Natural Gas Integrated Resource Plan
TAC #4

November 18, 2020

Agenda

1. CPA results from AEG (60 minutes) – Ken Walter
2. CPA results from ETO (60 minutes) – Spencer Moersfelder, Ted Light
3. Break (15 minutes)
4. Sendout Model (15 minutes) – Tom Pardee
5. Review assumptions (30 minutes) – Tom Pardee
6. Lunch break (60 minutes)
7. Final modeling results for Expected Case (60 minutes) – Tom Pardee
8. Final modeling results for Other Scenarios (60 minutes) – Tom Pardee
9. Action Plan and Next Steps (30 minutes) – Tom Pardee

2020 Natural Gas IRP Schedule

TAC 1: Wednesday, June 17, 2020: TAC meeting expectations, 2020 IRP process and schedule, energy efficiency update, actions from 2018 IRP, and a Winter of 2018-2019 review. Procurement Plan and Resource Optimization benefits. fugitive Emissions, Weather Analysis, Weather Planning Standard

TAC 2 (Dual Meeting with Power side): Thursday, August 6, 2020: Market Analysis, Price Forecasts, Cost Of Carbon, Environmental Policies

- Demand Results and Forecasting – August 18, 2020

TAC 3: Wednesday, September 30, 2020: Distribution, Avista's current supply-side resources overview, supply side resource options, renewable resources, Carbon cost, price elasticity, sensitivities and portfolio selection modeling.

TAC 4: Wednesday, November 18, 2020: CPA results from AEG & ETO, review assumptions and action items, final modeling results, portfolio risk analysis and 2020 Action Plan.

Applied Energy Group

2020 CONSERVATION POTENTIAL ASSESSMENT – UPDATE

Prepared for the Avista Technical Advisory Committee

Energy solutions. Delivered.

November 18, 2020

AVISTA 2020 NATURAL GAS CPA

CPA Methodology Overview

- Review of AEG Approach
- Levels of Potential
- Economic Screening and IRP Integration
- Retained enhancements from 2018 Action Plan

Summary of Results

- Summary of Potential
  - High level potential
  - Technical Achievable compared to Economic potential
- Comparison to previous CPA

ABOUT AEG

AEG Applied Energy Group

Planning

- Baseline studies
- Market assessment studies
- Program design & action plans
- End-use forecasting

EM&V

- EE portfolio & targeted programs
- Demand response programs & dynamic pricing
- Pilot design & experimental design
- Behavioral programs

Implementation & Technical Services

- Engineering review, due-diligence, QA/QC
- M&V, modeling & simulation, onsite assessments
- Technology R&D and data tools (DEEM)
- Program admin, marketing, implementation, application processing

Market Research

- Program / service pricing optimization
- Process evaluations
- Market assessment / saturation surveys
- Market segmentation
- Customer satisfaction / customer engagement

VISION DSM™ Platform

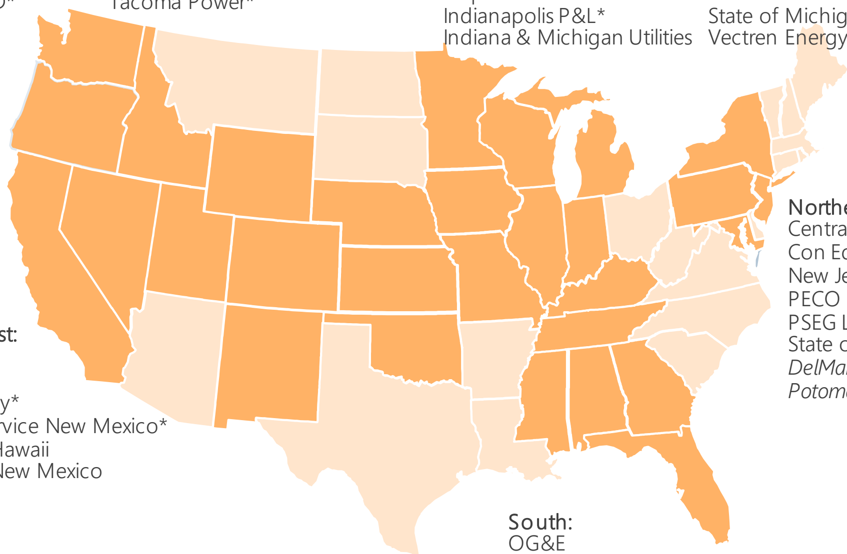
Full DSM lifecycle tracking & reporting

AEG EXPERIENCE IN PLANNING

Including Potential Studies and End-Use Forecasting

Northwest & Mountain:
Avista*
BPA*
Cascade Natural Gas
Chelan PUD
Cheyenne LFP
Colorado Electric*
Cowlitz PUD*
Inland P&L*
Oregon Trail EC
PacifiCorp*
PNGC
PGE*
Seattle City Light*
Tacoma Power*

Midwest:
Ameren Illinois*
Ameren Missouri*
Citizens Energy
Empire District Electric
Indianapolis P&L*
Indiana & Michigan Utilities
Kansas City Power & Light
MERC
NIPSCO*
Omaha Public Power District
State of Michigan
Vectren Energy*



Northeast & Mid Atlantic:
Central Hudson G&E*
Con Edison of NY*
New Jersey BPU
PECO Energy
PSEG Long Island
State of Maryland (*BG&E, DelMarva, PEPCO, Potomac Edison, SMECO*)

Southwest:
HECO
LADWP
NV Energy*
Public Service New Mexico*
State of Hawaii
State of New Mexico
Xcel/SPS

South:
OG&E
Kentucky Power
Southern Company (*APC, GPC, Gulf Power, MPC*)
TVA

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

* Two or more studies

AEG has conducted more than 60 planning studies for more than 40 utilities / organizations in the past five years.

AEG has a team of 11 experienced Planning staff plus support from AEG's Technical Services and Program Evaluation groups

AEG CPA Methodology

CPA OBJECTIVES

The Avista Conservation Potential Assessment (CPA) supports the Company's regulatory filing and other demand-side management (DSM) planning efforts and initiatives.

The two primary research objectives for the 2020 CPA are:

- **Program Planning:** insights into the market for natural gas energy efficiency (EE) measures in Avista's Washington and Idaho service territories
  - For example, CPAs provide insight into changes to existing program measures as well as new measures to consider
- **IRP:** long-term forecast of future EE potential for use in the IRP
  - Economic Achievable Potential (EAP) for natural gas

AEG utilizes its comprehensive LoadMAP analytical models that are customized to Avista's service territory.

OVERVIEW OF AEG'S APPROACH

Overview – Natural Gas CPA

Market Characterization

- Avista control totals
- Customer account data
- Secondary data
- Avista market research

Identify Demand-Side Resources

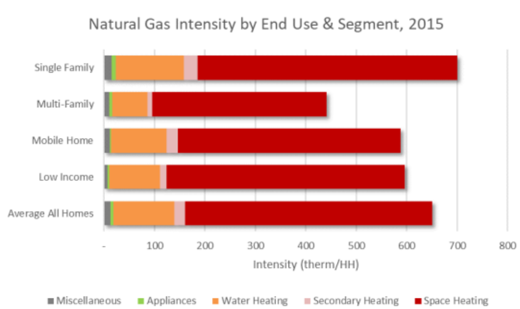
- EE technologies
- EE measures
- Emerging measures and technologies

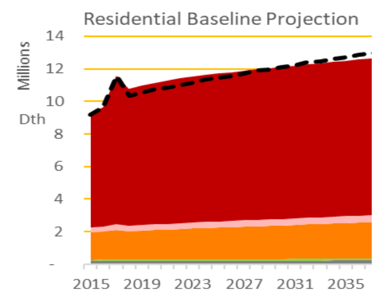
Baseline Projection

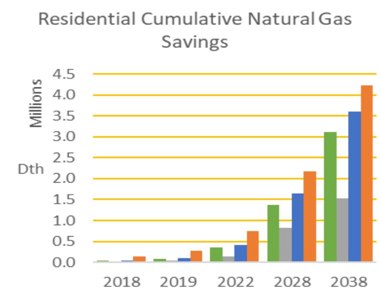
- Avista Load Forecast
- Customer growth
- Standards and building codes
- Efficiency options
- Purchase Shares

Potential Estimation

- Technical
- Technical Achievable
- Economic Screen *(TRC and UCT)*







KEY SOURCES OF DATA
Prioritization of Avista Data

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

Avista sources include:

- 2013 Residential GenPop Survey
- Forecast data and load research
- Recent-year accomplishments and plans

Regional sources include:

- NEEA studies (RBSA 2016, CBSA 2019, IFSA)
- RTF and Power Council methodologies, ramp rates, and measure assumptions

Additional sources include:

- U.S. DOE's Annual Energy Outlook
- Technical Reference Manuals and California DEER
- AEG Research

BASELINE PROJECTION
Overview

"How much energy would customers use in the future if Avista stopped running 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 natural gas consumption at the same level of detail as the market profile

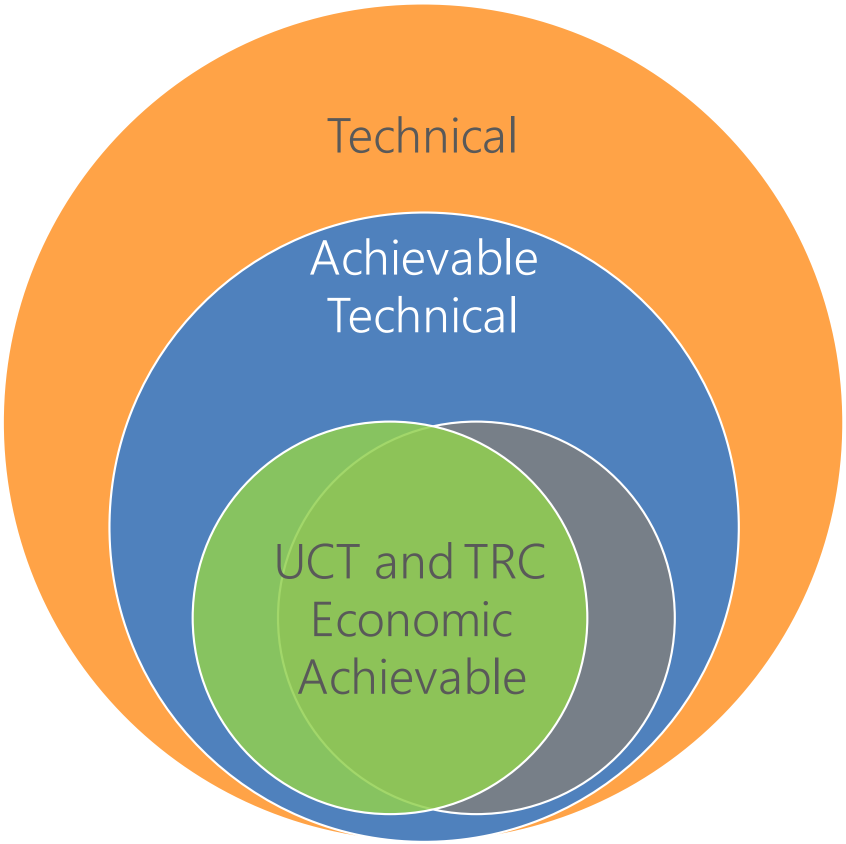
The baseline projection:

Includes	Excludes
• 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	• Expected impact of naturally occurring efficiency (except market baselines) • Impacts of current and future demand-side management programs

LEVELS OF POTENTIAL

We estimate three levels of potential. These are standard practice for CPAs in the Northwest:

- **Technical**: everyone chooses the most efficient option when equipment fails regardless of cost
- **Achievable Technical** is a subset of technical that accounts for achievable participation within utility programs as well as non-utility mechanisms, such as regional initiatives and market transformation
- **Achievable Economic** is a subset of achievable technical potential that includes only <u>cost-effective</u> measures. Tests considered within this study include UCT, and TRC.



ECONOMIC SCREENING

Two Cost-Effectiveness Tests

In assessing cost-effective, achievable potential within Avista's Washington and Idaho territories, AEG utilized two cost tests:

- **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 utility's and participant's perspectives. Includes non-energy impacts if they can be quantified and monetized.

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

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

ENHANCEMENTS RETAINED FROM 2018 CPA

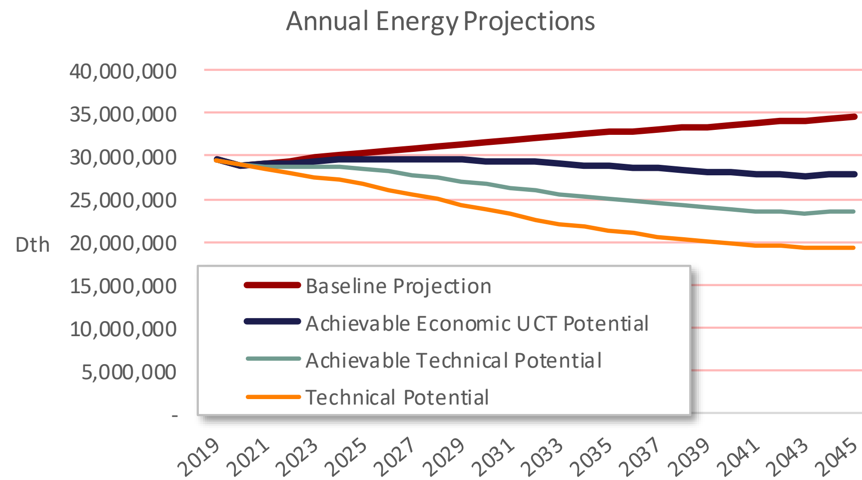
- The Measure Assumptions appendix is again available, containing UES data and other key assumptions and their sources
- **Fully Balanced TRC**. Using the same process developed in the 2018 CPA, the balanced TRC test includes an expanded scope of documentable and quantifiable impacts, including:
  1. 10% Conservation Credit in Washington
  2. Quantified and monetized non-energy impacts (e.g. water, detergent, wood)
  3. Projected cost of carbon in Washington
  4. Heating calibration credit for secondary fuels (12% for space heating, 6% for secondary heating)
  5. Electric benefits for applicable measures (e.g. cooling savings for smart thermostats, lighting and refrigeration savings for retrocommissioning)

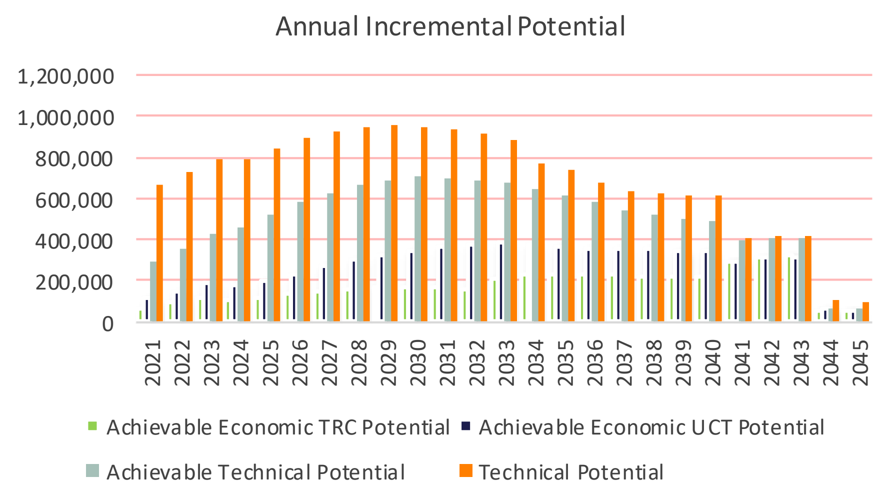
GAS ENERGY EFFICIENCY POTENTIAL

Potential Summary –WA & ID All Sectors

Projections indicate that gas savings of 1.5% of baseline consumption per year are Technically Achievable, and 0.8% per year is cost effective under the UCT test.

- TAP savings are 643,198 Dth in 2022, and 4,906,228 Dth in 2030
- UCT savings are 261,833 Dth in 2022 and 2,124,189 Dth in 2030
- Across the study period, ~46% of TAP savings are UCT cost-effective

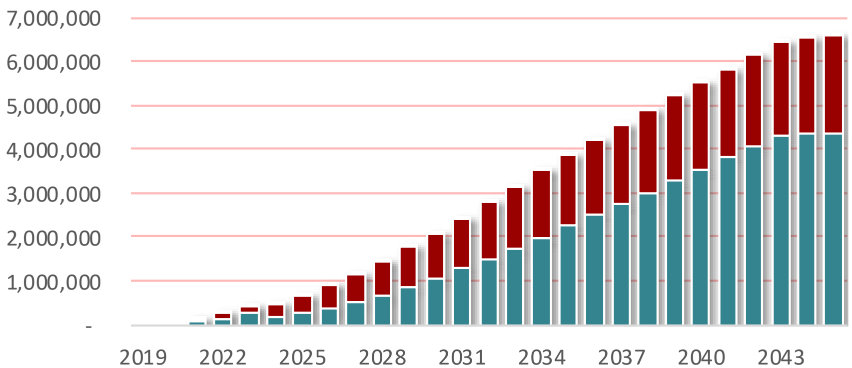




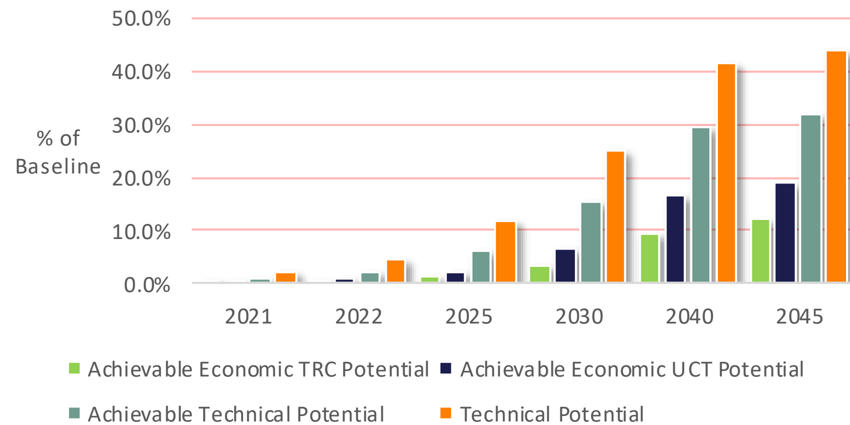
GAS EE POTENTIAL, CONTINUED

Potential Summary – WA & ID, All Sectors

Cumulative UCT Gas Savings (Dth) by Sector



Cumulative Gas Savings, Selected Years



Summary of Energy Savings (Dth), Selected Years	2021	2022	2025	2030	2040	2045
Reference Baseline	29,137,671	29,434,469	30,325,189	31,617,083	33,626,695	34,510,725
Cumulative Savings (Dth)						
Achievable Economic TRC Potential	68,091	163,156	364,805	1,125,806	3,188,178	4,257,057
Achievable Economic UCT Potential	111,637	261,833	686,706	2,124,189	5,585,922	6,625,682
Achievable Technical Potential	290,015	643,198	1,879,807	4,906,228	9,853,874	10,970,898
Technical Potential	662,737	1,387,924	3,587,536	7,862,508	13,922,189	15,068,864
Energy Savings (% of Baseline)						
Achievable Economic TRC Potential	0.2%	0.6%	1.2%	3.6%	9.5%	12.3%
Achievable Economic UCT Potential	0.4%	0.9%	2.3%	6.7%	16.6%	19.2%
Achievable Technical Potential	1.0%	2.2%	6.2%	15.5%	29.3%	31.8%
Technical Potential	2.3%	4.7%	11.8%	24.9%	41.4%	43.7%
Incremental Savings (Dth)						
Achievable Economic TRC Potential	68,091	95,046	117,484	165,797	218,288	49,635
Achievable Economic UCT Potential	111,637	150,478	202,477	345,896	343,741	56,935
Achievable Technical Potential	290,015	355,639	522,562	701,742	483,964	58,801
Technical Potential	662,737	730,524	845,047	950,617	611,563	98,433

GAS EE TOP MEASURES

Achievable Economic UCT Potential

Rank	Measure / Technology (Ranked by 1st year potential)	Achievable Economic UCT Potential (Dth) 2021	2022	2023	2030	% of Total
1	Residential - Furnace	35,602	81,473	134,334	136,211	6.4%
2	Residential - Gas Furnace - Maintenance	13,403	30,912	48,232	177,842	8.4%
3	Commercial - Water Heater	8,854	25,070	46,662	292,125	13.8%
4	Commercial - Space Heating - Heat Recovery Ventilator	7,569	15,162	22,499	65,615	3.1%
5	Commercial - Boiler	6,643	17,112	30,155	131,730	6.2%
6	Residential - Insulation - Ceiling, Installation	5,253	11,641	19,390	99,329	4.7%
7	Residential - ENERGY STAR Connected Thermostat	4,435	9,925	16,719	114,399	5.4%
8	Commercial - HVAC - Duct Repair and Sealing	3,777	7,461	11,046	33,252	1.6%
9	Commercial - Insulation - Wall Cavity	3,337	9,043	17,710	123,408	5.8%
10	Residential - Water Heater	2,954	9,266	19,112	162,884	7.7%
11	Industrial - Process Heat Recovery	2,849	5,670	8,461	21,943	1.0%
12	Commercial - Gas Boiler - Insulate Steam Lines/Condensate Tank	2,517	4,965	7,337	21,733	1.0%
13	Commercial - Insulation - Roof/Ceiling	2,507	6,823	13,348	89,849	4.2%
14	Commercial - Water Heater - Central Controls	1,901	3,766	5,585	13,155	0.6%
15	Commercial - Gas Boiler - Hot Water Reset	1,822	4,002	6,598	30,638	1.4%
16	Commercial - Gas Boiler - High Turndown	1,230	2,424	3,578	8,452	0.4%
17	Commercial - Fryer	1,210	2,946	5,199	29,424	1.4%
18	Commercial - Building Automation System	590	1,735	3,703	61,280	2.9%
19	Commercial - Water Heater - Faucet Aerator	581	1,269	2,079	9,046	0.4%
20	Commercial - Kitchen Hood - DCV/MUA	529	1,055	1,577	5,057	0.2%
	Total of Top 20 Measures	**107,565**	**251,718**	**423,324**	**1,627,371**	**76.6%**
	Total Cumulative Savings	**111,637**	**261,833**	**445,437**	**2,124,189**	**100.0%**

GAS EE TOP MEASURES

UCT & TRC Potential vs Technical Achievable

Rank	Measure / Technology (Ranked by 10-year TAP)	2030 Savings (Dth) TAP	UCT	TRC	*% of TAP* *UCT*	*TRC*
1	Residential - Windows - High Efficiency	670,667	905	0	*0.1%*	*0.0%*
2	Residential - Combined Boiler + DHW System (Storage Tank)	410,862	0	0	*0.0%*	*0.0%*
3	Residential - Combined Boiler + DHW System (Tankless)	338,983	0	0	*0.0%*	*0.0%*
4	Commercial - Water Heater	292,125	292,125	292,125	*100.0%*	*100.0%*
5	Residential - ENERGY STAR Homes	198,515	198,833	0	*100.2%*	*0.0%*
6	Residential - Gas Furnace - Maintenance	191,846	177,842	0	*92.7%*	*0.0%*
7	Residential - Water Heater	163,124	162,884	0	*99.9%*	*0.0%*
8	Residential - Insulation - Wall Cavity, Installation	162,690	8,840	0	*5.4%*	*0.0%*
9	Residential - Insulation - Ceiling, Installation	145,717	99,329	0	*68.2%*	*0.0%*
10	Residential - Furnace	136,211	136,211	136,211	*100.0%*	*100.0%*
11	Residential - ENERGY STAR Connected Thermostat	136,197	114,399	0	*84.0%*	*0.0%*
12	Commercial - Boiler	131,730	131,730	131,730	*100.0%*	*100.0%*
13	Residential - Insulation - Floor/Crawlspace	128,866	56,643	0	*44.0%*	*0.0%*
14	Commercial - Insulation - Wall Cavity	123,131	123,408	115,763	*100.2%*	*94.0%*
15	Commercial - Water Heater - Solar System	112,885	0	0	*0.0%*	*0.0%*
16	Residential - Windows - Low-e Storm Addition	108,983	0	121,262	*0.0%*	*111.3%*
17	Commercial - Insulation - Roof/Ceiling	97,447	89,849	31,527	*92.2%*	*32.4%*
18	Residential - Insulation - Ceiling, Upgrade	83,492	0	0	*0.0%*	*0.0%*
19	Residential - Insulation - Basement Sidewall	81,620	0	0	*0.0%*	*0.0%*
20	Commercial - Building Automation System	74,305	61,280	0	*82.5%*	*0.0%*
	Total of Top 20 Measures	**3,789,395**	**1,654,278**	**828,619**		
	Total Cumulative Savings	**4,906,228**	**2,124,189**	**1,125,806**	***43.3%***	***22.9%***

ACHIEVABLE POTENTIAL COMPARISON

Comparison with Prior Potential Study (2021-2038 **TAP**)

- The previous CPA included potential for 2018-2020, which is removed here
- For the 2021-2038 period, the current study shows quite a bit more **Technical Achievable** potential
- However, **UCT Cost Effective** potential is lower for this period.
  - Largest drop is in Residential water heating, due to a combination of factors:
    - Lower Water Heater unit savings
    - Removal or reduction in WA of HB-1444 affected water saving measures
    - New potential from measures like combination DHW+Boiler systems is expensive

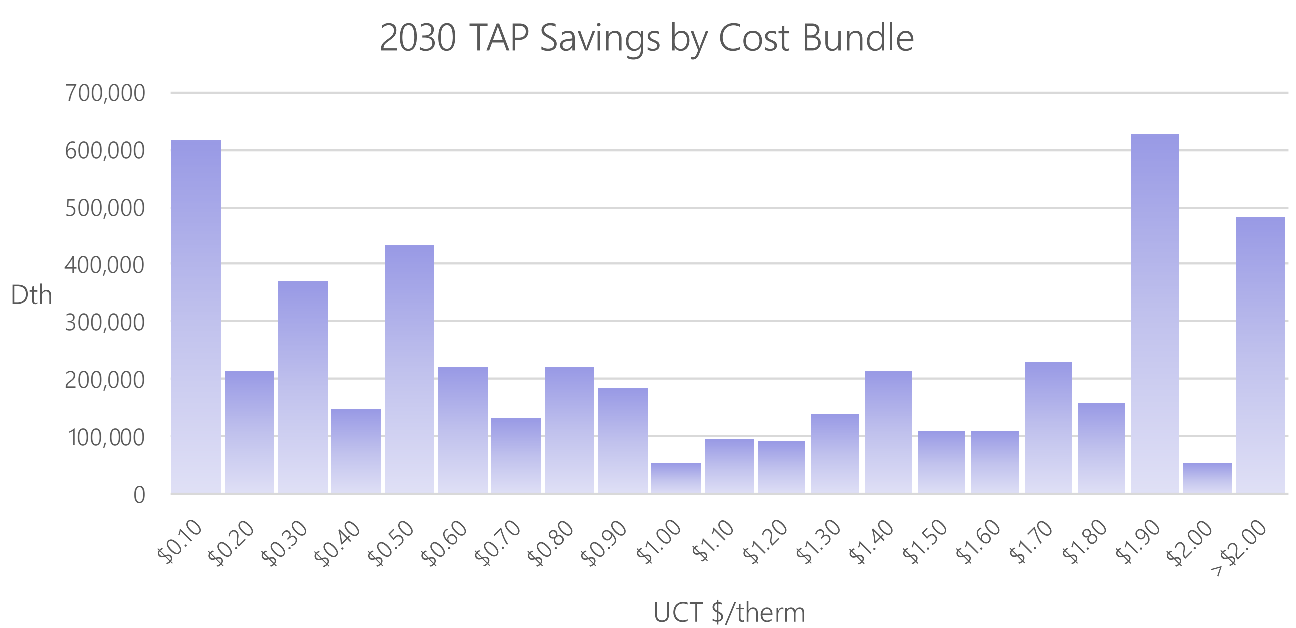
Sector (All States)	End Use	2038 TAP Savings (Dth) Prior CPA	Current Study	Diff.
Residential	Space Heating	2,879,487	4,019,918	1,140,431
	Secondary Heating	62,068	37,249	-24,819
	Water Heating	2,264,651	2,382,341	117,690
	Appliances	3,455	21,880	18,425
	Miscellaneous	2,682	3,172	490
Commercial	Space Heating	1,328,855	1,523,386	194,530
	Water Heating	268,621	903,545	634,924
	Food Preparation	136,388	139,204	2,816
	Miscellaneous	51	173	122
Industrial	Space Heating	7,145	8,125	980
	Process	15,435	40,310	24,875
	Miscellaneous	369	0	-369
Grant Total		**6,969,208**	**9,079,303**	**2,110,095**

Sector (All States)	End Use	2038 **UCT** Savings (Dth) Prior CPA	Current Study	Diff.
Residential	Space Heating	2,274,729	2,071,662	-203,067
	Secondary Heating	0	0	0
	Water Heating	2,223,975	943,071	-1,280,904
	Appliances	1,258	0	-1,258
	Miscellaneous	0	0	0
Commercial	Space Heating	1,131,121	1,088,143	-42,978
	Water Heating	135,582	638,616	503,033
	Food Preparation	136,388	139,204	2,816
	Miscellaneous	45	148	103
Industrial	Space Heating	1,747	6,906	5,159
	Process	14,367	34,395	20,028
	Miscellaneous	369	0	-369
Grant Total		**5,919,582**	**4,922,145**	**-997,437**

ACHIEVABLE POTENTIAL

2030 Savings (TAP) by UCT Cost Bundle – WA + ID All Sectors

UCT $/Therm	2030 TAP Savings (Dth)
$0.00 - $0.10	616,956
$0.10 - $0.20	213,315
$0.20 - $0.30	371,273
$0.30 - $0.40	146,027
$0.40 - $0.50	431,922
$0.50 - $0.60	219,860
$0.60 - $0.70	132,429
$0.70 - $0.80	222,526
$0.80 - $0.90	184,609
$0.90 - $1.00	55,730
$1.00 - $1.10	94,636
$1.10 - $1.20	91,213
$1.20 - $1.30	140,536
$1.30 - $1.40	215,089
$1.40 - $1.50	111,421
$1.50 - $1.60	109,370
$1.60 - $1.70	228,011
$1.70 - $1.80	158,836
$1.80 - $1.90	625,317
$1.90 - $2.00	54,020
$2 or more	483,133



Thank You!

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Energy Trust of Oregon

Energy Efficiency Resource Assessment Study

November 18, 2020

Agenda

- About Energy Trust
- 2019 Achieved Savings
- Resource Assessment Overview and Background
- Methodology
- Results
- Questions/Discussion

About us

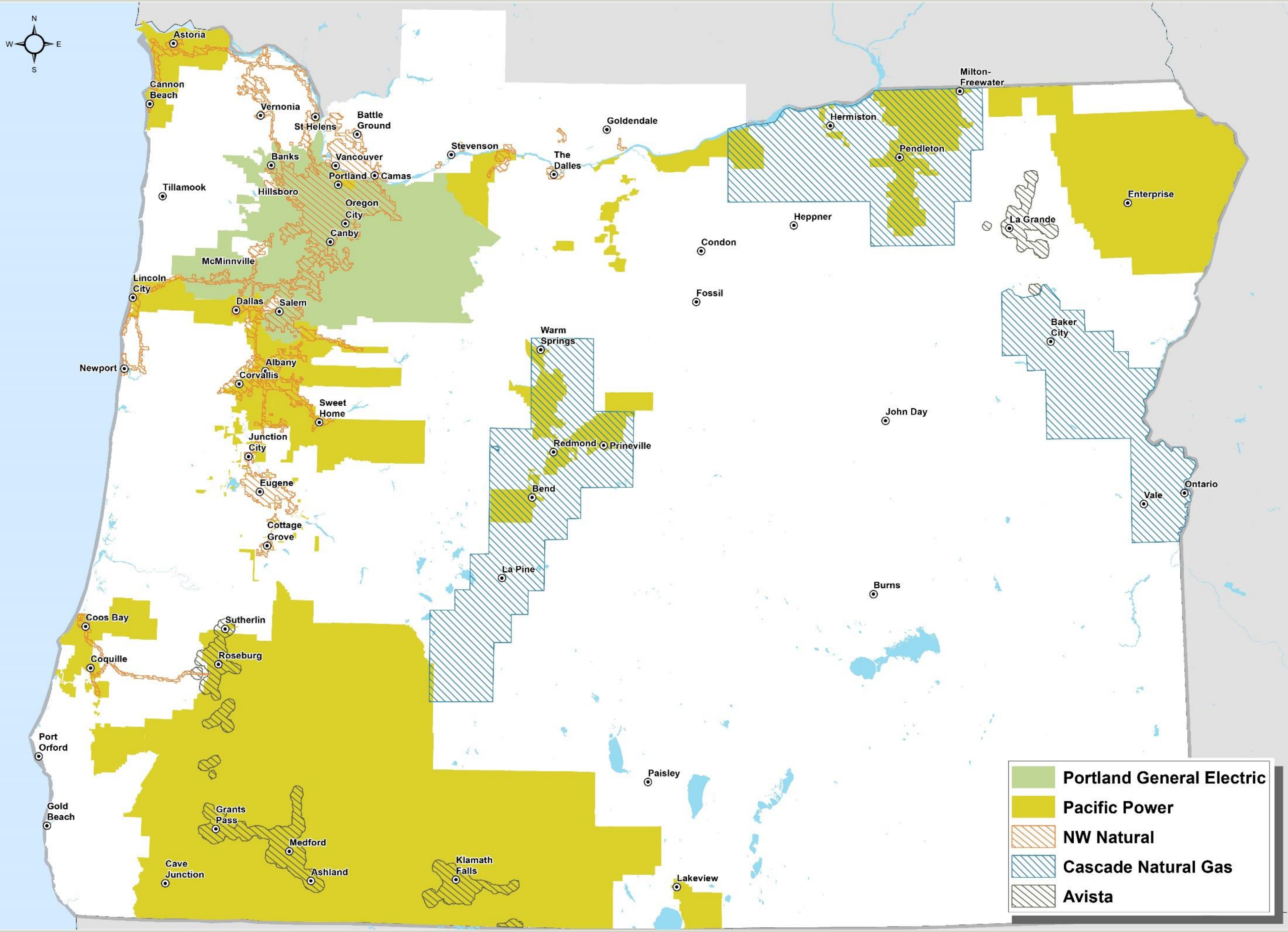
Independent nonprofit

Serving 1.6 million customers of Portland General Electric, Pacific Power, NW Natural, Cascade Natural Gas and Avista

Providing access to affordable energy

Generating homegrown, renewable power

Building a stronger Oregon and SW Washington



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Albany
Corvallis
Sweet Home
Junction City
Eugene
Cottage Grove
Stevenson
The Dalles
Goldendale
Milton-Freewater
Hermiston
Pendleton
Heppner
Condon
Fossil
La Grande
Enterprise
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Prineville
Bend
La Pine
John Day
Ontario
Vale
Burns
Coos Bay
Sutherlin
Roseburg
Coquille
Port Orford
Gold Beach
Grants Pass
Medford
Ashland
Cave Junction
Klamath Falls
Paisley
Lakeview
Portland General Electric
Pacific Power
NW Natural
Cascade Natural Gas
Avista

15 years of affordable energy

From Energy Trust's investment of $1.5 billion in utility customer funds:

Nearly 660,000 sites transformed into energy efficient, healthy, comfortable and productive homes and businesses

10,000 clean energy systems generating renewable power from the sun, wind, water, geothermal heat and biopower

$6.9 billion in savings over time on participant utility bills from their energy-efficiency and solar investments

20 million tons of carbon dioxide emissions kept out of our air, equal to removing 3.5 million cars from our roads for a year

A clean energy power plant

607 average megawatts saved

121 aMW generated

52 million annual therms saved

Enough energy to power **564,000** homes and heat **100,000** homes for a year

Avoided **20** million tons of carbon dioxide

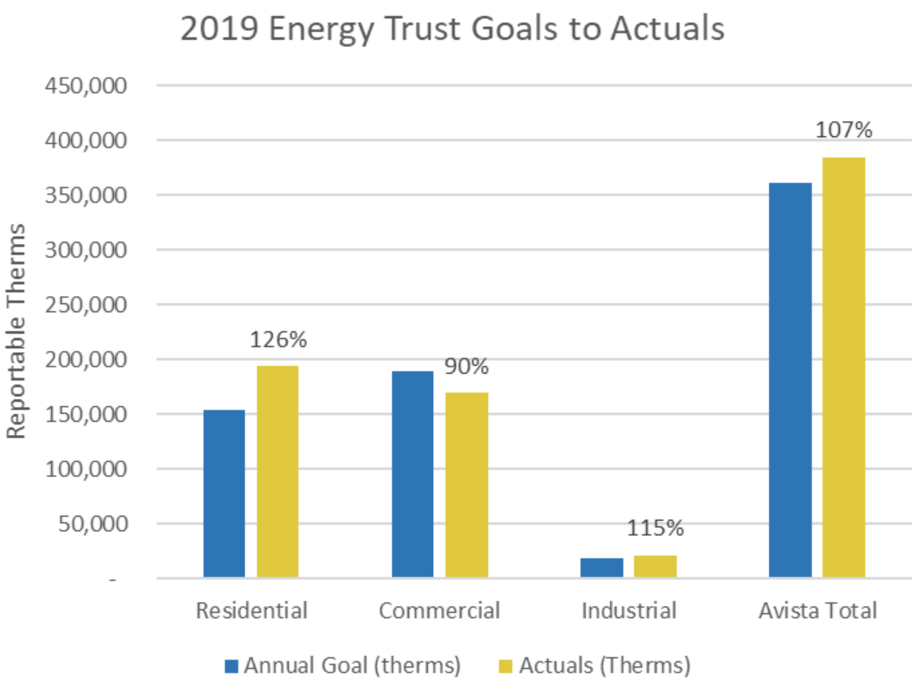
Energy Trust’s 2019 Achievements for Avista

Energy Trust Savings Achievements – 2019

- Energy Trust began serving Avista customers in Oregon in 2016.

- Overall achieved 107% of goal
  - Goal 360k Therms
  - Achieved 384k Therms

- Anticipate continued success as we solidify trade ally and customers relationships.



Energy Trust achieved 107% of goal in Avista service territory

Resource Assessment:
Purpose, Overview and Background

Resource Assessment (RA) Purpose

- Provides estimates of energy efficiency potential that will result in a reduction of load on Avista’s system for use in Avista’s Integrated Resource Plan (IRP).

- The purpose is to help Avista strategically plan future investment in both supply side and demand side resources.

Resource Assessment Overview

- What is a resource assessment?
  - Model that provides an estimate of energy efficiency resource potential achievable over a 20-year period
  - ‘Bottom-up’ approach to estimate potential starting at the measure level and scaling to a service territory

- Energy Trust uses a model in *Analytica* that was developed by Navigant Consulting
  - The *Analytica m*odel calculates Technical, Achievable and Cost-Effective Achievable Energy Efficiency Potential.
  - Final program/IRP targets are established via ramp rates that are applied outside of the model.

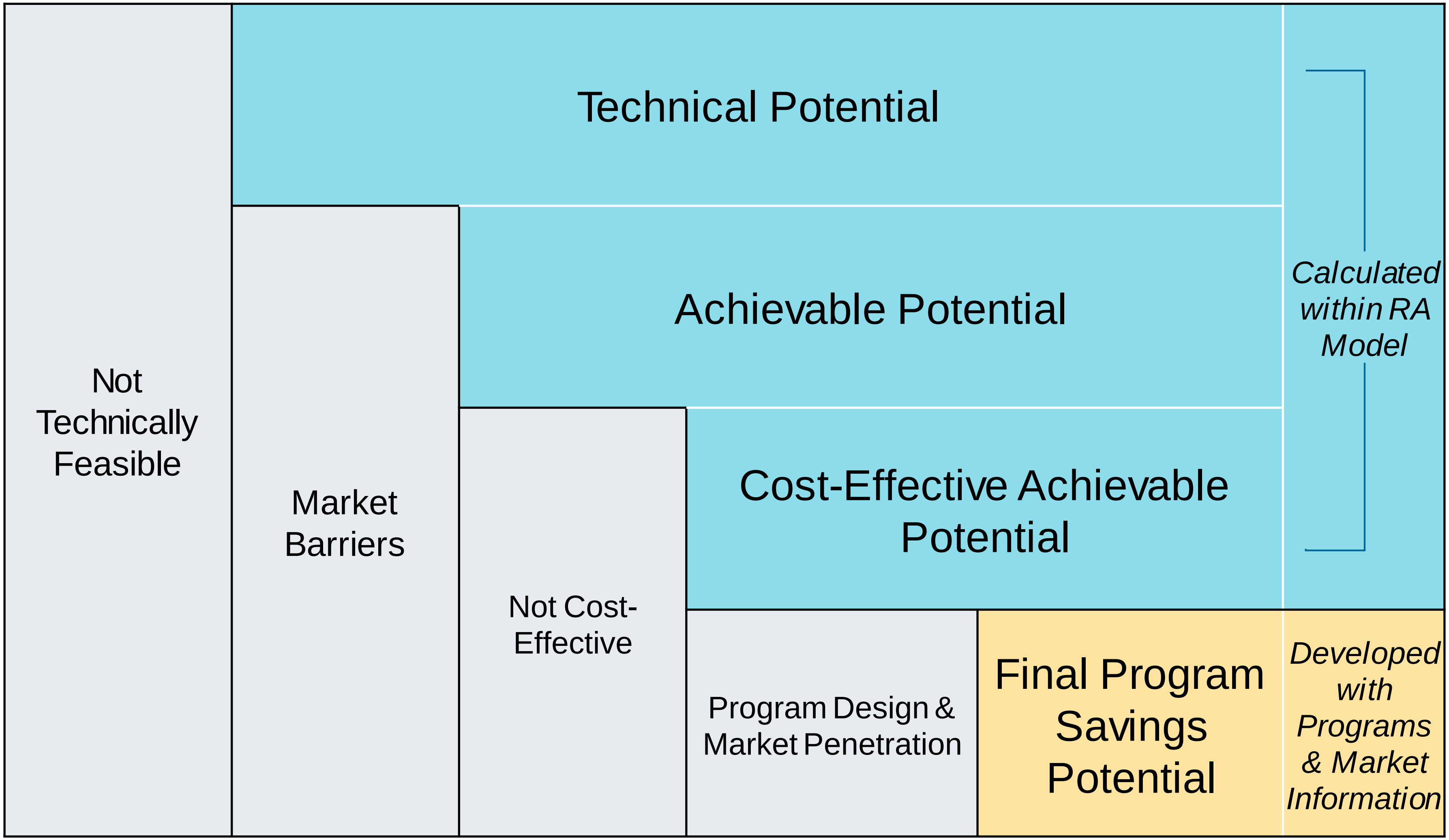
- Data inputs and assumptions in the model are updated in conjunction with IRP about every two years.

Additional Resource Assessment Background

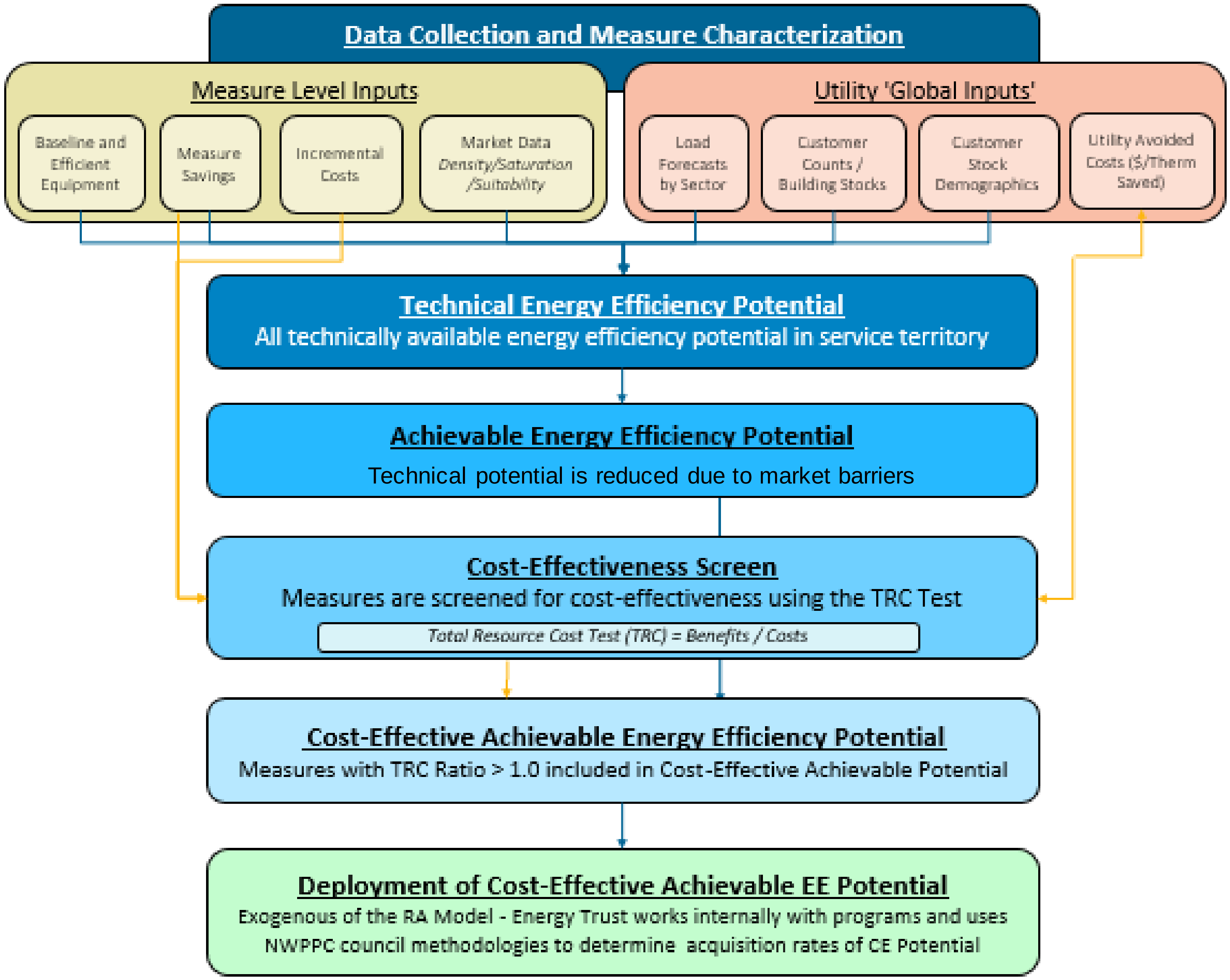
- Informs utility IRP work & Energy Trust strategic and program planning.
- Does not specify mechanism of savings acquisition (e.g. programs, market transformation, codes & standards)
- Does not dictate source or measure mix of annual energy savings acquired by programs
- Does not set incentive levels

20-Year Forecast Methodology

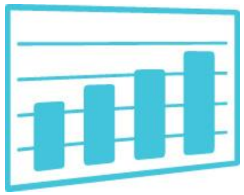
Forecasted Potential Types



20-Year IRP EE Forecast Flow Chart



RA Model inputs



Measure Inputs	Utility Inputs
Measure Definition: • Baseline & Efficient equipment • Applicable customer segments • Installation type* • Measure Life	**Customer and Load Forecasts** Used to scale measure level savings to a service territory • Residential Stock: Count of homes • Commercial Stock: Floor Area • Industrial Stock: Customer load
Measure Savings	**Avoided Costs**
Measure Cost • Incremental cost for lost opportunity measures • Full cost for retrofit measures	**Customer Stock Demographics:** • Heating fuel splits • Water heat fuel splits
Market Data • Density • Saturation of baseline equipment • Technical suitability	

**Retrofit, Replace on Burnout, or New Construction*

Model Updates

- The RA Model is a ‘living’ model and Energy Trust makes continuous improvements to it.
- Measure updates, new measures and new emerging technologies updated in model
- Alignment with high-level NW Power Council Power Plan deployment methodologies to obtain cost-effective achievable savings within market sectors and replacement types.

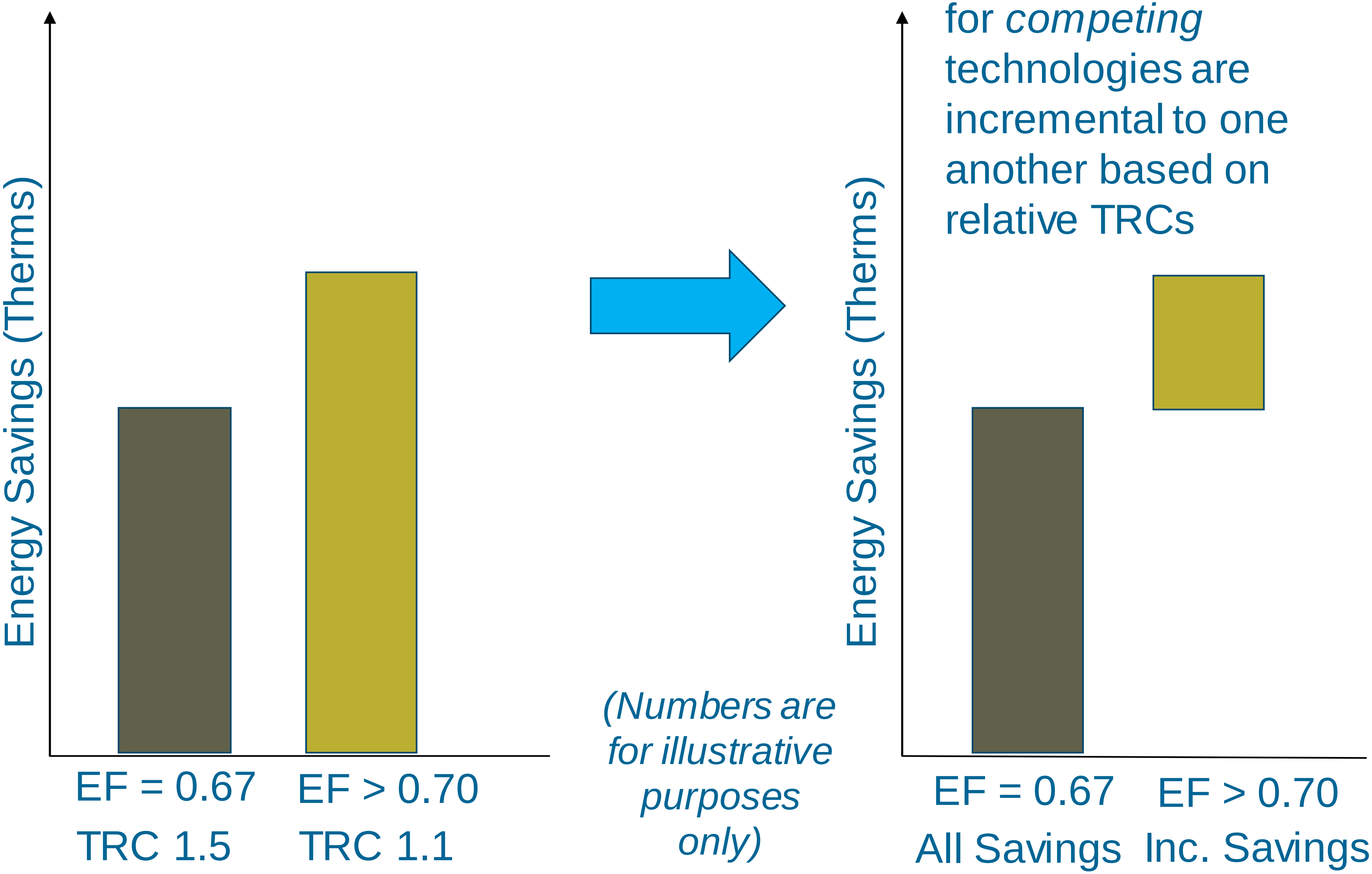
Example Measure: Residential Gas Tank Water Heater (>0.70 EF)

Key Measure Inputs:

- Baseline: 0.60 EF gas water heater
- Replacement Type: Replacement on Burnout / New
- Measure Incremental Cost: $218
- Conventional (not emerging, no risk adjustment)
- Lifetime:13 years
- Savings: 31.6 therms (annual)
- Non-Energy Benefits: $5.34 per year
- Customer Segments: SF, MF, MH
- Density, Saturation, Suitability
- Competing Measures: All efficient gas water heaters

Incremental Measure Savings Approach (Competition group: Gas water heaters)

Savings potential for *competing* technologies are incremental to one another based on relative TRCs



(Numbers are for illustrative purposes only)

Cost-Effectiveness Screen

- Energy Trust utilizes the Total Resource Cost (TRC) test to screen measures for cost effectiveness

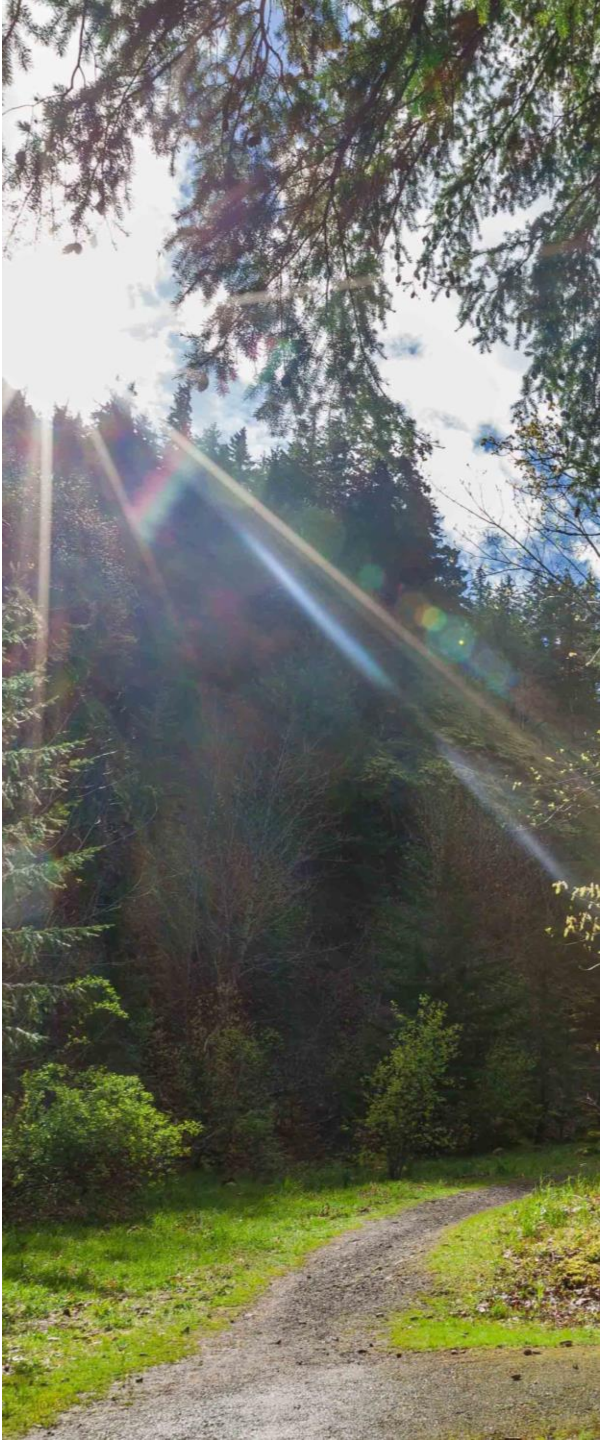
$$\mathrm{TRC} = \frac{\textit{Measure Benefits}}{\textit{Total Measure Cost}}$$

- If TRC is > 1.0, it is cost-effective

- Measure Benefits:
  - Avoided Costs (provided by Avista)
    - Annual measure savings x NPV avoided costs per therm
  - Quantifiable Non-Energy Benefits
    - Water savings, etc.

Total Measure Cost:

- The total cost of the EE measure (full cost if retrofit, incremental over baseline if replacement)



Cost-Effectiveness Override

Energy Trust applied this to measures found to be NOT Cost-Effective in the model but are offered through Energy Trust programs.

Reasons:

1. Blended avoided costs may produce different results than utility specific avoided costs
2. Measures offered under an OPUC exception per UM 551 criteria.

The following measures had the CE override applied (all under OPUC exception):

- Com Clothes Washers
- Res Insulation (ceiling, floor, wall)
- Res Clothes Dryers
- Res New Homes Packages

Emerging Technologies

Residential	Commercial	Industrial
• Path 5 Emerging Super Efficient Whole Home • Window Replacement (U<.20), Gas SF • Absorption Gas Heat Pump Water Heaters • Advanced Insulation	• DOAS/HRV - GAS Space Heat • Gas-fired HP HW • Gas-fired HP, Heating • Advanced Windows	• Gas-fired HP Water Heater • Wall Insulation- VIP, R0-R35

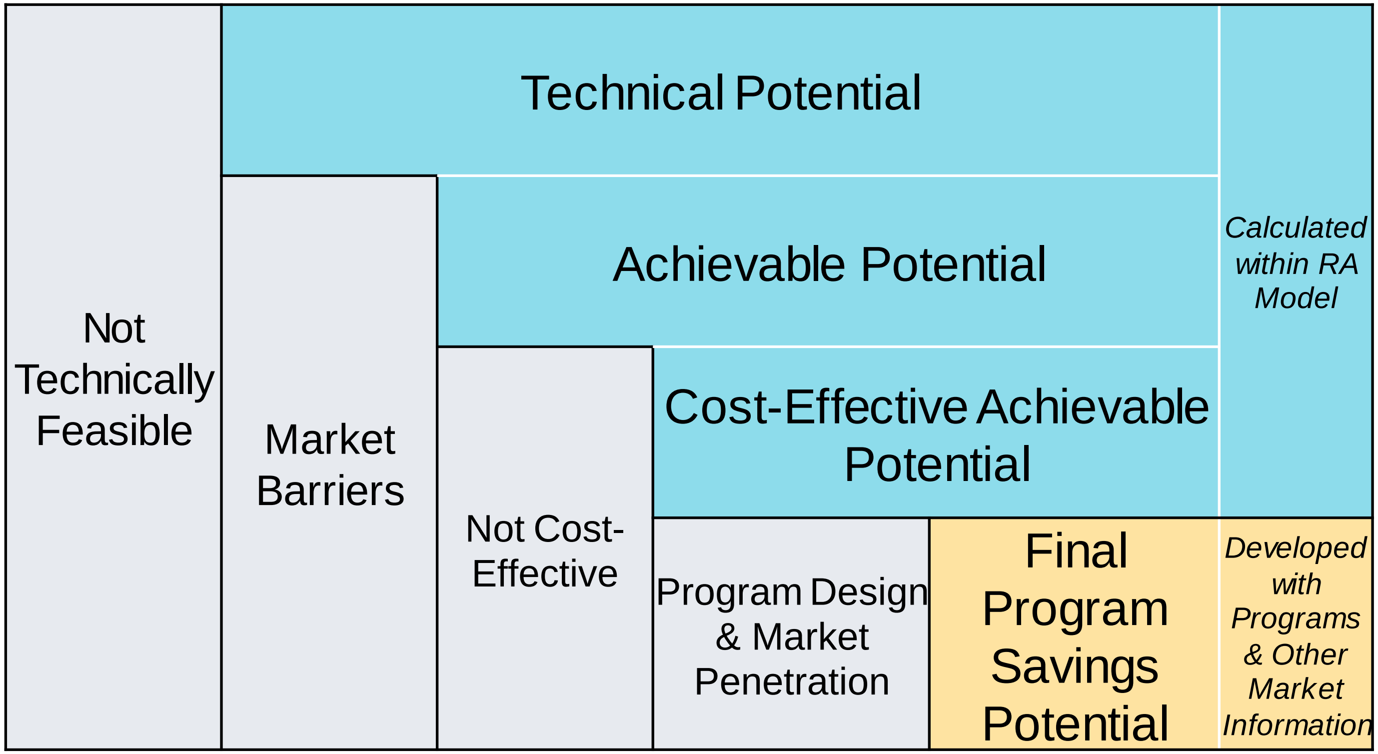
- Model includes savings potential from emerging technologies
- Factors in changing performance, cost over time
- Use risk factors to hedge against uncertainty

Risk Factors for Emerging Technologies

Risk Category	10%	30%	50%	70%	90%
Market Risk (25% weighting)	Requires new/changed business model Start-up, or small manufacturer Significant changes to infrastructure Requires training of contractors. Consumer acceptance barriers exist.		Training for contractors available. Multiple products in the market.	Trained contractors Established business models Already in U.S. Market Manufacturer committed to commercialization	
Technical Risk (25% weighting)	Prototype in first field tests. A single or unknown approach	Low volume manufacturer. Limited experience	New product with broad commercial appeal	Proven technology in different application or different region	Proven technology in target application. Multiple potentially viable approaches.
Data Source Risk (50% weighting)	Based only on manufacturer claims	Manufacturer case studies	Engineering assessment or lab test	Third party case study (real world installation)	Evaluation results or multiple third party case studies

Results

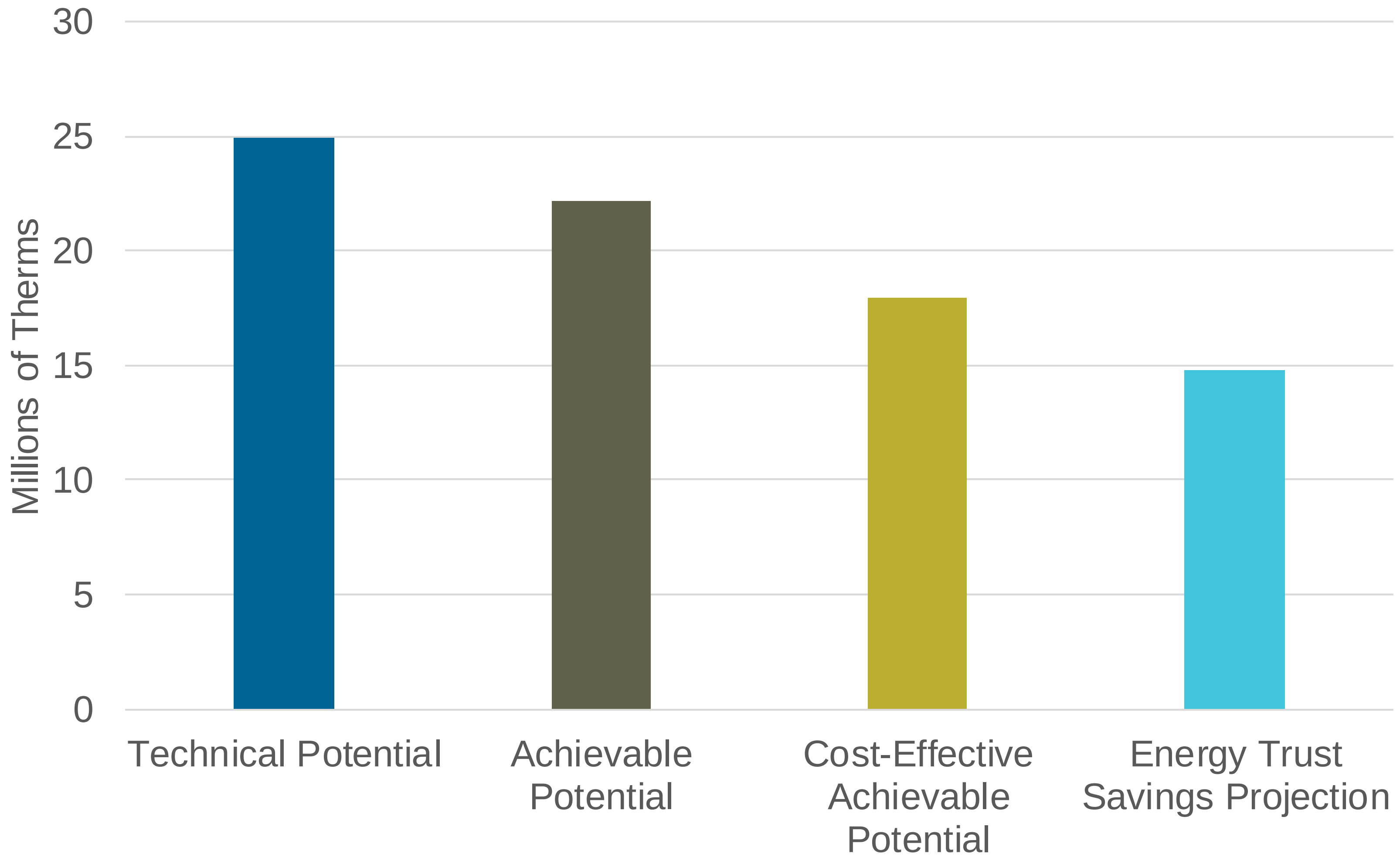
Outputs of Potential Type



The RA Model estimates the in Technical, Achievable and Cost-Effective Achievable potential

Final Program Savings Potential is deployed exogenously of the model using the Cost-Effective Achievable potential from the RA model in combination with program expertise on what can be achieved

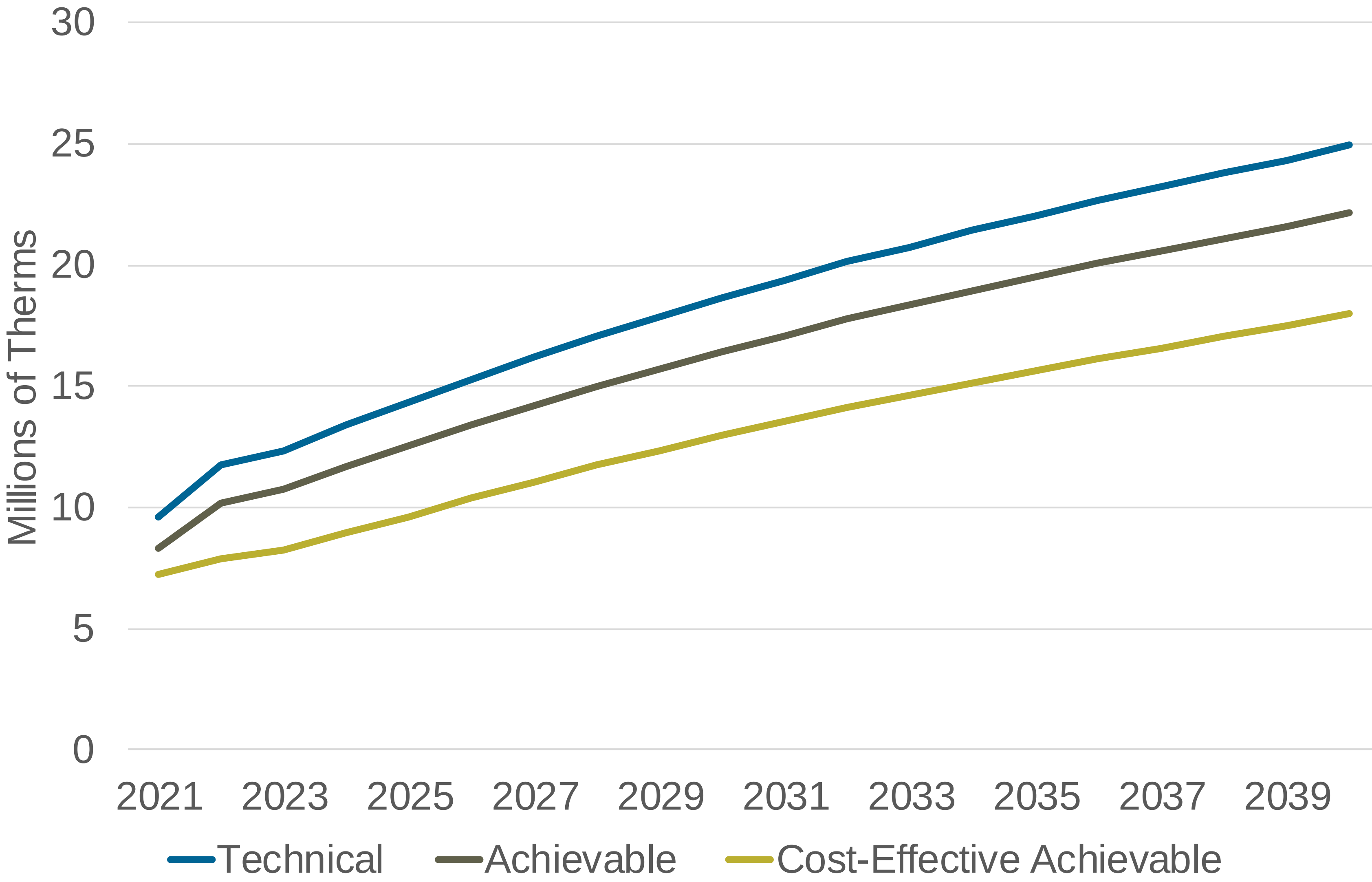
Overall Cumulative Savings Results



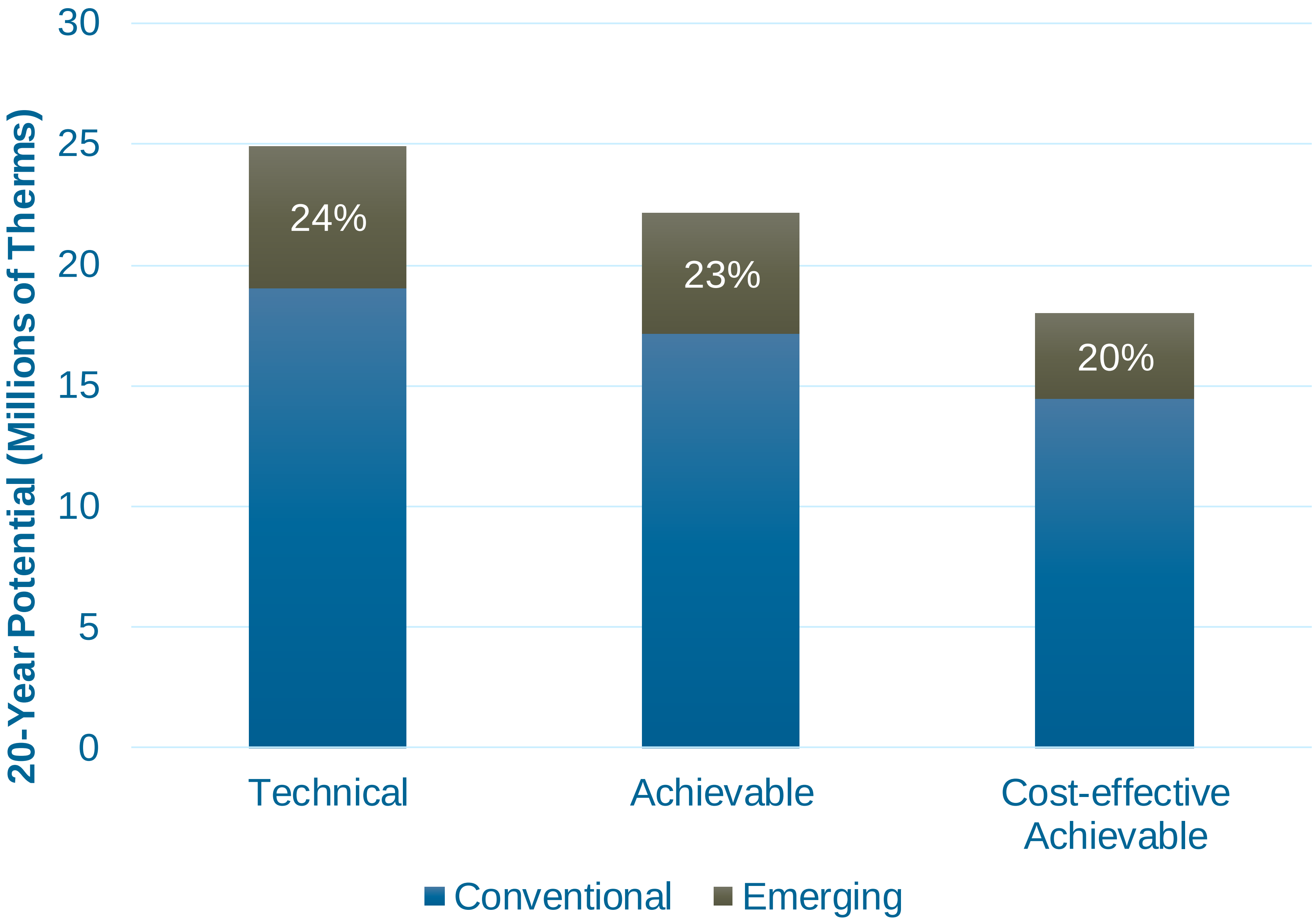
RA Model Results

Technical, Achievable, and Cost-Effective Achievable

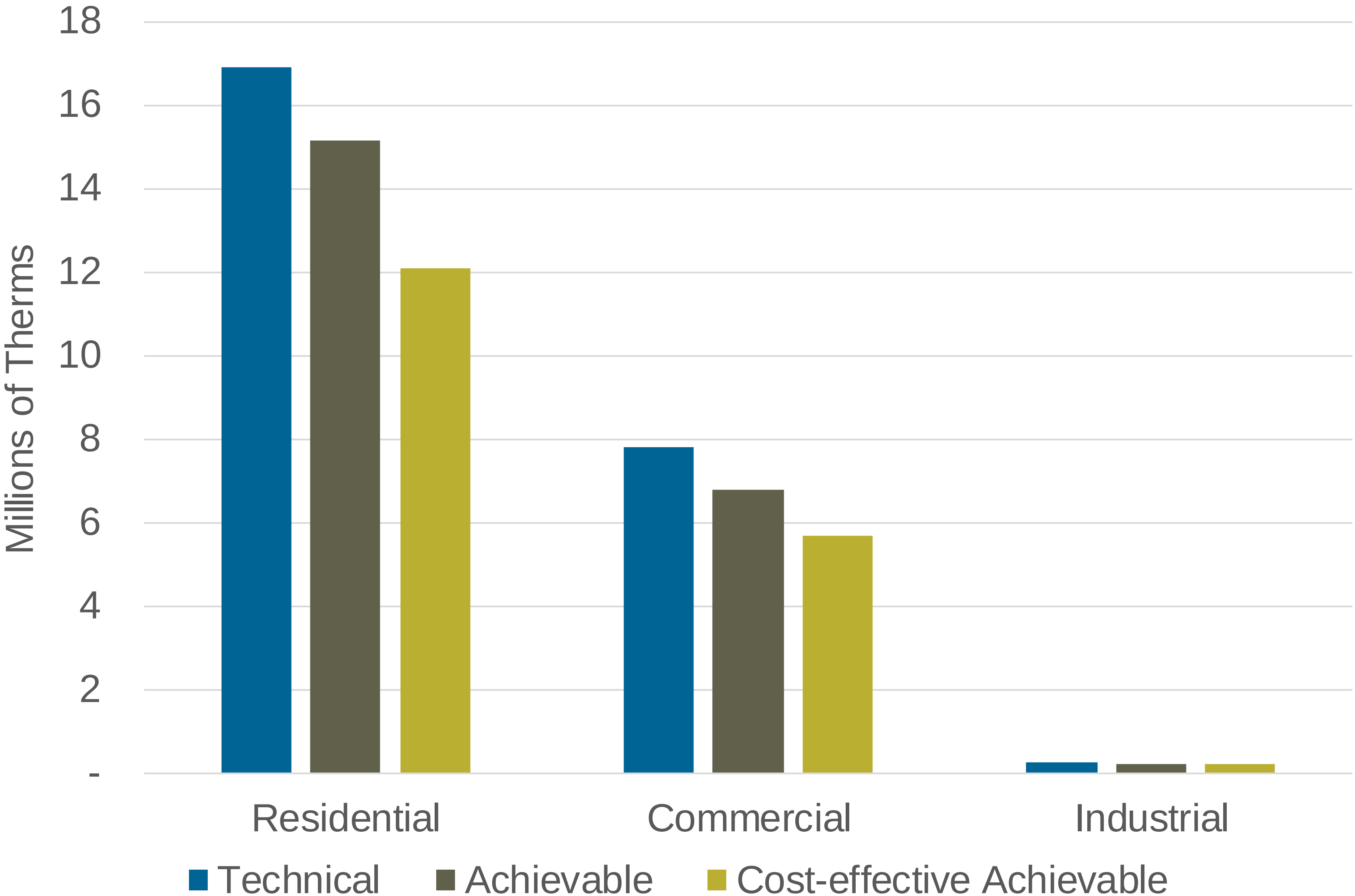
Cumulative Potential by Type and Year



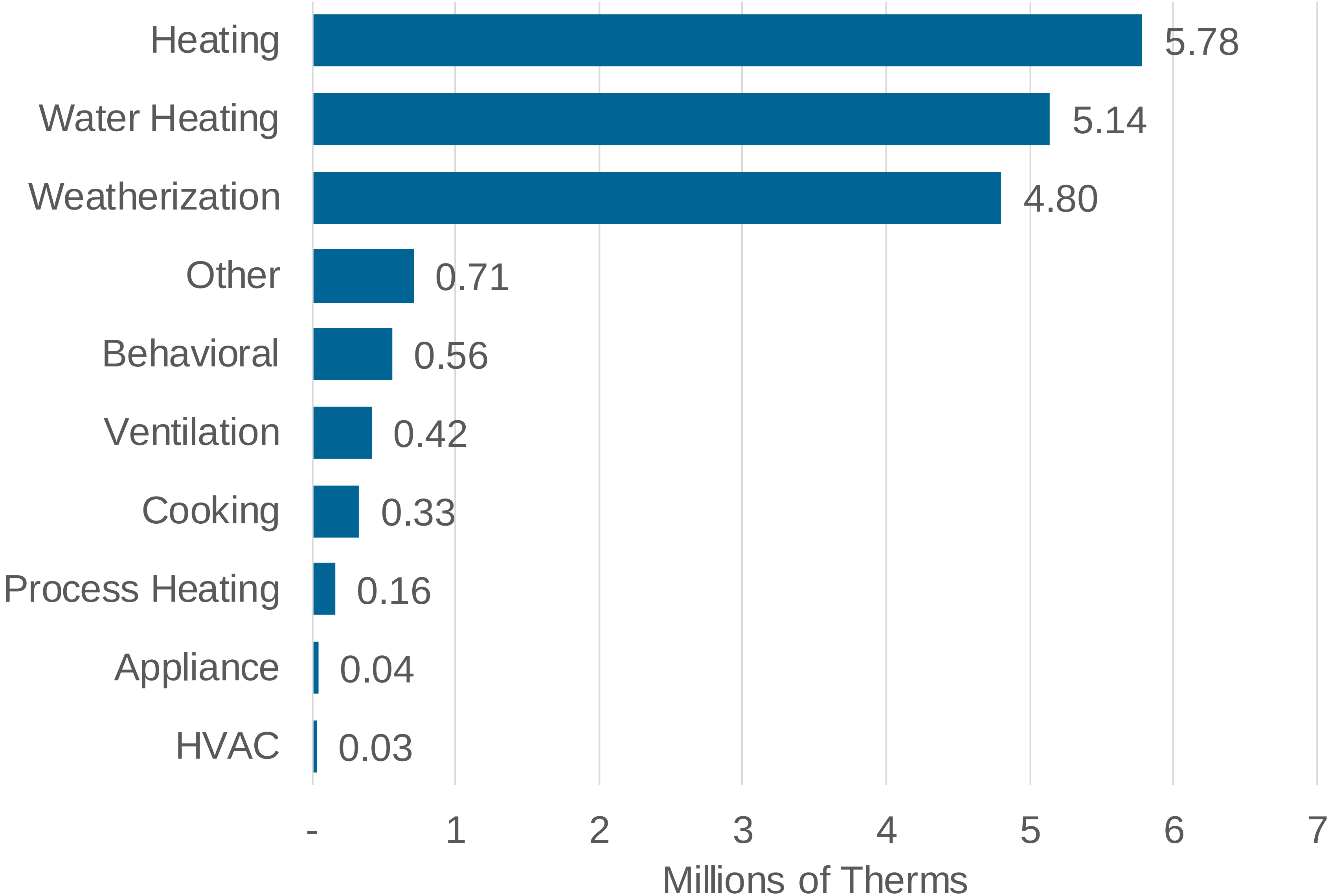
Contribution of Emerging Technology



Cumulative Potential by Sector and Type



Cost-effective Achievable Potential by End Use



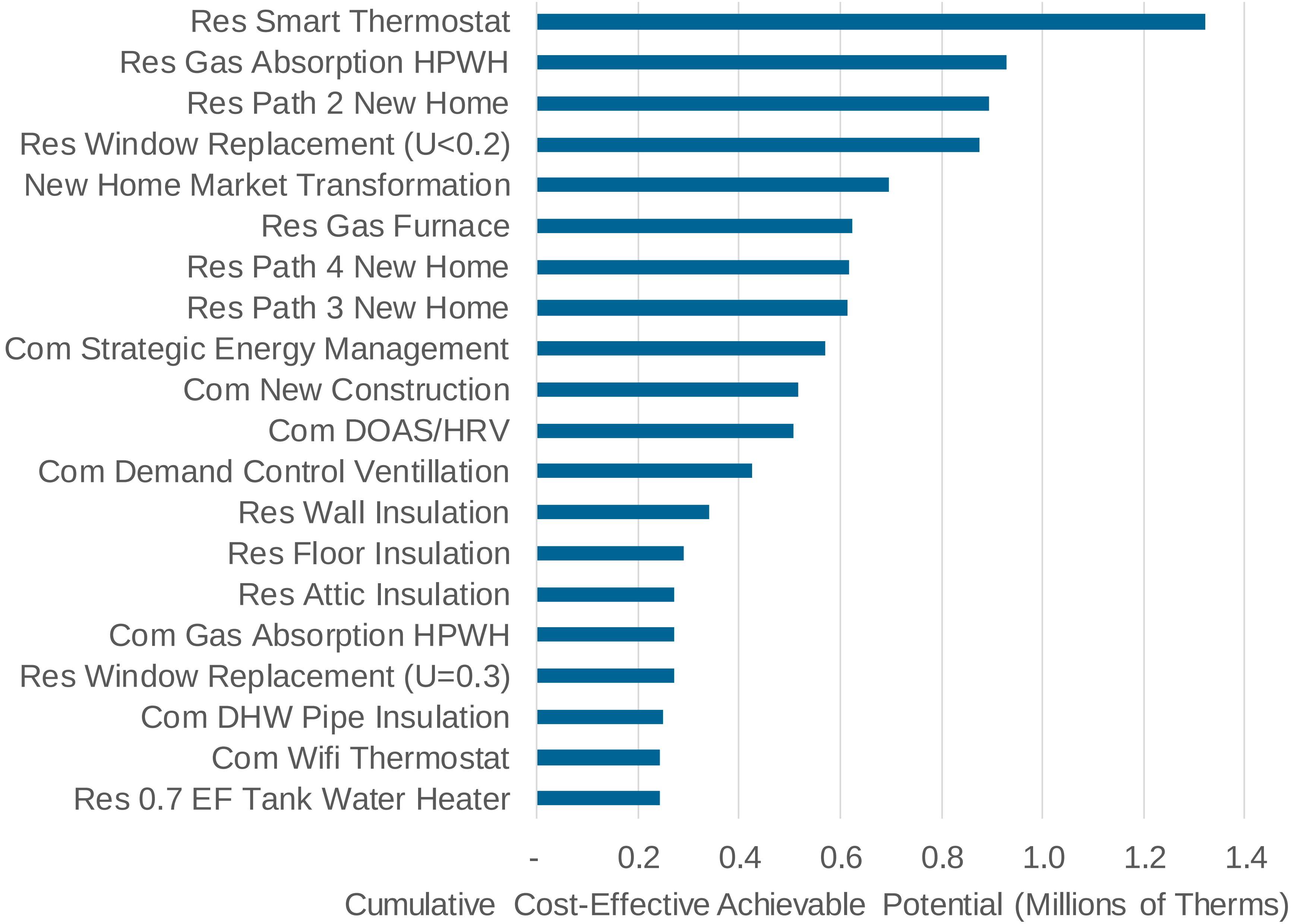
Cost-Effective Override Effect – (Millions of Therms)

Sector	Potential with Override	Potential without Override	Difference
Residential	12.1	10.9	1.2
Commercial	5.7	5.7	0.0
Industrial	0.2	0.2	0.0
Total	**18.0**	**16.8**	**1.2**

Measures with CE Override in Model:

- Res Insulation (ceiling, floor, wall)
- Res Clothes Dryers
- Res New Homes Packages
- Com Clothes Washers

Top-20 Measures



Final Savings Projections -
Deployed Results

Final Savings Projection Methodology

Energy Trust sets the first five years of energy efficiency acquisition to program performance and budget goals.

Years 1-2

- Program forecasts – they know what is happening short term best

Years 3-5

- Planning and Programs work together to create forecast

Years 6-20

- Planning forecasts long-term acquisition rate to generally align NWPCC

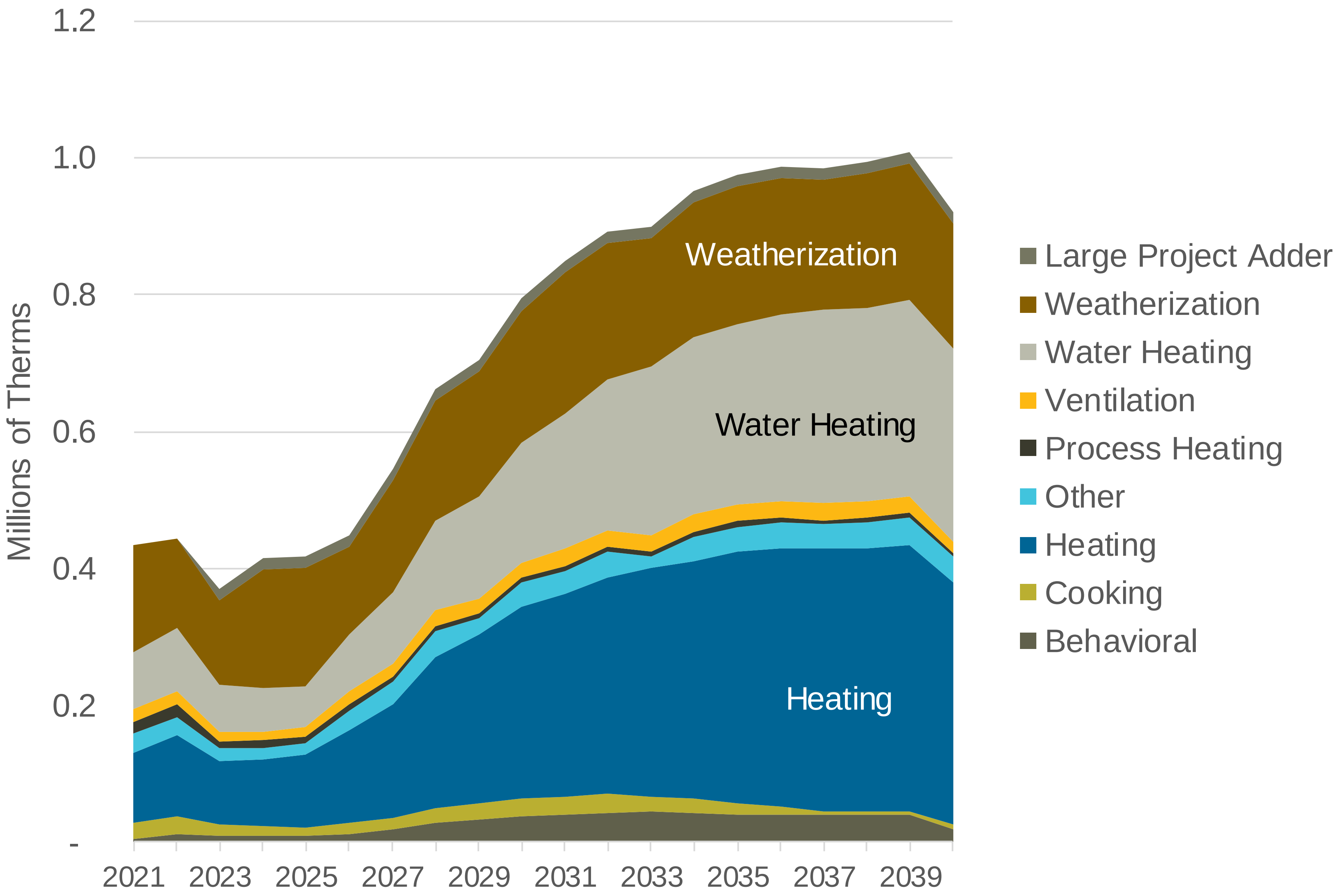
Cumulative Potential by Type – Millions of Therms

	Technical Potential	Achievable Potential	Cost-Effective Achievable Potential	Energy Trust Savings Projection
Residential	16.9	15.2	12.1	8.2
Commercial	7.8	6.8	5.7	6.1
Industrial	0.3	0.2	0.2	0.5
All Sectors	**24.9**	**22.2**	**18.0**	**14.8**

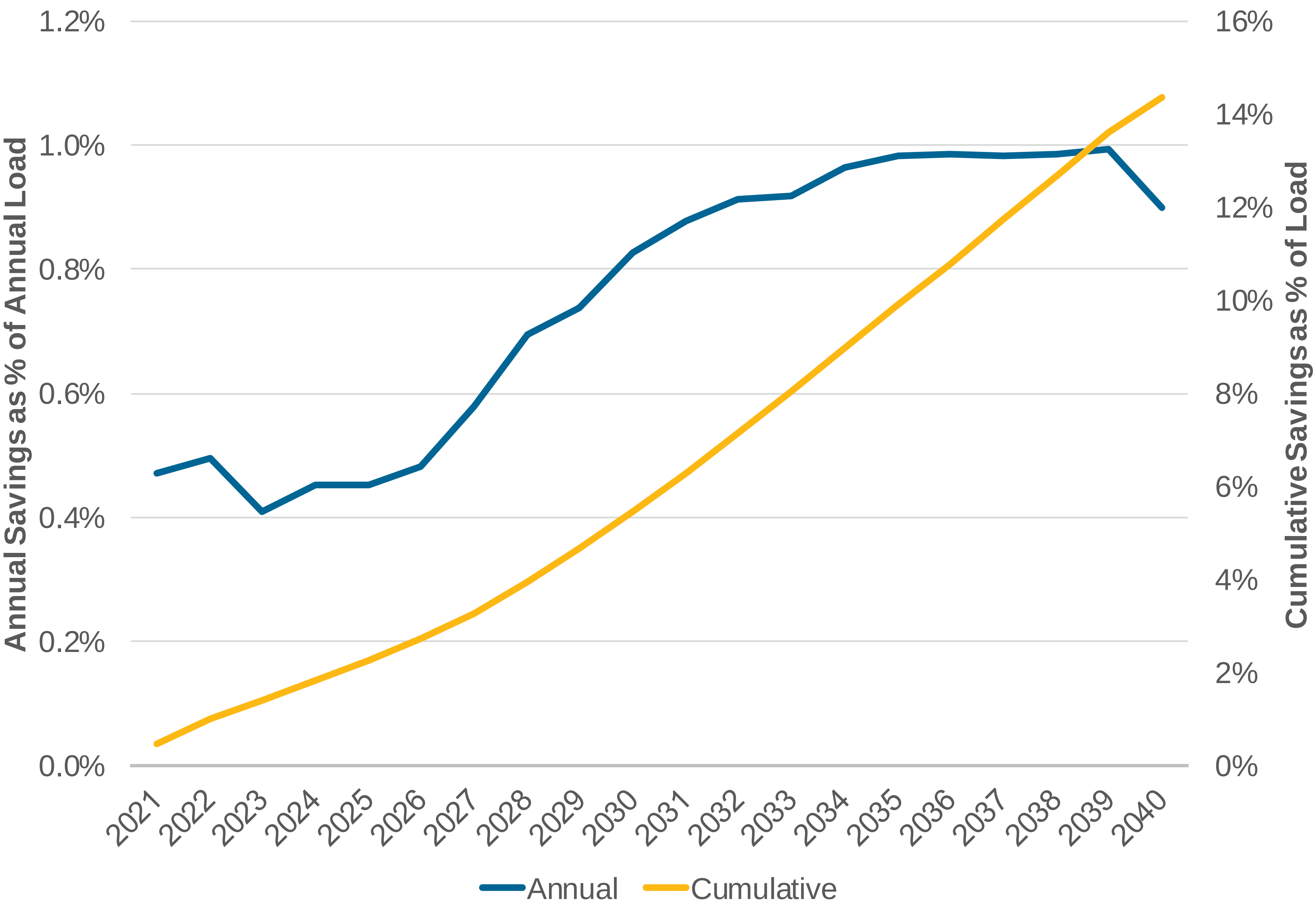
Not all Cost-Effective Potential is projected to be achieved because:

- Lost opportunity with 'Replacement' and 'New Constr.' measures
- Hard to reach measures (e.g. insulation)
- Other market barriers identified by programs & new service territory

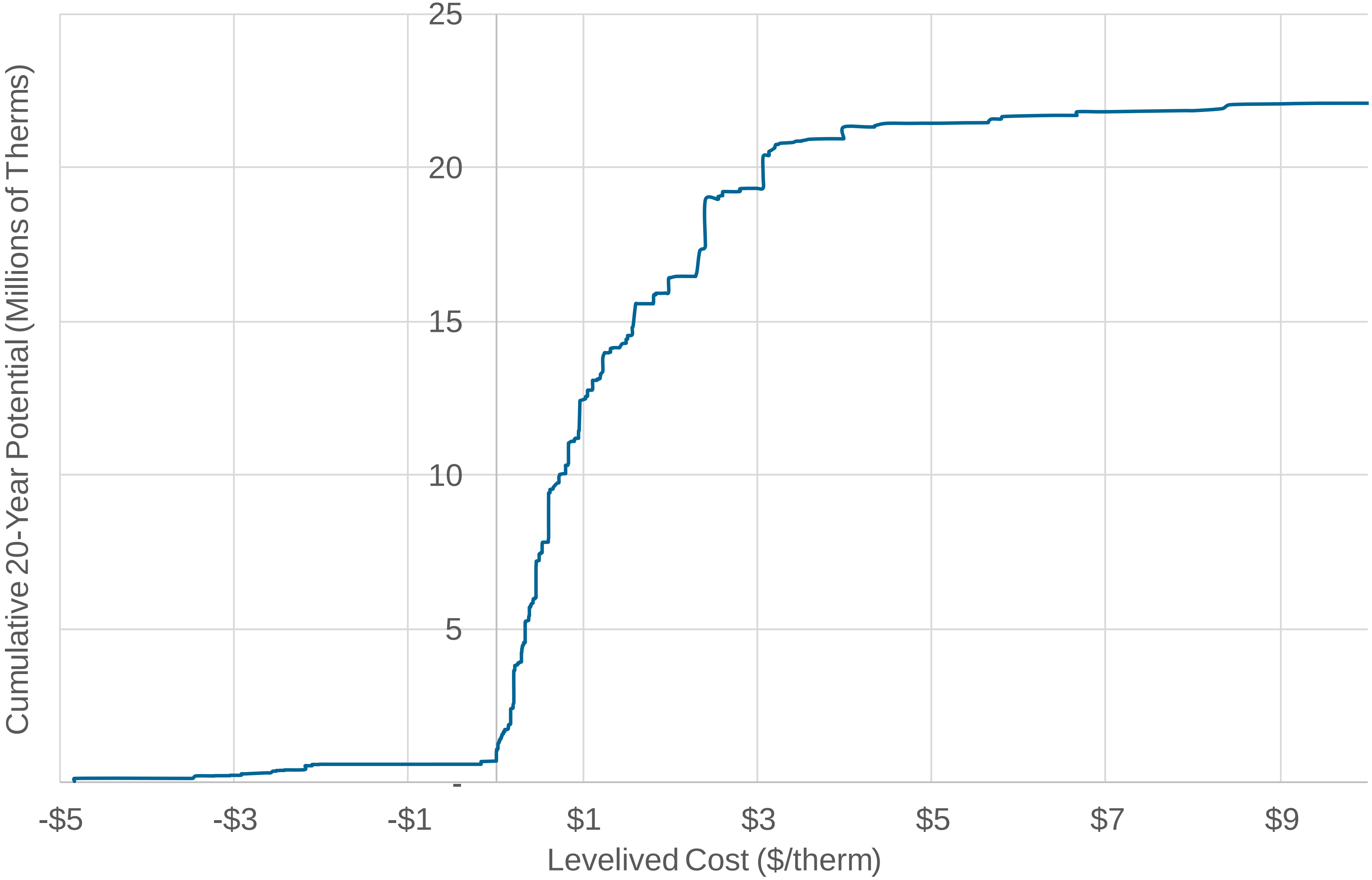
Cost-Effective Savings



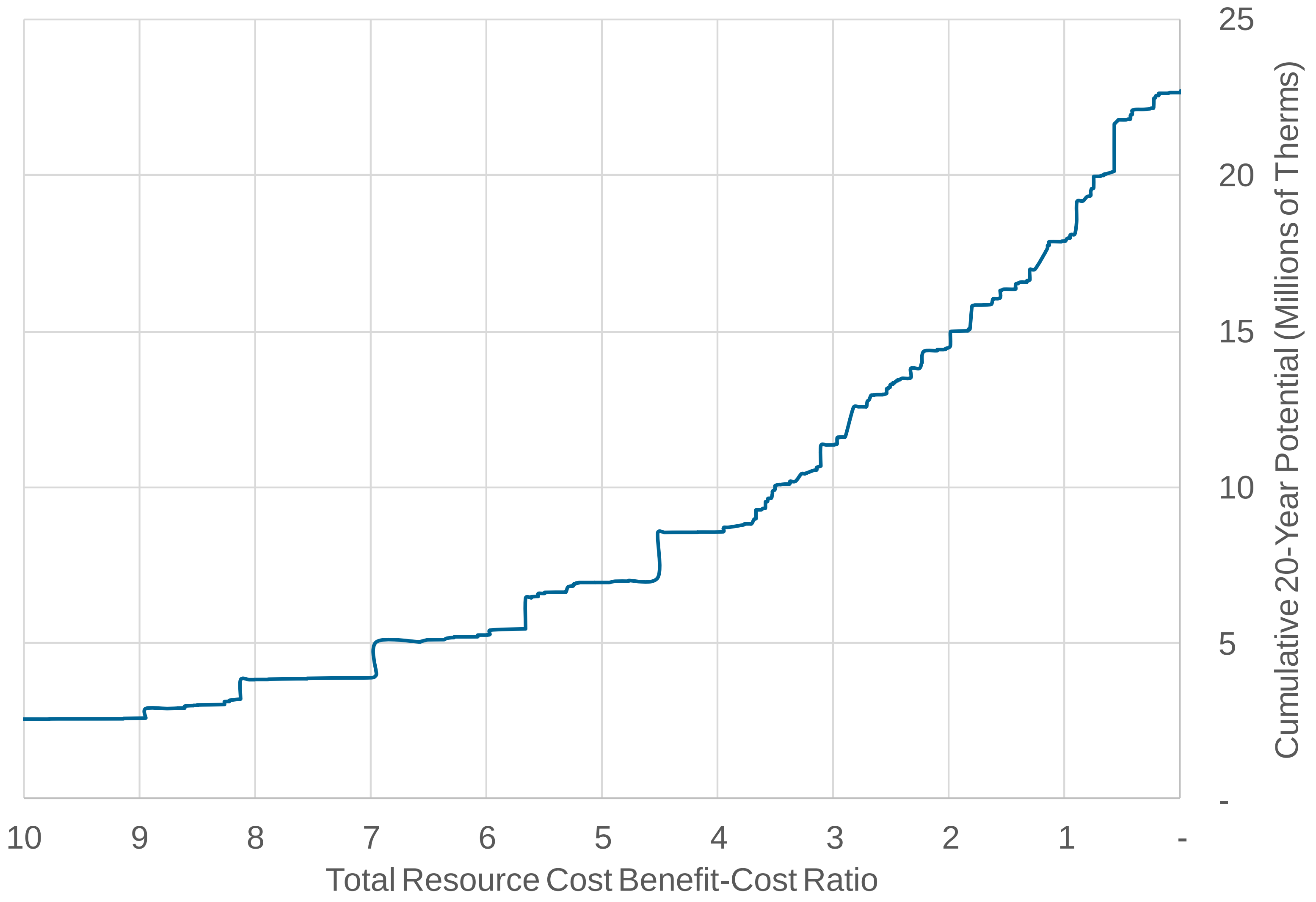
Projected Savings as Percent of Annual Load



Levelized Cost Supply Curve



Benefit Cost Ratio Supply Curve



Thank you

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Ted Light,

Lighthouse Energy Consulting

ted@lighthouseenergynw.com

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Sendout Model

Modeling Transportation In SENDOUT®

- Start with a point-in-time look at each jurisdiction's resources
  - Contracts – Receipt and Delivery Points
  - Rates
- Contractual vs. Operational
  - Contractual can be overly restrictive
  - Operational can be overly flexible
- Incorporating operational realities into our modeling can defer the need to acquire new resources
- Gas Supply's job is to get gas from the supply basin to the pipeline citygate
- Gas Engineering/Distribution's job is to take gas from the pipeline citygate to our customers
- The **major** limiting factor is receipt quantity – how much can you bring into the system?

Modeling Challenges

- Supply needs to get gas to the gate
- Contracts were created years ago, based on demand projections at that point in time
- Stuff happens (i.e. growth differs from forecast)
- Sum of receipt quantity and aggregated delivery quantity don’t identify resource deficiency for quite some time however…..
- The aggregated look can mask individual city gate issues, and the disaggregated look can create deficiencies where they don’t exist
- In many cases, operational capacity is greater than contracted
- Transportation resources are interconnected (two pipes can serve one area)
- WARNING – we need to be mindful of the modeling limitations

What is in SENDOUT®?

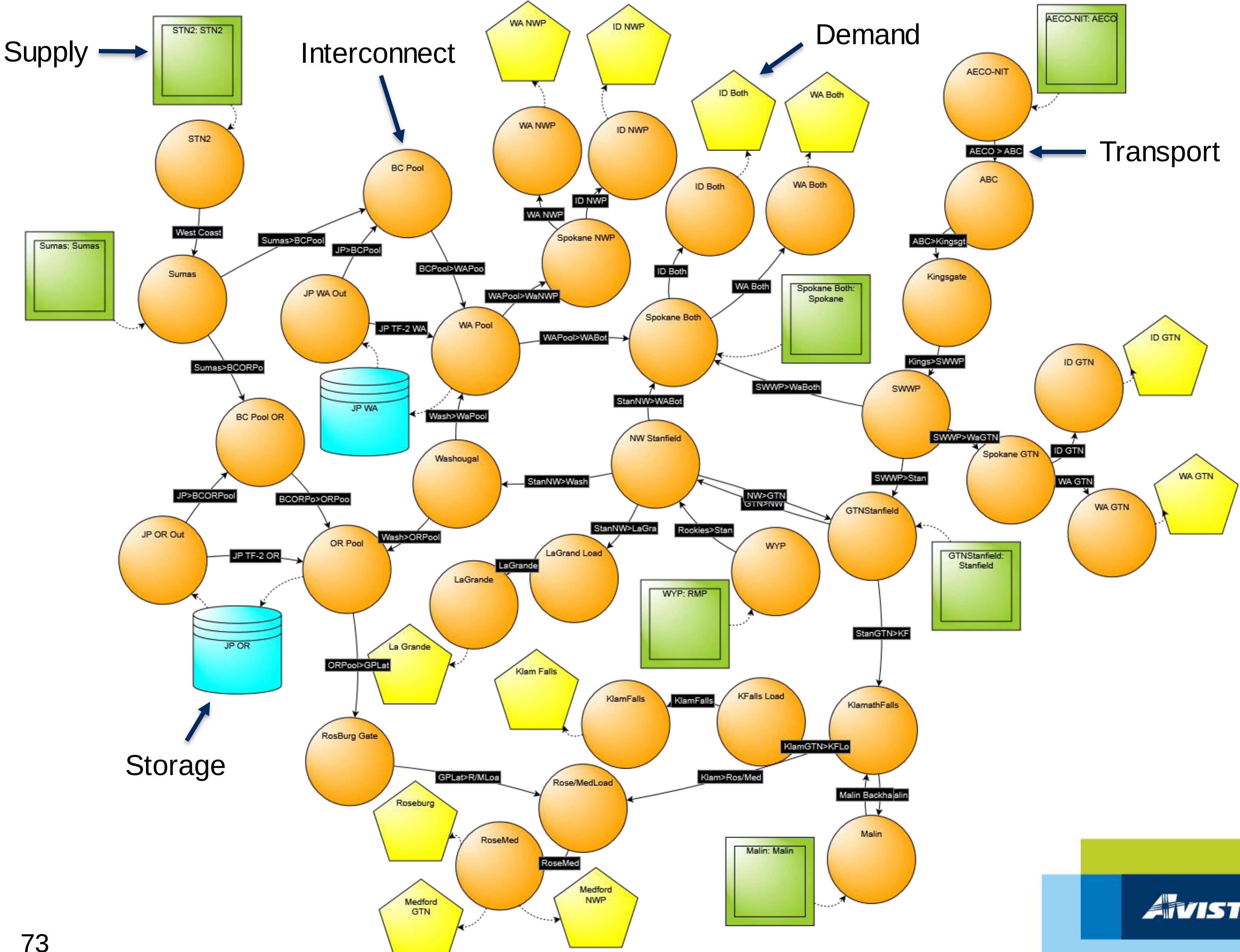
Inside:

- Demand forecasts at an aggregated level
- Existing firm transportation resources and current rates
    - Receipt point to aggregated delivery points/“zone”
    - Jurisdictional considerations
    - Long term capacity releases
- Potential resources, both supply and demand side

What is outside SENDOUT®?

Outside:

- Gate station analysis
  - Forecasted demand behind the gate
    - Growth rates consistent with IRP assumptions
    - Actual hourly/daily city gate flow data
  - Gate station MDDO's
  - Gate station operational capacities


Supply
Interconnect
Demand
Transport
Storage
STN2: STN2
STN2
West Coast
Sumas: Sumas
Sumas
Sumas>BCPool
BC Pool
JP>BCPool
JP WA Out
BCPool>WAPoo
JP TF-2 WA
WA Pool
JP WA
Wash>WaPool
Sumas>BCORPo
BC Pool OR
JP>BCORPool
BCORPo>ORPoo
JP OR Out
JP TF-2 OR
OR Pool
JP OR
Washougal
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WA NWP
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WAPool>WABot
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StanNW>WABot
NW Stanfield
StanNW>Wash
StanNW>LaGra
Rockies>Stan
NW>GTN
GTN>NW
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Kings>SWWP
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SWWP>WaBoth
SWWP>WaGTN
SWWP>Stan
Spokane GTN
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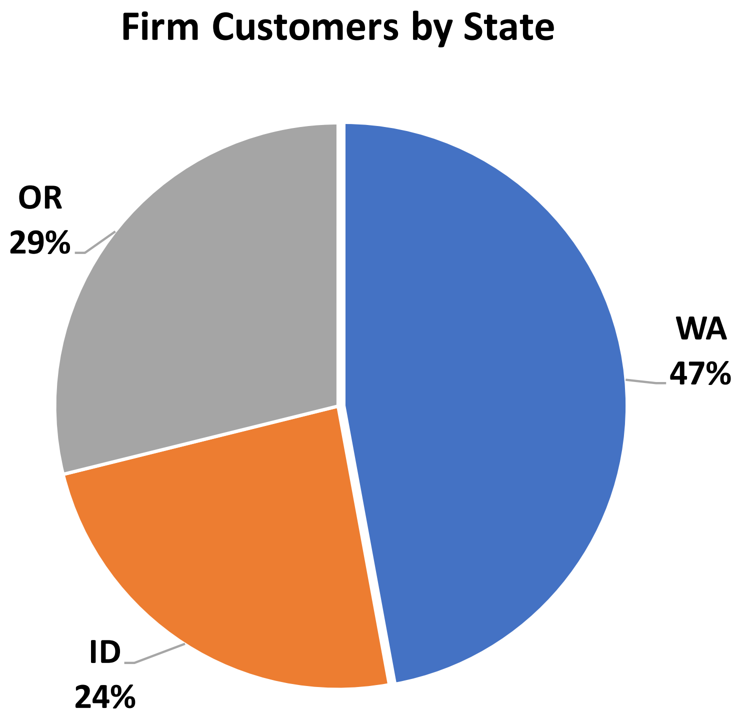
WYP
WYP: RMP
LaGrand Load
LaGrande
LaGrande
La Grande
ORPool>GPLat
StanGTN>KF
Klam Falls
KlamFalls
KlamFalls
KFalls Load
KlamathFalls
KlamGTN>KFLo
Klam>Ros/Med
Malin Backha alin
Malin
Malin: Malin
RosBurg Gate
GPLat>R/MLoa
Rose/MedLoad
Roseburg
RoseMed
RoseMed
Medford GTN
Medford NWP

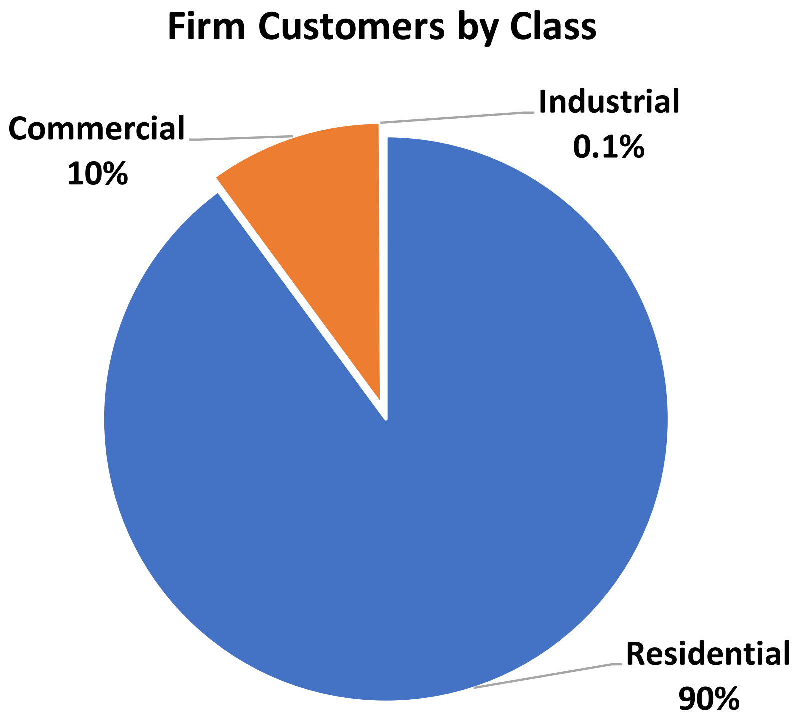
New Planning Software

- Avista is looking for a new software solution to model our natural gas system and the increasingly complex system with carbon reduction goals
- We hope to have this software available for the next round of Integrated Resource Planning (IRP) and to model it in parallel with Sendout

Assumptions Review

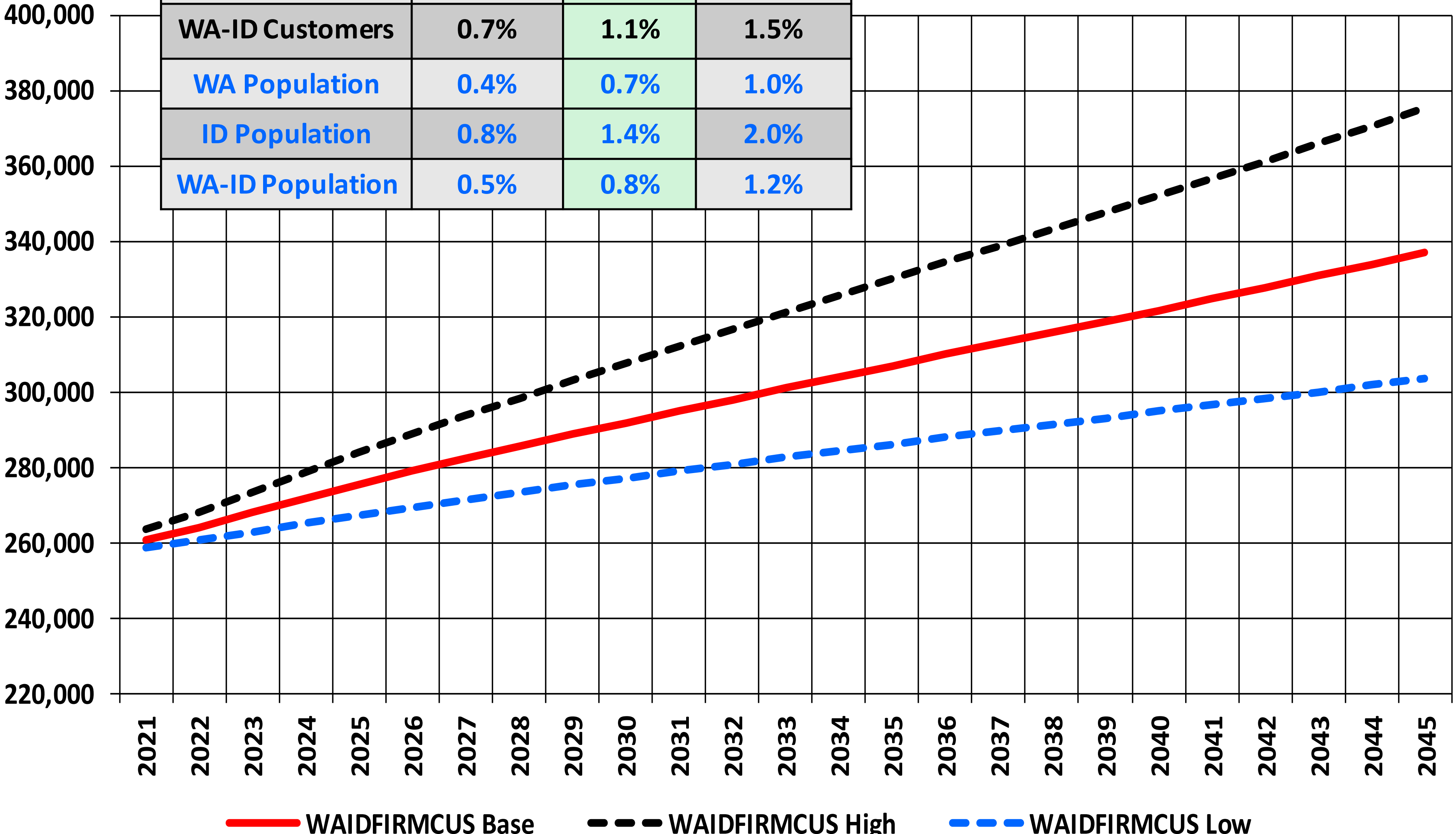
Firm Customers (Meters) by State and Class, 2019





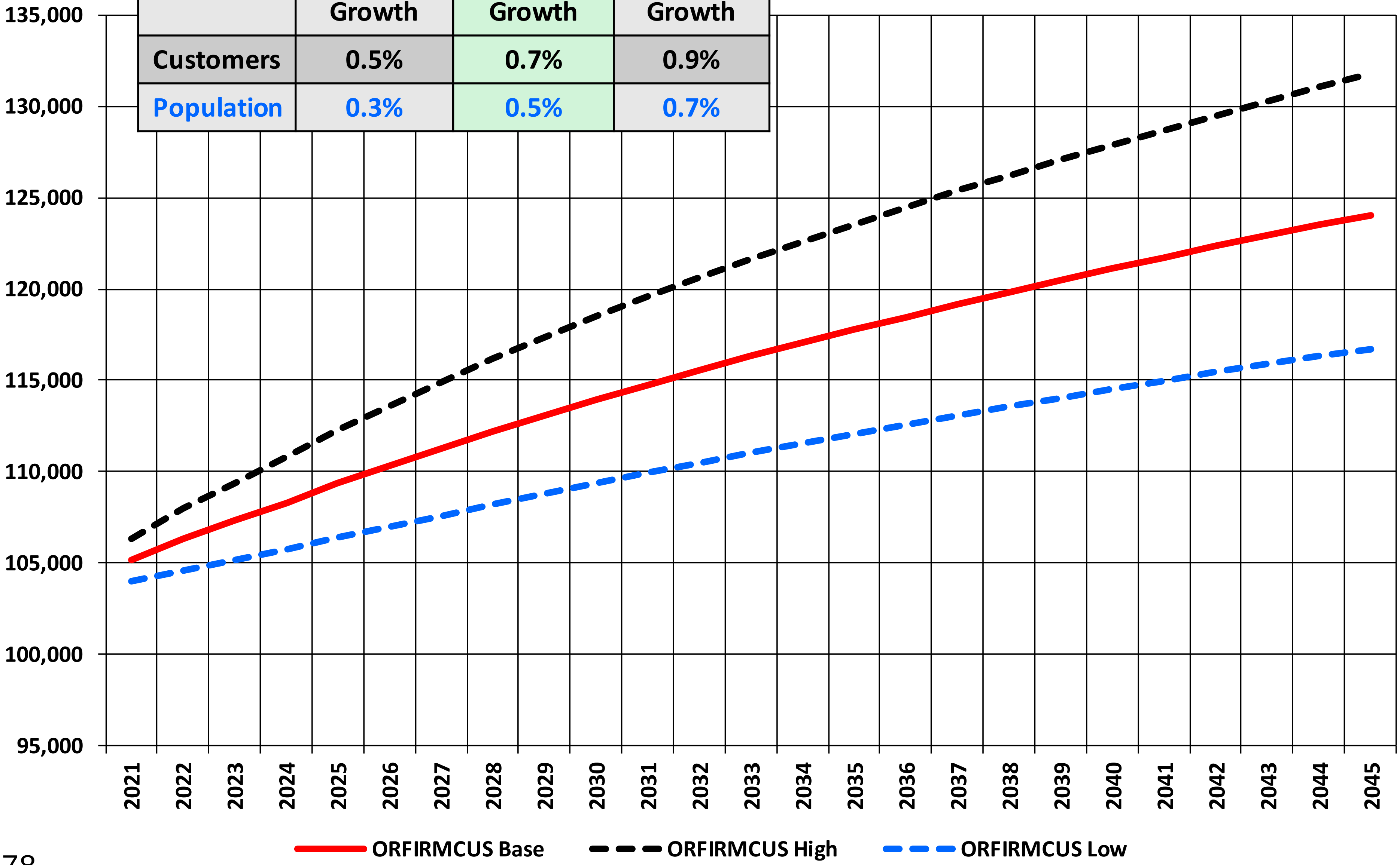
WA-ID Region Firm Customer Range, 2021-2045

Variable	Low Growth	Base Growth	High Growth
WA-ID Customers	0.7%	1.1%	1.5%
WA Population	0.4%	0.7%	1.0%
ID Population	0.8%	1.4%	2.0%
WA-ID Population	0.5%	0.8%	1.2%



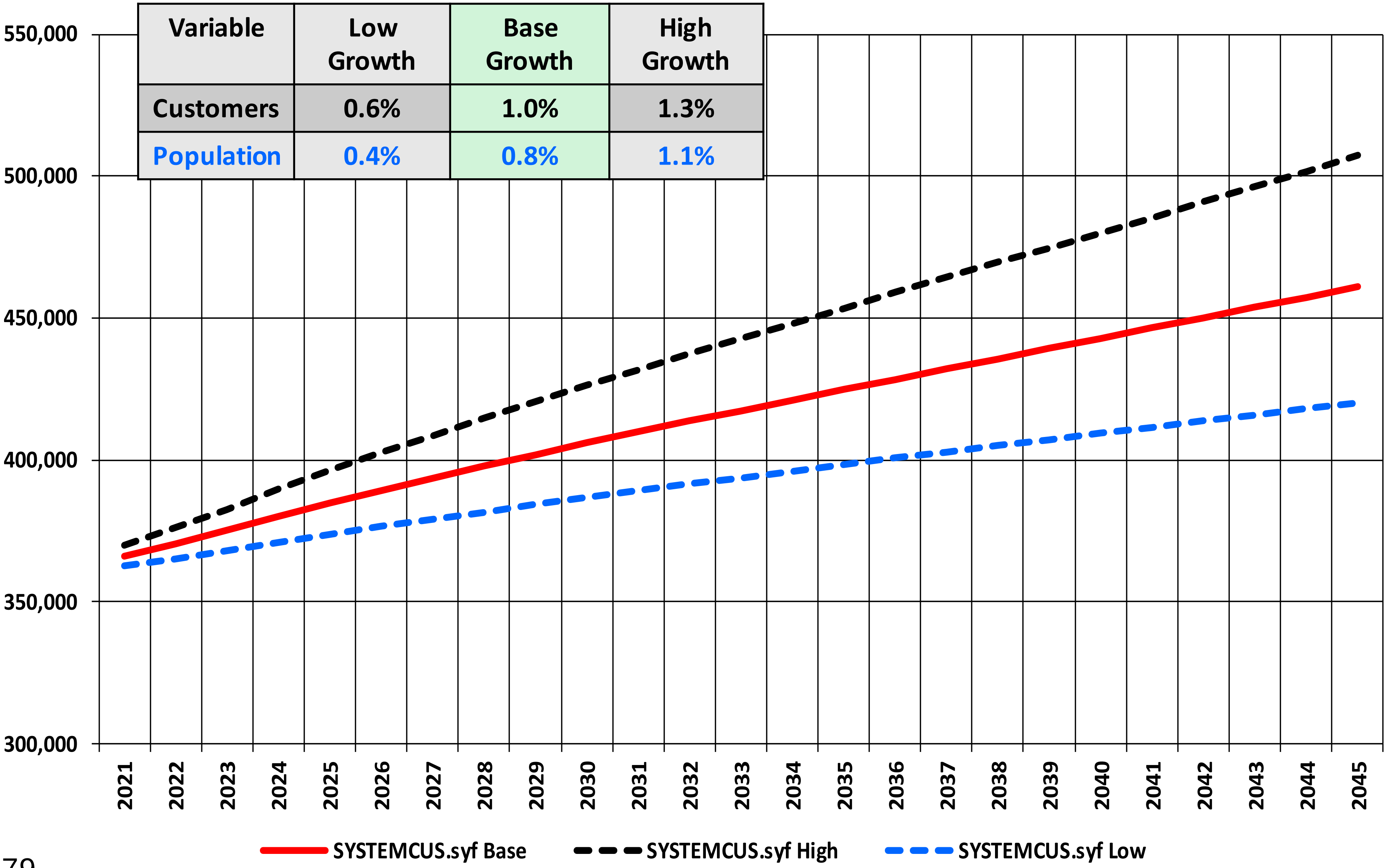
OR Region Firm Customer Range, 2021-2045

Variable	Low Growth	Base Growth	High Growth
Customers	0.5%	0.7%	0.9%
Population	0.3%	0.5%	0.7%



System Firm Customer Range, 2021-2045

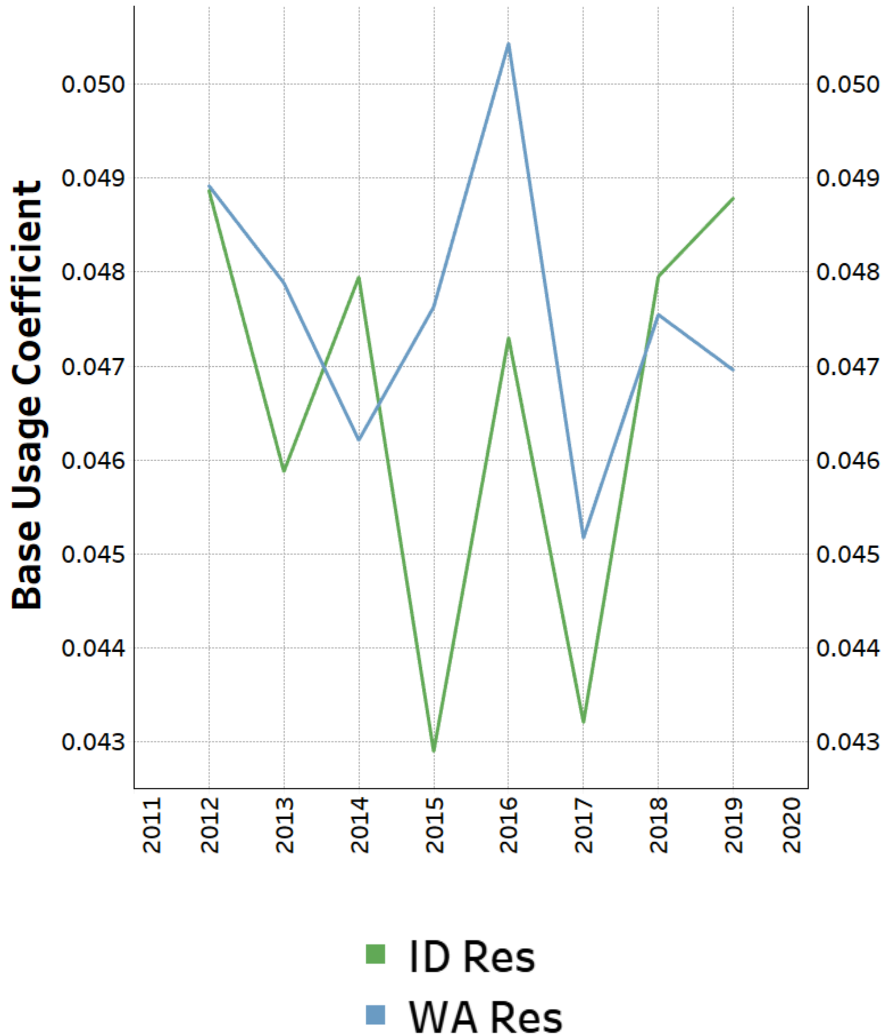
Variable	Low Growth	Base Growth	High Growth
Customers	0.6%	1.0%	1.3%
Population	0.4%	0.8%	1.1%

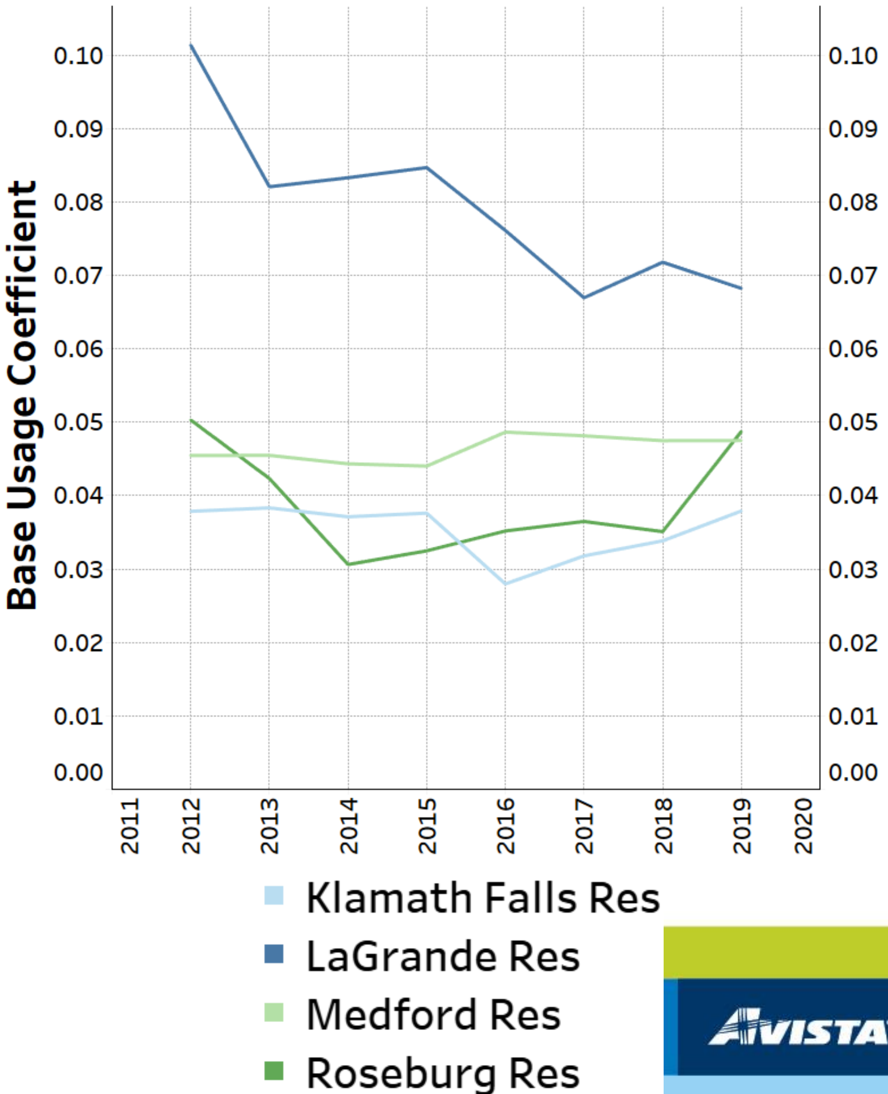


Summary of Growth Rates

System	Base-Case	High	Low
Residential	1.0%	1.4%	0.7%
Commercial	0.5%	0.8%	0.1%
Industrial	-0.8%	2.2%	-3.8%
Total	1.0%	1.3%	0.6%
WA	Base-Case	High	Low
Residential	1.0%	1.3%	0.7%
Commercial	0.4%	0.7%	0.1%
Industrial	-0.8%	1.9%	-3.6%
Total	1.0%	1.3%	0.7%
ID	Base-Case	High	Low
Residential	1.4%	2.0%	0.8%
Commercial	0.4%	1.0%	-0.2%
Industrial	-1.0%	1.8%	-3.4%
Total	1.3%	1.9%	0.7%
OR	Base-Case	High	Low
Residential	0.7%	0.9%	0.5%
Commercial	0.6%	0.8%	0.4%
Industrial	0.0%	4.5%	-10.6%
Total	0.7%	0.9%	0.5%

Base Coefficients (July and August Averaged)





Heat Coefficients

Planning Area - Residential Class	2 Year	3 Year	5 Year
Roseburg (Oregon)	0.008829	0.008046	0.00699
Medford (Oregon)	0.00639	0.0065	0.006068
La Grande (Oregon)	0.006223	0.007297	0.00665
Klamath Falls (Oregon)	0.005284	0.005268	0.004902
Idaho	0.006445	0.006344	0.005896
Washington	0.006307	0.006313	0.005957

*Avg. of monthly heat coefficient

*Historic Data – adjusted by price elasticity and DSM

Price Elasticity

- The elasticity as measured in the Medford and Roseburg areas will be used for the entire system as estimated elasticity.
- 0.81% decrease only for each price rise of 10%
- This elasticity is measured through heat coefficients and annual price changes

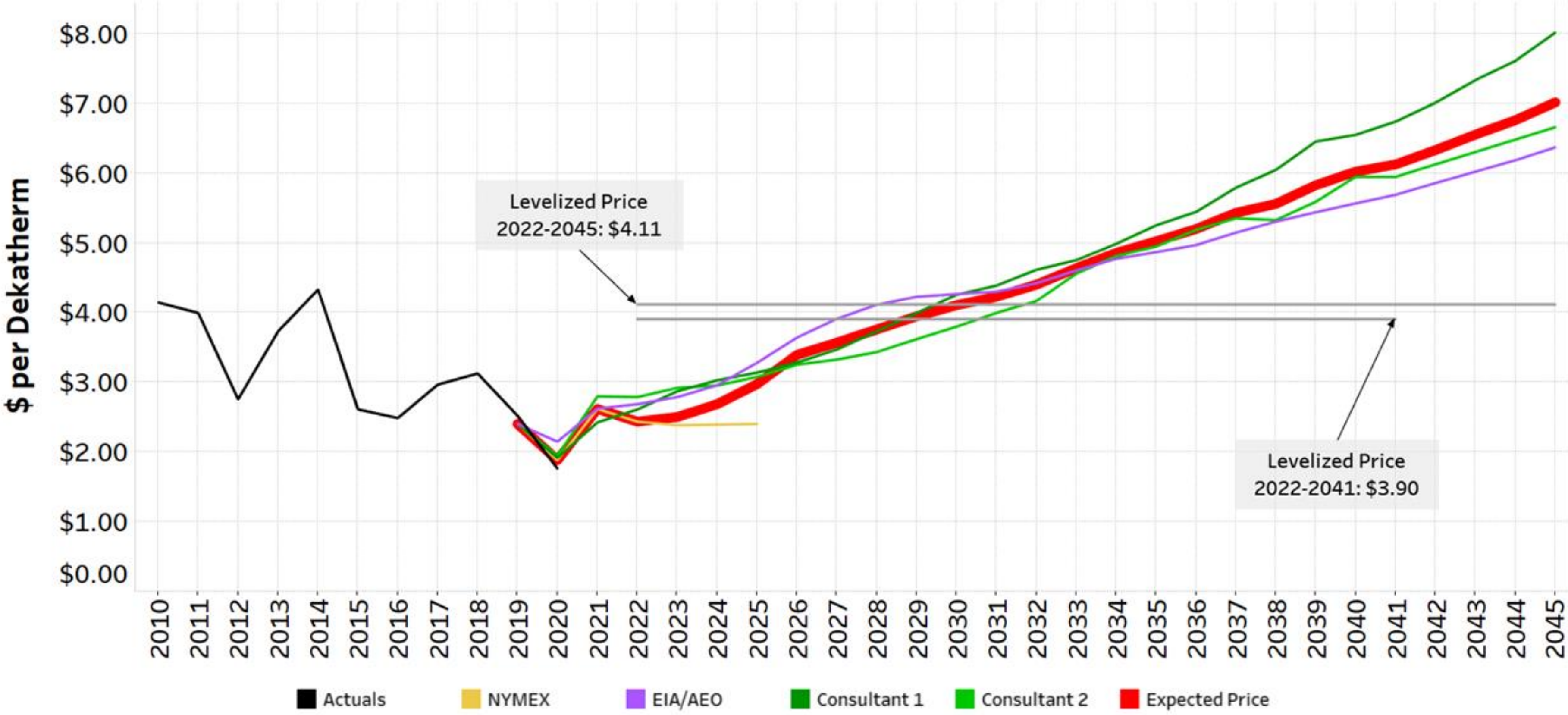
Avista Weather Planning Standard

- Utilize coldest day for each of the past 30 years with a 99% probability supply can be fulfilled

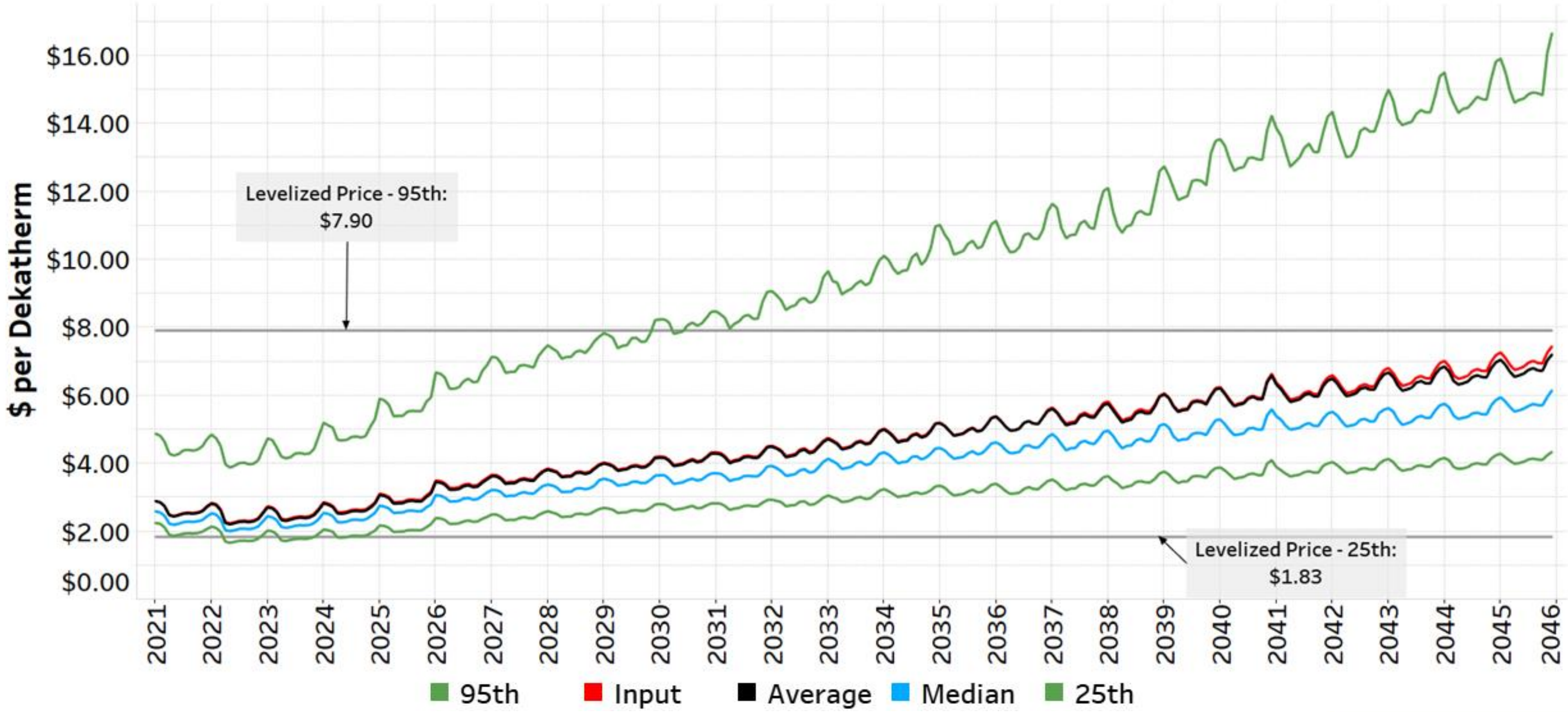
Area	99% Probability Avg. Temp
La Grande	-11
Klamath Falls	-9
Medford	11
Roseburg	14
Spokane	-12

AVISTA

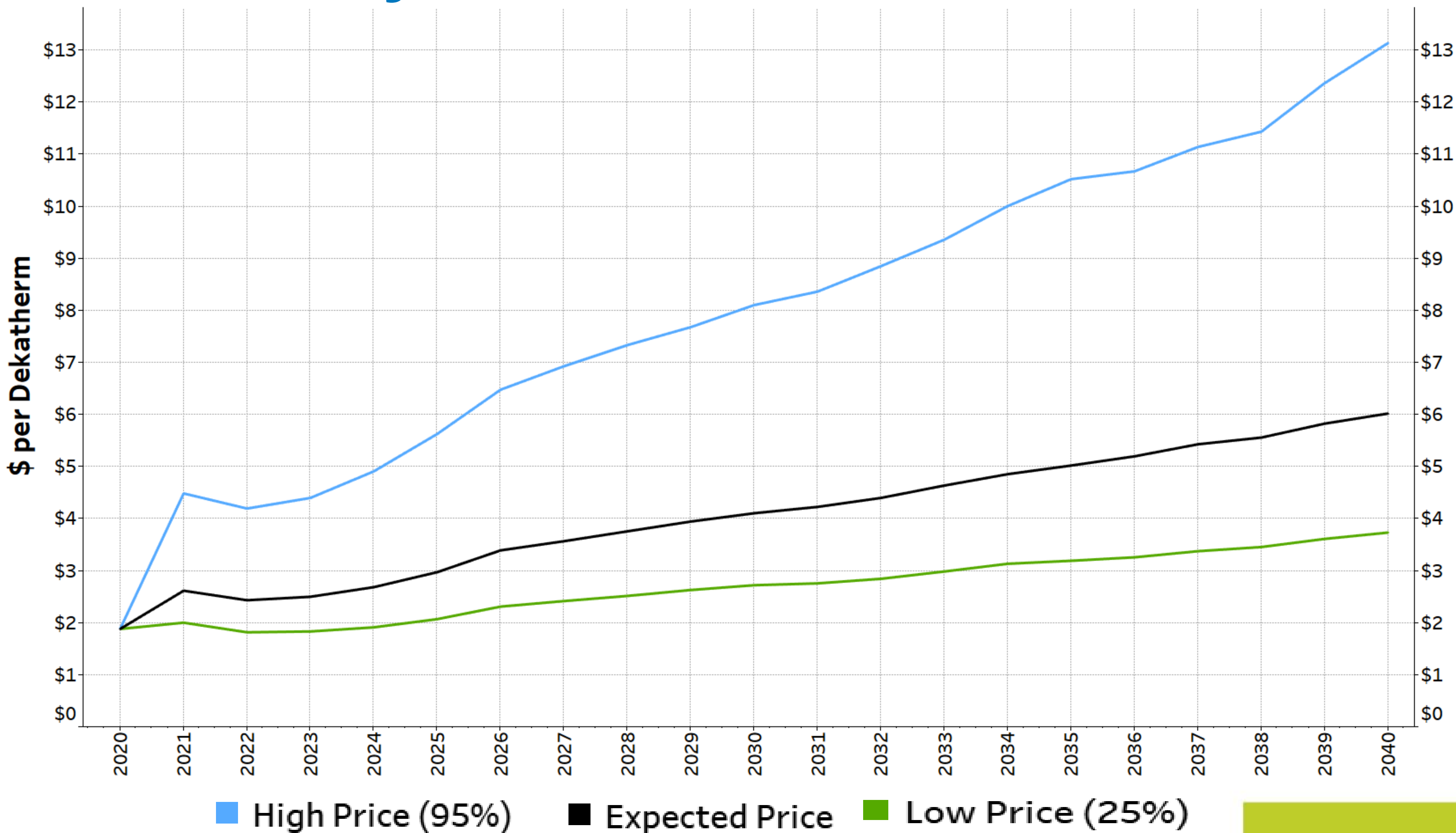
Henry Hub Expected Price and Average Annual Price Forecasts



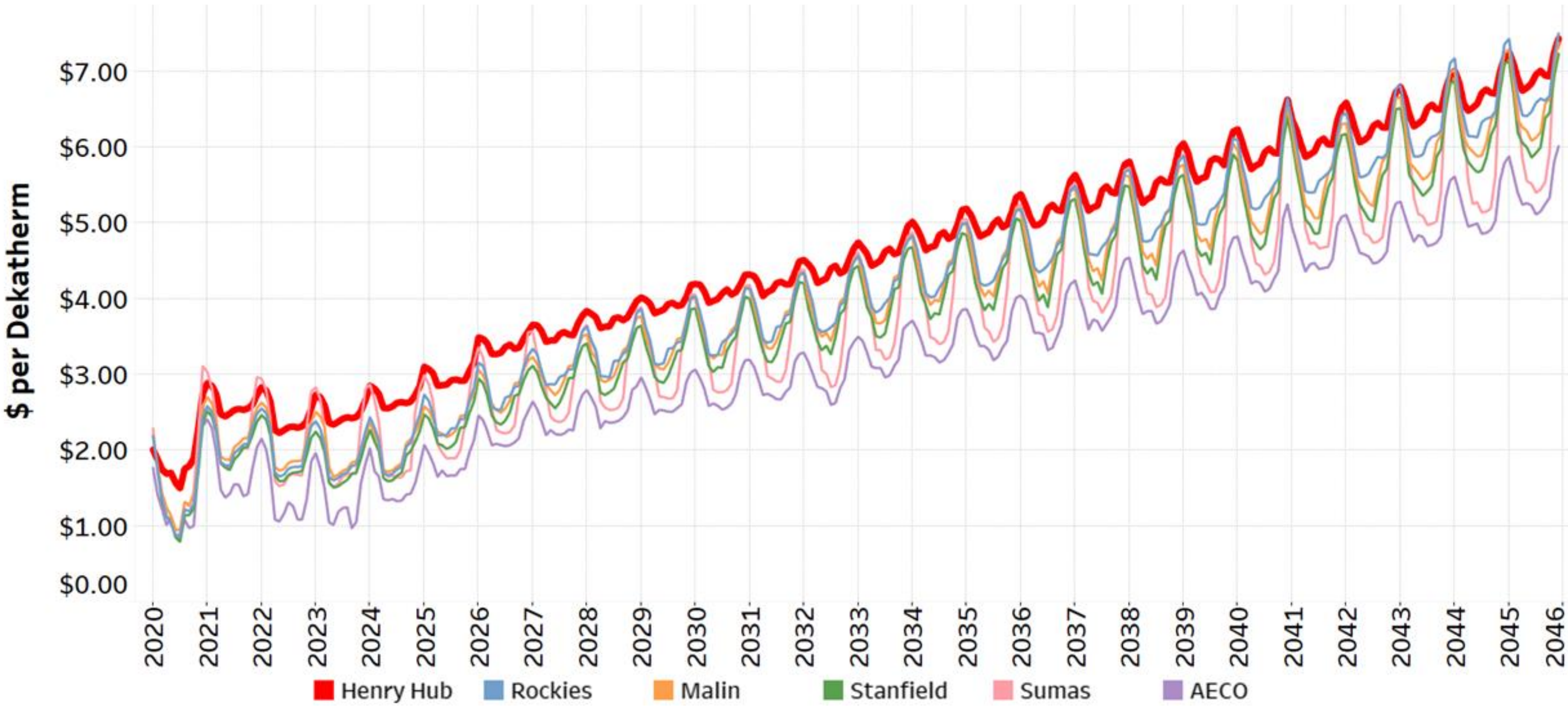
Stochastic Prices (Results from 1000 Draws)



2020 Henry Hub Prices - Nominal



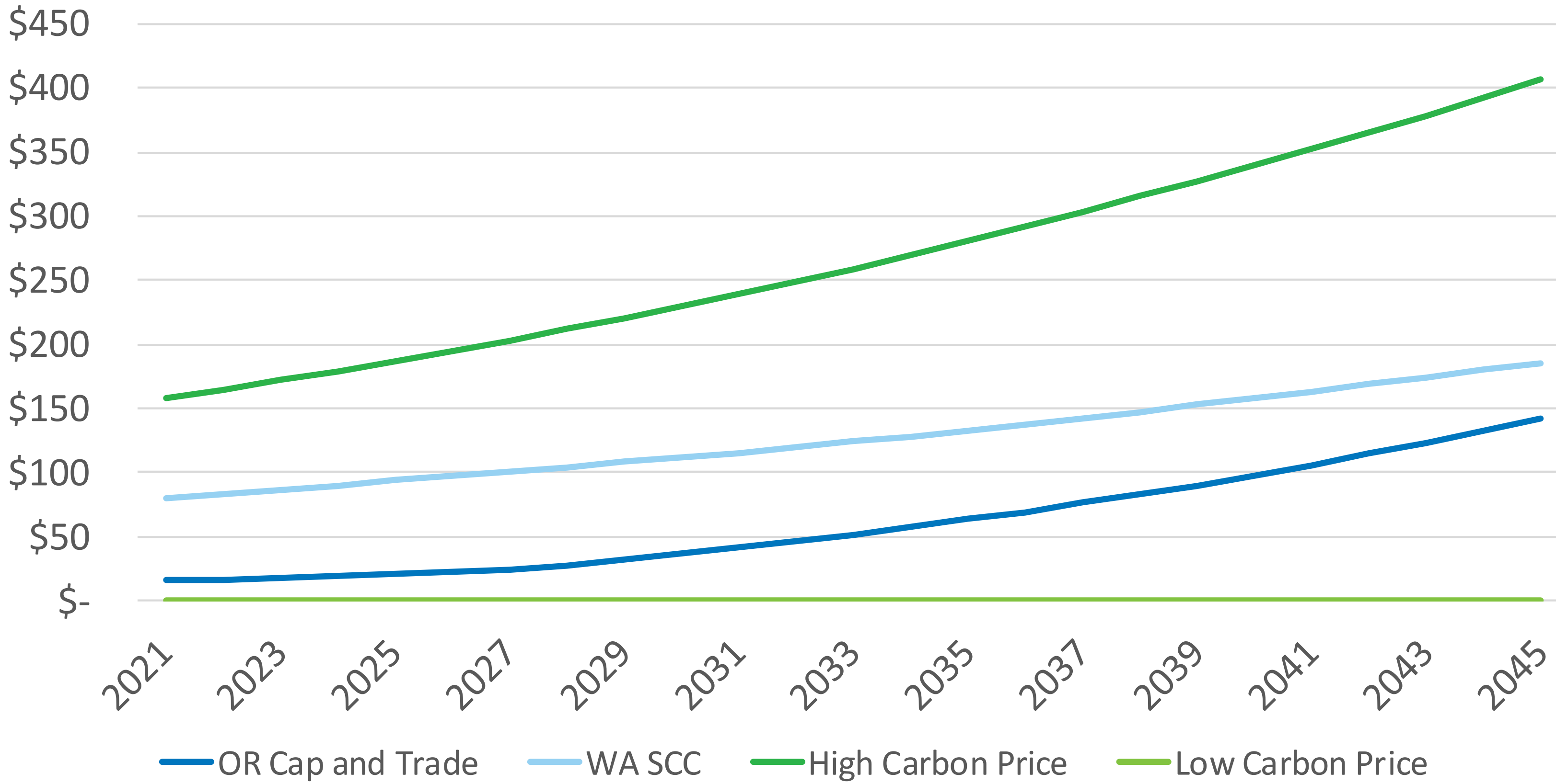
Prices by Gas Hub (Henry Hub Expected Price + Basis



Expected Case
Cost of Carbon by State - Summary

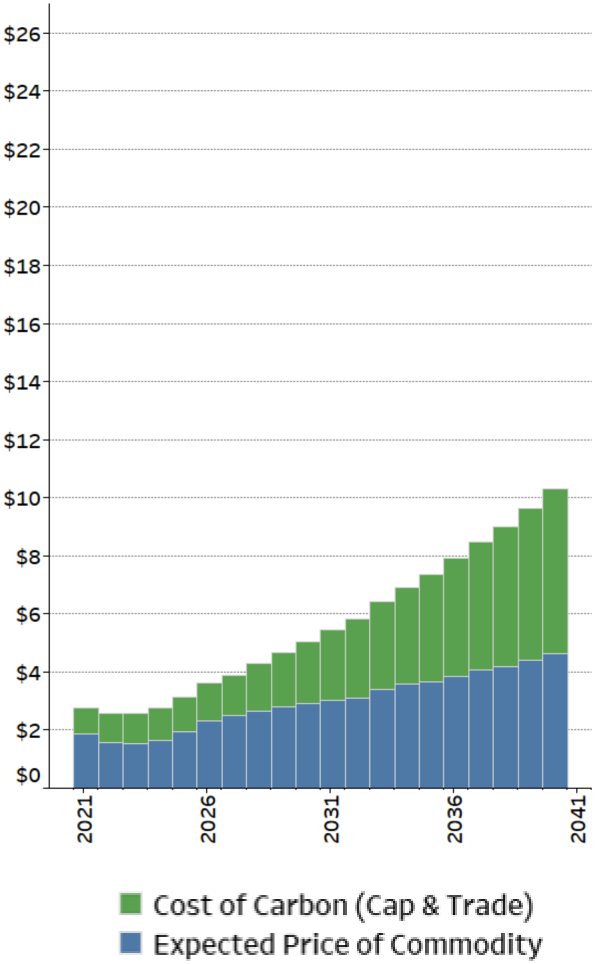
- Washington - Social cost of carbon @ 2.5% discount rate;
  - upstream emissions associated with natural gas drilling and transportation of natural gas to its end use.
- Oregon is based off a Wood Mackenzie estimate for Cap and Trade
- Idaho - carbon prices will not be included

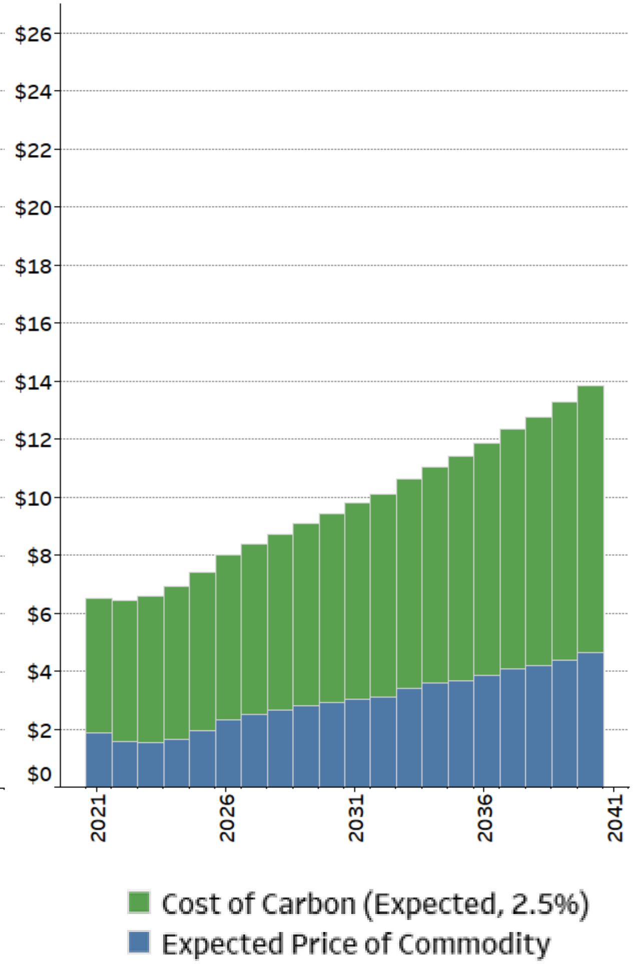
Carbon Costs

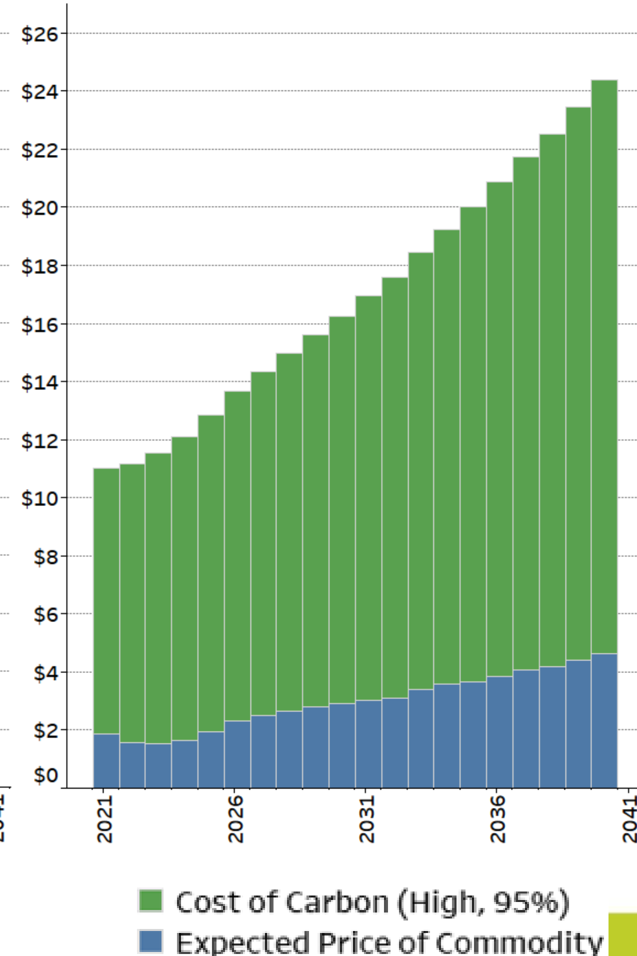


Levelized Cost per MTCO2e	$44.92	$113.75	$234.45	$0

Carbon Costs







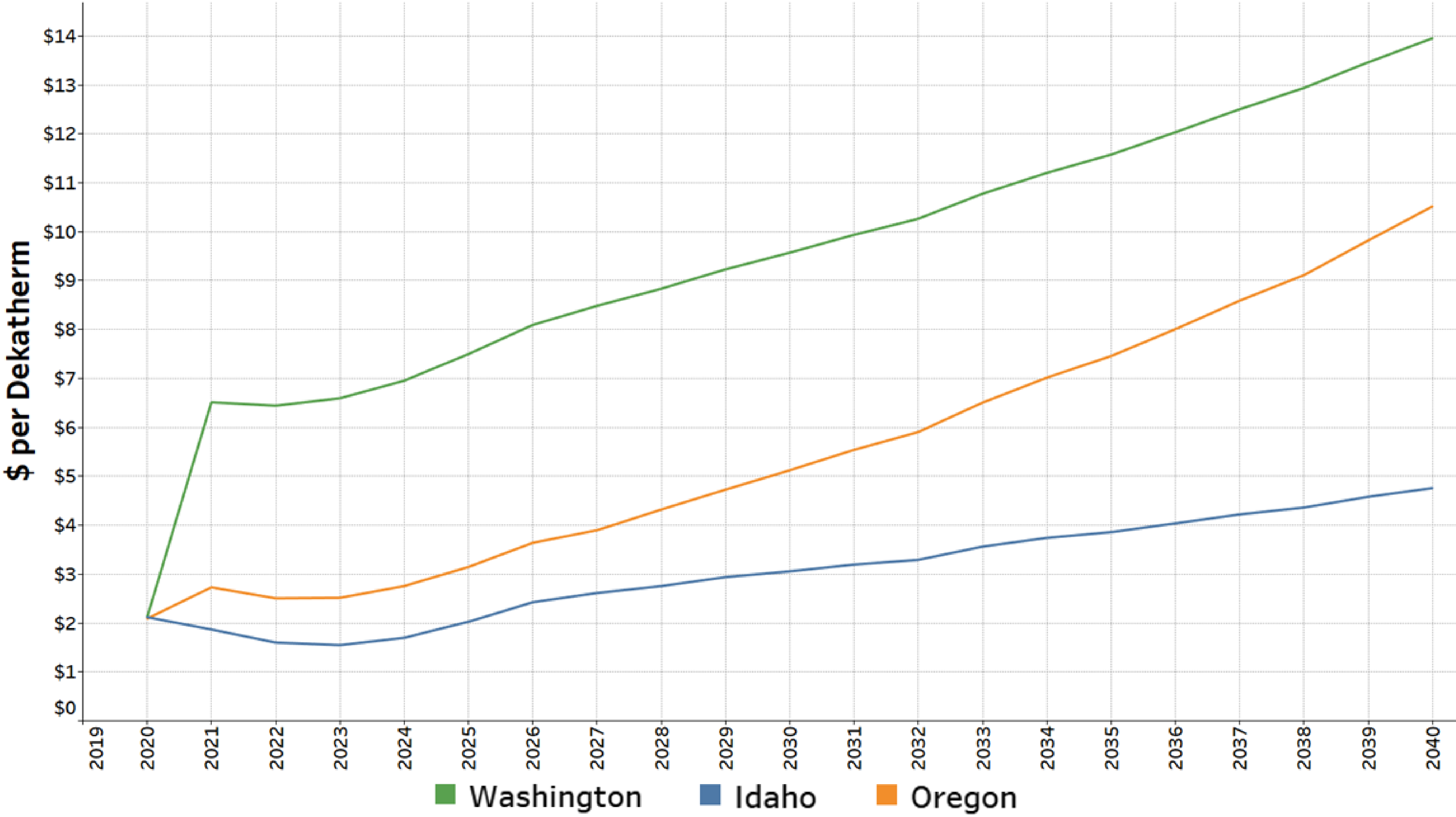
LDC Upstream Emissions

	Avista Specific Natural Gas	
Combustion	Lbs. GHG/MMBtu	Lbs. CO2e/Mmbtu
CO2	116.88	116.88
CH4	0.0022	0.0748
N2O	0.0022	0.6556
Total Combustion		117.61
Upstream		
CH4	0.313406851	10.66
Total		128.27
Upstream Emissions	Avista's Purchases	Emissions Location
0.77	89.72%	Canada
1.00	10.28%	Rockies
0.79		

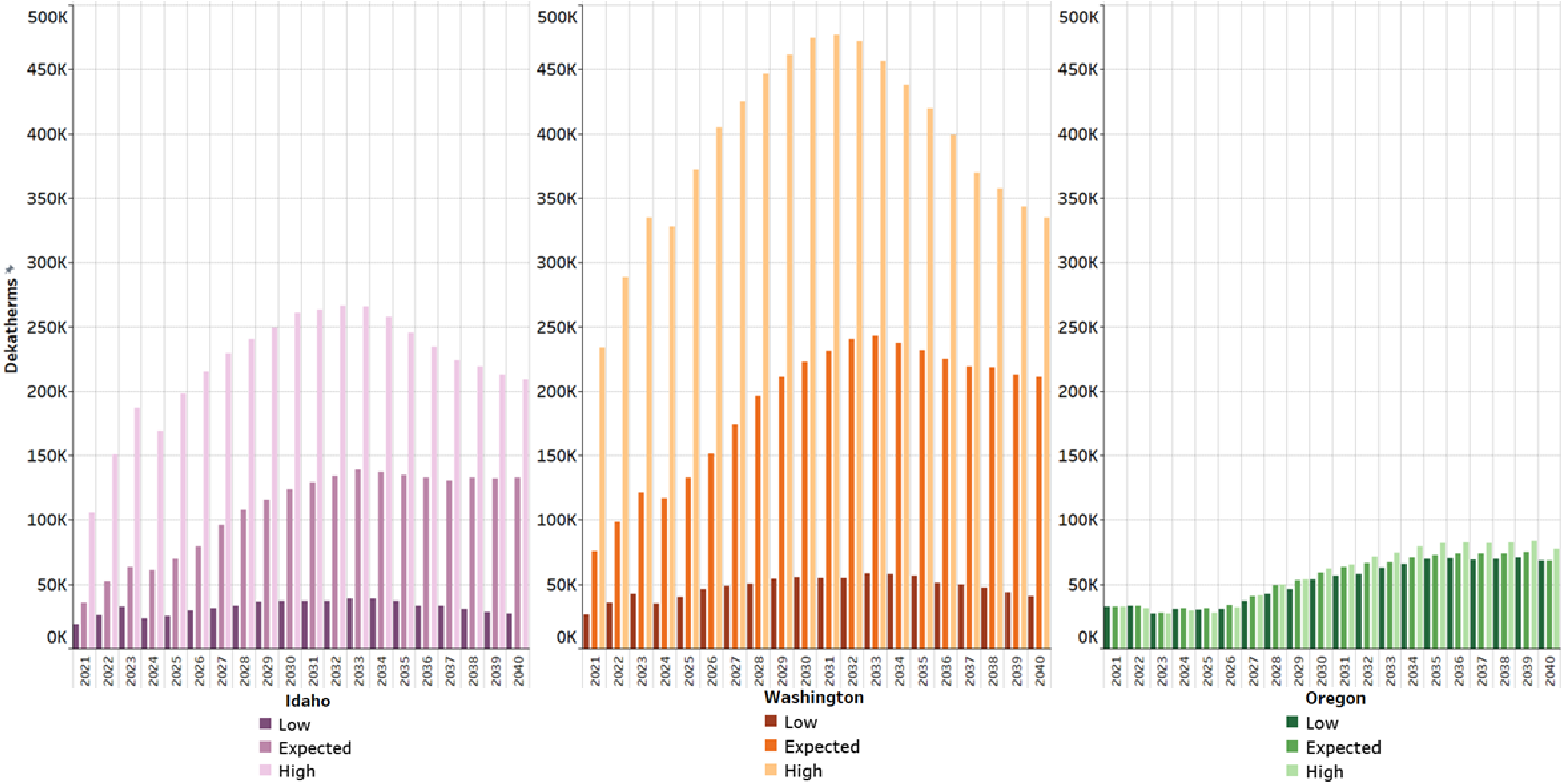
34 GWP

*Avista gas purchases
An average of the total volume purchased over the past 5 years by emissions location

Avoided Cost Comparison



DSM


Dekatherms
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2040
Idaho
Low
Expected
High
Washington
Low
Expected
High
Oregon
Low
Expected
High

Expected Case

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.

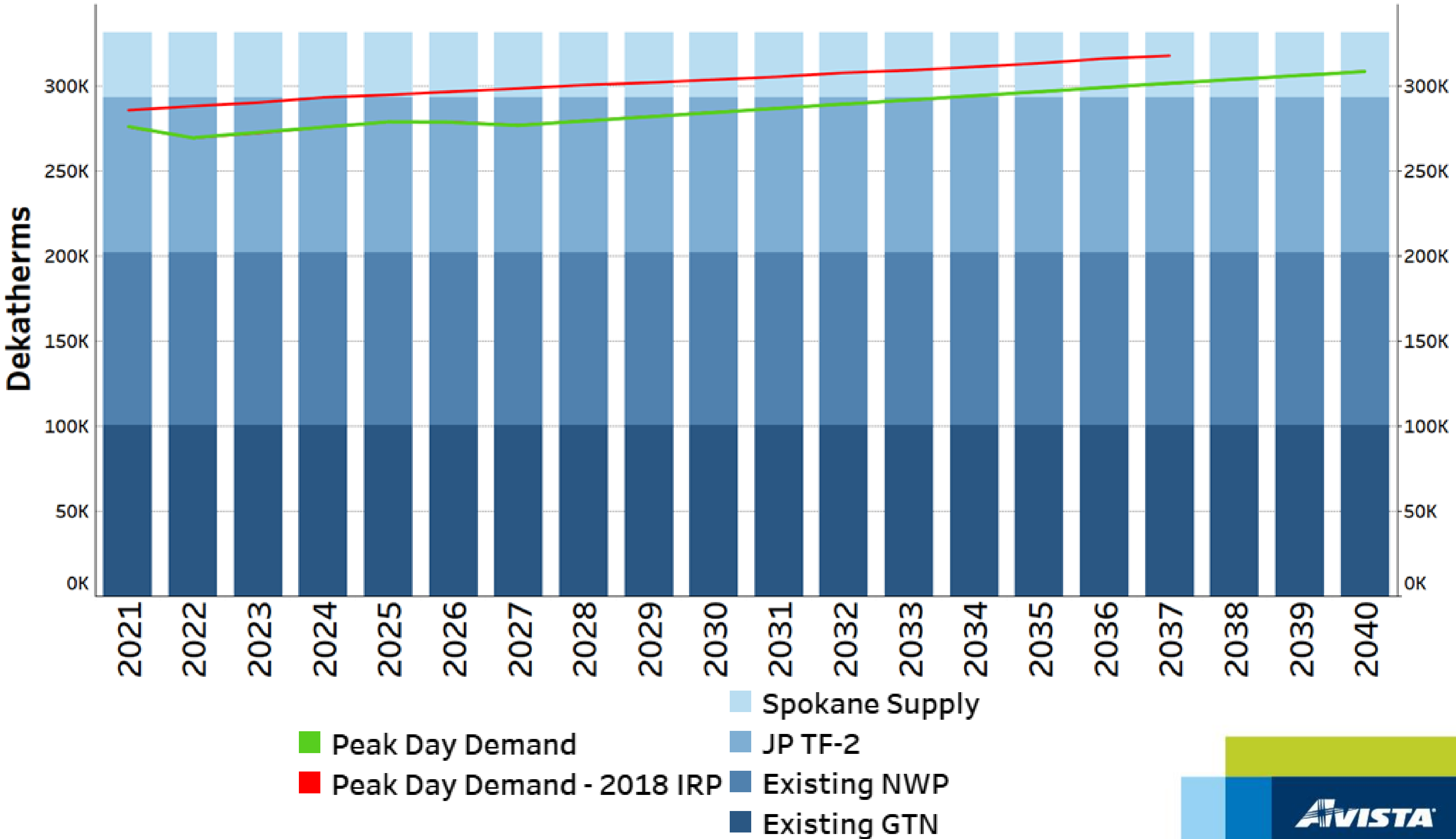
Proposed Scenarios

Proposed Scenarios INPUT ASSUMPTIONS	Expected Case	Average Case	Low Growth & High Prices	Carbon Reduction	High Growth & Low Prices
Customer Growth Rate	Reference Case Cust Growth Rates		Low Growth Rate	Reference Case Cust Growth Rates	High Growth Rate
Use per Customer	3 yr + Price Elasticity				
Demand Side Management	Expected Case CPA		High Prices DSM	Low Prices DSM	
Weather Planning Standard	99% probability of coldest in 30 years	20 year average	99% probability of coldest in 30 years		
GWP	100-Year GWP				
Prices Price curve	Expected		High	Low	
Carbon Legislation ($/Metric Ton)	SCC @ 2.5% WA; Cap and Trade forecast - OR; NO Carbon adder in ID		Carbon Cost - High (SCC 95% at 3%)	SCC @ 2.5% WA; Cap and Trade forecast - OR; NO Carbon adder in ID	$0

*1,000 Draws per scenario will be run stochastically

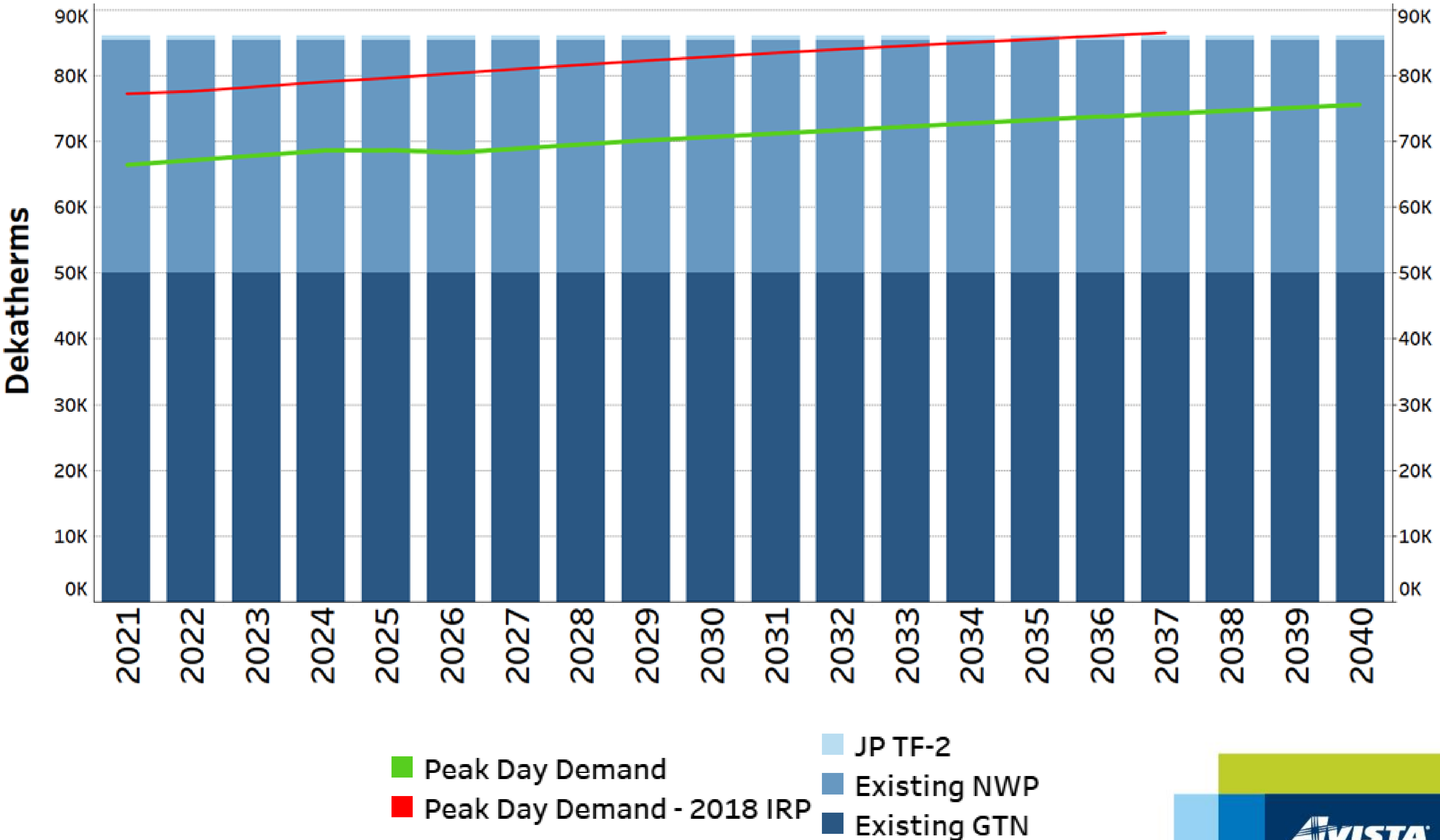
Existing Resources vs. Peak Day Demand

Expected Case – Washington/Idaho (DRAFT)



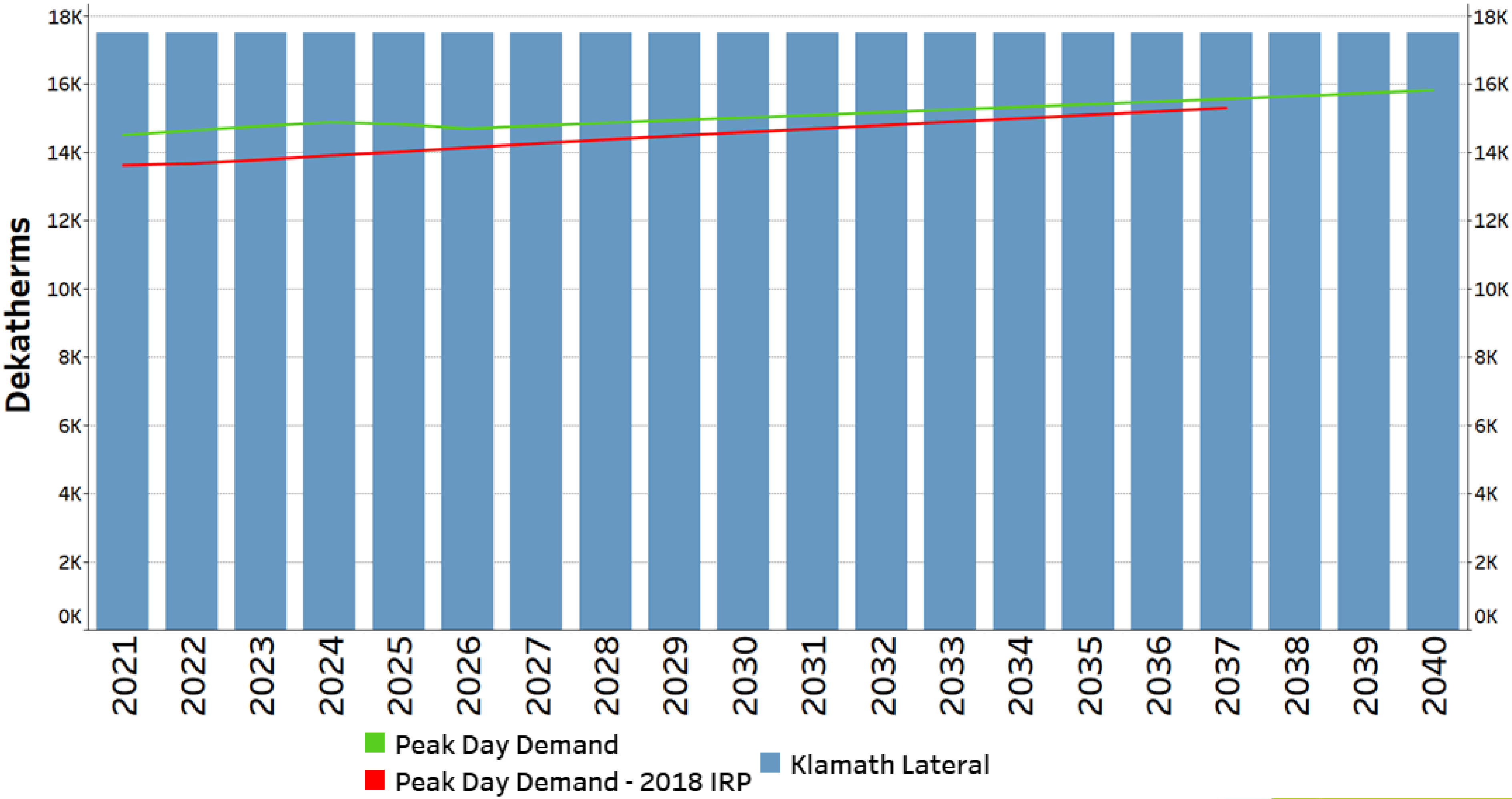
Existing Resources vs. Peak Day Demand

Expected Case – Medford/Roseburg (DRAFT)



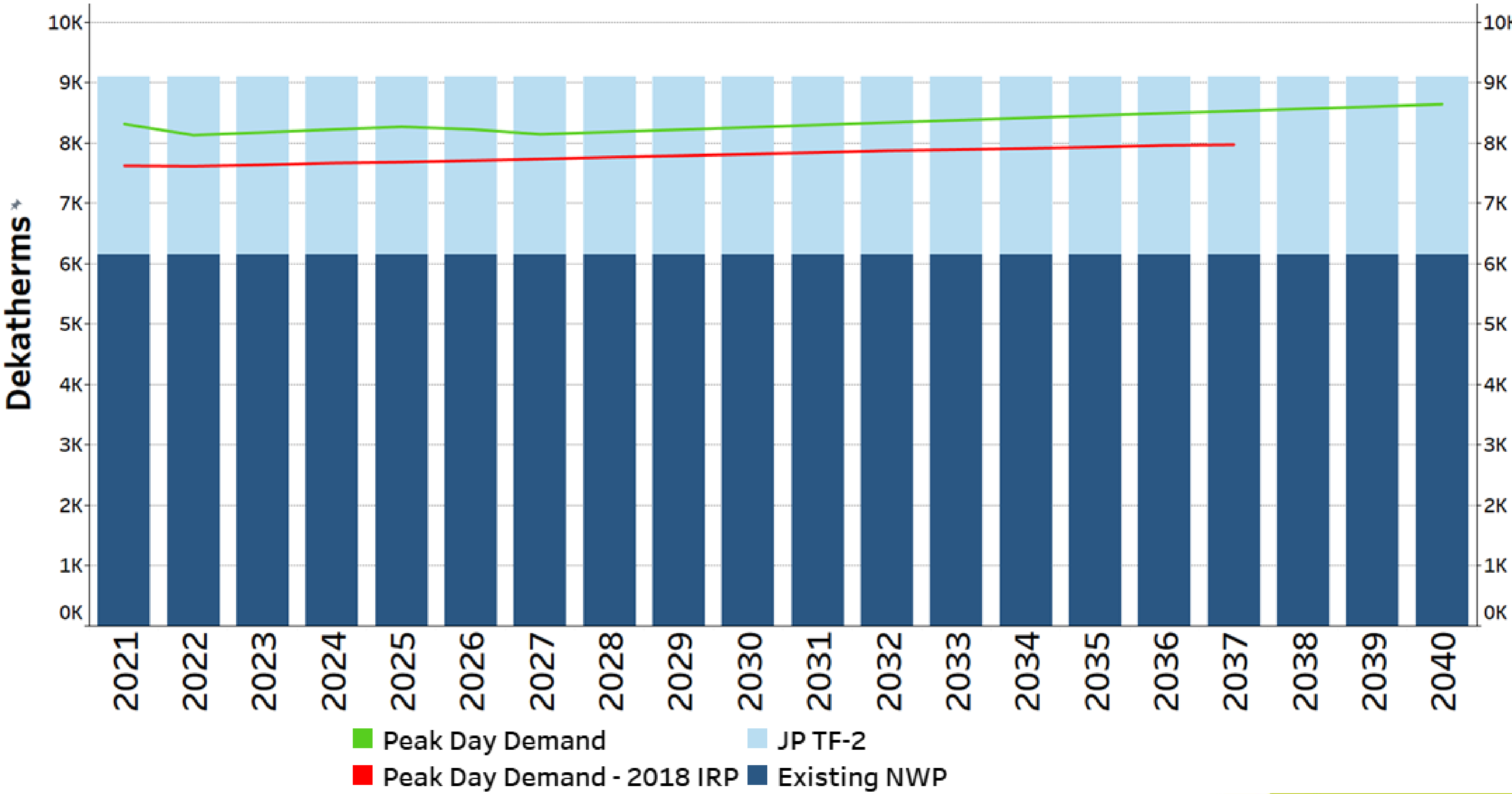
Existing Resources vs. Peak Day Demand

Expected Case – Klamath Falls (DRAFT)

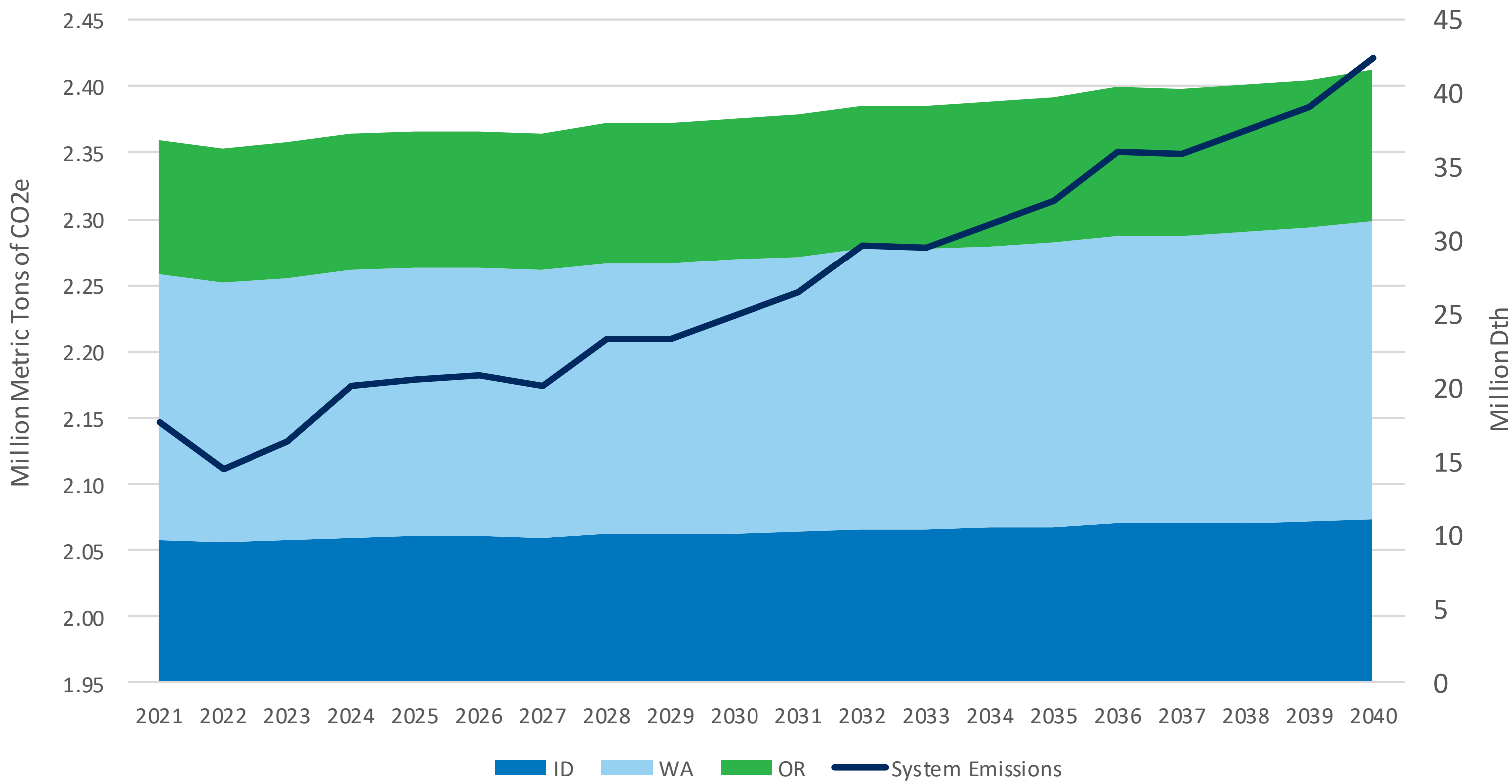


Existing Resources vs. Peak Day Demand

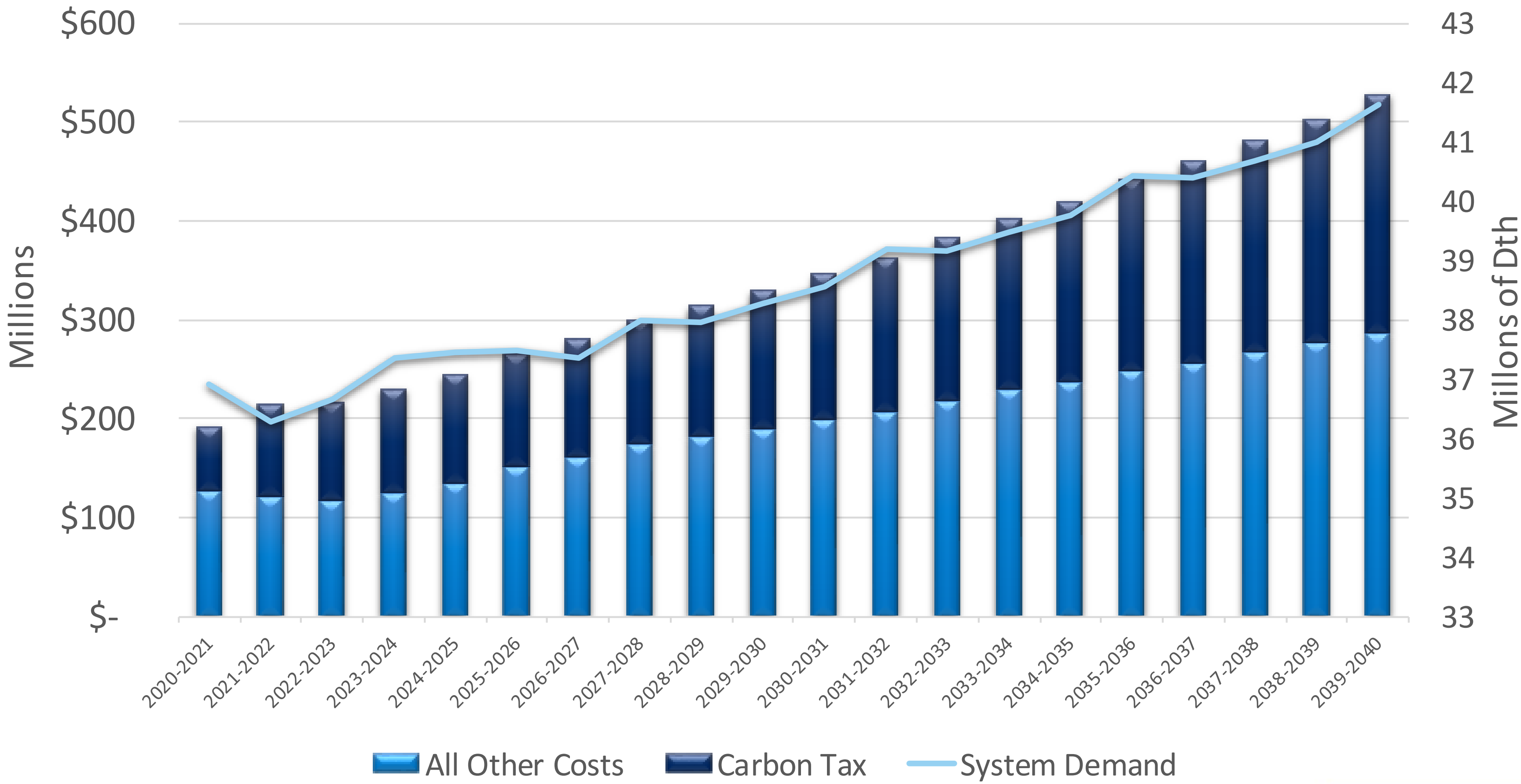
Expected Case – La Grande (DRAFT)



Expected Case - Emissions

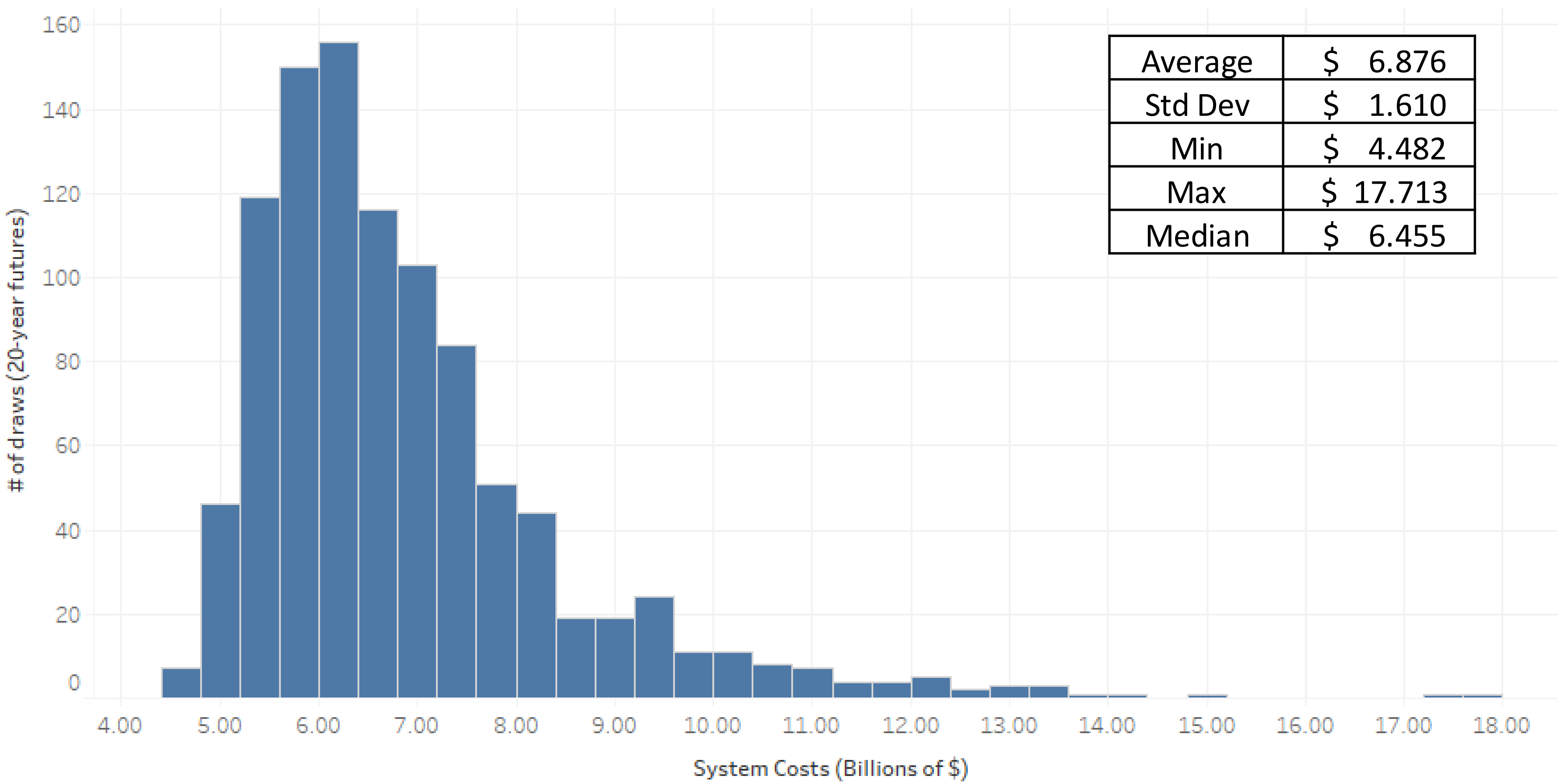


Expected Case Costs



$3.9B $3B

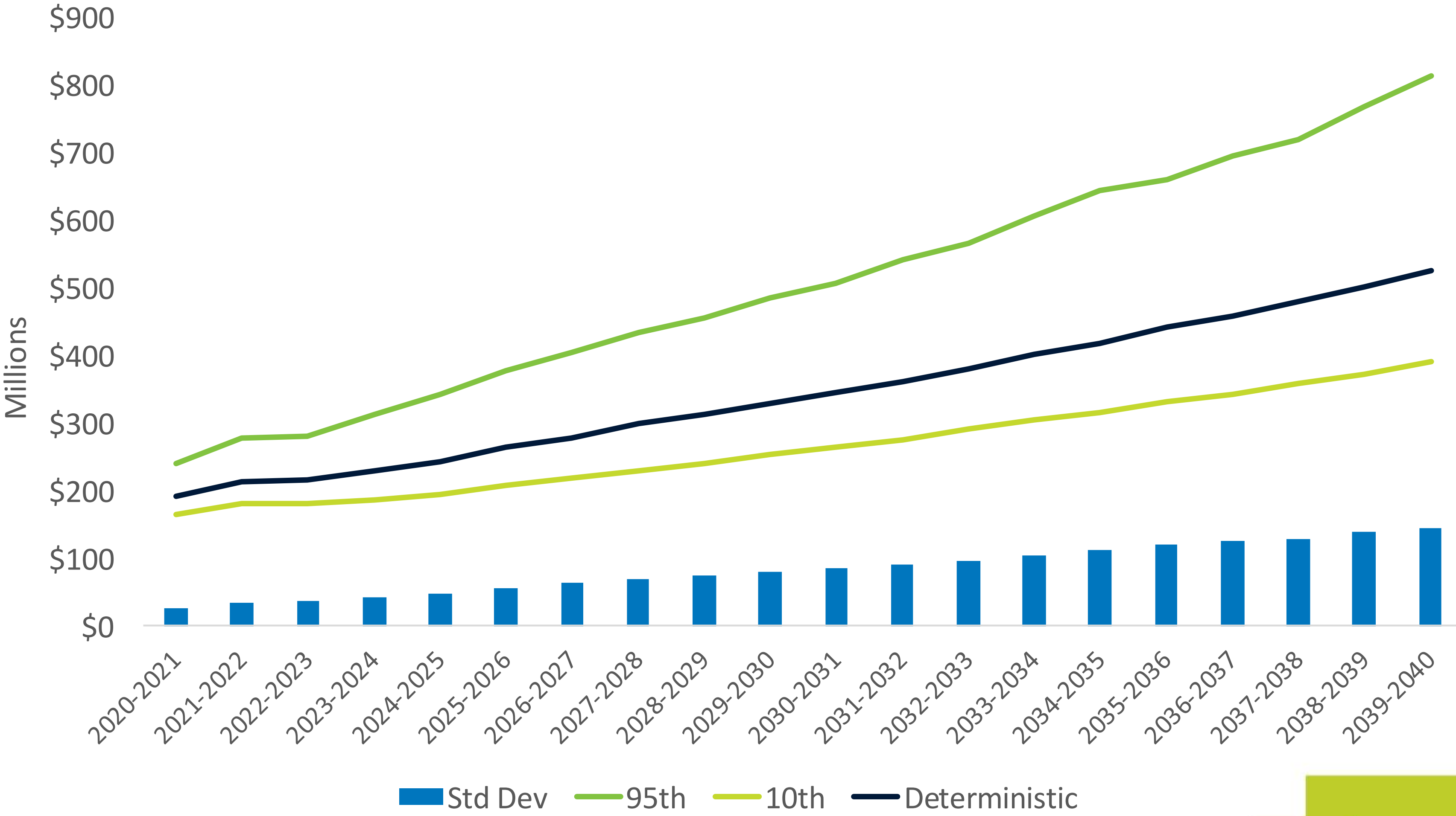
Expected Case distribution



Average	$ 6.876
Std Dev	$ 1.610
Min	$ 4.482
Max	$ 17.713
Median	$ 6.455

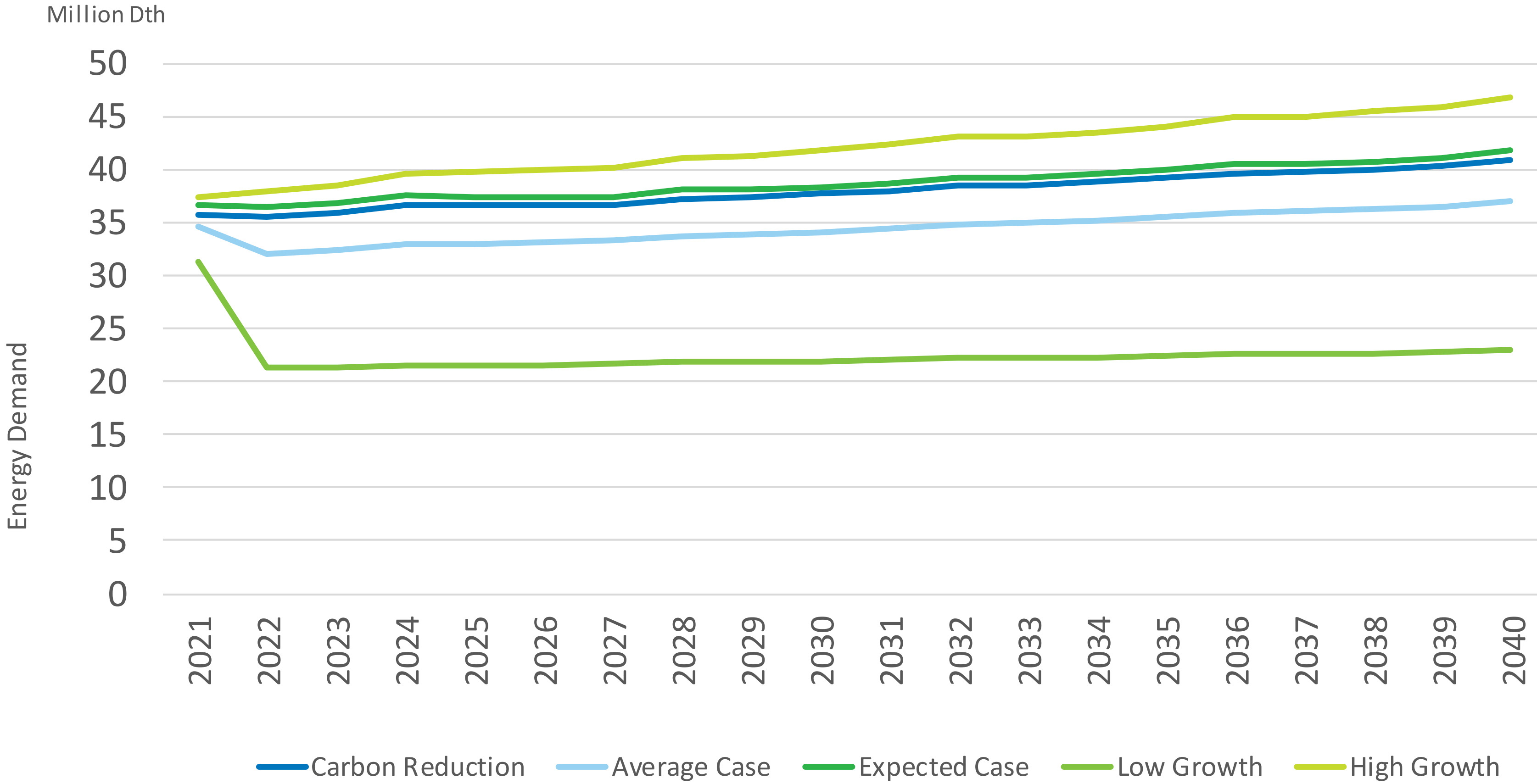
*1000 Simulations

Expected Case
1,000 Draws

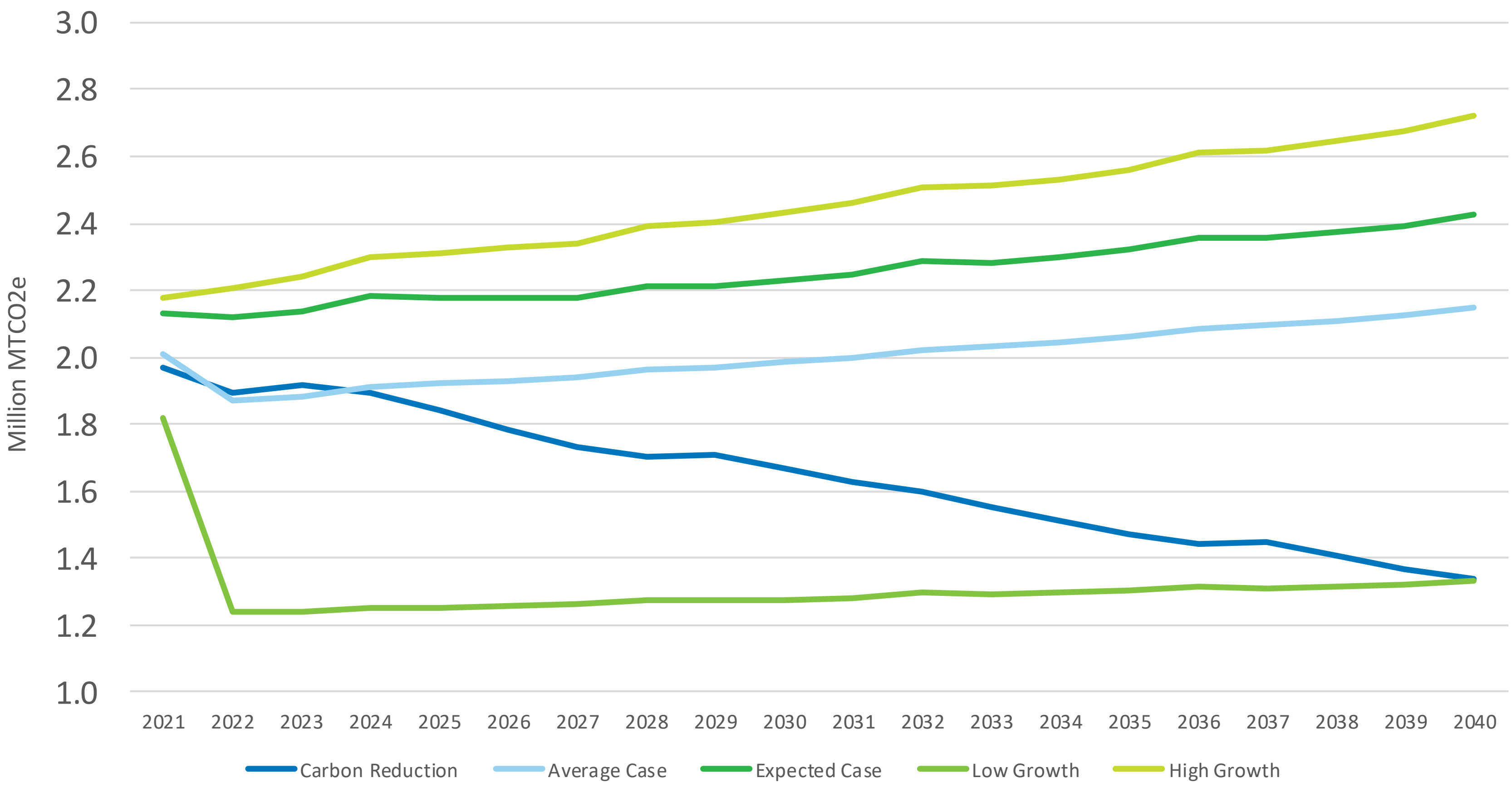


Other Scenarios

Energy Demand

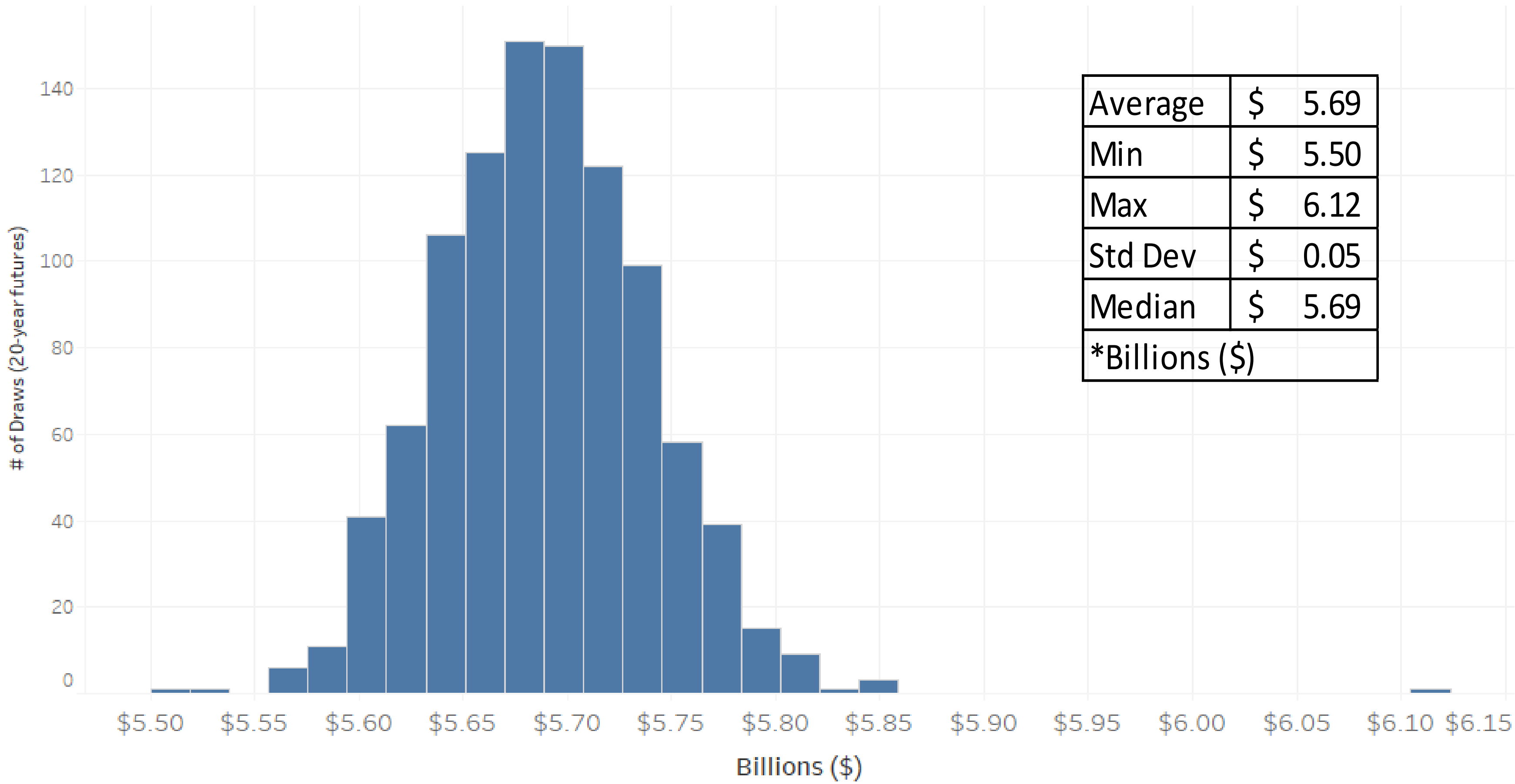


Emissions



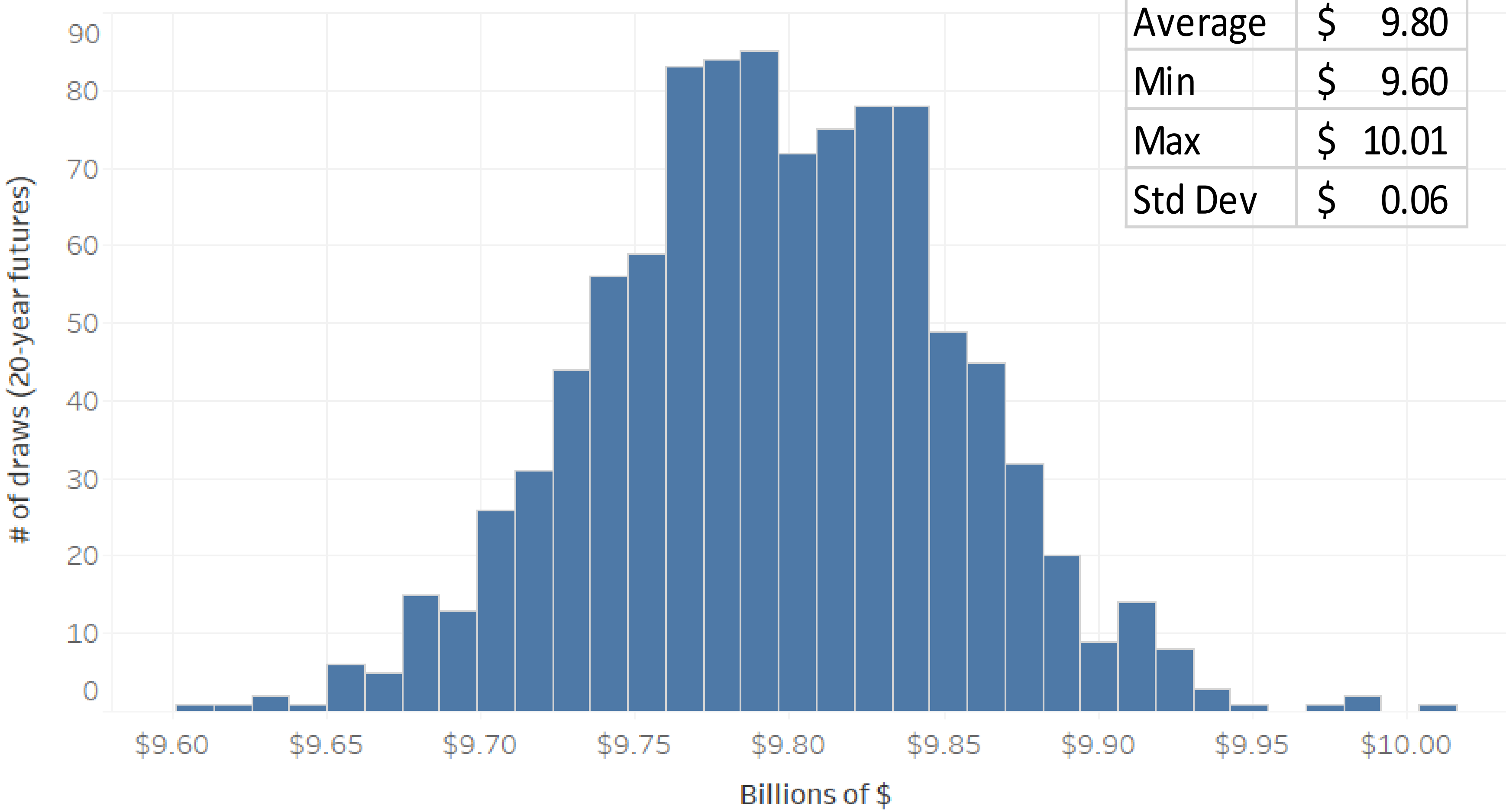
*Emissions assume carbon intensity of the supply resources

Average Case



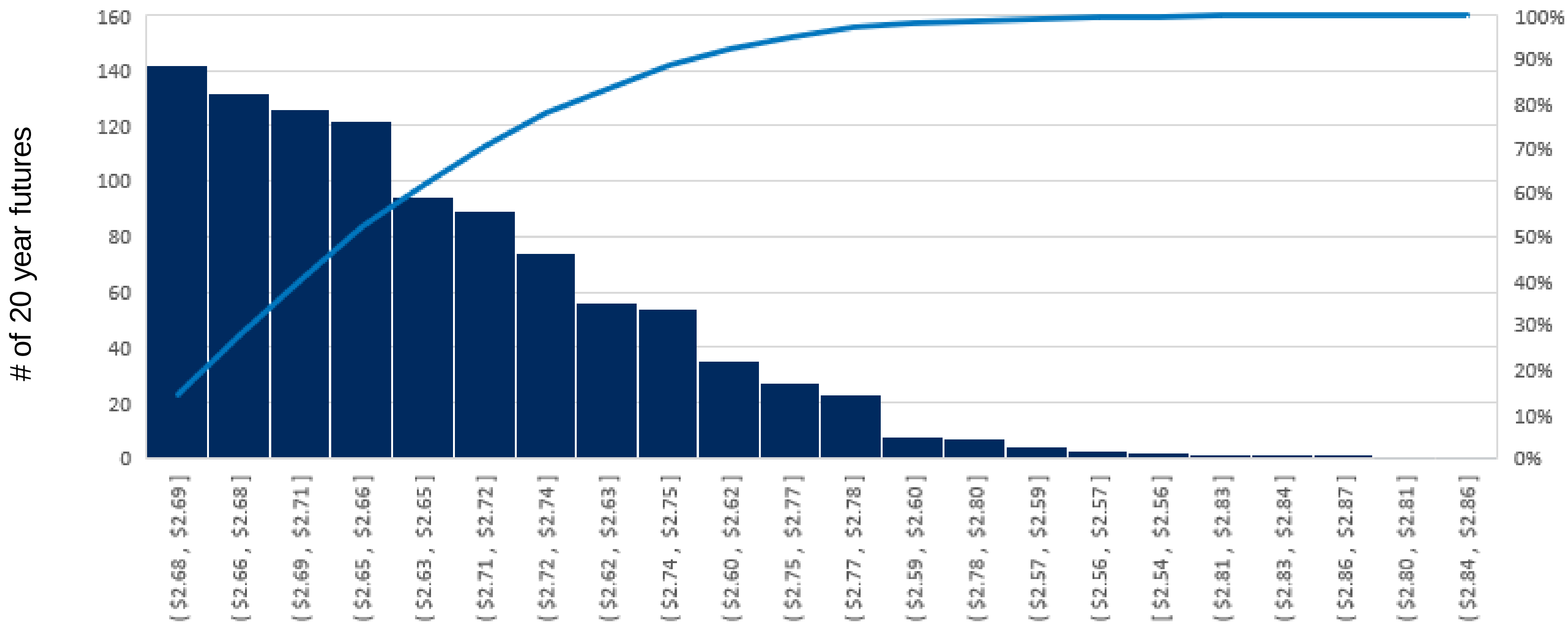
Average	$	5.69
Min	$	5.50
Max	$	6.12
Std Dev	$	0.05
Median	$	5.69
*Billions ($)		

Low Growth and High Prices



Average	$	9.80
Min	$	9.60
Max	$	10.01
Std Dev	$	0.06

High Growth & Low Prices
Least Cost/Risk - RNG solve



Solve - No Unserved	Average	Stdev	Median	Max	Min
RNG Resources Only	$ 2.683	$ 0.043	$ 2.681	$ 2.861	$ 2.542
Plymouth, RNG in La Grande	$ 2.721	$ 0.043	$ 2.719	$ 2.901	$ 2.580
GTN - RNG in La Grande	$ 2.734	$ 0.042	$ 2.675	$ 2.855	$ 2.540
Medford Lateral Expansion, RNG in La Grande	$ 2.734	$ 0.044	$ 2.731	$ 2.915	$ 2.600

*$ in Billions
**1,000 draws each scenario

Carbon Reduction Scenario

Carbon Reduction scenario

- Carbon reduction goals to meet 2035 targets of 45% below 1990 emissions and criteria are not known
- Any actual availability of physical RNG resources and rate impact by year can be further studied in future Integrated Resource Plans
- Actual projects will be considered on an ad-hoc basis to determine costs and environmental attributes which may make different RNG types a least cost solution
- Exact 1990 emissions are not known and are estimated based on prior 10k's
- Many of the rules from EO 20-04 will be coming out after this IRP is submitted
- Allowances are not considered

Resources Considered

Resource	Dth per year	Levelized Cost Per Dth (Year 1)
Distributed Renewable Hydrogen Production - WA	60,509	$47.25
Distributed Renewable Hydrogen Production - OR	60,509	$48.01
Distributed LFG to RNG Production - WA	231,790	$15.90
Centralized LFG to RNG Production - WA	662,256	$14.11
Dairy Manure to RNG Production - WA	231,790	$14.30
Wastewater Sludge to RNG Production - WA	187,245	$23.34
Food Waste to RNG Production - WA	108,799	$33.14
Distributed LFG to RNG Production - OR	231,790	$14.34
Centralized LFG to RNG Production - OR	662,256	$12.54
Dairy Manure to RNG Production - OR	231,790	$30.59
Wastewater Sludge to RNG Production - OR	187,245	$20.36
Food Waste to RNG Production - OR	108,799	$37.46

*Prices include carbon intensity, carbon costs, capital and overhead, and electricity and are considered Avista owned and operated
**Estimates are from a Black and Veach study

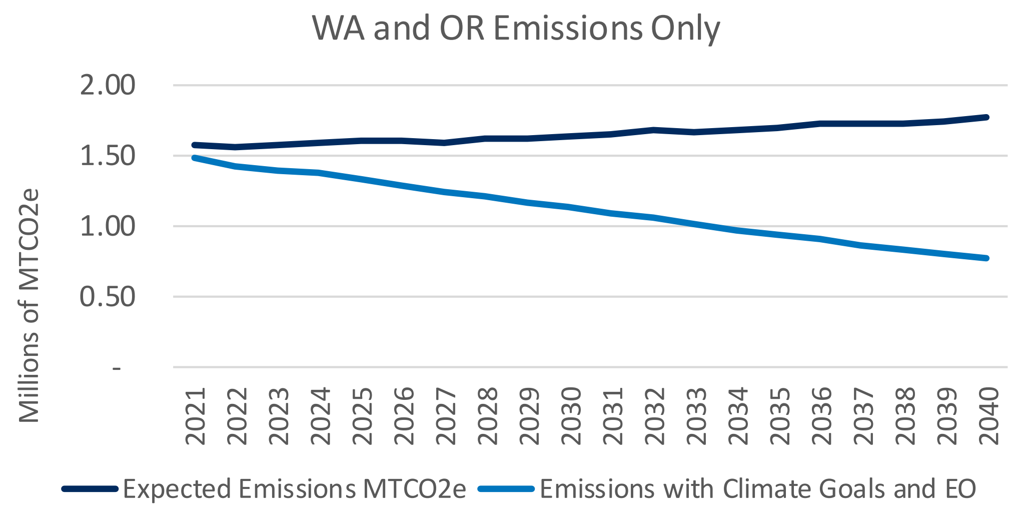
Carbon Intensity

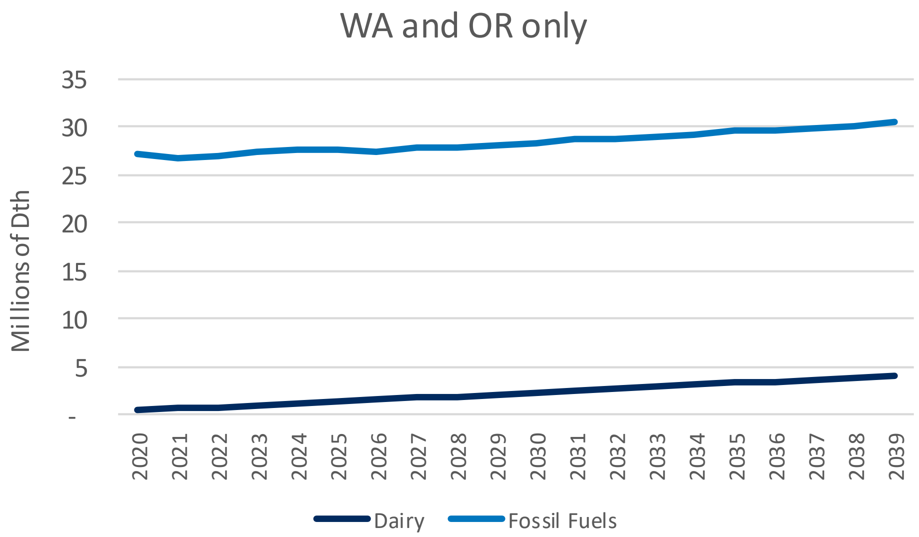
Source	Current Carbon Intensity (g CO_2e/MJ)	Percent of estimated Carbon reduction as compared to natural gas (as base value)	lbs. per Dth
Natural Gas	78.37		128.27
Landfill	46.42	41%	75.98
Dairy	-276.24	-452%	(580.40)
WWT	19.34	75%	31.65
Solid Waste	-22.93	-129%	(165.80)

Source: California Air Resources Board

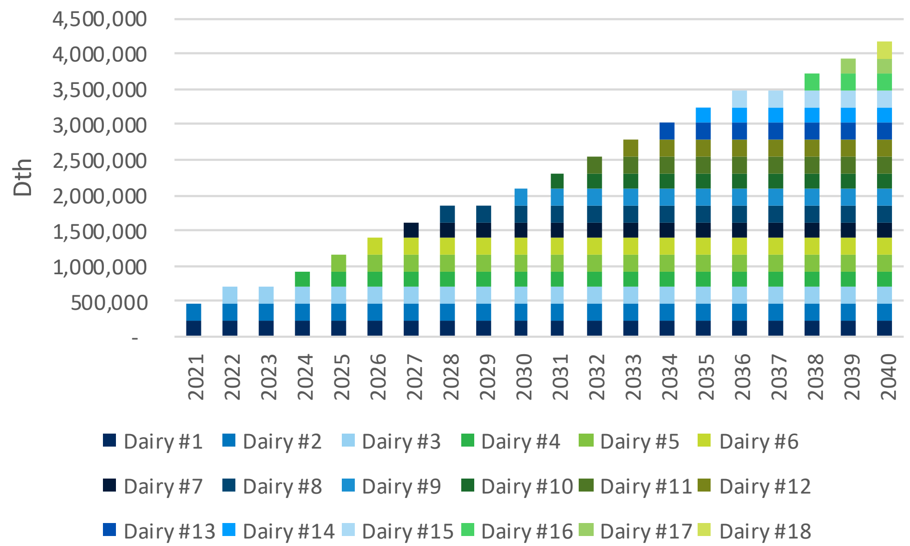
*Green H2 is considered to have no carbon or -128.27 lbs. per Dth as compared to Natural Gas

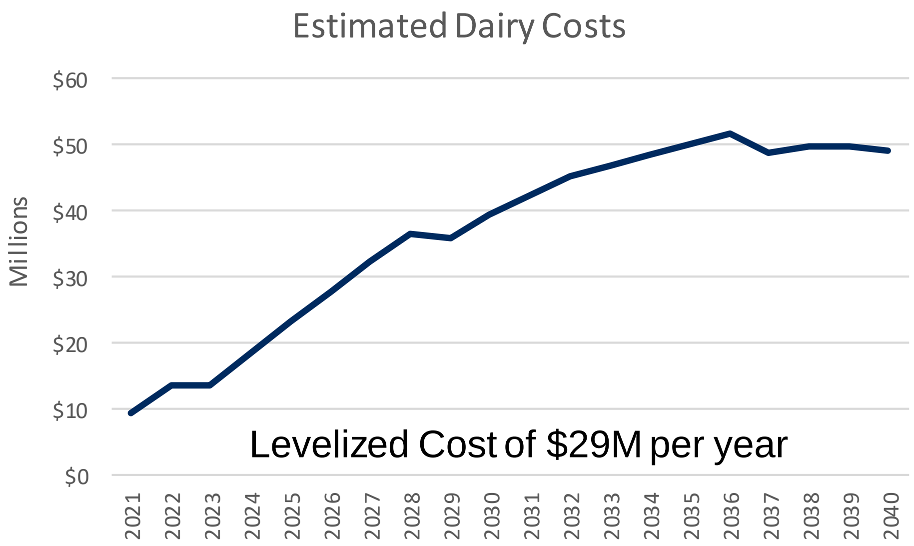
Climate Goals



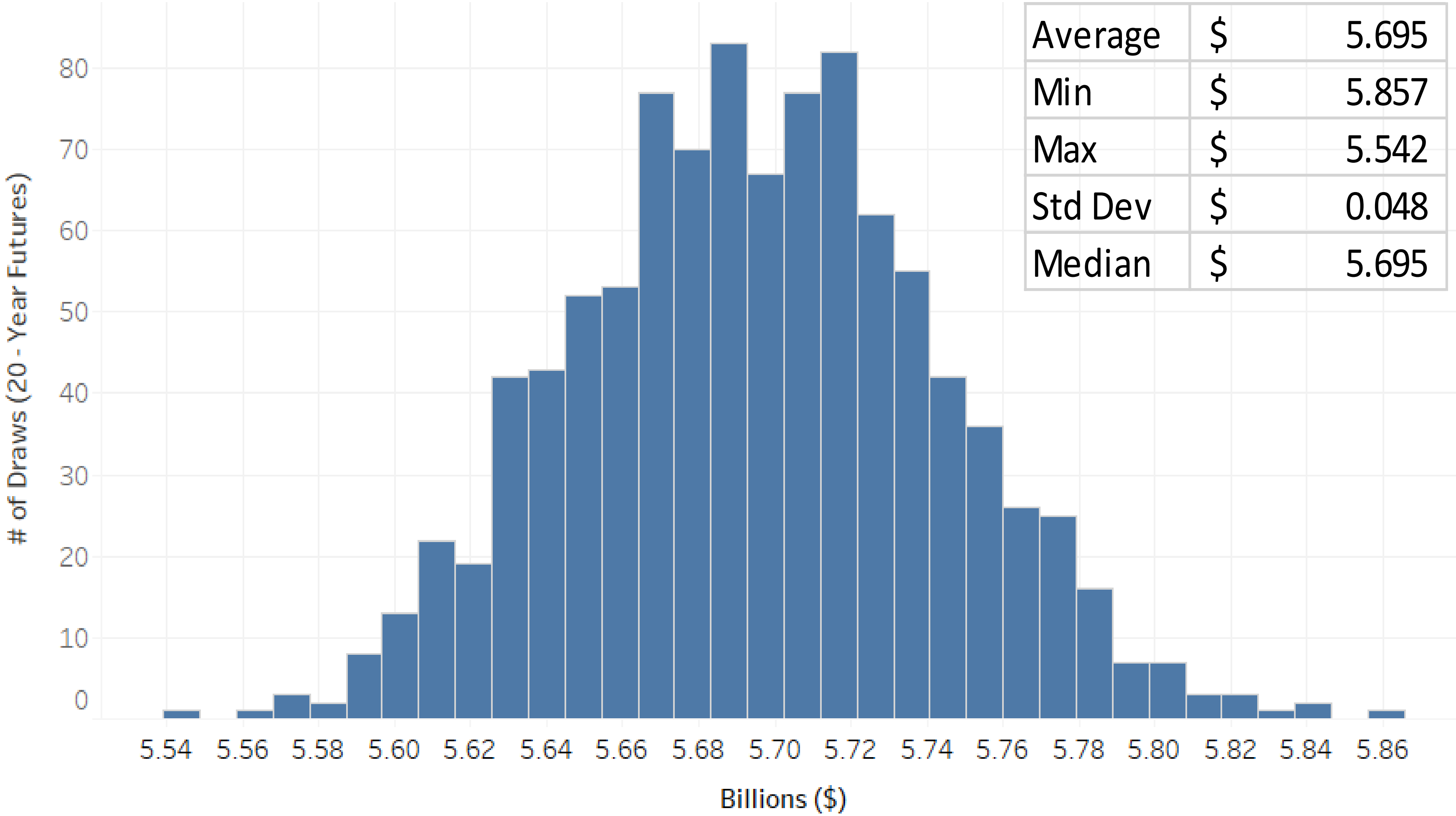


Resources Needed





Carbon Reduction



Average	$	5.695
Min	$	5.857
Max	$	5.542
Std Dev	$	0.048
Median	$	5.695

Carbon Reduction Summary

- Dairy
  - With a high carbon intensity and it's ability to reduce emissions dairy becomes the preferred resource in this IRP to reduce carbon
  - As the cost of carbon gets higher dairy becomes more economic as the carbon intensity combined with the SCC creates a low price
  - Unlike some other RNG resources a dairy farm has the potential to be reproduced unlike a landfill or waste water treatment plants
- Hydrogen
  - If the high carbon offset of dairy can be mitigated with a lower price of H2 this is both the primary and viable path
  - Green H2 has a large potential to offset emissions and provide the amount of energy demand forecasted
- Carbon offsets through allowances and the associated costs need to be considered to fully understand least cost and least risk
- Other RNG type programs will be modeled at a detailed level as projects are available and depending on costs and offsets could change least cost and least risk solution

Action Plan

- Further model carbon reduction
- Investigate new resource plan modeling software and integrate Avista's system into software to run in parallel with Sendout
- Model all requirements as directed in Executive Order 20-04
- Avista will ensure Energy Trust (ETO) has sufficient funding to acquire therm savings of the amount identified and approved by the Energy Trust Board

Next Steps

2020 Natural Gas IRP Draft Timeline

The following is Avista's tentative 2020 Natural Gas IRP timeline:

- June - November 2020 – Technical Advisory Committee meetings
- December 2020 – Prepare draft of IRP
- January 4, 2021 – Draft of IRP document sent to TAC
- February 1, 2021 – Comments on draft due back to Avista
- February 2021 – TAC final review meeting (if necessary)
- March 2021 – Final editing and printing of IRP
- April 1, 2021 – File IRP submission to Commissions and TAC