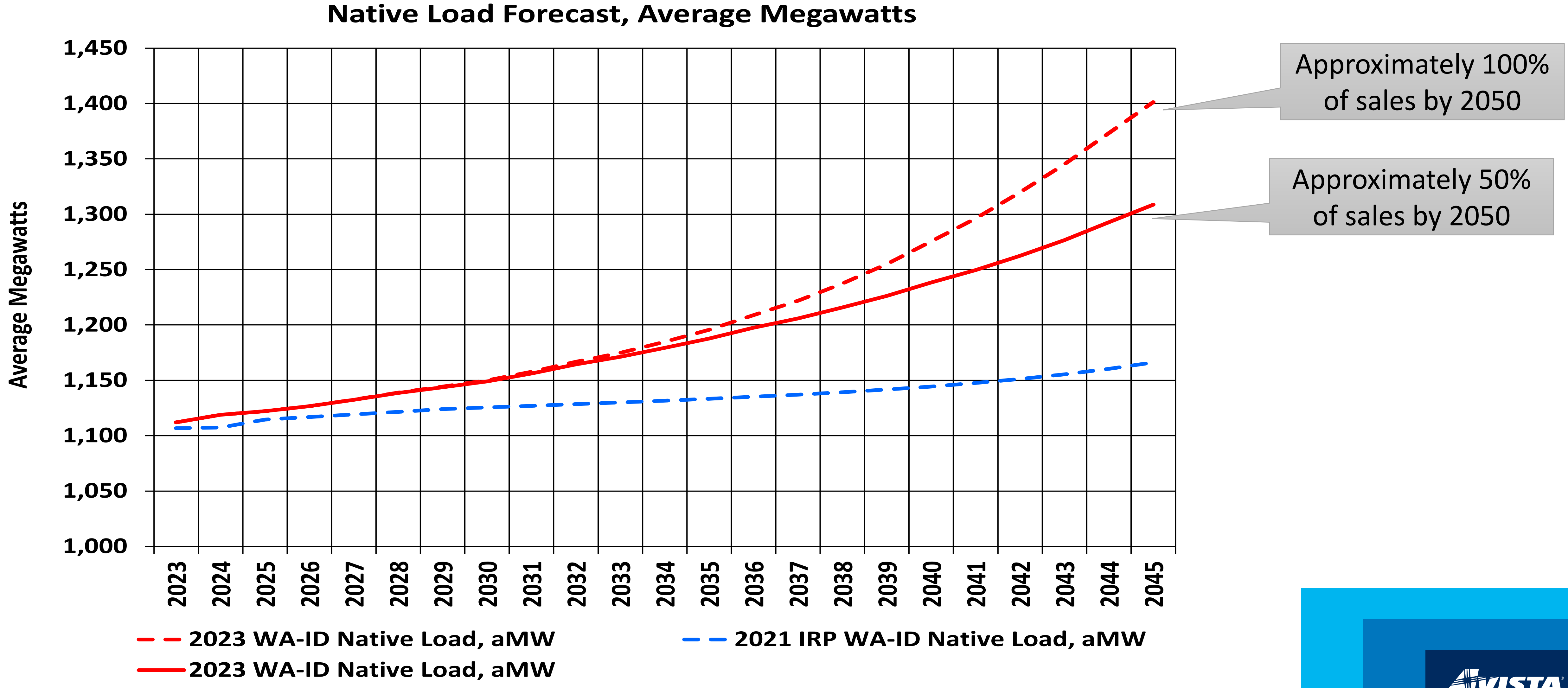


IRP	Avg. Annual Growth
2021 IRP	0.24%
2023 IRP	0.74%
2023 WA	0.72%
2023 ID	0.77%

Comments

- Higher load because of stronger customer growth, a lot more EVs, and adjustments for gas.
- Most of the change reflects EVs

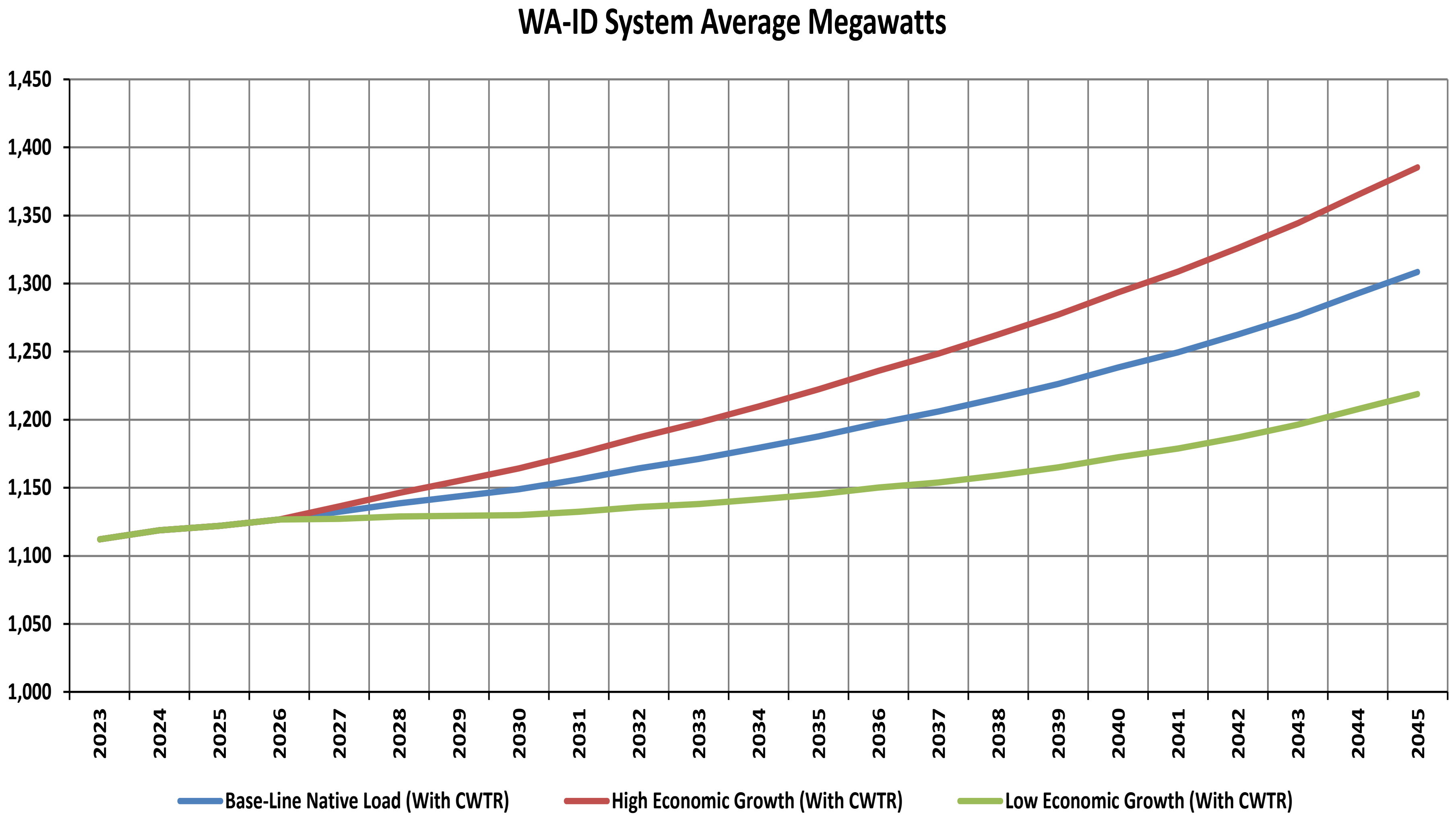
Long-term Energy Forecast: Native Load with MDV EVs



Approximately 100% of sales by 2050

Approximately 50% of sales by 2050

Long-term Energy Forecast: High-Low Based on Economics

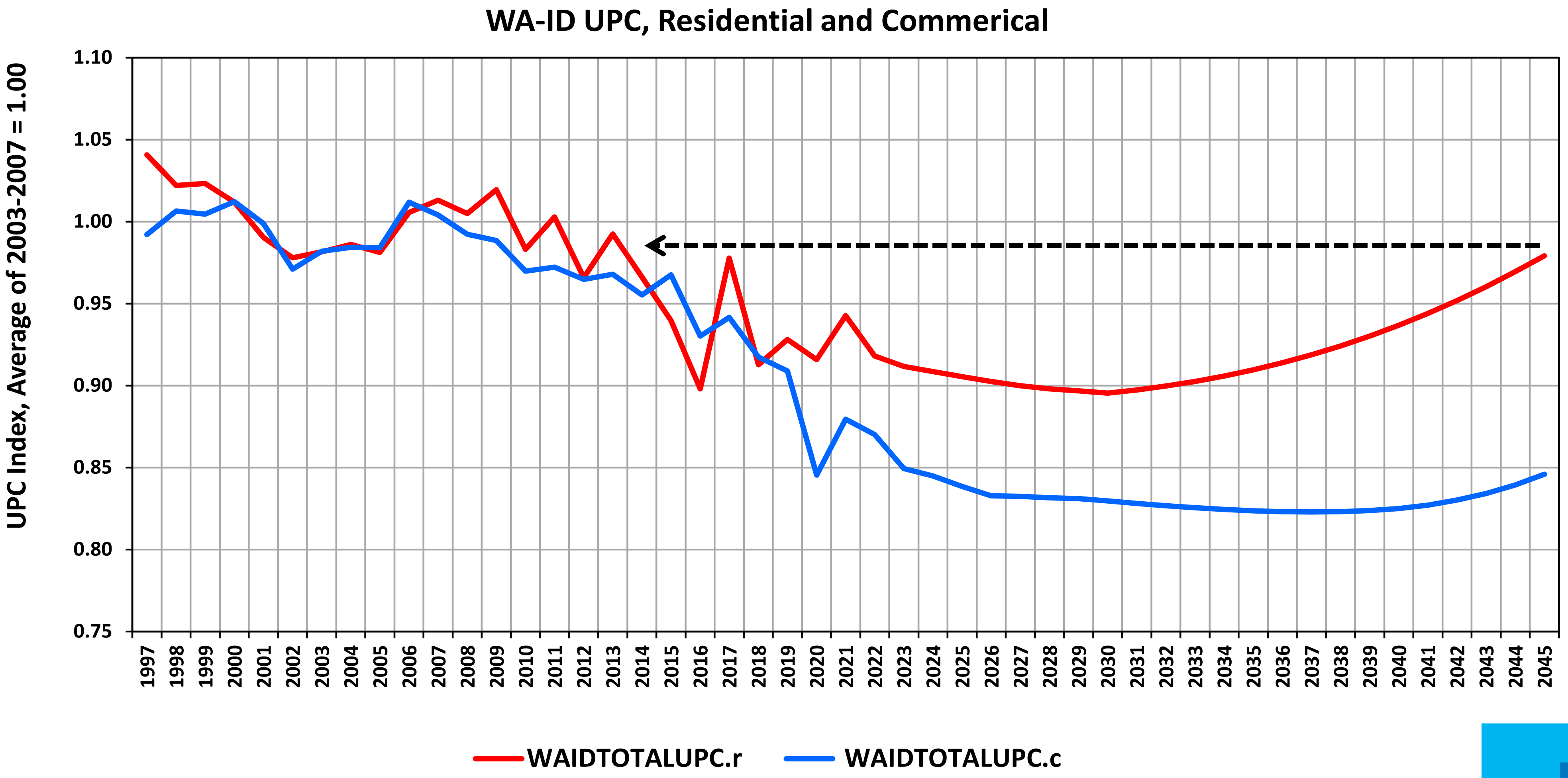


Variable	Base-Line	High	Low
GDP Growth	1.80%	2.40%	1.20%
WA Avg. Annual Res. Cus. Growth	0.69%	0.83%	0.47%
ID Avg. Annual Res. Cus. Growth	1.25%	1.55%	0.86%
WA-ID Avg. Annual Res. Cus. Growth	0.89%	1.09%	0.61%

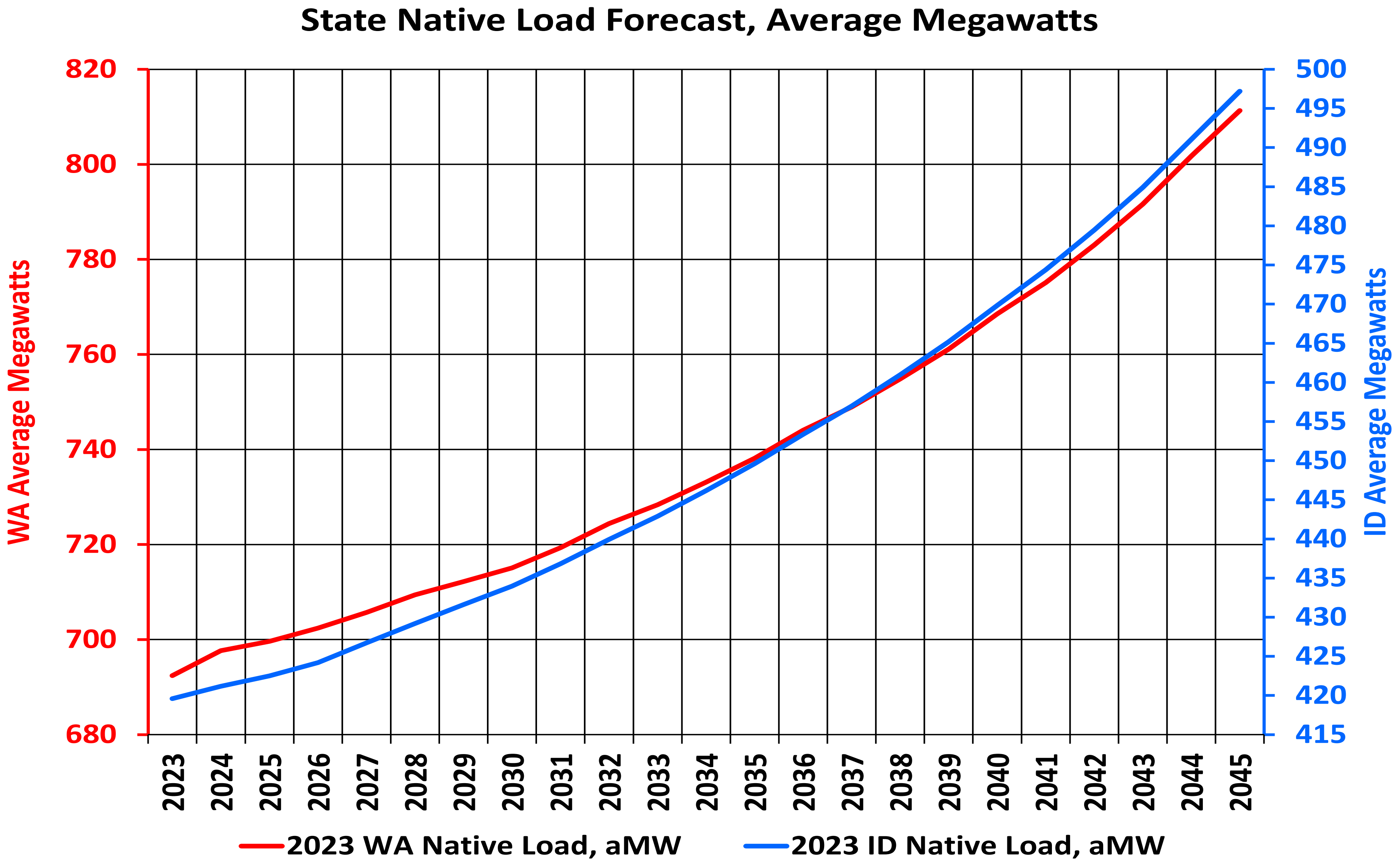
Comments

- **Base-line GDP growth is the Fed's estimate.**
- **Historically, the stronger U.S. growth, the stronger population growth to our service areas.**

Long-term Energy Forecast: UPC Trends

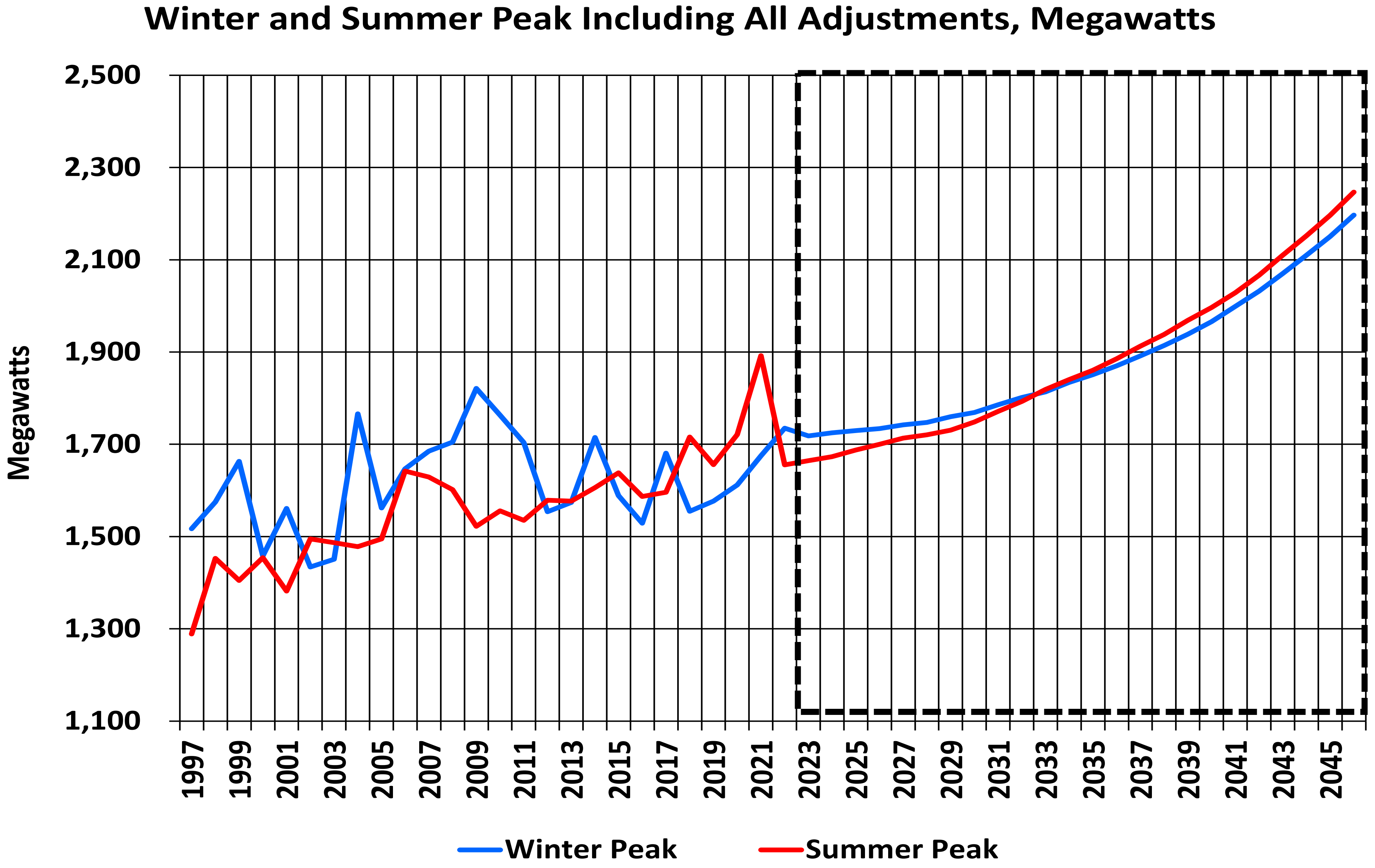


Long-term Energy Forecast: State Native Load



IRP	Avg. Annual Growth
2023 IRP	0.74%
2023 WA	0.72%
2023 ID	0.77%

Peak Load Forecast: Winter and Summer Forecast

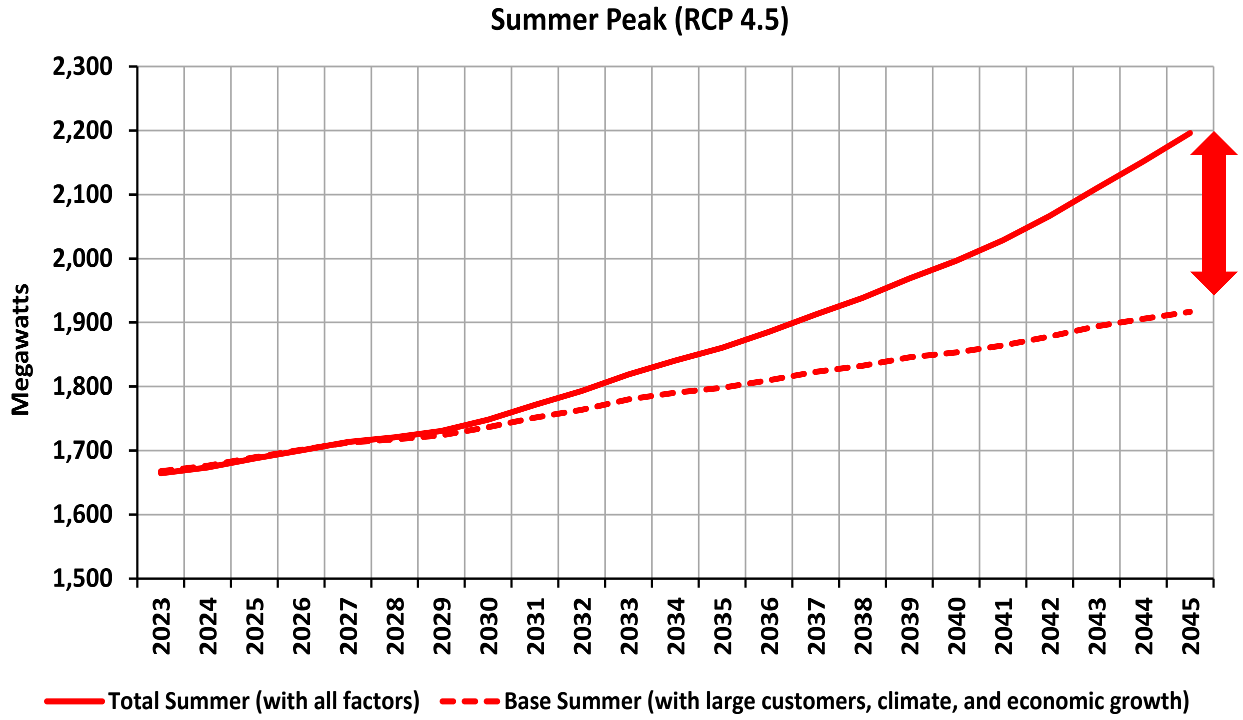


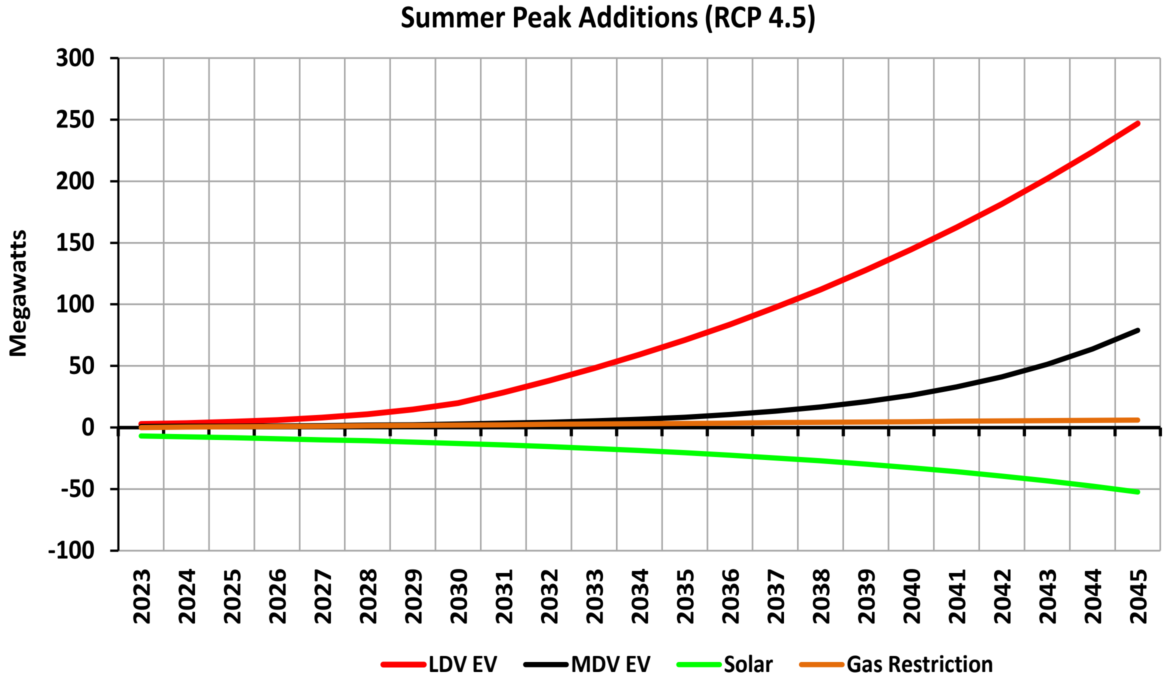
Peak	Avg. Growth 2023-45
Winter	1.02%
Summer	1.25%

Comments

- Reflects RCP 4.5.
- Over the forecast horizon, winter and summer peaks will be closer than previous IRPs. This largely reflects the impact of EVs and gas restrictions.

Peak Load Forecast: Change in IRP Summer Peak

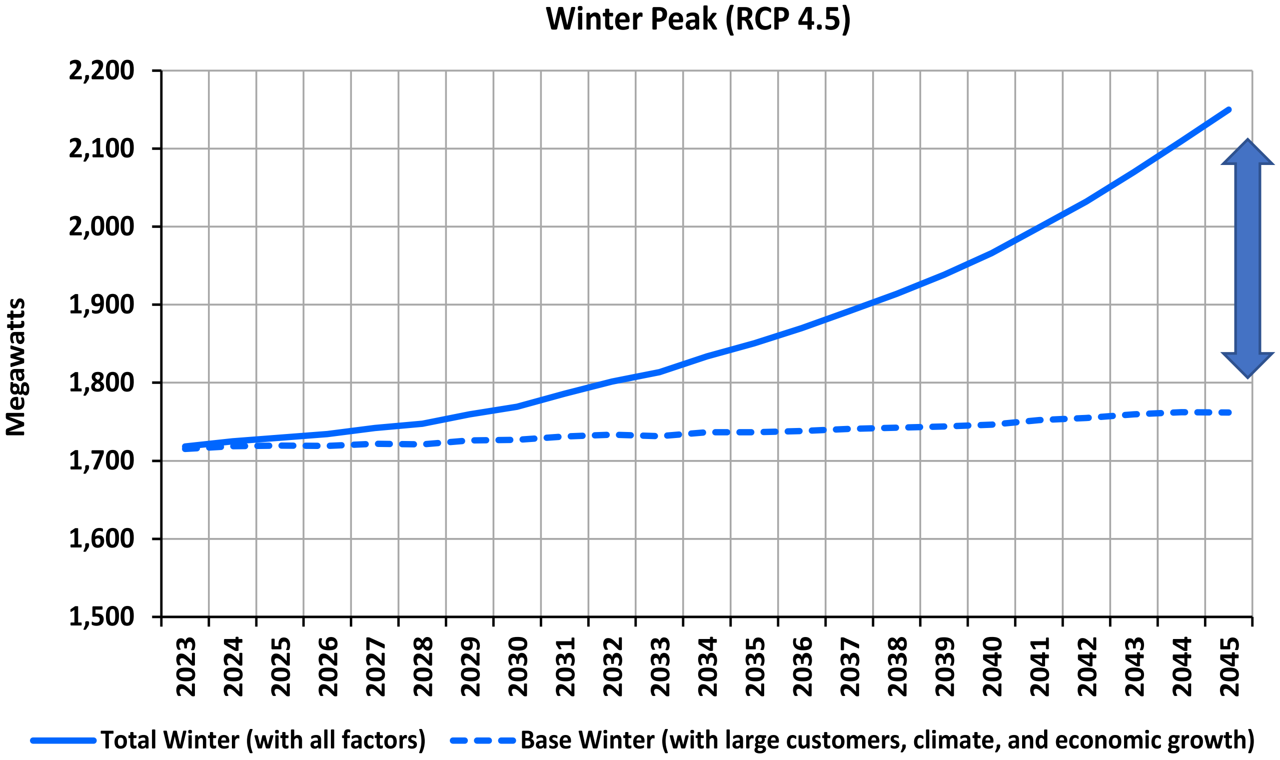


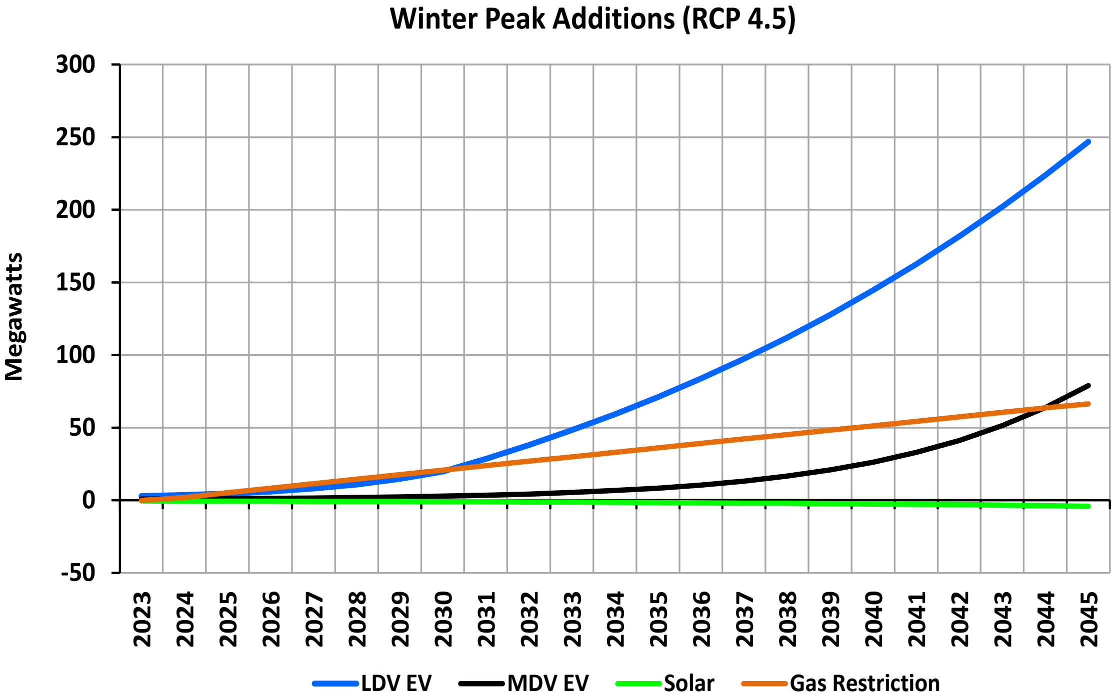


Comments

- **Economic growth and climate impacts are being dominated by EV additions.**
- **By 2045, 117% of additions over the base summer peak are from EVs (both LDVs and MDVs). The 117% reflects a significant negative impact from solar by 2045.**
- **Gas restriction impacts are modest and solar is not significant late 2030s.**

Peak Load Forecast: Change in IRP Winter Peak

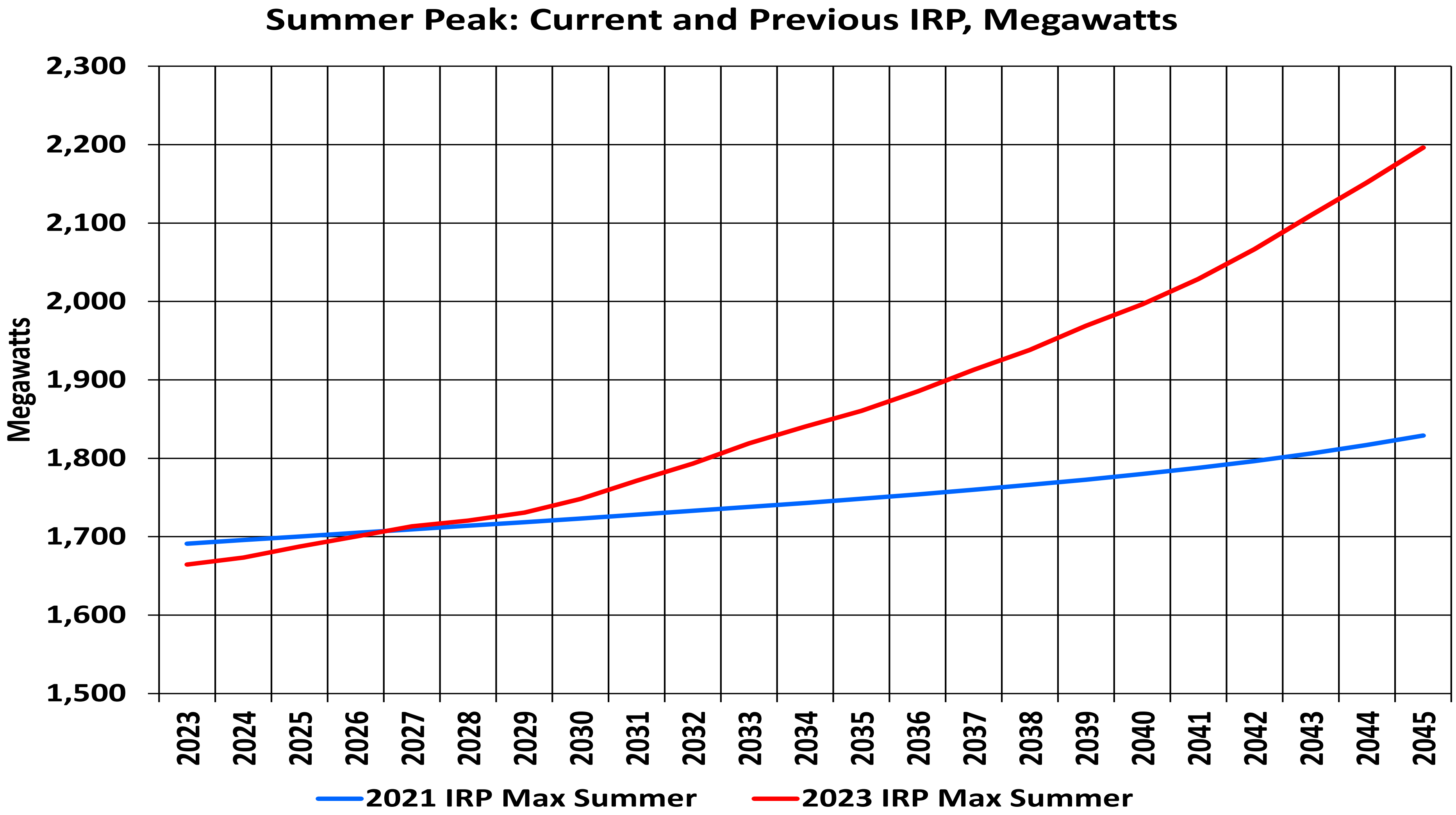




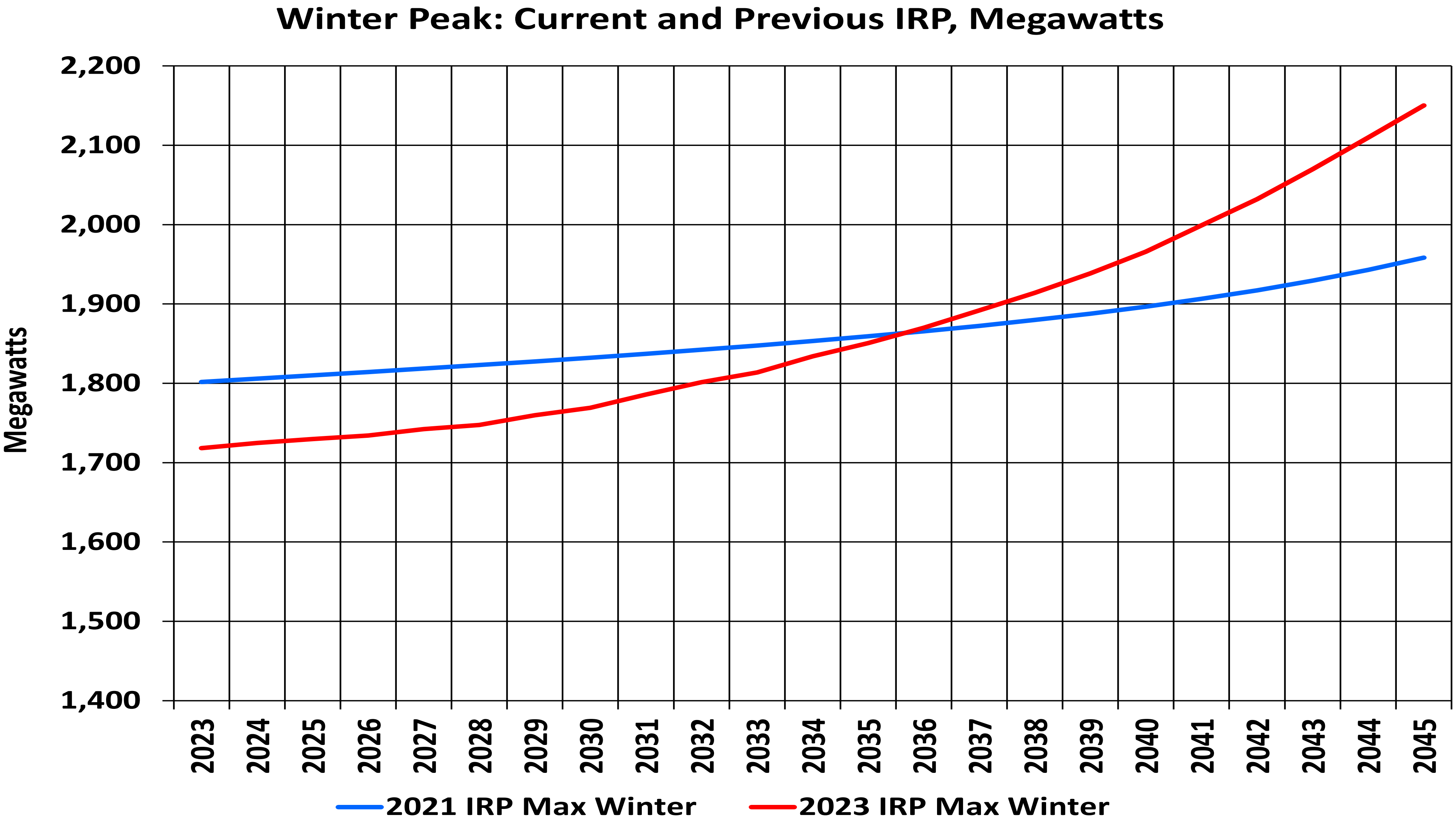
Comments

- **Economic growth and climate impacts are being dominated by EV additions.**
- **By 2045, 84% of additions over the base winter peak are from EVs (both LDVs and MDVs).**
- **Gas restriction impacts are significant by early 2030s, and solar is never significant.**

Peak Load Forecast: Change in IRP Summer Peak



Peak Load Forecast: Change in IRP Winter Peak



Questions?

Loads & Resources Update

2023 Avista Electric IRP

TAC 7 – October 11, 2022

Lori Hermanson, Senior Power Supply Analyst

Major L&R Changes Since 2021 IRP

- Load forecast
- Incorporates climate change impacts – hydro & loads
- Used WRAP QCCs for peak capacity contributions
- 30 MW industrial demand response (Washington Rate Case Settlement)
- Chelan County PUD purchase
- Assumed retirement dates for Colstrip (2025), Northeast (2035), Boulder Park and Kettle Falls CT (2040)
- Additional RFP resources - not included

Peak Planning Assumptions

- Peak load forecast
- Planning reserve margins
  - Winter – 22%
  - Summer – 13%
- Regulation – 16 MW
- Operating reserves for borderline contracts – average 16 MW (varies by month)
- Use WRAP's Qualifying Capacity Credits (QCC) for generation and demand response resources
  - Not incorporating the WRAP's planning reserve margins, but will share the impacts of these PRMs (slide 7)

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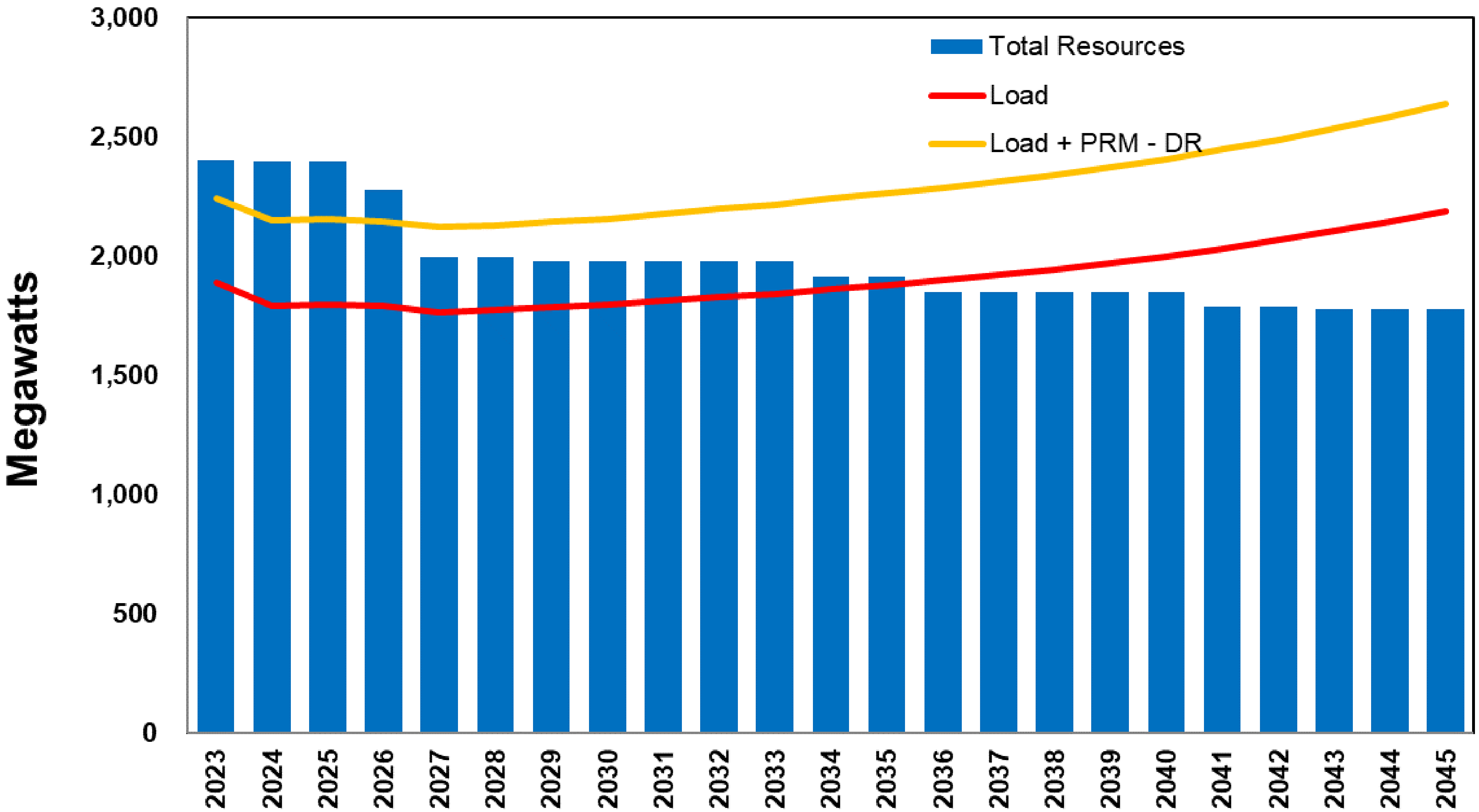
Winter Peak Load & Resource Balance



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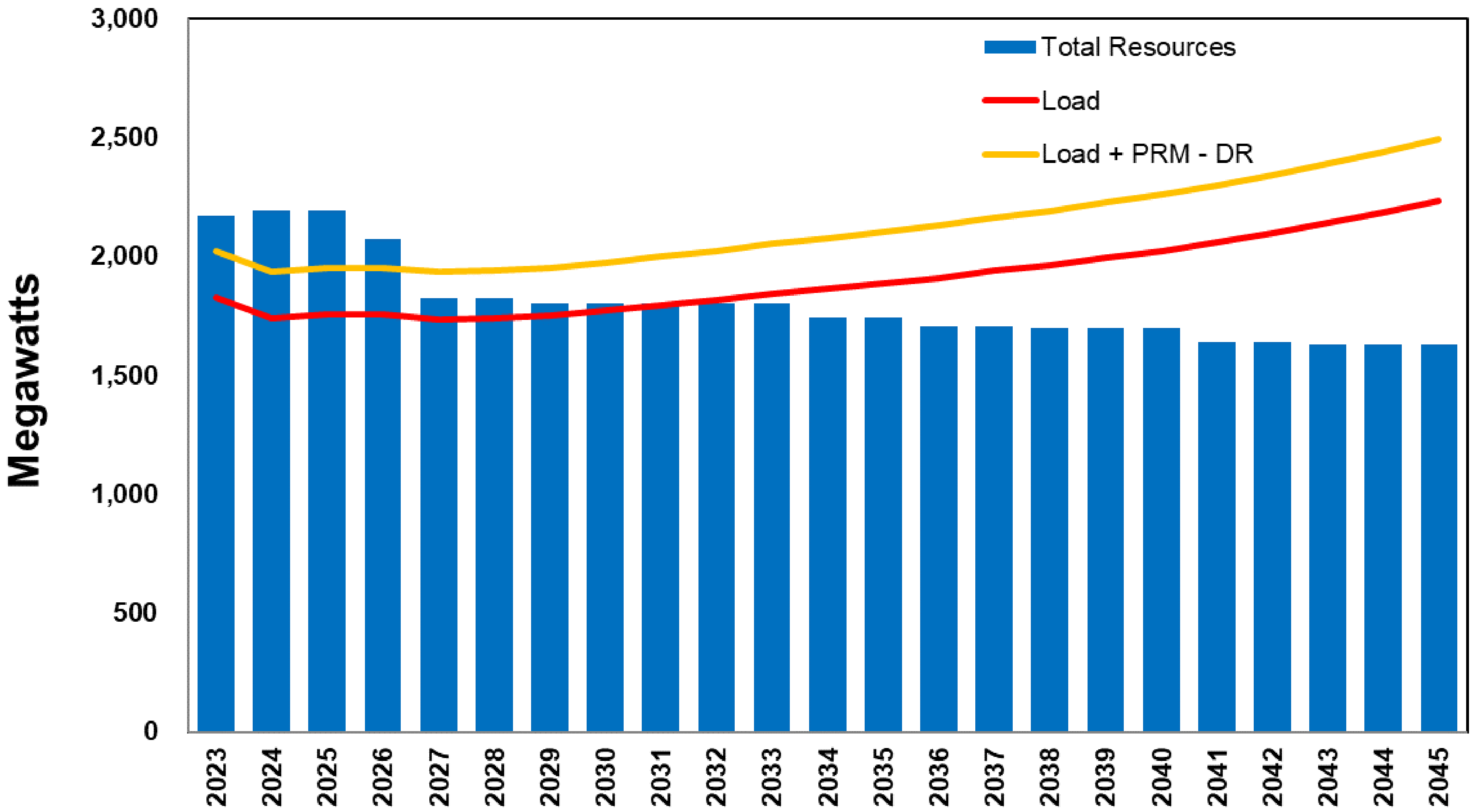
Summer Peak Load & Resource Balance



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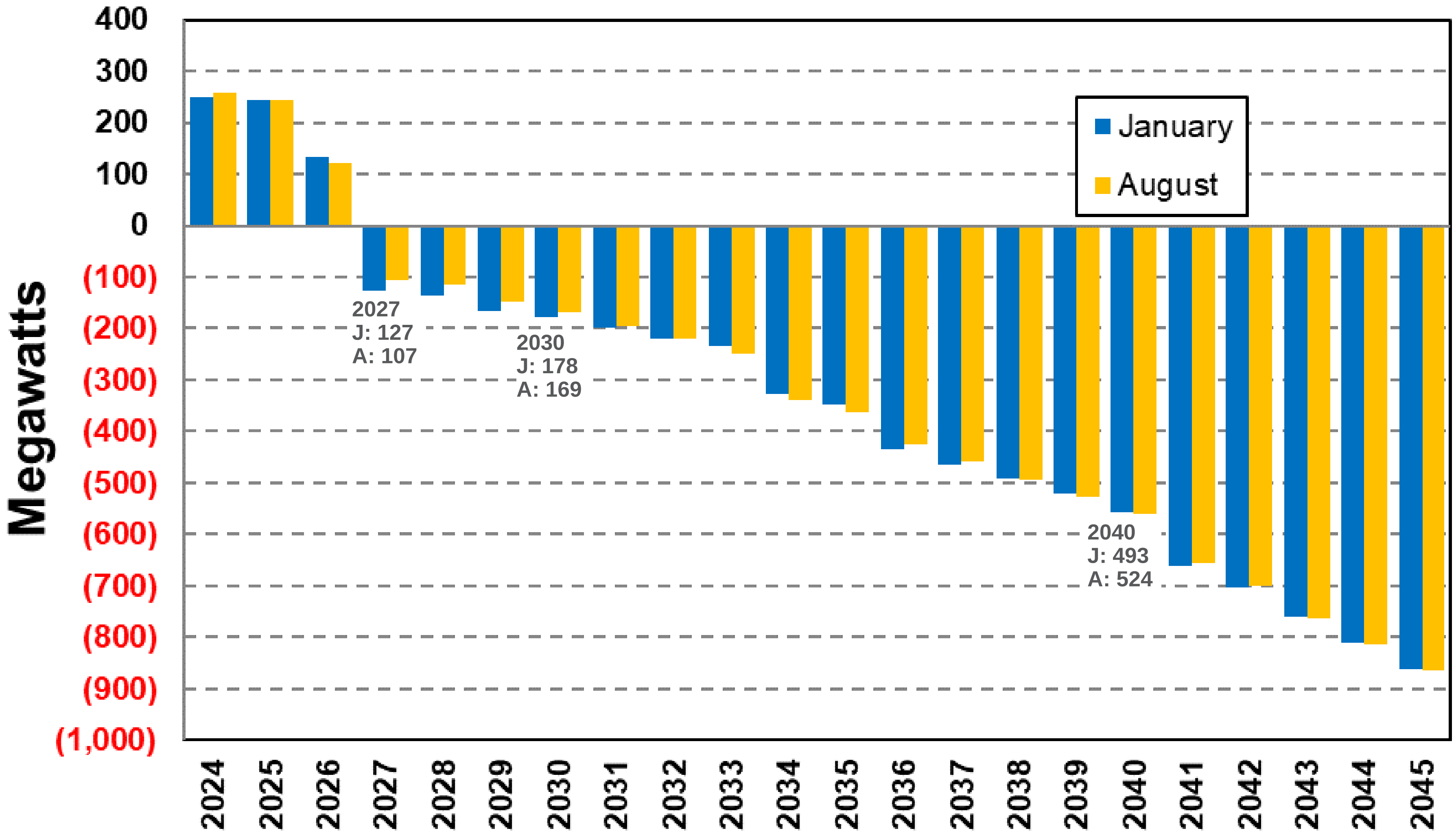
System Peak Capacity Position

Using historical peak planning criteria



2027
J: 127
A: 107

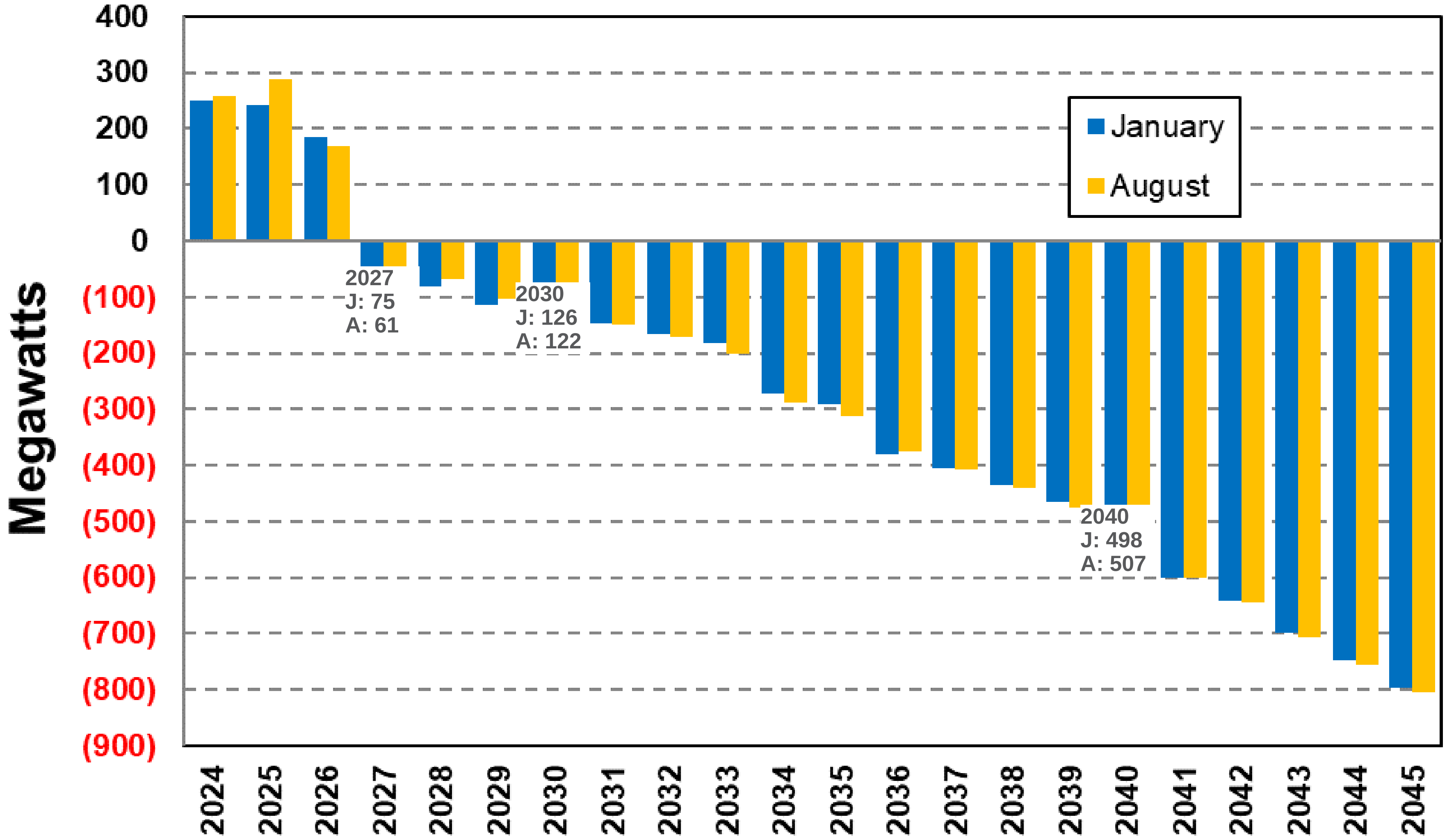
2030
J: 178
A: 169

2040
J: 493
A: 524

Seasonal winter/summer peak not included at this time, short position begins in Dec 1, 2026

System Capacity Position

Using Western Resource Adequacy Program Planning Reserve Margins



Seasonal winter/summer peak not included at this time, short position begins in Jan 1, 2027

Energy Planning

- Expected energy load forecast

- Production capability generation forecast
  - Normal weather conditions
  - Machine hour limits
  - Maintenance and forced outages

- Incorporates climate change impacts – hydro & loads

- Includes contingency for changes in load and variable generations

Energy Contingency

- Difference between average generation and load conditions with extreme conditions.

- Previous IRP
  - Difference between 90th percentile of load and average load + difference between 10th percentile of hydro generation and average generation

- 2023 IRP
  - Developed a dataset of load and renewables generation (varying hydro, wind and solar) for the period 1948-2019
  - Used average minus 95th percentile of the net of load minus renewable generation

Energy Contingency for Load and Renewable Variability 2023 (aMW)

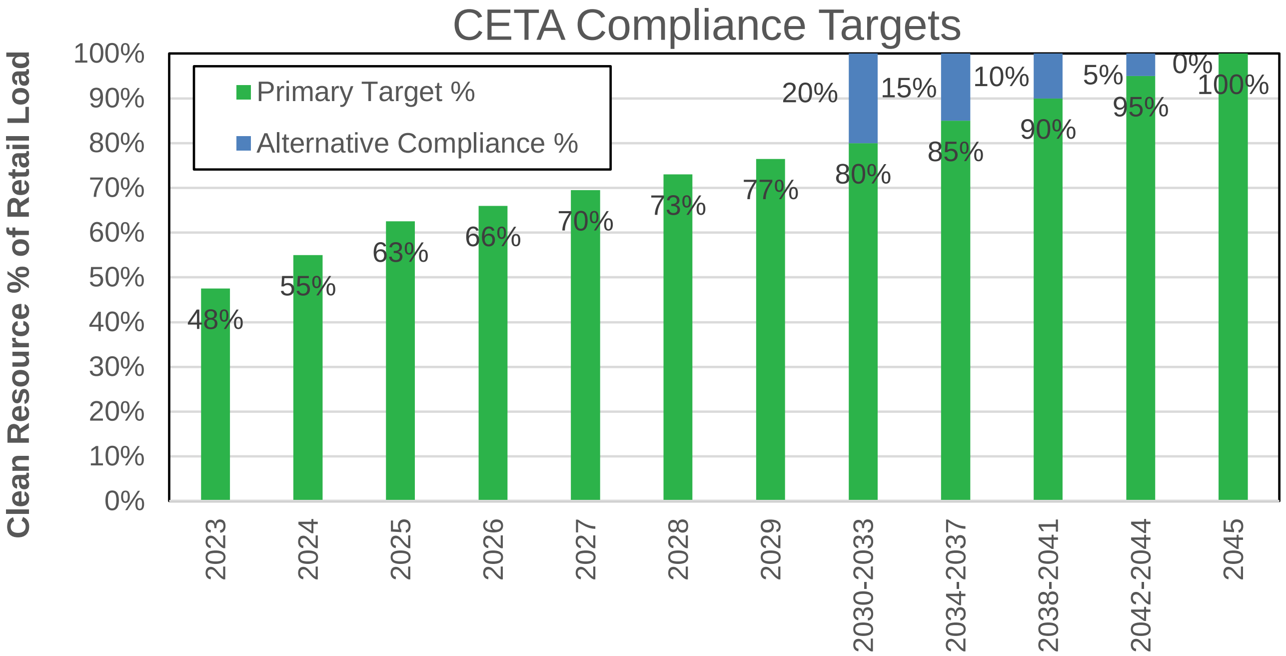
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Avg
Previous IRP	209	240	244	227	196	291	307	171	118	117	168	175	205
2023 IRP	227	216	211	253	186	320	306	170	118	120	170	125	202
Change	18	-24	-33	26	-10	29	-1	-1	0	3	2	-50	-3

System Planning Energy Position – Monthly (aMW)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2024	204	185	347	429	422	485	292	176	276	290	259	292
2025	212	207	360	375	507	590	298	175	275	286	259	293
2026	91	59	208	332	355	397	126	28	113	131	(130)	(120)
2027	(197)	(204)	(53)	149	296	299	(117)	(215)	(137)	(119)	(149)	(141)
2028	(203)	(221)	(57)	123	288	286	(139)	(229)	(140)	(131)	(163)	(159)
2029	(202)	(204)	(39)	138	334	273	(150)	(249)	(151)	(132)	(164)	(151)
2030	(204)	(208)	(30)	136	220	267	(158)	(259)	(158)	(133)	(169)	(158)
2031	(211)	(208)	(22)	123	291	268	(150)	(261)	(154)	(136)	(176)	(163)
2032	(203)	(218)	(22)	118	307	271	(146)	(262)	(156)	(139)	(181)	(167)
2033	(209)	(211)	(22)	126	359	260	(157)	(272)	(156)	(145)	(179)	(170)

Proposed CETA Compliance Methodology

- CEIP outlines 2023-2025 clean energy targets
- 2026-2029 target continue trend to 2030
- “Use” rules for CETA compliance not complete
  - If clean generation exceeds monthly “net” retail sales, it qualifies as alterative compliance after 2030
  - Renewable energy can be sourced from allocated Washington share or purchased from Idaho customers (wind/new PPA hydro)
  - Assumes Idaho allocated hydro available after 2030 for alternative compliance



Production/Load risk still needs to be accounted for with compliance windows

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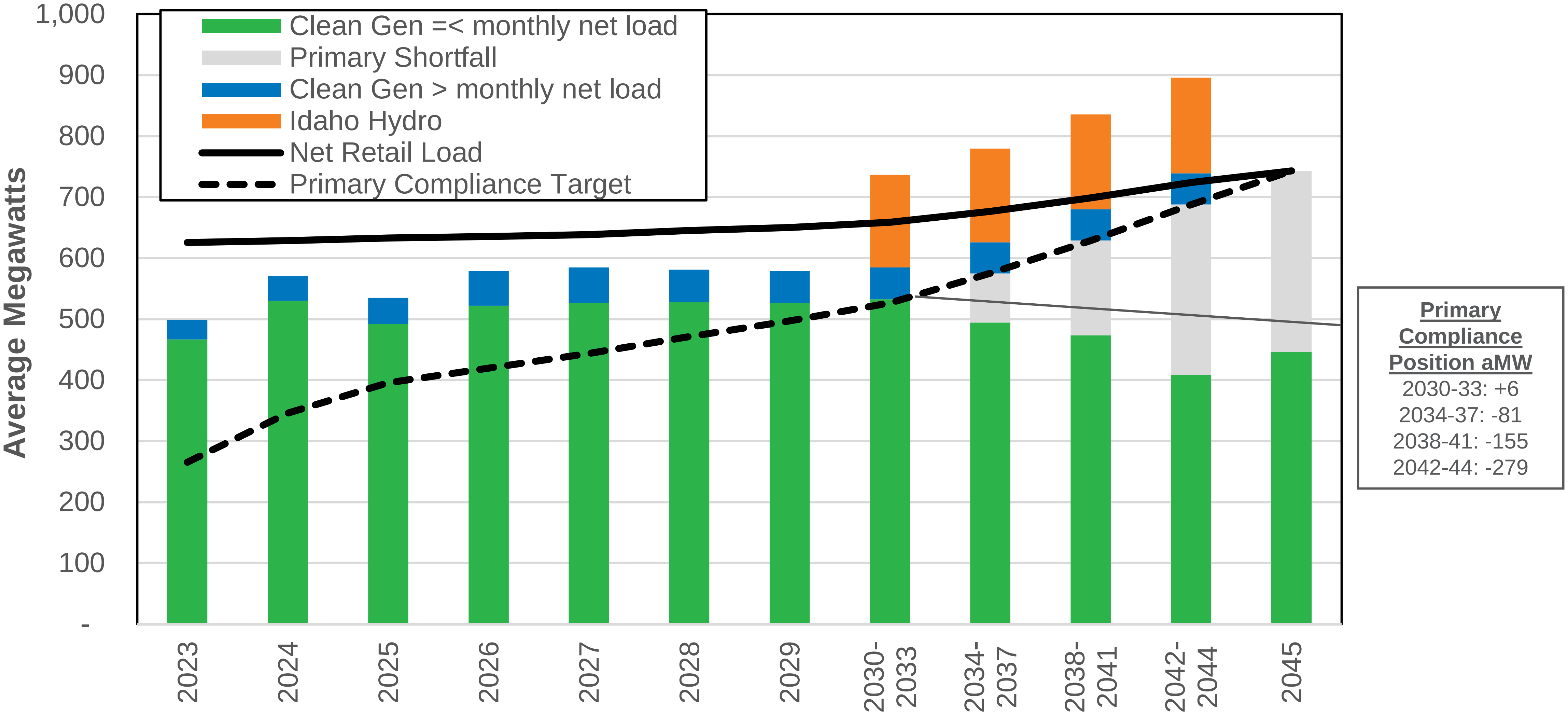
Washington Clean Energy Position



Primary Compliance Position aMW

2030-33: +6
2034-37: -81
2038-41: -155
2042-44: -279

AVISTA

Natural Gas Market Dynamics and Prices

Michael Brutocao

Tom Pardee

DRAFT

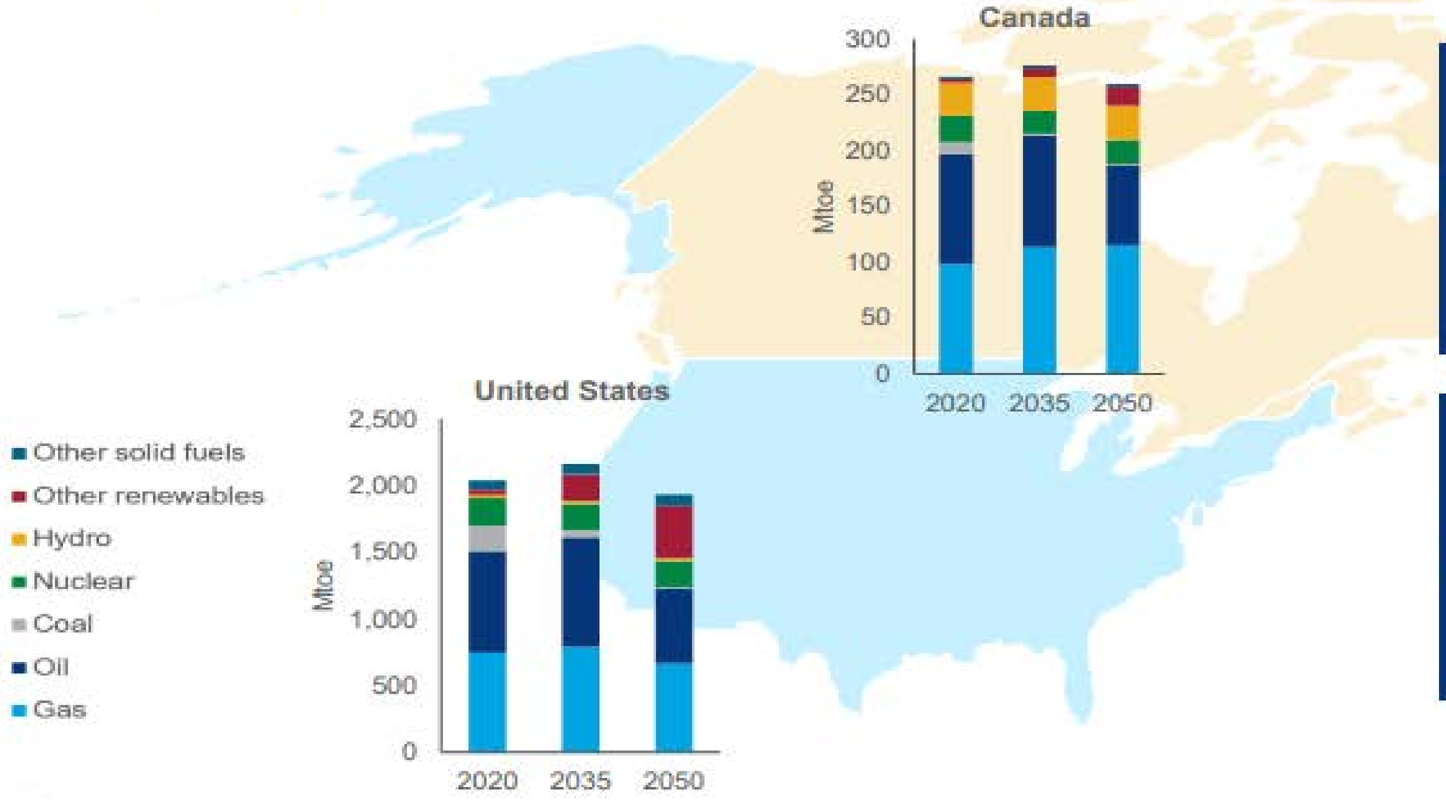
Wood Mackenzie – Legal Disclaimer

The foregoing [chart/graph/table/information] was obtained from the North America Gas Service™, a product of Wood Mackenzie.” Any Information disclosed pursuant to this agreement shall further include the following disclaimer: "The data and information provided by Wood Mackenzie should not be interpreted as advice and you should not rely on it for any purpose. You may not copy or use this data and information except as expressly permitted by Wood Mackenzie in writing. To the fullest extent permitted by law, Wood Mackenzie accepts no responsibility for your use of this data and information except as specified in a written agreement you have entered into with Wood Mackenzie for the provision of such of such data and information."

Natural gas remains strategically important in North America as it represents at least a third of total energy demand over the next 30 years

The pace of energy transition threatens gas demand growth as fossil fuel demand wanes in the long term

Primary energy demand mix in North America



Canada

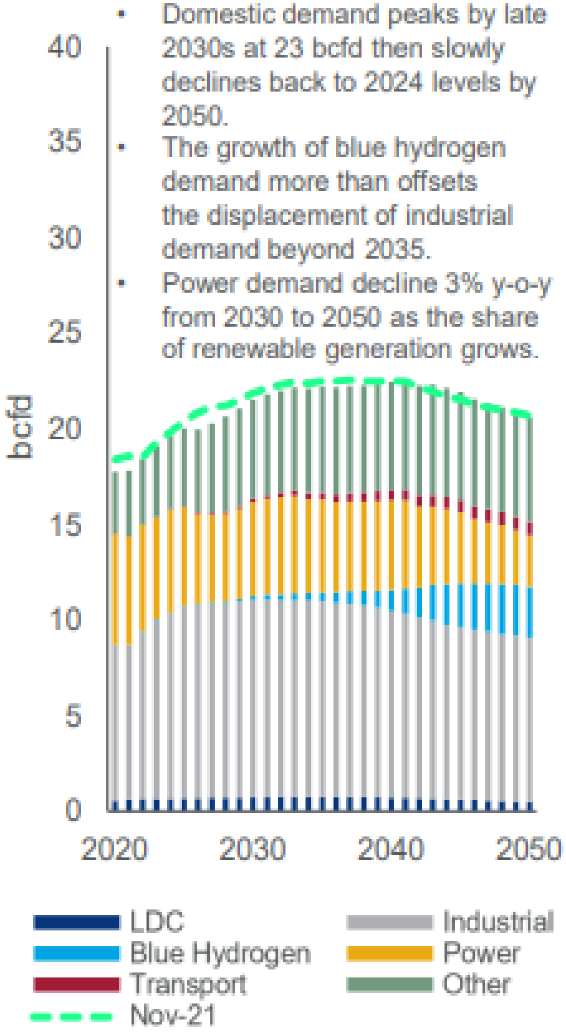
- Domestic gas demand is expected to grow mainly due to rising blue hydrogen demand as local and federal governments support the development of CCS industry.
- The oil sands sector could drive incremental industrial demand growth but the future role of oil in the energy mix limits market potential beyond 2035.
- Rising renewable penetration will impact gas demand in the power sector post 2040 but the impact of displacement is less severe than the US due to renewable resource potential.

United States

- Gas continues to play a vital role in the United States even as the economy announces emissions reduction targets for 2030
- Industrial demand and other demand lead growth in the mid-term to 2035 while blue hydrogen demand reaches 1 bcfd by 2030 and accelerates to the end of our outlook
- Post 2024, power demand falls due to higher renewable penetration, resulting from policies that support low-carbon generation

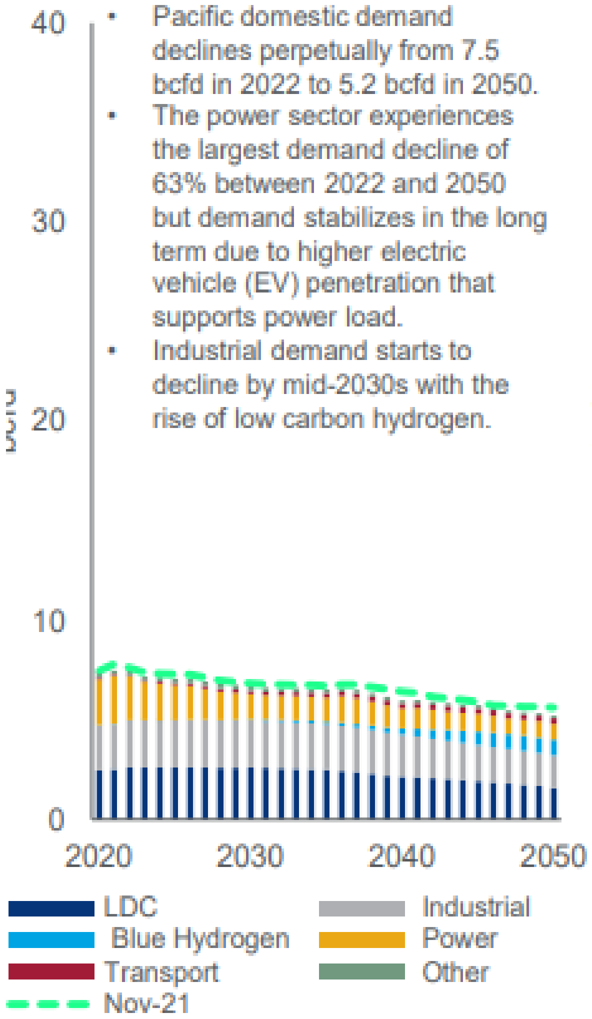
US regional demand: the Gulf Coast stands out as domestic demand increases despite peaking in late 2030s

Gulf Coast



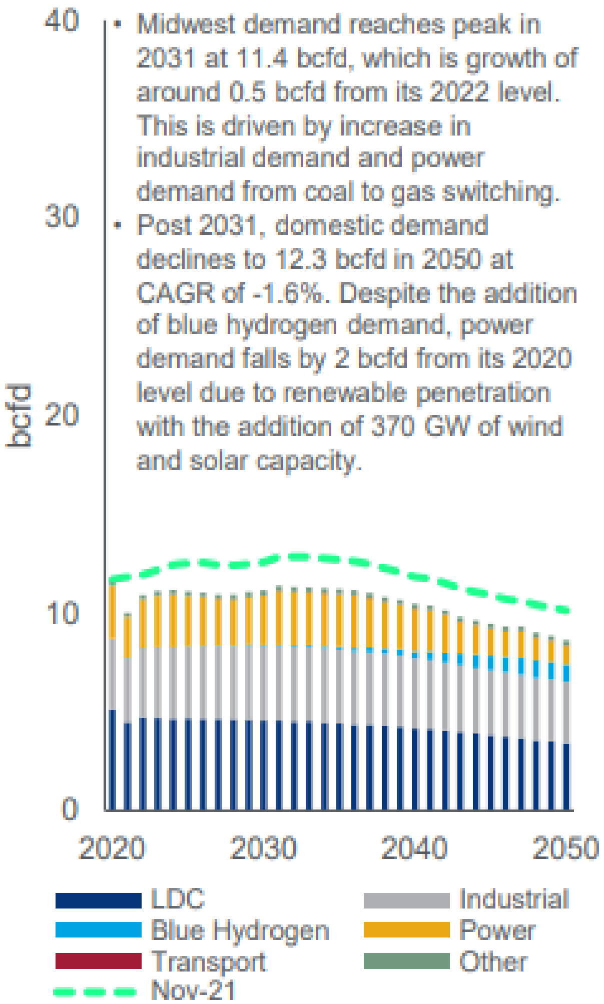
- Domestic demand peaks by late 2030s at 23 bcfd then slowly declines back to 2024 levels by 2050.
- The growth of blue hydrogen demand more than offsets the displacement of industrial demand beyond 2035.
- Power demand decline 3% y-o-y from 2030 to 2050 as the share of renewable generation grows.

Pacific



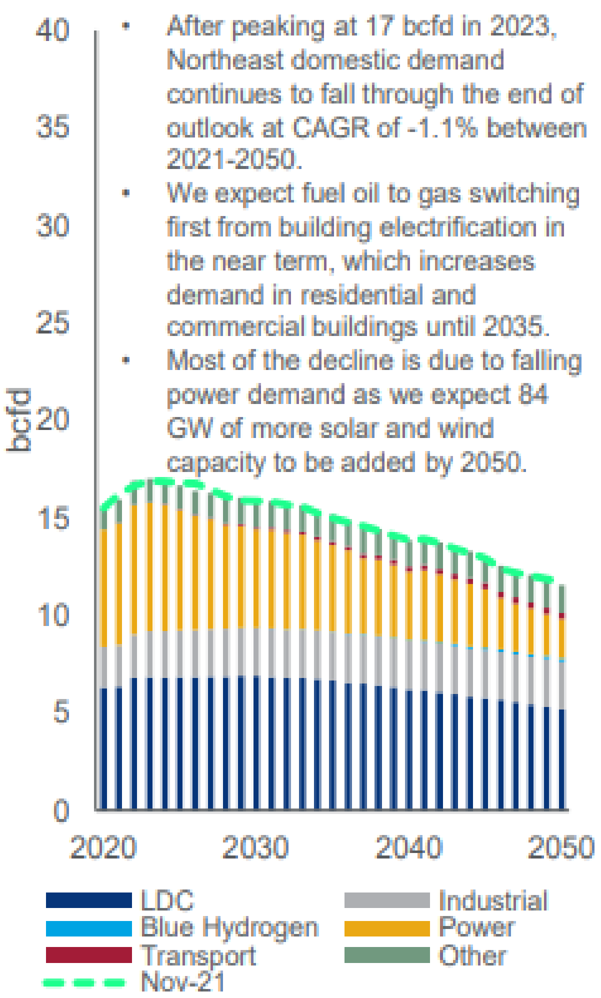
- Pacific domestic demand declines perpetually from 7.5 bcfd in 2022 to 5.2 bcfd in 2050.
- The power sector experiences the largest demand decline of 63% between 2022 and 2050 but demand stabilizes in the long term due to higher electric vehicle (EV) penetration that supports power load.
- Industrial demand starts to decline by mid-2030s with the rise of low carbon hydrogen.

Midwest



- Midwest demand reaches peak in 2031 at 11.4 bcfd, which is growth of around 0.5 bcfd from its 2022 level. This is driven by increase in industrial demand and power demand from coal to gas switching.
- Post 2031, domestic demand declines to 12.3 bcfd in 2050 at CAGR of -1.6%. Despite the addition of blue hydrogen demand, power demand falls by 2 bcfd from its 2020 level due to renewable penetration with the addition of 370 GW of wind and solar capacity.

Northeast

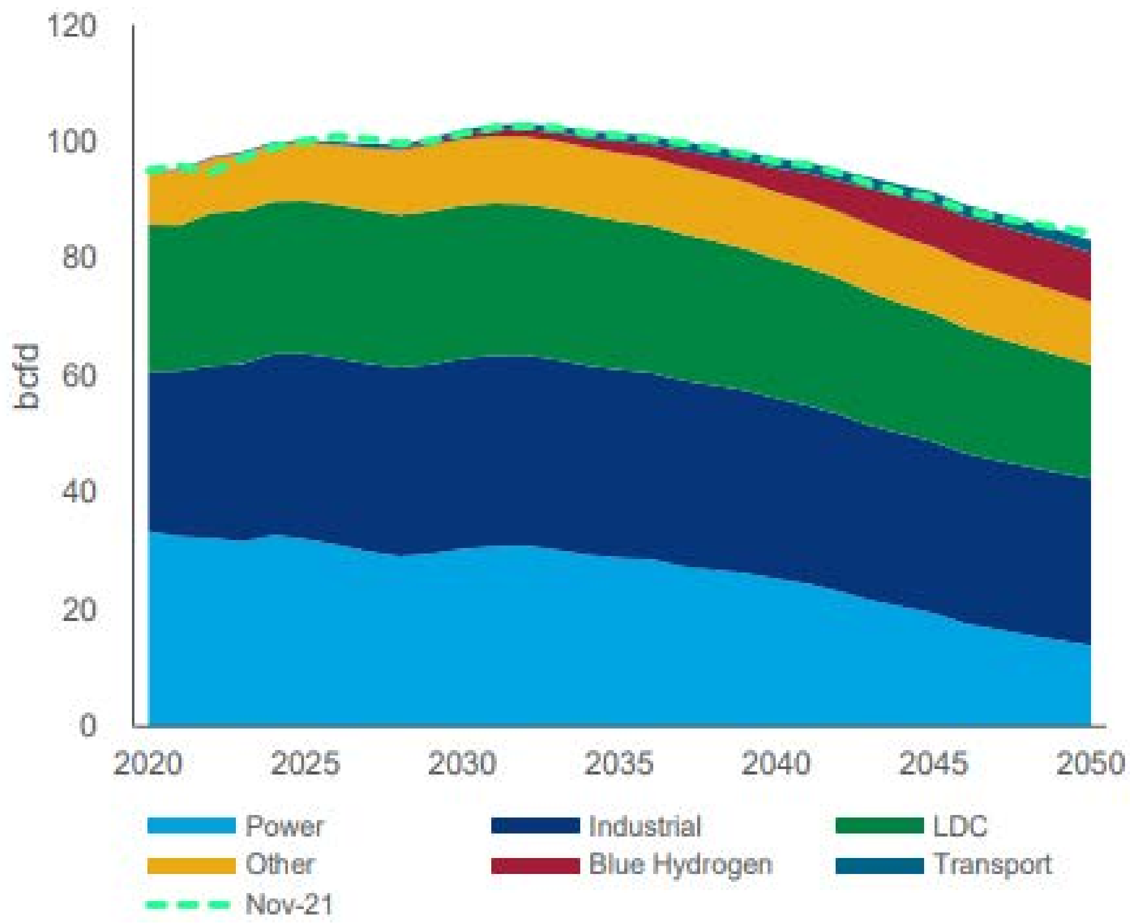


- After peaking at 17 bcfd in 2023, Northeast domestic demand continues to fall through the end of outlook at CAGR of -1.1% between 2021-2050.
- We expect fuel oil to gas switching first from building electrification in the near term, which increases demand in residential and commercial buildings until 2035.
- Most of the decline is due to falling power demand as we expect 84 GW of more solar and wind capacity to be added by 2050.

North American domestic demand reaches its peak in the early 2030s; longer term growth only from blue hydrogen and transport sectors

Energy transition impacts power demand the most with demand falling by almost two thirds between 2022 and 2050

North America gas demand by sector

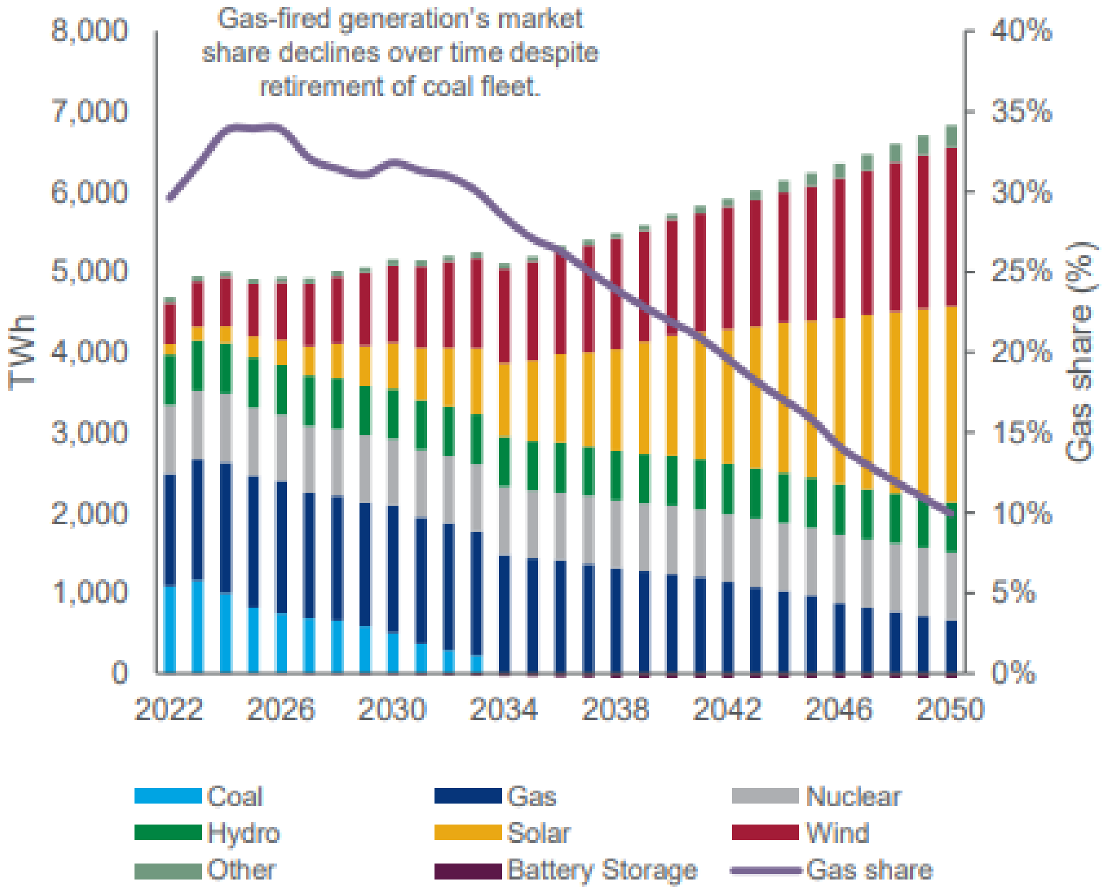


Transport	Transportation demand includes gas consumed in natural gas vehicles (NGV) and small-scale bunkers. Most of the growth is attributed to NGV demand, driven by heavy long-haul trucks and freight rails
Blue hydrogen	Low-cost natural gas supply in both US and Canada support blue hydrogen projects where demand grows to 8.5 bcfd by 2050. We expect clean energy policies, such as Canada's federal carbon price and US 45Q incentive, to drive its growth.
Other	Other demand includes lease & plant fuel and pipeline losses, which is the gas used within the industry. The two biggest components to its growth are supply and LNG export losses
LDC	Residential and commercial demand reach a peak in 2029 and declines as hydrogen and building electrification accelerate to displace gas in the long-term. Heating electrification in the US will reach 68% penetration by 2050.
Industrial	Post 2031, industrial demand deviates from GDP growth and continues to decline as we expect net zero targets and clean energy policies to drive low-carbon hydrogen to replace grey hydrogen from Steam Methane Reformers (SMRs) in the ammonia, refining, and methanol sectors.
Power	In the near term out to 2024, power demand grows due to coal-to-gas switching and retirements. Post-2024, gas demand in the power sector starts to structurally decline with the accelerated renewable build-out spurred by policy incentives.

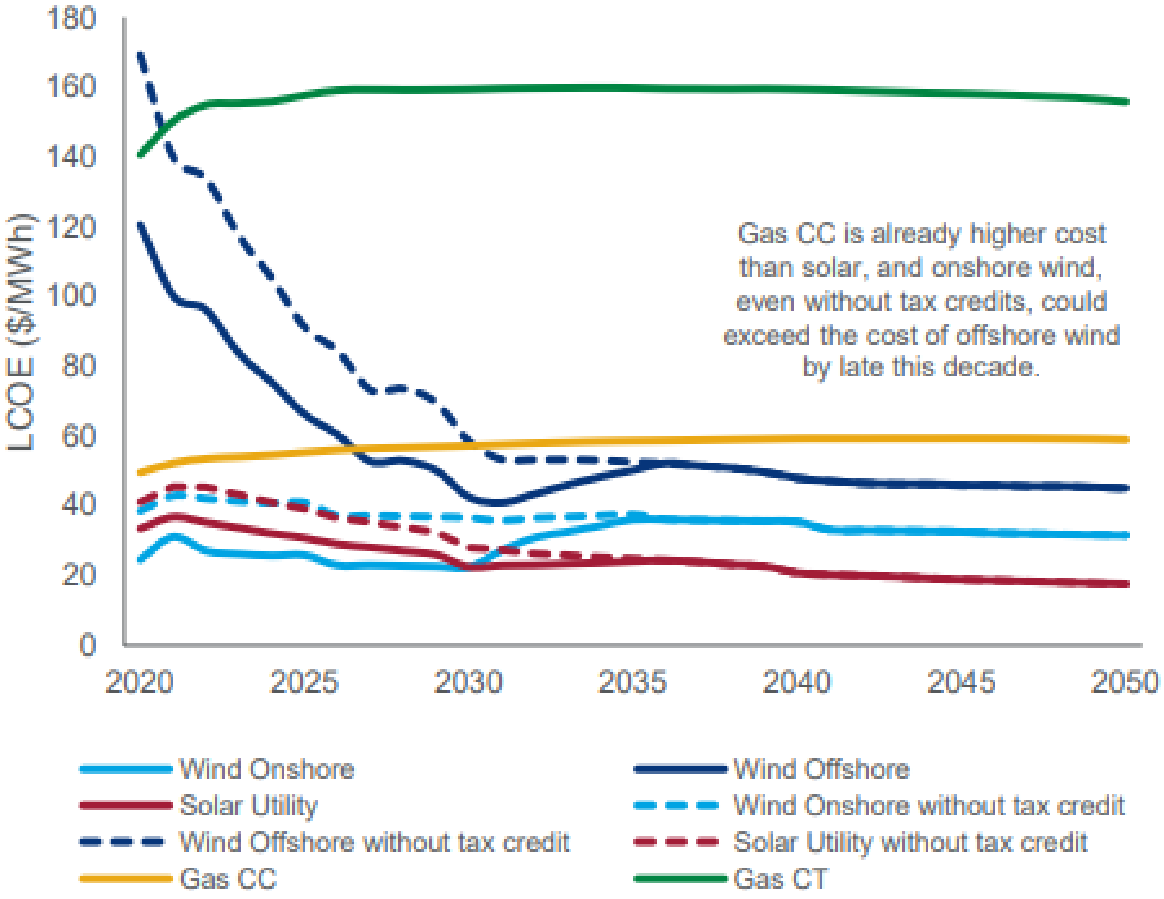
Accelerated coal retirements allows for more coal-to-gas switching in the 2020s but gas burns decline over time with higher renewable penetration

Power load has been revised higher mostly in the late 2040s due to higher EV conversion, heating electrification and stronger industrial requirements

North America power generation by type



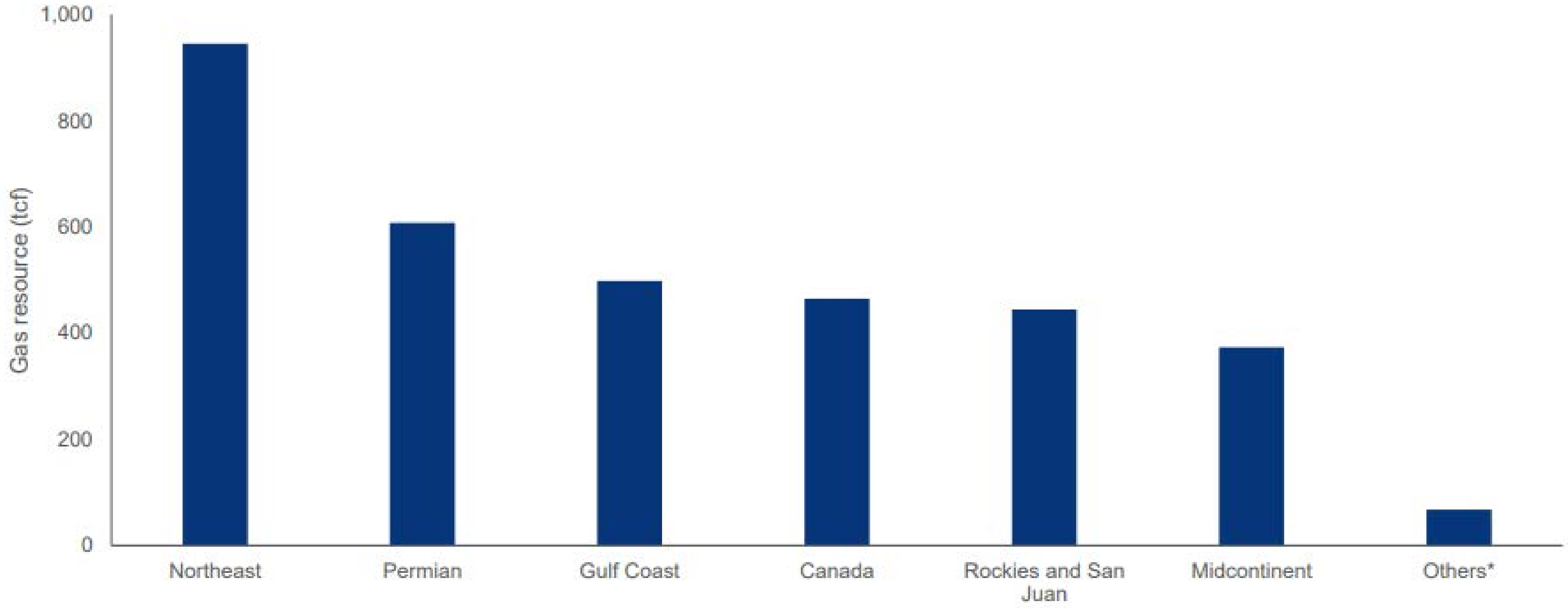
Levelized cost of energy (LCOE)



North America has large quantities of gas resources available

In addition to commodity prices, factors such as well economics, infrastructure development, and investor sentiment will dictate how much resource is ultimately produced

Remaining gas resources for key onshore North America regions



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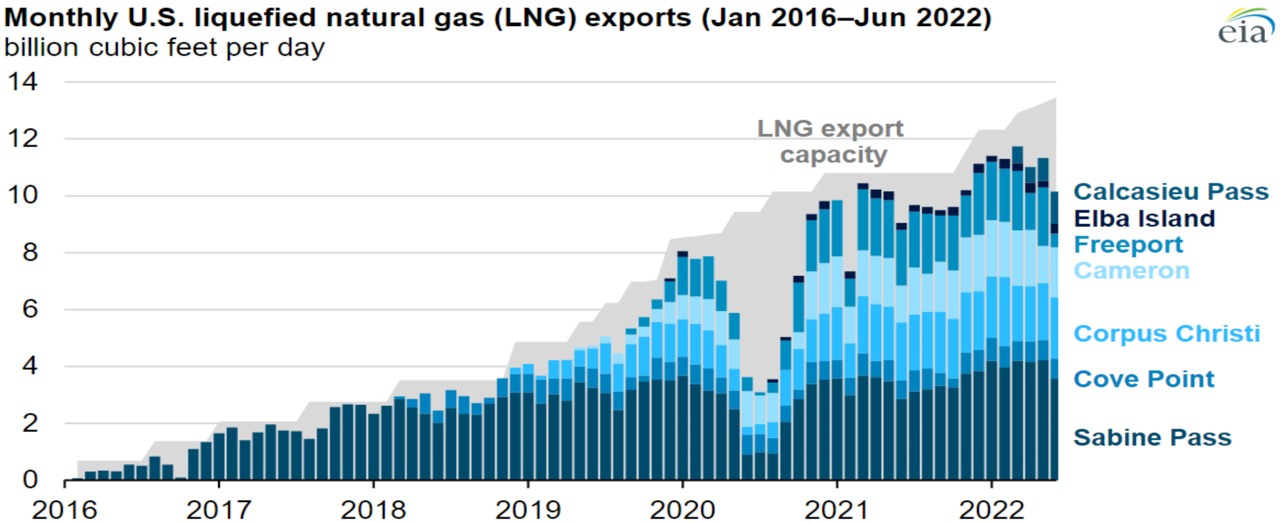
LNG Exports

The United States became the world’s largest LNG exporter in the first half of 2022

Monthly U.S. liquefied natural gas (LNG) exports (Jan 2016–Jun 2022)
billion cubic feet per day



Data source: U.S. Energy Information Administration, *Liquefaction Capacity Table*, and U.S. Department of Energy *LNG reports*
Note: June 2022 LNG exports are EIA estimates based on tanker shipping data. LNG export capacity is an estimated peak LNG production capacity of all operational U.S. LNG export facilities.

US exports more LNG to Europe, less to Asia, Brazil, Mexico.

Exports of U.S. liquified natural gas, first half 2021 vs. first half 2022.

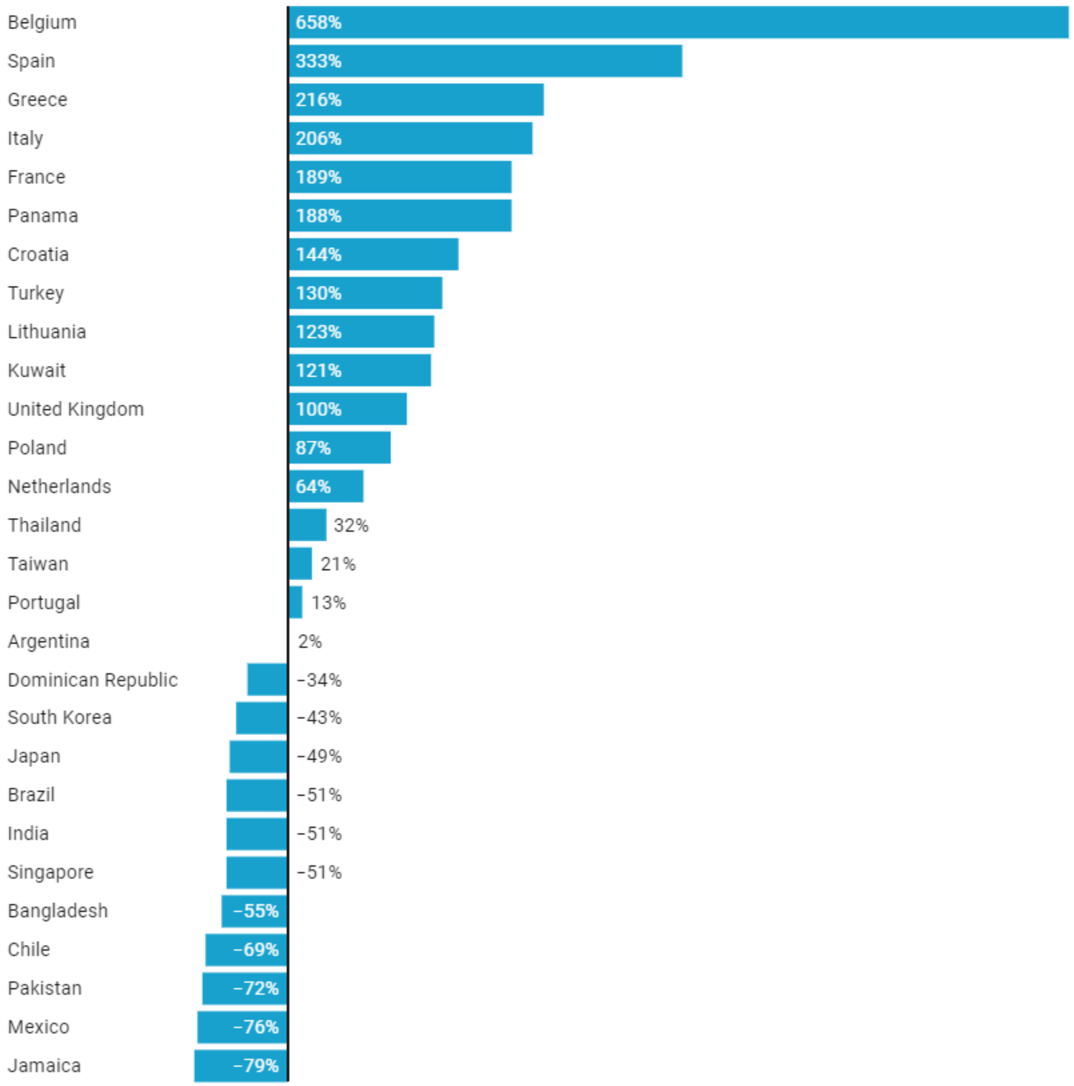
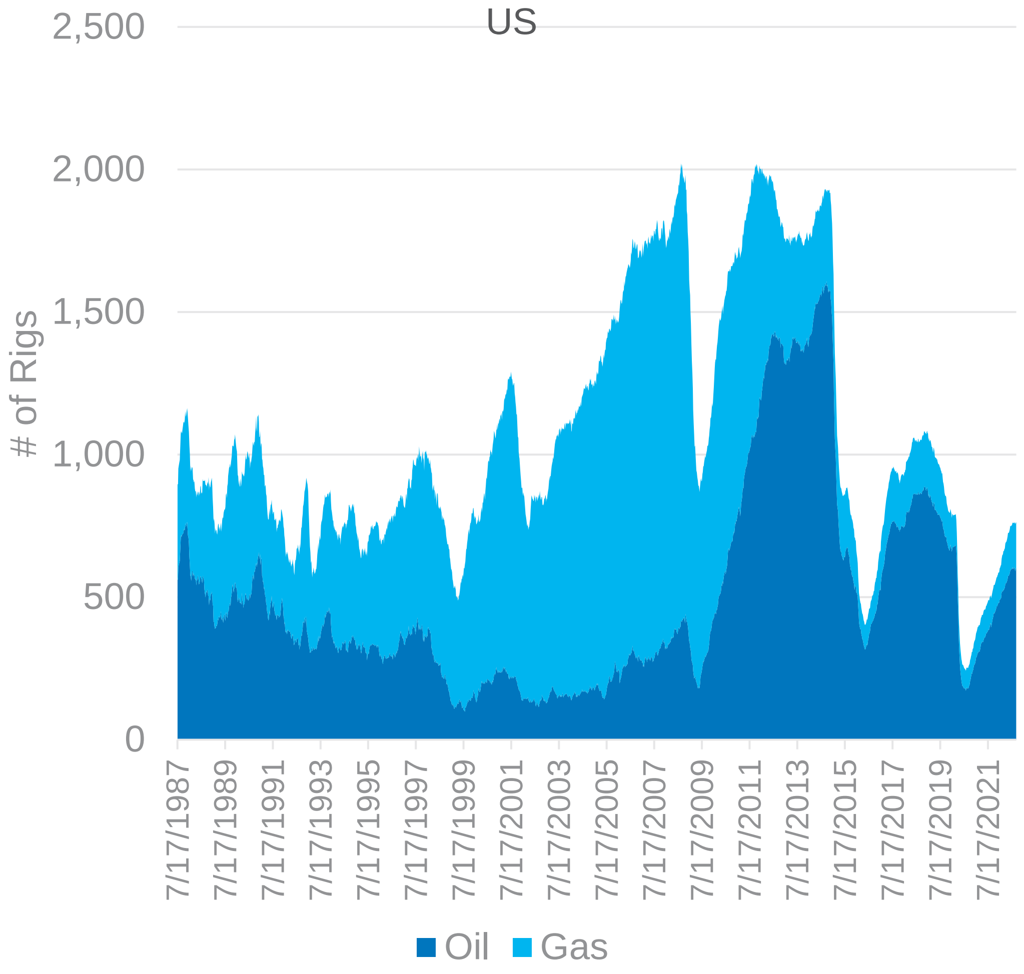
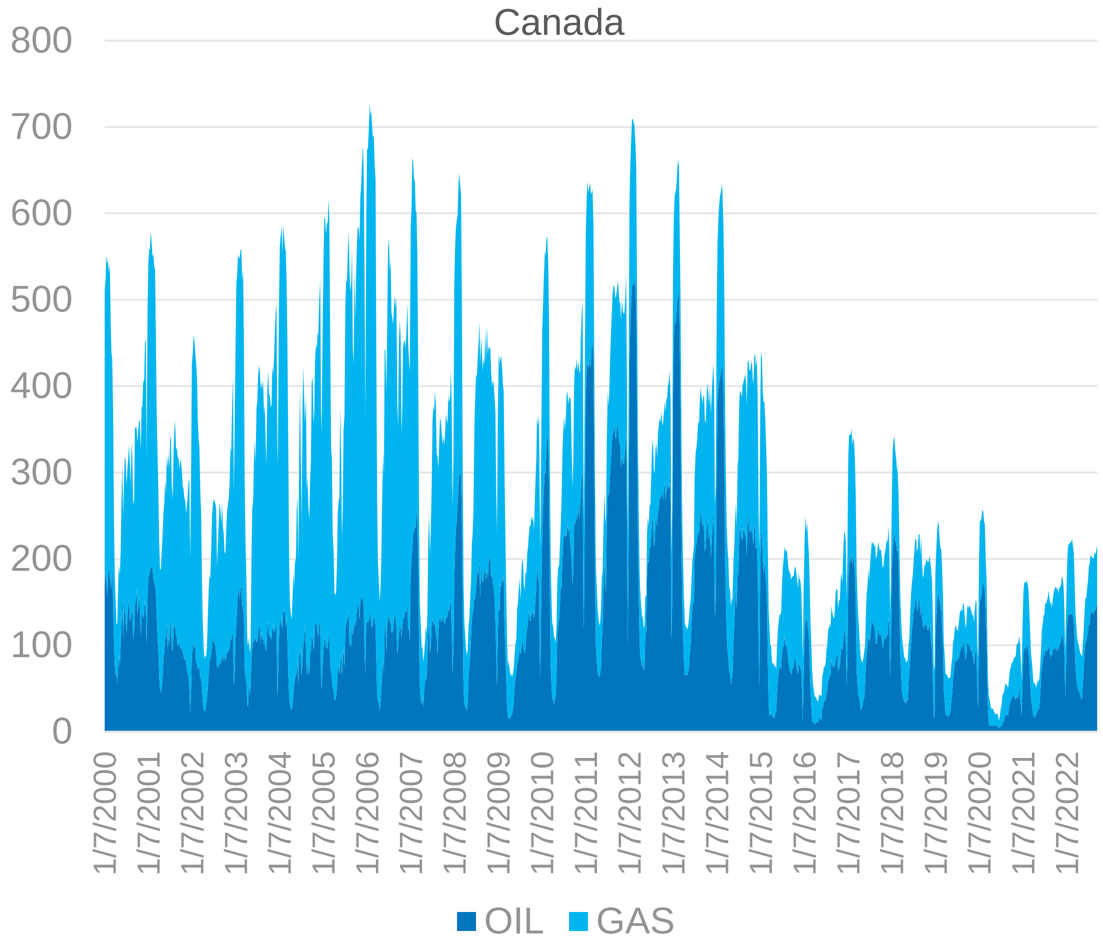


Chart: Reuters staff • Source: Refinitiv • Get the data

North American Rig Count

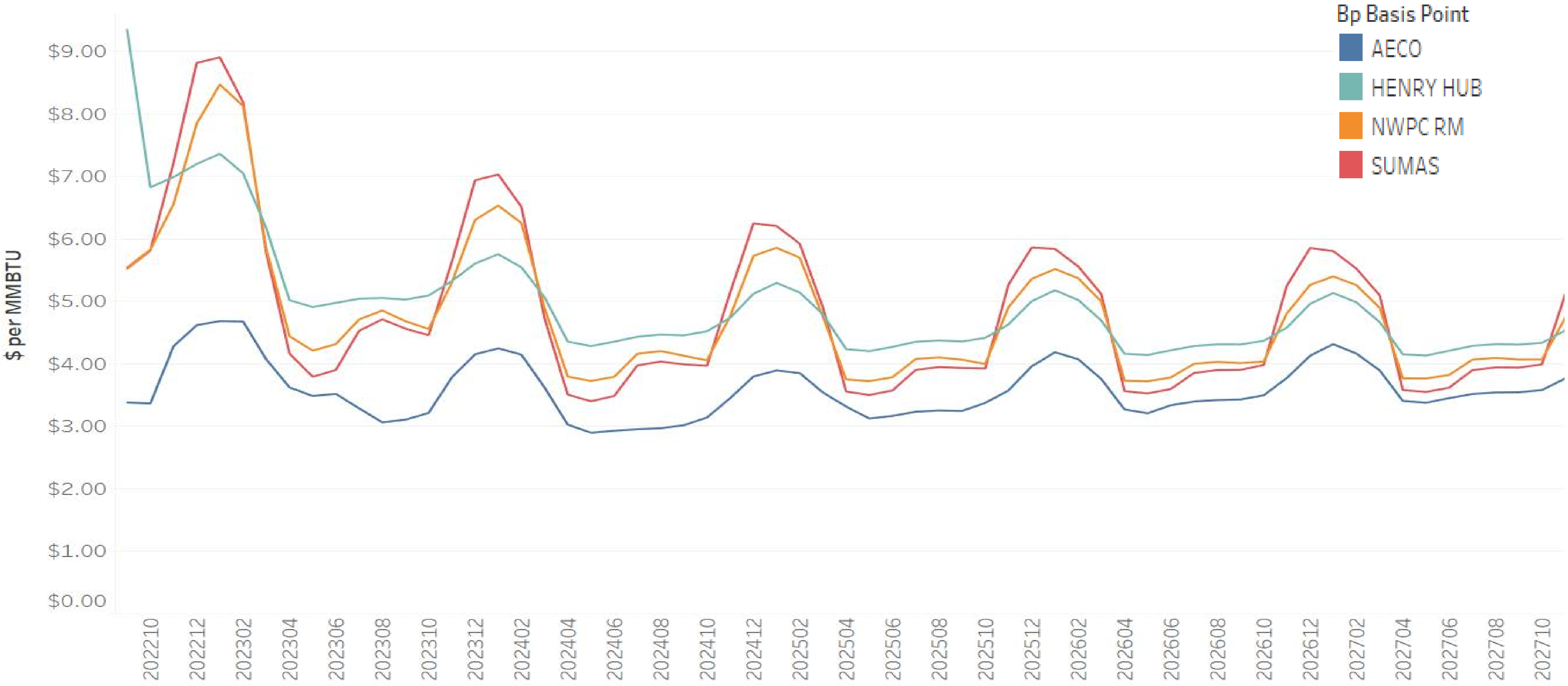




Source: Baker Hughes

DRAFT

Forward Prices (9/23/2022)



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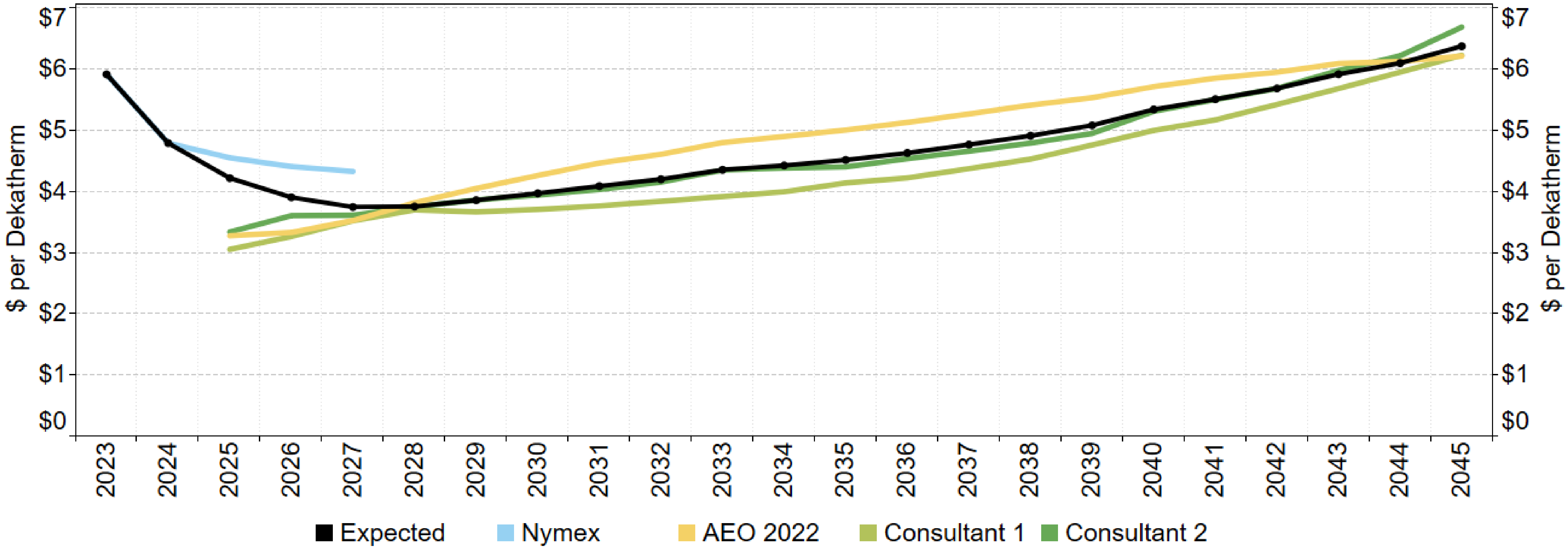
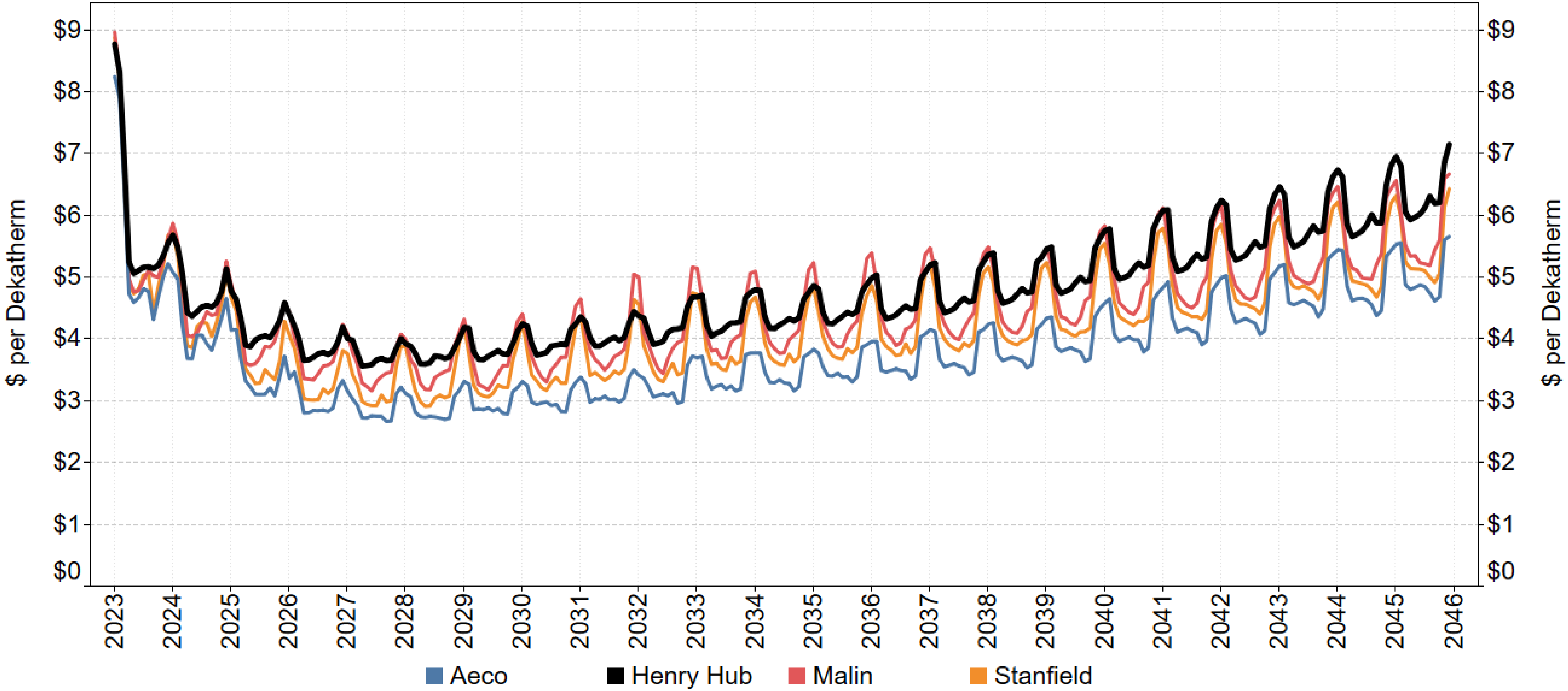
Price Forecast Blending



	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
NYMEX	100%	100%	75%	50%	25%																		
AEO 2022			8%	17%	25%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%
Consultant 1			8%	17%	25%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%
Consultant 2			8%	17%	25%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%

Expected Case Price Forecasts



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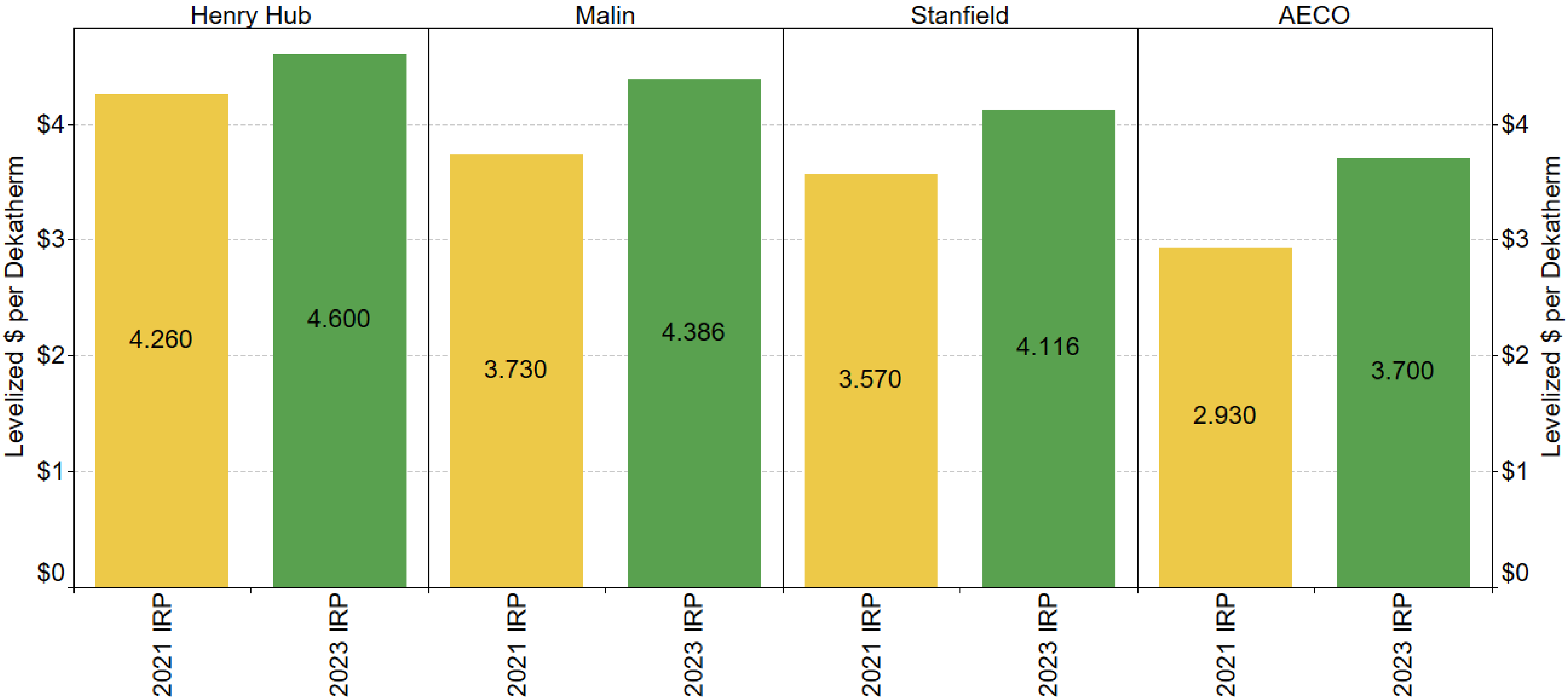
Levelized Costs (2023 – 2045)



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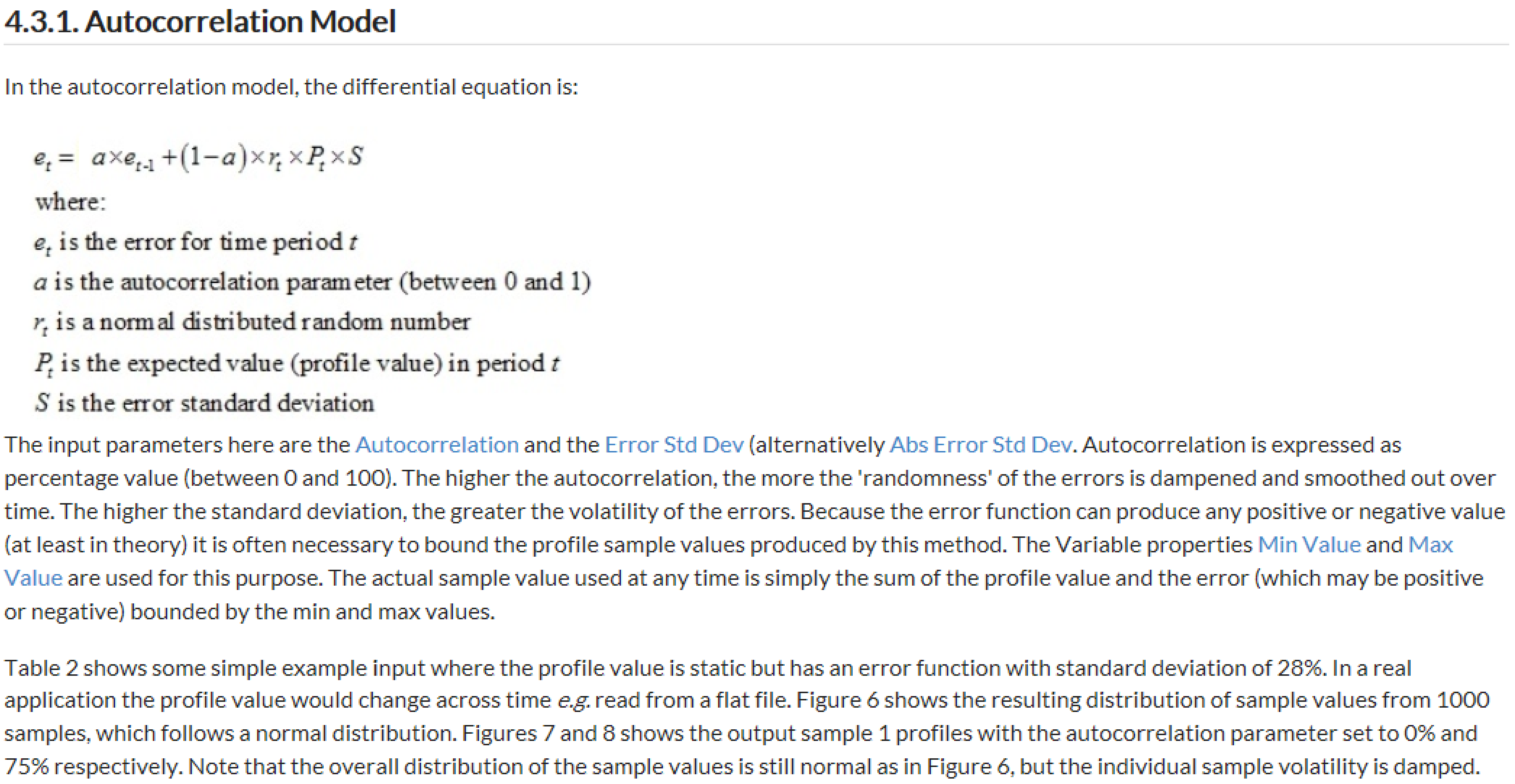
PLEXOS Stochastics



4.3.1. Autocorrelation Model

In the autocorrelation model, the differential equation is:

$$e_t = \; a \times e_{t\text{-}1} + (1-a) \times r_t \times P_t \times S$$

where:

e_t is the error for time period t

a is the autocorrelation parameter (between 0 and 1)

r_t is a normal distributed random number

P_t is the expected value (profile value) in period t

S is the error standard deviation

The input parameters here are the Autocorrelation and the Error Std Dev (alternatively Abs Error Std Dev. Autocorrelation is expressed as percentage value (between 0 and 100). The higher the autocorrelation, the more the 'randomness' of the errors is dampened and smoothed out over time. The higher the standard deviation, the greater the volatility of the errors. Because the error function can produce any positive or negative value (at least in theory) it is often necessary to bound the profile sample values produced by this method. The Variable properties Min Value and Max Value are used for this purpose. The actual sample value used at any time is simply the sum of the profile value and the error (which may be positive or negative) bounded by the min and max values.

Table 2 shows some simple example input where the profile value is static but has an error function with standard deviation of 28%. In a real application the profile value would change across time *e.g.* read from a flat file. Figure 6 shows the resulting distribution of sample values from 1000 samples, which follows a normal distribution. Figures 7 and 8 shows the output sample 1 profiles with the autocorrelation parameter set to 0% and 75% respectively. Note that the overall distribution of the sample values is still normal as in Figure 6, but the individual sample volatility is damped.

PLEXOS Stochastics Continued

Without Autocorrelation

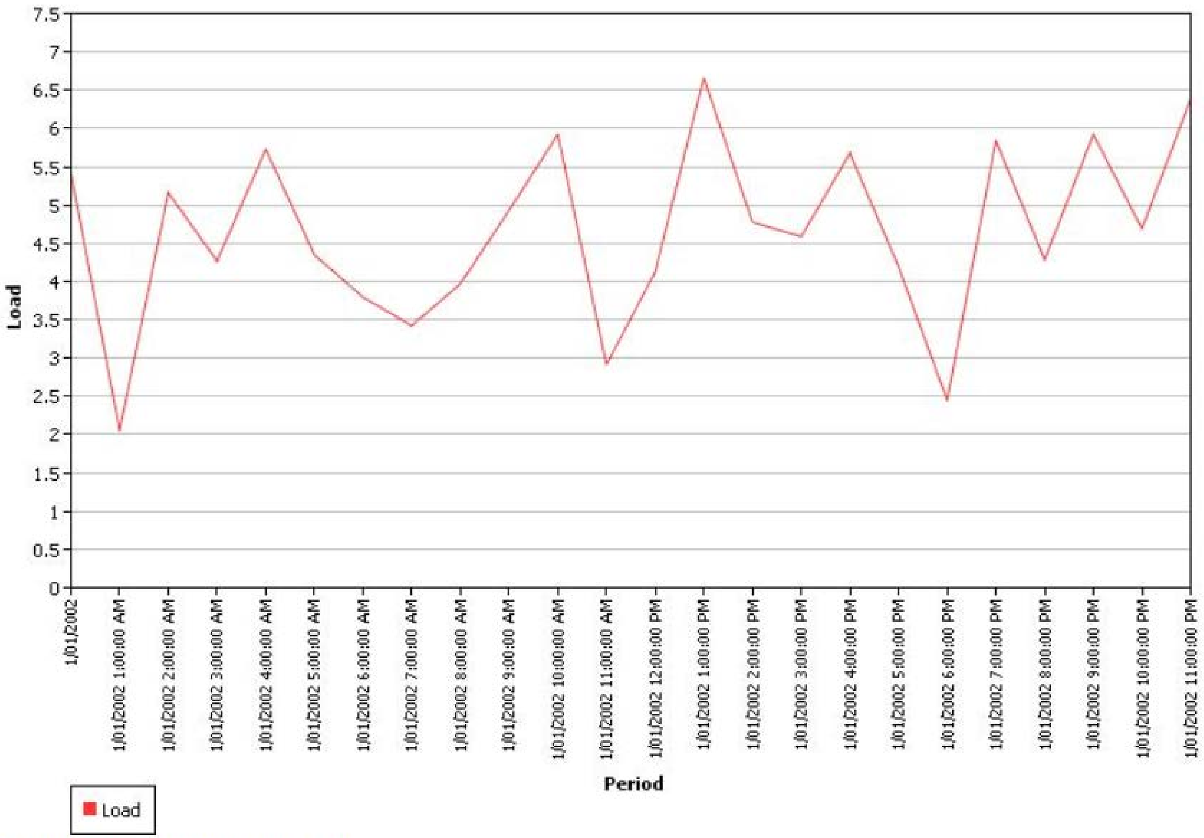


Figure 7: Sample 1 Profile with No Autocorrelation

With Autocorrelation

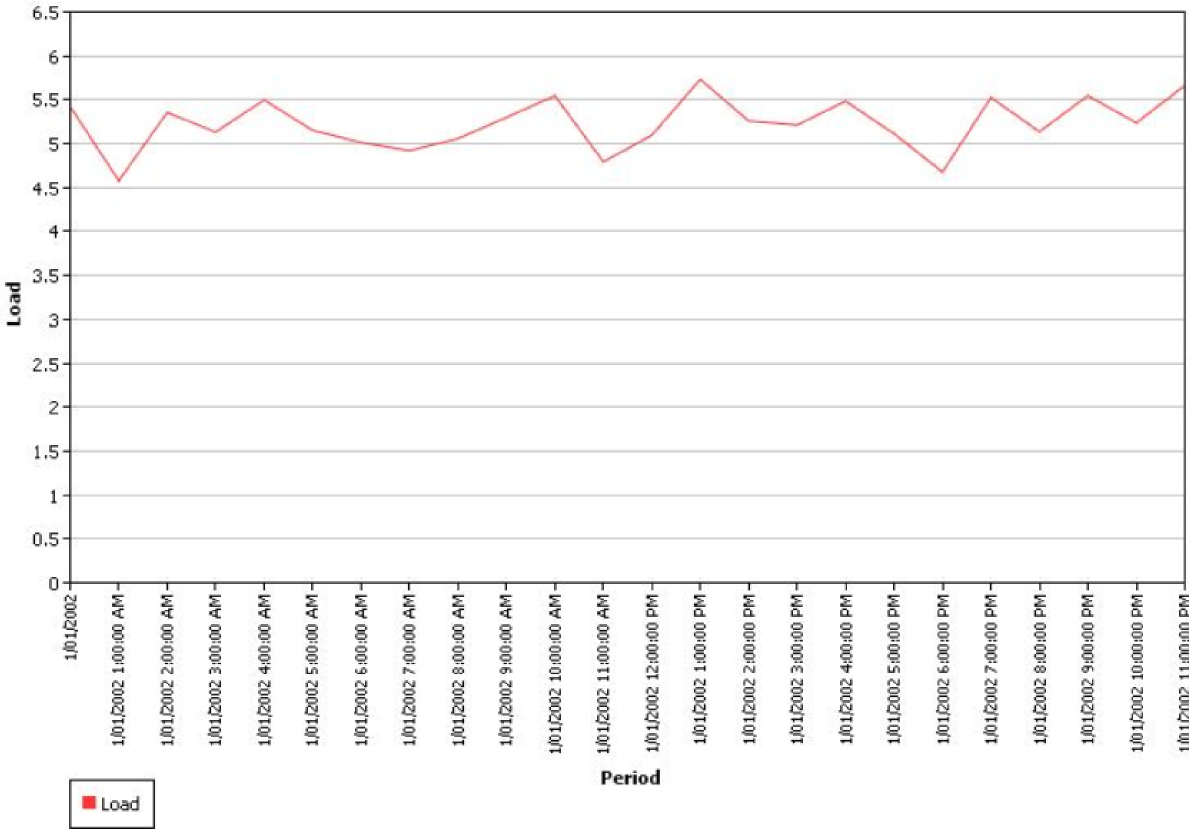
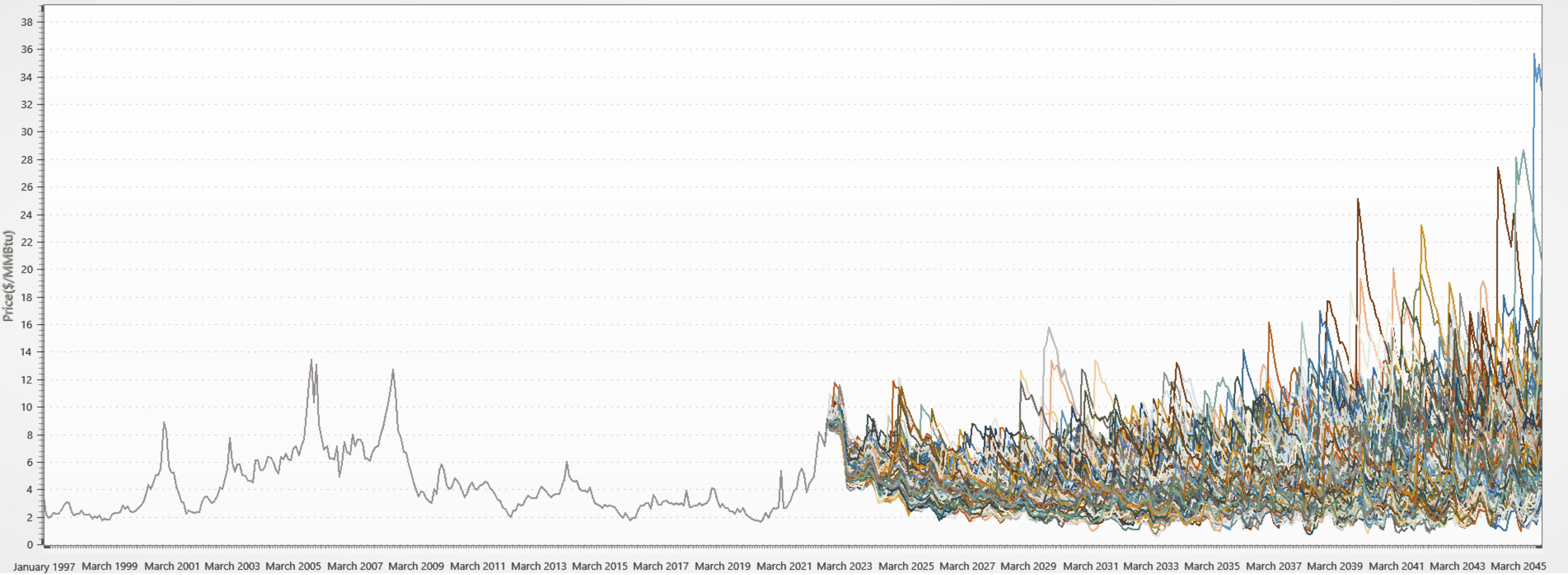


Figure 8: Sample 1 Profile with 75% Autocorrelation

Stochastics: Henry Hub (300 Draws)



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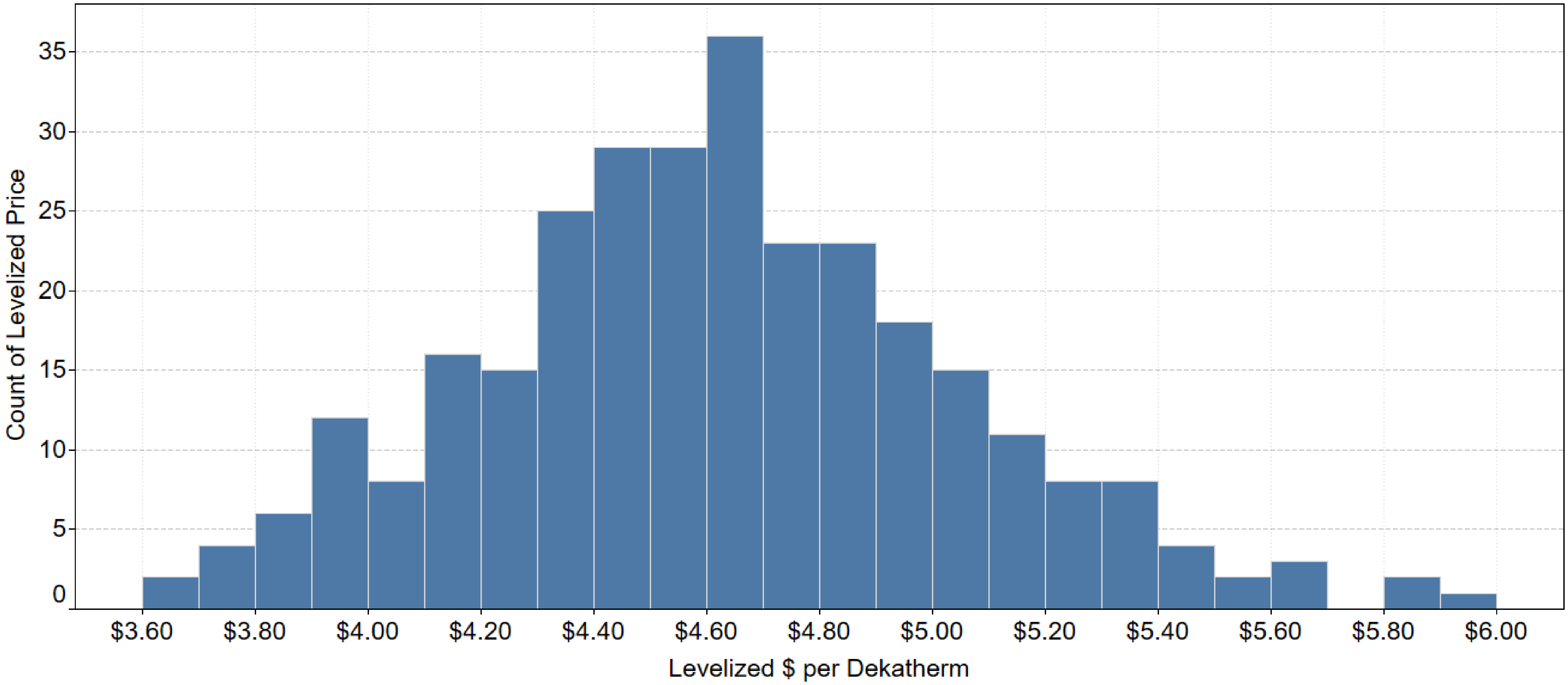
Stochastics: Henry Hub Levelized Prices (300 Draws)



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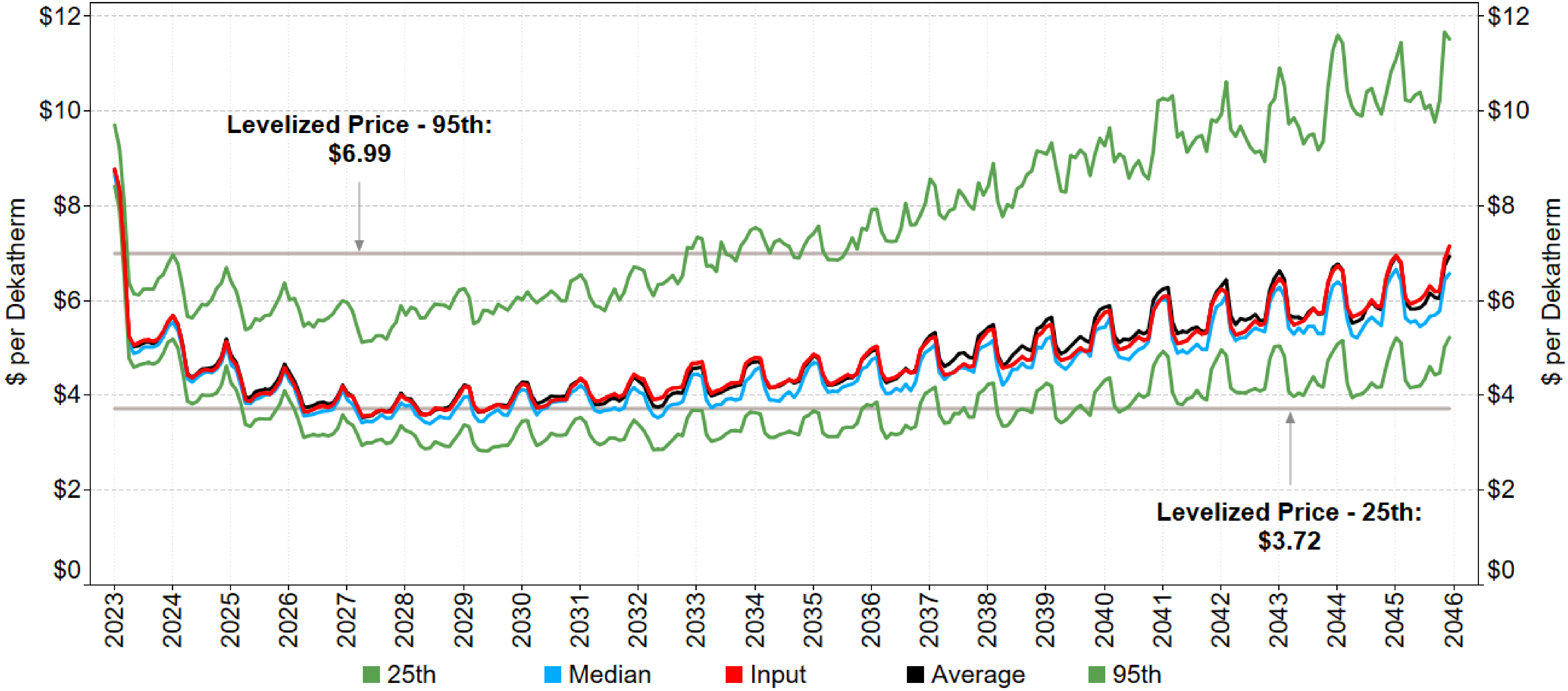
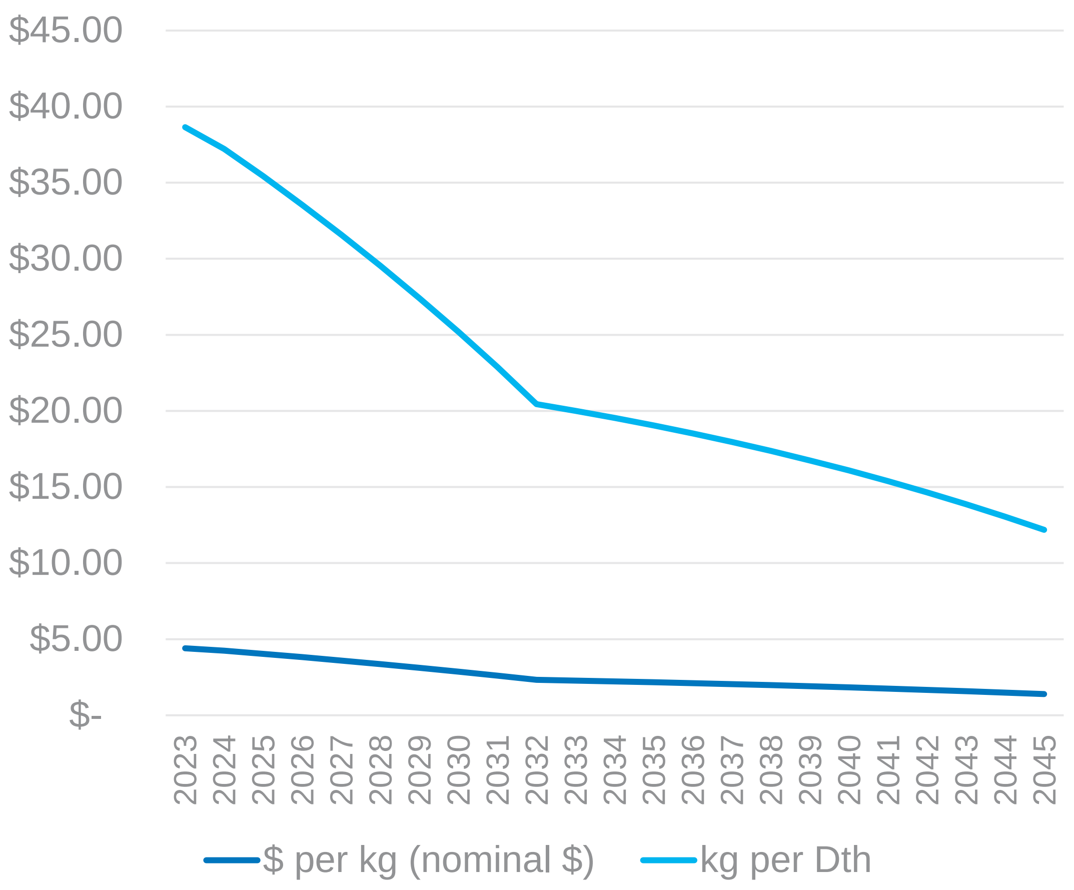
Results: Henry Hub Stochastics (300 Draws)



Green Hydrogen (H2)

- Hydrogen is the most abundant element in the universe
- The lightest element and wants to escape making it harder to contain
- Highly combustible
- Tax credits from IRA assumed at a levelized credit for the full $3 per kg incentive from green H2



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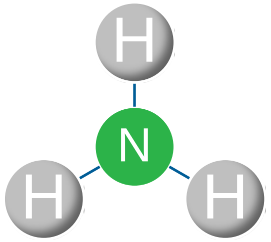
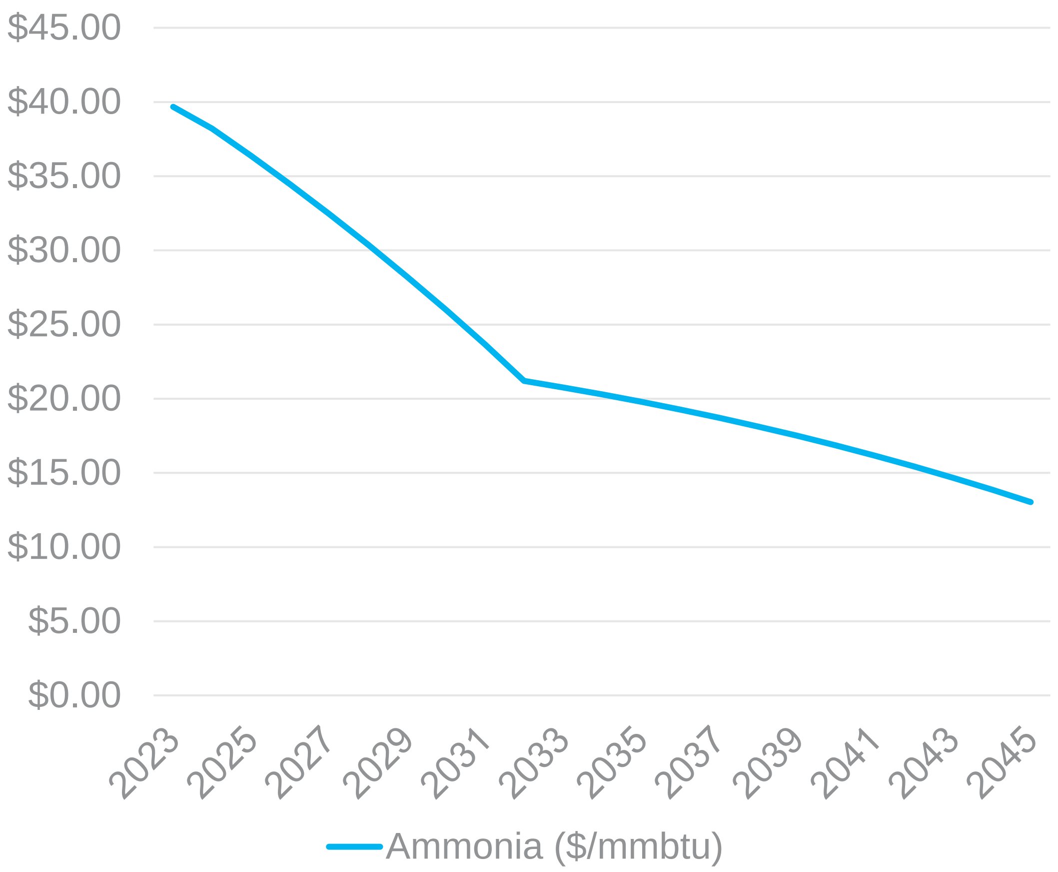
Ammonia



- One of the most produced chemicals in the United States
- Usually shipped as a compressed liquid in steel containers
- Not highly flammable
- Can be used as a fuel in emission-free fuel cells and turbines
- Can be made using green H2 from water electrolysis and nitrogen separated from the air
  - Fed into the "Haber Process" and combined at high temperatures and pressures to produce ammonia



Electric Wholesale Market Price Forecast

Lori Hermanson, Senior Resource Analyst
Electric IRP, Seventh Technical Advisory Committee Meeting
October 11, 2022

Overview

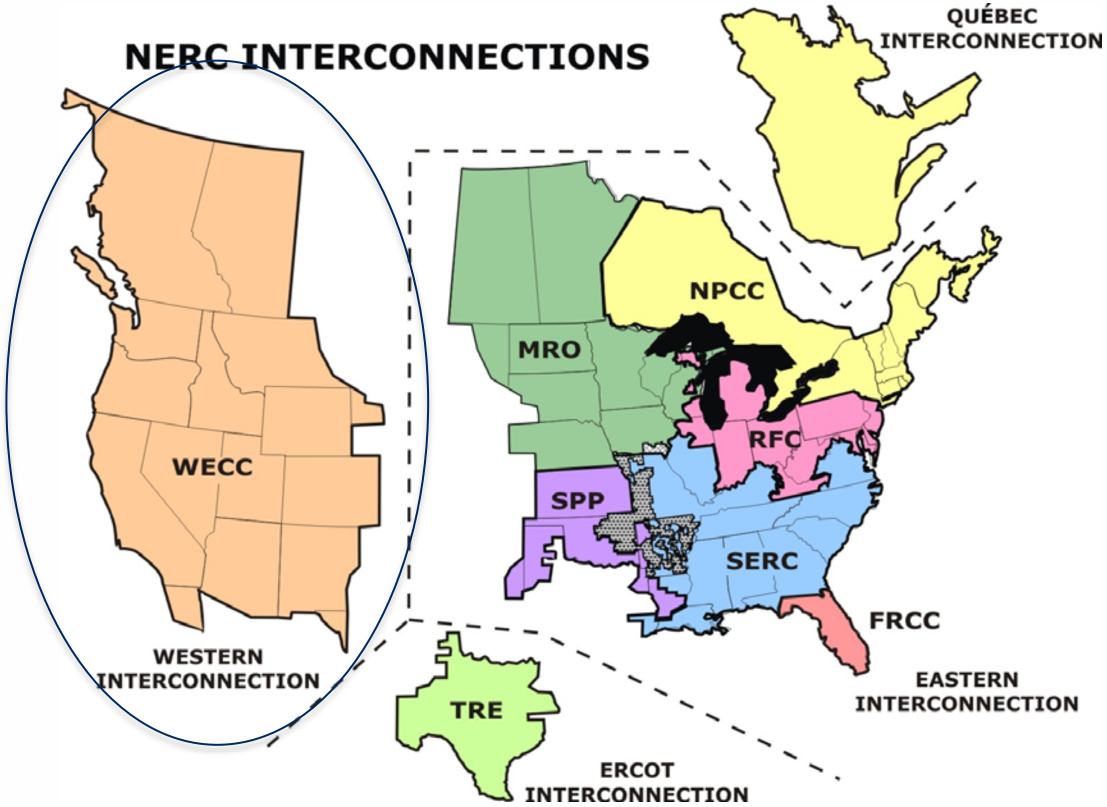
- This market price forecast will be used in the IRP

- Updated from draft price forecast presented in March
  - Loads
  - Climate impacts for hydro and loads
  - Natural gas and carbon prices
  - Consultant inputs

- Stochastics electric price modeling in process

Market Price Forecast – Purpose

- Estimate “market value” of resources options for the IRP
- Estimate dispatch of “dispatchable” resources
- Informs avoided costs
- May change resource selection if resource production is counter to needs of the wholesale market



Source: NERC

Methodology

- 3rd party software - Aurora by Energy Exemplar
- Electric market fundamentals - production cost model
- Simulates generation dispatch to meet regional load
- Outputs:
  - Market prices (electric)
  - Regional energy mix
  - Transmission usage
  - Greenhouse gas emissions
  - Power plant margins, generation levels, fuel costs
  - Avista’s variable power supply costs

Modeling Process

1 Vendor Database

(2020 North American)

2 Input Changes

30 yr hydro w climate change

NG prices

Regional Loads

Avista Resources/Loads

Operational Detail

3 Capacity Expansion

Add new resource forecast

(Capacity/RPS)

Include known retirements

Model adds resources to meet planning targets

4 Prelim Deterministic Study

5 Test Year Stochastic Study

Test Resource Adequacy

6 Re-Run Capacity Expansion

Increase/Decrease Planning Margin Targets

7 Run Full Forecast

Stochastic & Deterministic

8 Run Scenarios

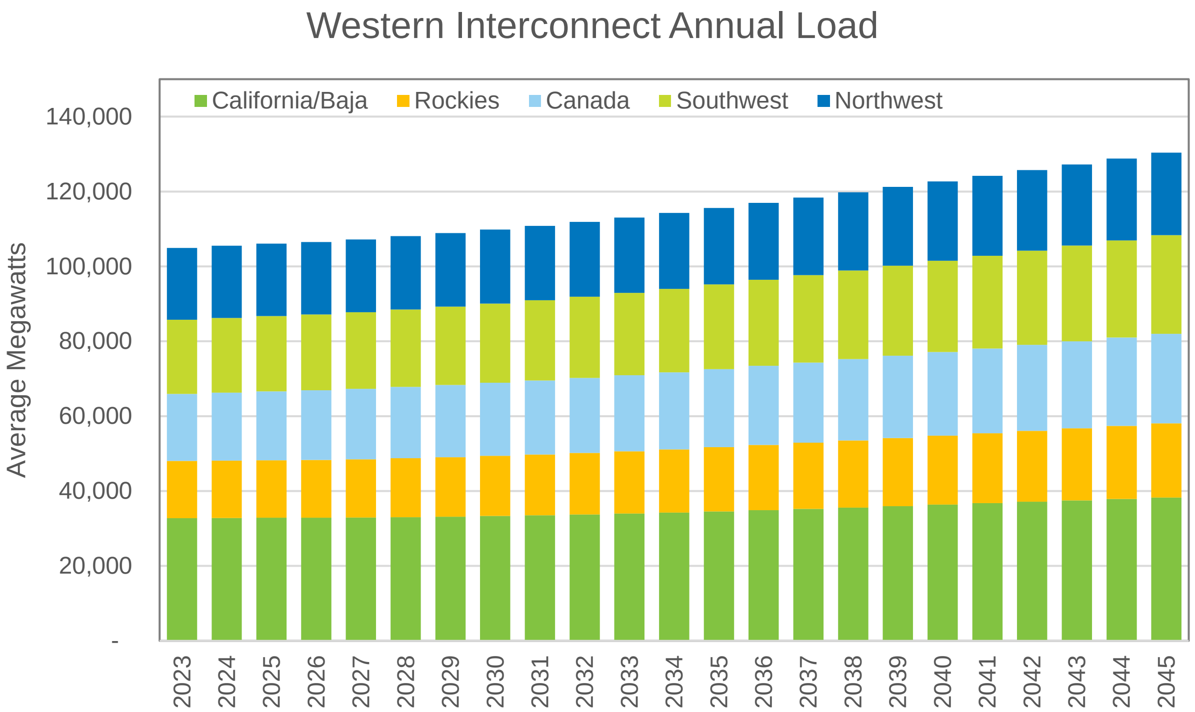
Deterministic

Stochastic (if necessary)

Draft Forecast

Load Forecast

- Regional load forecast from IHS
  - Forecast includes energy efficiency
- Add net meter resource forecast
  - Annual input with hourly shape
- Add electric vehicle forecast
  - Annual input with hourly shape
- Future load shape differs from today’s load shape

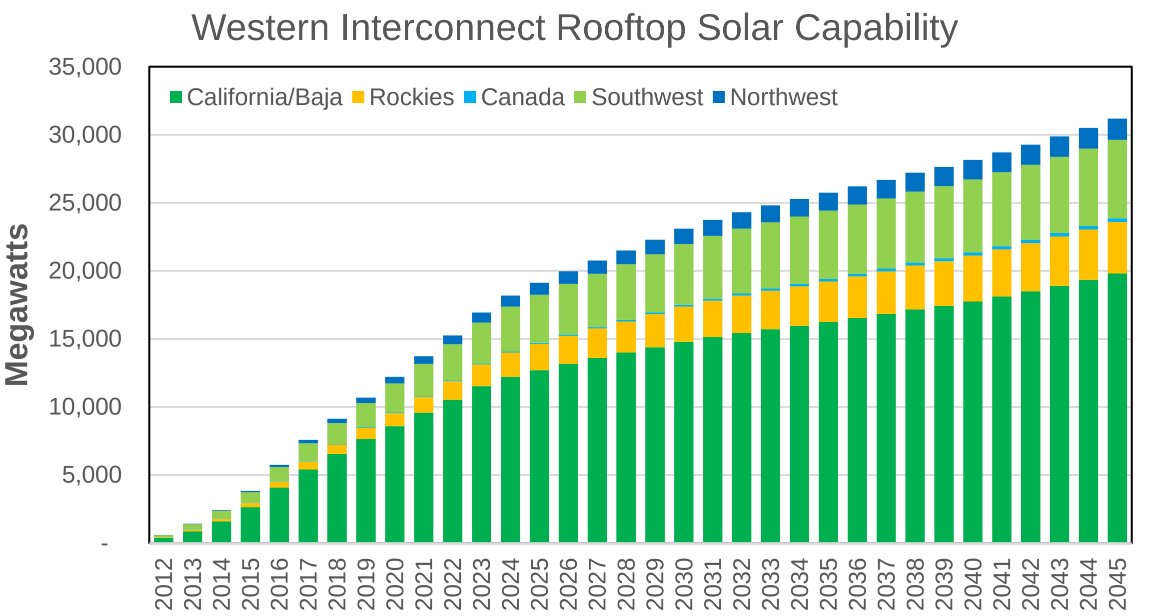


Draft Forecast

Electric Vehicle and Solar Adjustments

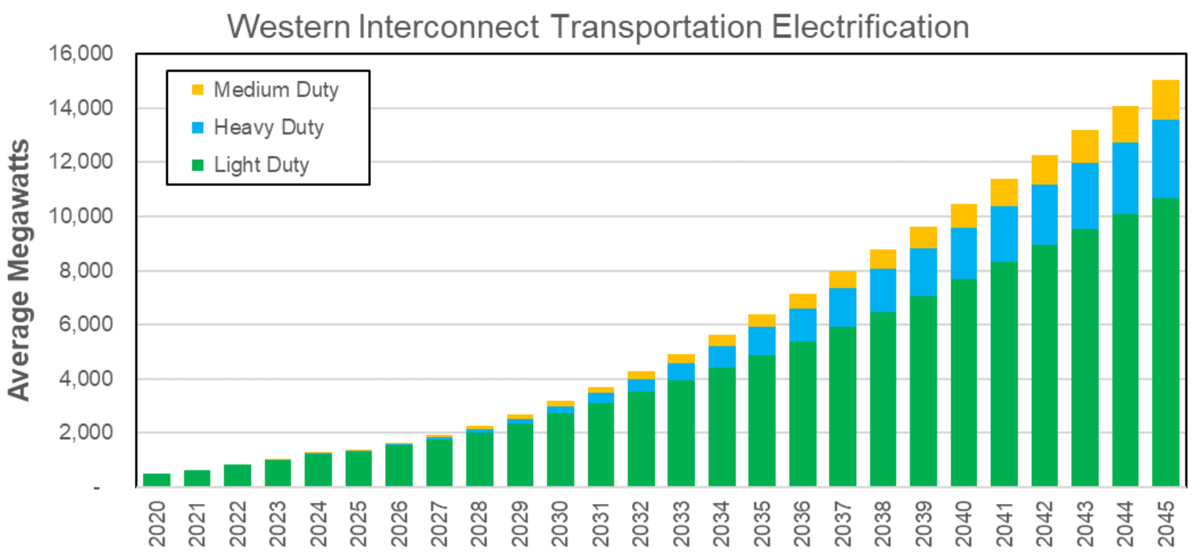
Roof Top Solar

- EIA existing estimates for history
- IHS regional growth rates



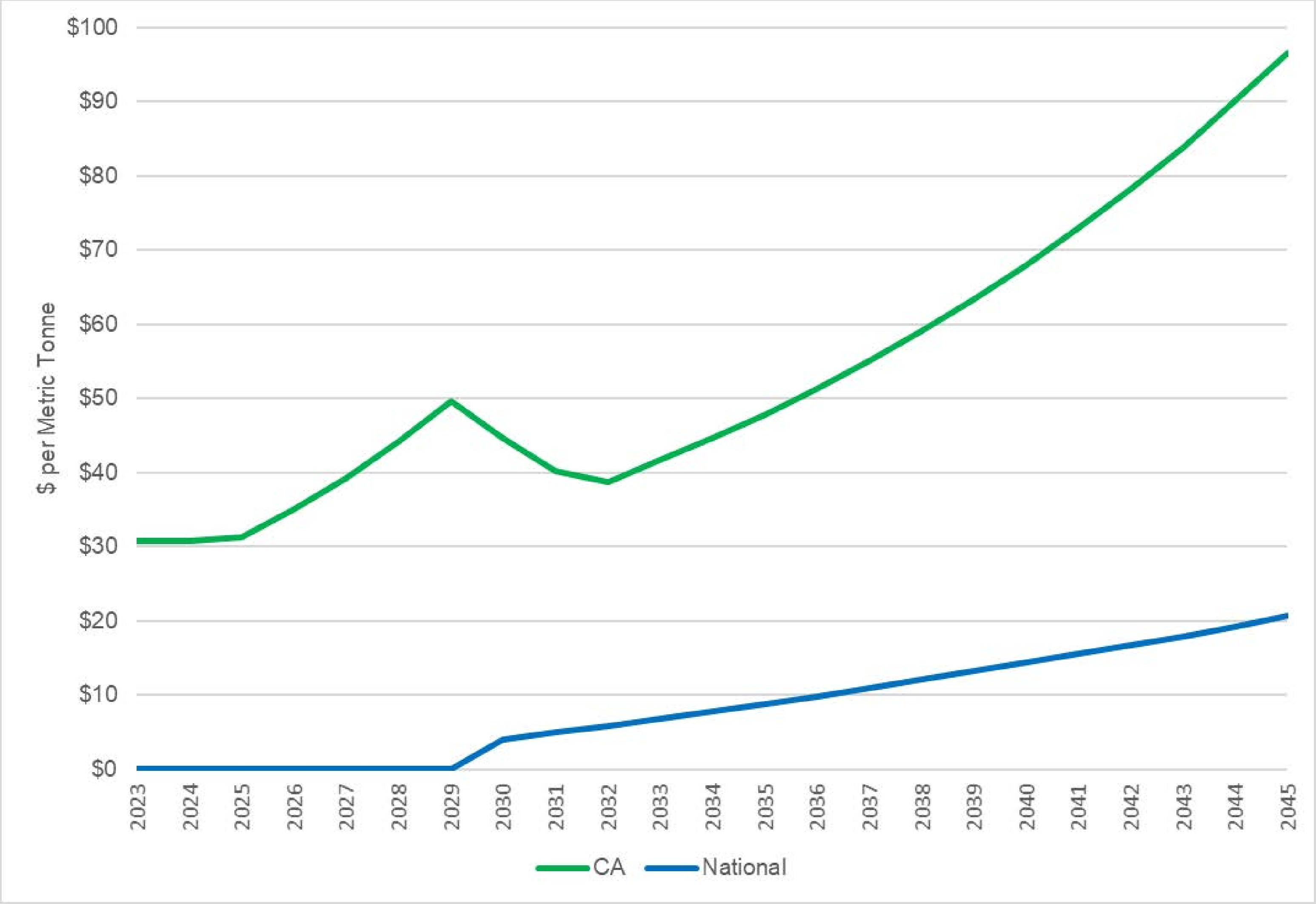
Electric Vehicles

- Penetration rates increase each year
- 15-65% light duty (2040)
- 12-15% medium duty (2040)
- 5% heavy duty (2040)



Draft Forecast

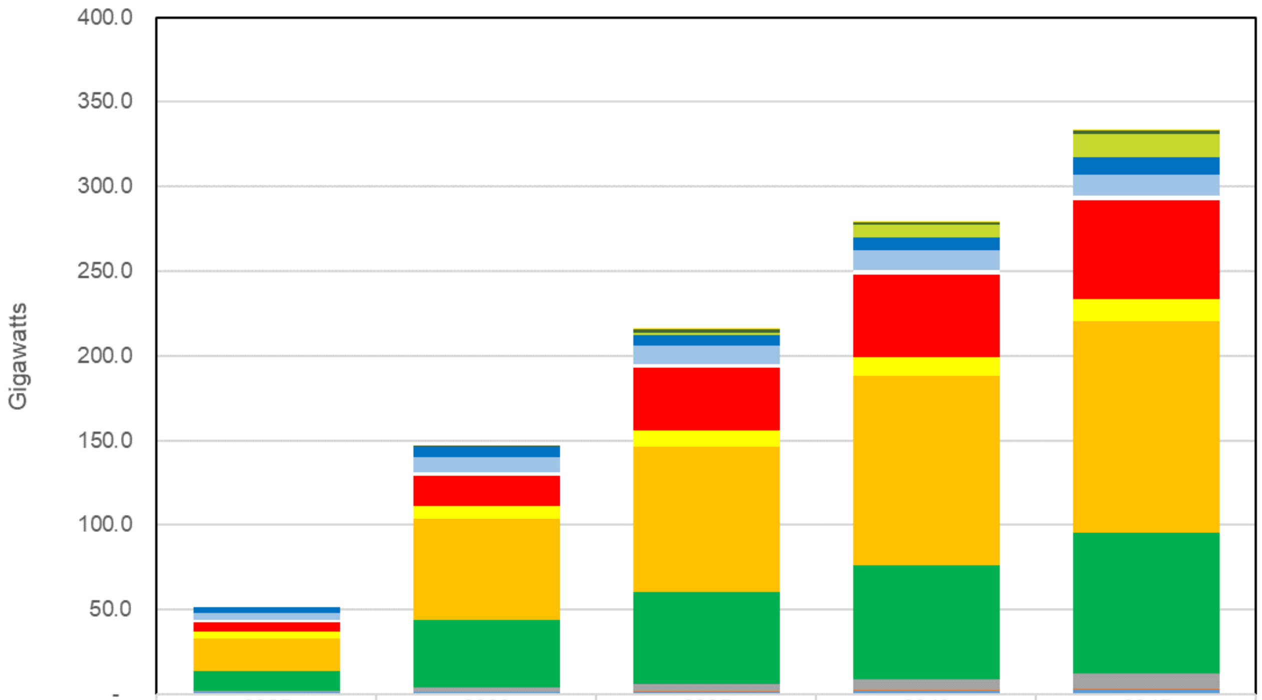
WECC Weighted GHG Emission Prices



- CA current prices + 2030 national carbon price
- $5.43 levelized per Metric Tonnes (WA)
- Revised 2019 IEPR Carbon Price Projections (CA) and national price estimate (consultant)
- To address imports, exporting region incurs a carbon price adder to transfer power
- CCA rules are not final; still determining the price forecast impact from CCA; will publicize final price forecast when complete

New Resource Forecast (Western Interconnect)

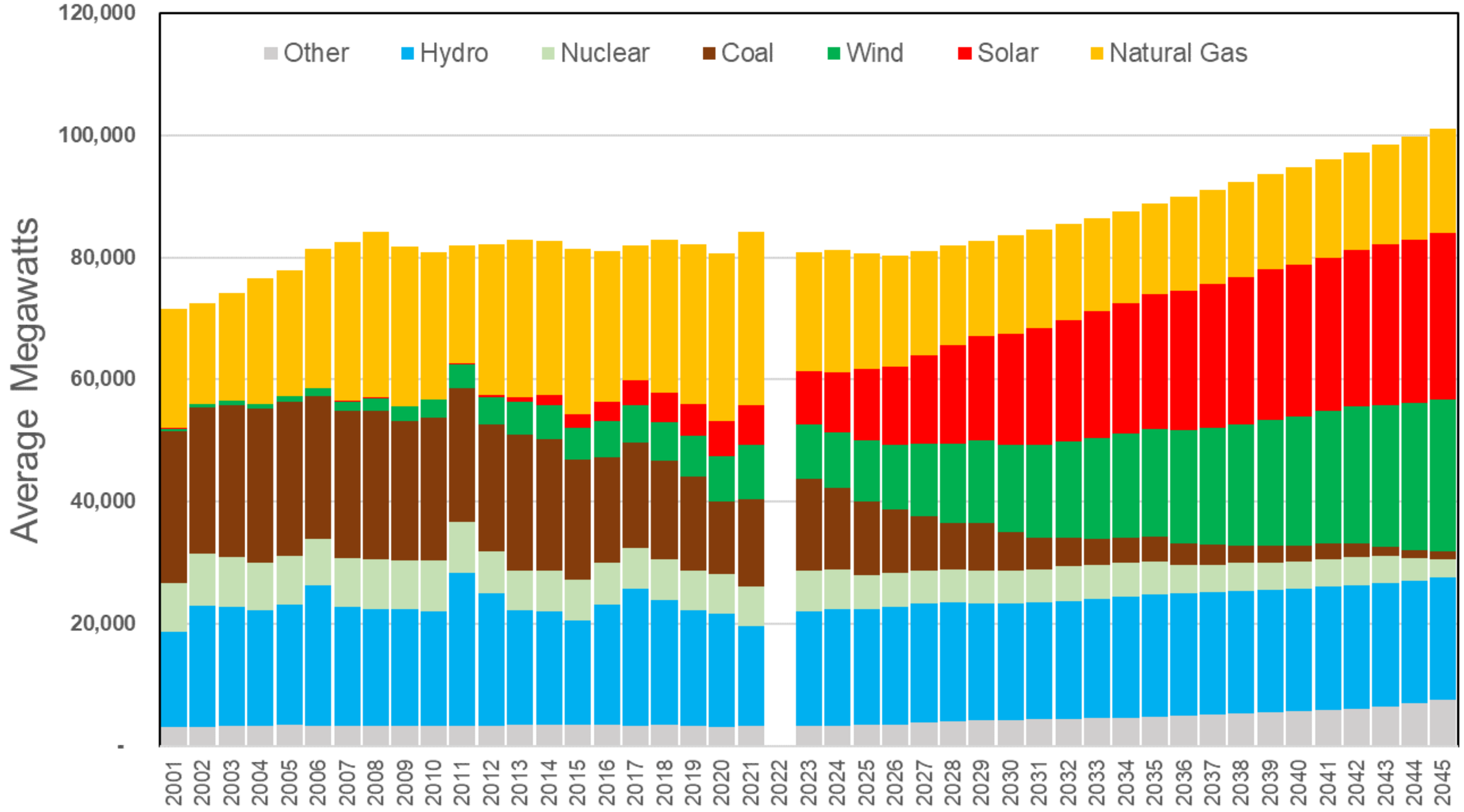
Draft Forecast



	2025	2030	2035	2040	2045
🟨 Nuclear	-	-	0.5	0.5	0.5
🟩 H2CT	-	0.5	1.4	1.7	2.4
🟩 OSWind	-	-	1.5	7.1	13.7
🟦 CCCT	3.8	6.2	6.2	7.9	10.0
🟦 SCCT	3.6	8.9	11.1	11.8	12.8
DR	1.5	2.1	2.3	2.5	2.8
🟥 Storage	5.2	18.3	37.0	48.7	58.1
🟨 Net-Meter	4.5	7.6	9.5	11.1	12.8
🟧 Solar	19.0	59.4	85.8	111.5	125.4
🟩 Wind	11.9	39.8	54.2	67.5	83.2
⬜ Geothermal	0.7	2.5	4.1	6.2	8.9
🟧 Biomass	0.1	0.3	0.5	0.7	0.8
🟦 Hydro	1.3	1.5	1.8	2.1	2.5

Draft Forecast

U.S. West Resource Type Forecast

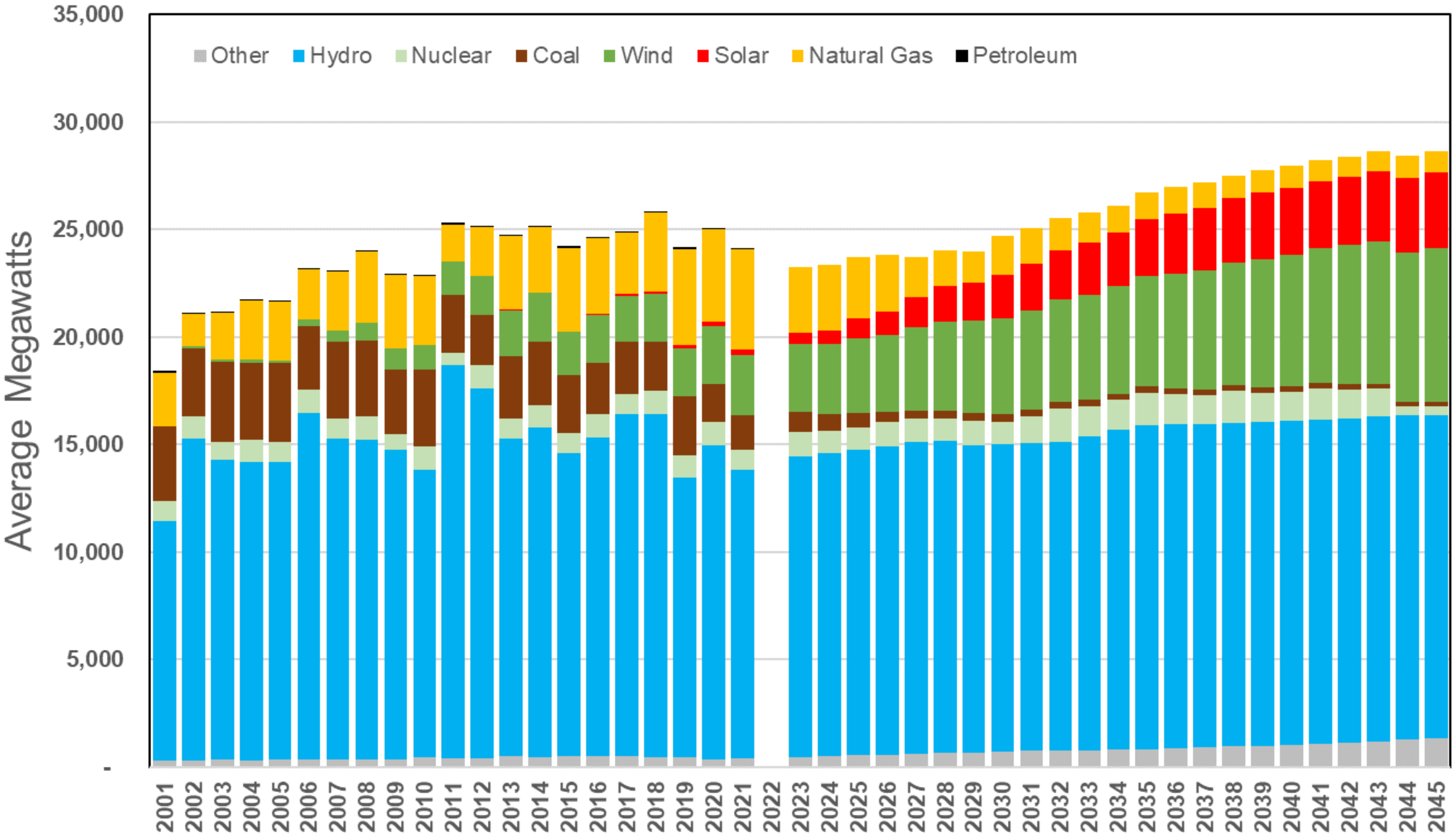


Significant changes 2045 to 2023 (aGW)

Solar:	+ 18.4
Wind:	+ 16.0
Nat Gas:	- 2.4
Coal:	- 13.6
Nuclear:	- 3.9
Other:	+ 5.7
Total:	+ 20.2

Draft Forecast

Northwest Resource Type Forecast

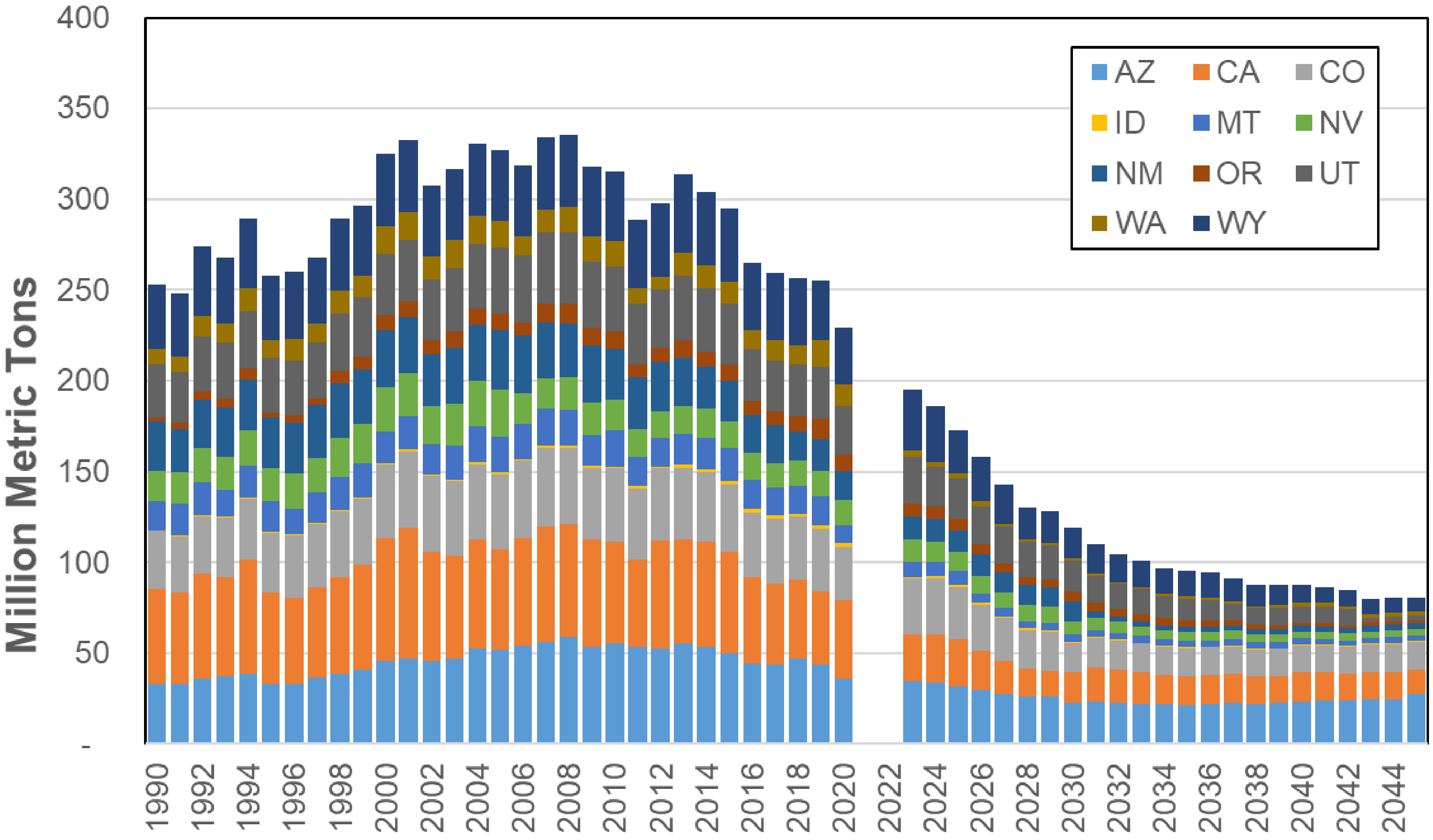


Significant changes (aGW)
2045 to 2023

Solar: + 3.0
Wind: + 4.0
Nat Gas: - 2.1
Coal: - 0.7
Other: + 0.2
Nuclear: - 0.8
Total: + 5.4

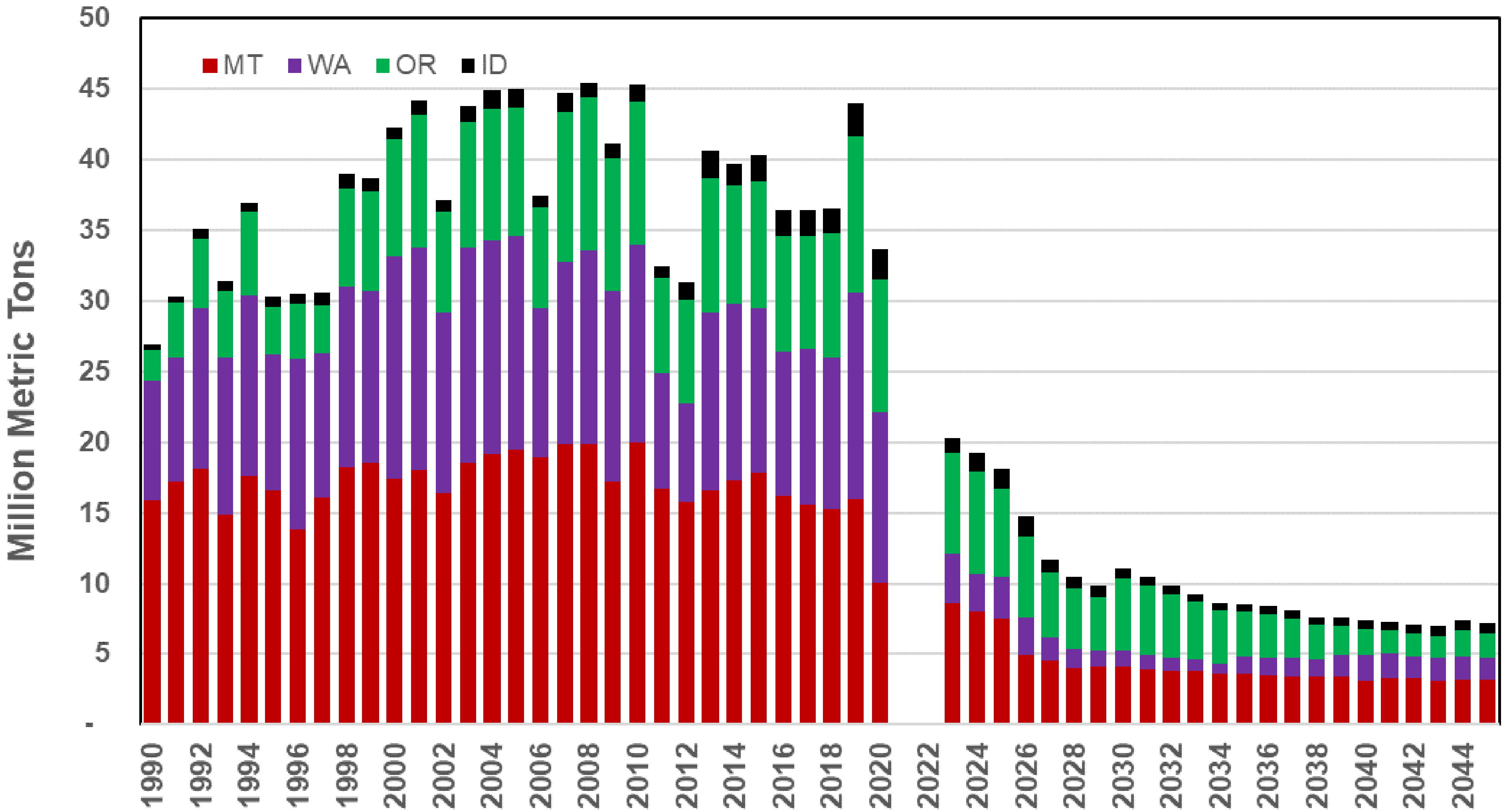
Greenhouse Gas Forecast
U.S. Western Interconnect

Draft Forecast



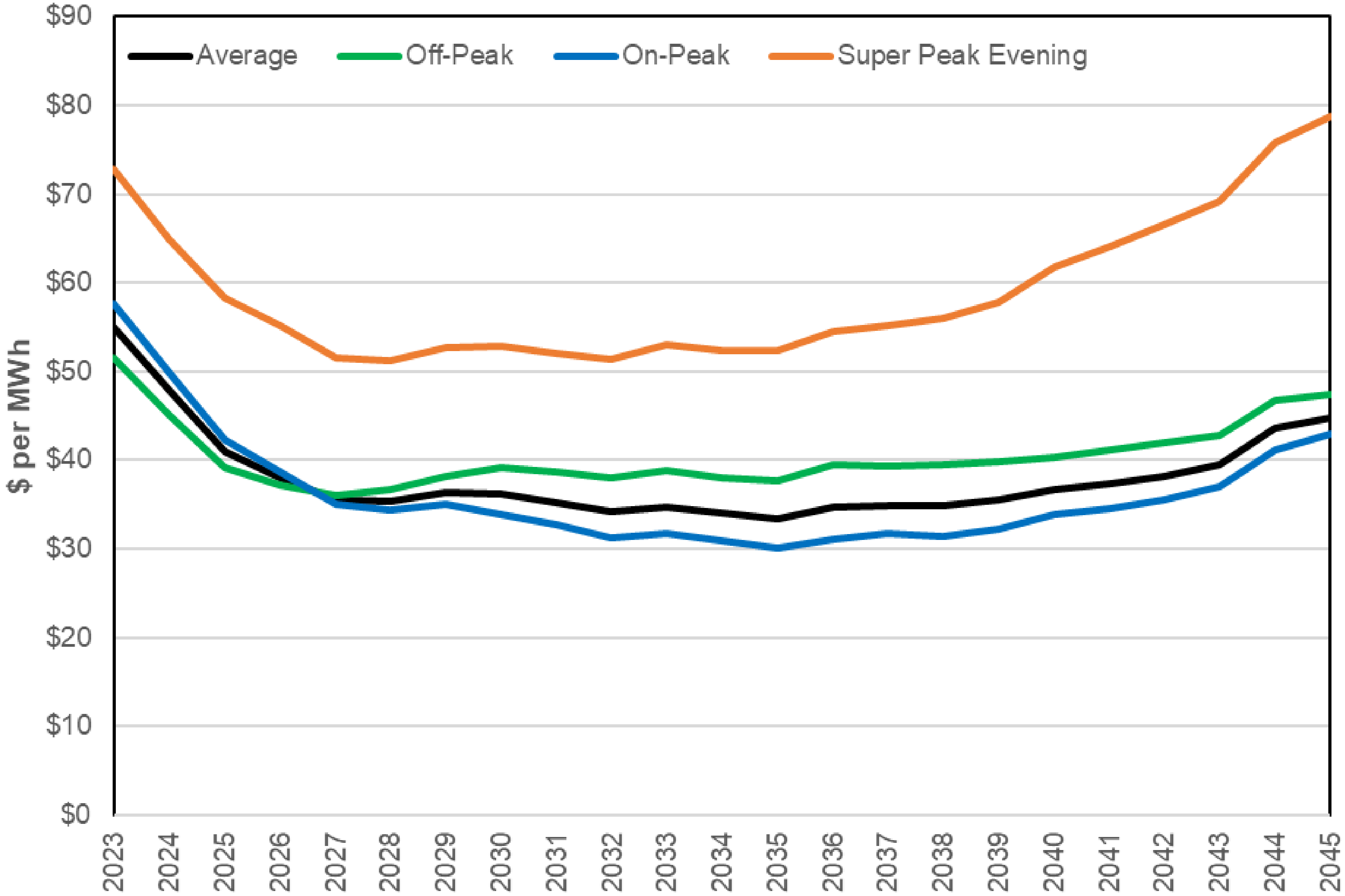
Greenhouse Gas Forecast
Northwest States

Draft Forecast



Draft forecast

Mid-C Electric Price Forecast

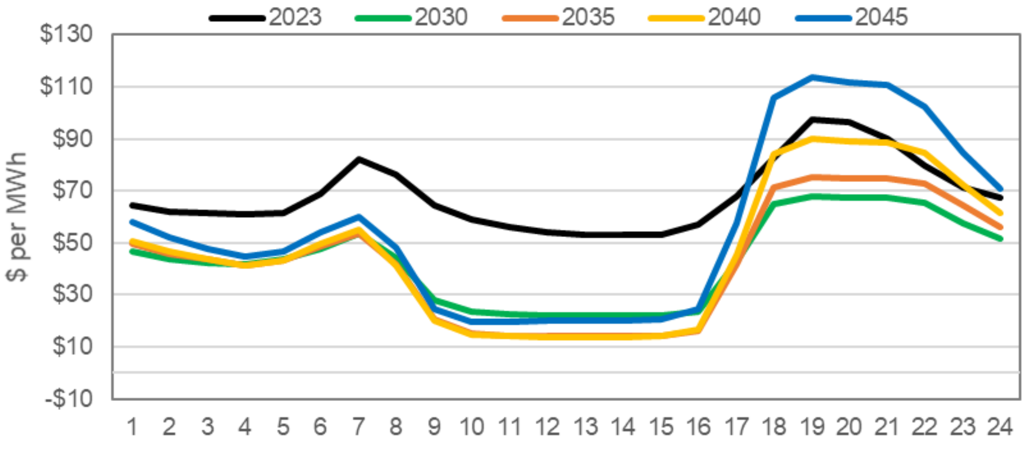


- Levelized Price:
  - 2023-45: $38.16/MWh
- Off-peak prices overtake on-peak in 2027 on an annual basis
- Super peak evening (4pm-10pm) prices remain high

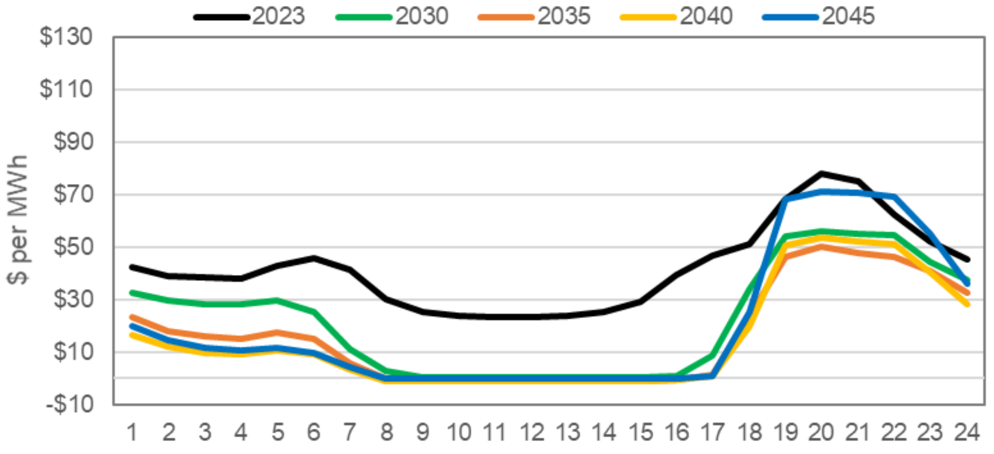
Draft Forecast

Hourly Wholesale Mid-C Electric Price Shapes

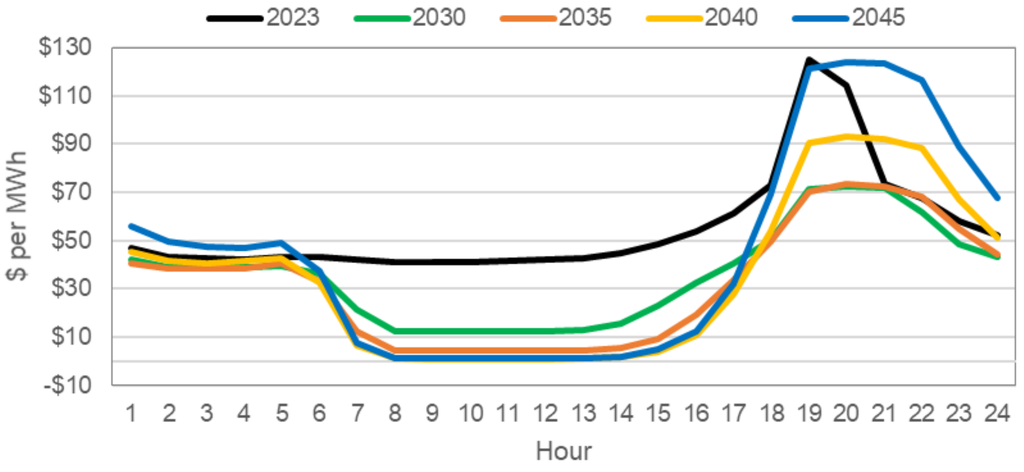
Winter: Dec 16 - Mar 15



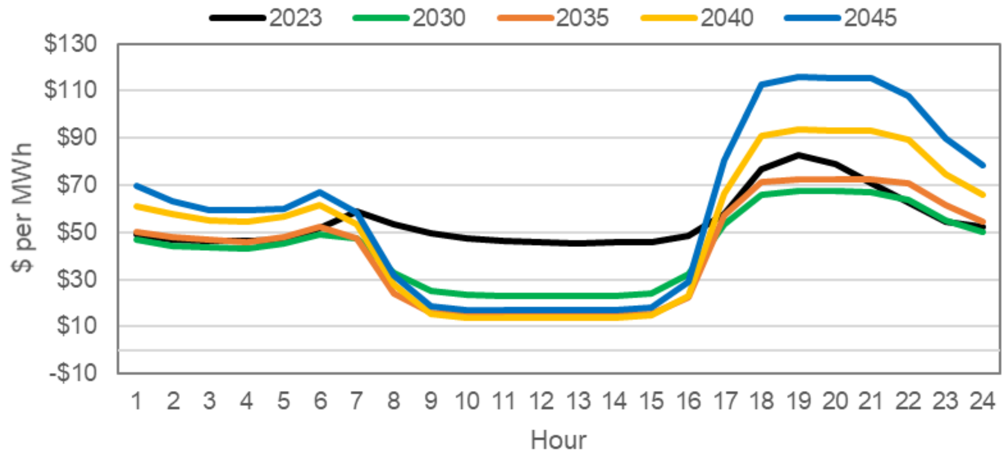
Spring: Mar 16 - Jun 15



Summer: Jun 16 - Sep 15



Fall: Sep 16 - Dec 15



Data Availability

Outputs

- Expected Case: annual Mid-C prices by iteration
- Expected Case: hourly Mid-C prices
- Regional resource dispatch
- Regional GHG emissions

WESTERN RESOURCE ADEQUACY PROGRAM

Review of preliminary, non-binding WRAP regional data for the current participating footprint

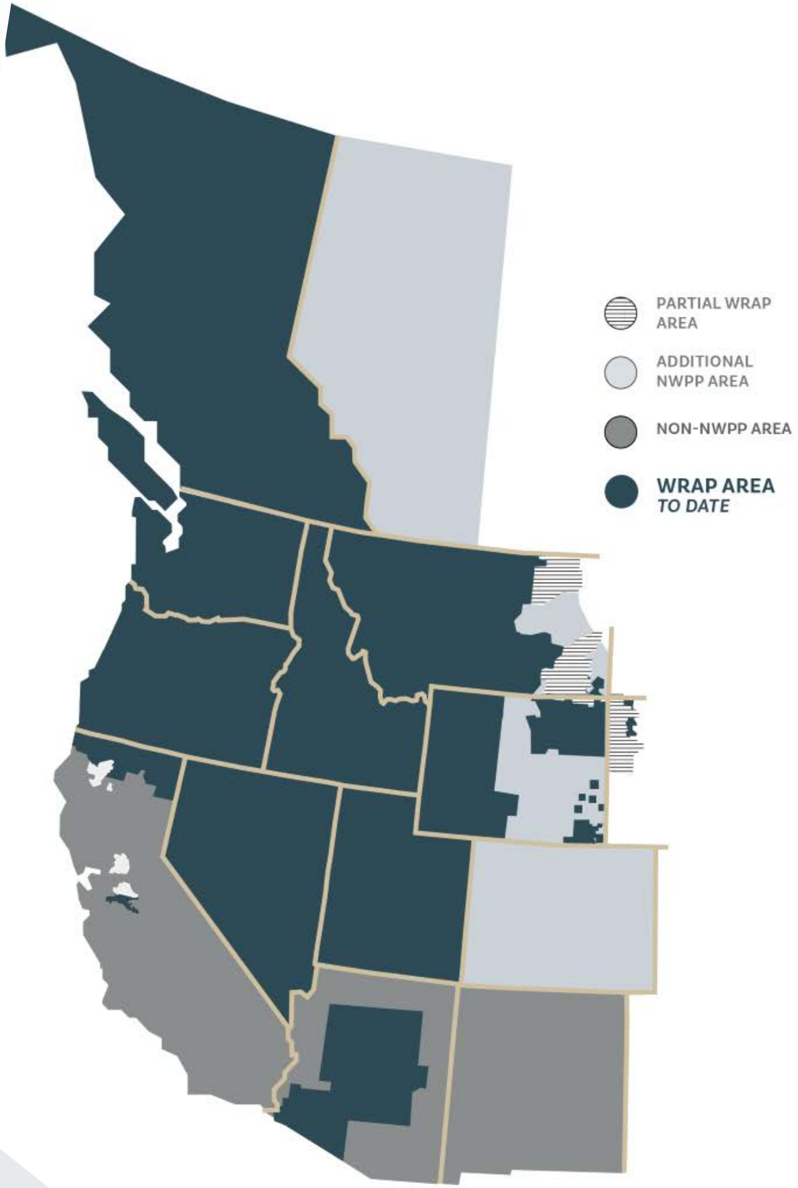
Avista IRP TAC Meeting

October 11, 2022

Link to public webinar

OVERVIEW

- *Reliability first!* Implementing a west-wide resource adequacy program must be a priority for the region as the regions resource mix changes
- Currently 26 utilities are participating in the WRAP non-binding program phase
- Western Power Pool is the Program Administrator and filed a tariff with FERC seeking program approval by the end of the year
- Southwest Power Pool is the Program Operator and performed all modeling and data analysis



TODAY'S OBJECTIVES

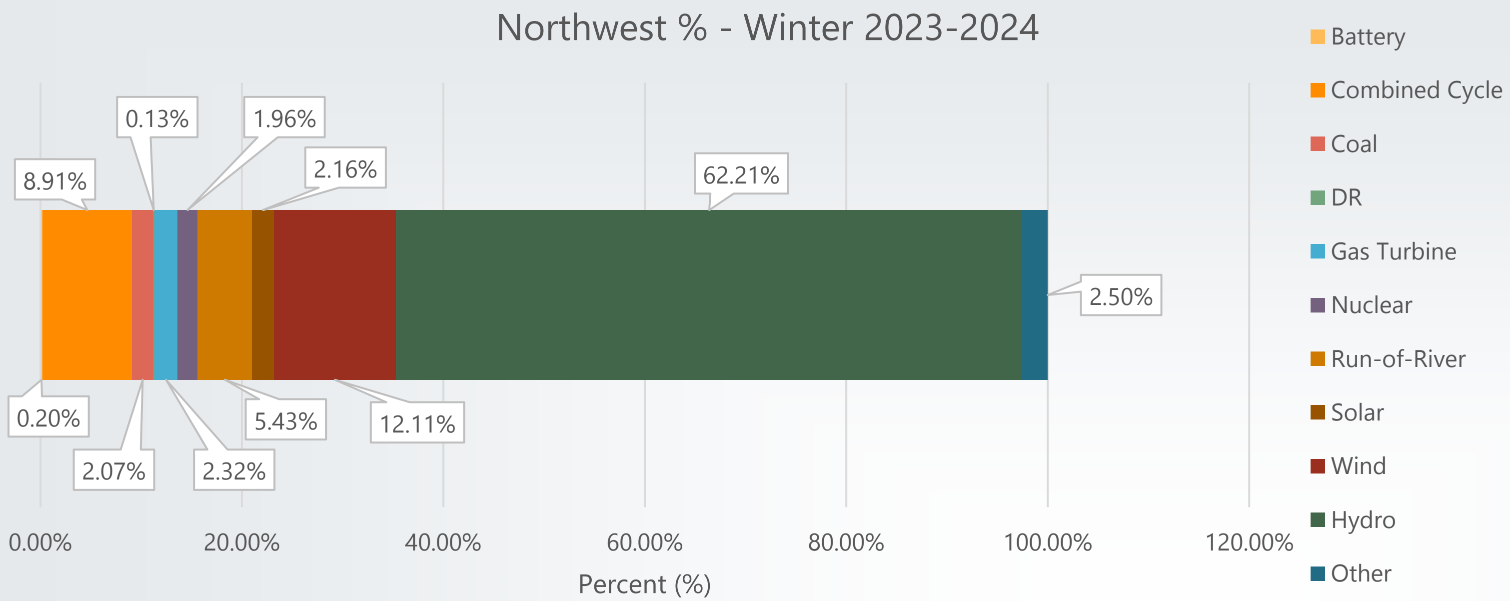
- Provide an overview of the loads and resources in the WRAP MW footprint
- Provide and overview of installations and nameplate for wind and solar
- Provide an overview of the QCC and ELCC values for each resource class
- Provide an overview of Planning Reserve Margin values (PRM)

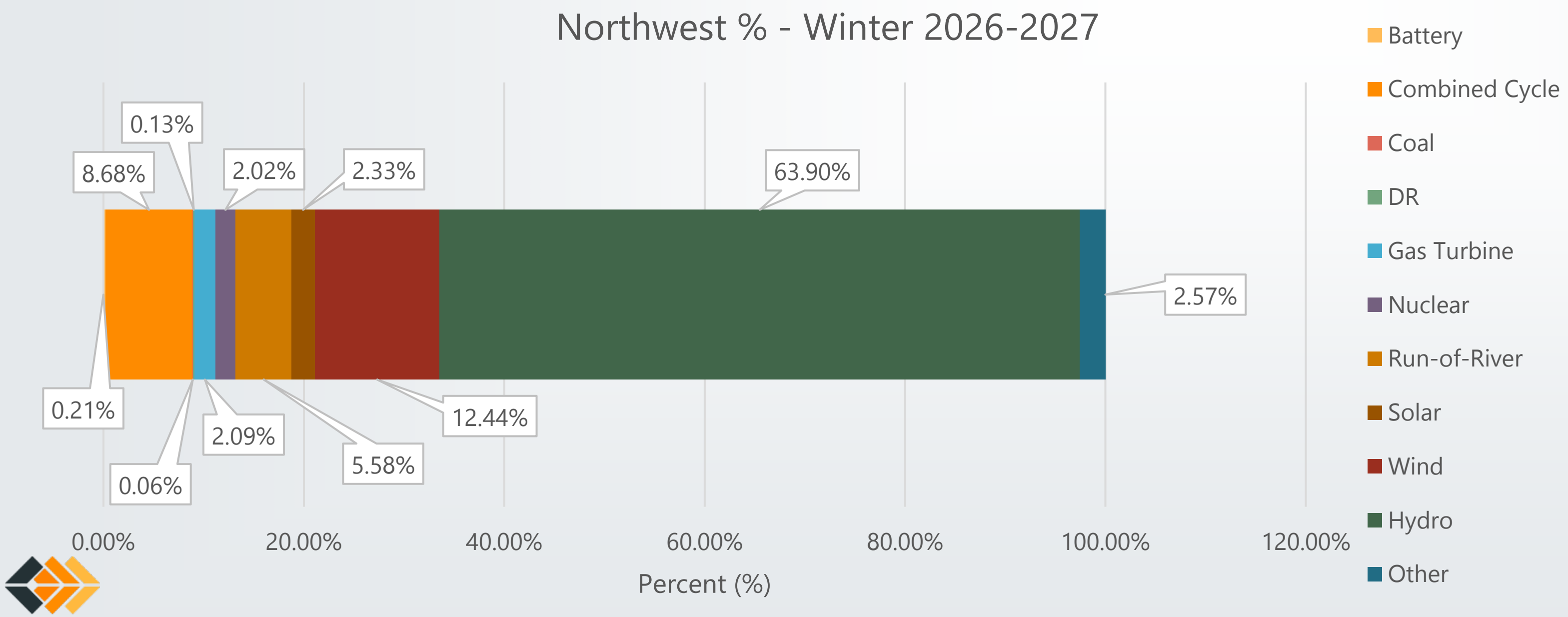
BEFORE WE BEGIN

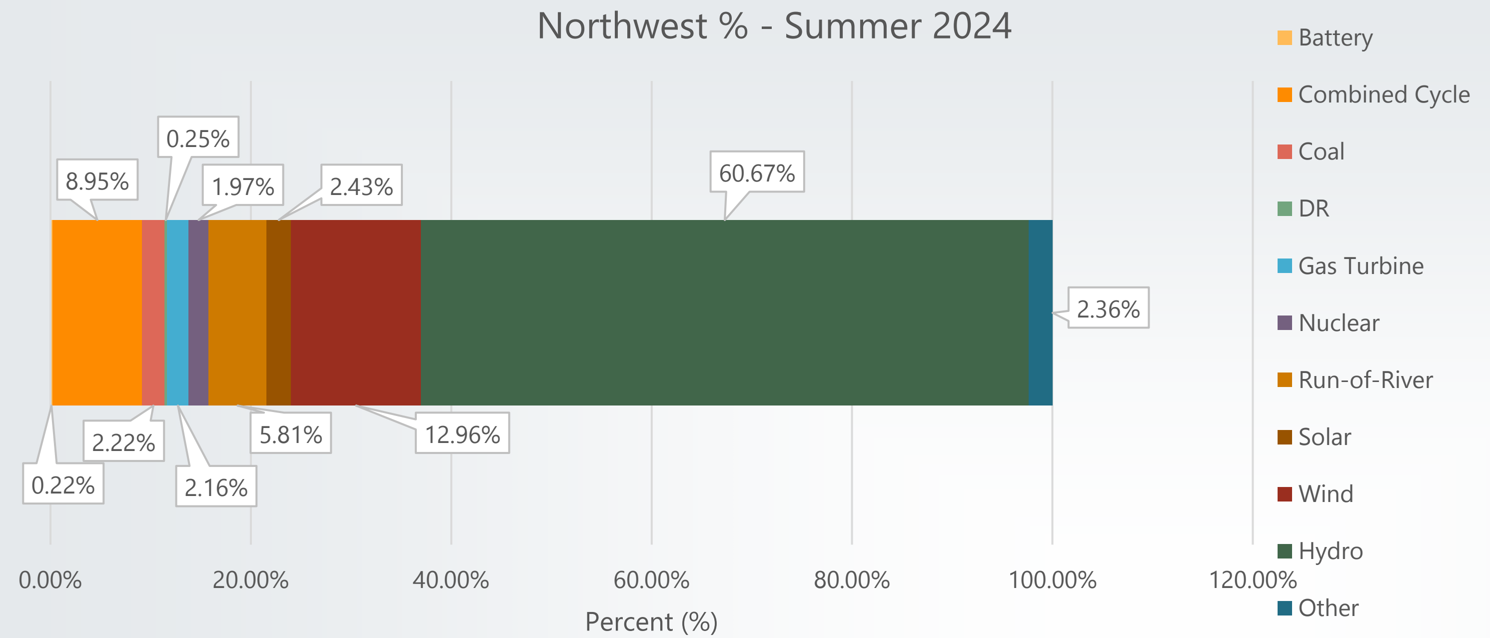
- Modeling provided utilizes WRAP program design, assuming full binding implementation of the WRAP as designed
  - Metrics assume diversity benefit and a level of forward procurement on aggregate that is not presently expected without implementation of the WRAP
- Modeling was performed based on the current footprint of participants
  - Changes to WRAP participation in future phases will impact these metrics
  - These assessments cannot account for adequacy needs or activities of non-participating load or resources
- Be aware of the limits of drawing regional conclusions from aggregate information
  - Information is best applied at individual LREs; WRAP's scope does not include matching LREs in need of additional forward procurement with available resources
  - It cannot be assumed that all resources modeled in the loss of load expectation study will be available to the WRAP footprint

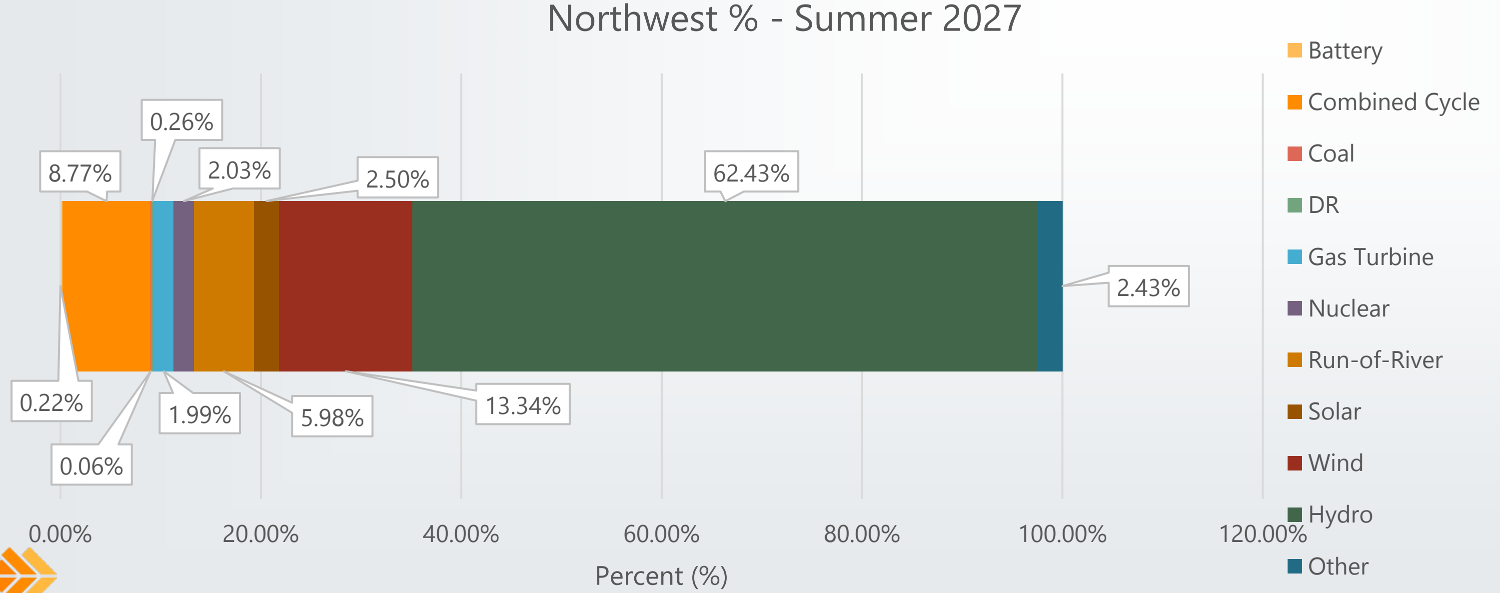
NORTHWEST WINTERS

Percentage






Northwest % - Summer 2024

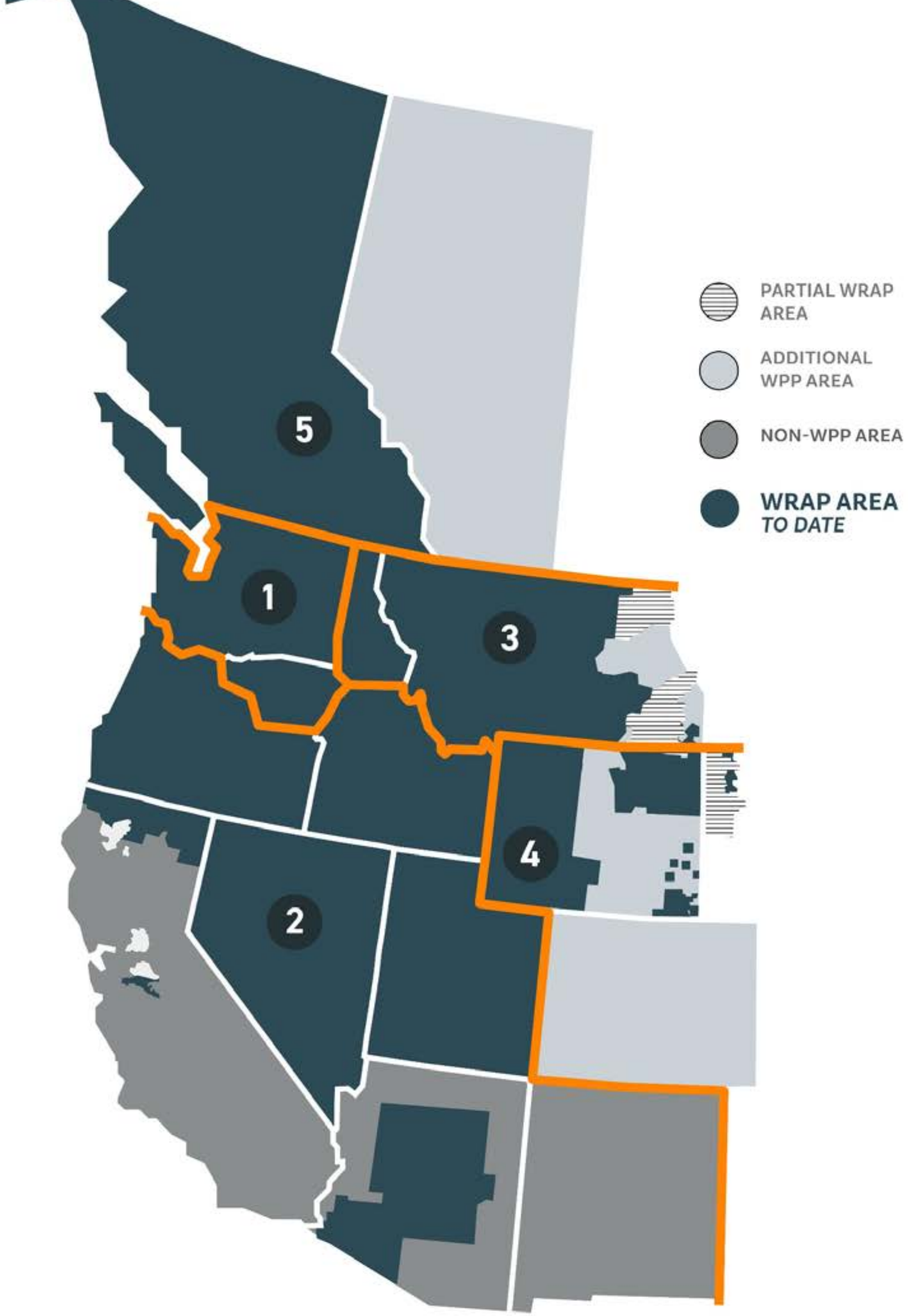

Northwest % - Summer 2027

NORTHWEST SUMMERS

Percentage

KEY REMINDERS

- Not all resources shown in the preceding slides can be assumed to be available to the WRAP footprint for resource adequacy purposes
  - Planned outages are not considered; they will be managed by LREs from their surplus
  - Does not account for activities and needs of neighboring, non-participating regions or entities
  - Based on information and projections provided by participants
- Aggregate information does not give insight into whether individual participants have enough supply
  - WRAP motivates participants to acquire the necessary capacity
  - Cannot assume this has yet happened or will happen without binding implementation of WRAP



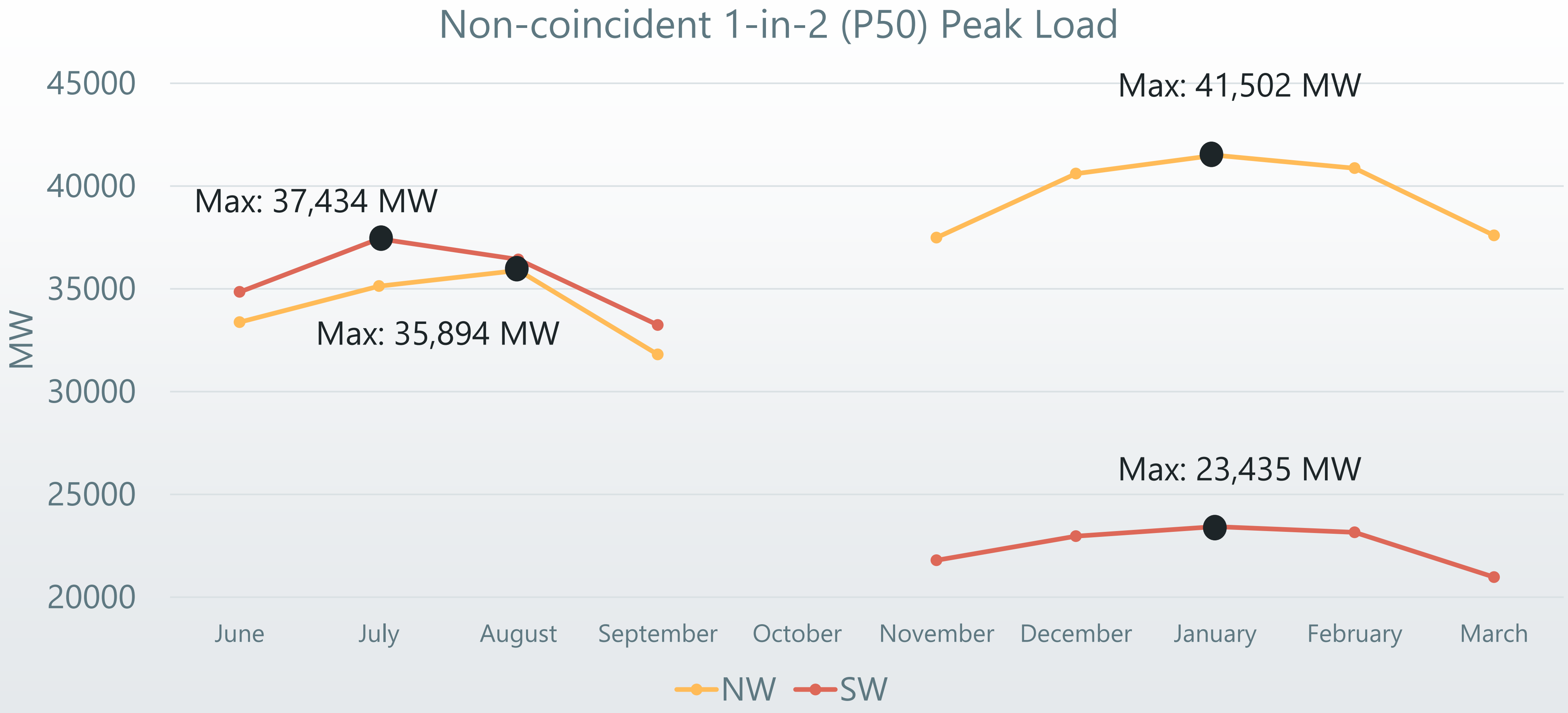
WIND ZONES

Zone	# of Plants	Nameplate Capacity (MW)
Wind VER1	54	5,734
Wind VER2	44	2,400
Wind VER3	23	1,378
Wind VER4	24	2,429
Wind VER5	Aggregate	747
Total	**146**	**12,688**

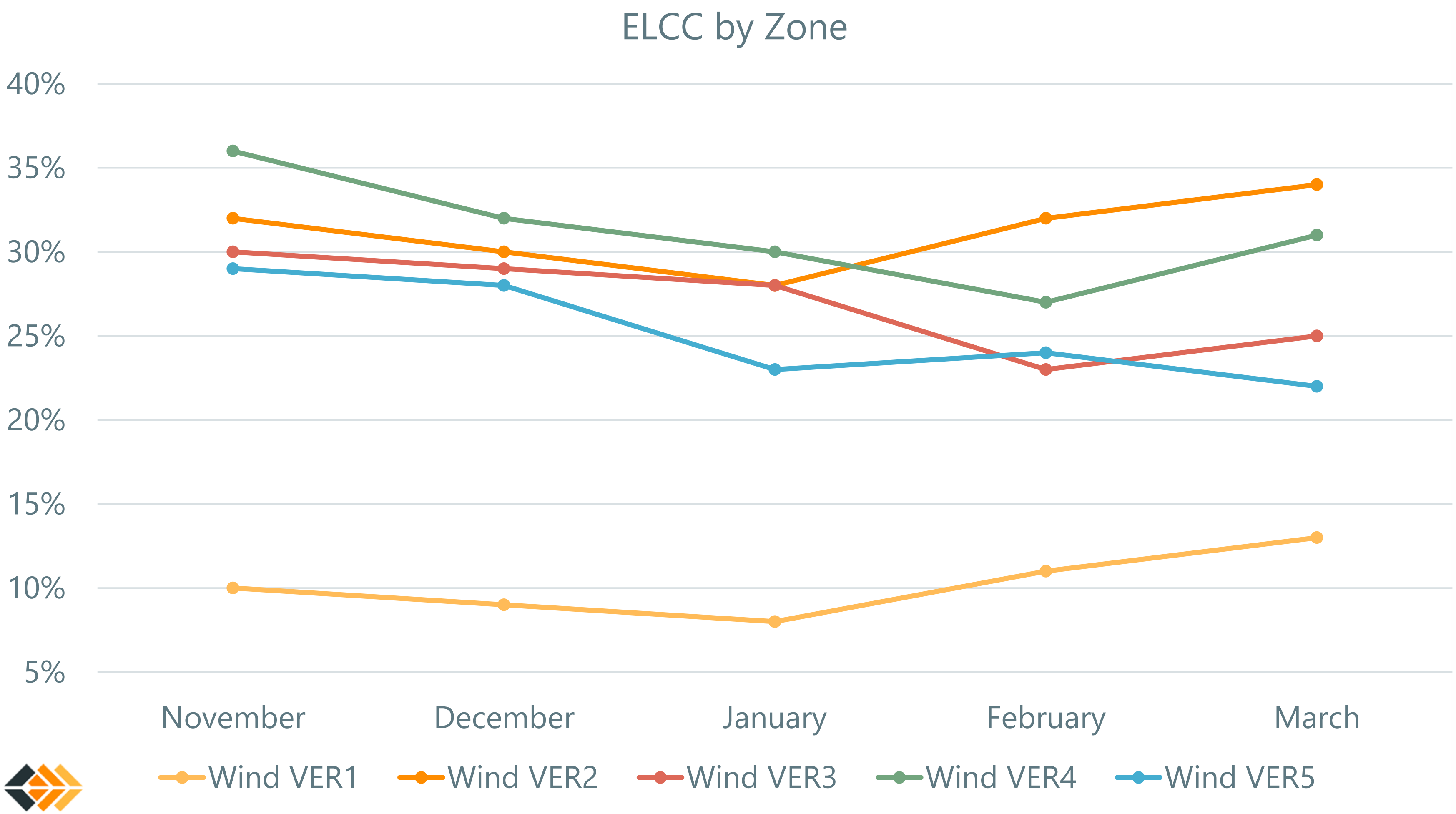
SOLAR ZONES

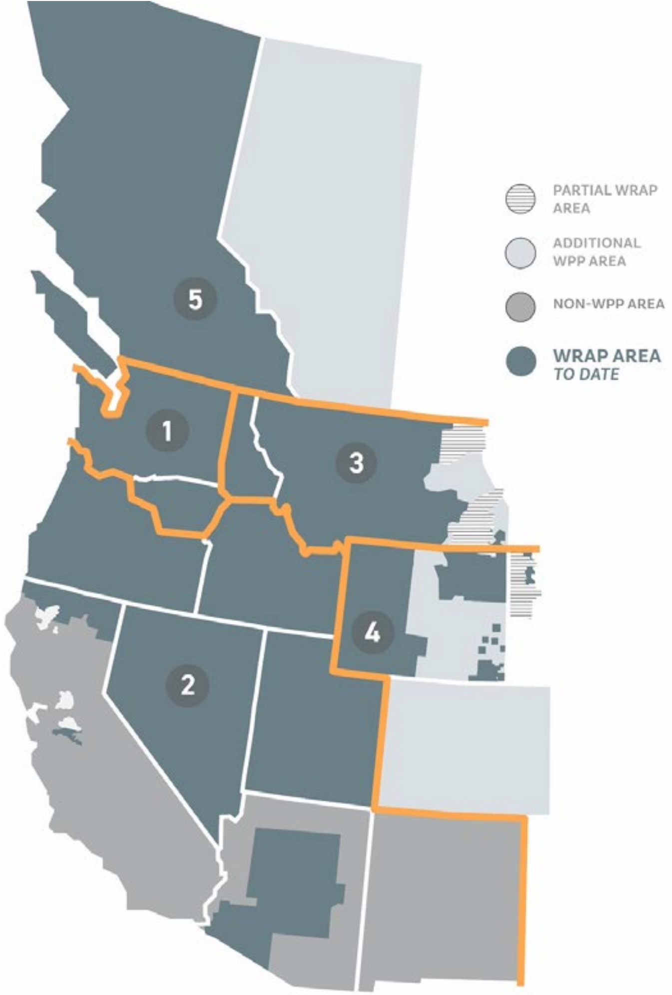
Zone	# of Plants	Nameplate Capacity (MW)
Solar VER1	159	2,138
Solar VER2	108	9,024
Total	**267**	**11,162**

PEAK LOAD

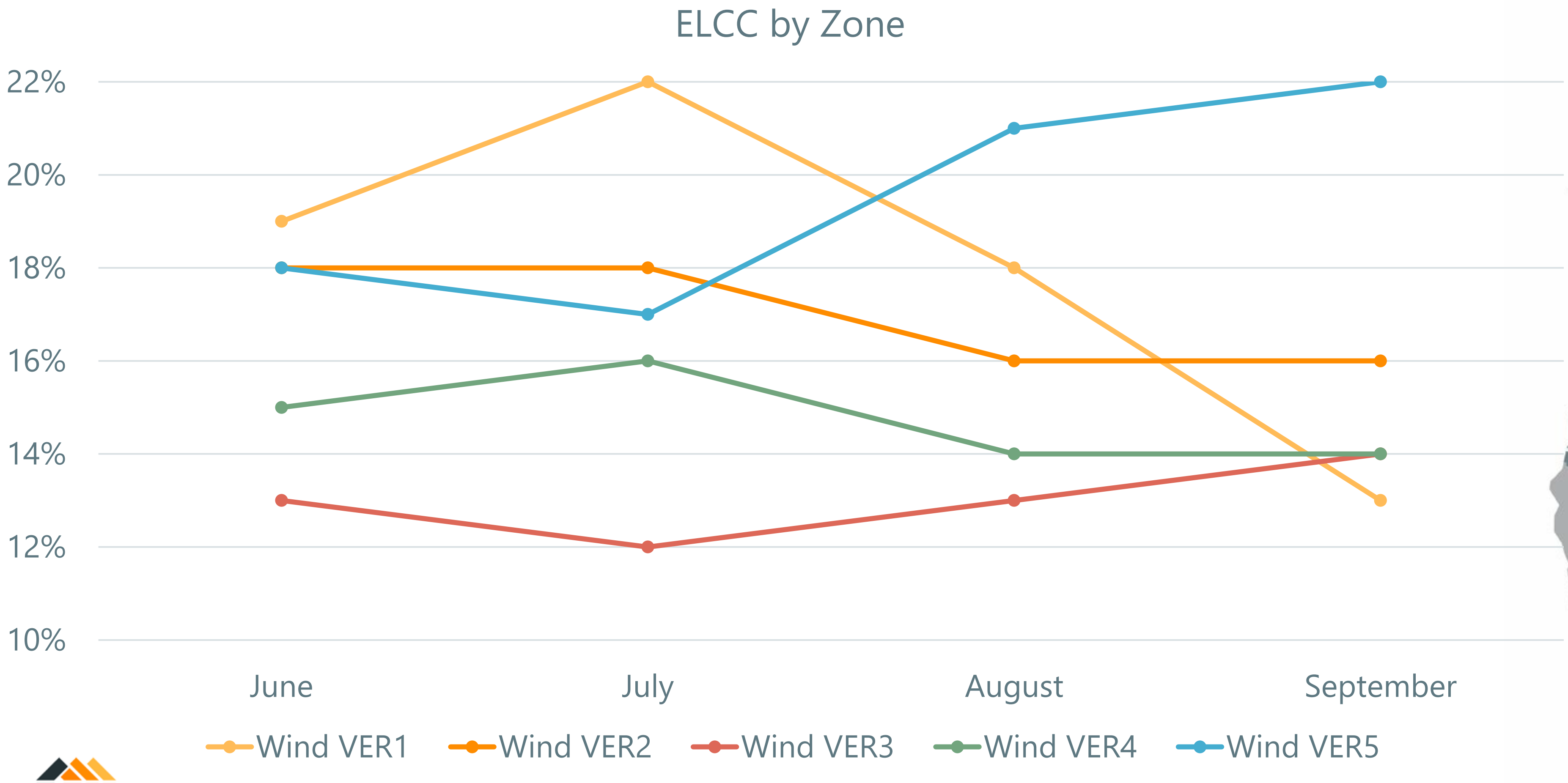

Non-coincident 1-in-2 (P50) Peak Load
MW
45000
40000
35000
30000
25000
20000
Max: 37,434 MW
Max: 35,894 MW
Max: 41,502 MW
Max: 23,435 MW
June
July
August
September
October
November
December
January
February
March
NW
SW

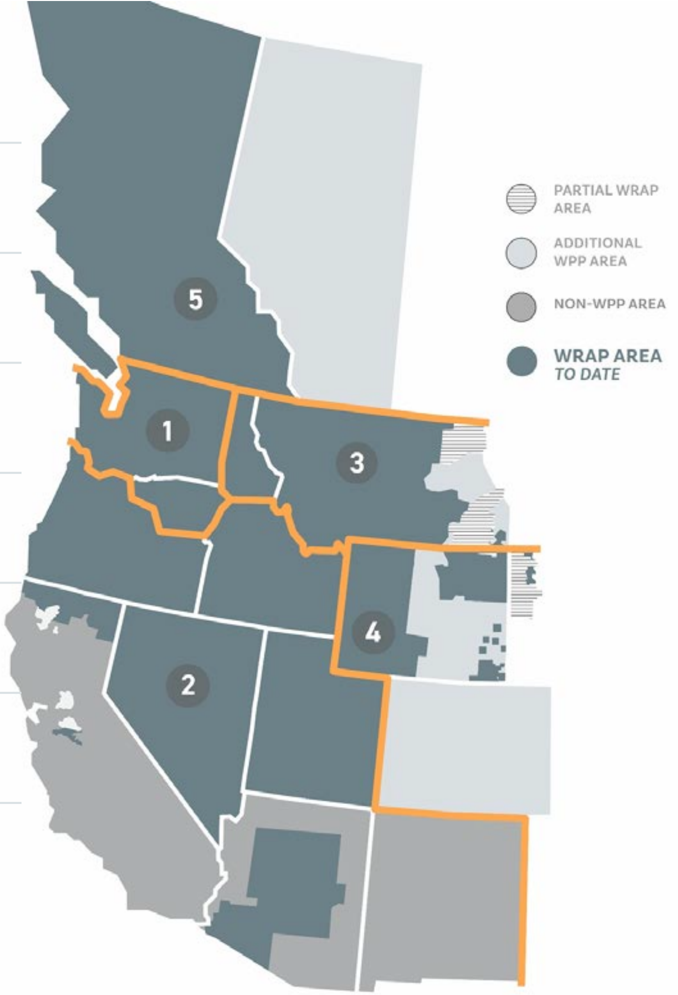
WIND ELCC - WINTER





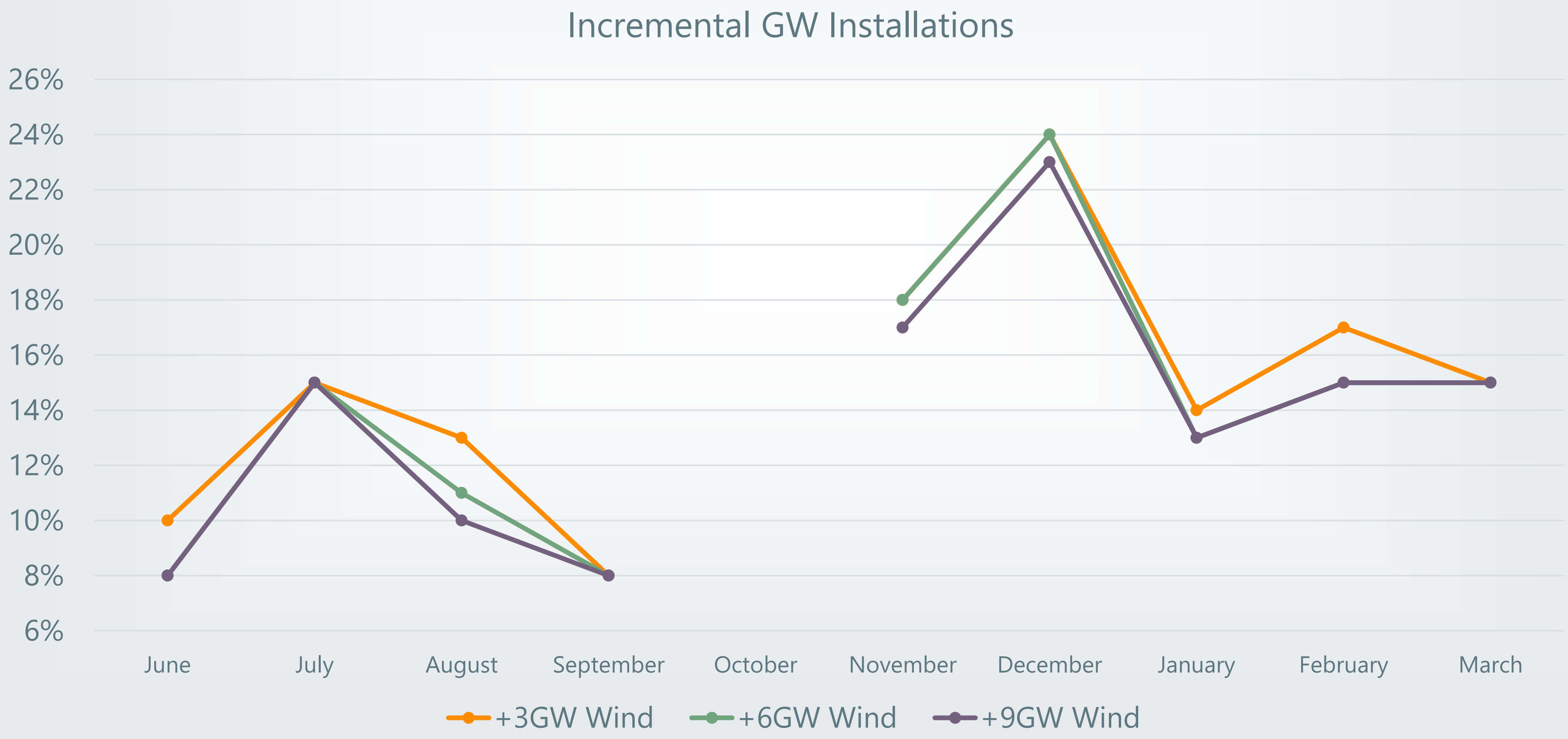
WIND ELCC - SUMMER



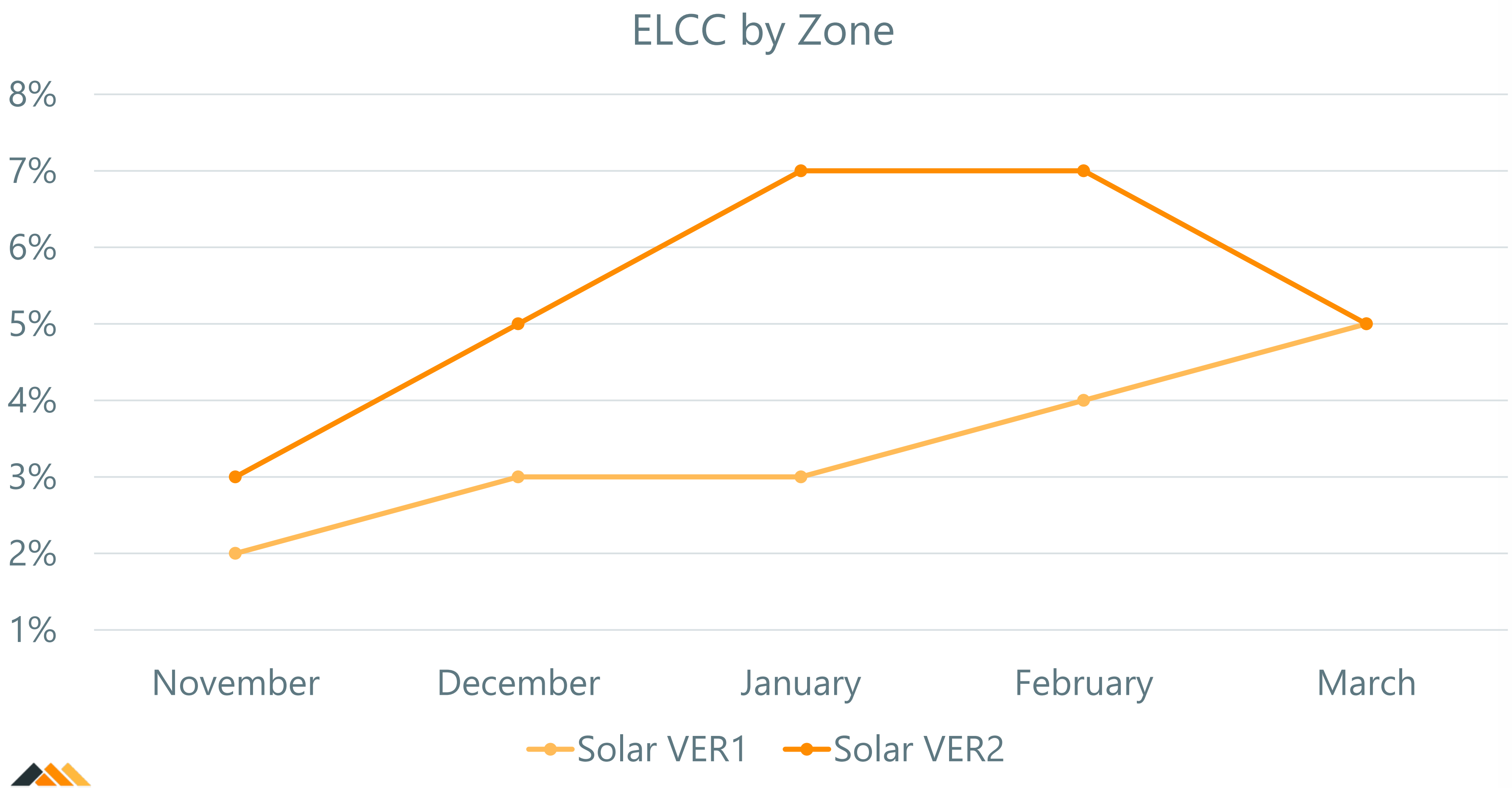


WIND ELCC –

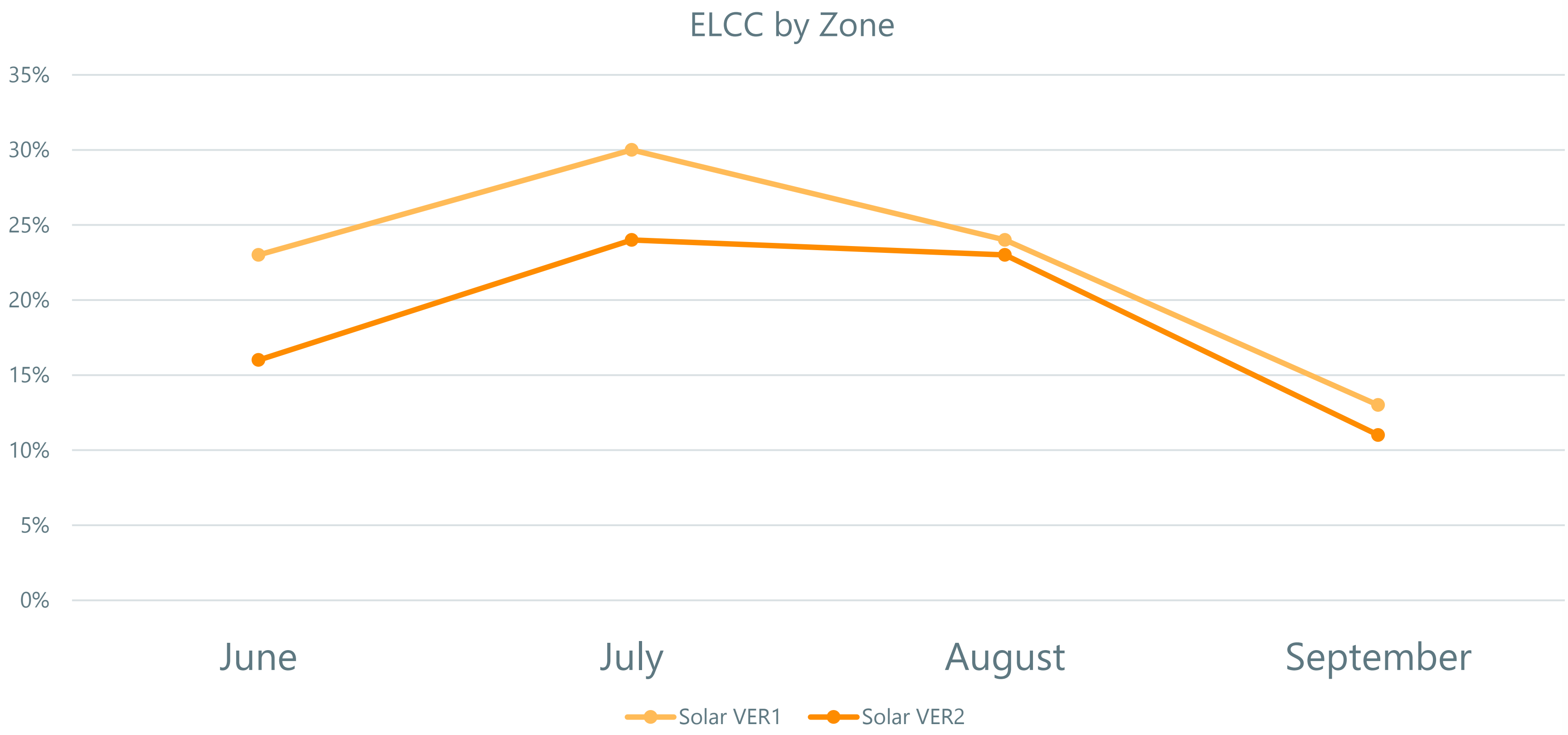
WIND AT INCREMENTAL GW INSTALLATIONS



SOLAR ELCC - WINTER

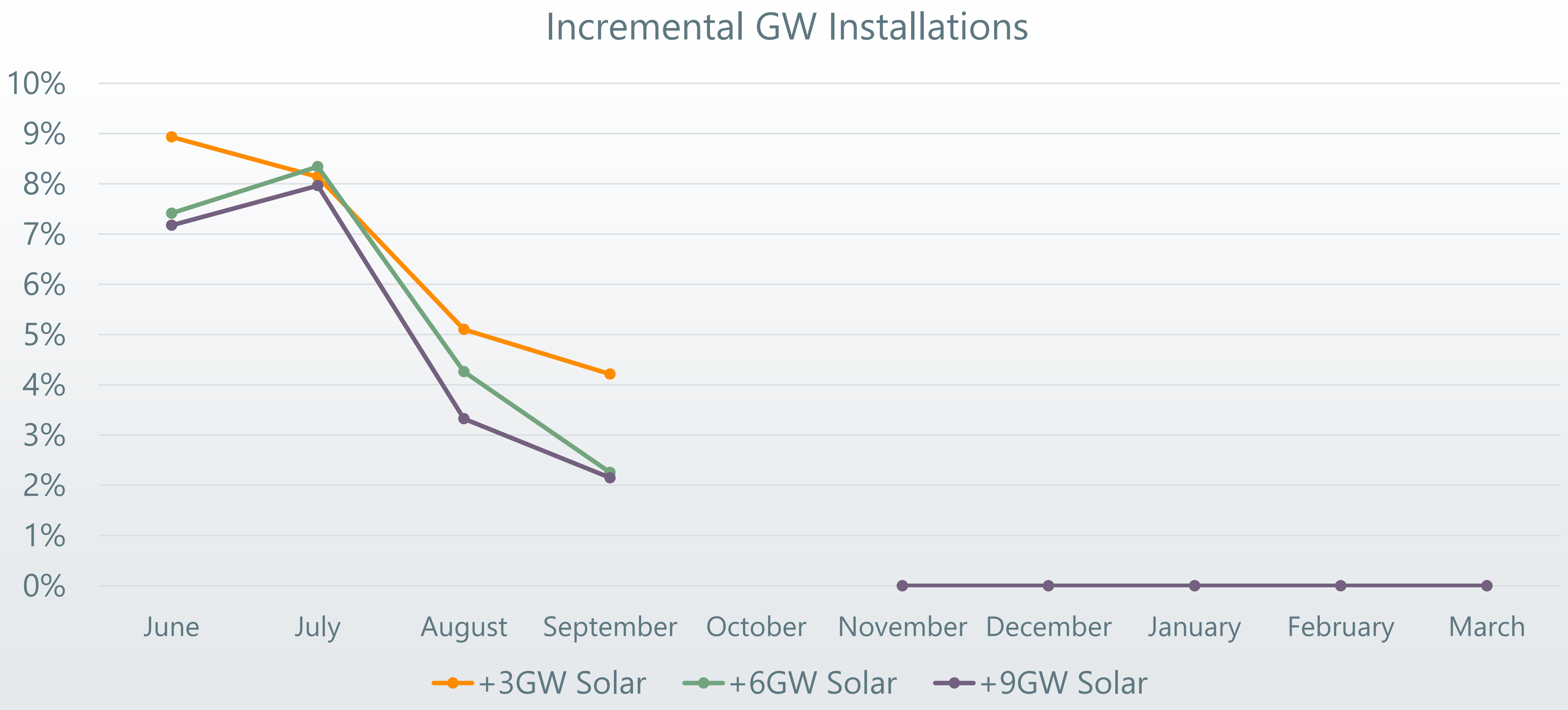


SOLAR ELCC - SUMMER



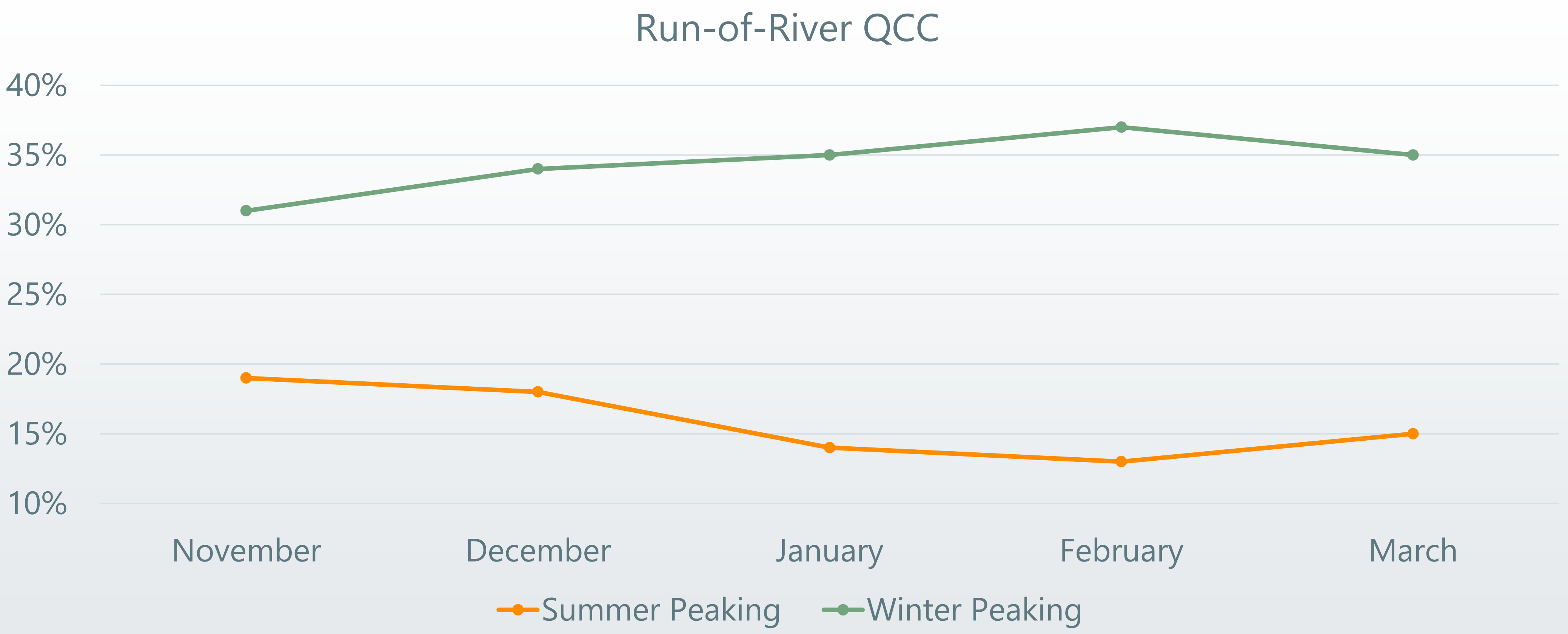
WRAP
POWERED BY WPP

SOLAR ELCC –
SOLAR AT INCREMENTAL GW INSTALLATIONS



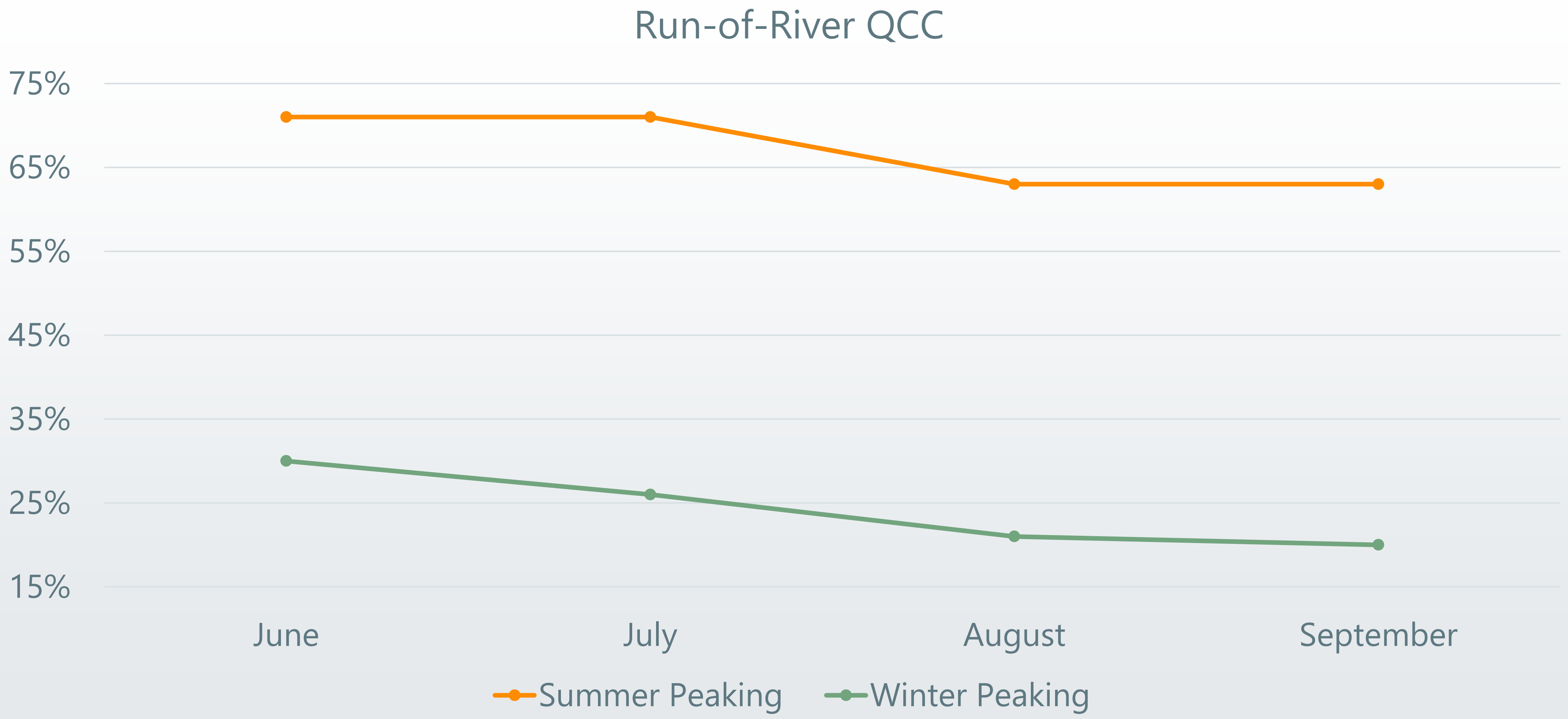
RUN-OF-RIVER QCC

WINTER

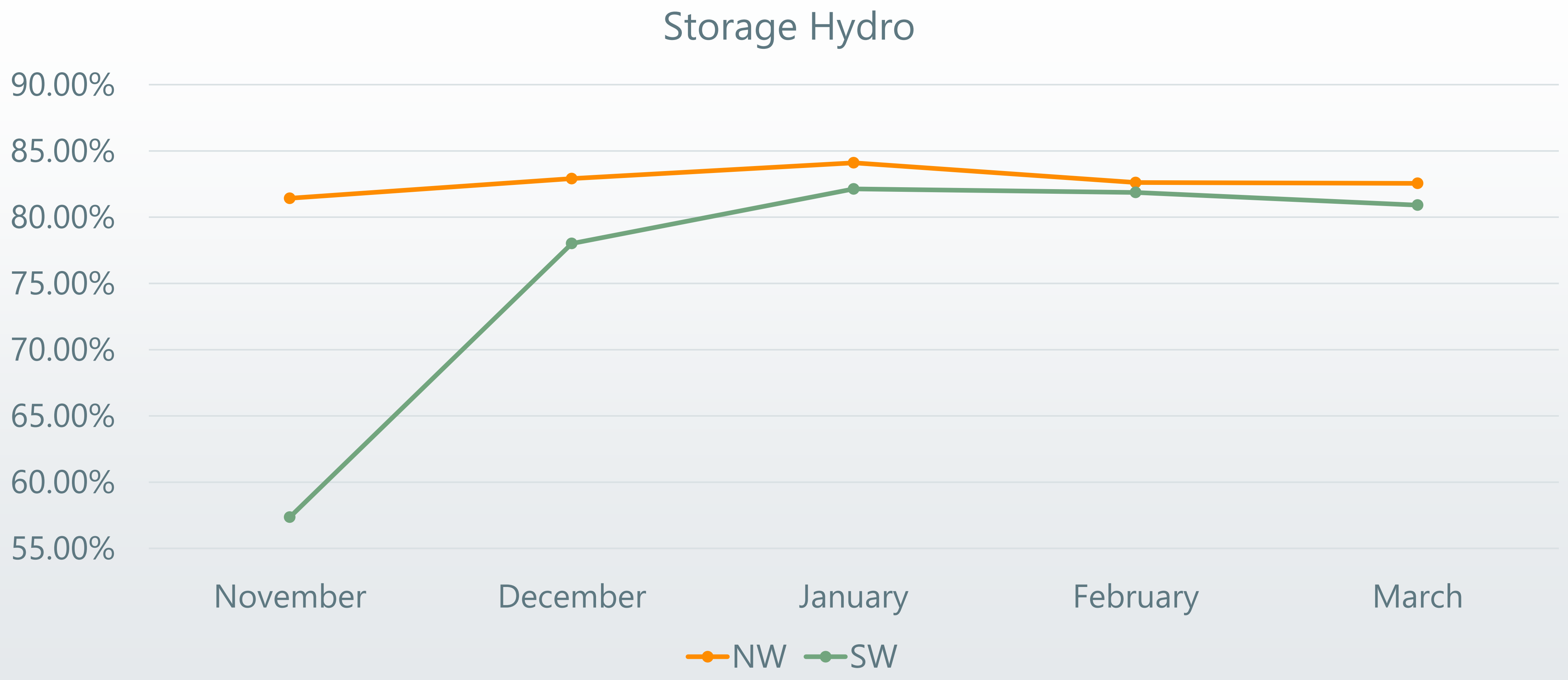


RUN-OF-RIVER QCC

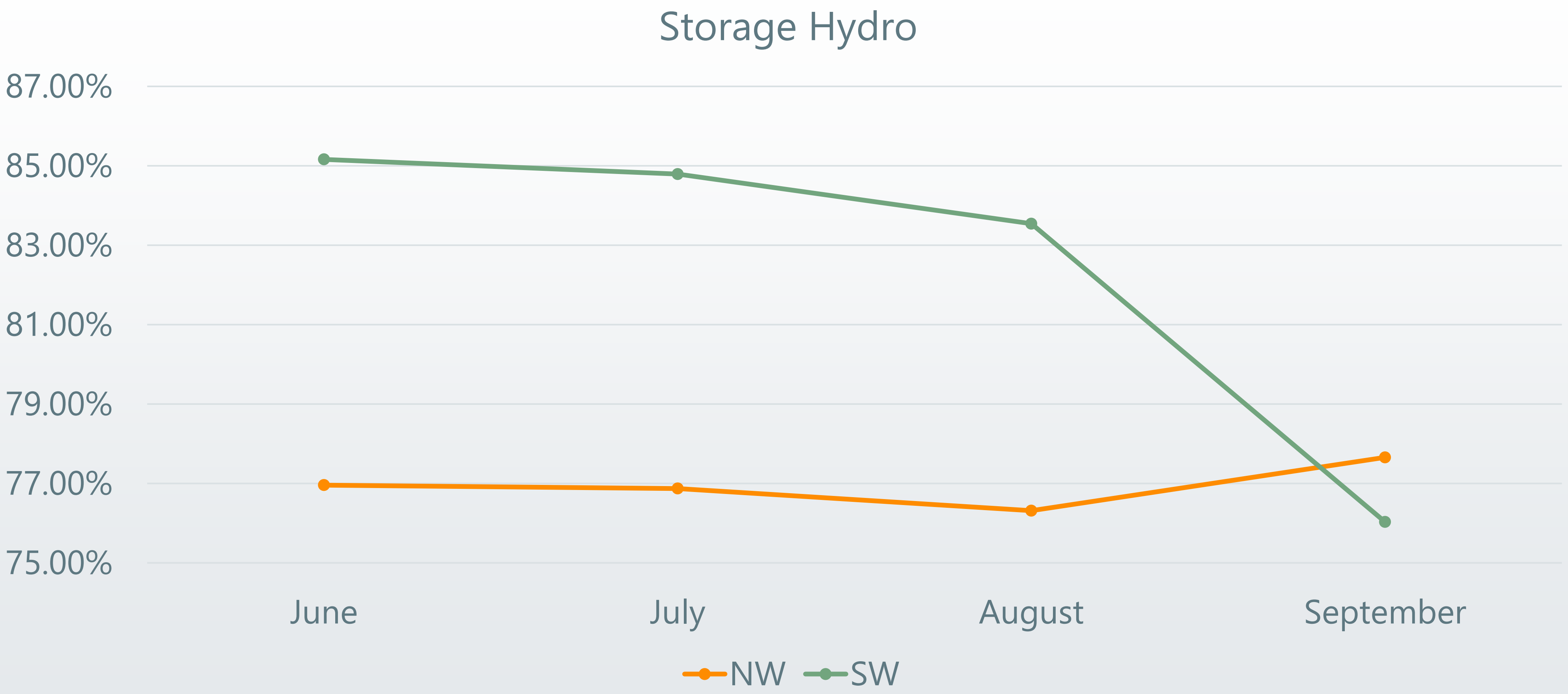
SUMMER



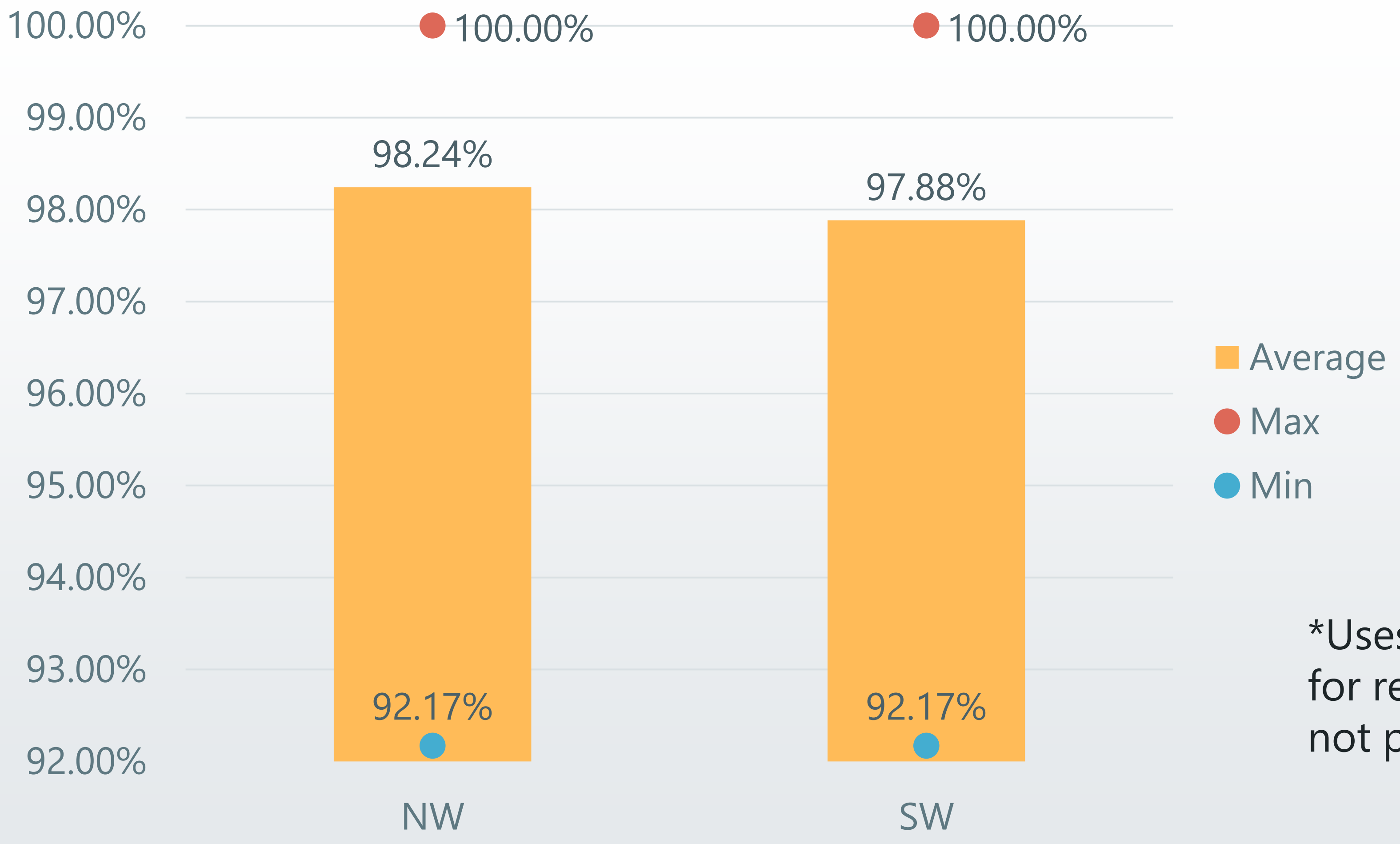
STORAGE HYDRO QCC - WINTER



STORAGE HYDRO QCC - SUMMER

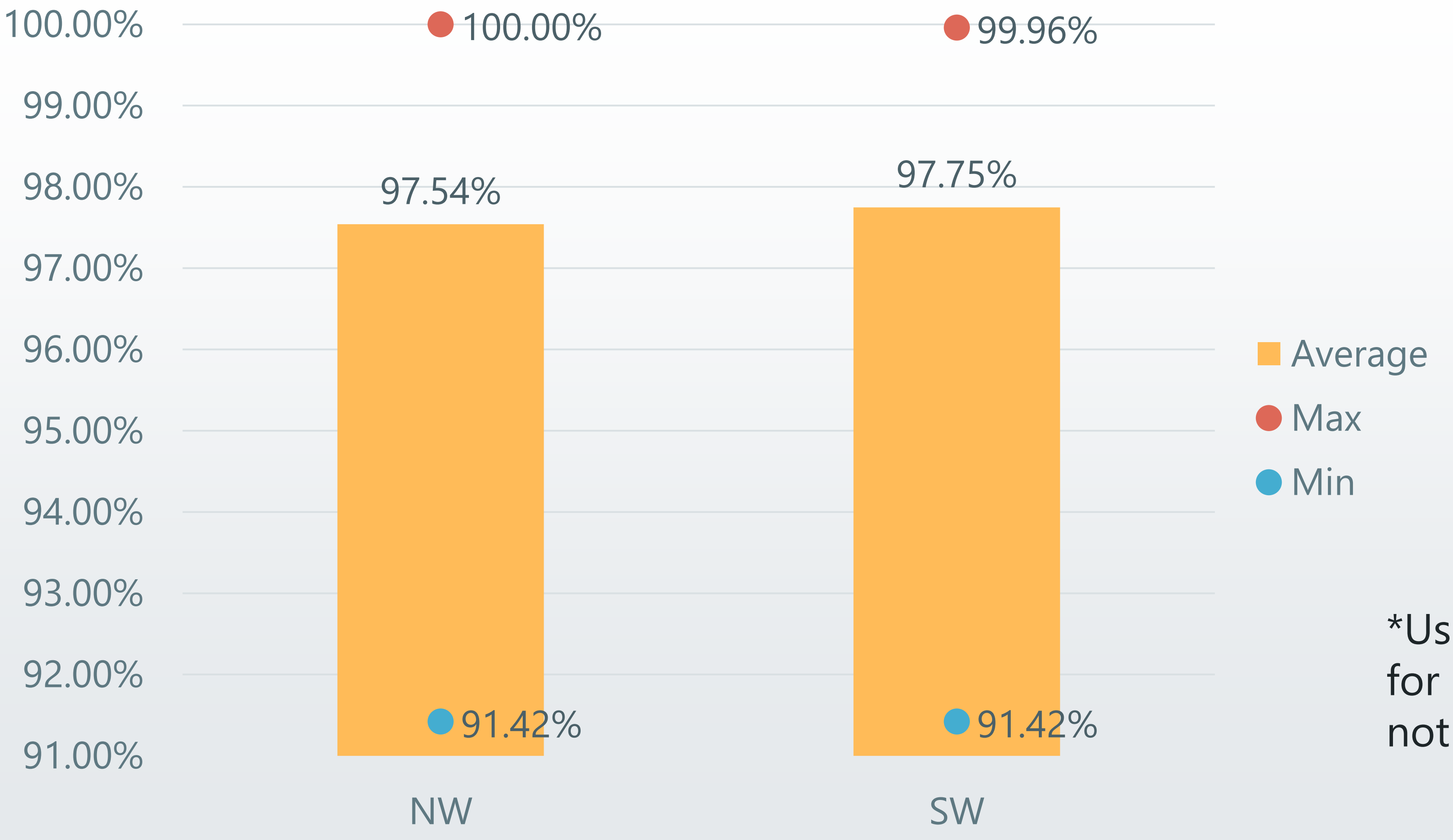


THERMAL QCC- WINTER



*Uses indicative values for resources that did not provide GADS data

THERMAL QCC- SUMMER

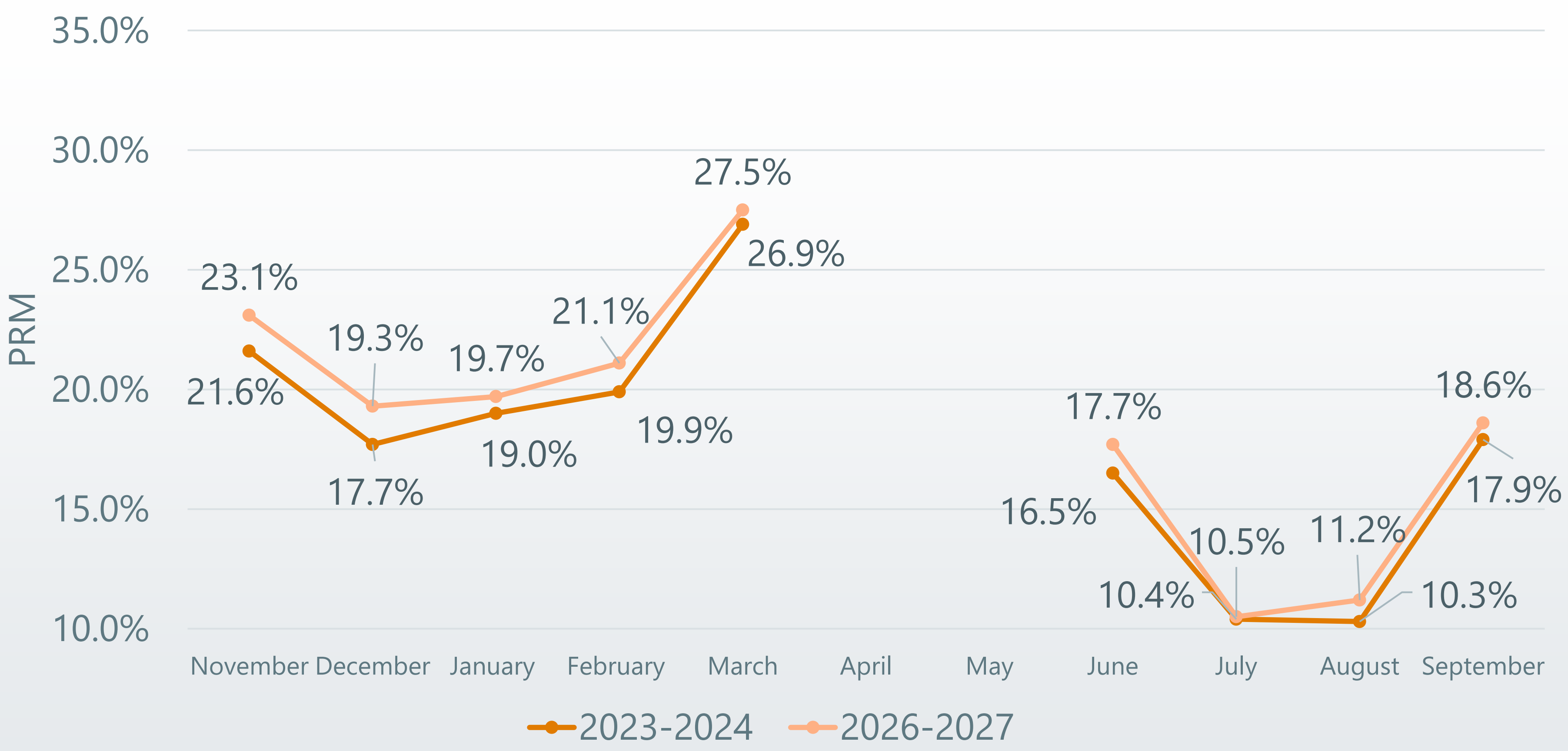


*Uses indicative values for resources that did not provide GADS data

PRM CONSIDERATIONS

- Attempting to maintain 0.1 LOLE across the season
- Allow up to 0.01 LOLE in each individual month
- Non-Coincidental Peak load for a given month is a significant factor in calculation of PRM (lower load months will have higher PRM value)

PRM – NORTHWEST (UCAP)

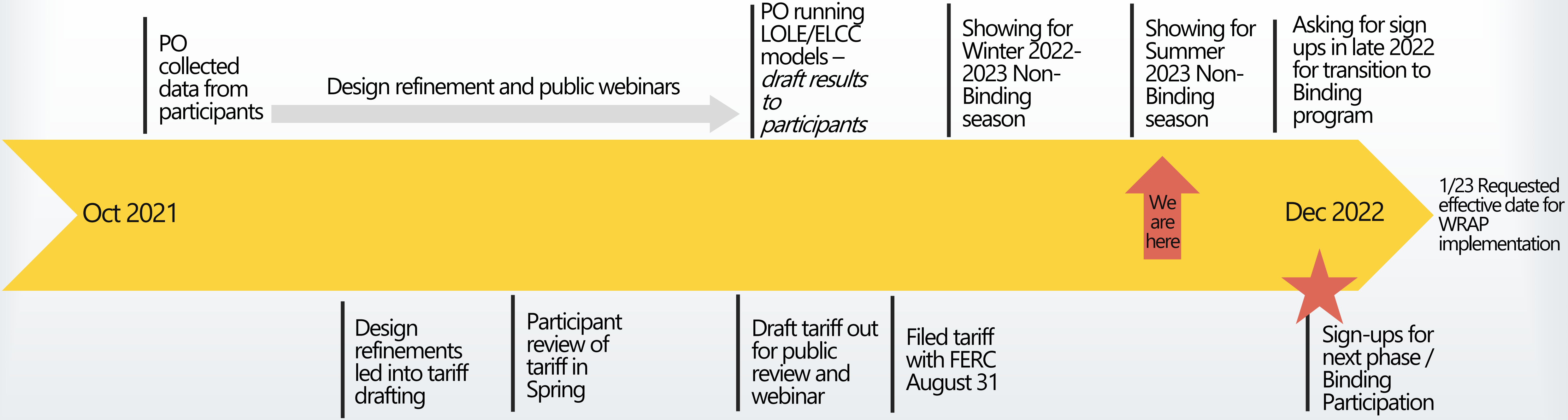


Current Phase Activities

PO = Program Operator

LOLE = Loss of Load Expectation

ELCC = Expected Load Carrying Capacity



PO collected data from participants

Design refinement and public webinars

PO running LOLE/ELCC models – *draft results to participants*

Showing for Winter 2022-2023 Non-Binding season

Showing for Summer 2023 Non-Binding season

Asking for sign ups in late 2022 for transition to Binding program

Oct 2021

We are here

Dec 2022

1/23 Requested effective date for WRAP implementation

Design refinements led into tariff drafting

Participant review of tariff in Spring

Draft tariff out for public review and webinar

Filed tariff with FERC August 31

Sign-ups for next phase / Binding Participation

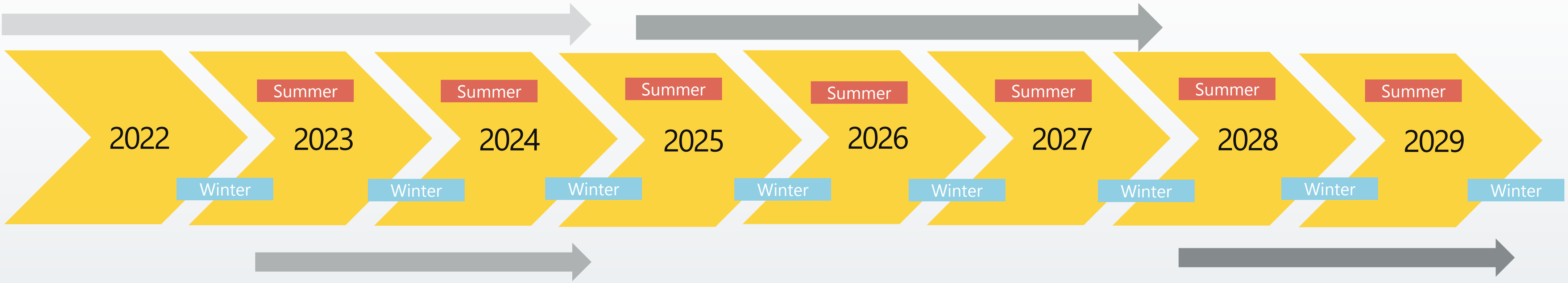
WRAP – PHASED ROLL OUT

Non-Binding Forward Showing

Winter 22-23, Summer 23, Winter 23-24, Summer 24, Winter 24-25

Binding Program With Transition Provisions (FS and Ops)

Summer 25, Winter 25-26, Summer 26, Winter 26-27, Summer 27, Winter 27-28



Non-Binding Operations Program

Summer 23 (trial – will include testing scenarios), Winter 23-24, Summer 24, Winter 24-25

Binding Program Without Transition Provisions

Summer 28 and all seasons following

THANK YOU

For general inquiries or to be added to our mailing list: wrap@westernpowerpool.org

WRAP
POWERED BY WPP

Washington Resource Selection & Customer Benefit Indicators

Annette Brandon, Wholesale Marketing Manager
Electric IRP, Seventh Technical Advisory Committee Meeting
October 11, 2022

CEIP Development

Integrated Resource Plan (IRP) – Filed final April 30, 2021

20+ year resource planning identifying customer future resource needs

Clean Energy Action Plan (CEAP) – Filed jointly with IRP

Sets **10-Year targets** for resources based on the lowest reasonable cost plan including; filed jointly with IRP

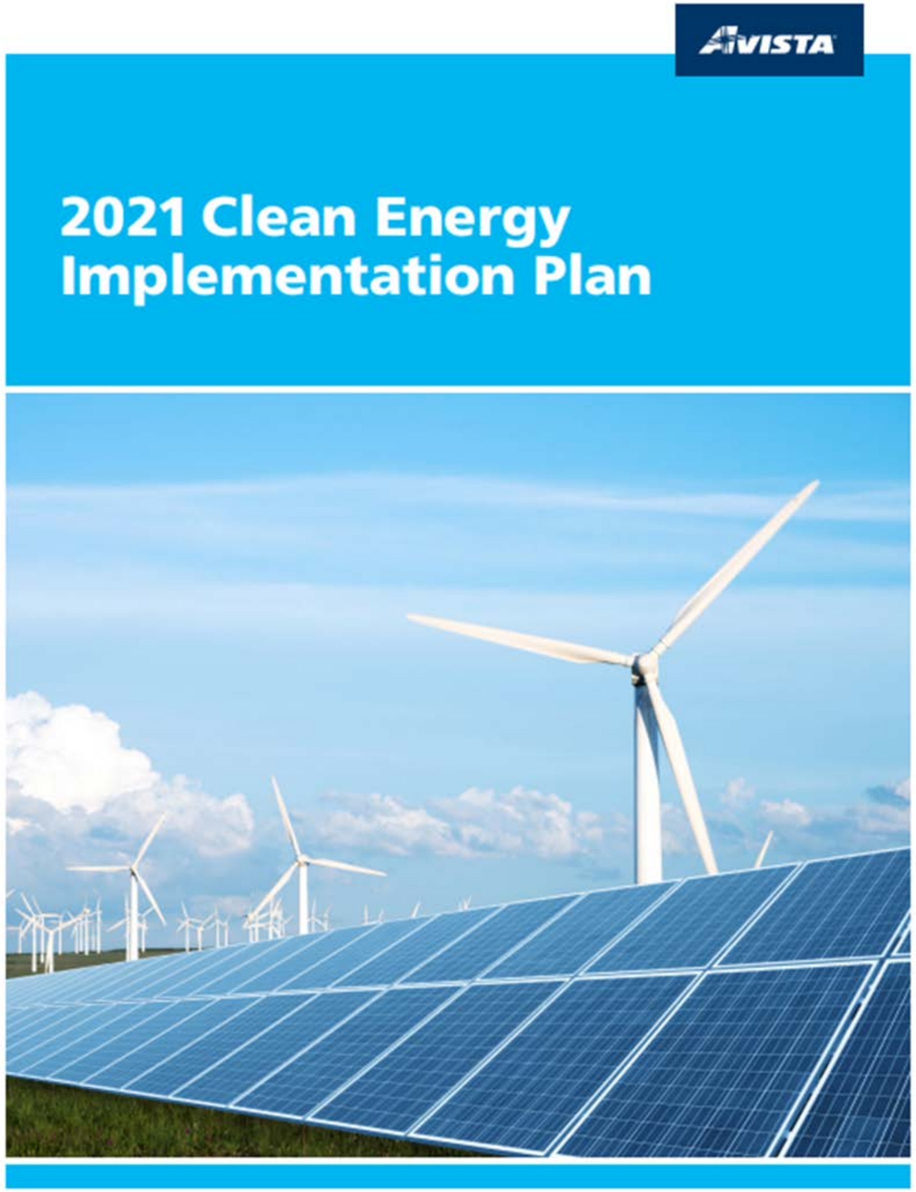
Public Participation Plan – May through September 2021

Provides **road map** for engagement and solicitation of input from customers, Equity Advisory Group, and existing Advisory Groups (including Stakeholders from public agencies)

Clean Energy Implementation Plan (CEIP) 2022-2025 – Filed October 1, 2021

CEIP establishes the **actions** the utility will take to comply with CETA goals over the next four years.

- Informed by Public Participation Process
- Identifies the projects, programs and investments
- Ensures Customer Benefit are attributes of those actions.
- **Approved June 2022 with Conditions**



AVISTA

2021 Clean Energy Implementation Plan

Public Participation Groups and Process

Equity is at the core of the transition to clean energy. Company must ensure the “equitable distribution of energy and nonenergy benefits and reductions of burdens to vulnerable populations and highly impacted communities” in development of CEIP.

Benefits/Barriers “Equity Areas”

- Benefits of Clean Energy
- Ensure benefits are equitably distributed
- Barriers to participation

Identify Named Communities

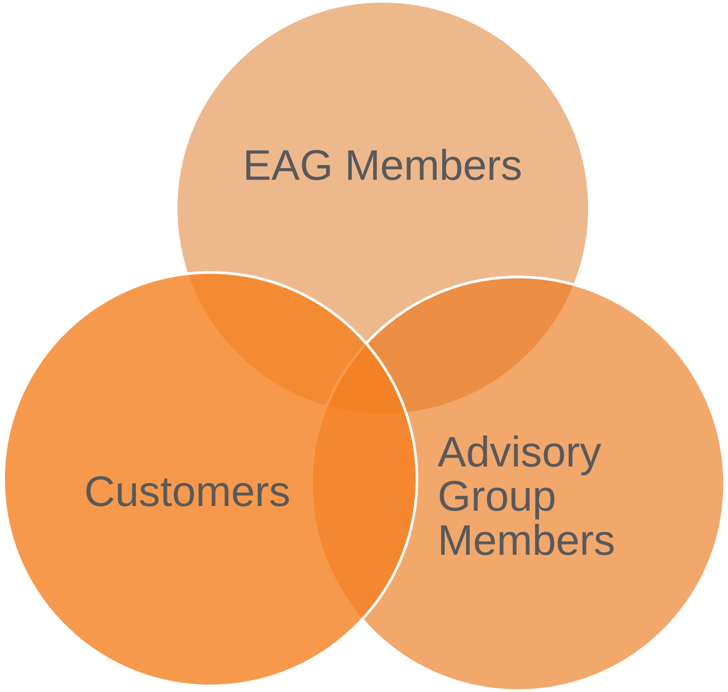
- Who is likely to be most impacted?
- Highly Impacted Communities
- Vulnerable Populations

Customer Benefit Indicators

- Ensure customers are receiving benefits of clean energy
- Measurements for accountability

Specific Actions – What specific steps will Avista take?

- Clean Energy resources – ensure CBIs are attributes mix of renewable, energy efficiency, demand response



EAG Members

Customers

Advisory Group Members

What is a “Customer Benefit Indicator”?

> “…is an attribute, either quantitative or qualitative, of resources or related distribution investments associated with customer benefits described in RCW 19.405.040(8).”

Equity

- Equitable distribution of energy and non-energy benefits and reductions of burdens (non-energy impacts) to vulnerable populations and highly impacted communities

Public Health / Environment

- Long-term and short-term public health and environmental benefits and reductions of costs and risks;
- Such as less air pollution which results in lower asthma rates

Energy Security and Resiliency

- Energy Security – strategic objective to maintain energy services and protecting against disruption
- Energy Resiliency – ability to adapt to challenging conditions from disruptions

Cost and Risk Reduction

- Lowers customer costs
- Reduces risk

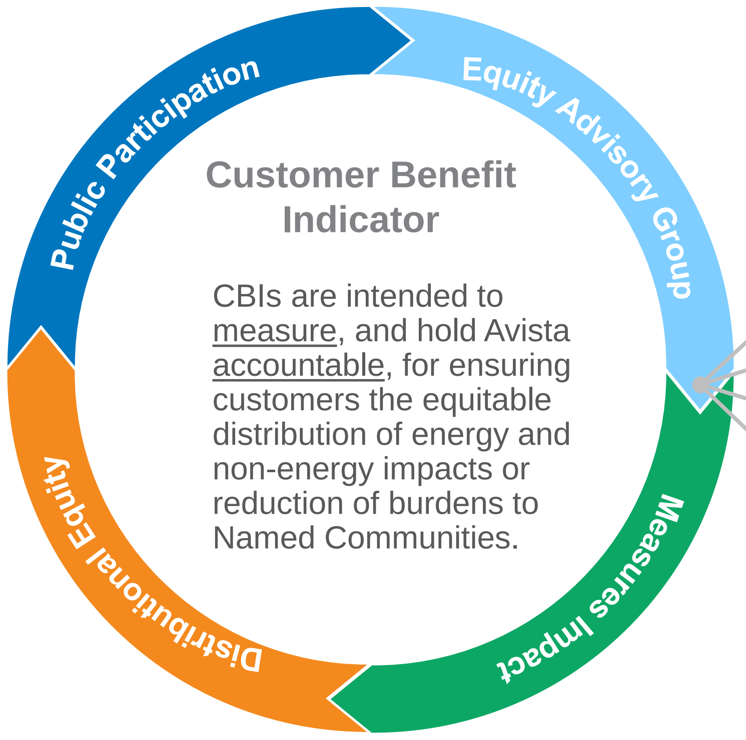
How can we ensure our customers benefit from the clean energy implementation actions we are taking?

Which resources or investment could provide benefits to our customers?

How can we measure how we are doing?

*RCW 19.405.040(8) “… through the equitable distribution of energy and nonenergy benefits and reduction of burdens to vulnerable populations and highly impacted communities; long-term and short-term public health and environmental benefits and reduction of costs and risks; and energy security and resiliency. “

Customer Benefit Indicator – Process



Customer Benefit Indicator

CBIs are intended to measure, and hold Avista accountable, for ensuring customers the equitable distribution of energy and non-energy impacts or reduction of burdens to Named Communities.

Public Participation

- Informed by a Public Participation Process in development of Clean Energy Implementation Plan

Equity Advisory Group (EAG)

- EAG provides equity lens applied to resources selection and CBIs part

Measurable and Accountable

- Each CBI will be compared against established base to ensure benefit of clean energy transition
- Initially Will be reported via Avista website quarterly

Distributional Equity / Named Communities

- Ensures that communities highly impacted by adverse socioeconomic conditions, pollution and climate change - or experience a disproportionate cumulative risk of environmental burdens benefit from of the clean energy transition.

Approved Customer Benefit Indicator (CBI) by Equity Area

- Participation in Company Programs
- Number of Households with high energy burden (>6%)

Affordability

- Outreach and Communication
- Transportation Electrification

Access

- Named Community Clean Energy
- Investment in Named Communities

Community Development

- Energy Availability
- Energy Generation Location
- Residential Arrearages and Disconnections

Energy Resiliency & Security

- Outdoor Air Quality
- Greenhouse Gas Emissions

Environmental

- Employee diversity
- Supplier diversity
- Indoor Air Quality

Public Health

Several Impact multiple benefit areas:

- Energy
- Non-energy
- Reduction of burdens
- Public Health and Environmental
- Energy Security and Resiliency
- Cost and Risk Reduction

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*RCW 19.405.040(8) "… through the equitable distribution of energy and nonenergy benefits and reduction of burdens to vulnerable populations and highly impacted communities; long-term and short-term public health and environmental benefits and reduction of costs and risks; and energy security and resiliency. "

What is a Non-Energy Impact?

- **NEIs are at the vital intersection of energy and equity and central part of the metrics of equity**
- Non-energy impacts is a way to understand the total contribution of investments that goes beyond the simple energy and demand savings
- These impacts (either positive or negative) can come in the form of economic, social, and/or personal ways.
- Non-energy impacts can be called many things, but they all mean the same thing: non- energy impacts (NEIs), NEBs, co-benefits, etc.

Participant Benefits	
O & M Savings	Employee Productivity Increase
Health Benefits	Property Value Increase
Comfort Increase	Benefits to Low Income Customers

Societal Benefits	
Public Health	Economic Development
Improved Air Quality	Increased Employment
Water quality and quantity	Energy Security
Benefits to Low Income families	

Utility Benefits	
Peak Load Reduction	Less Debt Write Off
Transmission and Distribution Savings	Lower Collection Costs
Reduced arrearages	Fewer customer calls

Non-Energy Impacts in IRP

Supply-Side Resources

Public Health
PM2.5, SO2, NOx

Safety
Direct and indirect fatalities per GWh

Environment
Land use, water use, wildfire risk

Economic
Jobs, earnings, output, value add added

Demand-Side Resources*

Income & Health
Economic Develop. (income) less missed days of work

Health
Related to avoided costs such as medical

Property Value
Noise, visual air/temperature

Energy Burden
Reduction in costs related to utility bill

IRP Resource Selection

- Non-energy impacts quantified from DNV (third party) analysis in economic potential.
- Non-energy impacts quantified from DNV (third party) analysis in supply-side resource selection as adder.
- Not all NEIs are able to be quantified due to lack of data or difficultly in obtaining data.
- Additional study may be performed for Supply side resources.
- Phase II Demand Side Resource NEI Study to occur in 2022.

*for illustrative purposes – residential used on this slide

Customer Benefit Indicator and Non-Energy Impact Clean Energy Implementation Plan Condition #2

- Avista will apply Non-Energy Impacts (NEIs) and Customer Benefit Indicators (CBIs) to all resource and program selections in determining its Washington resource strategy

- Avista agrees to engage and consult with its applicable advisory groups (IRP Technical Advisory Committee (TAC) and Energy Efficiency Advisory Group (EEAG)) regarding an appropriate methodology for including NEIs and CBIs in its resource selection.

- Avista will consult with its EAG after the development of this methodology to ensure the methodology does not result in inequitable results

CBIs and Resource Measurements Not applicable to Resource Selection

The following CBIs are measurement tools for implementation of various resources or to address qualitative inequities primarily in Named Communities

(1) Participation in Company Programs	• Participation in Weatherization Programs • Saturation rates for energy assistance • Number of residential appliance and equipment rebates to Named Communities / rental units	• Measures impact of the success of execution of BCP • Coordinated effort with CBI (3) Methods/Modes of Communication • May be used in program prioritization
(2) Number of households with a high energy burden	• Number of households with a high energy burden (>6%) will be tracked separately for all electric customers, known low income, and Named communities • Average Excess Burden per Household	• IRP will forecast total cost and indirectly impacts to energy burden • Not measured directly for EE. Embedded with NEI for bad debt, O & M (participant) and thermal comfort.
(3) Availability of Methods/Modes of Communication	• Number of contacts for each energy assistance and energy efficiency outreach event offered, and impressions from energy assistance and energy efficiency marketing • Track increased availability of translation services	• Intended to address barriers to participation/access; not selection criteria

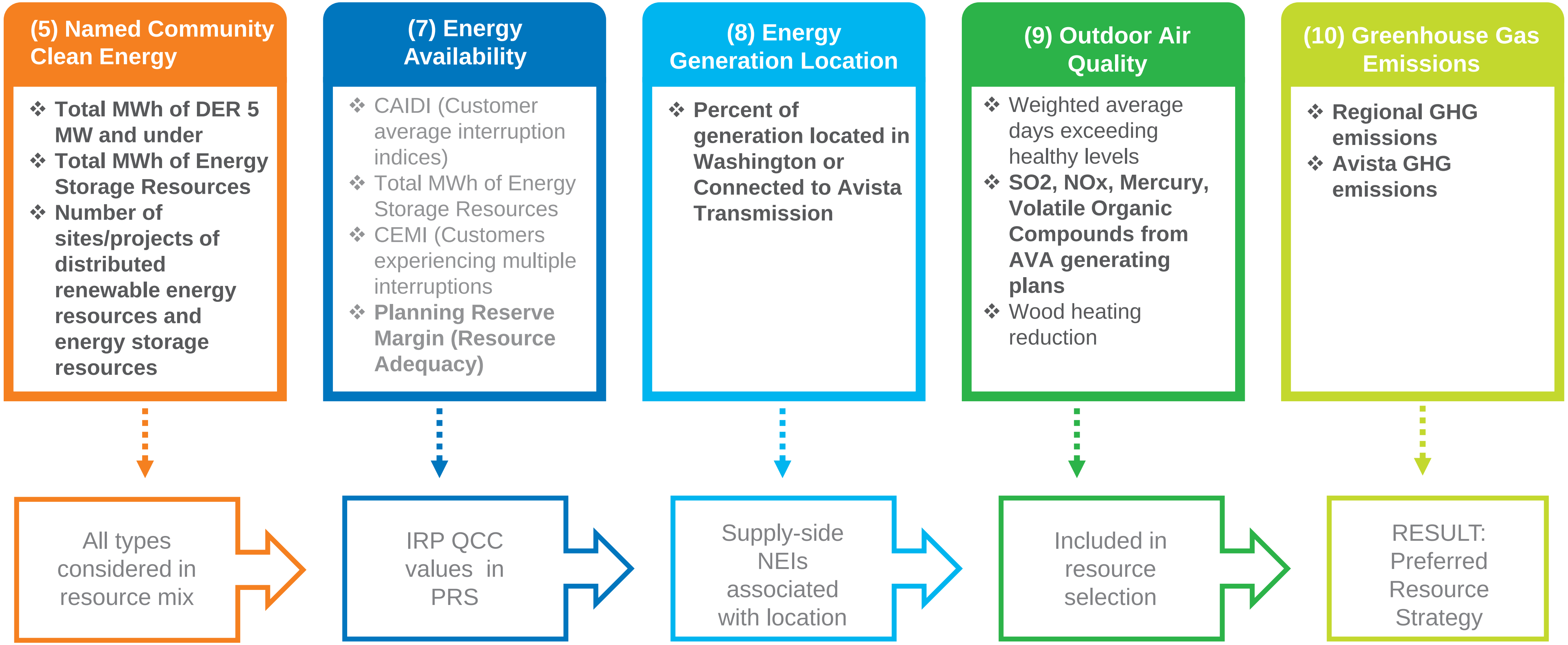
CBIs and Resource Measurements
Not applicable to Resource Selection Continued

(4) Transportation Electrification CBO – Community Based Organization	• Number of Trips provided by CBO • Number of annual passenger miles provided by CBOs • Number of Public Charging Stations located in Named Communities.	• Measurement of plan implementation In accordance with TE Plan
(6) Named Community Investments	• Incremental annual spending of investments in Named Communities • Annual number of customers and/or CBOs • Quantification of annual energy and non-energy benefits from investments (if applicable)	• Results measurement of individual investments not identified in RFP
(11) Employee Diversity **(12) Supplier Diversity**	• 11 – employee diversity equal to communities served by 2035 • 12 – Supplier Diversity of 11% by 2035	• Intended to address "public health threat" or other historical/current inequities resulting from systemic racism (or other inequities)
(14) Residential Arrearages and Disconnections for non-payment	• Number and percent of residential electric disconnections for non-payment per month • Residential arrearages for residential electric data by month by known low income, vulnerable populations, highly impacted communities and all customers	• Indirectly associated with access to clean energy or programs which may impact affordability and energy burden. • Not directly related to specific action

CBIs and Resource Selection
Applicable CBIs and Metrics

CBIs which can be quantified for use in the Integrated Resource Plan

May be applicable to one or more resource type



(5) Named Community Clean Energy

- ❖ **Total MWh of DER 5 MW and under**
- ❖ **Total MWh of Energy Storage Resources**
- ❖ **Number of sites/projects of distributed renewable energy resources and energy storage resources**

All types considered in resource mix

(7) Energy Availability

- ❖ CAIDI (Customer average interruption indices)
- ❖ Total MWh of Energy Storage Resources
- ❖ CEMI (Customers experiencing multiple interruptions
- ❖ **Planning Reserve Margin (Resource Adequacy)**

IRP QCC values in PRS

(8) Energy Generation Location

- ❖ **Percent of generation located in Washington or Connected to Avista Transmission**

Supply-side NEIs associated with location

(9) Outdoor Air Quality

- ❖ Weighted average days exceeding healthy levels
- ❖ **SO2, NOx, Mercury, Volatile Organic Compounds from AVA generating plans**
- ❖ Wood heating reduction

Included in resource selection

(10) Greenhouse Gas Emissions

- ❖ **Regional GHG emissions**
- ❖ **Avista GHG emissions**

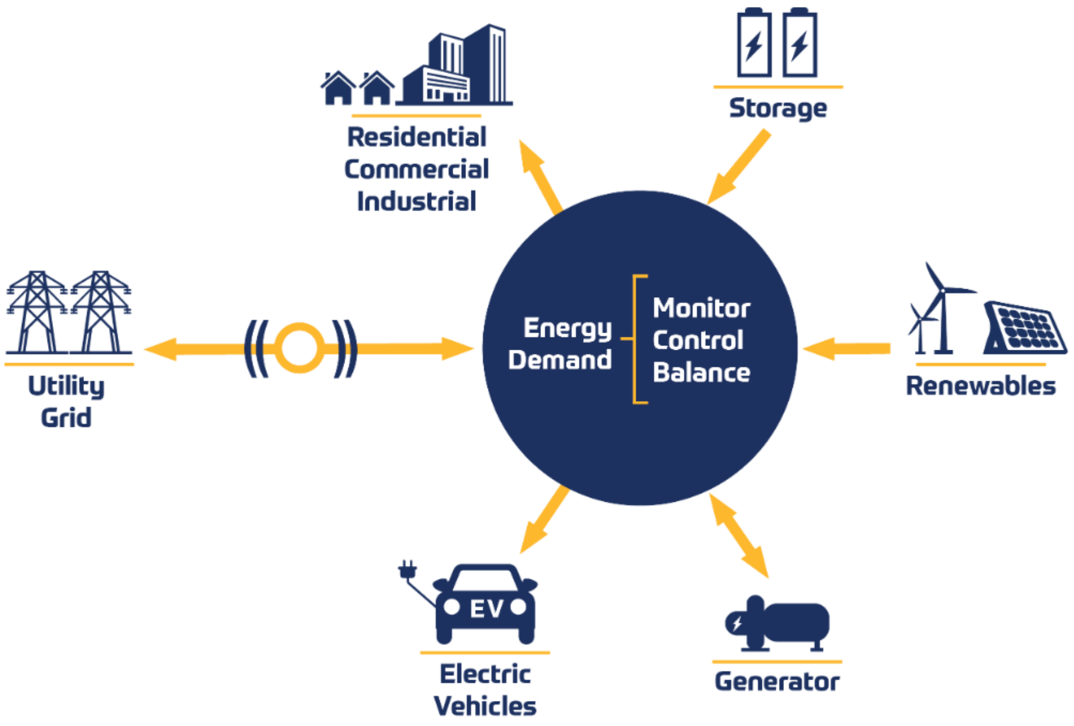
RESULT: Preferred Resource Strategy

CBIs and Resource Selection

Applicable CBIs and Metrics

(5) Named Community Clean Energy

❖ Total MWh of DER 5 MW and under
❖ Total MWh of Energy Storage Resources
❖ Number of sites/projects of distributed renewable energy resources and energy storage resources



✓ DER and Energy Storage included as options in the preferred resource strategy analysis.

✓ Baseline in development.

✓ Named Community Investment Fund may be additional method for incorporating into overall Business strategy

Source: Impact Power Solutions

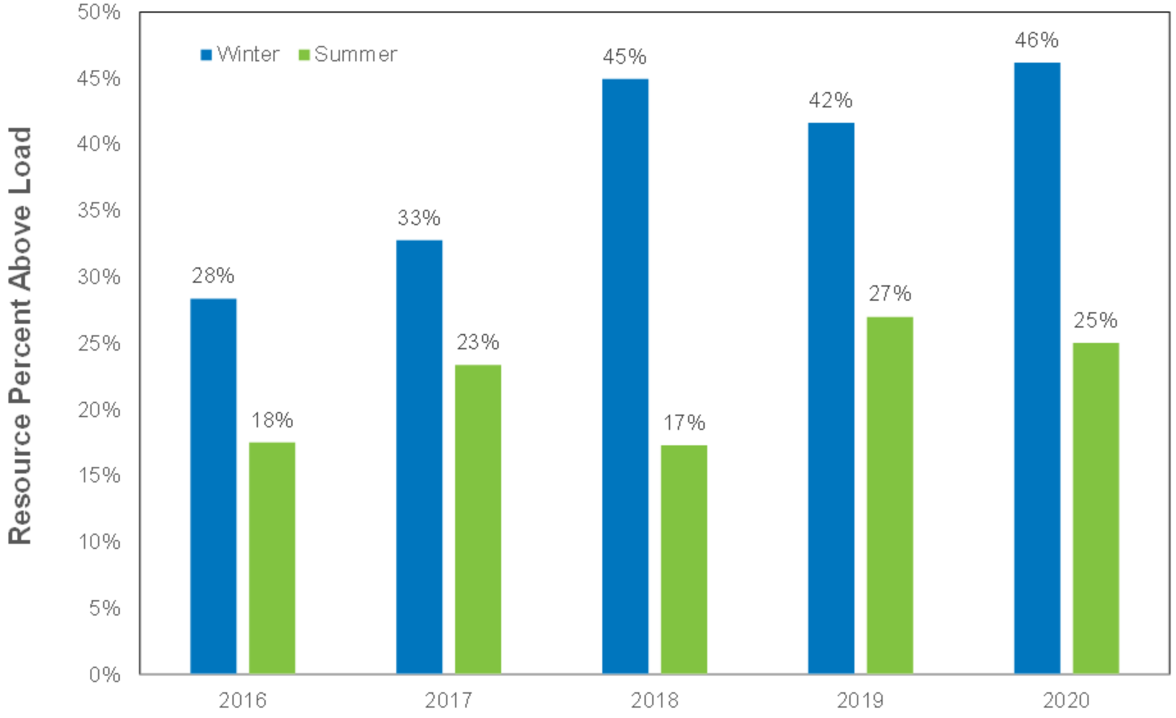
CBIs and Resource Selection Applicable CBIs and Metrics

(7) Energy Availability

- ❖ Customer Average Interruption Duration (CAIDI)
- ❖ Frequency of outages for all customers, vulnerable populations, highly impacted communities. Avista will measure using IIEE Index, Customers experiencing multiple outages (CEMI)
- ❖ **Resource Adequacy – Planning Reserve Margin**

Baseline

Resource Adequacy Planning Margin



- ✓ CAIDI and CEMI reporting metrics
- ✓ **Resource Adequacy** – Avista will maintain its current planning margin targets of 22% winter and 13% summer until the Western Resource Adequacy Program (WRAP) is implemented

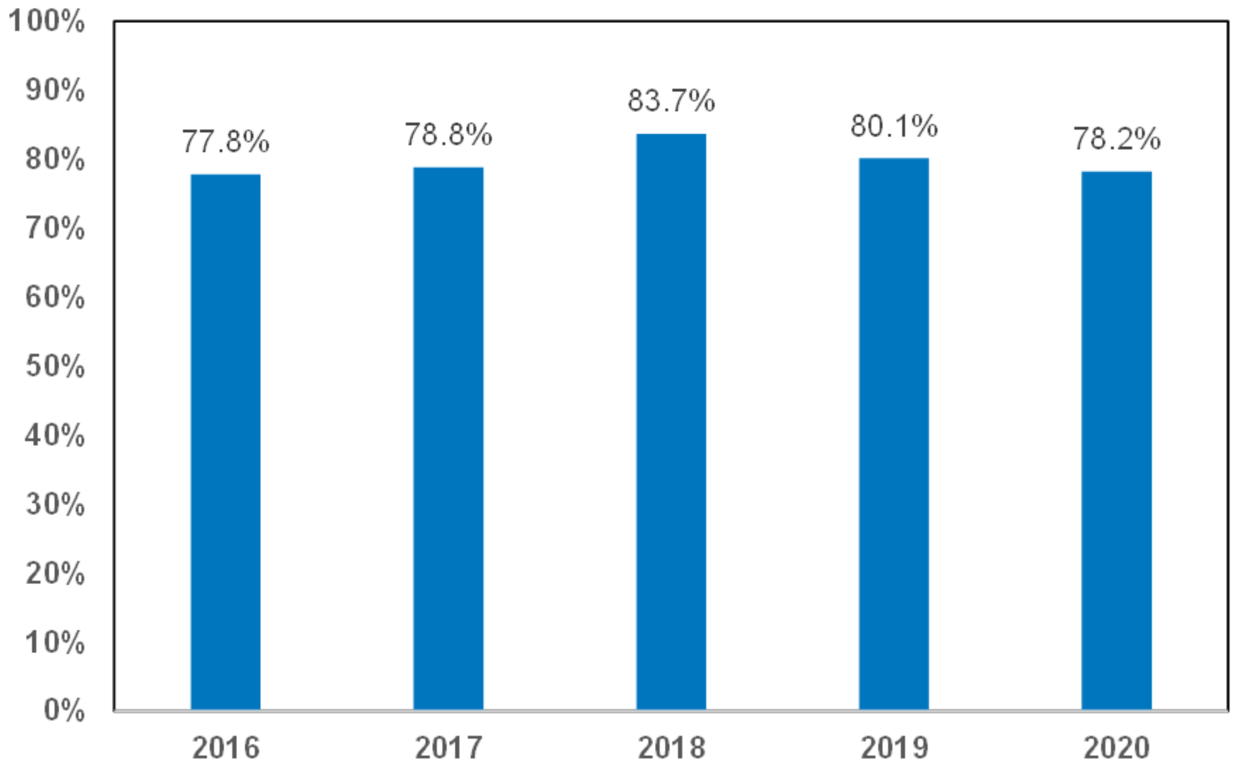
CBIs and Resource Selection Applicable CBIs and Metrics

(8) Energy Generation Location

- % of Generation located in WA or AVA Transmission

Baseline

Percent of Generation located in Washington or Connected to Avista Transmission System



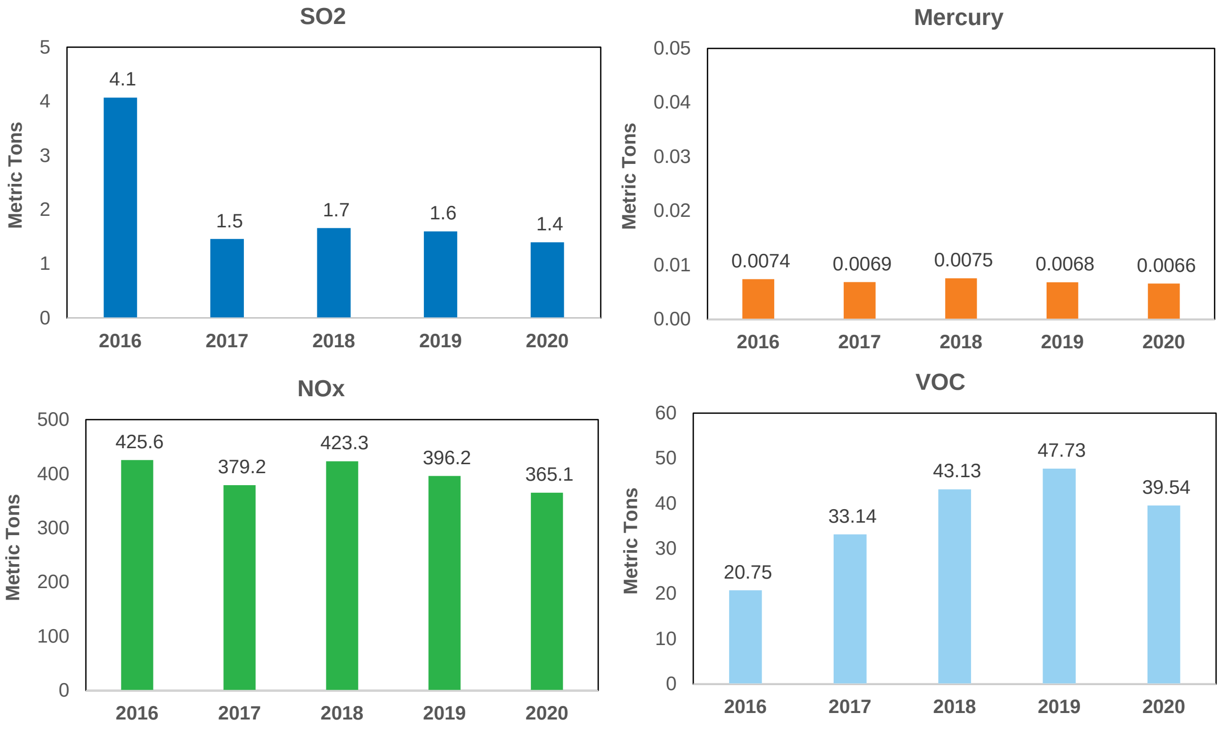
- Will track and have economic benefit of new resource options within Avista’s service territory in IRP Selection Process
- Included in RFP Selection Criteria

CBIs and Resource Selection
Applicable CBIs and Metrics

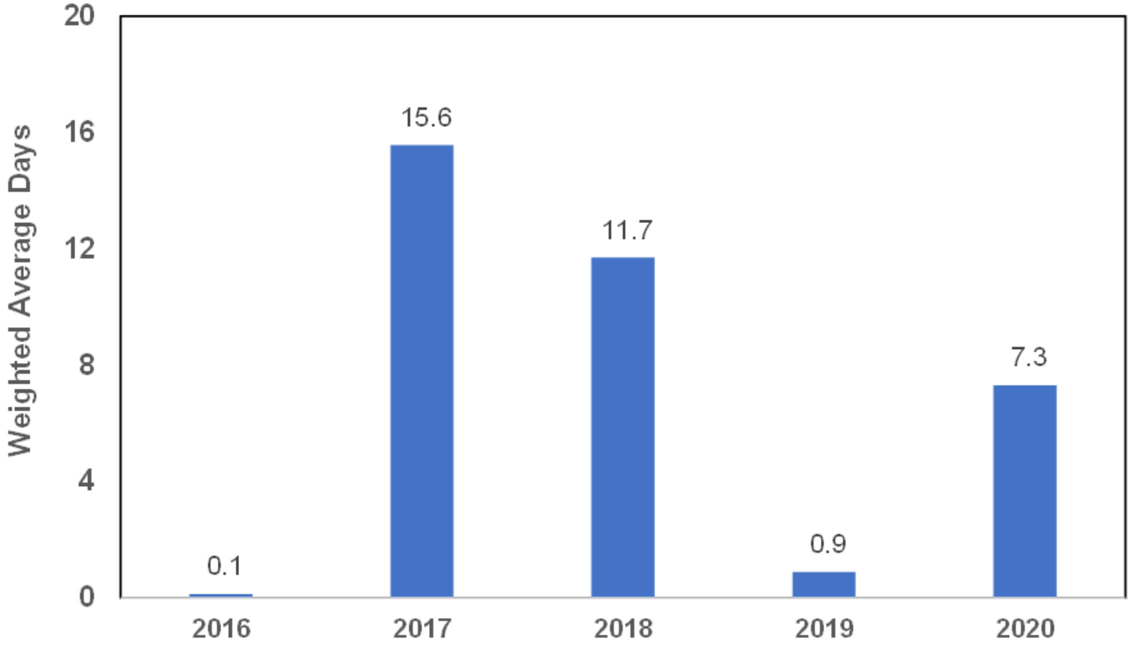
NEI will help to account for the impact of air emissions in new resource selection

(9) Outdoor Air Quality

- ❖ Weighted average days exceeding healthy levels
- ❖ **SO2, NOx, Mercury, Volatile Organic Compounds from AVA generating plans**
- ❖ Wood heating reduction



Baseline - Avista’s Generation Outdoor Air Emissions



Baseline – Weighted Average Days Exceeding Healthy Levels

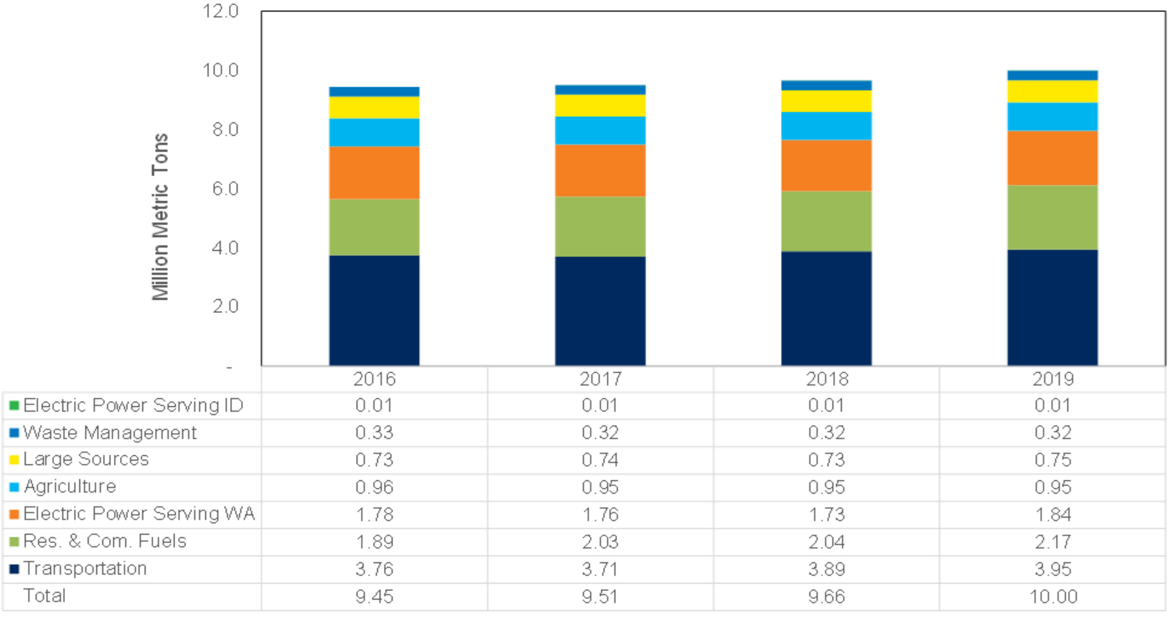
CBIs and Resource Selection
Applicable CBIs and Metrics

NEI will help to account for the impact of GHG Emissions

(10) Greenhouse Gas Emissions

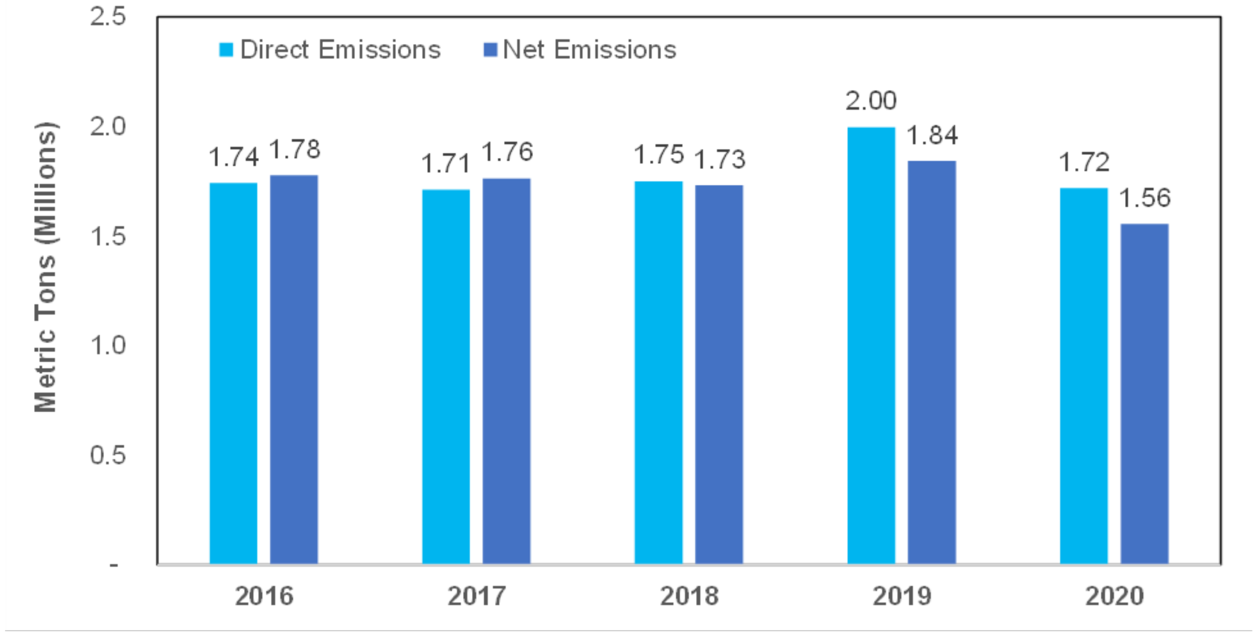
- ❖ Regional GHG emissions
- ❖ Avista GHG emissions

Baseline - Region GHG Emissions



	2016	2017	2018	2019
🟩 Electric Power Serving ID	0.01	0.01	0.01	0.01
🟦 Waste Management	0.33	0.32	0.32	0.32
🟨 Large Sources	0.73	0.74	0.73	0.75
🟦 Agriculture	0.96	0.95	0.95	0.95
🟧 Electric Power Serving WA	1.78	1.76	1.73	1.84
🟩 Res. & Com. Fuels	1.89	2.03	2.04	2.17
⬛ Transportation	3.76	3.71	3.89	3.95
Total	9.45	9.51	9.66	10.00

Baseline - Avista GHG Emissions



CBI in IRP / Progress Report Resource Selection

STEP ONE:

Resource Requirements

STEP TWO: Resource Options & Costs

STEP THREE: CBI and NEI (NEW)

FINAL STEP:

Least Reasonable Cost Optimization

RESULT:

Preferred Resource Strategy

- Winter Resource Adequacy
- Summer Resource Adequacy
- Annual energy production
- Renewable Energy production
- Energy Efficiency Reductions

- Utility Scale Generation
- Distributed Energy Resources
- Energy Efficiency
- Demand Response

- Preferred Resource Strategy will include five identified CBIs (5, 7, 8, 9, 10)
- NEI study will prioritize selection based on quantified impact

- Compare resource options against energy market.
- Non-energy impact valuation and total resource cost for efficiency analysis.
- Social cost of greenhouse gas inclusion for fossil fuel resources.
- Resource selection must satisfy all resource requirement objectives.

- Renewable Energy
- Energy Efficiency
- Demand Response/ Distributed Energy Resource

Implementation

Implementation – Resource and Program Selection and Prioritization

- Several CBIs, while not utilized in IRP, will be utilized in program selection and/or prioritization.
- Other CBIs are more applicable to measurement of success of Company efforts in areas such as:
  - Access to clean energy – i.e. increased participation in programs
  - Overcoming barriers to participation – i.e. increased translation services
  - Methods and modes of Communication – i.e. reaching additional customers as measured in saturation rate for all and Named Communities

Named Community Investment Fund

40% or up to $2.0 million
- Supplement and support energy efficiency efforts targeted to Named Communities

20% or up to $1.0 million
- Investments in distribution resiliency efforts for Named Communities

20% or up to $1.0 million
- Incentives or grants to develop projects by local customers or third parties

10% or up to $500,000
- Used for newly developed targeted outreach and engagement efforts specifically for Named Communities.

10% or up to $500,000
- Used for other projects, programs or initiatives specific to Named Communities

May be used for:
- Distributed Energy Resources
- Economic Development
- Other – as identified by EAG or other Named Community members

Evaluation Process – All Source RFP

Initial Screen Evaluation Scoring Matrix

Weighting						
20%	**40%**	**5%**	**20%**	**10%**	**5%**	**100%**
Risk Management	**Financial Energy Impact***	**Price Risk**	**Electric Factors**	**Environmental**	**Non-Energy Impact****	**Total Score**
Developer Experience, Proven Technology, etc.	Financial Analysis of Price to include PPA/Ownership, capacity costs/value, transmission, cost of carbon, etc.	Potential for change in costs, fixed vs variable pricing, variable energy, etc.	Interconnection status and transmission plan	Permitting such as Conditional Use Permit, SEPA, Studies, etc.	Energy security, benefit to service territory, named communities, DEI, etc.	

*Financial evaluation based on highest score of Capacity or Energy.

** Non-Energy Impact includes impact of Clean Energy Implementation Plan Customer Benefit Indicators (where applicable).

1st Yr. Customer Benefit

Energy Impact

Non-Energy Impact

Measure	Bill Savings	Energy Burden (NEI Only)	Air Quality	Named Community Investment	Total Benefit	NEI contribution to total benefit
LI-Building Envelope-Windows*	$0.60	$0.69	$1.95	$0.15	$3.39	82%
LI-Building Envelope-Energy Star Rated Doors	$16.19	$17.61	$48.63	$5.09	$87.52	81%
LI-Building Envelope-Attic Insulation*	$0.06	$0.03	$0.05	$0.03	$0.17	67%
LI-Building Envelope-Air Infiltration	$63.10	$33.79	$50.55	$23.92	$171.36	63%
LI-Building Envelope-Floor Insulation*	$0.12	$0.06	$0.06	$0.06	$0.29	60%
LI-Building Envelope-Wall Insulation*	$0.14	$0.07	$0.07	$0.07	$0.35	60%
LI-HVAC-Air Source Heat Pump	$87.84	$35.64	$35.59	$41.79	$200.86	56%
LI-HVAC-Ductless Heat Pump (w FAF)	$301.62	$133.65	$72.54	$142.76	$650.58	54%
LI-HVAC-Duct Insulation*	$0.27	$0.12	$0.01	$0.12	$0.52	48%
LI-HVAC-Duct Sealing	$70.99	$27.73	$1.53	$21.86	$122.12	42%
LI-Hot Water-Heat Pump Water Heater	$58.73	$19.08	$0.00	$17.23	$95.04	38%
LI-Lighting-Outreach/Direct Install LED	$0.10	$0.03	$0.00	$0.02	$0.16	35%

*Sq Ft.

2023 IRP Scenario Analysis

James Gall, Integrated Resource Planning Manager
Electric IRP, Seventh Technical Advisory Committee Meeting
October 11, 2022

2023 IRP vs 2023 Progress Report

- Washington Progress Report to be filed on January 3, 2023. This report includes only scenarios that estimate avoided costs.
  - Progress report will be based on a stochastic study of 300 potential futures with varying market drivers.
  - Due to the resource acquisition process, the progress report will have a "planning" portfolio based on IRP resource options to meet resource shortfalls rather then actual resources from the RFP.

- 2023 IRP will include the scenario analysis
  - 2023 IRP will have signed PPAs/projects from the RFP.

- 2023 IRP is an Idaho only filing, but due to portfolio impacts of Washington policy this IRP will consider scenarios related to Washington policy.

Proposed Market Scenarios

- 300 Stochastics
  - Load, fuel prices, wind, hydro, inflation
- High natural gas prices
- Low natural gas prices
- National greenhouse gas price
- No Climate Commitment Act
- Climate Commitment Act (CCA) dispatch pricing options for thermal units outside Washington (2023-2025)
  - No CCA Pricing
  - PT Ratio CCA Pricing
  - Full CCA Pricing

Proposed Portfolio Scenarios

Resource/Planning Margin Portfolios

- Idaho Colstrip exit selected by model
  - 1 or 2 units
  - PT ratio shares vs entire units
- WRAP planning reserve margin
- WRAP planning reserve margin + risk
- Market only (for avoided costs)
- No CETA (for avoided costs)
- No WA SCGHG (for avoided costs)
- Resource allocation (TBD)

Load Portfolios

- Low economic conditions
- High economic conditions
- Building electrification
  - Washington new residential construction only
  - All Washington customers transition by 2050
  - Space Heating Above 40 degree + Water Heat
- High transportation electrification

2023 Electric Integrated Resource Plan

Technical Advisory Committee Meeting No. 8 Agenda

Wednesday, December 14, 2022
Microsoft Teams Virtual Meeting

Topic	**Time**	**Staff**
Introductions	9:00	John Lyons
Resource Acquisitions	9:05	Chris Drake
Placeholder Resource Strategy • Energy Efficiency • Demand Response • Resource Selection • Avoided Cost	9:40	James Gall
CBI Forecast	10:10	Mike Hermanson
Progress Report Outline	10:35	Lori Hermanson
Next Steps	10:50	James Gall
Adjourn	11:00	

IRP Introduction

2023 Avista Electric IRP

TAC 8 – December 14, 2022

John Lyons, Ph.D. Senior Resource Policy Analyst

Remaining 2023 Electric IRP TAC Meeting Schedule

- Virtual Public Meeting Gas & Electric IRPs: March 8, 2023 (12 to 1 pm and 5:30 to 6:30 pm PST)

- TAC 9: March 15, 2023 (9 am to 4 pm PST)

Other Important Dates

- Washington Progress Report – January 3, 2023

- External IRP draft released to TAC – March 31, 2023, public comments due – May 12, 2023

- Final 2023 IRP submission to Commissions and TAC – June 1, 2023

Today’s Agenda

9:00	Introductions, John Lyons
9:05	Resource Acquisitions, Chris Drake
9:40	Placeholder Resource Strategy, James Gall
	- Energy Efficiency
	- Demand Response
	- Resource Selection
	- Avoided Cost
10:10	CBI Forecast, Mike Hermanson
10:35	Progress Report Outline, Lori Hermanson
10:50	Next Steps, James Gall
11:00	Adjourn

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2022 RFP Resource Acquisitions

Chris Drake, Manager of Resource Optimization and Marketing
Technical Advisory Committee Meeting No. 8
December 14, 2022

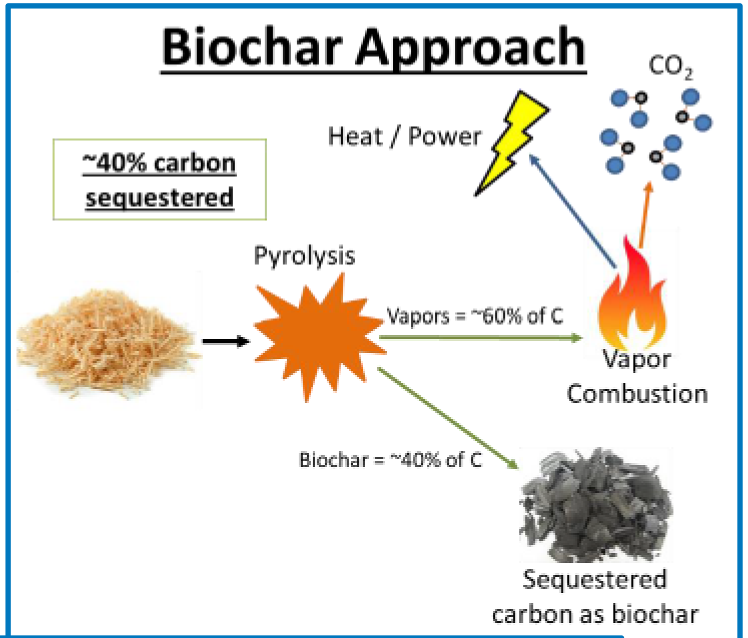
Avista's Kettle Falls Biomass upgrade

Capacity, Energy, Financial

- 11 MW net capacity increase
- 18 MW from 3rd party steam
- ~$50 Levelized Cost of Energy over 20 years
- $11.2 million incremental capital into KF

Environmental, Community

- ~100,000 CO_2e sequestered annually
- ~30% reduction in annual NO_X emissions, CO, and VOCs intensity
- Delay or eliminate need for ash disposal landfill (~$10 million savings)
- Anticipated 15 new FTEs from biochar/steam contractor



Biochar Approach

~40% carbon sequestered

Heat / Power

CO_2

Pyrolysis

Vapors = ~60% of C

Vapor Combustion

Biochar = ~40% of C

Sequestered carbon as biochar

Columbia Basin Hydropower

Irrigation Hydro

- 23-year supply deal in total
- Projects ramping in between 2023 and 2030
- 100% of the output from 7 hydro projects throughout central Washington (3 BPA, 2 Grant, 2 Avista BAs)
- Approximately 145 MW of max generation.
- March–October generation shaped like solar generation with no hourly variability (and includes off-peak energy)

Facilities

- Main Canal Headworks
- Summer Falls
- Russell D. Smith
- Eltopia Branch Canal (EBC)
- Potholes East Canal (PEC)
- Potholes East Headworks (PEC Headworks)
- Quincy Chute

2023 Placeholder Resource Strategy

James Gall, Manager of Integrated Resource Planning
Technical Advisory Committee Meeting No. 8
December 14, 2022

Safe Harbor Statement

This document contains forward-looking statements. Such statements are subject to a variety of risks, uncertainties and other factors, most of which are beyond the Company’s control, and many of which could have a significant impact on the Company’s operations, results of operations and financial condition, and could cause actual results to differ materially from those anticipated.

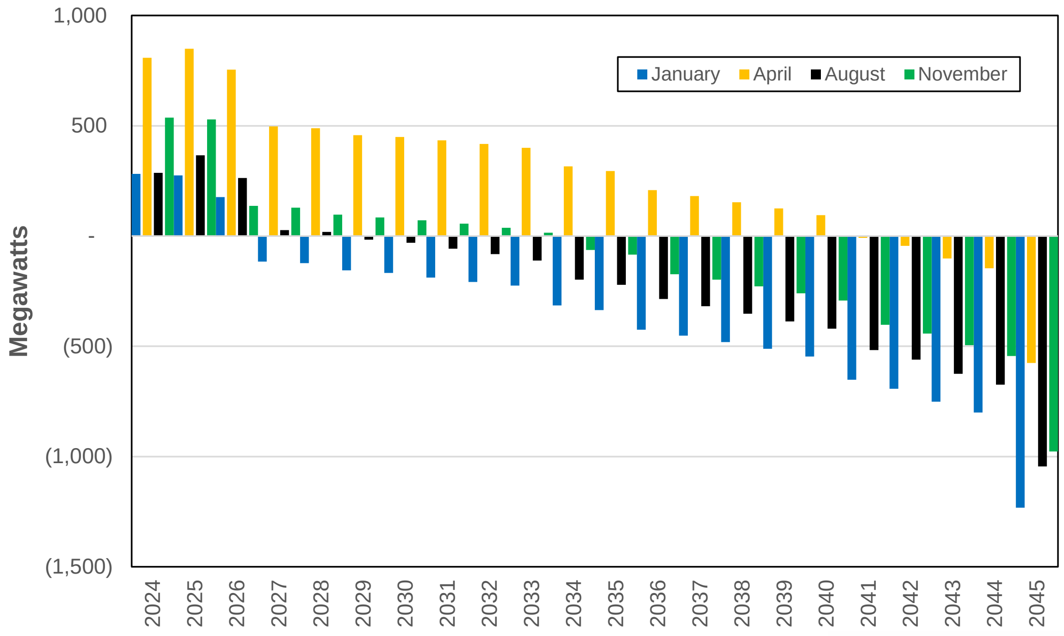
For a further discussion of these factors and other important factors, please refer to the Company’s reports filed with the Securities and Exchange Commission. The forward-looking statements contained in this document speak only as of the date hereof. The Company undertakes no obligation to update any forward-looking statement or statements to reflect events or circumstances that occur after the date on which such statement is made or to reflect the occurrence of unanticipated events. New risks, uncertainties and other factors emerge from time to time, and it is not possible for management to predict all of such factors, nor can it assess the impact of each such factor on the Company’s business or the extent to which any such factor, or combination of factors, may cause actual results to differ materially from those contained in any forward-looking statement.

Other Caveats

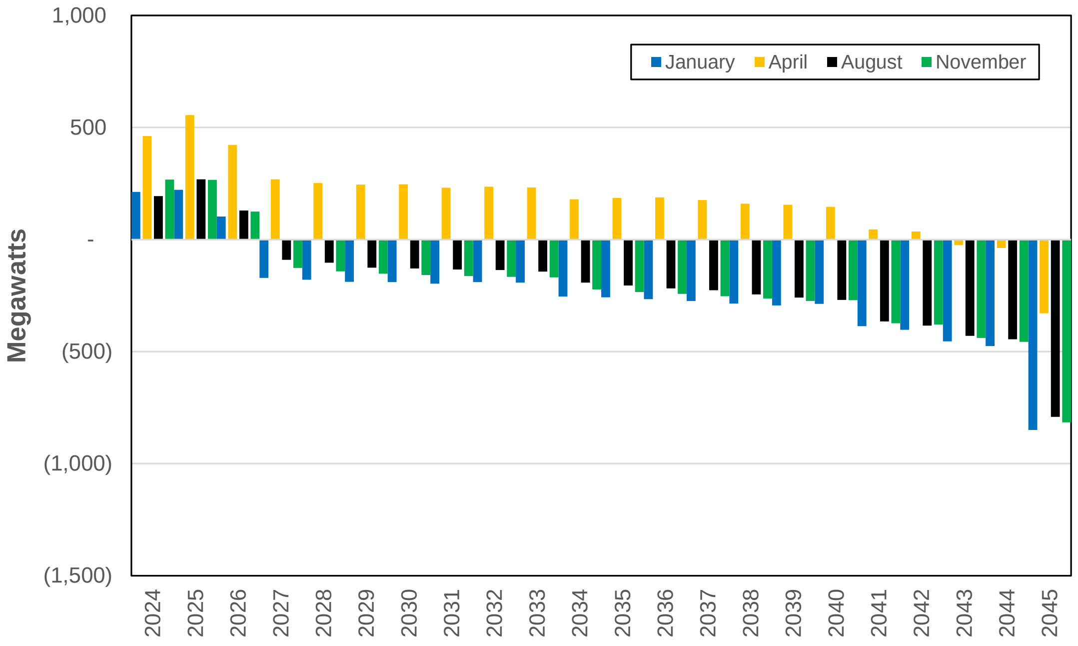
- **Avista is negotiating with 2022 All-Source Request for Proposals (RFP) shortlist bidders. The Placeholder Resource Strategy will significantly change to include new resources after RFP negotiations conclude. Changes will be reflected in the June 2023 IRP Filing.**
- IRP resource options are primarily “new” resource options - RFP will determine if existing resources can be acquired at similar or lower cost than the assumed IRP options.
- Not all resources within an IRP option list are bid into RFPs, also costs are based on Bidder’s pricing not generic estimates used in IRPs.
- Avista may not be able to physically retire or exit certain resources as the IRP PRiSM model determines because of contract limitations.
- No future state specific resource cost allocation agreement has been made.
- Forward looking rates include non-modeled power supply cost escalating at 3.8% per year-
  - **THIS IS NOT A RATE FORECAST**
  - This is for informational purposes only

Resource Needs Begin November 2026

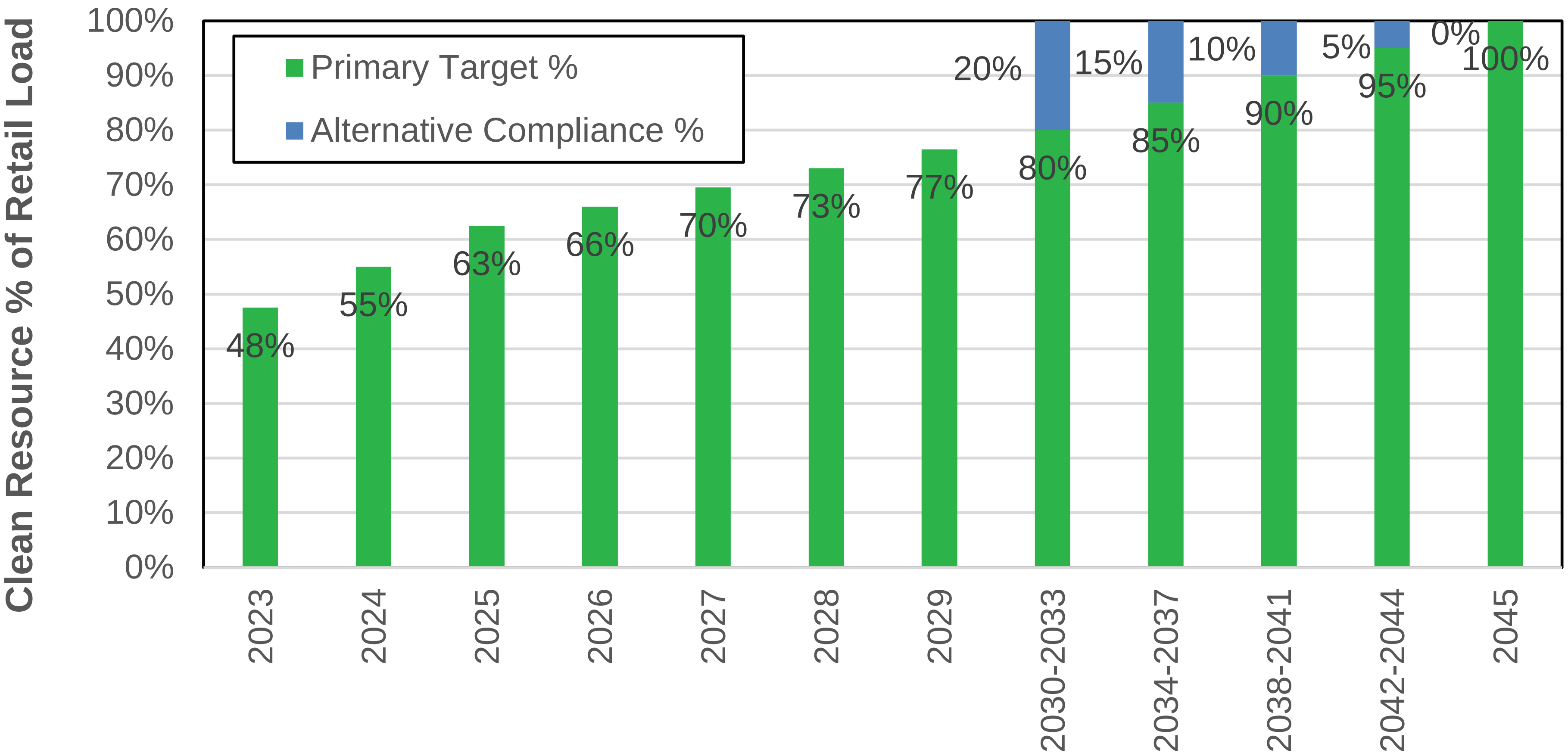
Capacity Needs



Energy Needs



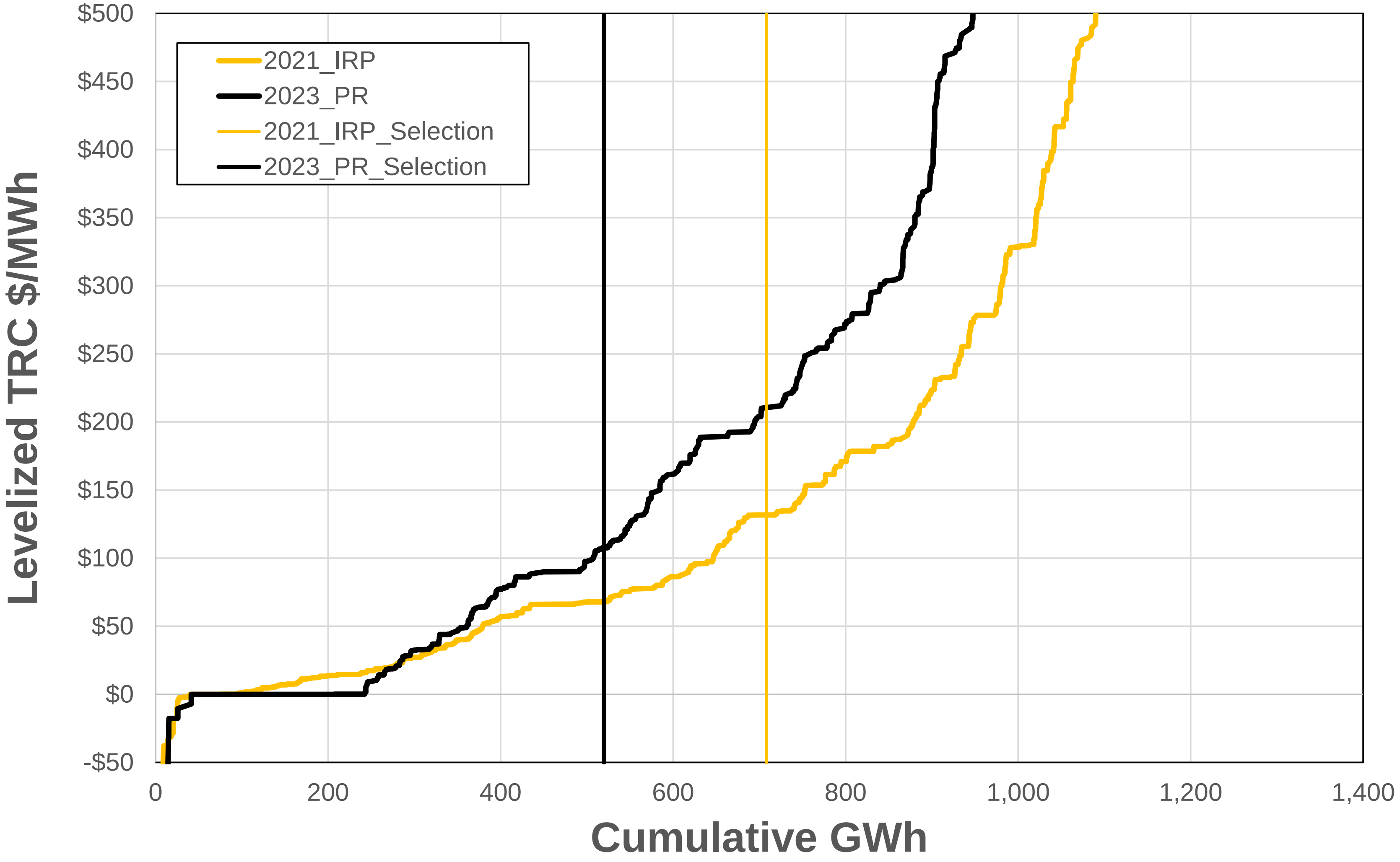
CETA Renewable Energy Goal



Named Community Investment Fund Projects

- Methodology
  - Spending constraints
    - $2 million annually in low-income energy efficiency beyond cost effective programs.
    - $500k distributed energy resources ($100k for program administration).
  - Results
    - 2.4 GWh additional EE though 2033 (0.7 percent increase).
    - 700 kW annual Low Income Community additions 2024 through 2033 with funding from state low-income community solar funding.
    - After 2034, 100 to 200 kW solar programs w/ storage.
    - Additional programs from the remaining funding will be included as projects are known.
      - (if they have an effect on power supply needs)

2024-2045 Cumulative Energy Efficiency Supply Curve Washington Jurisdiction Comparison between 2021 IRP



Cumulative Energy Efficiency End Use Results (GWh)

	Washington			Idaho		
End Use	**2024**	**2033**	**2045**	**2024**	**2033**	**2045**
Appliances	0.5	6.2	8.2	0.2	1.5	1.9
Electronics	0.2	6.4	13.3	0.1	3.0	6.3
Exterior Lighting	6.0	77.5	164.3	3.1	40.1	83.0
Food Preparation	0.1	2.6	11.2	0.0	0.0	0.0
Interior Lighting	0.2	1.4	1.7	0.1	1.9	2.0
Miscellaneous	2.2	24.2	36.7	1.1	11.9	17.9
Motors	3.9	59.5	60.2	0.0	0.3	0.4
Office Equipment	0.1	6.9	14.6	0.0	1.5	2.7
Process	1.4	18.8	22.0	1.1	14.3	16.1
Refrigeration	2.6	17.7	19.0	1.9	19.7	21.1
Ventilation	0.4	4.6	7.0	0.2	2.1	3.1
Water Heating	1.3	16.8	25.5	0.9	10.2	16.5
Space Heating/Cooling	5.1	80.8	115.7	0.9	19.6	33.2
Total	**24.1**	**323.3**	**499.3**	**9.6**	**125.8**	**204.2**
2021 IRP equivelent	**41.8**	**526.3**	**708.0**	**13.2**	**138.6**	**202.2**

Cumulative Energy Efficiency Segment Results (GWh)

	Washington			Idaho		
Segment	**2024**	**2033**	**2045**	**2024**	**2033**	**2045**
College	0.7	7.5	12.2	0.4	3.7	5.7
Grocery	1.1	15.2	23.9	1.2	16.9	26.3
Health	0.6	5.3	7.4	0.0	0.4	0.6
Industrial	2.5	32.5	48.5	2.0	25.3	35.3
Large Office	0.7	7.2	12.1	0.6	5.8	9.8
LI - Mobile Home	0.3	5.0	8.4	-	-	-
LI - Multi-Family	0.9	14.1	21.0	-	-	-
LI - Single Family	4.9	69.1	79.4	-	-	-
Lodging	1.1	8.9	14.2	0.5	5.0	6.8
Miscellaneous	1.4	16.1	30.6	1.2	16.2	29.3
Mobile Home	0.1	3.9	8.5	-	-	-
Multi-Family	0.0	1.6	2.7	-	-	-
Pumping	0.6	8.2	10.4	0.4	5.2	6.1
Restaurant	1.1	14.6	21.9	0.7	9.1	13.6
Retail	2.6	28.1	49.5	1.6	19.2	30.7
School	1.1	14.9	28.2	0.1	0.9	1.7
Single Family	1.8	37.7	57.7	0.3	11.0	25.5
Small Office	1.2	16.7	32.2	0.3	3.2	6.2
Warehouse	1.4	16.9	30.5	0.3	4.0	6.5
Total	24.1	323.3	499.3	9.6	125.8	204.2

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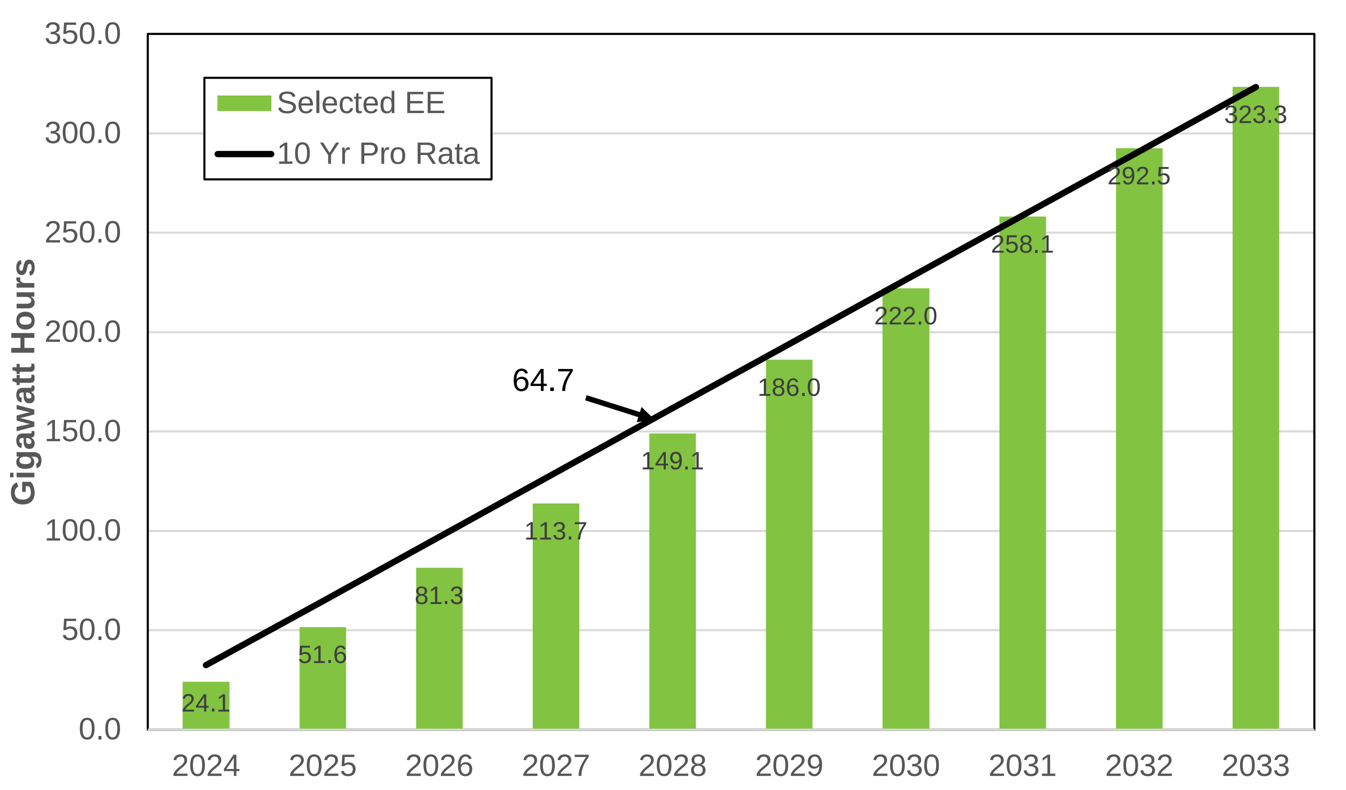
Lower Washington Energy Efficiency Goals

Lower Avoided Costs & Lower Potential

2024-2025 Biennial Conservation Target (MWh)	
CPA Pro-Rata Share	64,667
EIA Target	64,667
Decoupling Threshold	3,233
Total Utility Conservation Goal	67,900
Excluded Programs (NEEA)	-10,162
Utility Specific Conservation Goal	57,739
Decoupling Threshold	-3,233
EIA Penalty Threshold	54,505



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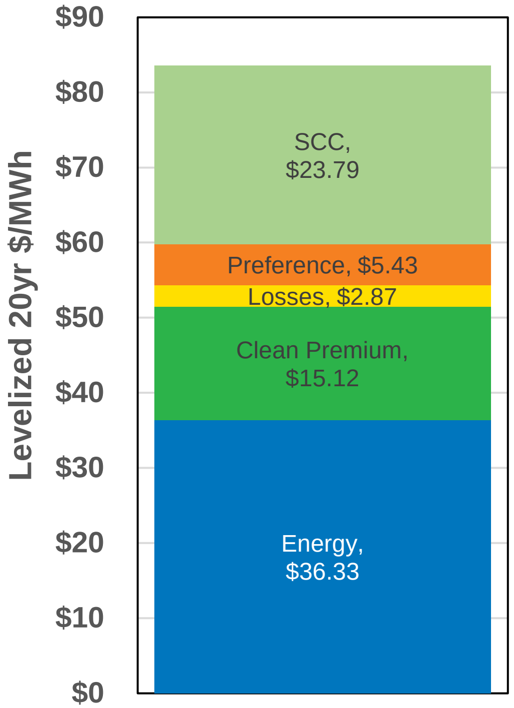
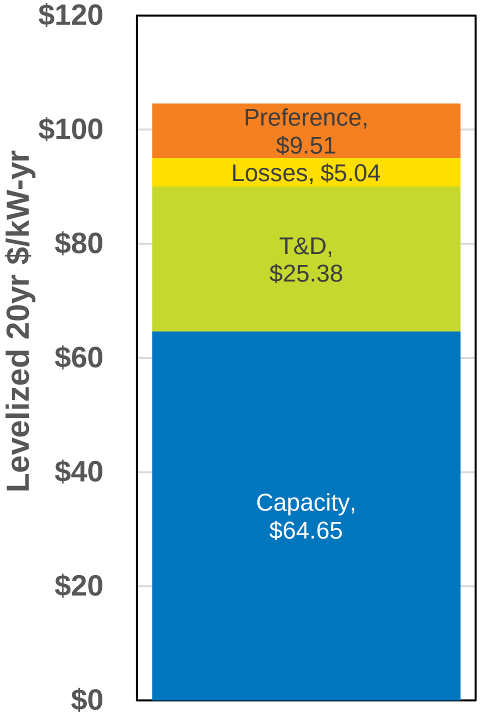
24-yr Levelized Avoided Cost for Energy Efficiency

Washington

Energy Value

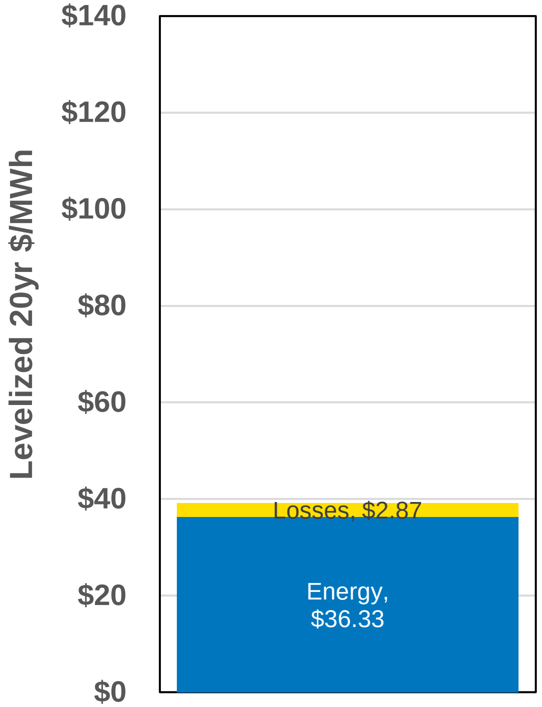


Capacity Value

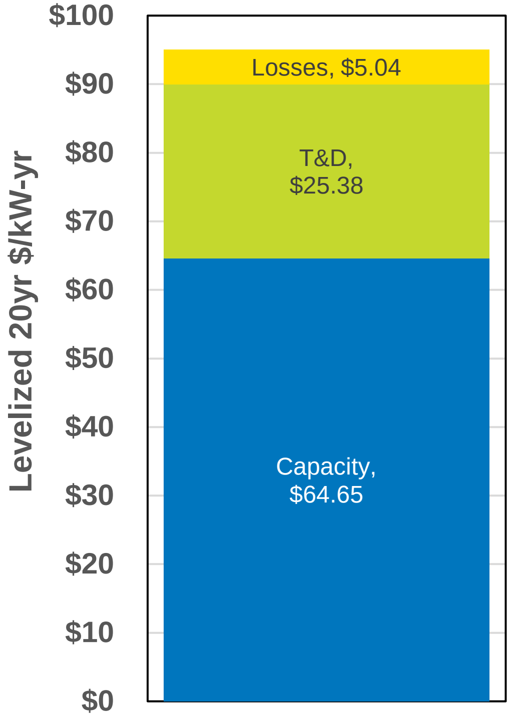


Idaho

Energy Value



Capacity Value



Demand Response

- 30 MW of industrial demand response already contracted
- Avista is preparing 3 opt-in pilot programs:
  - Time of use rates
  - Peak time rebate
  - CTA-2045 water heaters
- 2023 IRP Progress Report Results
  - 2025 start date, only Washington programs selected (2045 cumulative savings shown)
    - Time of Use: 6.6 MW
    - Peak Time Rebate and Variable Peak Pricing is on the margin, but not selected.

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“Placeholder” PRS Selection (MW)

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2024-2033	2034-2045
Washington																								
Demand Response	0.0	6.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7	0
Natural Gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	3
Baseload Renewable	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	20	20
Nuclear	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
NW Wind	0.0	0.0	0.0	0.0	0.0	0.0	150.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	140.0	105.0	0.0	137.2	508.4	150	891
Montana Wind	0.0	0.0	0.0	125.1	0.0	0.0	0.0	0.0	174.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	300	0
Off Shore Wind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Distributed Solar/ wStorage	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	7	2
Utility Scale Solar	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Short Duration Storage (<8hr)	0.0	0.0	0.0	25.0	0.0	35.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.5	0.0	0.0	0.0	25.0	0.0	61	76
Medium Duration Storage (8-24hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Long Duration Storage (>24hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	147.4	0.0	0.0	0.0	0.0	0.0	59.8	0.0	0.0	75.8	0.0	68.0	0.0	318.8	147	522
Total	**0.7**	**7.4**	**0.7**	**150.8**	**0.7**	**36.4**	**150.7**	**20.7**	**323.1**	**0.8**	**0.2**	**0.2**	**3.5**	**0.2**	**60.0**	**0.2**	**51.7**	**216.0**	**105.2**	**68.2**	**162.4**	**847.4**	**692**	**1,515**
Idaho																								
Demand Response	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Natural Gas	0.0	0.0	0.0	186.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	186	2
Baseload Renewable	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Nuclear	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
NW Wind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Montana Wind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Off Shore Wind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Distributed Solar/ wStorage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Utility Scale Solar	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Short Duration Storage (<8hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.8	0.0	0.0	0.0	0	38
Medium Duration Storage (8-24hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Long Duration Storage (>24hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31.3	0.0	0.0	39.7	0.0	35.6	0.0	79.0	0	185
Total	**0.0**	**0.0**	**0.0**	**186.2**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.7**	**0.0**	**31.3**	**0.0**	**0.0**	**39.7**	**37.8**	**35.6**	**0.0**	**79.0**	**186**	**225**

Used for Energy Efficiency Potential Study Only- Will change after all RFP resources are added.

Transmission Needs

- Most generation selection is off-system or up to interconnection limits before major transmission upgrades needed.
- 2045 renewable & long-duration storage requirements will require significant build outs in Big-Bend and Rathdrum areas.
- Earlier construction may be necessary if low-cost interconnection resources are purchased by other utilities.

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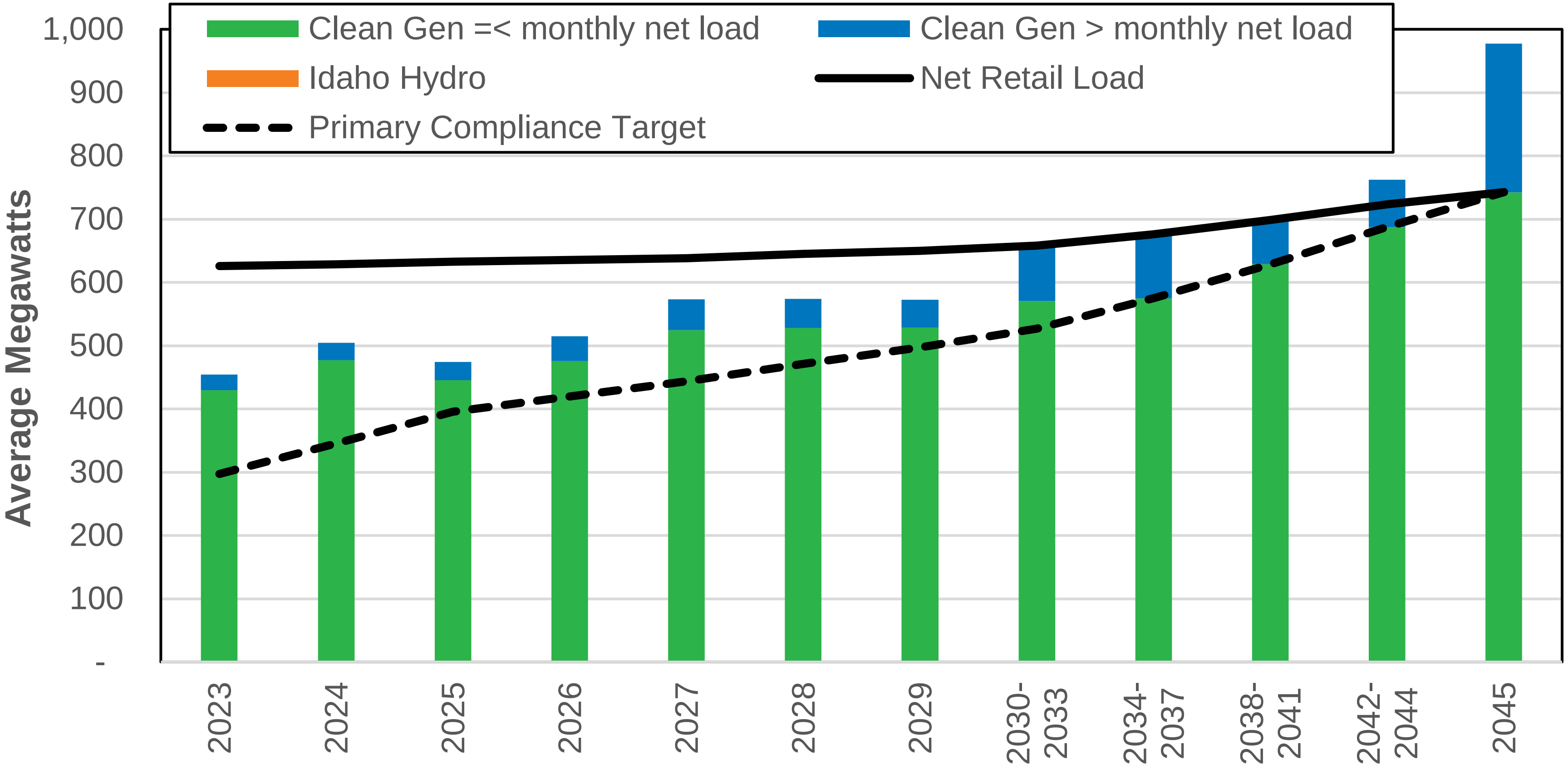
Washington CETA Clean Energy Comparison (aMW)



CETA Cost Cap Analysis

- Cost cap compares utility’s strategy to an “Alternative Least Reasonable Cost Portfolio”
  - How do we define this portfolio?
  - When does “alternative” begin?
    - For example, should this portfolio exclude past decisions to acquire resources used to comply with CETA?
      - Without excluding these resources, the incremental cost will be too low over time as base cost will include higher priced resources.
    - Do we need to maintain a resource portfolio over time with “theorical” resources we would have acquired?
  - Should Preferred Resource Strategy reflect changes if cost cap is reached?

CETA Cost Cap Analysis Example

- Assumes No Columbia Basin Hydro. (Chelan PUD #2/#3 can be added for final IRP)
- Assumes CS2 available in 2045.
- Assumes no CETA compliance requirements.
- Includes Social Cost of Greenhouse Gas.
- **Cost cap reached in final compliance period.**

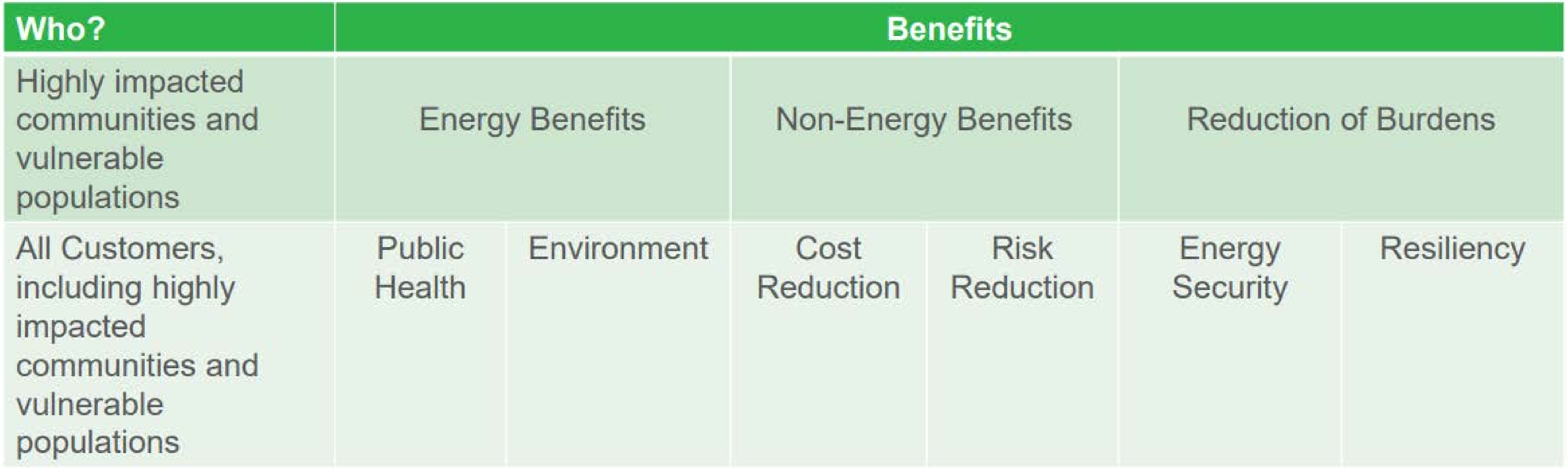
	2026-2029	2030-2033	2034-2037	2038-2041	2042-2045
Cost Cap Spending Limit	$136m	$159m	$183m	$210m	$244m
PRS w NCF spending	$10m	$40m	$51m	$43m	$212m
Delta	$125m	$118m	$133m	$167m	$31m

CBI Forecast

Mike Hermanson, Senior Power Supply Analyst
Electric IRP, 8th Technical Advisory Committee Meeting
December 14, 2022

Background

- Customer Benefit Indicators (CBIs) are required to ensure equitable distribution of energy and non-energy benefits and reductions of burdens to highly impacted communities and vulnerable populations.



Who?	Benefits					
Highly impacted communities and vulnerable populations	Energy Benefits		Non-Energy Benefits		Reduction of Burdens	
All Customers, including highly impacted communities and vulnerable populations	Public Health	Environment	Cost Reduction	Risk Reduction	Energy Security	Resiliency

Background

- CEIP includes 14 CBIs:

1. Participation in Company Programs	**8. Energy Generation Location**
2. Number of households with a High Energy Burden (>6%)	**9. Outdoor Air Quality**
3. Availability of Methods/Modes of Outreach and Communication	**10. Greenhouse Gas Emissions**
4. Transportation Electrification	11. Employee Diversity
5. Named Community Clean Energy	12. Supplier Diversity
6. Investments in Named Communities	13. Indoor Air Quality
7. Energy Availability	14. Residential Arrearages and Disconnections for Nonpayment

- 7 CBIs forecasted in IRP modeling.

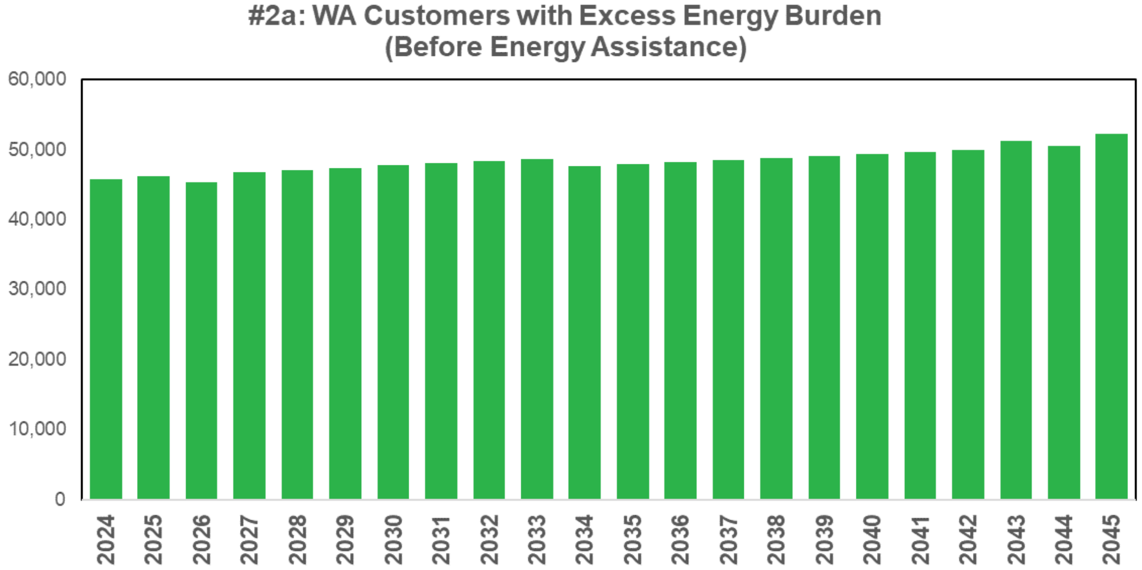
Number of households with a High Energy Burden (>6%)

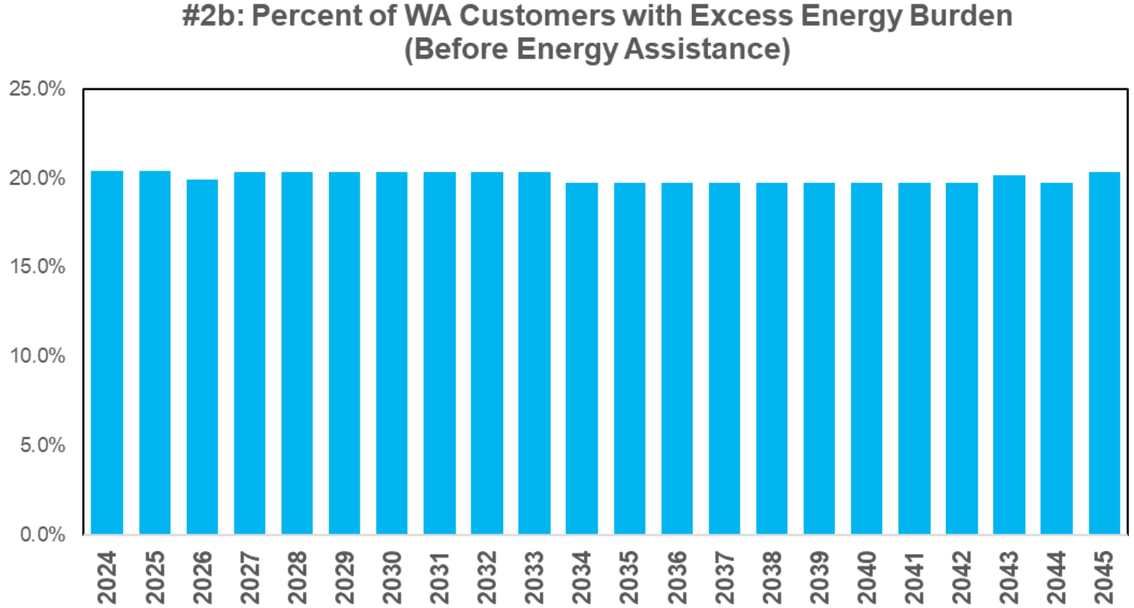
- High energy burden is annual energy cost (electric & gas) greater than 6% of annual income.

- Forecasted by:

(PRS rates x annual energy usage)/annual income

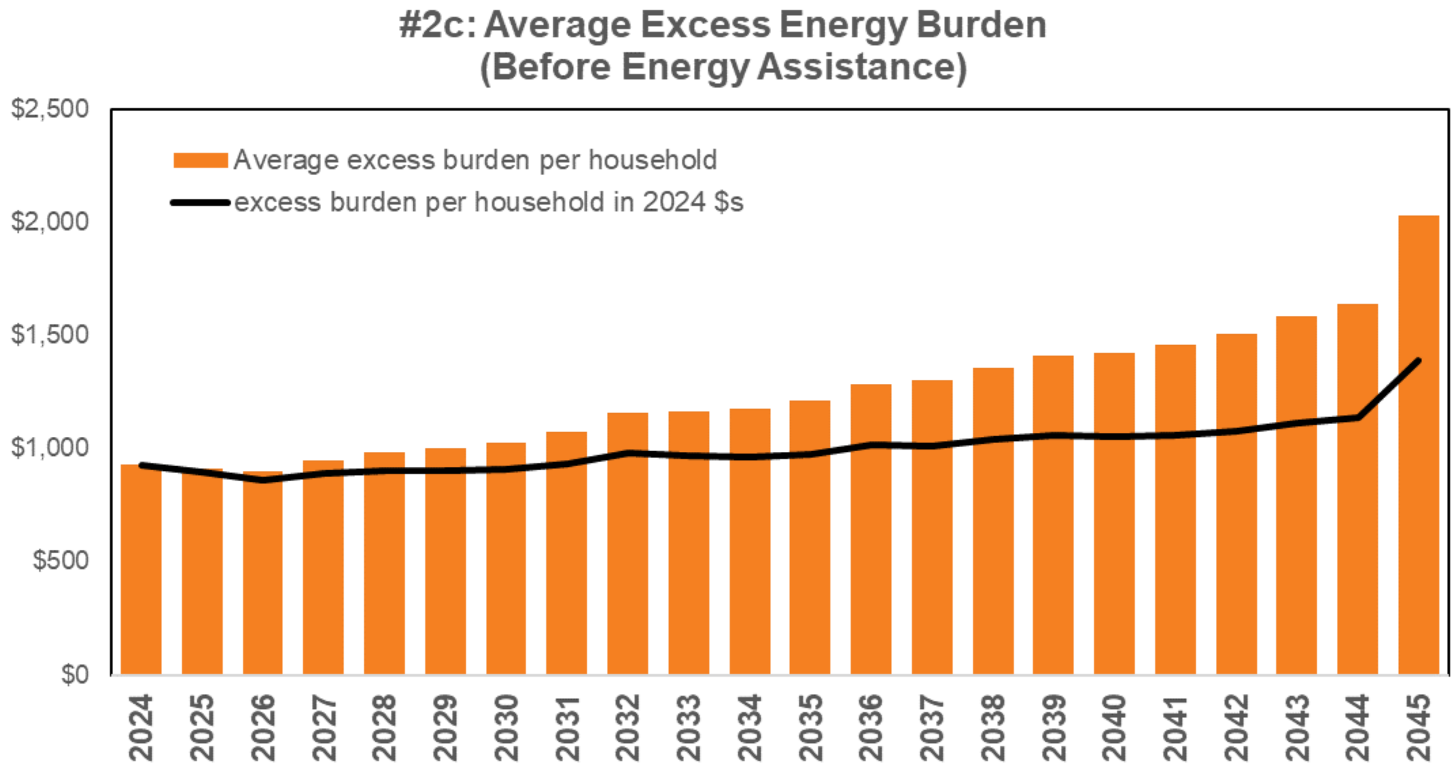
- Forecast includes:
  - Reductions in energy usage from low-income energy efficiency programs selected by PRiSM.
  - Historic income increases for specific income groups projected forward.


#2a: WA Customers with Excess Energy Burden (Before Energy Assistance)


#2b: Percent of WA Customers with Excess Energy Burden (Before Energy Assistance)

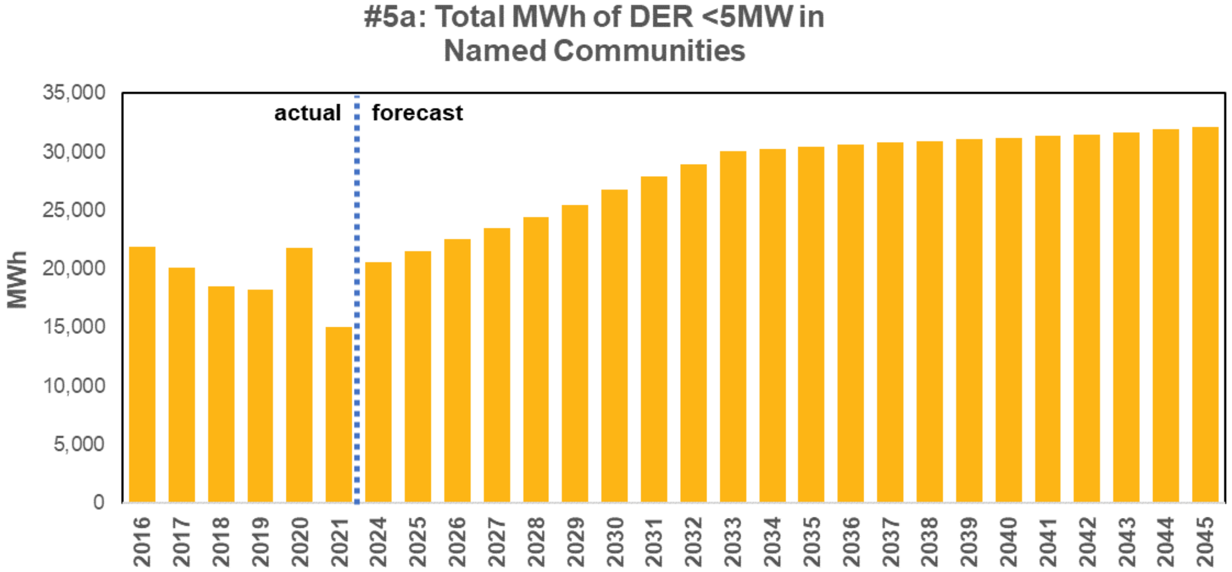
Number of households with a High Energy Burden (>6%)

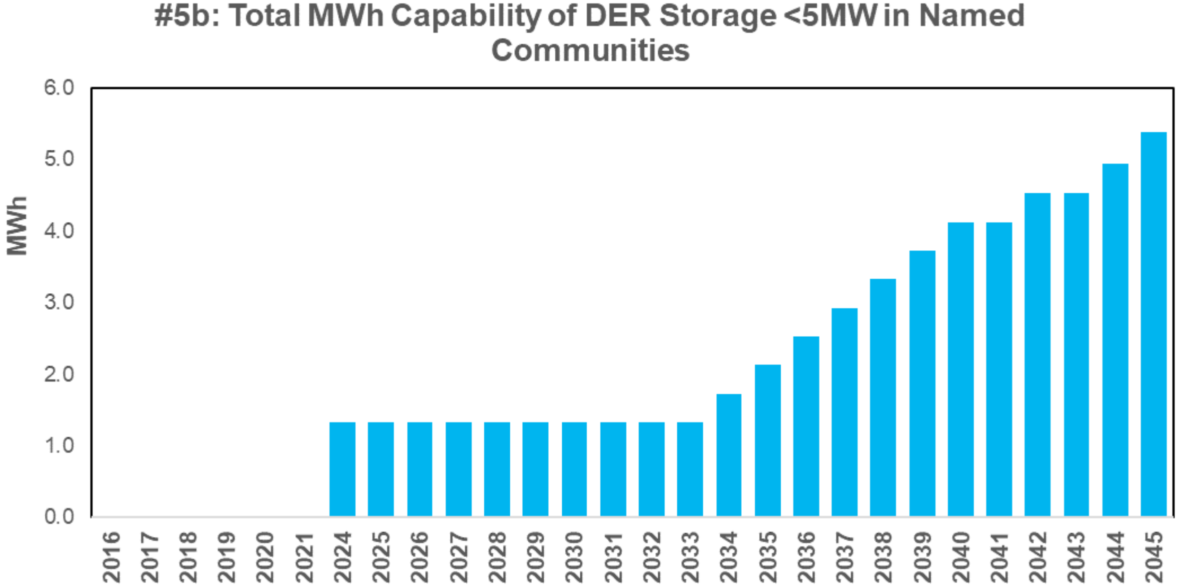
- Excess energy burden amount in excess of 6% of annual income.



Named Community Clean Energy

- DER generation includes:
  - PURPA generation in named communities
  - Community solar
  - Customer net metering
- Community solar selected between 2024 – 2033 supported by tax incentives.
- Community solar with battery storage selected after 2034.



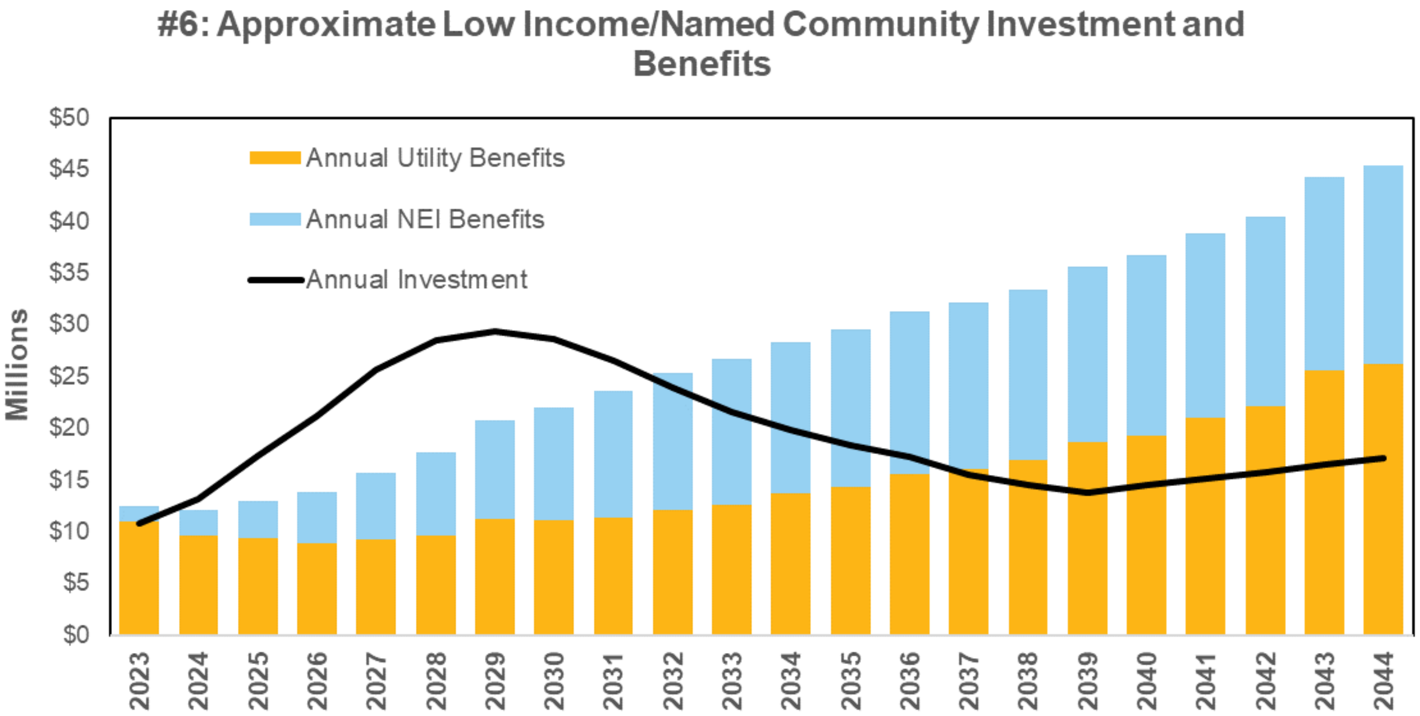


Investments in Named Communities

- Includes low-income EE investment and likely named community demand response investment.

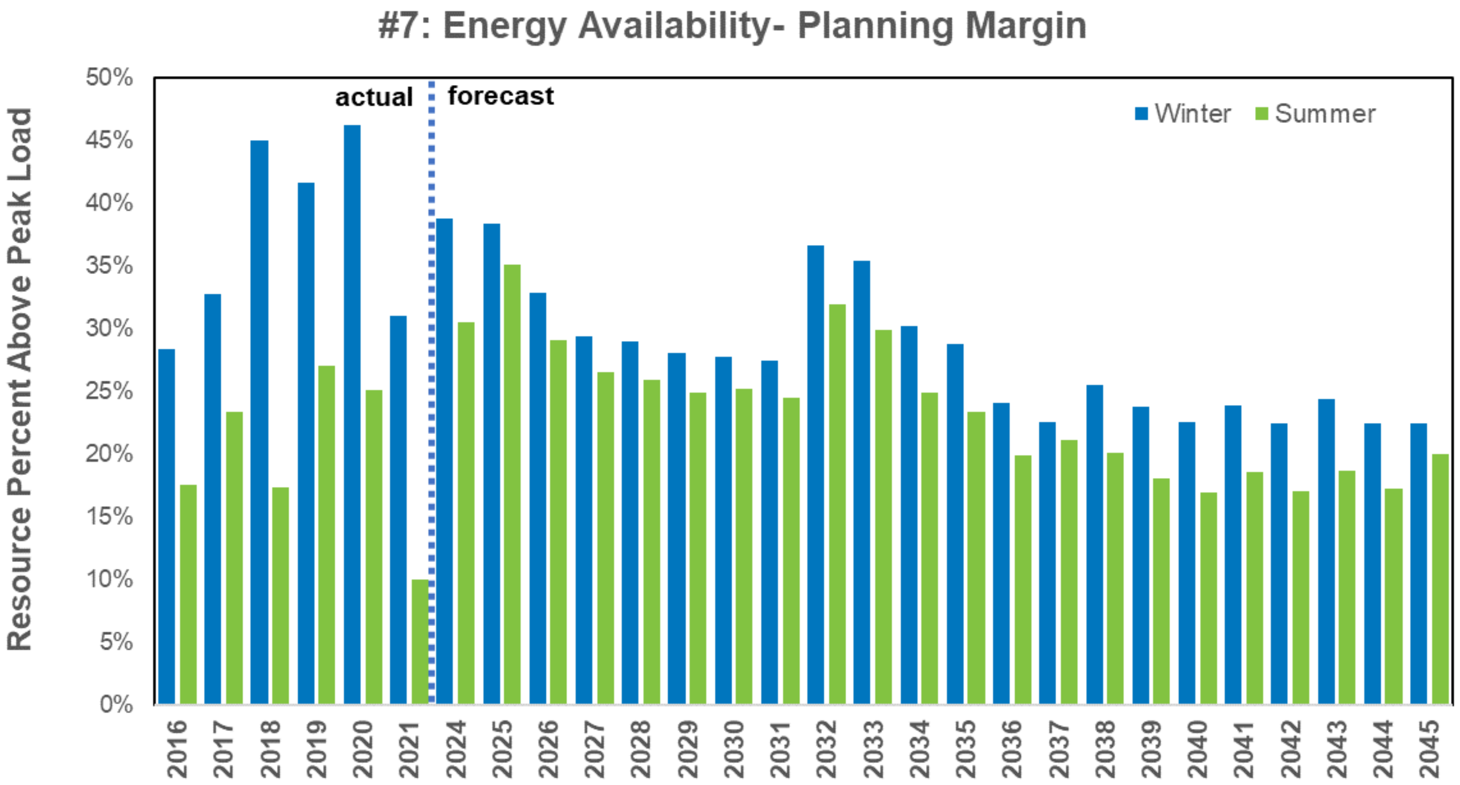
- Annual NEI and utility benefit is the market value or established NEI unit rate of energy associated with EE and named community demand response.

- Investment declines as EE opportunities decline over the planning horizon.



Energy Availability

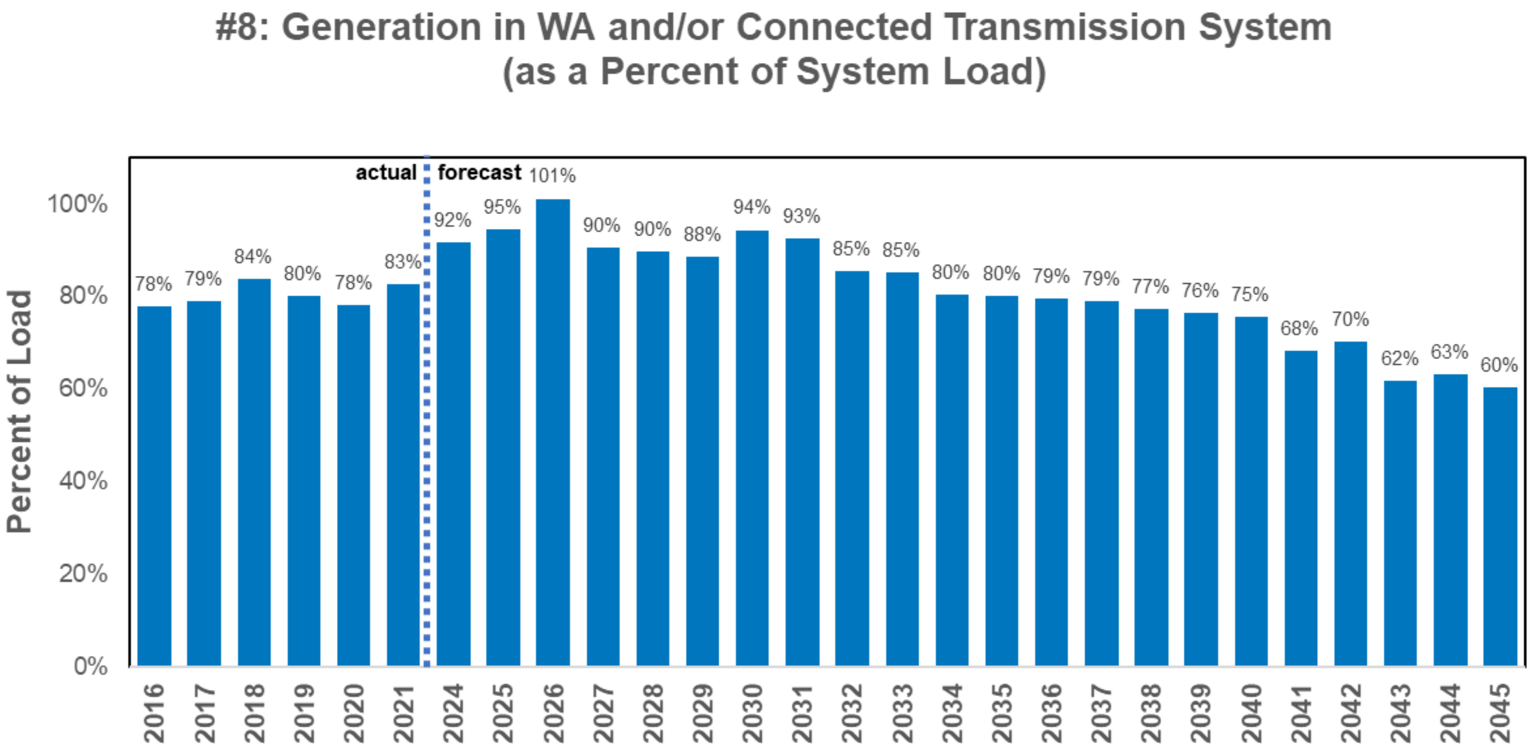
- Energy availability is related to energy resiliency.
- Planning margins:
  - Winter – 22%
  - Summer – 13%
- Energy needs drive selection so resources exceed the planning margin.
- After resource additions planning margin decreases but does not reach target.



Energy Generation Location

- Energy generation location and connectivity is related to customer energy security.

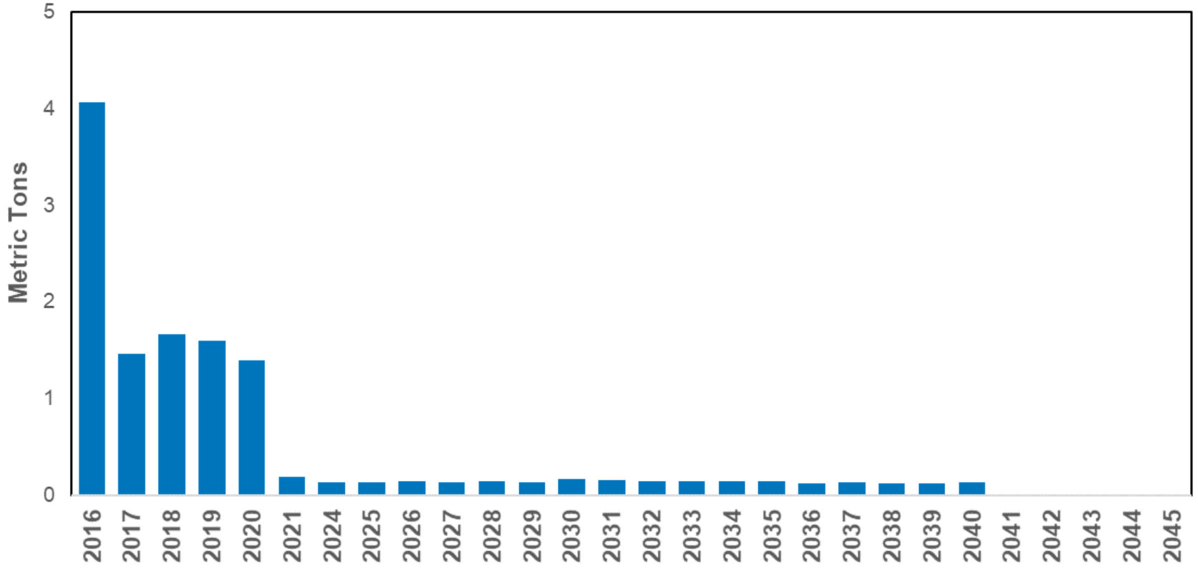
- As a % of load, WA located and/or connected to Avista transmission system decreases as more off system wind generation is added over the planning horizon.



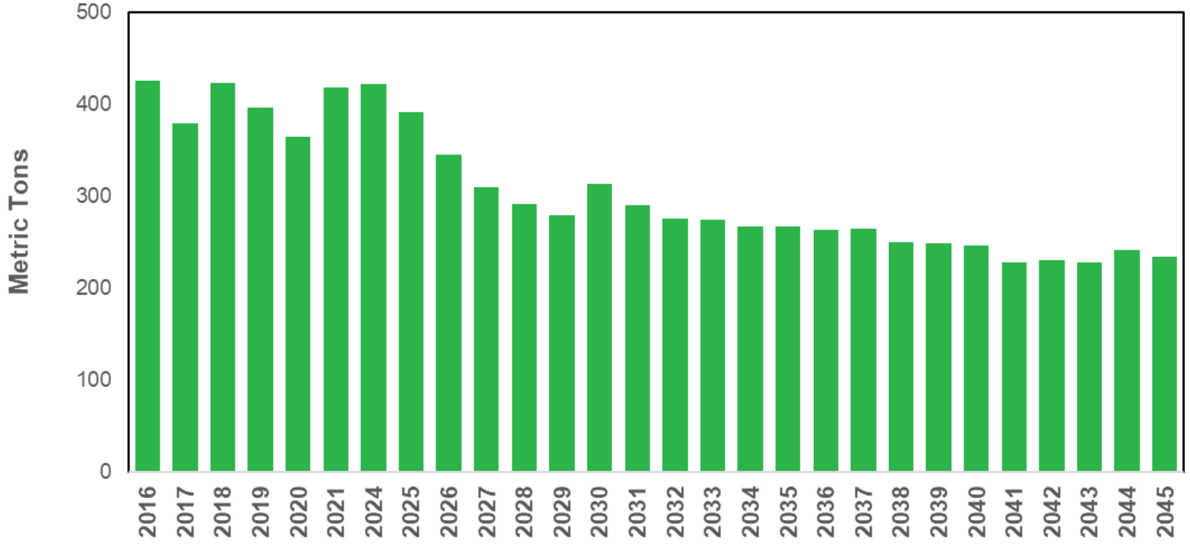
#8: Generation in WA and/or Connected Transmission System (as a Percent of System Load)

Outdoor Air Quality

- Emissions related to thermal generation located in WA.
- SO_2 results related to non-detect field measurements. In the process of confirming results.
- NOx emissions reduce over time as a result of decreased emission rates from Kettle Falls upgrade and decreased dispatch of Kettle Falls.



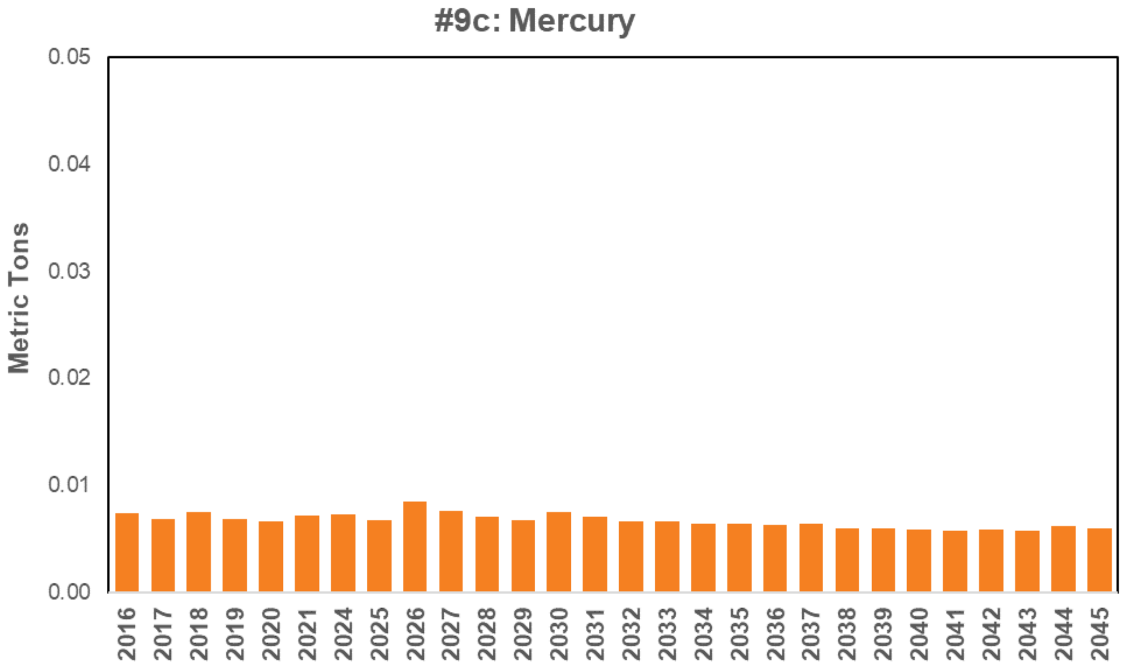
#9a: SO2

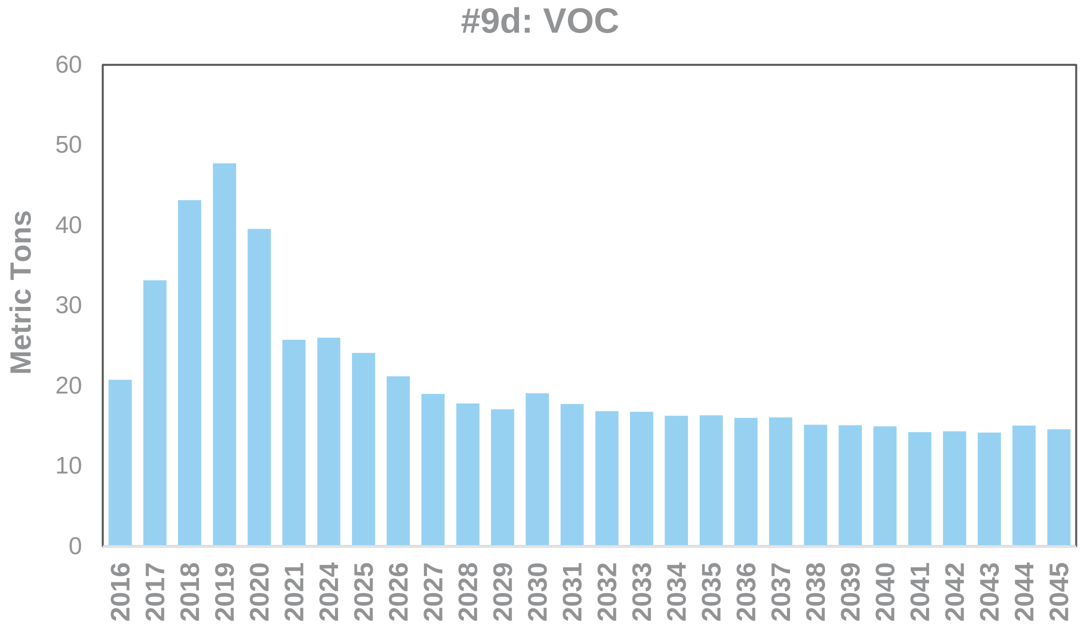


#9b: NOx

Outdoor Air Quality

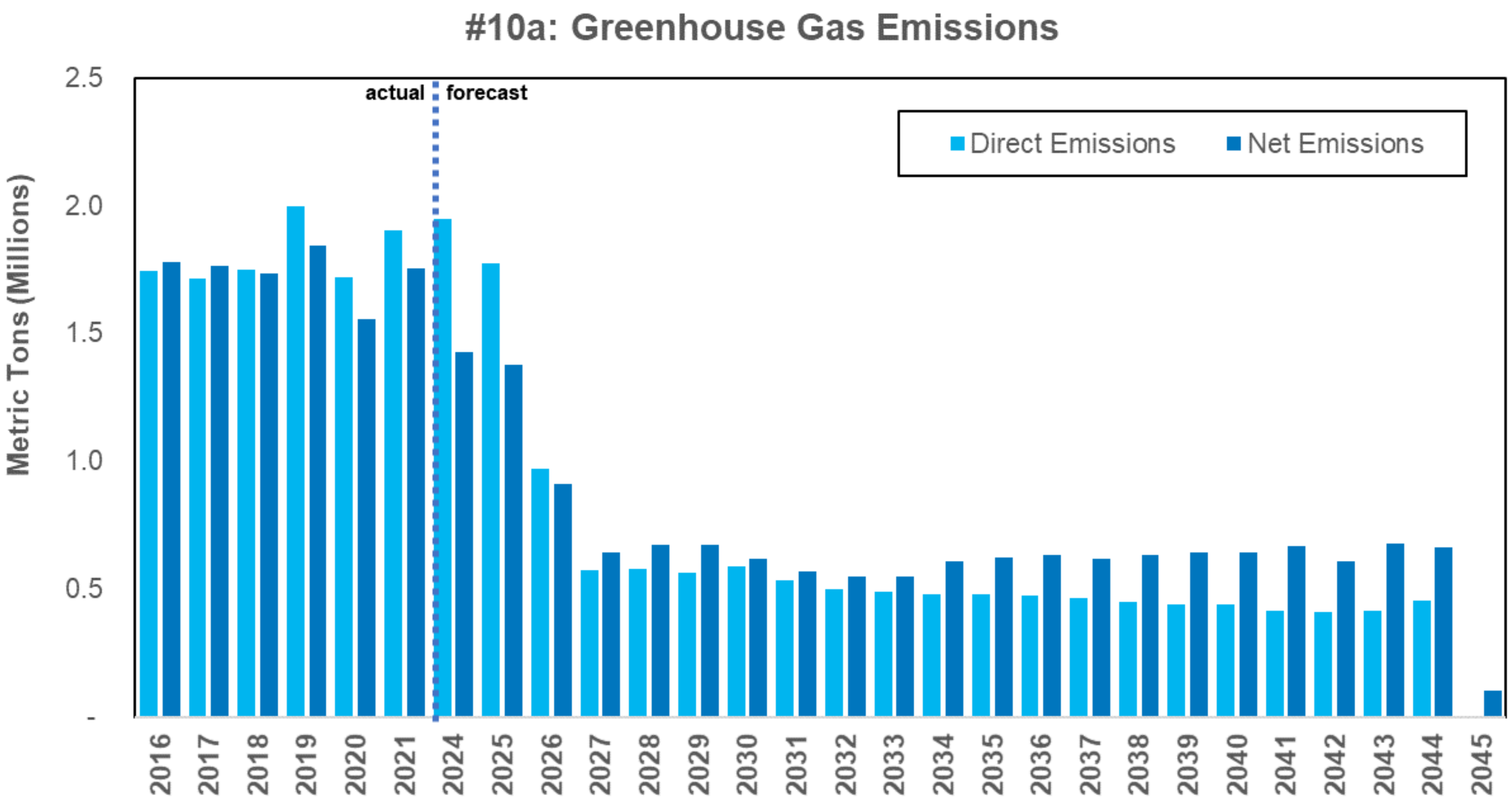
- Emissions related to thermal generation located in WA.
- Small reduction in Mercury emissions.
- VOC emissions reduce over time as a result of decreased emission rates from Kettle Falls upgrade and decreased dispatch of Kettle Falls.





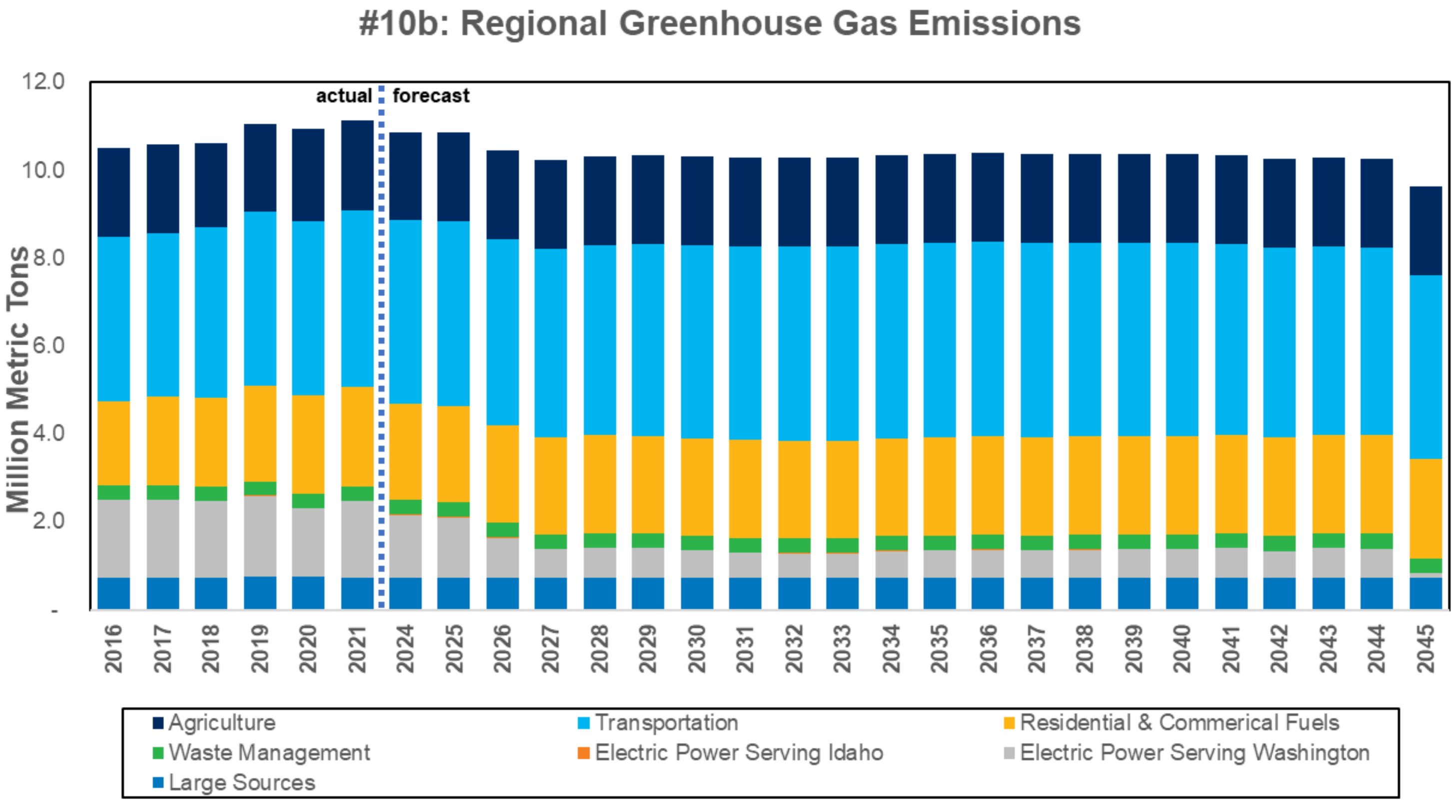
Greenhouse Gas Emissions

- Direct emissions are the WA portion of total system emissions.
- Net emissions are the WA portion of total system emissions net of market transactions.
- Significant reduction in 2025 from use of Colstrip for WA retail load.
- Net emissions begin to exceed direct emissions as more market purchases used to supply WA retail load.



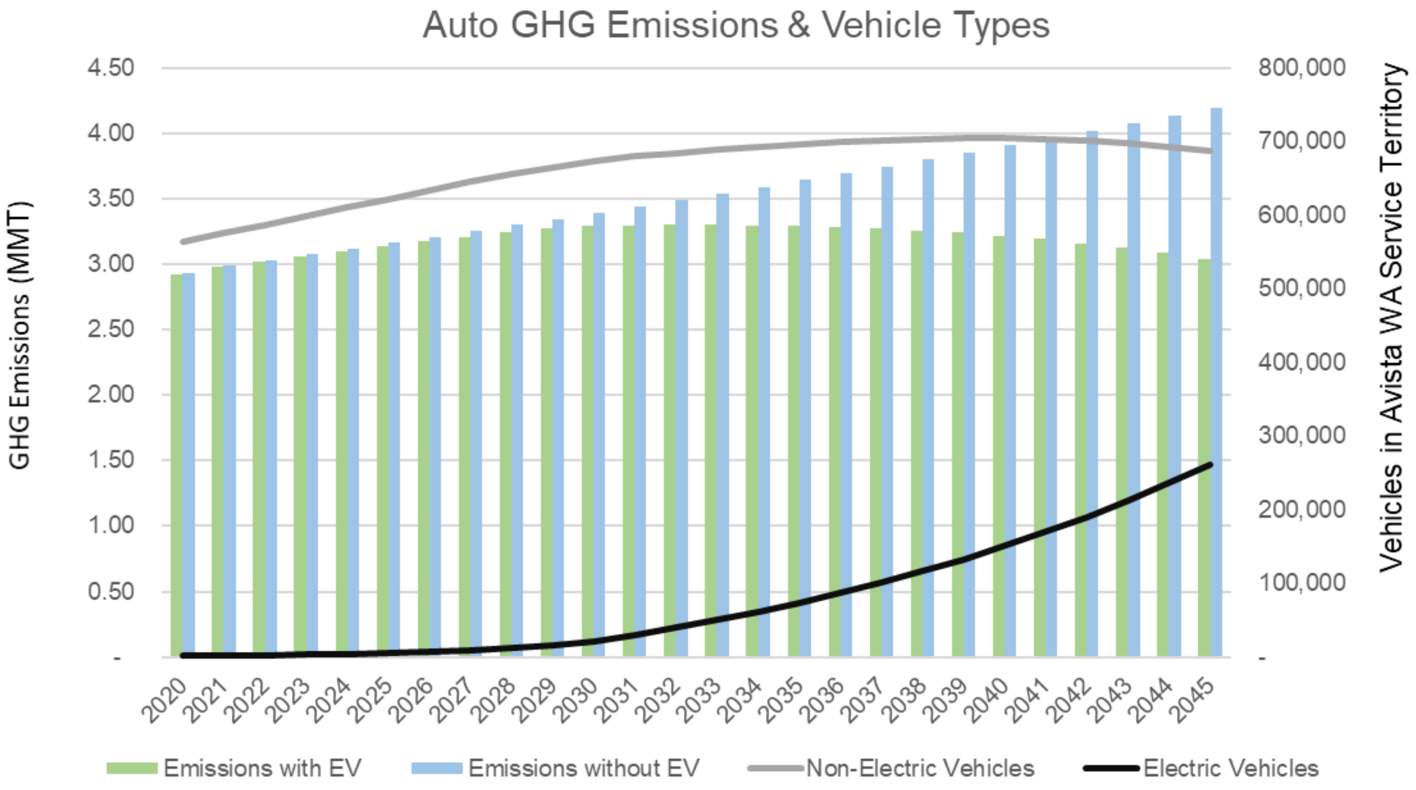
Greenhouse Gas Emissions

- Agriculture & large sources held constant over forecast period.
- Electric power from IRP modeling.
- Waste Management increases in proportion to population.
- Residential & commercial fuels from Gas IRP forecast.
- Transportation:
    - Rail held constant
    - Air increases in proportion to population
    - Auto from EV forecast



Greenhouse Gas Emissions

- Electric vehicle forecast from load forecast.
- In 2045 28.6% of vehicles are electric.
- Forecast includes increased gas efficiency over the planning horizon.
- 0.12 MMT increase over planning horizon.
- 1.16 reduction over no electric vehicle scenario.



*Emission estimates do not include full life cycle carbon emissions associated with each vehicle type

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2023 Progress Report Outline

Lori Hermanson, Senior Power Supply Analyst
Technical Advisory Committee Meeting No. 8
December 14, 2022

Progress Report Outline

- Chapter 1 - Progress Report Introduction
- Chapter 2 - Economic and Load Forecast
- Chapter 3 - Existing Supply-side Resources
- Chapter 4 - Long-term Position
- Chapter 5 - Distributed Energy Resources (includes EE and DR)
- Chapter 6 - Supply-side Resource Options
- Chapter 7 - Transmission & Distribution
- Chapter 8 - Market Analysis
- Chapter 9 – Placeholder Resource Strategy
- Chapter 10 - Customer Impacts

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Next Steps

James Gall, Manager of Integrated Resource Planning
Technical Advisory Committee Meeting No. 8
December 14, 2022

Next Steps

- Washington Progress Report to be filed **January 3, 2023**
- Virtual Public Meetings on **March 8, 2023**
- Schedule Changes
  - Combines February and March meetings
    - Next TAC meeting **March 15, 2023**, 9am to 4pm (in person/ Teams)
  - Draft IRP release moved to **March 31, 2023**
- File final IRP **on June 1, 2023**
- Schedule may change subject to RFP negotiations