2018 Avista Natural Gas IRP

Technical Advisory Committee Meeting # 4

May 10, 2018

Olympia, WA

Agenda

- Introductions
- AEG – Idaho and Washington DSM
- ETO – Oregon DSM
- Lunch
- Dynamic DSM
- Sendout Modeling
- Assumptions Review
- Solving for Unserved Demand
- Stochastics
- 2016 IRP Action Items
- 2018 Highlights
- Wrap-Up and Review schedule

2018 IRP Timeline

- **August 31, 2017** – Work Plan filed with WUTC
- **January through May 2018** – Technical Advisory Committee meetings. Meeting topics will include:
  - **TAC 1: Thursday, January 25, 2018: TAC meeting expectations, review of 2016 IRP acknowledgement letters, customer forecast, and demand-side management (DSM) update.**
  - **TAC 2: Thursday, February 22, 2018: Weather analysis, environmental policies, market dynamics, price forecasts, cost of carbon.**
  - **TAC 3: Thursday, March 29, 2018 :** Distribution, supply-side resources overview, overview of the major interstate pipelines, RNG overview and future potential resources.
  - **TAC 4: Thursday, May 10, 2018:** DSM results, stochastic modeling and supply-side options, final portfolio results, and 2020 Action Items.
  - **June 21, 2018–** TAC final review meeting to review final stochastics (if necessary)
- **July 2, 2018 –** Draft of IRP document to TAC
- **July 13, 2018 –** Comments on draft due back to Avista
- **August 31, 2018 –** File finalized IRP document

2018 CONSERVATION POTENTIAL ASSESSMENT

Study Results, Prepared for the Avista DSM Advisory Group

CONTENTS

CPA-Related Action Plan Activities

- Measure Screening
- Measure Documentation
- Fully-Balanced TRC
- Barriers To DSM Uptake

Potential Study Summary

- LoadMAP Modeling Approach
- Levels of Potential

Potential Results

- Summary of Potential
- Comparison with Existing Programs
- Comparison with 2016 CPA

Sector-Level Potential, WA and ID (Supplemental Slide Deck)

- *Residential*
- *Commercial*
- *Industrial*

CPA-Related Action Plan Activities

Discussion of Action Items

2017-2018 ACTION PLAN

New Activities for 2018 IRP

In the 2018 IRP, ensure that the entity performing the Conservation Potential Assessment (CPA) evaluates and includes the following information:

- All conservation measures excluded from the CPA, including those excluded prior to technical potential determination;
- Rationale for excluding any measure;
- Description of Unit Energy Savings (UES) for each measure included in the CPA; specify how it was derived and the source of the data;
- Explain the efforts to create a fully-balanced TRC cost effectiveness metric within the planning horizon. Additionally, while evaluating the effort to eventually revert back to the TRC, Avista should consult the DSM Advisory Group and discuss appropriate non-energy benefits to include in the CPA.

In developing the 2018 IRP, discuss with the TAC:

- Discuss the barriers surrounding the uptake of DSM and how Avista can improve an increased level of achievable potential. (percentage of baseline dropped from 1.2 (economic) to 0.3 (achievable))

MEASURE SCREENING
Exclusions from CPA

Recommended Activity:

In the 2018 IRP, ensure that the entity performing the Conservation Potential Assessment (CPA) evaluates and includes the following information:

- All conservation measures excluded from the CPA, including those excluded prior to technical potential determination;
- Rationale for excluding any measure;

Handling in CPA:

- Very few measures were excluded from the current CPA prior to estimation of technical potential. Those explicitly excluded were highly custom commercial and industrial controls/process measures that were instead captured under a retrocommissioning or strategic energy management program.
- Measures that did not pass the economic screen were still counted in within achievable technical potential, allowing Avista to review for inclusion in programs if portfolio-level cost-effectiveness allows.

MEASURE SCREENING

Achievable Technical Top Measures in 2018

Rank	Measure / Technology	Achiev. Technical	UCT Achiev. Economic	Difference
1	Res - Furnace - Direct Fuel - AFUE 95%	22,707	19,091	3,616
2	Res - Windows - High Efficiency - Double Pane LowE CL22	9,426	9,426	-1
3	Com - Thermostat - WiFi Enabled - Wi-Fi/interactive thermostat installed	7,719	0	7,719
4	Com - Boiler - AFUE 97%	6,337	6,337	0
5	Res - Water Heater <= 55 gal. - Instantaneous - ENERGY STAR (UEF 0.87)	4,193	4,193	0
6	Com - Retrocommissioning - HVAC - Optimized HVAC flow and controls	2,809	661	2,148
7	Res - Gas Furnace - Maintenance - Restored to nameplate 80% AFUE	2,203	0	2,203
8	Com - Water Heater - Solar System - Solar system installed	1,812	0	1,812
9	Com - Fryer - ENERGY STAR	1,775	1,775	0
10	Com - Destratification Fans (HVLS) - Fans Installed	1,494	0	1,494
11	Res - Thermostat - Wi-Fi/Interactive - Interactive/learning thermostat	1,343	1,344	-1
12	Com - Gas Boiler - Insulate Steam Lines/Condensate Tank	1,152	1,152	0
13	Res - Insulation - Floor/Crawlspace - R-30	1,132	1,132	0
14	Com - Gas Boiler - Hot Water Reset - Reset control installed	1,123	1,123	0
15	Com - HVAC - Demand Controlled Ventilation - DCV enabled	1,033	1,033	0
16	Com - Thermostat - Programmable - Programmable thermostat installed	937	0	937
17	Res - Water Heater - Solar System - 40 sq ft supplemental solar system	858	0	858
18	Com - Insulation - Roof/Ceiling - R-38	847	850	-3
19	Com - Water Heater - TE 0.94	838	838	0
20	Com - Steam Trap Maintenance - Cleaning and maintenance	820	820	0
Subtotal		**70,558**	**49,774**	**20,784**
Total Savings in Year		**86,389**	**61,279**	**25,110**

MEASURE DOCUMENTATION

Documentation of Savings and Other Assumptions

Recommended Activity:

- Description of Unit Energy Savings (UES) for each measure included in the CPA; specify how it was derived and the source of the data;

Handling in CPA:

- The measure list developed during the CPA includes descriptions of each measure included. AEG will provide this as an appendix to the final report.
- Source documentation for assumptions, including UES, lifetime, and costs (including NEIs) may be found in the "Measure Summary" spreadsheet delivered as an appendix to the final report.
  - This will include the name of the source and version (if applicable)

FULLY-BALANCED TRC

Non-Energy Impacts

Recommended Activity:

- Explain the efforts to create a fully-balanced TRC cost effectiveness metric within the planning horizon. Additionally, while evaluating the effort to eventually revert back to the TRC, Avista should consult the DSM Advisory Group and discuss appropriate non-energy benefits to include in the CPA.

Addressed in CPA:

- As we will discuss throughout this presentation, TRC potential was estimated alongside UCT for each measure analyzed. In this study, we expanded the scope of non-energy/non-gas impacts to include the following:
  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)

BARRIERS TO DSM UPTAKE

Non-Energy Impacts

AEG Applied Energy Group

Recommended Activity:

- Discuss the barriers surrounding the uptake of DSM and how Avista can improve an increased level of achievable potential. (percentage of baseline dropped from 1.2 (economic) to 0.3 (achievable))

Addressed in CPA:

- In 2018, Washington achievable technical potential is at 40% of technical, compared to roughly 25% in the 2016 CPA.
- By 2038, Washington achievable technical potential is at 84% following the Council's 85% long-term achievability assumption.
  - Idaho potential is slightly lower due to a program start-up period
- Many measures currently in Avista programs are on fast ramp rates (such as heating and food preparation equipment)
  - Others may be newer programs or experience substantial implementation barriers (contractors may be less willing to install measures that require crawlspace work)
- Barriers may possibly be alleviated by bundling measures, "cross-selling" additional measures to active participants, and assisting in market transformation initiatives

AEG
Applied Energy Group

Potential Study Summary

Overview of Objectives, Approach, and Levels of Potential

LOADMAP MODELING APPROACH

Overview

Market Characterization

- Baseline studies
- Utility data
- Secondary data

Identify Demand-side Resources

- EE equipment
- EE measures
- Emerging tech.

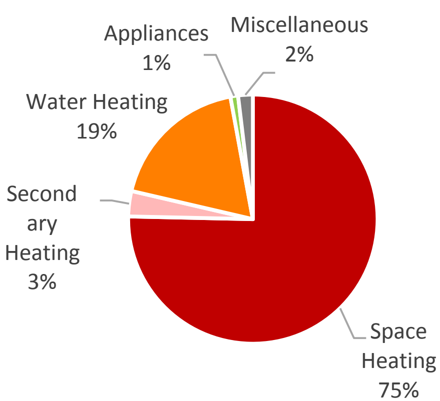
Baseline Projection

- Utility forecasts
- Standards and building codes

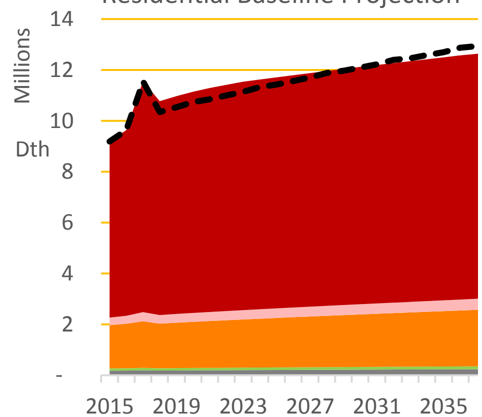
Potential Estimation

- Technical
- Achievable Tech.
- Economic Achiev.

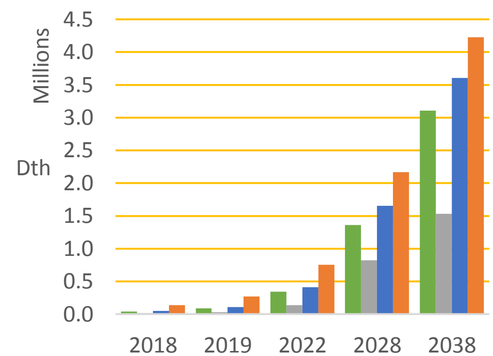
Residential Gas Use by End Use, 2015



Residential Baseline Projection



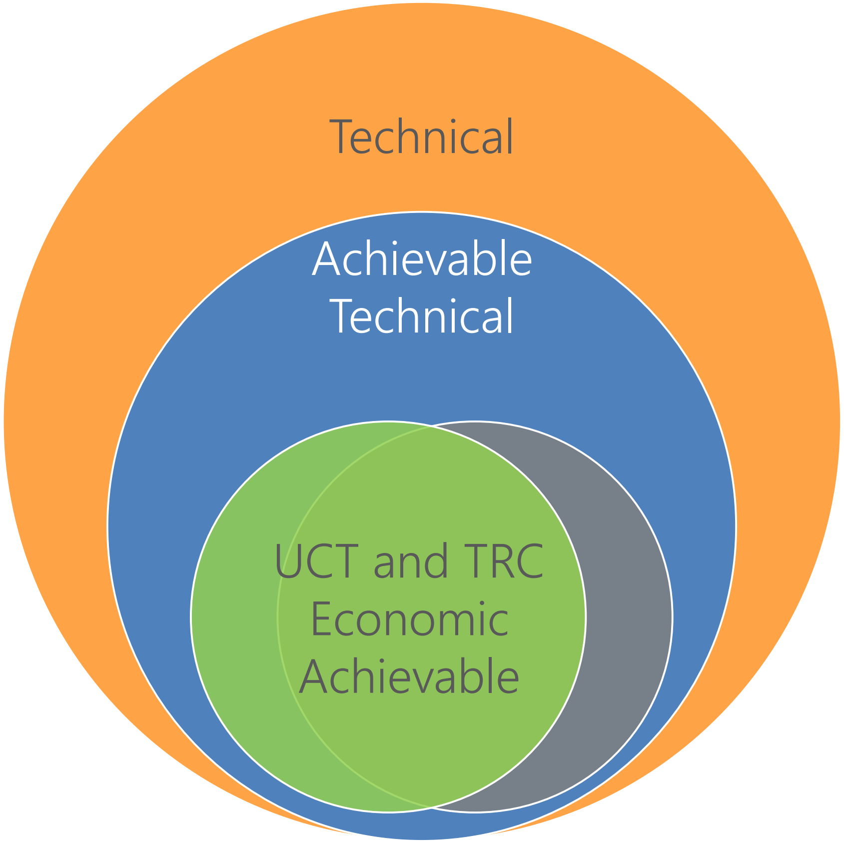
Residential Cumulative Natural Gas Savings



LEVELS OF POTENTIAL

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

- **Technical**: everyone chooses the 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 cost-effective measures. Tests considered within this study include UCT, and TRC.



ECONOMIC SCREENING

Three 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

Potential Results

Combined Results Avista's Residential, Commercial, and Industrial Sectors

DEFINITIONS OF POTENTIAL

Cumulative and Incremental

Over the following slides, we will display potential both as a **cumulative** impact on baseline as well as in annual **increments**

Cumulative potential includes the impacts of potential acquired from the first year of the study period (2018) through the year of interest, including effects of measures persistence

- We begin in 2018 for alignment with the current IRP period and to capture similarities with Avista programs and accomplishments
- This is particularly important in Idaho where programs are restarting and ramping up

Incremental potential summarizes new impacts realized in any given year of interest, excluding the effects of measure repurchases

Due to the effect of repurchases, the sum of incremental savings will always be <u>greater than or equal to</u> the cumulative potential in any given year

POTENTIAL ESTIMATES

Achievability

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

Achievable technical potential reaches 85% of technical by the end of the study, consistent with the Council assumptions

- **Please note** Power Council's ramp rates include potential realized from outside of utility DSM programs, including regional initiatives and market transformation

POTENTIAL ESTIMATES

Total Avista Washington, **Cumulative** Potential

Scenario	2018	2019	2022	2028	2038
Baseline Forecast (Dth)	17,221,900	17,418,177	17,878,550	18,517,630	19,498,948
Cumulative Savings (Dth)					
UCT Achievable Economic	61,279	133,576	500,422	1,916,441	4,139,016
TRC Achievable Economic	33,893	73,100	276,379	1,297,679	2,420,649
Achievable Technical	86,389	186,065	655,389	2,405,890	4,901,043
Technical	217,202	434,037	1,189,331	3,251,362	5,804,041
Energy Savings (% of Baseline)					
UCT Achievable Economic Potential	0.4%	0.8%	2.8%	10.3%	21.2%
TRC Achievable Economic Potential	0.2%	0.4%	1.5%	7.0%	12.4%
Achievable Technical Potential	0.5%	1.1%	3.7%	13.0%	25.1%
Technical Potential	1.3%	2.5%	6.7%	17.6%	29.8%

POTENTIAL ESTIMATES

Total Avista Idaho, **Cumulative** Potential

Scenario	2018	2019	2022	2028	2038
Baseline Forecast (Dth)	8,557,178	8,667,149	8,958,733	9,352,011	9,975,077
Cumulative Savings (Dth)					
UCT Achievable Economic	26,340	58,352	235,414	965,825	2,107,684
TRC Achievable Economic	9,846	22,432	108,249	635,250	1,204,809
Achievable Technical	37,324	81,526	310,222	1,218,944	2,514,049
Technical	103,071	206,214	582,638	1,660,809	2,993,151
Energy Savings (% of Baseline)					
UCT Achievable Economic Potential	0.3%	0.7%	2.6%	10.3%	21.1%
TRC Achievable Economic Potential	0.1%	0.3%	1.2%	6.8%	12.1%
Achievable Technical Potential	0.4%	0.9%	3.5%	13.0%	25.2%
Technical Potential	1.2%	2.4%	6.5%	17.8%	30.0%

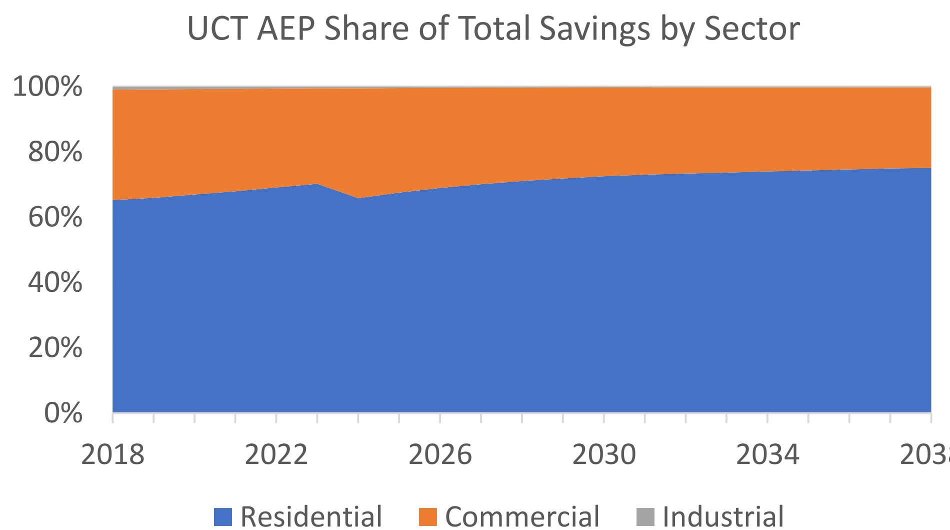
POTENTIAL BY SECTOR

Total Avista Washington, **Cumulative** Potential

As the largest sector, residential represents the largest portion of **cumulative** UCT achievable economic potential (AEP) throughout the study period.

The industrial sector only includes customers eligible for programs, which represent a very small percentage of total industrial consumption.

Some residential measures are not cost-effective on a TRC basis. This is due to the use of full measure costs rather than just a utility's portion. Inclusion of a heating calibration credit and non-gas impacts somewhat mitigates this effect.



UCT Savings (Dth)	2018	2019	2022	2028	2038
Residential	39,979	88,051	345,801	1,362,078	3,107,847
Commercial	20,731	44,393	151,733	547,834	1,021,211
Industrial	569	1,132	2,887	6,528	9,957
Total	**61,279**	**133,576**	**500,422**	**1,916,441**	**4,139,016**

TRC Savings (Dth)	2018	2019	2022	2028	2038
Residential	14,920	32,308	139,361	824,953	1,573,939
Commercial	18,376	39,603	134,004	465,827	836,014
Industrial	597	1,188	1,785	6,899	10,696
Total	**33,893**	**73,100**	**276,379**	**1,297,679**	**2,420,649**

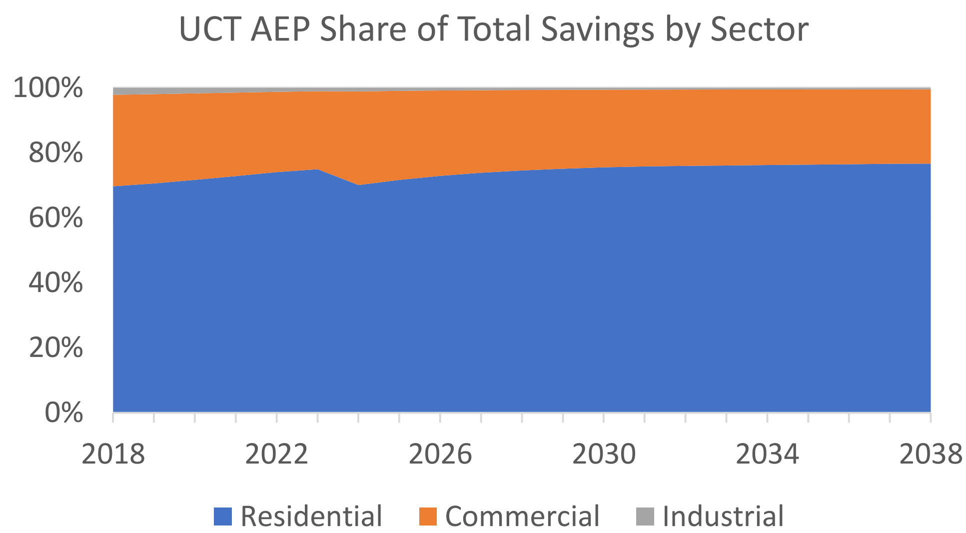
POTENTIAL BY SECTOR

Total Avista Idaho, **Cumulative** Potential

As the largest sector, residential represents the largest portion of **cumulative** UCT achievable economic potential (AEP) throughout the study period. This is slightly larger in Idaho than Washington.

The industrial sector only includes customers eligible for programs, which represent a very small percentage of total industrial consumption.

Some residential measures are not cost-effective on a TRC basis. This is due to the use of full measure costs rather than just a utility's portion. Inclusion of a heating calibration credit and non-gas impacts somewhat mitigates this effect.



UCT Savings (Dth)	2018	2019	2022	2028	2038
Residential	18,354	41,176	174,333	720,226	1,615,844
Commercial	7,417	16,035	58,160	239,015	481,888
Industrial	569	1,140	2,922	6,584	9,952
Total	**26,340**	**58,352**	**235,414**	**965,825**	**2,107,684**

TRC Savings (Dth)	2018	2019	2022	2028	2038
Residential	3,744	9,243	62,156	458,445	833,329
Commercial	5,529	12,039	43,123	169,784	360,683
Industrial	573	1,150	1,738	7,021	10,797
Total	**9,846**	**22,432**	**108,249**	**635,250**	**1,204,809**

RESIDENTIAL ACCOMPLISHMENTS

Washington, Comparison with Current Avista Programs

2018 UCT achievable economic estimates are lower than Avista's 2017 accomplishments and 2018 Plan

- Furnaces potential is lower, but unit installations are similar to current levels - indicating a drop in unit energy savings due to new construction installations and the 2015 WSEC.
- Smart thermostat potential is mapped to the Council's electric ramp rate
- Windows represent substantial potential, in line with 2017 accomplishments.
- ENERGY STAR home savings in Washington have are lower due to the impacts of 2015 WSEC – but not to the level of the RTF, who assumes everyone will be installing high-efficiency water heaters
  - Anecdotal evidence from builders indicates that this is not the case

2018 UCT Achievable Economic (Dth)	2017 Accomplish	2018 Plan	LoadMAP 2018 ATP
Furnace	40,003	28,600	19,091
Boiler	453	0	619
Water Heater	6,621	1,042	4,257
ENERGY STAR Homes	122	365	294
Smart Thermostat	4,884	2,340	1,344
Programmable TStat.	0	55	0
Ceiling Insulation	540	280	1,072
Wall Insulation	218	240	904
Floor Insulation	66	266	1,135
Doors	40	63	0
Windows	8,911	15,940	9,426
Air Sealing	207	112	0
Duct Insulation	30	144	367
Duct Sealing	48	0	0
Showerheads	0	954	575
Miscellaneous	14	0	893
Total	**62,156**	**50,402**	**39,979**

2015 WASHINGTON ENERGY CODE

Impact on Residential New Construction

Effective since the middle of 2016, the 2015 WSEC results in a much more efficient new construction baseline

- Mandatory, very efficient, shell measures substantially reduce heating loads, which lowers furnace usage by 30%
  - e.g. 650*.7 = 455 therms
- Since usage is down, savings from upgrading to an efficient system are reduced proportionally

Credits are also required to meet section R406.2

- Although high efficiency equipment is allowed under this section, we have heard that builders are opting for cheaper methods of compliance, such as designing homes with interior ductwork

For a new home of average size:

- Ceiling Insulation: R49
- Wall Insulation: R21
- Floor Insulation: R30 – R38
- Window U-Factor: 0.28-0.30
- Air Leakage: 3-5 ACH50

For optional credits, the following may be utilized:

- 94% AFUE furnace
- 0.95 EF water heater
- 1.75 GPM showerheads
- Inside ducting

RTF Analysis: https://rtf.nwcouncil.org/standard-protocol/new-homes

RESIDENTIAL ACCOMPLISHMENTS

Idaho, Comparison with Current Avista Programs

2018 UCT achievable economic estimates are very similar to Avista's 2018 Plan and 2017 accomplishments

- Furnace potential is very similar to current accomplishments – mainly due to new construction potential
- Smart thermostats and windows pass UCT screening
- ENERGY STAR Homes reflect Idaho building codes, which do not lower space heating savings due to a substantially tighter building shell

2018 UCT Achievable Economic (Dth)	2017 Accomplish	2018 Plan	LoadMAP 2018 ATP
Furnace	12,783	11,716	11,816
Boiler	134	0	307
Water Heater	1,775	2,077	2,014
ENERGY STAR Homes	41	41	146
Smart Thermostat	1,628	1,040	664
Programmable Tstat.	0	0	0
Ceiling Insulation	129	56	534
Wall Insulation	17	102	452
Floor Insulation	29	119	774
Doors	11	19	0
Windows	1,407	1,708	820
Air Sealing	87	48	0
Duct Insulation	56	153	181
Duct Sealing	59	0	0
Showerheads	0	233	286
Miscellaneous	2	0	362
Total	**18,158**	**17,311**	**18,354**

C&I ACCOMPLISHMENTS

Washington, Comparison with Current Avista Programs

Program potential is similar to current Avista programs

- LoadMAP UCT Achievable Economic is between 2017 accomplishments and 2018 plan
- Even with very high ramp rates, food preparation potential is lower than current programs (LO50Fast)
- Many HVAC-specific measures would be considered "Custom" but assigned to this category since that is where those savings are ultimately realized
- Industrial adds an additional 569 Dth to the "Custom" program in the 2018 LoadMAP Projections

2018 UCT Achievable Economic (Dth)	2017 Accomplish	2018 Plan	LoadMAP 2018 UCT AEP
HVAC	14,000	3,214	11,925
Weatherization	1,657	2,080	1,694
Appliances	380	0	838
Food Preparation	3,987	4,956	2,761
Custom	2,381	10,000	4,082
Total	**22,405**	**20,251**	**21,300**

C&I ACCOMPLISHMENTS

Idaho, Comparison with Current Avista Programs

Program potential is higher than 2017 accomplishments and similar to 2018 plan

- Idaho programs ramped up between 2017 and 2018 due to recent restarting of offerings
- Industrial adds an additional 569 Dth to the "Custom" program in the 2018 LoadMAP Projections (similar to WA when rounded)

2018 UCT Achievable Economic (Dth)	2017 Accomplish	2018 Plan	LoadMAP 2018 UCT AEP
HVAC	1,390	805	3,769
Weatherization	874	940	941
Appliances	35	0	198
Food Preparation	1,359	1,490	1,045
Custom	0	4,100	2,033
Total	**3,657**	**7,336**	**7,986**

COMPARISON WITH 2016 CPA

Residential, First-Year Potential

Comparison of first-year UCT Achievable economic potential between 2016 and 2018 CPAs for the residential sector

Measures mapped to current Avista programs similarly to current CPA

Program	Washington		Idaho		Notes
	2017	2018	2017	2018	
Furnace	9,524	19,091	3,209	11,816	Accelerated from 2017 per Avista accomplishments
Boiler	251	619	112	307	
Water Heater	718	4,257	254	2,014	Accelerated from 2017 per Avista accomplishments
ENERGY STAR Homes	0	294	0	146	Now passing cost-effectiveness
Smart Thermostat	445	1,344	213	664	More mature measure, higher starting point
Programmable Thermostat	0	0	0	0	
Ceiling Insulation	1,218	1,072	577	534	
Wall Insulation	0	904	0	452	Now cost-effective
Floor Insulation	0	1,135	0	774	Now cost-effective
Doors	0	0	0	0	
Windows	8,491	9,426	4,044	820	$/sqft is low as percent of measure cost, slowed in ID as a result, but demand for measure appears high in WA
Air Sealing	0	0	0	0	
Duct Insulation	0	367	0	181	
Duct Sealing	939	0	0	0	
Showerheads	1,627	575	736	286	No accomplishments in 2017, allowing time for program to "ramp up"
Miscellaneous	4,387	893	1,992	362	Maintenance measures no longer cost-effective due to updated labor cost calculations.
Total	**27,598**	**39,979**	**11,138**	**18,354**	

COMPARISON WITH 2016 CPA

C&I, First-Year Potential

Comparison of first-year UCT Achievable economic potential between 2016 and 2018 CPAs for the commercial sector

Custom measures reduce the most. This was due to retrocommissioning, which was cost-effective in the prior CPA

Program	Washington		Idaho		Notes
	2017	2018	2017	2018	
HVAC	8,065	11,925	3,400	3,769	Similar to prior study, slightly accelerated
Weatherization	1,636	1,694	540	941	
Appliances	953	838	453	198	
Food Preparation	577	2,761	228	1,045	Heavily accelerating measures due to program accomplishments, particularly fryers and ovens
Custom	12,130	4,082	4,997	2,033	Retrocommissioning was a top measure in prior CPA, but no longer cost-effective after to UES update.
Total	**23,362**	**21,300**	**9,618**	**7,986**	

COMPARISON WITH 2016 CPA

10-year Cumulative UCT Achievable Potential

	Current Study: 2027 Potential (Dth)	Prior Study: 2026 Potential (Dth)	Change from Prior Study (Dth)
Washington			
Residential	1,131,013	497,074	633,939
Commercial	476,648	413,219	63,429
Industrial	5,974	4,050	1,924
WA Total	**1,613,635**	**914,343**	**699,292**
Idaho			
Residential	596,450	208,875	387,575
Commercial	205,064	170,883	34,181
Industrial	6,034	4,411	1,623
ID Total	**807,547**	**384,169**	**423,378**
Avista			
Residential	1,727,462	705,949	1,021,513
Commercial	681,712	584,102	97,610
Industrial	12,007	8,461	3,546
Avista Total	**2,421,181**	**1,298,512**	**1,122,669**

- 10-year cumulative UCT Achievable Potential increased substantially
- In the prior CPA, we gradually increased ramp rates over time and did not max out ramp rates at 85%
- This is causing a spike in mid-year potential since many of the faster rates are already at 85%

AEG
Applied Energy Group

Ingrid Rohmund, Senior Vice President
irohmund@appliedenergygroup.com

Kurtis Kolnowski, Senior Project Manager
kkolnowski@appliedenergygroup.com

Ken Walter, Senior Analyst
kwalter@appliedenergygroup.com

Energy Trust of Oregon

Energy Efficiency Resource Assessment Study

May 10th, 2018

Energy Trust of Oregon

Agenda

- About Energy Trust
- 2017 Achieved Savings
- Resource Assessment Overview and Background
- Methodology
- Results
- Questions/Discussion

About us

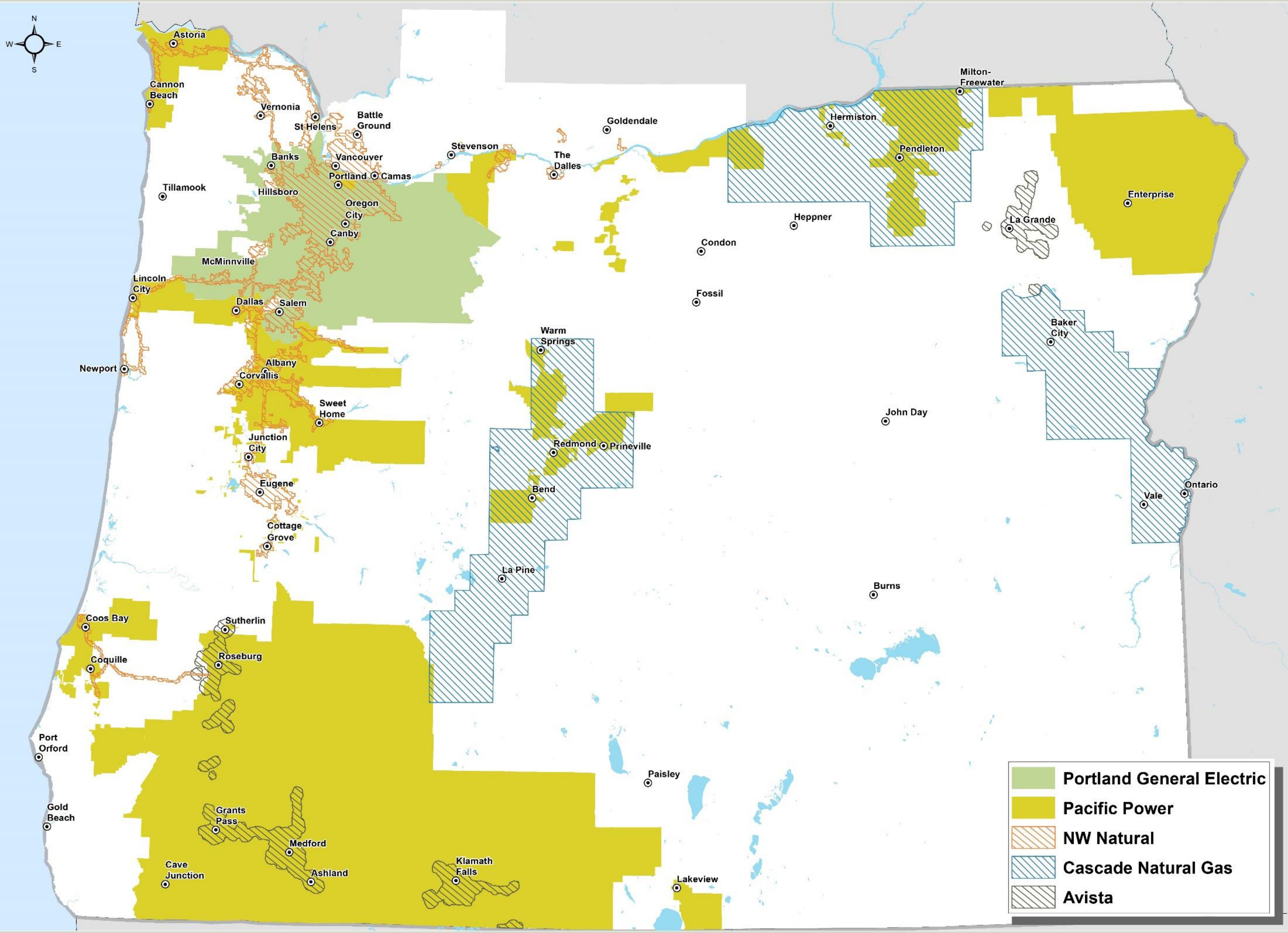
Independent nonprofit

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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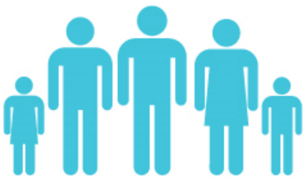
Goldendale
Milton-Freewater
Hermiston
Pendleton
Tillamook
Hillsboro
Oregon City
Canby
Heppner
Condon
La Grande
Enterprise
McMinnville
Lincoln City
Dallas
Salem
Fossil
Warm Springs
Baker City
Newport
Albany
Corvallis
Sweet Home
John Day
Junction City
Redmond
Prineville
Eugene
Bend
Ontario
Vale
Cottage Grove
La Pine
Burns
Coos Bay
Sutherlin
Roseburg
Coquille
Port Orford
Paisley
Gold Beach
Grants Pass
Medford
Ashland
Klamath Falls
Cave Junction
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

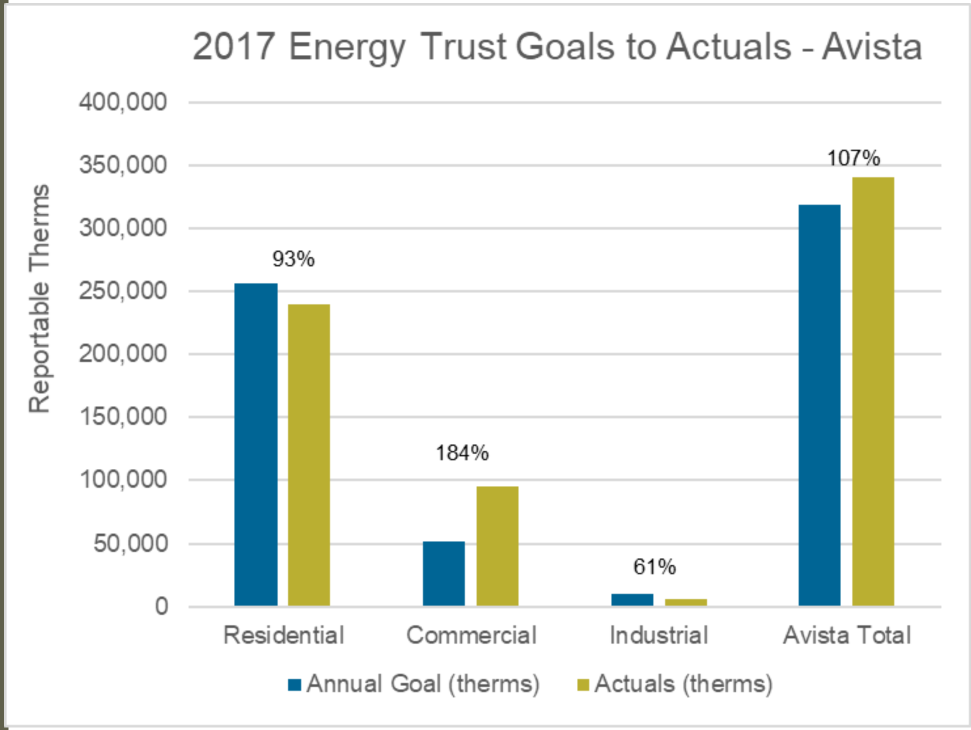
Enough energy to power **564,000** homes and heat **100,000** homes for a year

Avoided **20** million tons of carbon dioxide

Energy Trust's 2017 Achievements for Avista

Energy Trust Savings Achievements – 2017

- Our first full year serving Avista customers in Oregon
- Overall achieved 107% of goal
  - Goal 318k Therms
  - Achieved 341k Therms
- Anticipate continued success as we move into year 2 and Trade Ally networks expand



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.

- Estimates of energy efficiency potential are in ‘gross’ savings, not ‘net’, as gross savings are what will be reflected on the Avista system.

Resource Assessment Overview

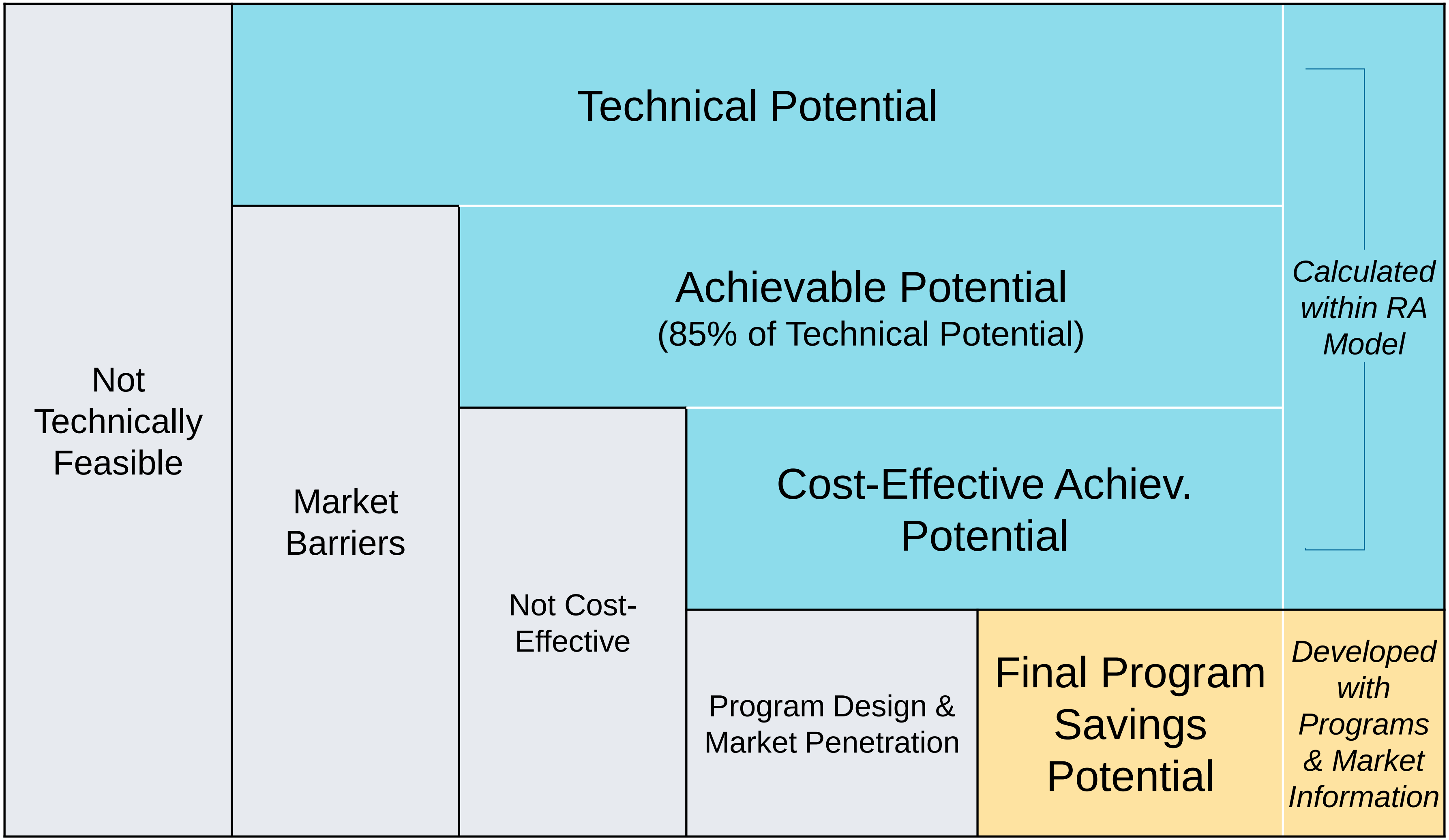
- What is a resource assessment?
  - Model that provides an estimate of energy efficiency resource potential achievable over a 20-year period
  - ‘Bottom-up’ approach to estimate potential starting at the measure level and scaling to a service territory
- Energy Trust uses a model in *Analytica* that was developed by Navigant Consulting in 2014
  - The *Analytica* RA Model calculates Technical, Achievable and Cost-Effective Achievable Energy Efficiency Potential.
  - Final program/IRP targets are established via a deployment protocol exogenous of the model.
- Data inputs and assumptions in the model are updated in conjunction with IRP about every two years.

Additional RA Background

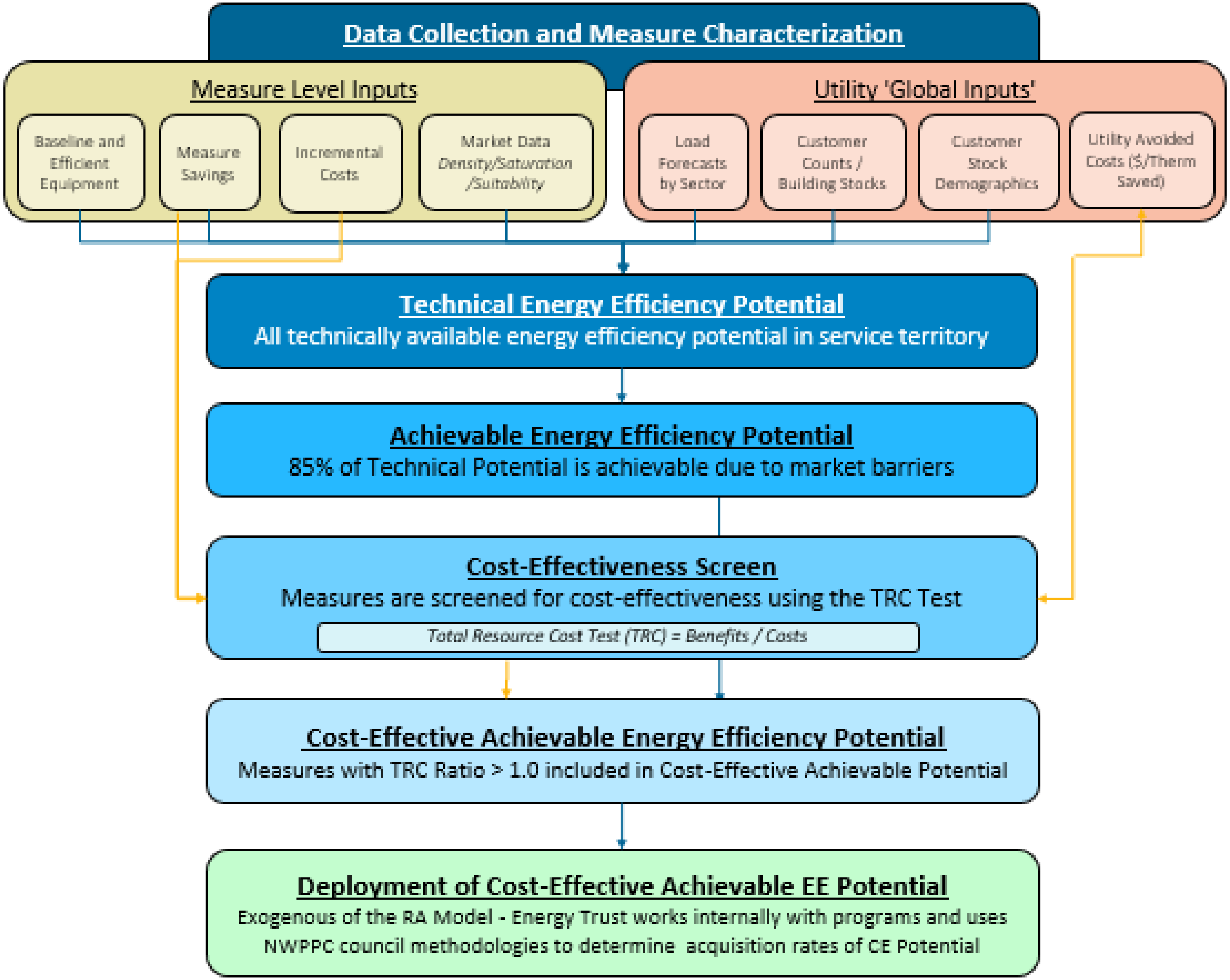
- Informs utility IRP work & Energy Trust strategic and program planning.
- Does not dictate source or measure mix of annual energy savings acquired by programs
- Does not set incentive levels

20-Year Forecast Methodology

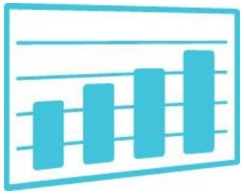
Forecasted Potential Types



20-Year IRP EE Forecast Flow Chart



RA Model inputs



Measure Level Inputs

Measure Definition and Application:
- Baseline/Efficient equip. definition
- Applicable customer segments
- Installation yype (RET/ROB/NEW)*
- Measure Life

Measure Savings

Measure Cost
- Incremental cost for ROB/NEW measures
- Full cost for retrofit measures

Market Data (for scaling)
- Density
- Baseline/efficient equipment saturations
- Suitability

Utility ‘Global’ Inputs

Customer and Load Forecasts
- Used to scale measure level savings to a service territory
  - Residential Stocks: # of homes
  - Commercial Stocks: 1000s of Sq.Ft.
  - Industrial Stocks: Customer load

Avoided Costs (provided by Avista)

Customer Stock Demographics:
- Heating fuel splits
- Water heat fuel splits

** RET = Retrofit; ROB = Replace on Burnout; NEW = 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 included in model
- More alignment with high-level NWPCC 7th Power Plan deployment methodologies to obtain cost-effective achievable savings within market sectors and replacement types.
- Cost-effective potential may be realized through programs or codes and standards.

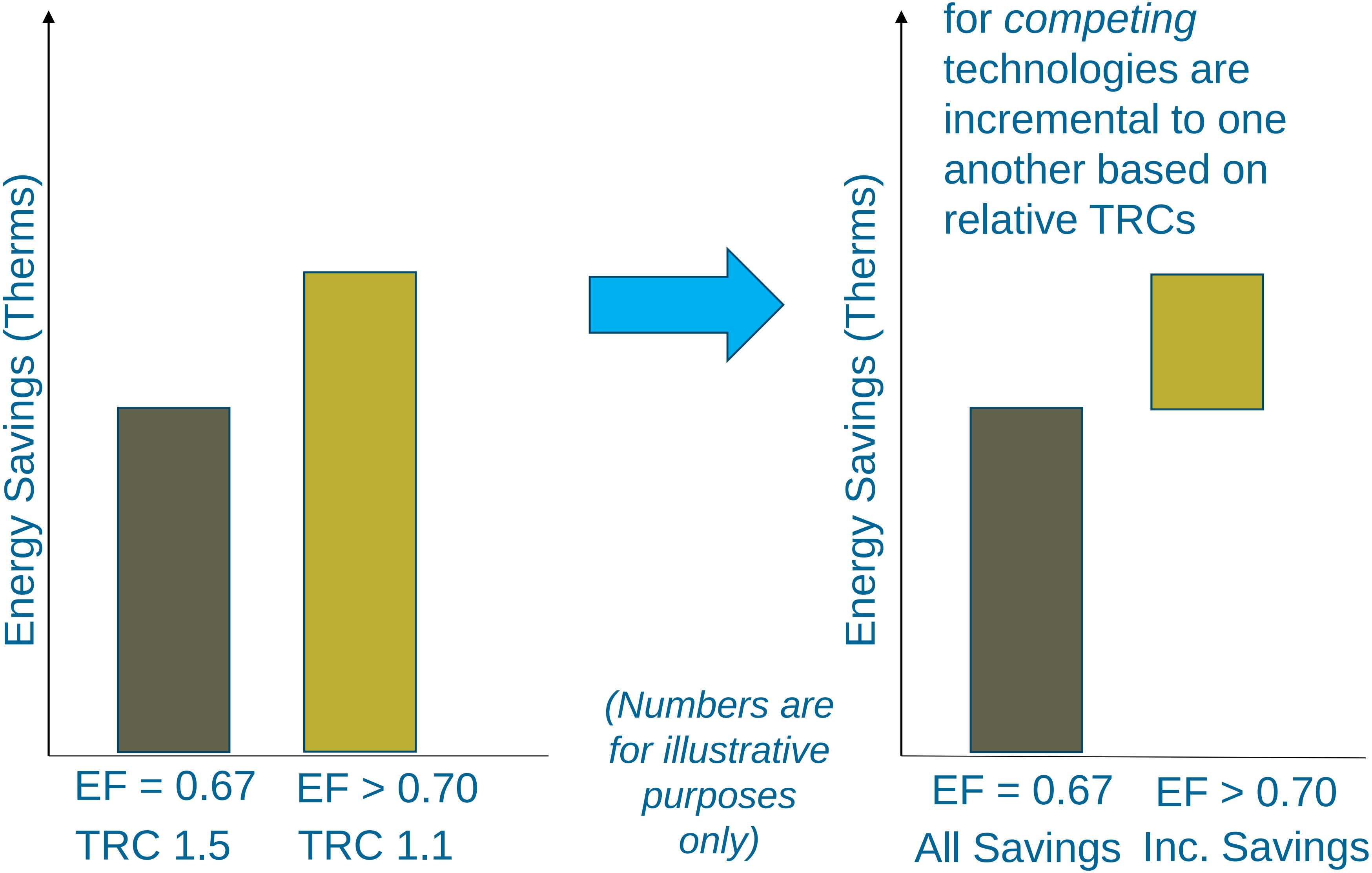
Example Measure: Residential Gas Tank Water Heater (>0.70 EF)

Key Measure Inputs:

- Baseline: 0.60 EF gas water heater
- Replacement Type: Replacement on Burnout / New
- Measure Incremental Cost: $193
- Conventional (not emerging, no risk adjustment)
- Lifetime:13 years
- Savings: 31.5 therms (annual)
- Non-Energy Benefits: $5.95
- Customer Segments: SF, MF, MH
- Density, Saturation, Suitability
- Competing Measures: All efficient gas water heaters

Incremental Measure Savings Approach (Competition groups – 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

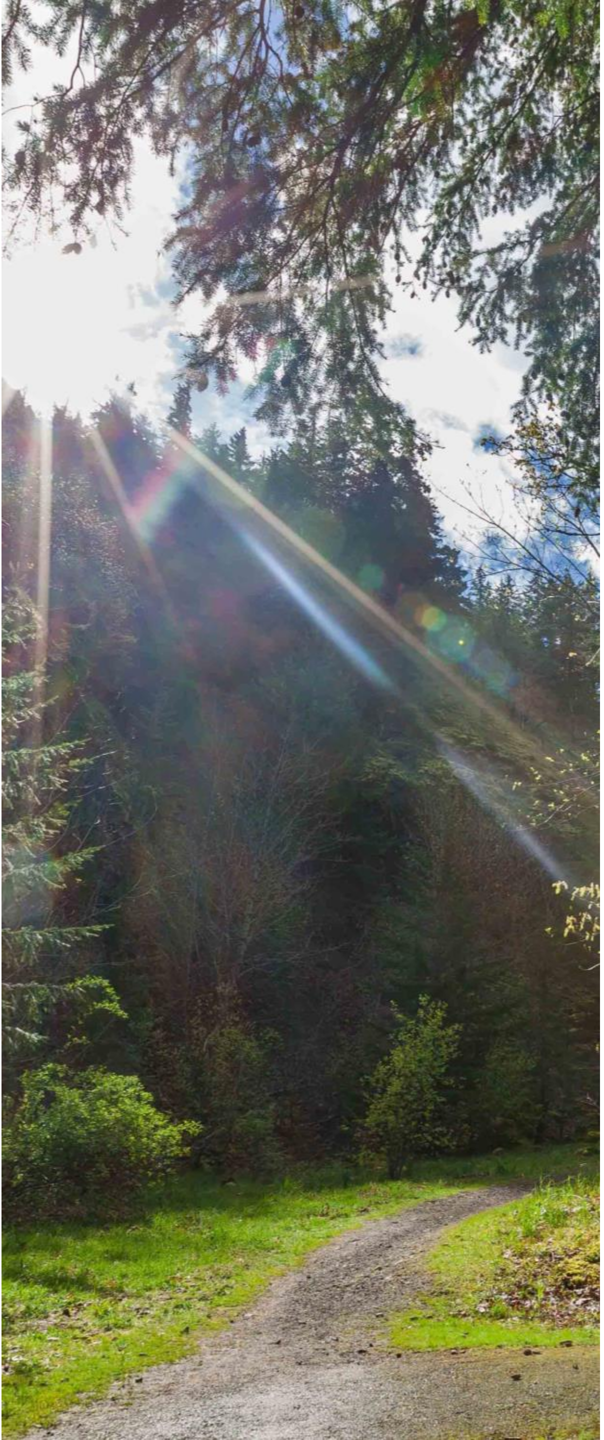
$$\text{TRC} = \frac{\textit{Measure Benefits}}{\textit{Total Measure Cost}}$$

- 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 Costs:

- The customer cost of installing an EE measure (full cost if retrofit, incremental over baseline if replacement)



Cost-Effectiveness Override in Model

Energy Trust applied this feature 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):

- Res Insulation (ceiling, floor, wall)
- Res Tank Water Heater (0.67-0.69 only)

Emerging Technologies

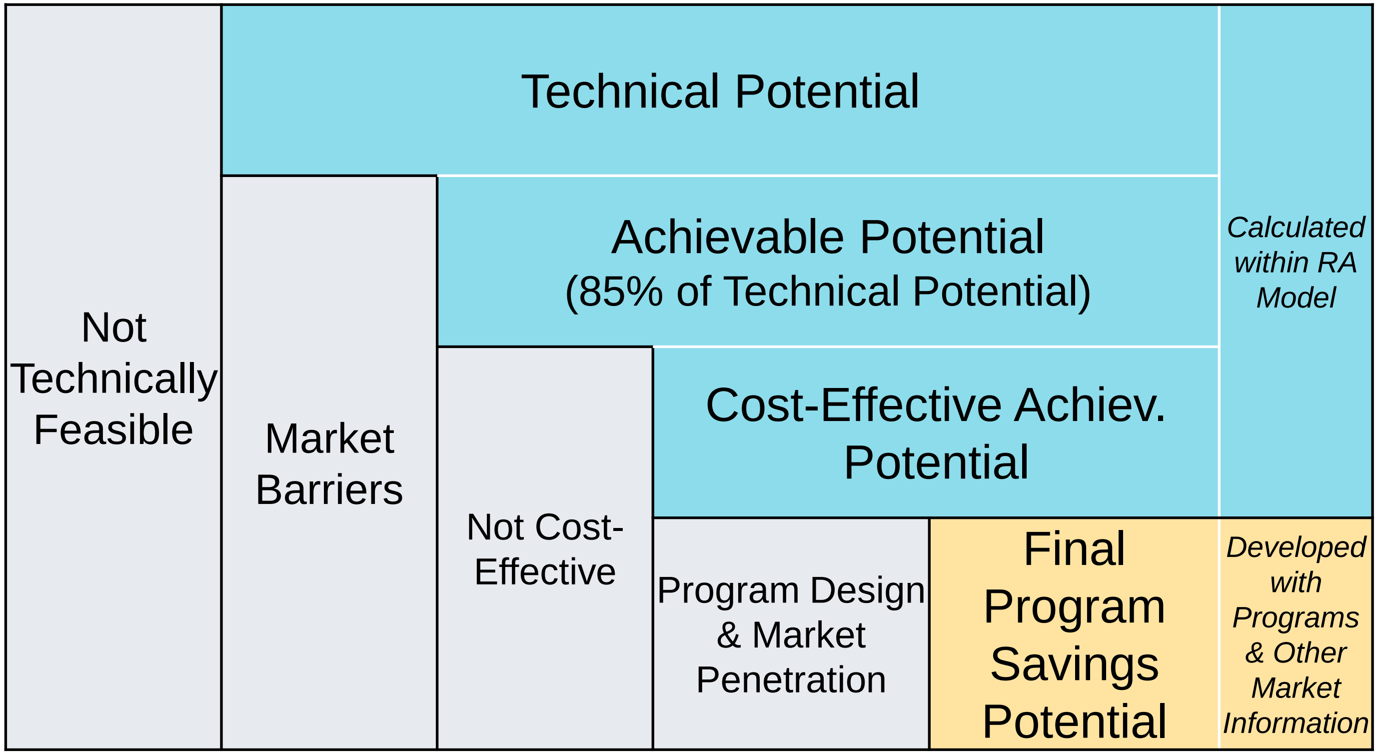
Residential	Commercial	Industrial
• Path 5 Emerging Super Efficient Whole Home • Window Replacement (U<.20), Gas SF • Absorption Gas Heat Pump Water Heaters • Advanced Insulation • Behavior Competitions	• Advanced Ventilation Controls • DOAS/HRV - GAS Space Heat • DHW Circulation Pump • Gas-fired HP HW • Gas-fired HP, Heating • Zero Net Energy Path • AC Heat Recovery, HW	• 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

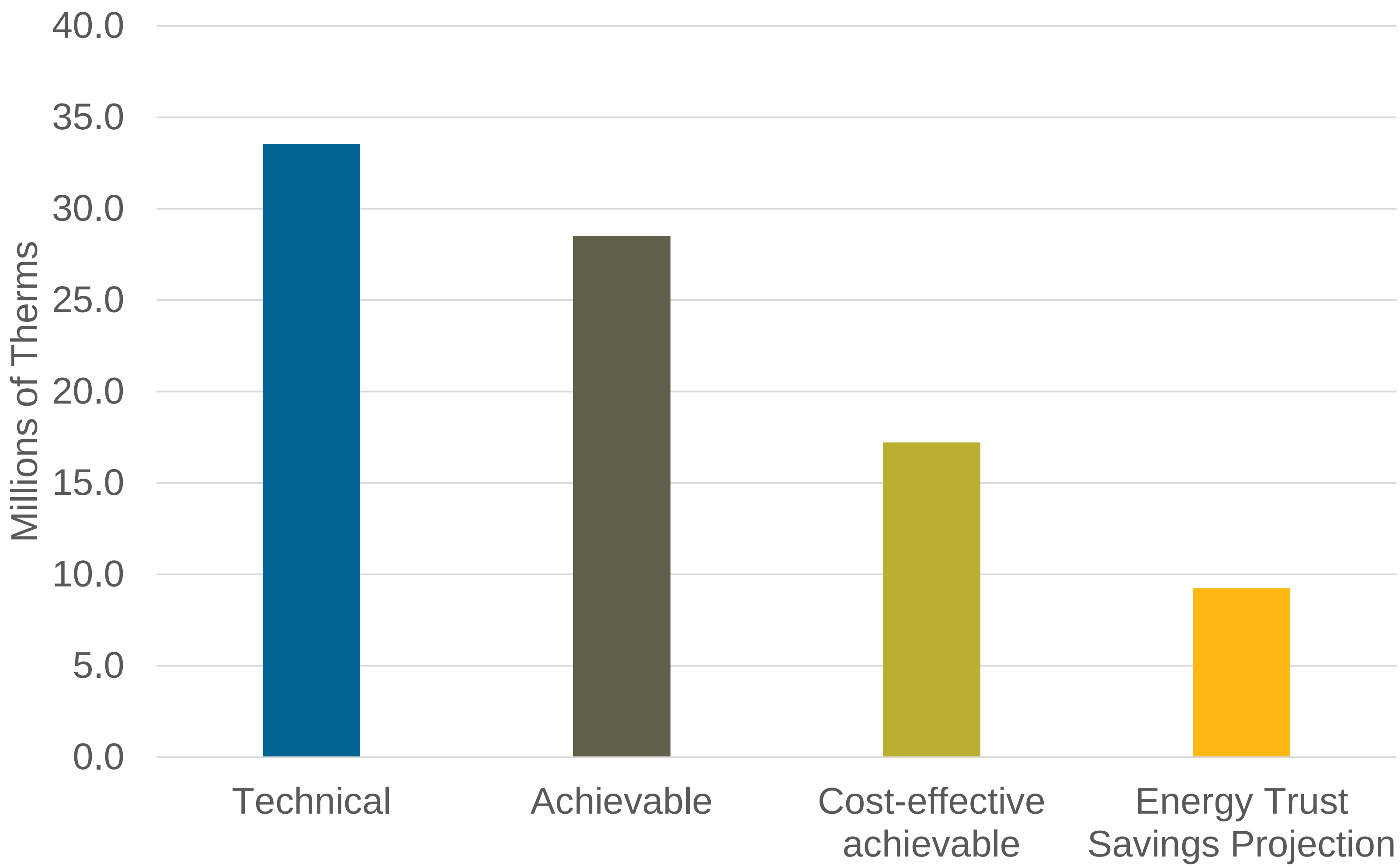
Outputs of Potential Type



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 actually be achieved

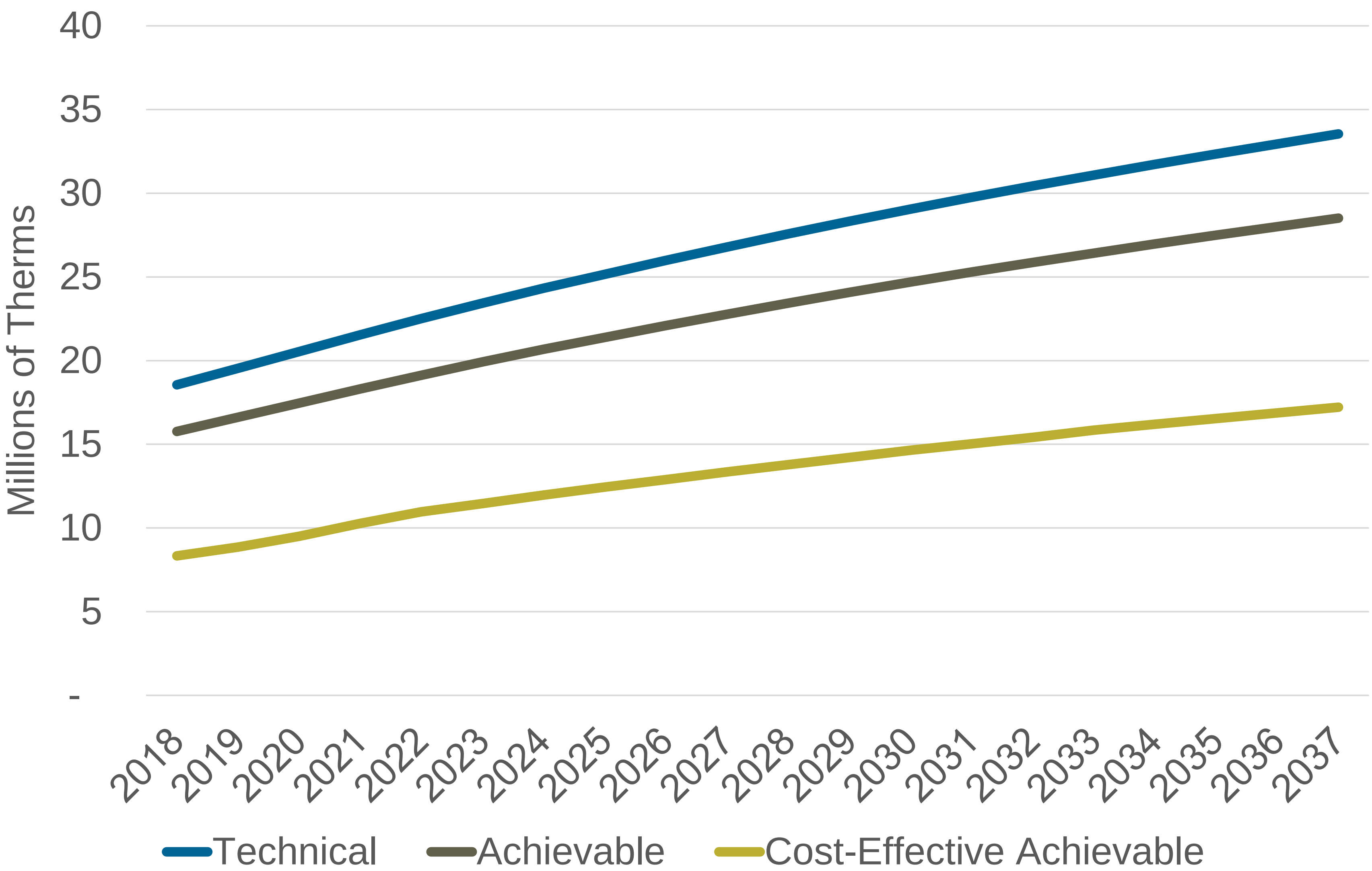
Overall Cumulative Savings Results – Millions of Therms



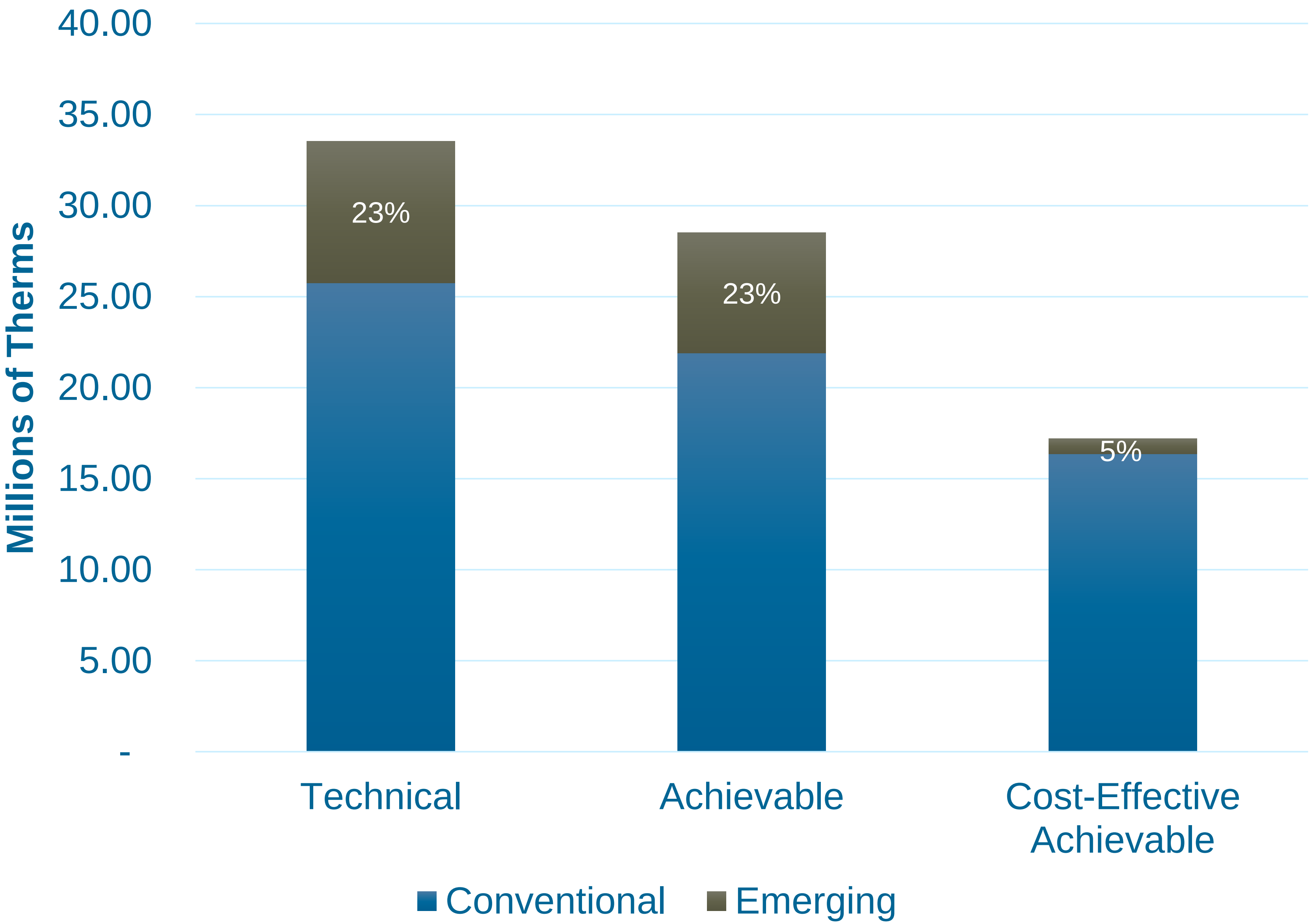
RA Model Results

Technical, Achievable, and Cost-Effective

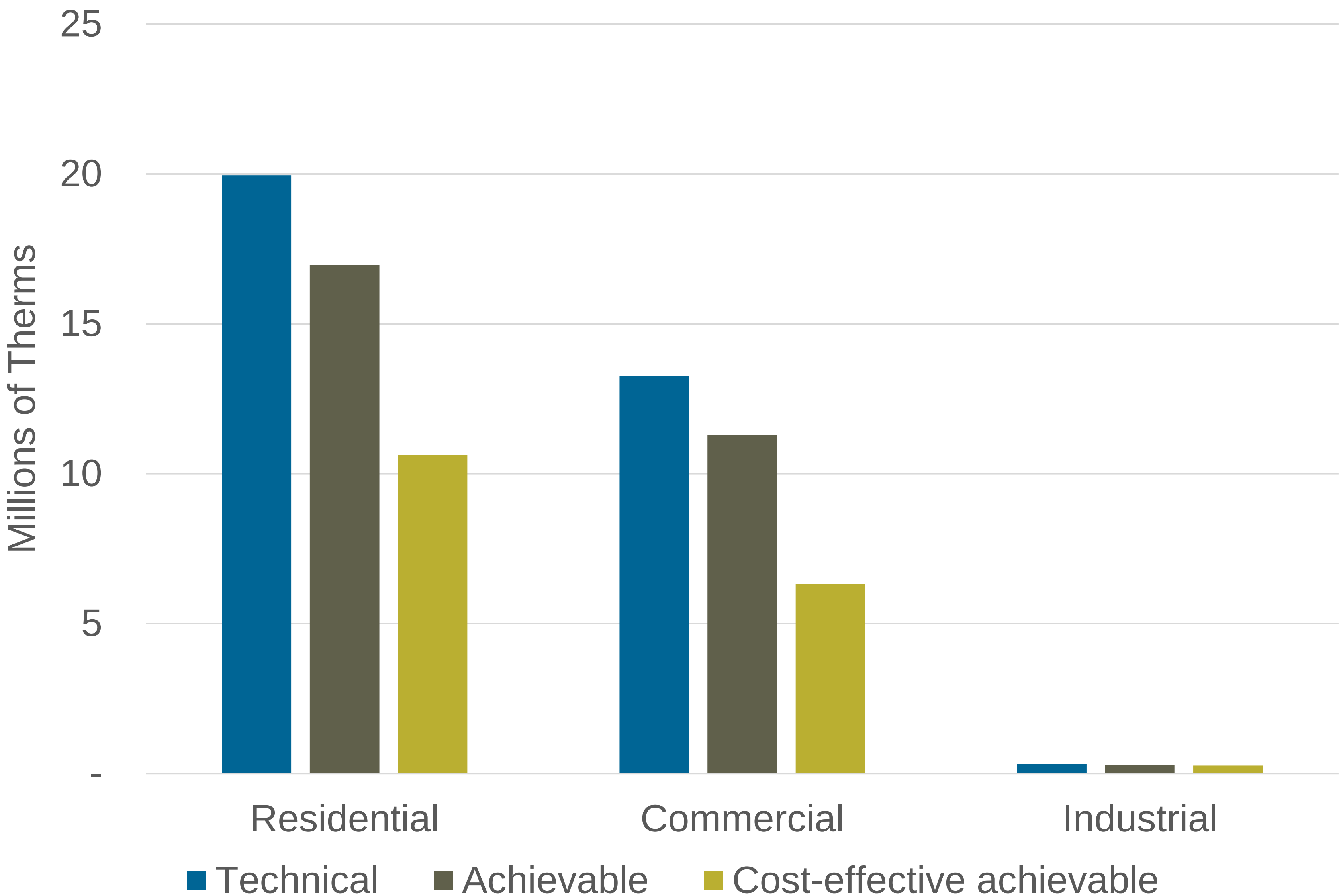
Model Output Cumulative Potential by Type and Year (2018-2037)



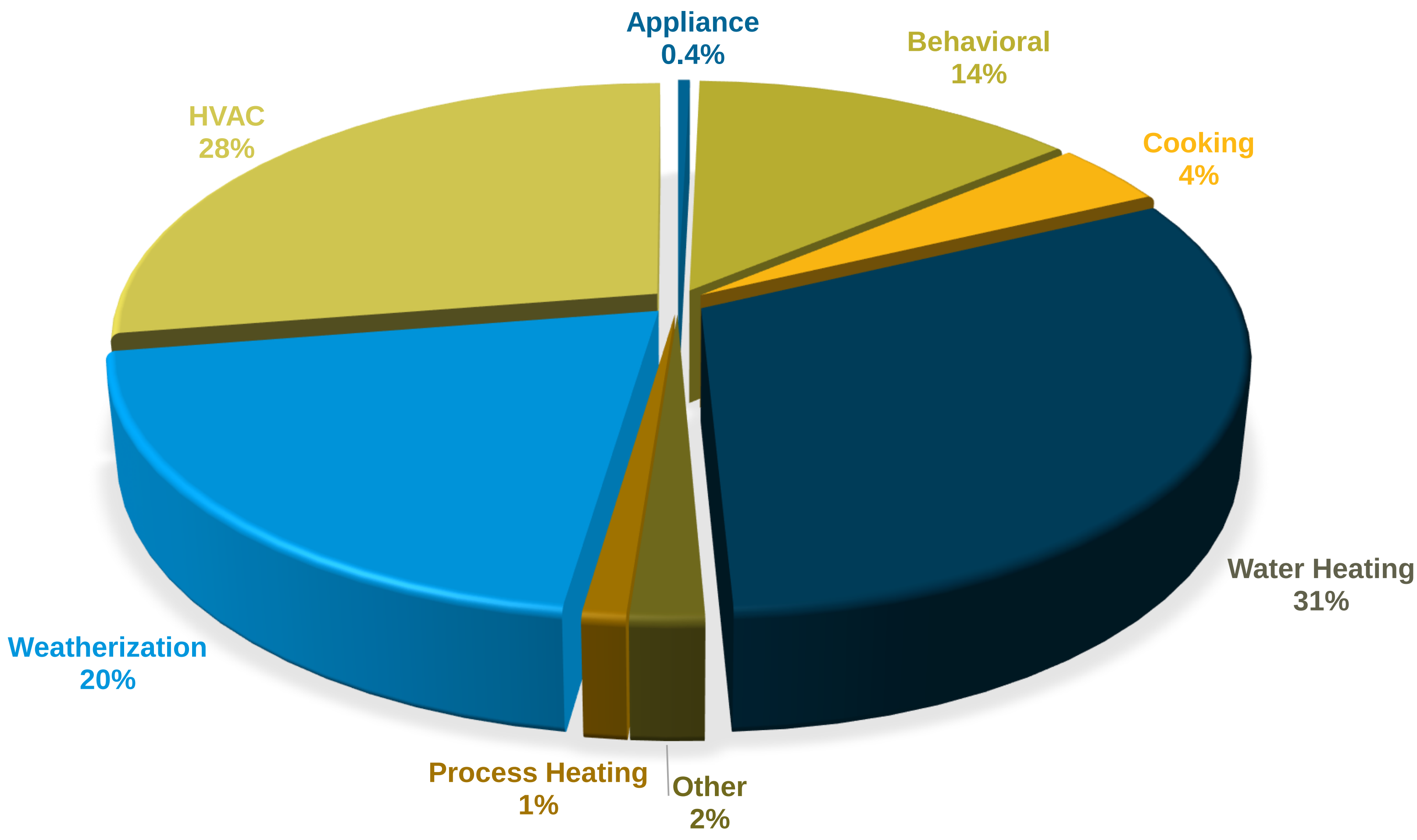
Cumulative Emerging Technology Contribution – Millions of Therms



Cumulative Potential by Sector and Type – Millions of Therms



Proportion of Cumulative Cost-effective Potential by End Use



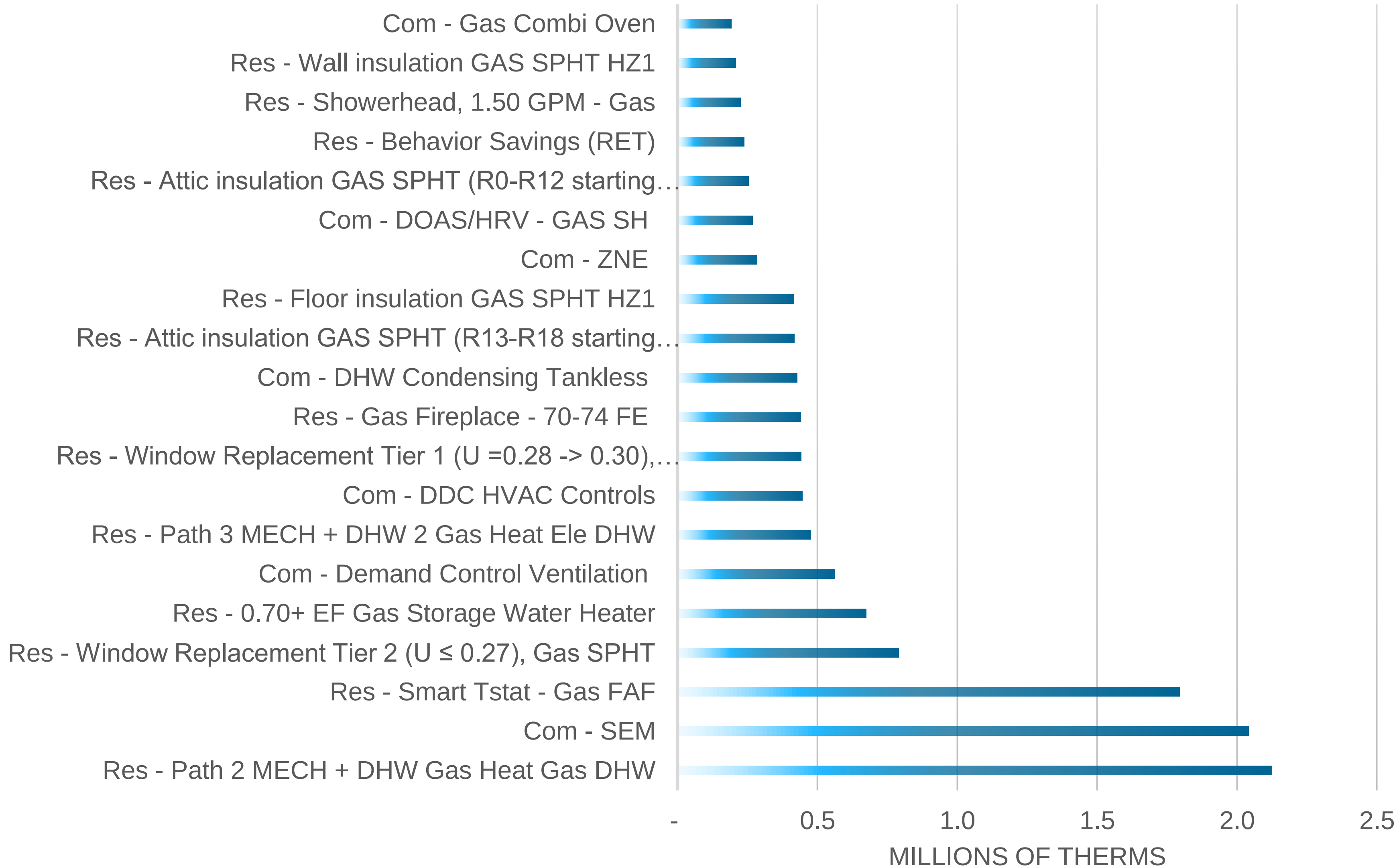
Cost-Effective Override Effect – Cumulative CE Potential (Millions of Therms)

Sector	Potential with CE Override	Potential with NO CE Override	Difference (total CE potential with override)
Residential	10.63	8.33	2.3
Commercial	6.32	6.32	-
Industrial	0.26	0.26	-
Total DSM:	17.21	14.91	2.30

Measures with CE Override in Model

- Res Insulation (ceiling, floor, wall)
- Res Tank Water Heater (0.67-0.69 only)

Top-20 Measures – Cost-Effective Cumulative Potential



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

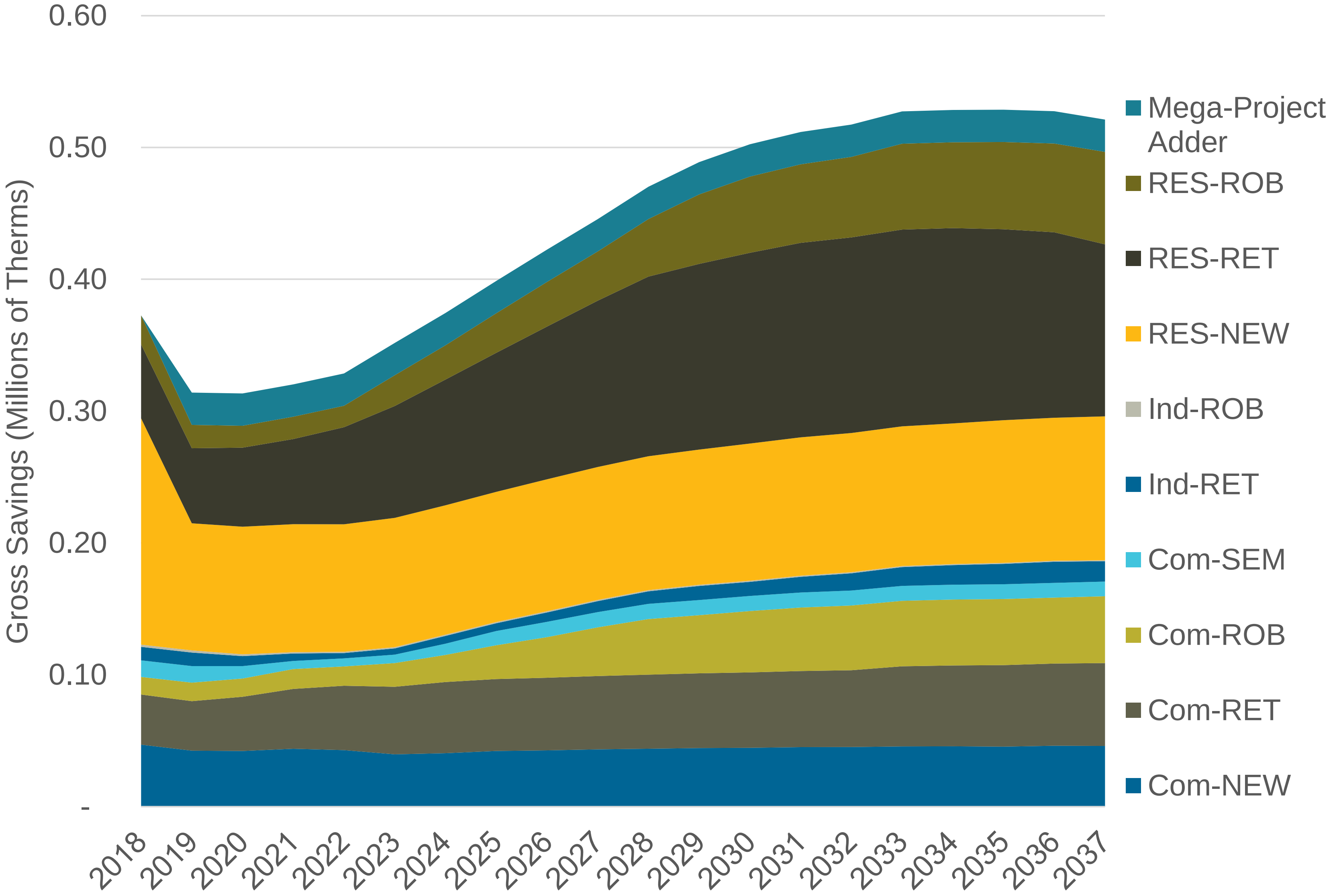
20-Year Cumulative Potential by Type – Millions of Therms

	Technical Potential	Achievable Potential	Ach. Cost-Effective Potential	Energy Trust Savings Projection
Residential	20.0	17.0	10.6	5.7
Commercial	13.3	11.3	6.3	3.3
Industrial	0.3	0.3	0.3	0.2
All Sectors	**33.5**	**28.5**	**17.2**	**9.2**

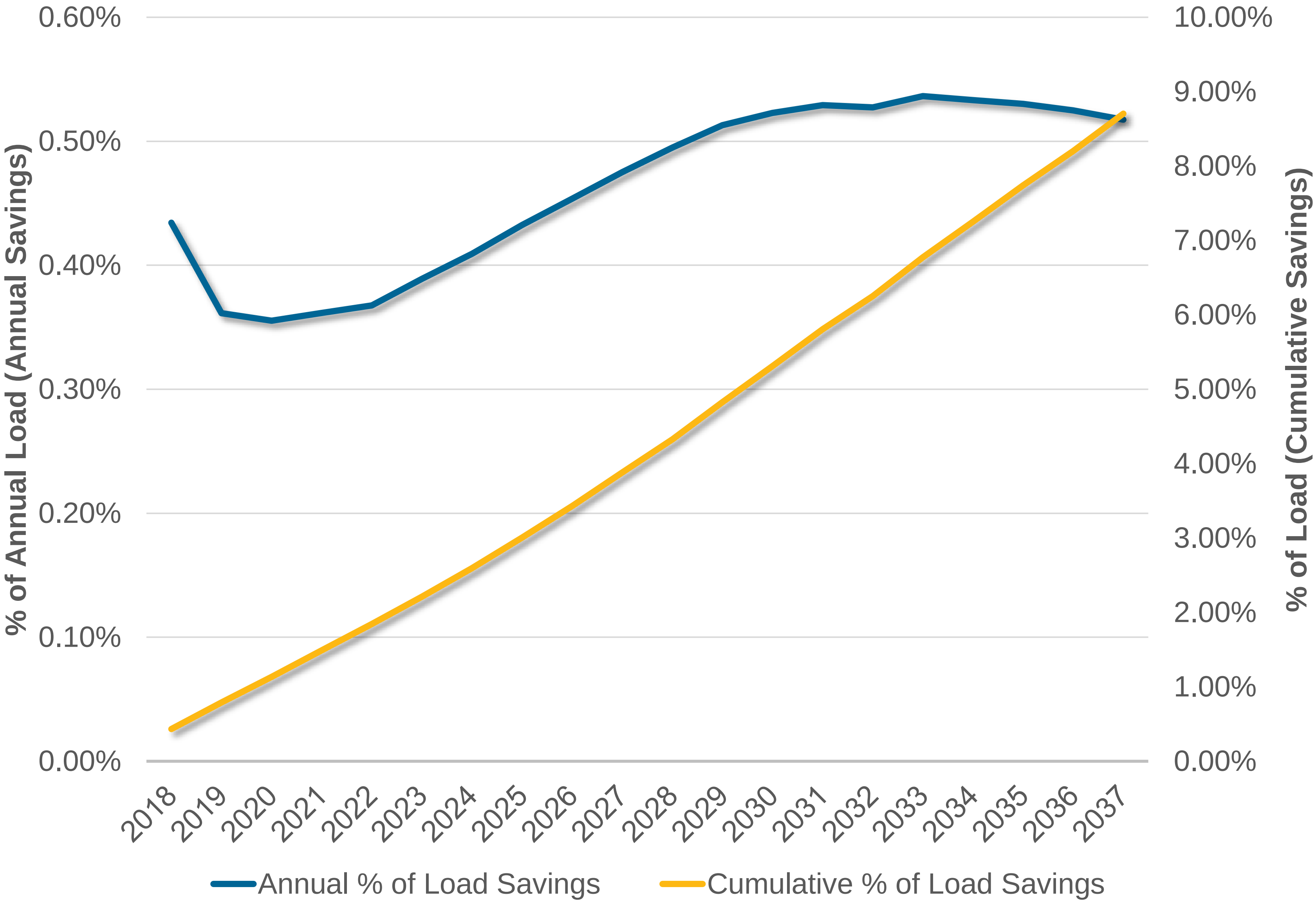
Not all Cost-Effective Potential is projected to be achieved because:

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

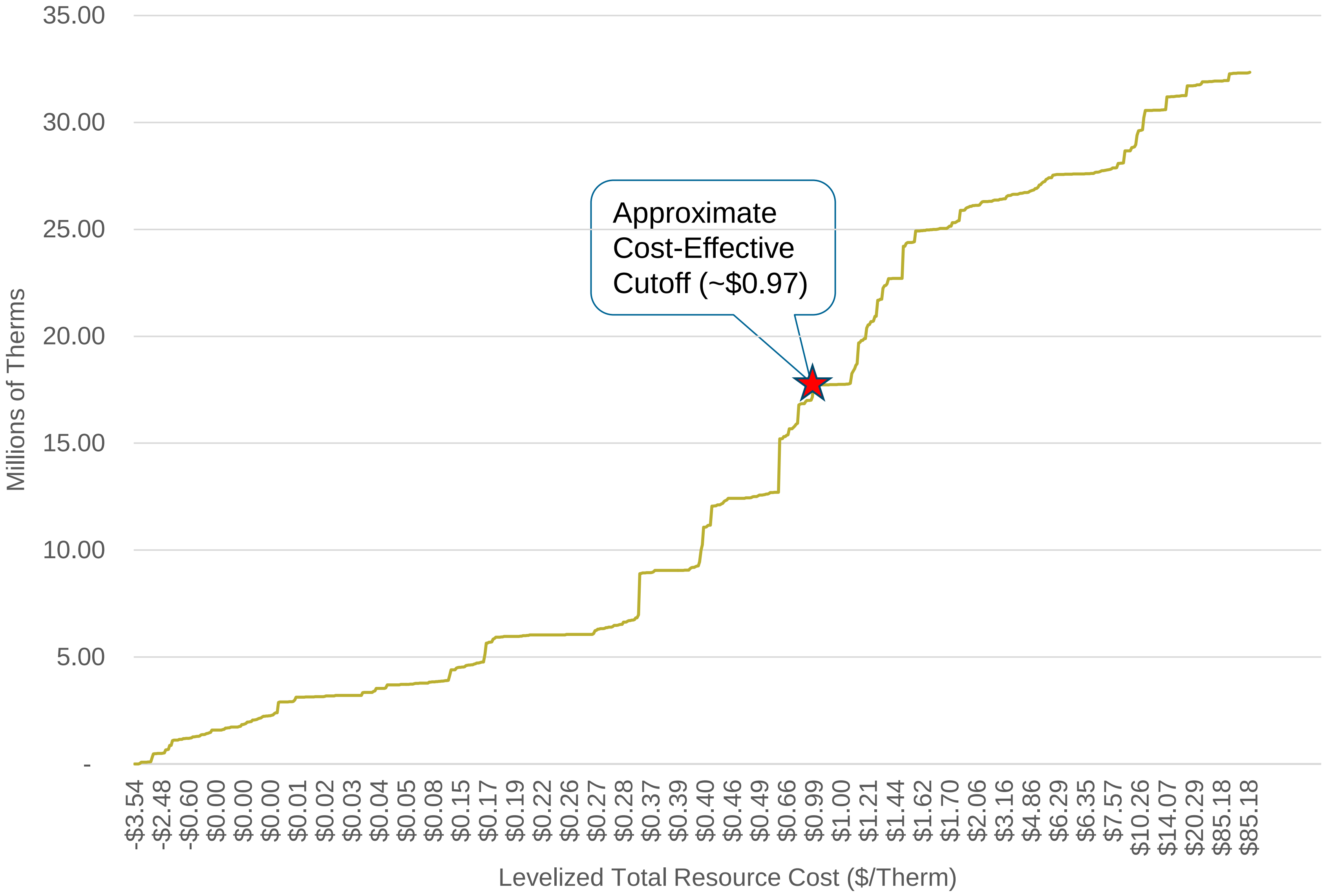
Cost-Effective Avista Savings Projection 2018-2037 – Millions of Therms



Annual Projected Savings as Percent of Avista's Annual Load Forecasts



2018 Supply Curve – 20 Year Technical Potential by Levelized Cost of Energy ($/Therm)



Thank you

Jack Cullen

Sr. Project Manager, Planning

Jack.Cullen@energytrust.org

503.548.1596

WUTC 2016 IRP comments

- Discuss with the TAC:
  - The results of Northwest Energy Efficiency Alliance (NEEA) coordination, including non-energy benefits to include in the CPA.
  - The appropriateness of listing and mapping all prospective distribution system enhancement projects planned on the 20 year horizon, and comparing actual projects completed to prospective projects listed in previous IRP’s.

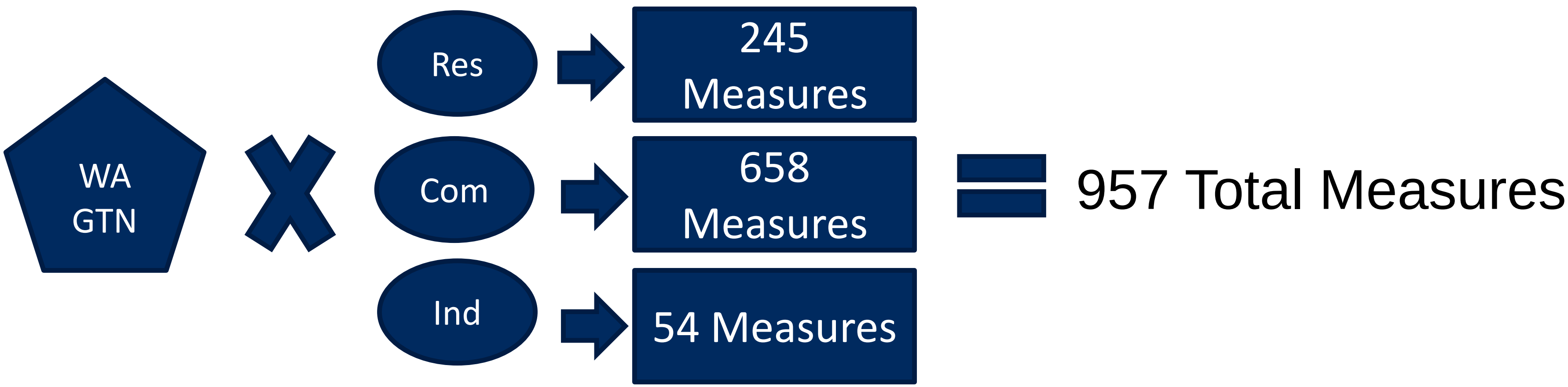
Dynamic DSM

Kaylene Schultz

Sendout and Dynamic DSM

- Action Plan: Avista's 2018 IRP will contain a dynamic DSM program structure in its analytics. In prior IRP's, it was a deterministic method based on Expected Case assumptions. In the 2018 IRP, each portfolio will have the ability to select conservation to meet unserved customer demand. Avista will explore methods to enable a dynamic analytical process for the evaluation of conservation potential within individual portfolios.

DSM Example


WA
GTN
Res
Com
Ind
245 Measures
658 Measures
54 Measures
957 Total Measures

Needed Measures

Demand Areas

WA GTN

ID GTN

WA NWP

ID NWP

WA Both

ID Both

Medford NWP

La Grande

Medford GTN

Roseburg

Klamath Falls

=

11 demand areas X 957 measures per area = 10,527 needed measures to solve

Sendout and DSM Issues

- Attempts to group measures
  - Unique measures can have different curves and device lives
  - Intent of modeling DSM as a resource is to provide individual resources the ability to fill demand along the demand curve and not lump assumptions
  - As the model works today, we would have to solve for individual area and class, each in a separate model; this would miss the mark on system optimization and peak day events

2020 Action Plan

- Avista will use the same software our electric IRP team has as a solution to this action plan
  - The solution is outside of the Sendout model in an enhanced Excel solver, meaning we will rebuild our system model in Sendout into excel
  - This solution is known to our WA and ID commissions as “PRiSM”, which is used to solve and create Avista’s DSM goals in each jurisdiction

Modeling in Sendout

Kaylene Schultz

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®?

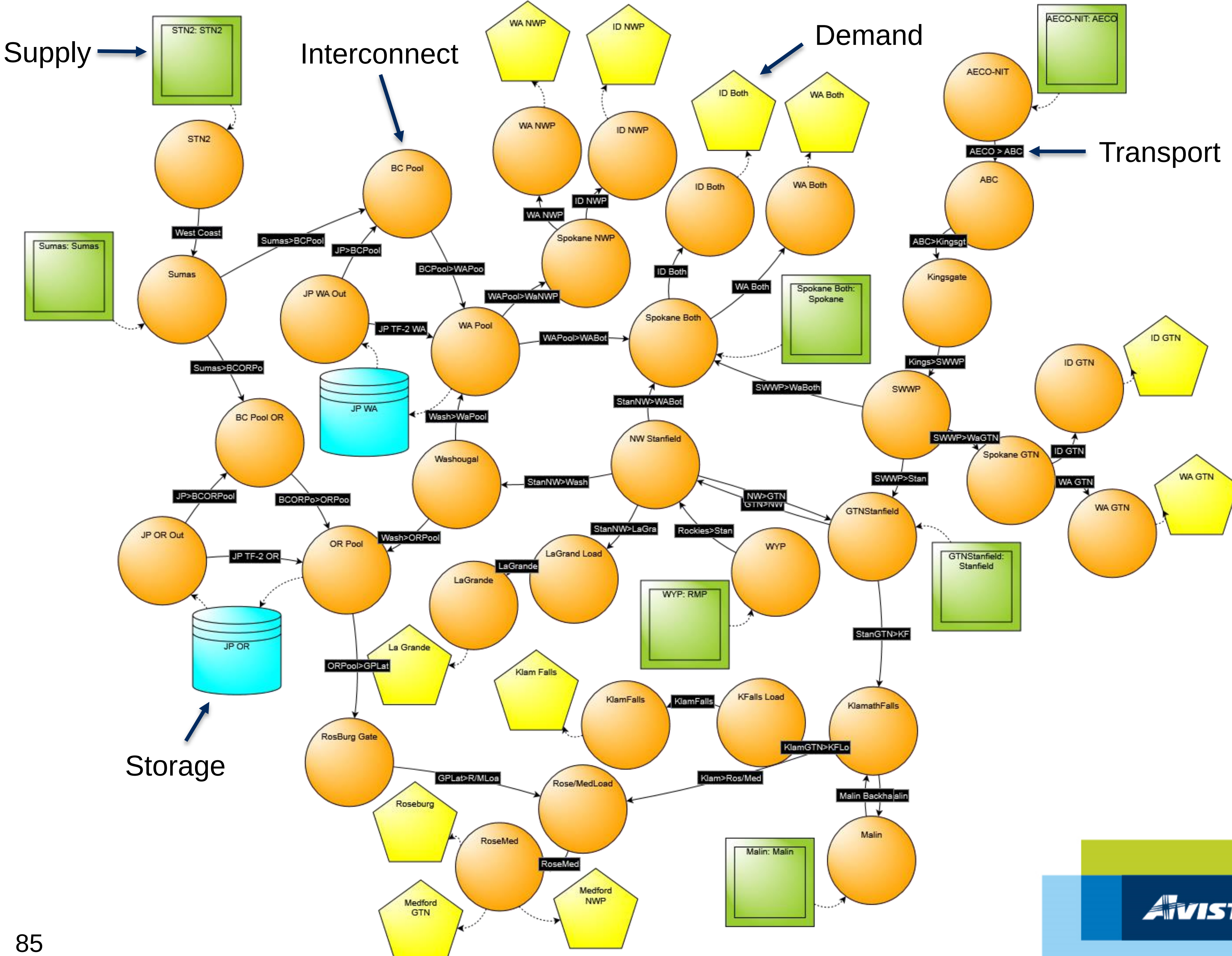
Inside:

- 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
JP>BCPool
BC Pool
BCPool>WAPoo
JP WA Out
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
Wash>ORPool
WA NWP
ID NWP
Spokane NWP
WAPool>WaNWP
WAPool>WABot
ID Both
WA Both
Spokane Both
Spokane Both: Spokane
StanNW>WABot
NW Stanfield
StanNW>Wash
StanNW>LaGra
Rockies>Stan
NW>GTN
GTN>NW
AECO-NIT: AECO
AECO-NIT
AECO > ABC
ABC
ABC>Kingsgt
Kingsgate
Kings>SWWP
SWWP
SWWP>WaBoth
SWWP>WaGTN
SWWP>Stan
Spokane GTN
ID GTN
WA GTN
GTNStanfield
GTNStanfield: Stanfield
WYP
WYP: RMP
LaGrand Load
LaGrande
La Grande
ORPool>GPLat
RosBurg Gate
Klam Falls
KlamFalls
KFalls Load
StanGTN>KF
KlamathFalls
KlamGTN>KFLo
Klam>Ros/Med
Malin Backha
alin
Malin
Malin: Malin
GPLat>R/MLoa
Rose/MedLoad
Roseburg
RoseMed
Medford GTN
Medford NWP

Assumptions Review

Developing a Reference Case

Customer count forecast + Use per customer coefficients + Weather = Reference Case Demand

1. Customer annual growth rates:

System	Base-Case	High	Low
Residential	1.2%	1.6%	0.9%
Commercial	0.7%	1.0%	0.3%
Industrial	-0.3%	2.2%	-3.3%
Total	1.2%	1.5%	0.8%

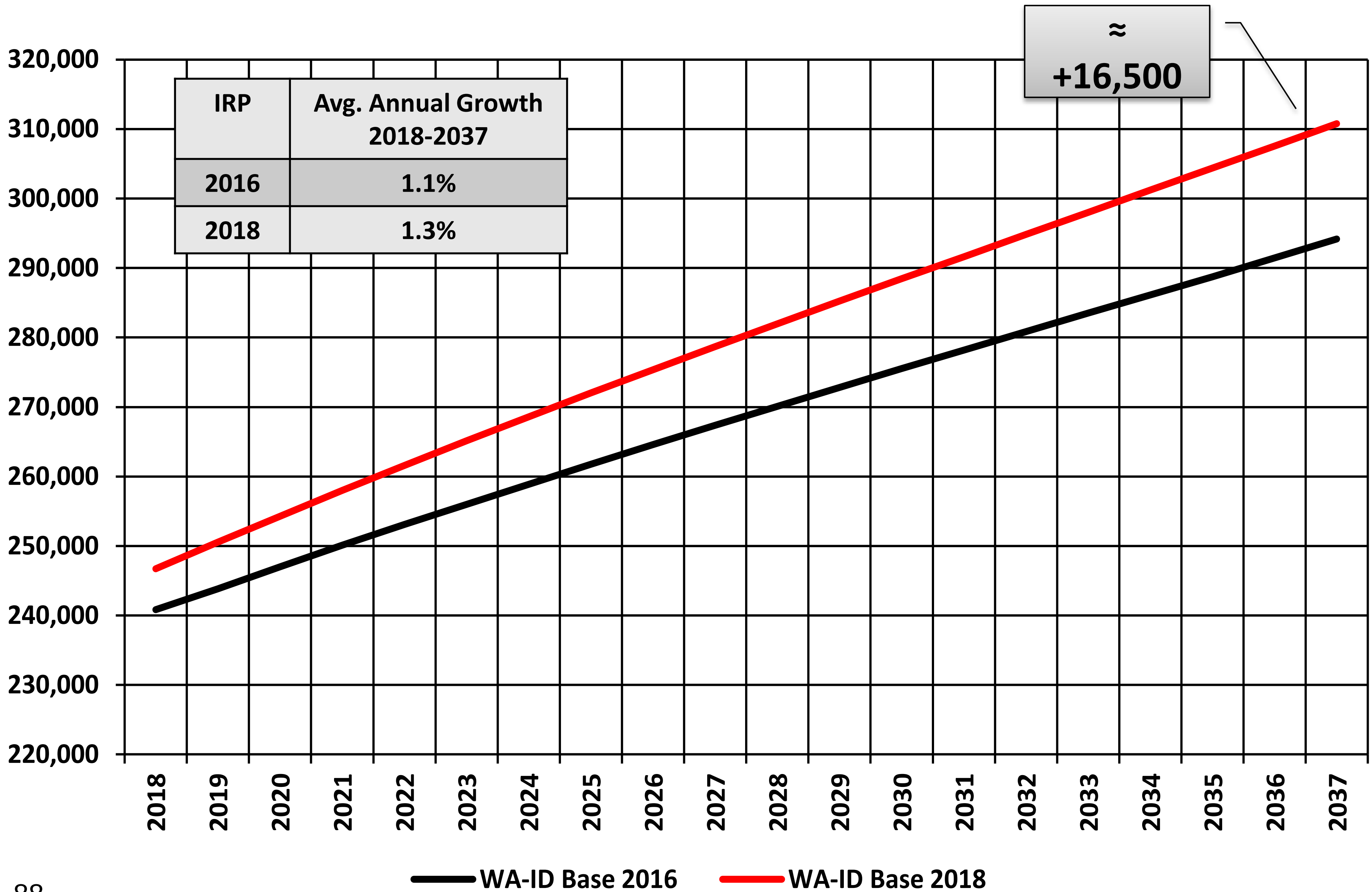
WA	Base-Case	High	Low
Residential	1.2%	1.5%	0.9%
Commercial	0.7%	1.0%	0.4%
Industrial	-0.8%	1.9%	-3.1%
Total	1.2%	1.5%	0.8%

ID	Base-Case	High	Low
Residential	1.5%	2.0%	1.0%
Commercial	0.6%	1.1%	0.1%
Industrial	0.1%	1.7%	-2.7%
Total	1.4%	1.9%	0.9%

OR	Base-Case	High	Low
Residential	1.0%	1.3%	0.6%
Commercial	0.7%	1.1%	0.4%
Industrial	0.1%	4.7%	-7.8%
Total	0.9%	1.3%	0.6%

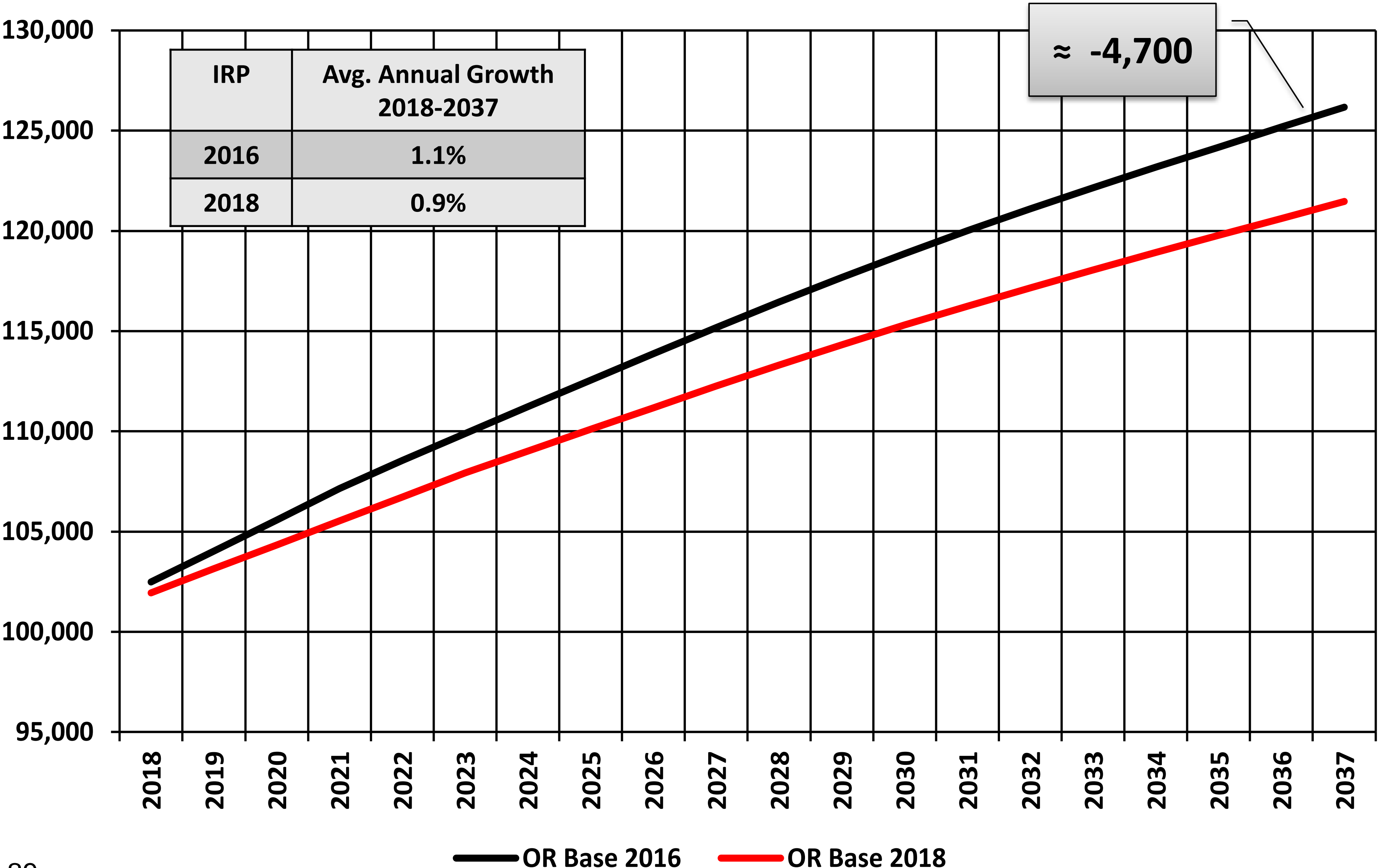
2. Use per customer coefficients –3 year average use per HDD per customer
3. Weather planning standard – coldest day on record
   - WA/ID 82; Medford 61; Roseburg 55; Klamath 72; La Grande 74

WA-ID Region Firm Customers: 2018 IRP and 2016 IRP



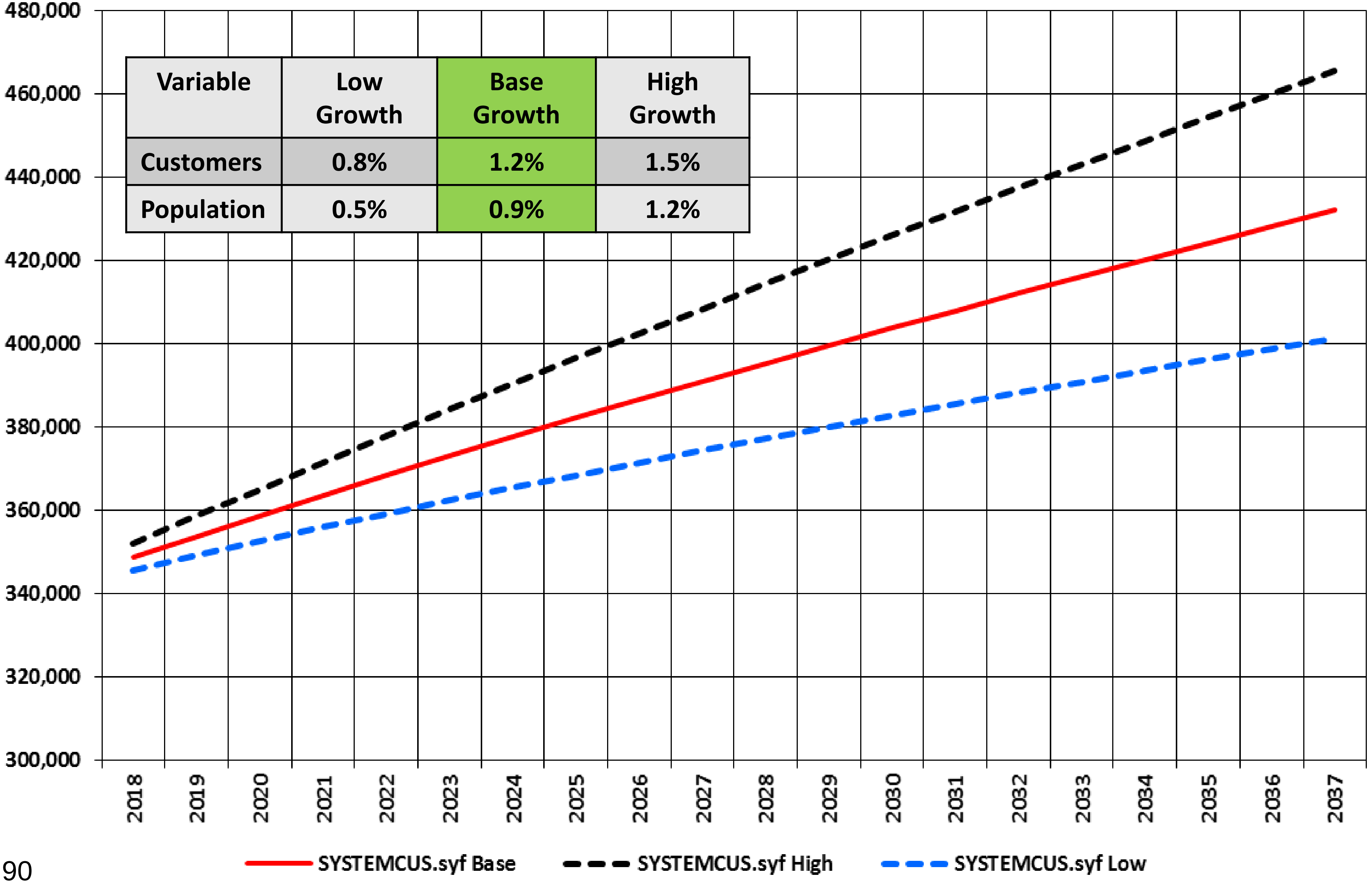
IRP	Avg. Annual Growth 2018-2037
2016	1.1%
2018	1.3%

OR Region Firm Customers: 2018 IRP and 2016 IRP



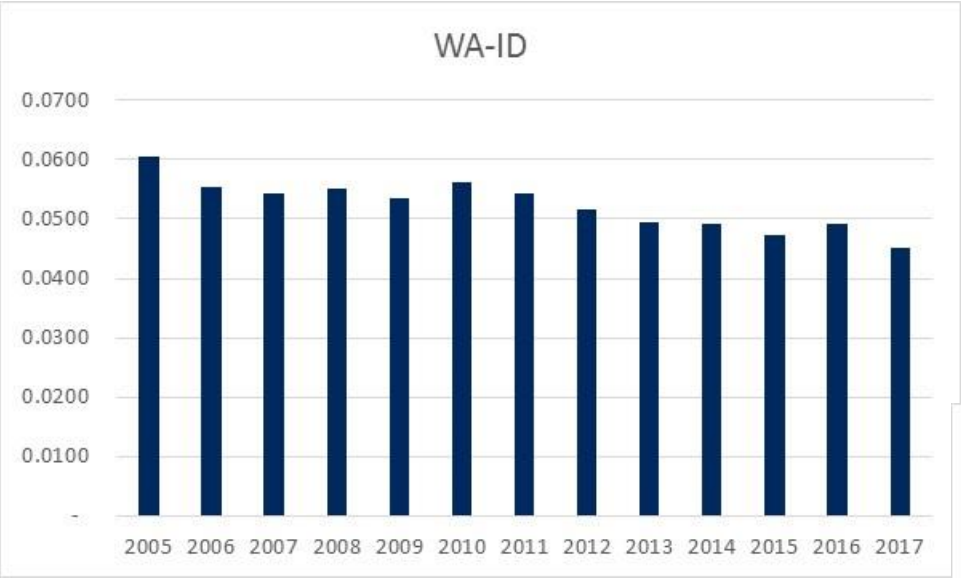
IRP	Avg. Annual Growth 2018-2037
2016	1.1%
2018	0.9%

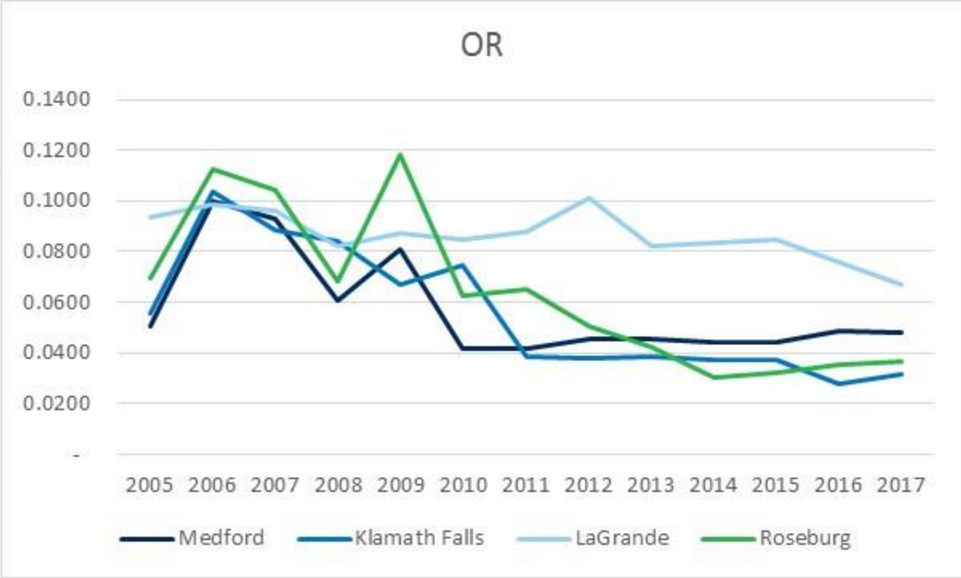
System Firm Customer Range, 2018-2037



Variable	Low Growth	Base Growth	High Growth
Customers	0.8%	1.2%	1.5%
Population	0.5%	0.9%	1.2%

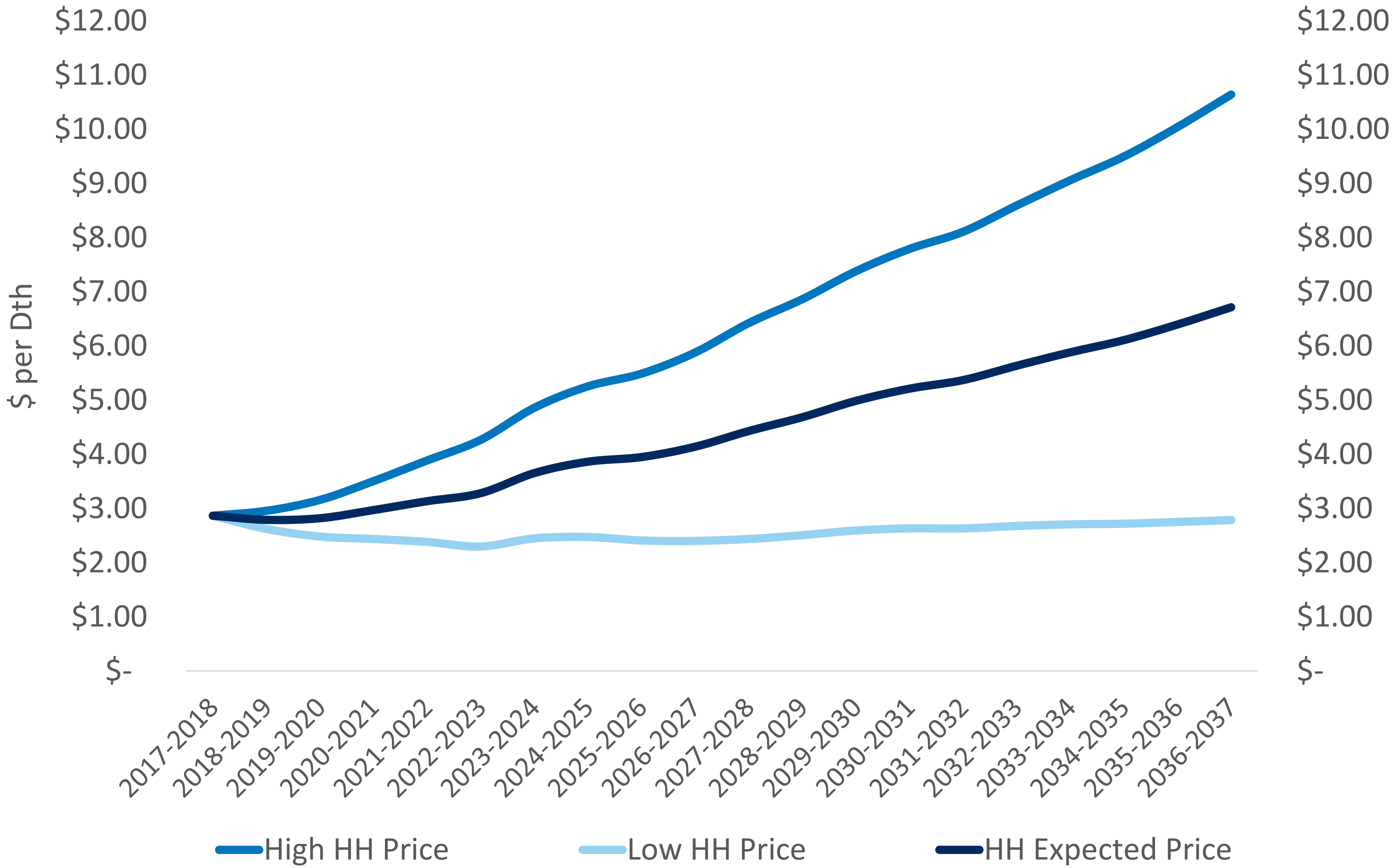
Base Coefficients



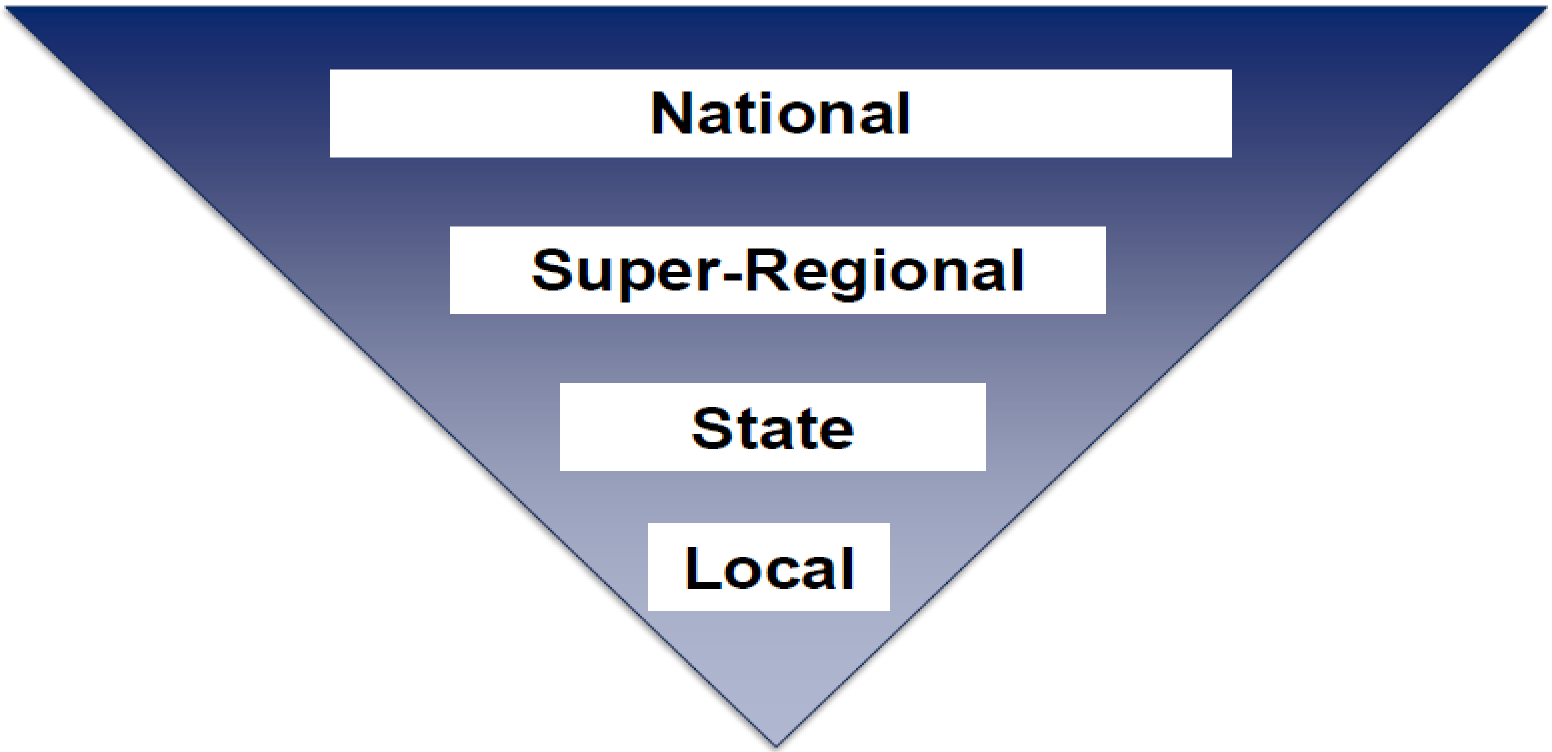


July and August Average

2018 Henry Hub Prices - Nominal



Price Elasticity: What does the research show?



Statistical significance of own-price becomes more uncertain as geographic area of measurement shrinks.*

*Bernstein, M.A. and J. Griffin (2005). *Regional Differences in Price-Elasticity of Demand for Energy*, Rand Corporation.

Price Elasticity Proposed Assumptions

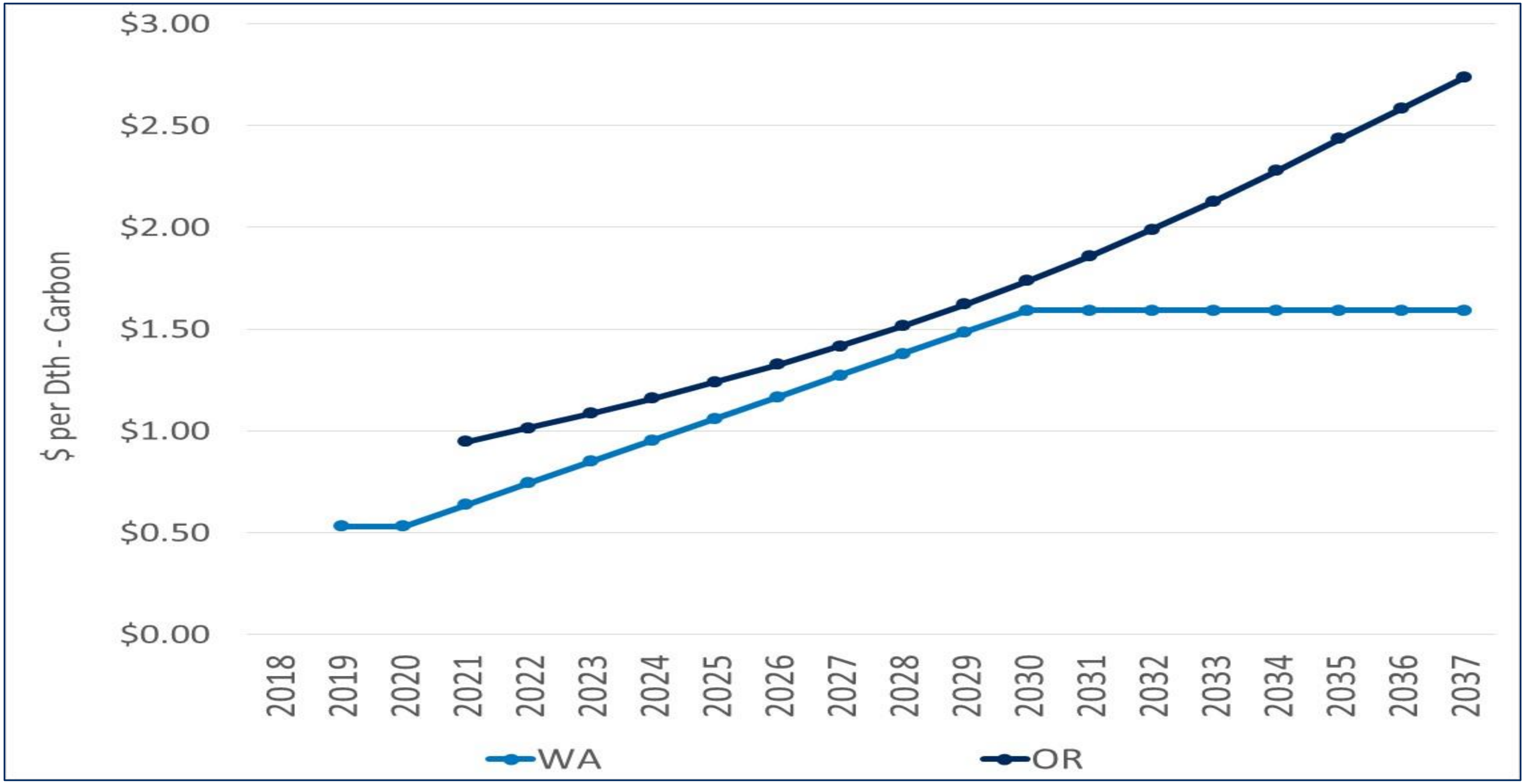
- The data is a mixed bag at best:
  - 8 of 9 super regions have statistically significant short and long run elasticity's.
  - At a state level only 10 of 50 show statistical significant elasticity's.
  - In some cases, the estimated elasticity's are positive.

– We incorporated a -.10 price elastic response for our expected elasticity assumption as found in our Medford and Roseburg service areas.

Carbon Tax Summary

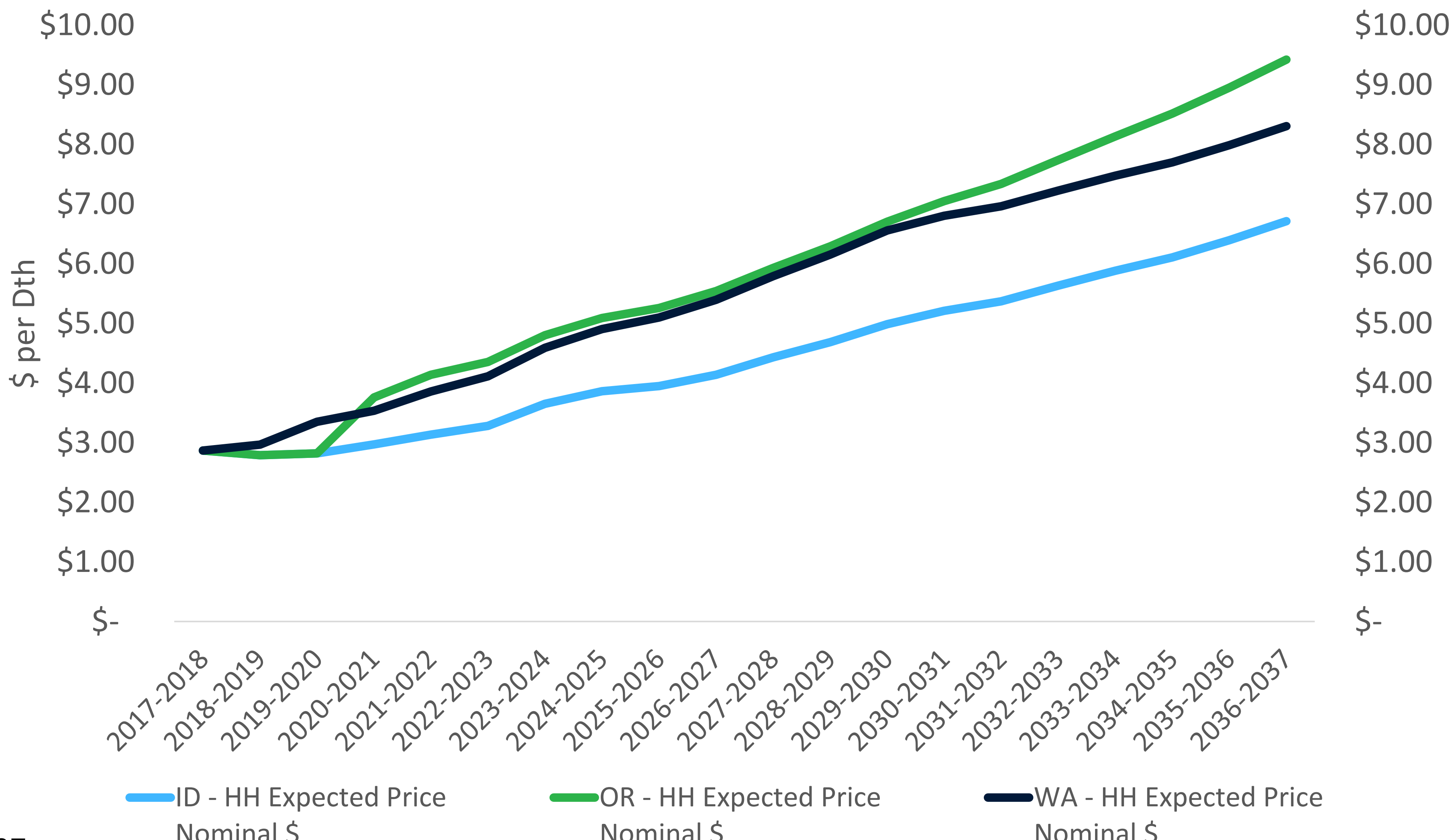
- ID – None
- OR – Cap and Investment Program SB1070
  - Avista's price assumption are based on CA cap and trade program (2018 annual price of $14.53)
    - Begins in 2021 at $17.86 and increases by 5% plus inflation each year until reaching $51.58 in 2037
- WA – Governor Inslee proposed Carbon tax (SB 6203)
  - Starts at $10 per MTCO2e in July 2019 and in 2021 adds $2 per year until capping at $30 in 2030.

Carbon Price by Jurisdiction



*Idaho has no carbon price adder

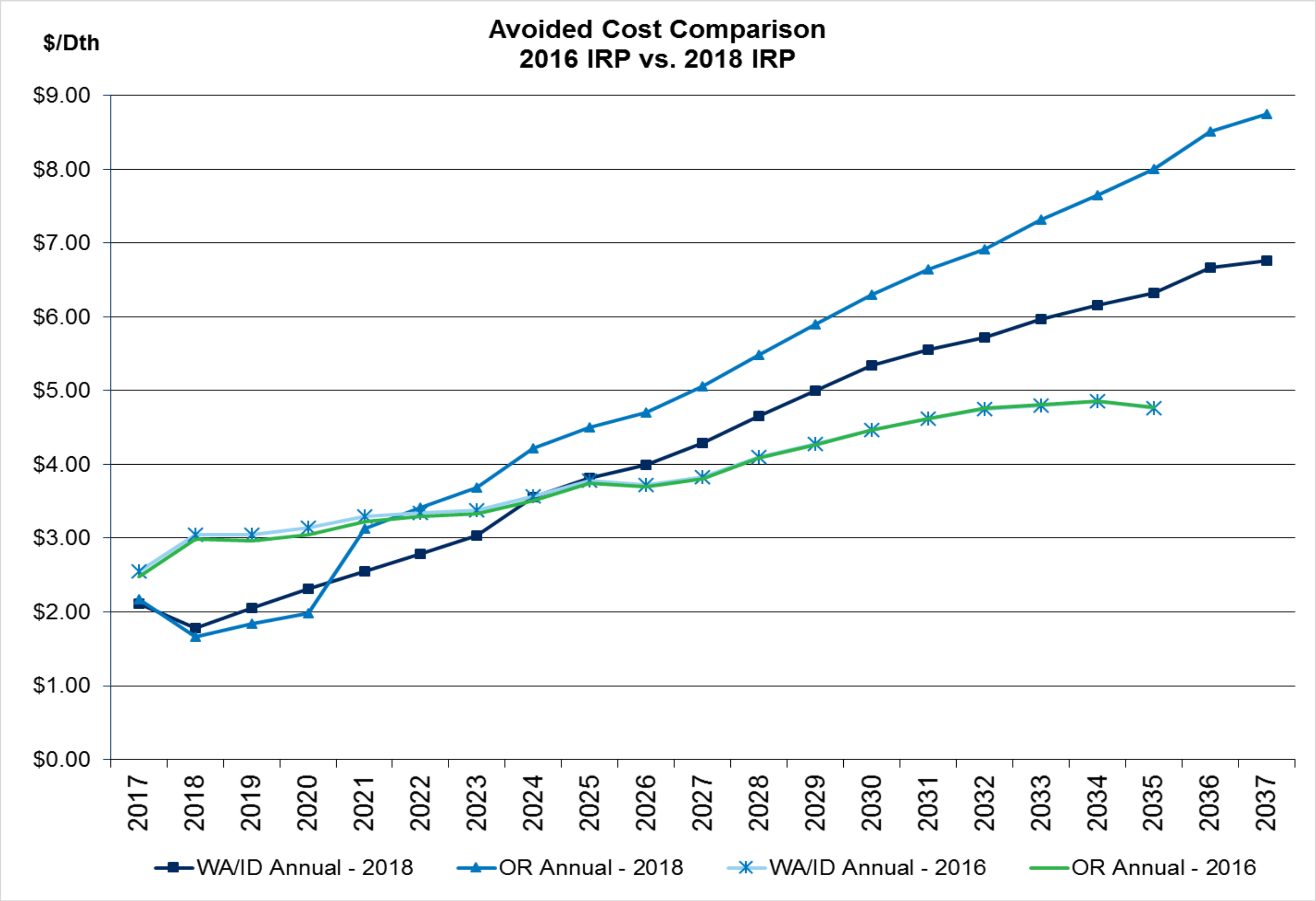
2018 Henry Hub Expected Price Including Carbon Adders by State



Planning Standard Assumptions

Area	Coldest in 20 Year HDD	Coldest on Record HDD
WA-ID	76	82
Klamath Falls	72	72
La Grande	66	74
Medford	52	61
Roseburg	48	55

Coldest on Record Dates
WA/ID – December 30, 1968
Medford – December 9, 1972
Roseburg – December 22, 1990
Klamath Falls – January 6, 2017
La Grande – January 23, 1996


Avoided Cost Comparison
2016 IRP vs. 2018 IRP
$/Dth
$9.00
$8.00
$7.00
$6.00
$5.00
$4.00
$3.00
$2.00
$1.00
$0.00
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
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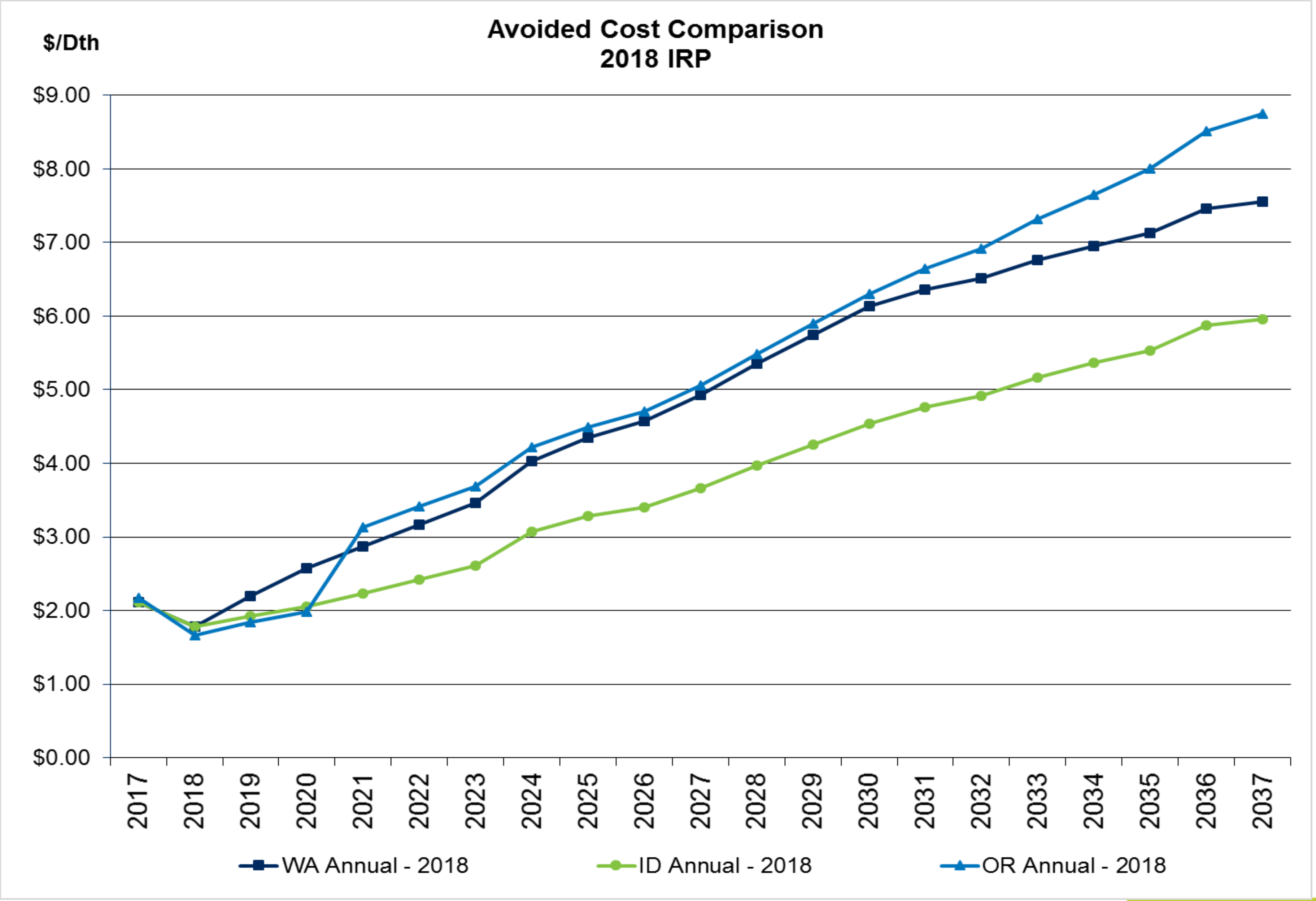
2036
2037
WA/ID Annual - 2018
OR Annual - 2018
WA/ID Annual - 2016
OR Annual - 2016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$3.00
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$0.00
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
WA Annual - 2018
ID Annual - 2018
OR Annual - 2018

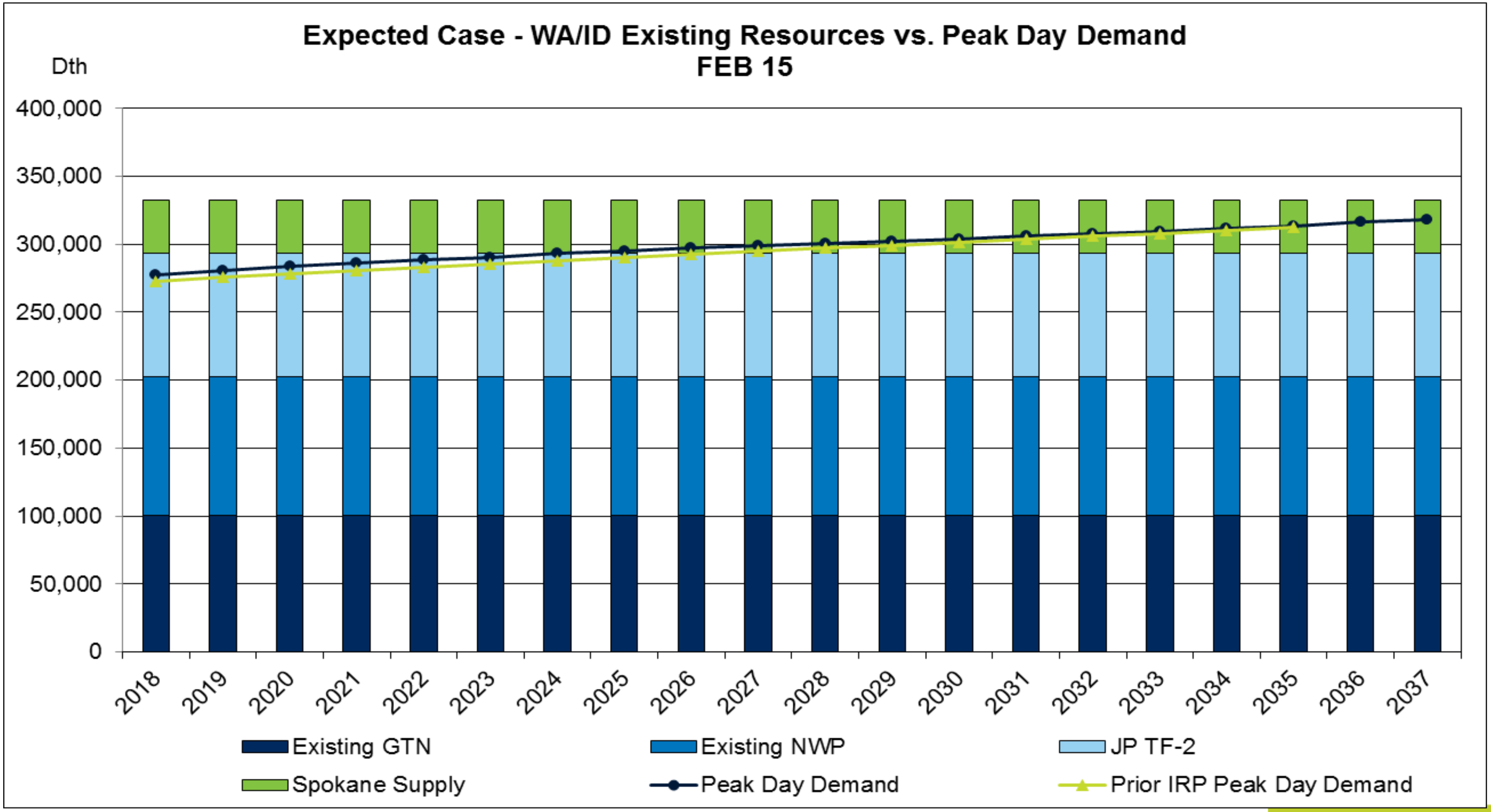
Scenario Analysis

2018 Proposed Scenarios

Proposed Scenarios INPUT ASSUMPTIONS	Expected Case	Cold Day 20yr Weather Std	Average Case	Low Growth & High Prices	80 % below 1990 emissions (Oregon and Washington only)	High Growth & Low Prices
Customer Growth Rate	Reference Case Cust Growth Rates			Low Growth Rate	Reference Case growth with emissions 80% below 1990 target	High Growth Rate
Use per Customer	3 yr Flat + Price Elasticity					3 yr Flat + Price Elasticity
Demand Side Management	Yes					
Weather Planning Standard	Historical Coldest Day	Coldest in 20 years	20 year average	Historical Coldest Day		
Prices Price curve	Expected			High	Low	
Carbon Legislation ($/Metric Ton)	$10-$30 WA $17.86-$51.58 OR $0 ID					None
RESULTS						
First Gas Year Unserved						
WA/ID	N/A	N/A	N/A	N/A	N/A	2032
Medford	N/A	N/A	N/A	N/A	N/A	2031
Roseburg	N/A	N/A	N/A	N/A	N/A	2031
Klamath	N/A	N/A	N/A	N/A	N/A	N/A
La Grande	N/A	N/A	N/A	N/A	N/A	2032
Scenario Summary						
	Most aggressive peak planning case utilizing Average Case assumptions as a starting point and layering in coldest weather on record. The likelihood of occurrence is low.	Evaluates adopting an alternate peak weather standard. Helps provide some bounds around our sensitivity to weather.	Case most representative of our average (budget, pga, rate case) planning criteria.	Stagnant growth assumptions in order to evaluate if a shortage does occur. Not likely to occur.	Reduction of the use of natural gas to 80% below 1990 targets in OR and WA by 2050. The case assumes the overall reduction is an average goal before applying figures like elasticity and dsm.	Aggressive growth assumptions in order to evaluate when our earliest resource shortage could occur. Not likely to occur.

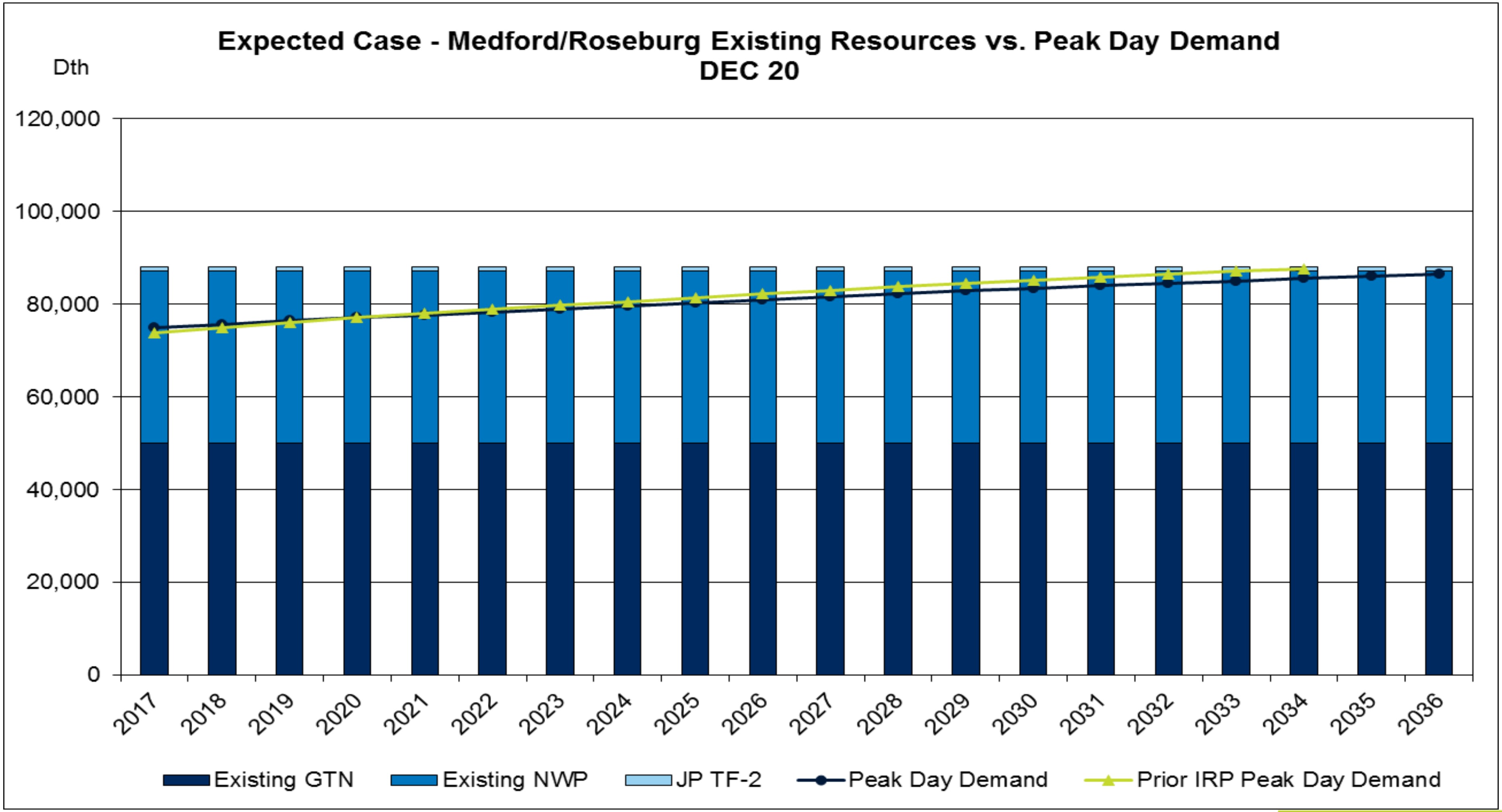
Existing Resources vs. Peak Day Demand

Expected Case – Washington/Idaho (DRAFT)



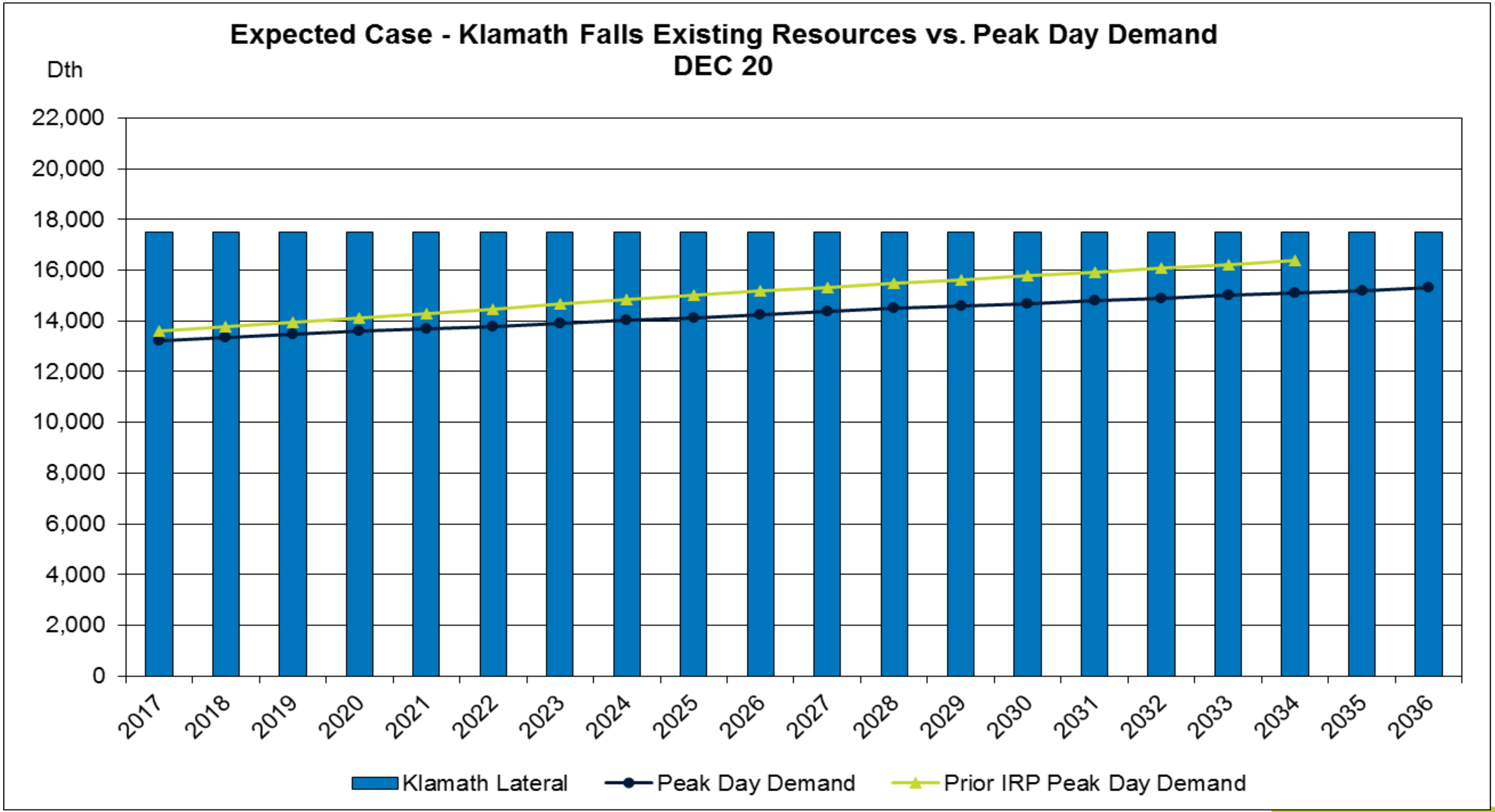
Existing Resources vs. Peak Day Demand

Expected Case – Medford/Roseburg (DRAFT)



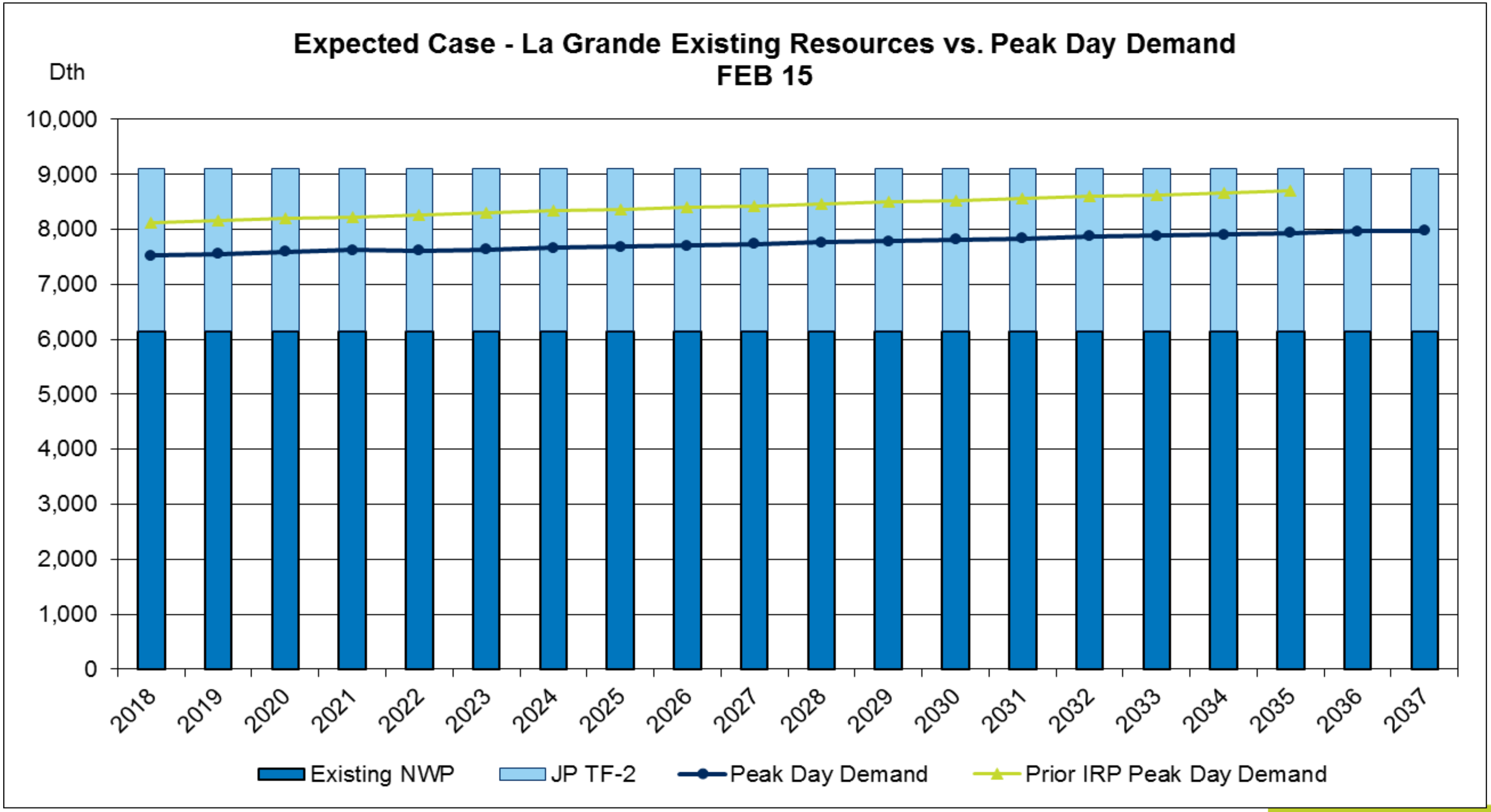
Existing Resources vs. Peak Day Demand

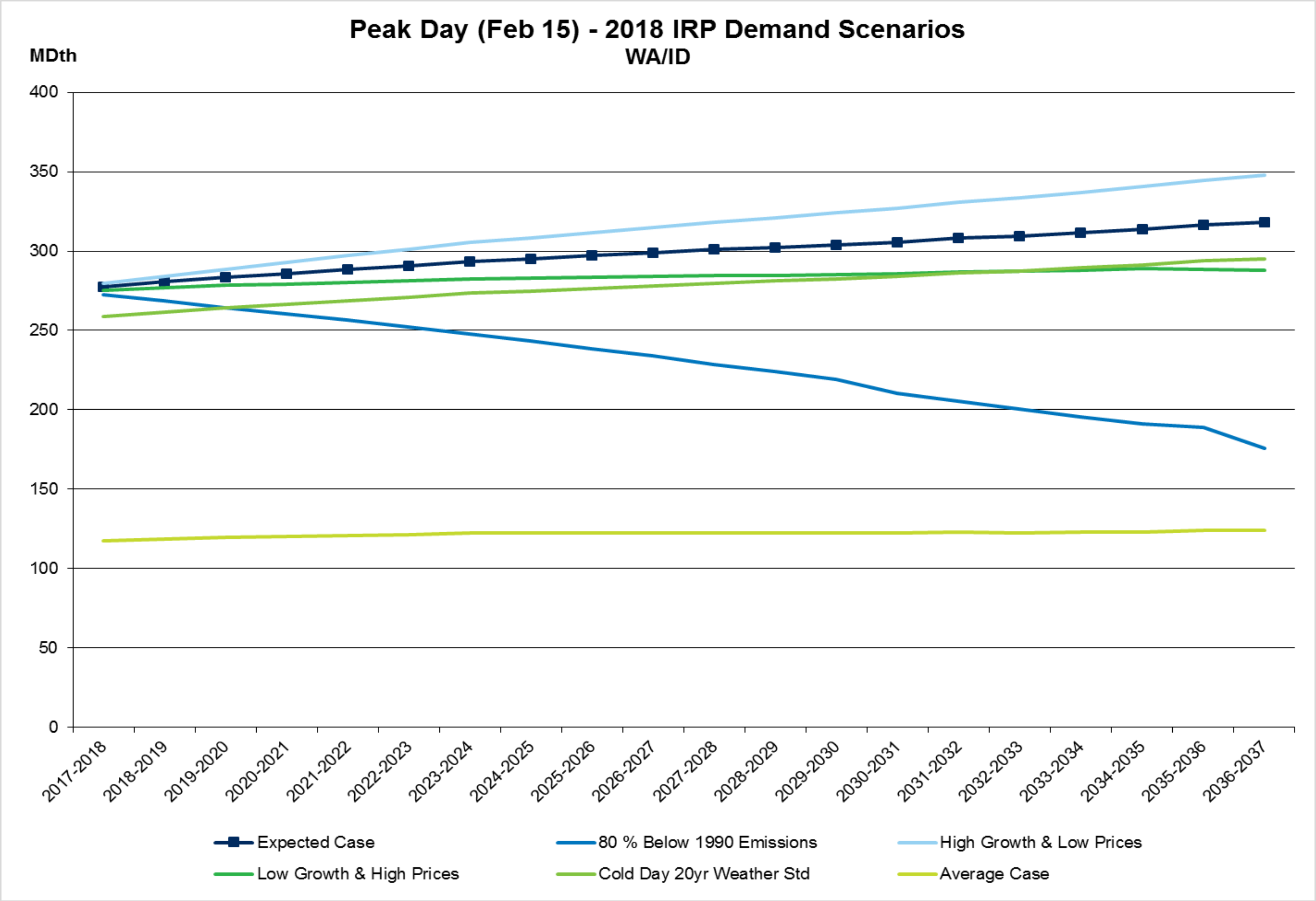
Expected Case – Klamath Falls (DRAFT)



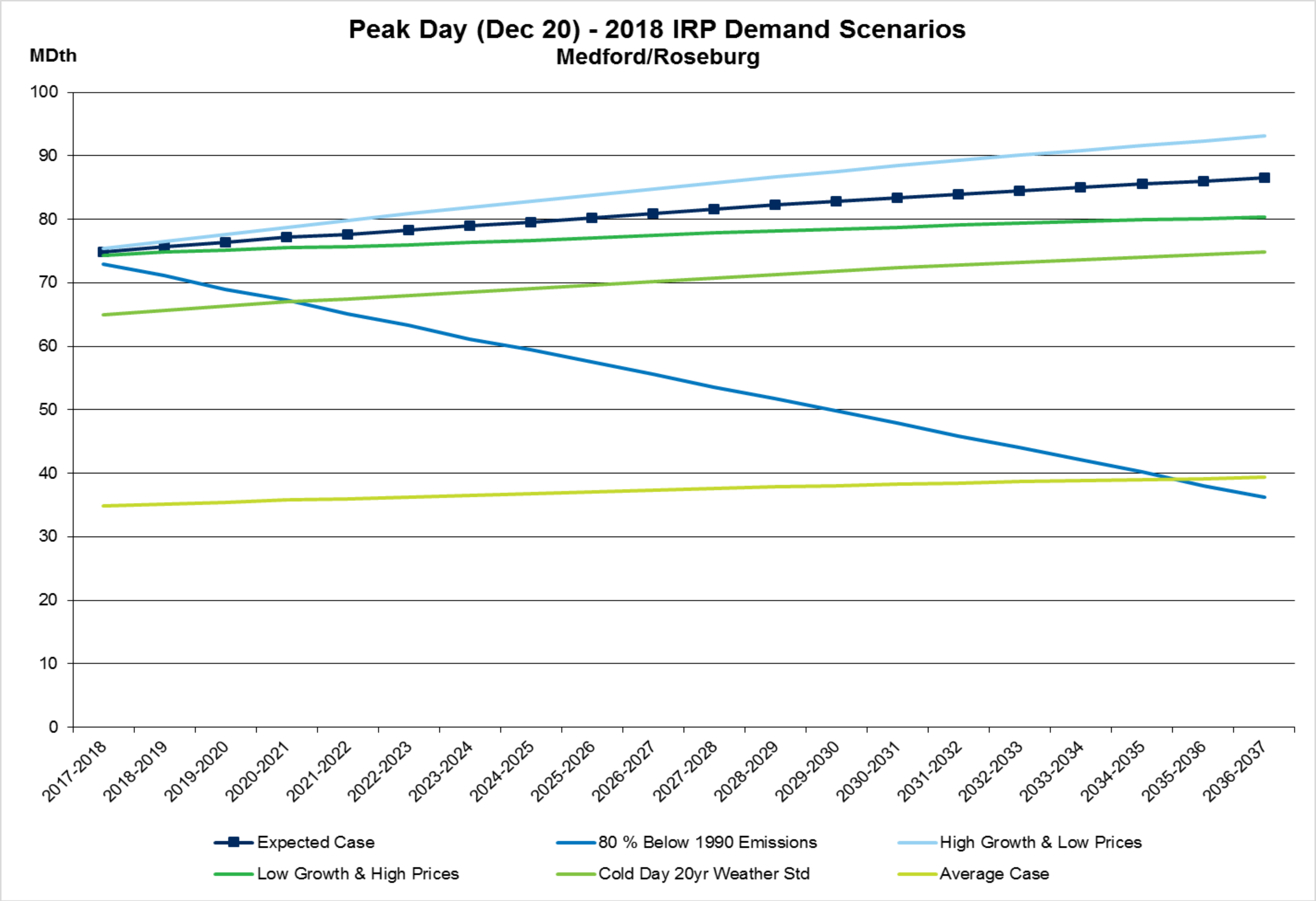
Existing Resources vs. Peak Day Demand

Expected Case – La Grande (DRAFT)





Peak Day (Feb 15) - 2018 IRP Demand Scenarios
WA/ID
MDth
400
350
300
250
200
150
100
50
0
2017-2018
2018-2019
2019-2020
2020-2021
2021-2022
2022-2023
2023-2024
2024-2025
2025-2026
2026-2027
2027-2028
2028-2029
2029-2030
2030-2031
2031-2032
2032-2033
2033-2034
2034-2035
2035-2036
2036-2037
Expected Case
80 % Below 1990 Emissions
High Growth & Low Prices
Low Growth & High Prices
Cold Day 20yr Weather Std
Average Case


Peak Day (Dec 20) - 2018 IRP Demand Scenarios
Medford/Roseburg
MDth
100
90
80
70
60
50
40
30
20
10
0
2017-2018
2018-2019
2019-2020
2020-2021
2021-2022
2022-2023
2023-2024
2024-2025
2025-2026
2026-2027
2027-2028
2028-2029
2029-2030
2030-2031
2031-2032
2032-2033
2033-2034
2034-2035
2035-2036
2036-2037
Expected Case
80 % Below 1990 Emissions
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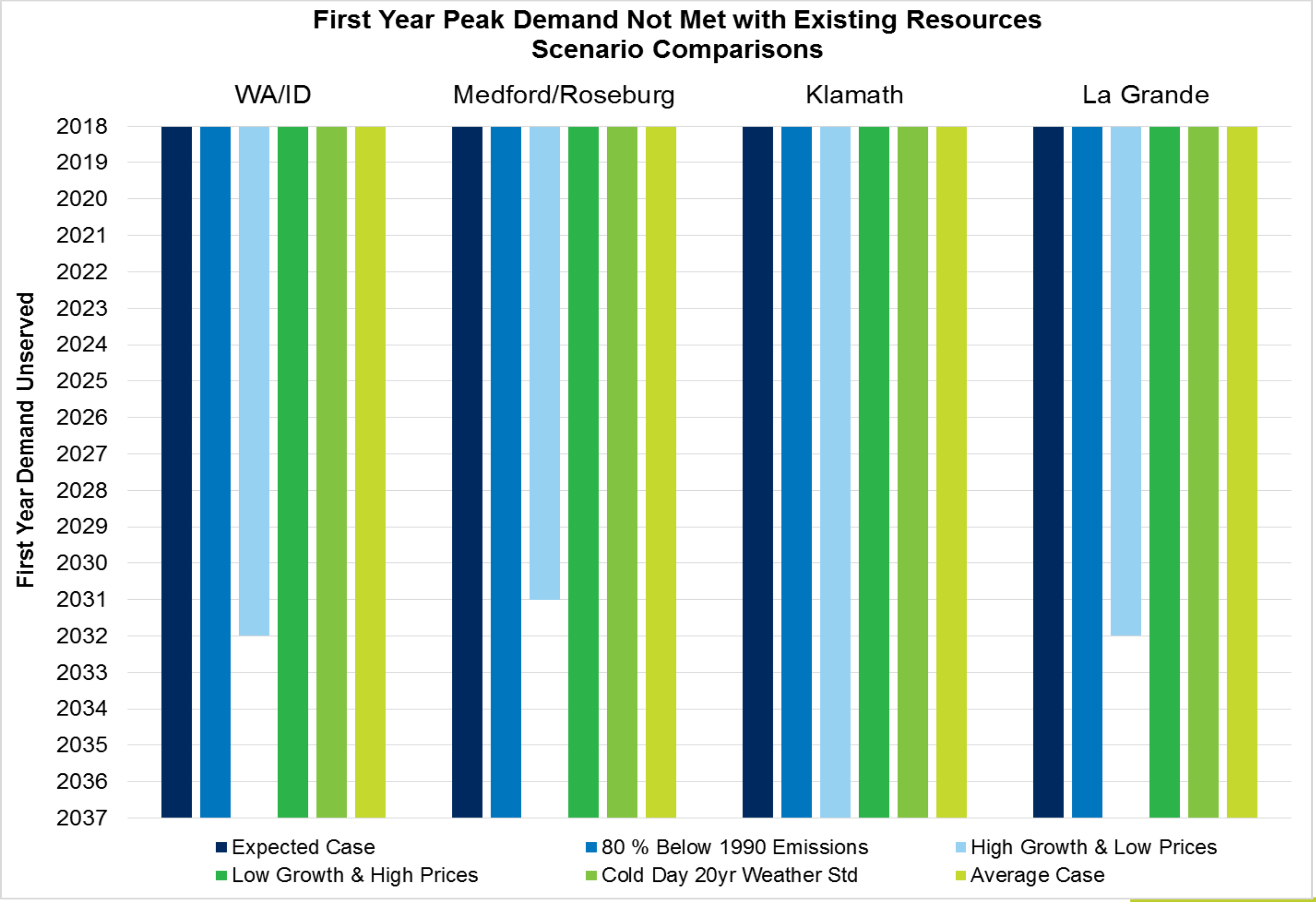
Average Case


First Year Peak Demand Not Met with Existing Resources
Scenario Comparisons
WA/ID
Medford/Roseburg
Klamath
La Grande
First Year Demand Unserved
2018
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2020
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2022
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2037
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Cold Day 20yr Weather Std
Average Case

Solving for unserved demand

Tom Pardee

When unserved demand does show up……

There are a few questions we need to ask:

1. Why is the demand unserved?
2. What is the magnitude of the short? (i.e Are we 1 Dth or 1000 Dth’s short?)
3. What are my options to meet it?

When current resources don't meet demand what could we consider?

- Transport capacity release recalls
- "Firm" backhauls
- Contract for existing available transportation
- Expansions of current pipelines
- Peaking arrangements with other utilities (swaps/mutual assistance agreements) or marketers
- In-service territory storage
- Satellite/Micro LNG (storage inside service territory)
- Large scale LNG with corresponding pipeline build into our service territory
- Structured products/exchange agreements delivered to city gates
- Biogas (assume it's inside Avista's distribution)
- Hydrogen blend (assume it's inside Avista's distribution)
- Avista distribution system enhancements
- Demand side management

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New Resource Risk Considerations

- Does is get supply to the gate?
- Is it reliable/firm?
- Does it have a long lead time?
- How much does it cost?
  - New build vs. depreciated cost
  - The rate pancake
- Is it a base load resource or peaking?
- How many dekatherms do I need?
- What is the “shape” of resource?
- Is it tried and true technology, new technology, or yet to be discovered?
- Who else will be competing for the resource?

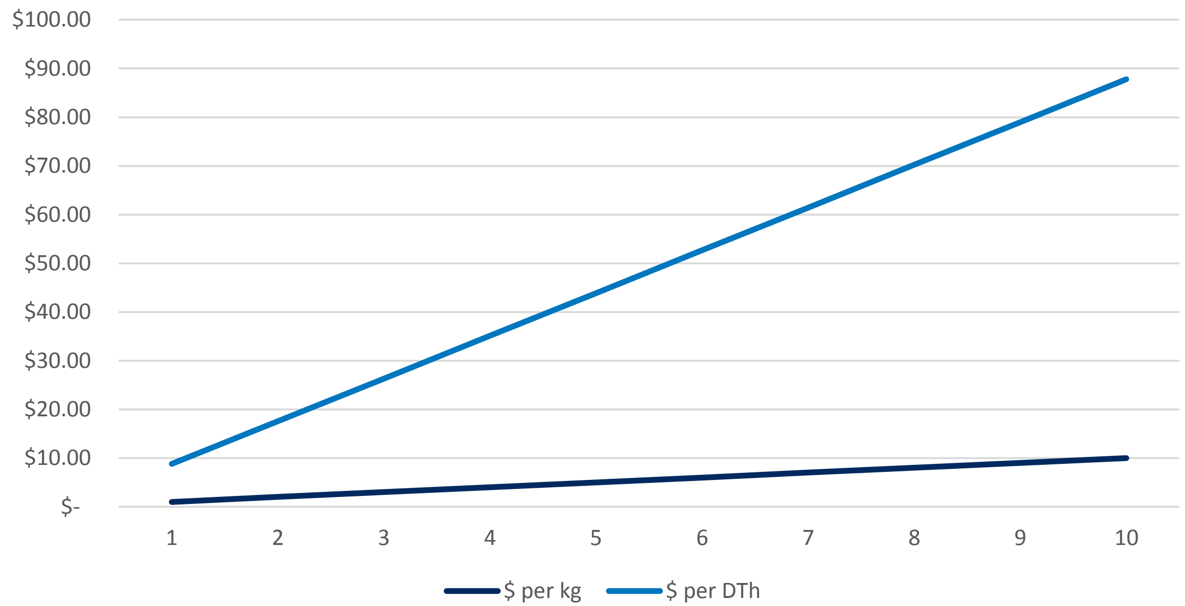
Potential New Supply Resources Considerations

- Availability
  - By Region – which region(s) can the resource be utilized?
  - Lead time considerations – when will it be available?
- Type of Resource
  - Peak vs. Base load
  - Firm or Non-Firm
  - “Lumpiness”
- Usefulness
  - Does it get the gas where we need it to be?
  - Last mile issues
- Cost

$ per kg vs $ per Dth

$ per kg	$ per DTh
$ 1.00	$ 8.78
$ 2.00	$ 17.55
$ 3.00	$ 26.33
$ 4.00	$ 35.11
$ 5.00	$ 43.88
$ 6.00	$ 52.66
$ 7.00	$ 61.44
$ 8.00	$ 70.21
$ 9.00	$ 78.99
$ 10.00	$ 87.77

*1 kg is roughly equivalent to a gallon of gasoline LHV

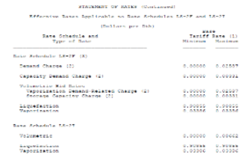


National Renewable Energy Laboratory (NREL) estimates hydrogen fuel prices from around $8 - $10 per kg by 2020 to 2025 period.

USDOE target is below $4 (excludes compression and delivery)

Source: https://www.energy.gov/eere/fuelcells/doe-technical-targets-onboard-hydrogen-storage-light-duty-vehicles

Supply Resources - Modeled

Additional Resource	Size	Cost/Rates	Availability	Notes
Unsubscribed GTN Capacity	Up to 50,000 Dth	GTN Rate	Now	Currently available unsubscribed capacity from Kingsgate to Stanfield
Medford Lateral Exp	50,000 Dth / Day	$35M capital + GTN Rate	2018	Additional compression to facilitate more gas to flow from mainline GTN to Medford.
*Hydrogen	20% of heat content of a Dth or 200,000 btu	$10 kg 1 LHV kg = 113,937 btu	2030	Roughly 20% of yearly gas demand to mix with natural gas in current pipeline. Cost is from the DOE target for cost of Hydrogen. Costs from a consultant will be utilized in the final document, but were unavailable for modeling in time for TAC #4
*Renewable Natural Gas – Landfill, Dairy, Waste Water, Food waste to (RNG)	1,370 Dth / Day	$10, $12, $14, $16/ Dth equivalent	2030	Dairy Farm estimate. Costs from a consultant for each specific type of RNG will be utilized in the final document, but were unavailable for modeling in time for TAC #4
Plymouth LNG	241,700 Dth w/70,500 Dth deliverability		2018	Provides for peaking services and alleviates the need for costly pipeline expansions. -Pair with excess pipeline MDDO's to create firm transport

*Avista has retained a consultant to estimate costs for RNG & Hydrogen and will be included in Avista's 2018 IRP

Future Supply Resources – Not Modeled

Other Resources to Consider

Additional Resource	Size	Cost/Rates	Availability	Notes
Co. Owned LNG	600,000 Dth w/ 150,000 of deliverability	$75 Million plus $2 Million annual O&M	2022	On site, in service territory liquefaction and vaporization facility
Various pipelines – Pacific Connector, Trails West, NWP Expansion, GTN Expansion, etc.	Varies	Precedent Agreement Rates	2020	Requires additional mainline capacity on NWPL or GTN to get to service territory
Large Scale LNG	Varies	Commodity less Fuel	2020	Speculative, needs pipeline transport
In Ground Storage	Varies	Varies	Varies	Requires additional mainline transport to get to service territory

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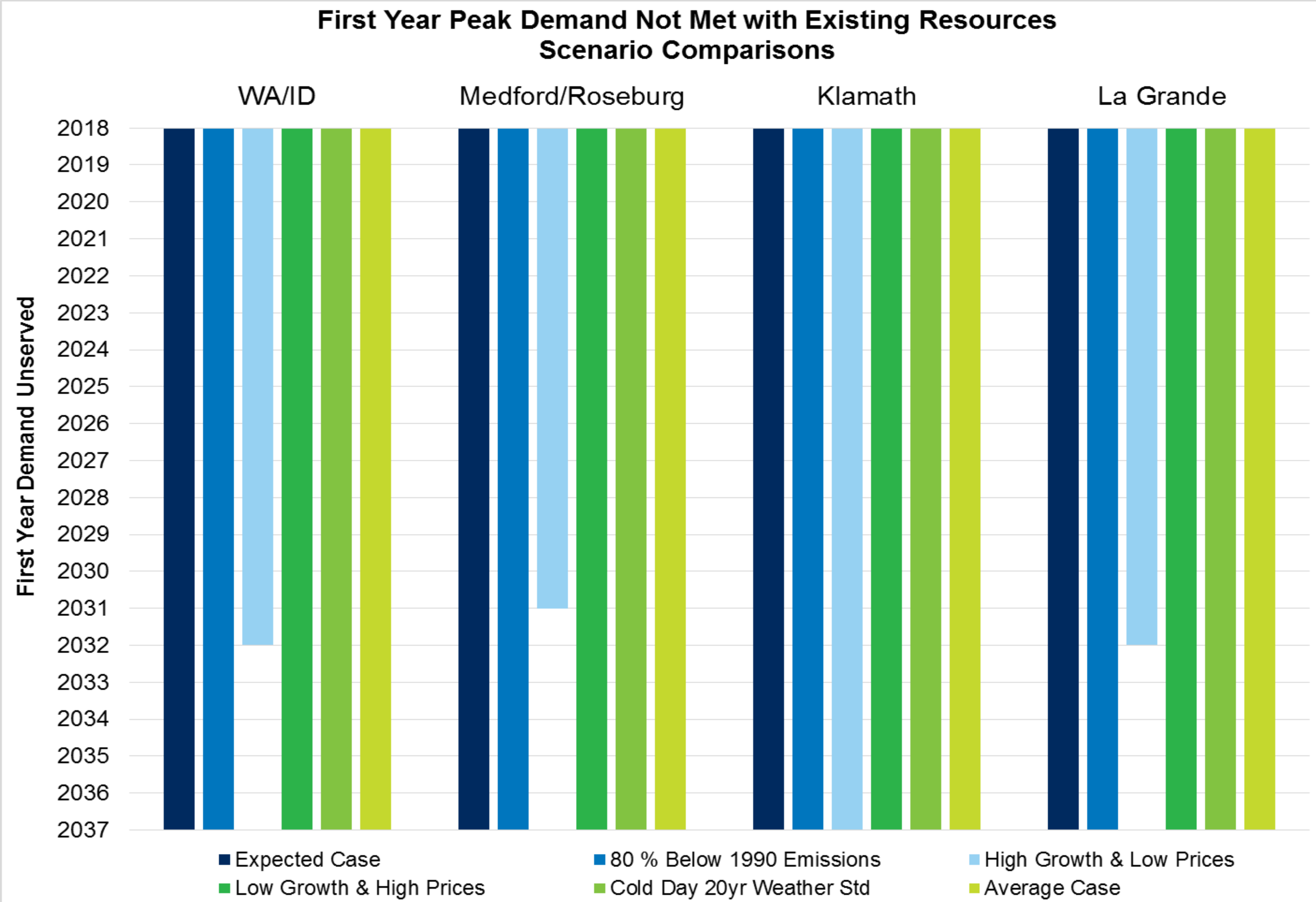
Stochastic Analysis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Expected Case
80 % Below 1990 Emissions
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Cold Day 20yr Weather Std
Average Case

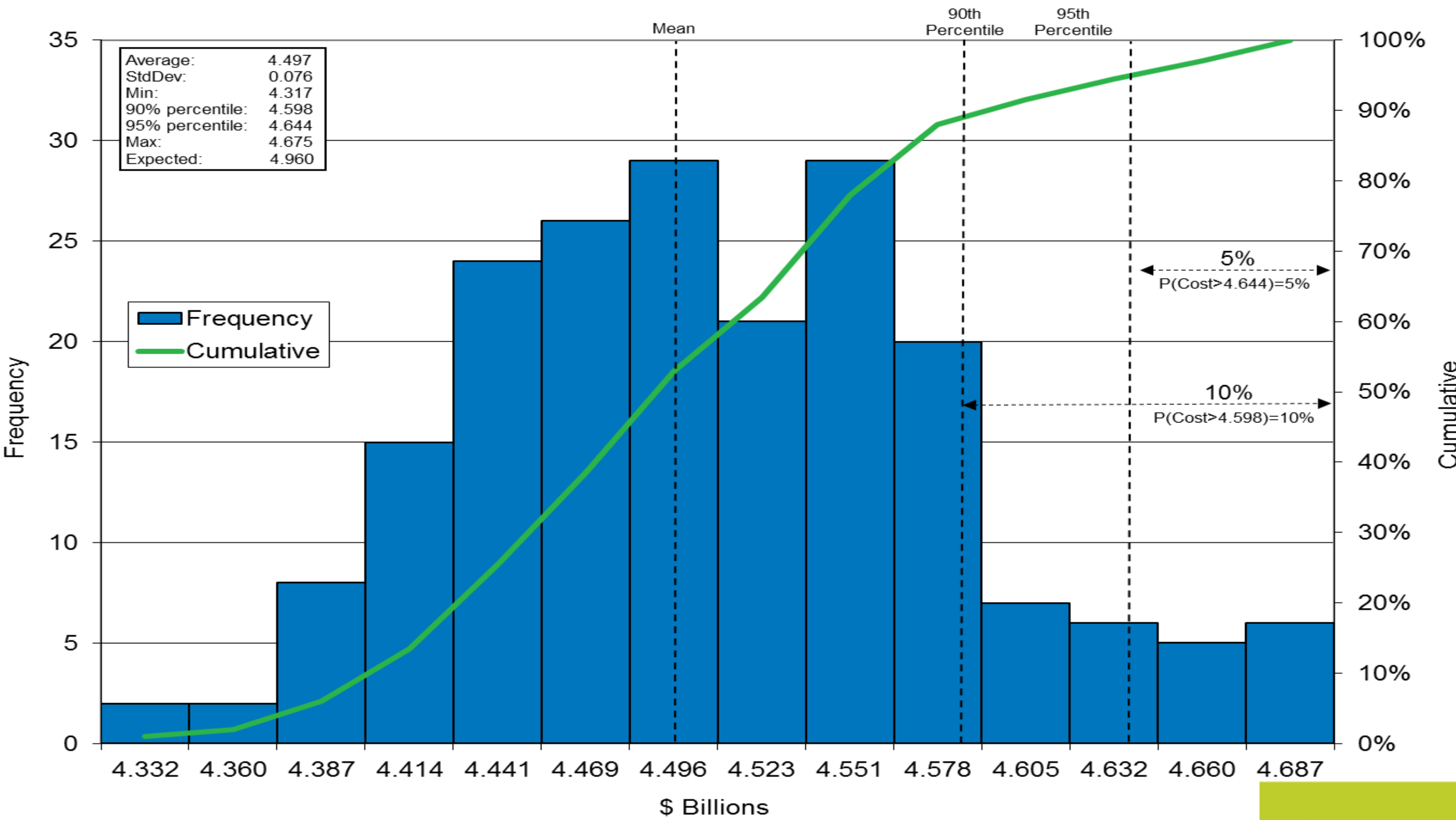
Monte Carlo Simulations

- A way to estimate the probability of potential future outcomes by allowing for a random set of variables
- Uses historical price and weather data
- Avista's Sendout model uses RMIX to help choose an optimal resource stack and costs under varying conditions

Unserved Demand and Stochastic Analysis

- Avista has no unserved demand in its resource stack using a deterministic analysis in our Expected case (coldest on record every year in every location for 20 years)
- In order to show how we would solve for a shortage we will utilize our high growth & low prices case
  - This models new potential resources and allows Sendout to solve using an resource mix (RMIX) option to select a least cost portfolio and run it through a monte carlo simulation at 200 draws to measure risk and uncertainty

Expected Case distribution

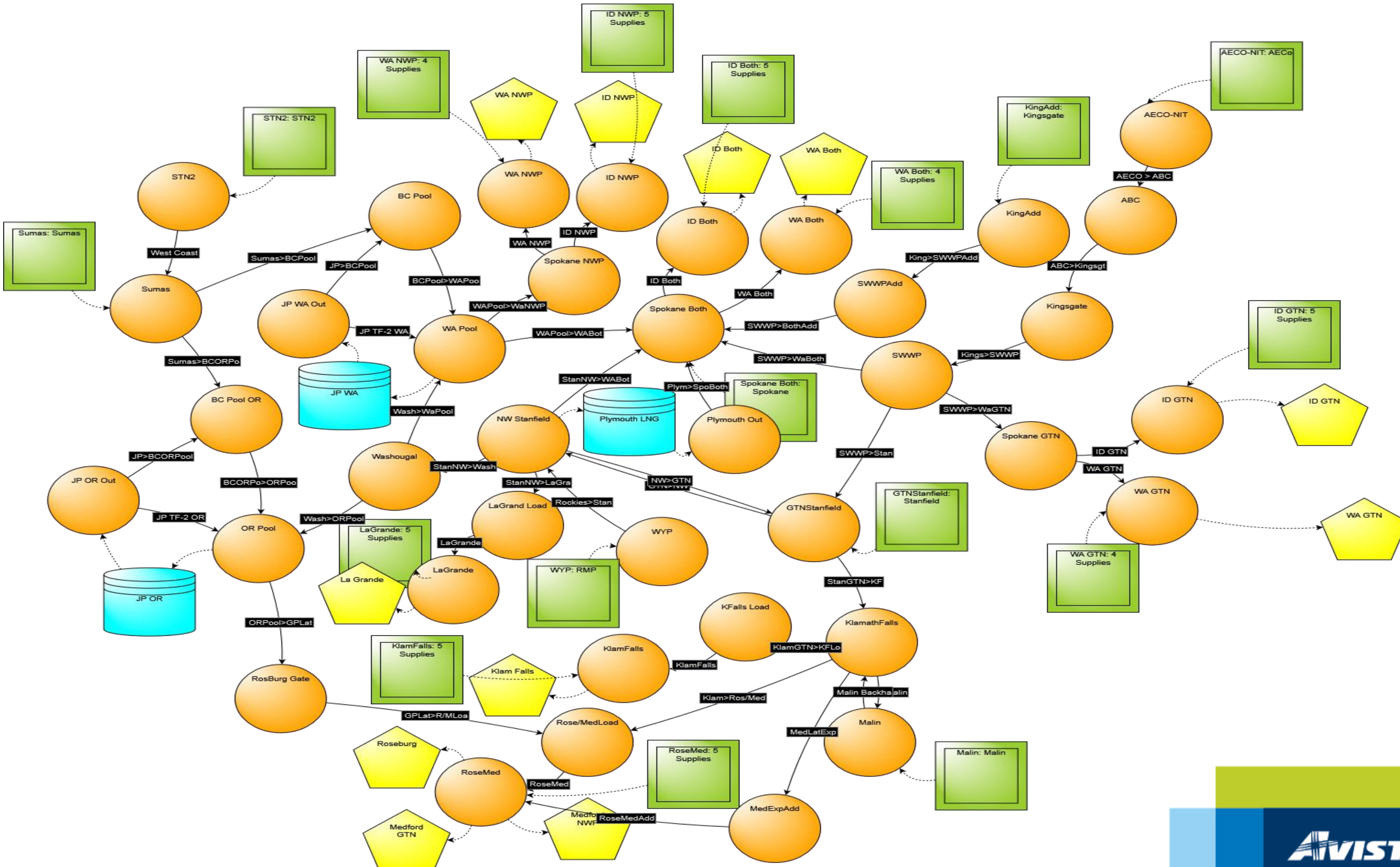


*200 Simulations

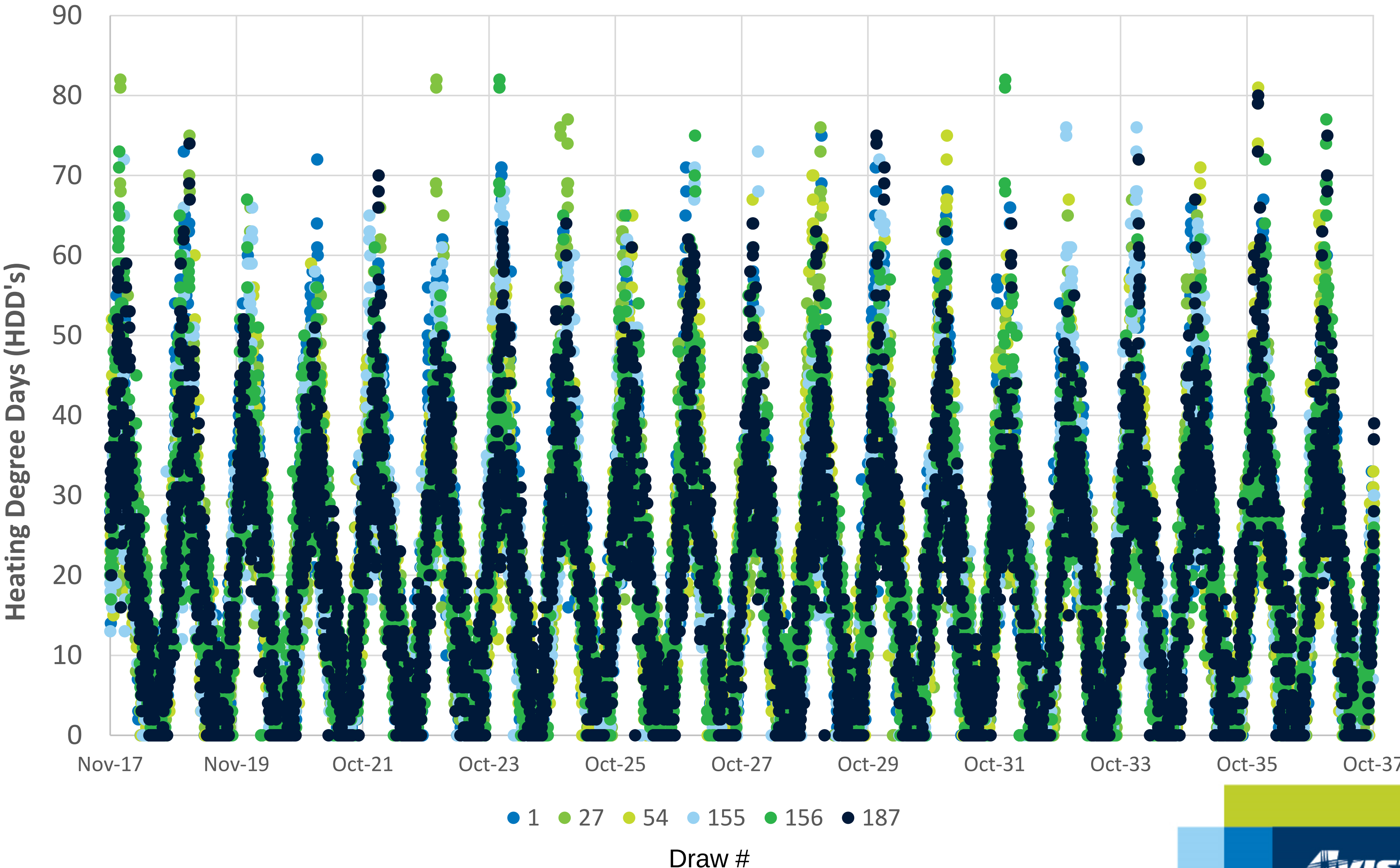
High Growth and Low Prices Scenario

(Example of determining additional resources to unserved demand)

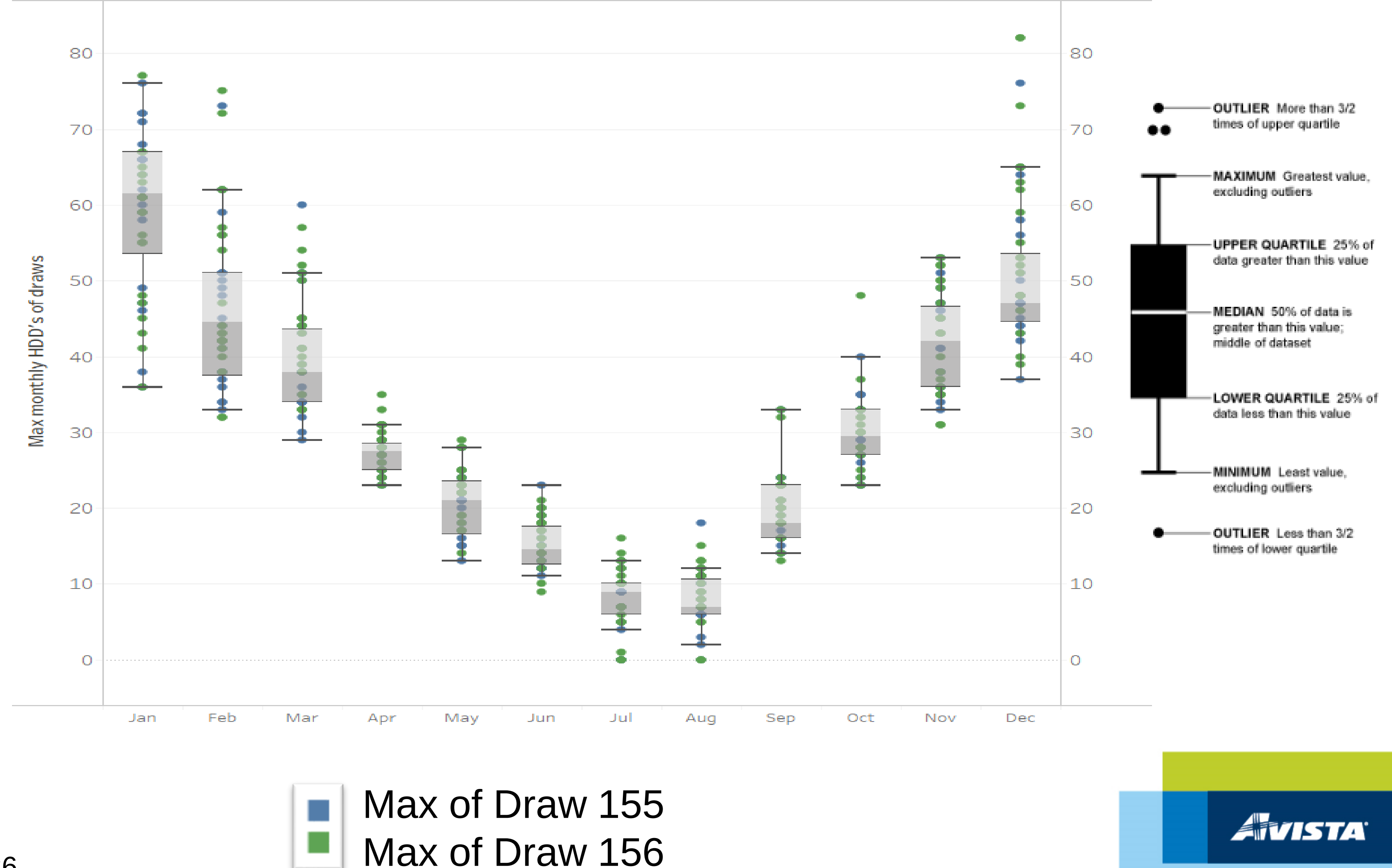
Network Diagram for additional resources



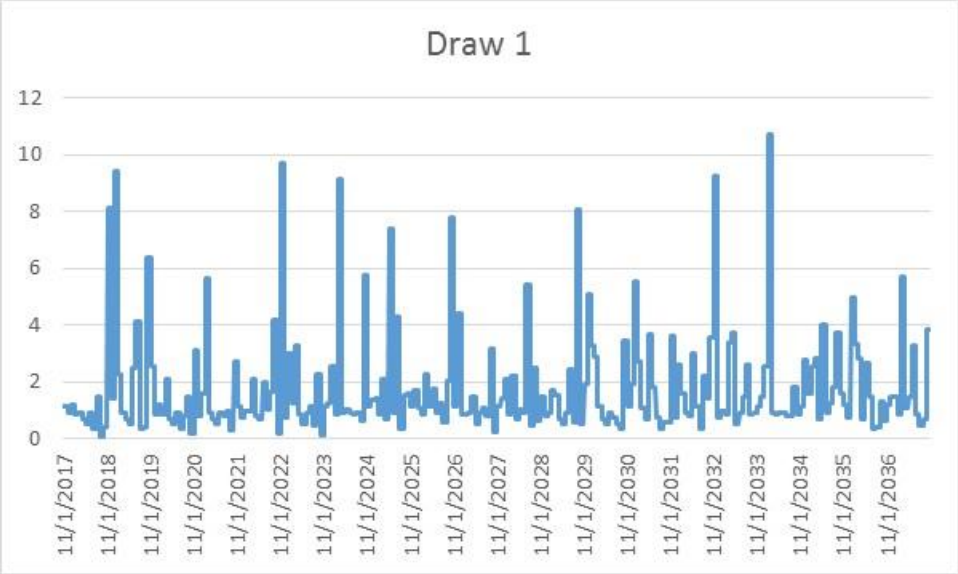
Spokane Weather Monte Carlo example

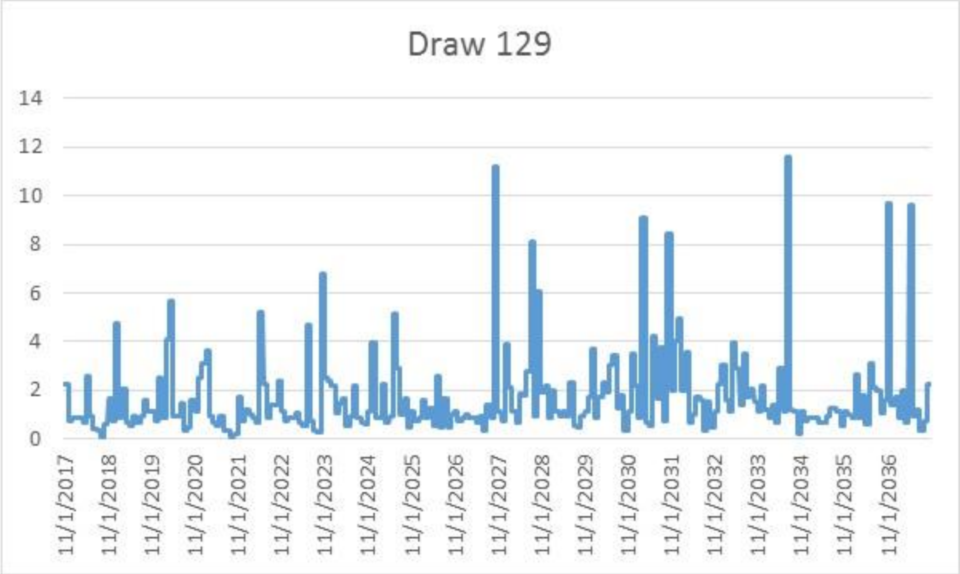


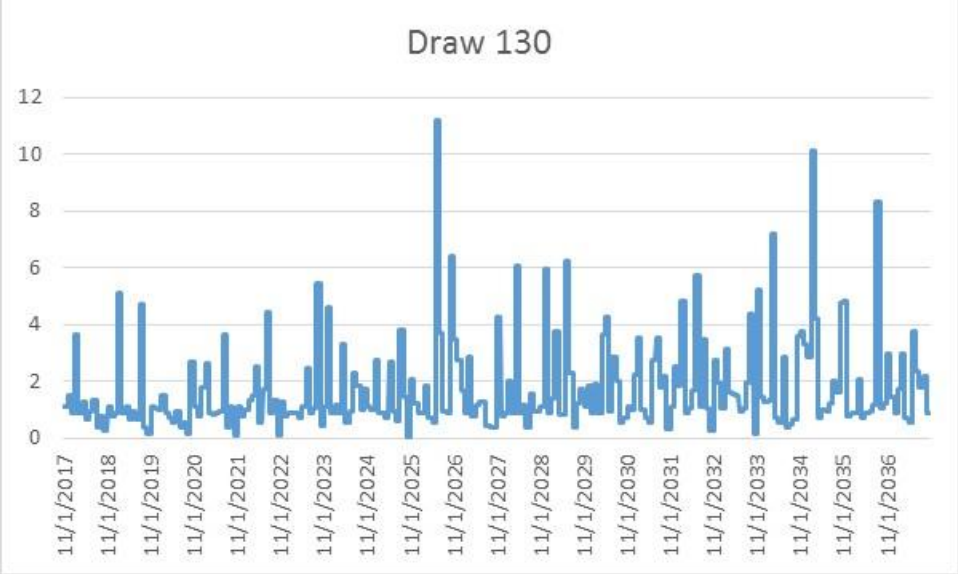
Monte Carlo weather draw examples

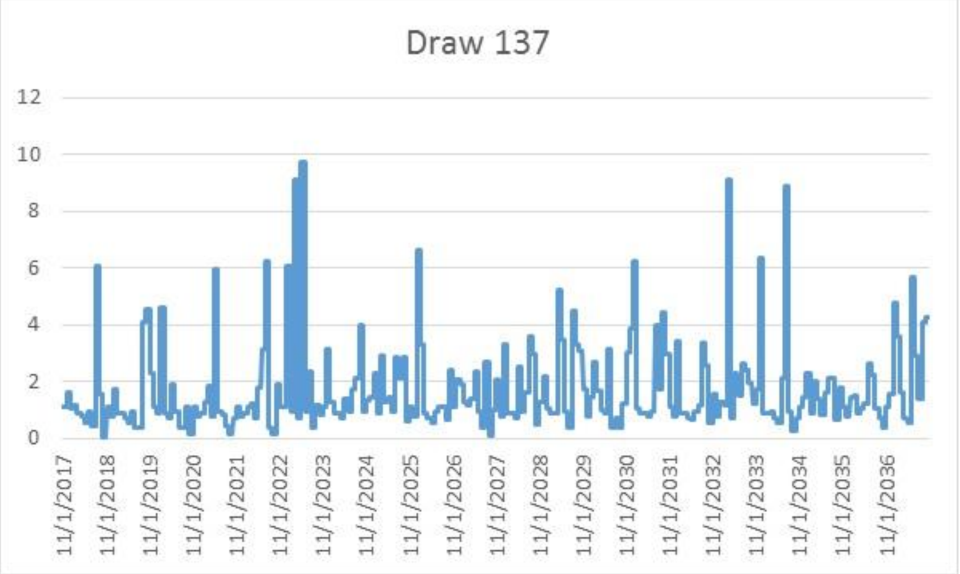


AECO Monte Carlo Draw Example

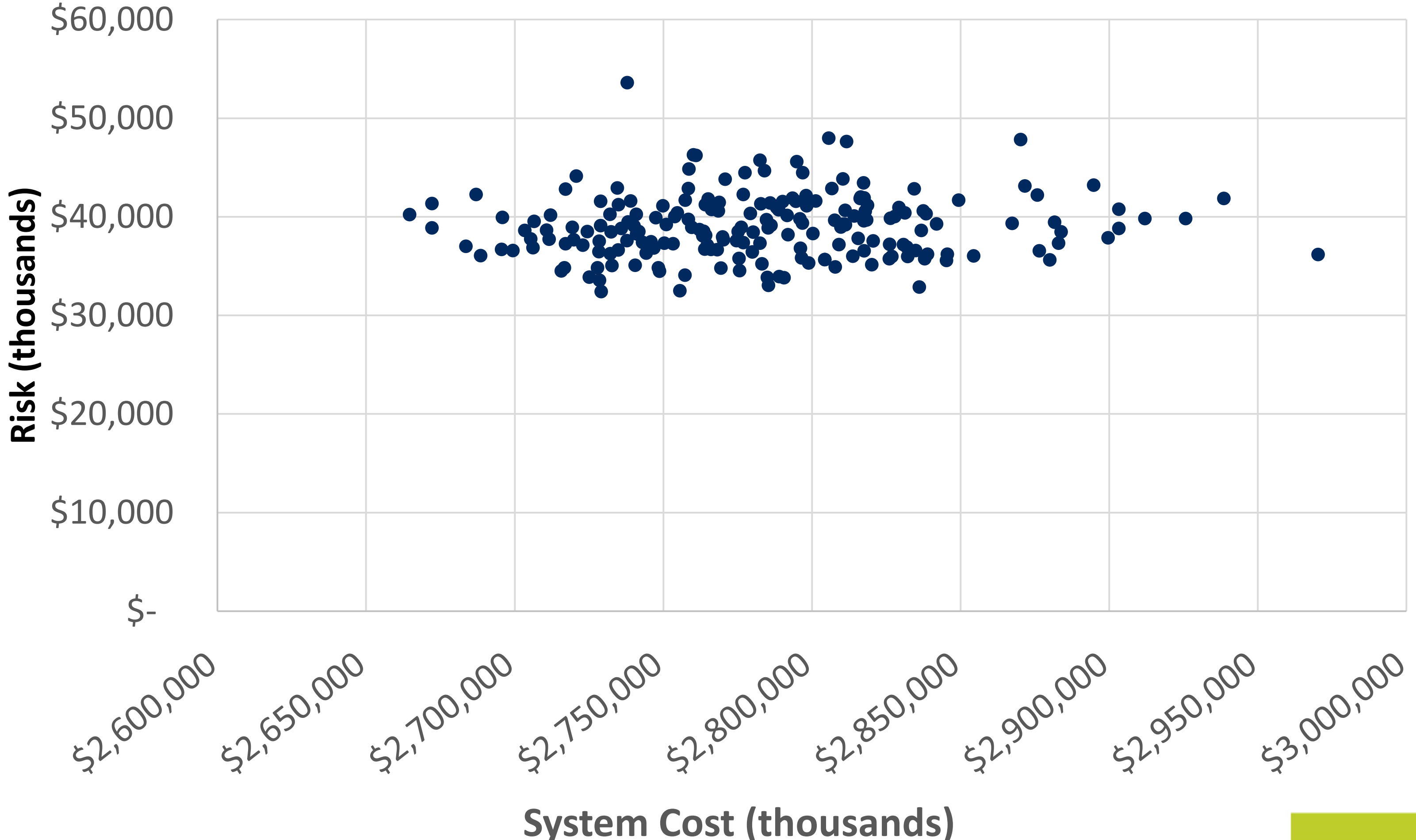




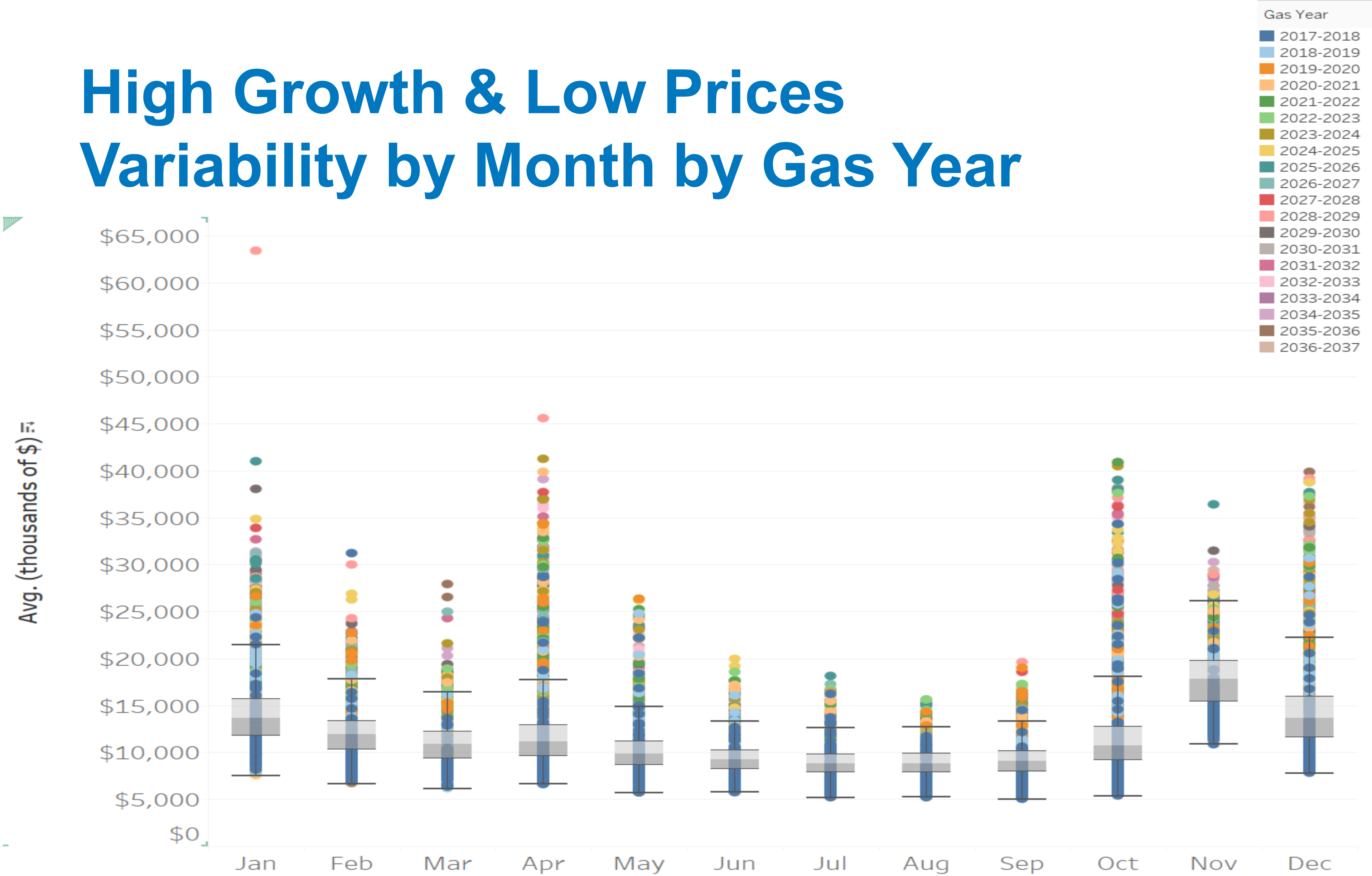




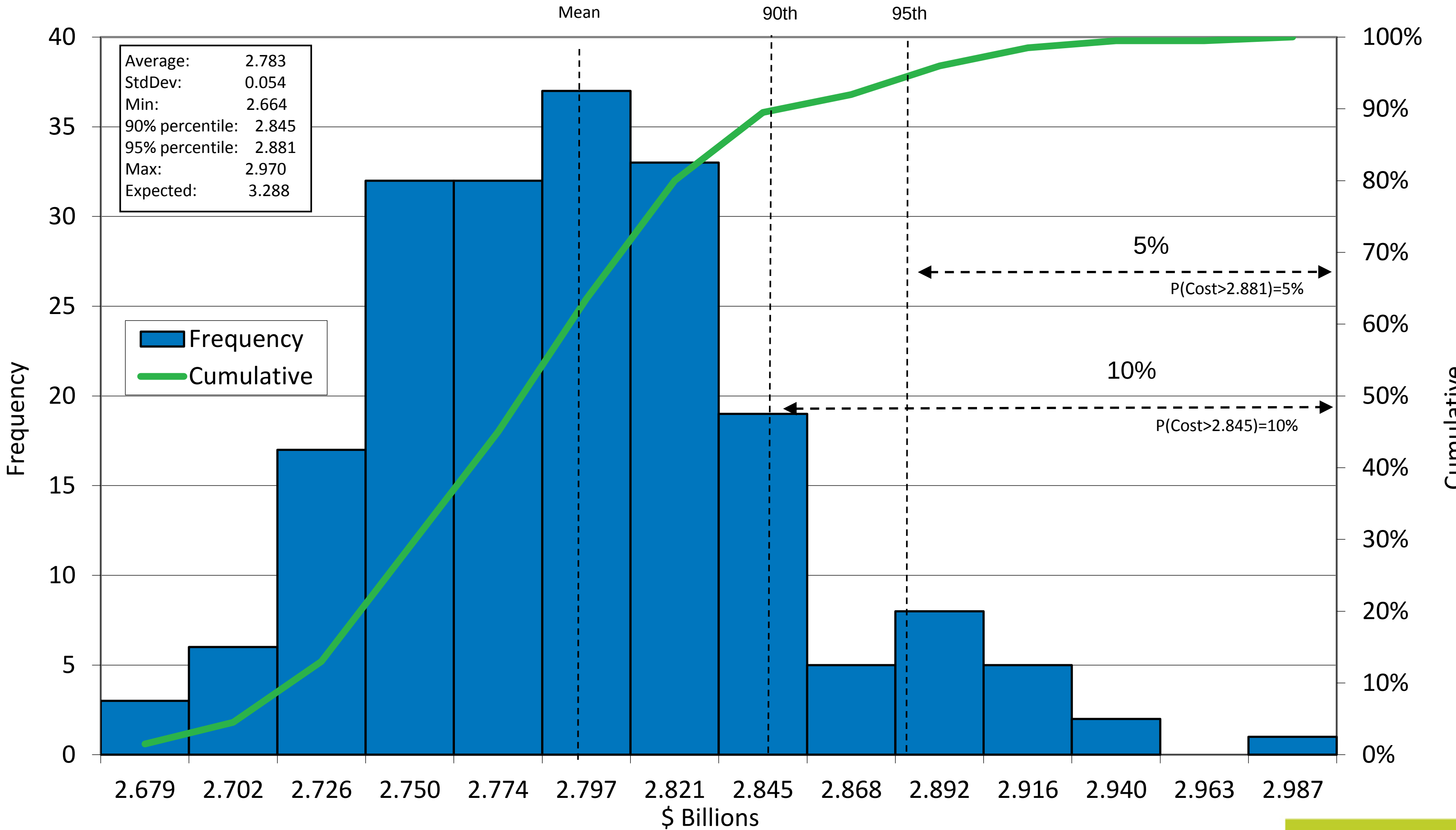
High Growth & Low Prices
200 Draws



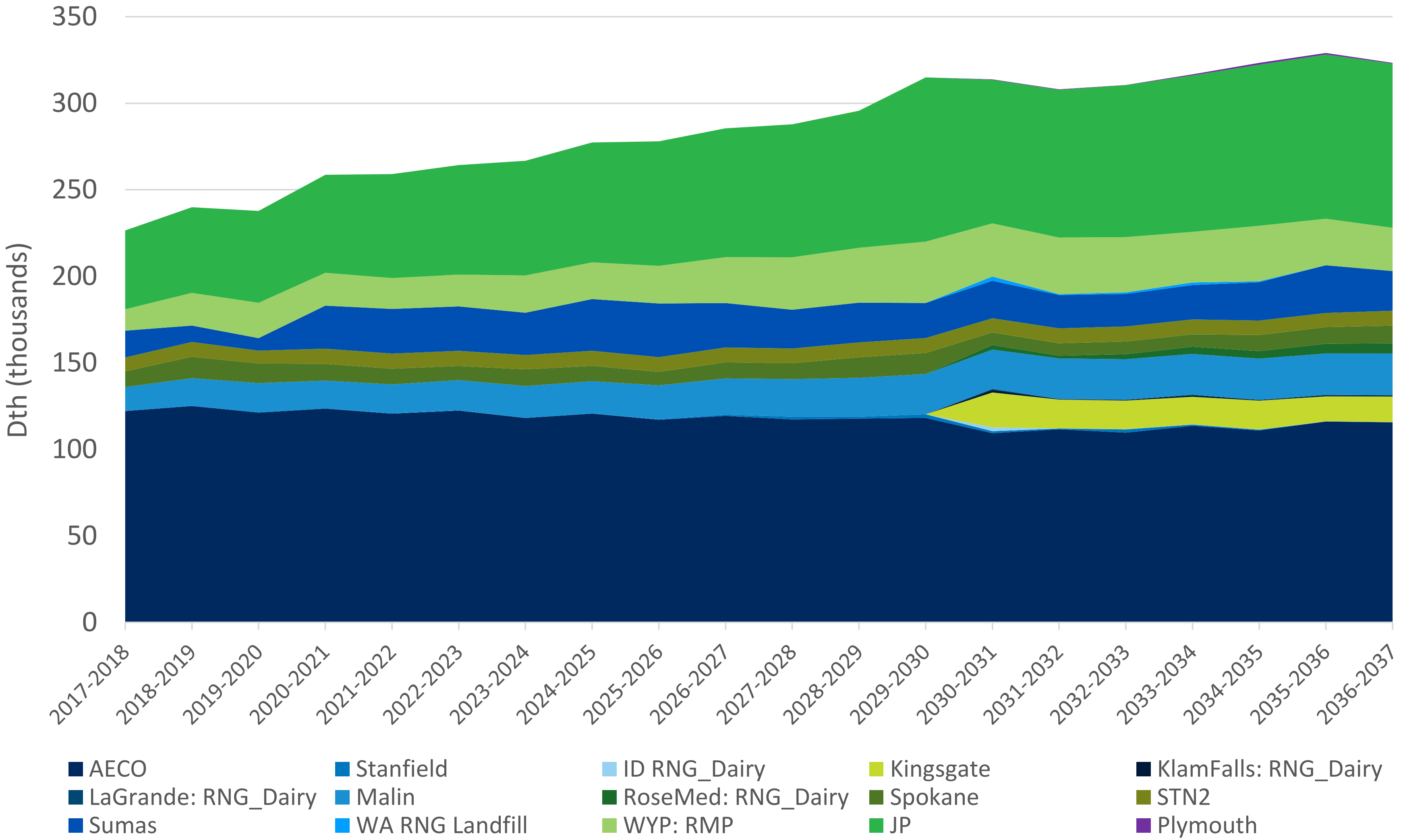
High Growth & Low Prices Variability by Month by Gas Year



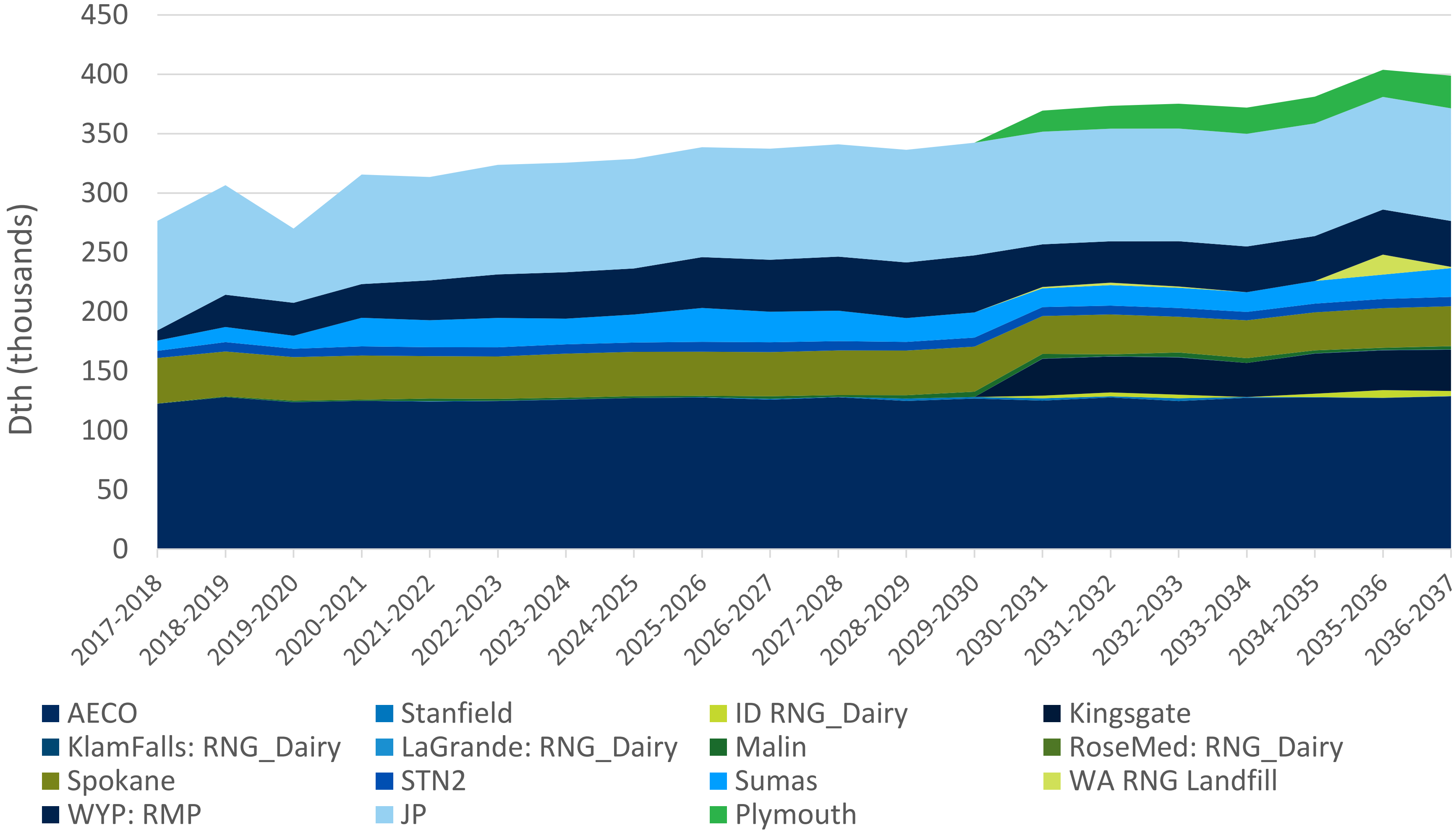
High Growth & Low Prices



Supply by source and Area December 20th



Supply by source and Area February 15th



Summary

- Plymouth, Kingsgate and RNG are selected as a solve to unserved demand
- Another 200 draw simulation of the High Growth & Low prices case will be done once final costs are provided by consultant

*This information will be provided in the draft IRP unless the TAC would like to review during an additional meeting

Key Issues / Document Discussion

IPUC

- Staff believes public participation could be further enhanced through "bill stuffers, public flyers, local media, individual invitations, and other methods."
- Result: Avista utilized it's Regional Business Managers in addition to digital communications and newsletters in all states in order to try and gain more public participation. Previous IRP's relied on website data and word of mouth.
  - eCommunity newsletter was sent out on January 15, 2018

OPUC

- Staff Recommendation No. 1
  - Staff recommends in Avista's 2018 IRP that Avista pursue an updated methodology, wherein the low/high gas price curves continue to be based on low (high) historic prices in a Monte Carlo setting, but are inflated to match the growth rate (yr/yr) of the expected price curve. The resulting curves wouid be based on historic prices and also produce symmetric .risk profiles throughout the time horizon.
  - Result: Avista updated its method as recommended by the Oregon commission. This new method deviates from the expected price by the following method:
- Pricing starts at the expected price for the first year
  - Years 2-6 the high and low price deviate +/- 6% per year from the expected price
  - Years 7-11 the high and low price deviate by +/- 3% per year from the expected price
  - Years 12 – 20 the high and low price deviate by +/- 1.5% per year from the expected price
  - By the 20 year mark the high and low deviate from the expected price by +/- 58.5%
- Staff Recommendation No. 2
  - Staff recommends that Avista forecast its number of customers using at least two different methods and to compare the accuracy of the different methods using actual data as a future task in its next IRP.
  - Result: Avista analyzed the data, but there was nothing material discovered the come up with a meaningful forecast alternative.

OPUC cont.

- Staff Recommendation No. 3
  - Avista's 2018 IRP will contain a dynamic DSM program structure in its analytics.
    - In, prior IRPs, it was a deterministic method based on Expected Case assumptions, in the 2018 IRP, each portion will have the ability to select conservation to meet unserved customer demand, Avista will explore methods to enable a dynamic analytical process for the evaluation of conservation potential within individual portfolios and will work with Energy Trust of Oregon in the development of this process and in producing any final results for its 2018 IRP for Oregon customers.
      - Result – After attempting to get dynamic dsm into the Sendout model we determined an alternate method is necessary.
      - 1 – The total dsm measures has a maximum of 999 measures. If we were to model our areas as is combined with 400 measures by area we would come up with a total need of 4400 measures.
      - 2 – If we were able to group them by dollars or efficiency levels it takes away the desired approach of measure by measure.
      - 3 – We have every bit of data both ETO and AEG can provide and the model is not acting appropriately and cannot determine a stopping point for taking a single measure. This means it would take the maximum, if cheaper than gas, to fill the entire demand. Clearly, this won't work. There are other issues with the program we will discuss during TAC 4. Another factor in this decision is the vendor does not know the dsm module and cannot provide assistance. We cannot see the code behind the application so it's all a guess as to how to input the measures.
      - 4 – The output data from ETO and AEG is very different and we need to understand it better before modeling. Avista has used AEG in some form for the past 4 IRPs so we are comfortable with it. ETO, in Oregon only, has a different model and method and is still rather foreign to us.
- Staff Recommendation No. 4
  - Staff recommends that Avista provide Staff and stakeholders with updates regarding its discussions and analysis regarding possible regional pipeline projects that may move forward.
    - Regional pipeline projects were discussed during TAC #3 meeting on March 29th, 2018. Avista does not have a shortage of resources for the 2018 Expected case. The regional pipelines take many years to place into service affording Avista the time to consider resources should they come into our territory. New pipeline builds are expensive with unofficial quotes averaging $1 / Dth.
- Staff Recommendation No. 5
  - Staff recommends that in its 2018 IRP process Avista work with Staff and stakeholders to establish and complete stochastic analysis that considers a range of alternative portfolios for comparison and consideration of both cost and risk.
    - Result – This was shown in detail and with risk and cost in TAC 4 on May 10, 2018. Potential resources were

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OPUC cont.

- Staff Recommendation No. 6
  - Environmental Considerations
    - 1. Carbon Policy including federal and state regulations, specifically those surrounding the Washington Clean Air Rule and federal Clean Power Plan;
      - Result: Carbon Policy including the Clean Power Plan and Clean Air Rule were both reviewed and included in TAC 2 Meeting materials on 2/22/2018. An indicator of where Avista's carbon reduction requirements under the CAR was also included. Since the CAR was invalidated on 12/15/2017 in Thurston County Superior Court this analysis is intended to meet the action item in addition to showing the potential impacts of similar policies.
    - 2. Weather analysis specific to Avista's service territories;
      - Result: A weather analysis was included and reviewed in TAC 2 meeting materials on 2/22/2018
    - 3. Stochastic Modeling and supply resources; and
    - 4. Updated DSM methodology including the integration of ETO

WUTC

- Include a section that discusses impacts of the Clean Air Rule (CAR).
  - In its 2018 IRP expected case, Avista should model specific CAR impacts as well as consider the costs and risk of additional environmental regulations, including a possible carbon tax.
  - Result:
    - Carbon Policy including the Clean Power Plan and Clean Air Rule were both reviewed and included in TAC 2 Meeting materials on 2/22/2018. An indicator of where Avista's carbon reduction requirements under the CAR was also included. Since the CAR was invalidated on 12/15/2017 in Thurston County Superior Court this analysis is intended to meet the action item in addition to showing the potential impacts of similar policies.
    - For the 2018 IRP Avista is utilizing SB6203 from the WA Senate energy committee on Feb. 1 as a proxy of a possible carbon tax in Washington State.

WUTC

- Provide more detail on the company's natural gas hedging strategy, including information on upper and lower pricing points, transactions with counterparties, and how diversification of the portfolio is achieved.
  - Avista's natural gas hedging strategy was discussed during the TAC 2 Meeting on 2/22/2018. The upper and lower pricing points in Avista's programmatic hedges is controlled by taking into consideration the volatility over the past year for the specific hedging period. This volatility is weighted toward the more recent volatility. The window length and quantity of windows is also a part of the equation. Avista transacts on ICE with counterparties meeting our credit rating criteria. The diversification of the portfolio is achieved through the following methods:
  - **Components:** The plan utilizes a mix of index, fixed price, and storage transactions.
  - **Transaction Dates:** Hedge windows are developed to distribute the transactions throughout the plan.
  - **Supply Basins:** Plan to primarily utilize AECO, execute at lowest price basis at the time.
  - **Delivery Periods:** Hedges are completed in annual and/or seasonal timeframes. Long-term hedges may be executed.

WUTC cont.

- Ensure that the entity performing the CPA evaluates and includes the following information:
  - All conservation measures excluded from the CPA, including those excluded prior to technical potential determination
  - The rationale for excluding any measure
  - A description of Unit Energy Savings (UES) for each measure included in the CPA, specifying how it was derived and the source of the data
  - The rationale for any difference in economic and achievable potential savings, including how the Company is working towards an achievable target of 85 percent of economic potential savings.
  - A description of all efforts to create a fully-balanced cost effectiveness metric within the planning horizon based on the TRC.

WUTC cont.

- Discuss with the TAC:
  - The results of Northwest Energy Efficiency Alliance (NEEA) coordination, including non-energy benefits to include in the CPA.
  - The appropriateness of listing and mapping all prospective distribution system enhancement projects planned on the 20 year horizon, and comparing actual projects completed to prospective projects listed in previous IRP's.
- Provide a rationale for any difference in economic and achievable potential savings

2017 – 2018 Avista's Action Plan

- The price of natural gas has dropped significantly since the 2014 IRP. This is primarily due to the amount of economically extractable natural gas in shale formations, more efficient drilling techniques, and warmer than normal weather. Wells have been drilled, but left uncompleted due to the poor market economics. This is depressing natural gas prices and forcing many oil and natural gas companies into bankruptcy. Due to historically low prices Avista will research market opportunities including procuring a derivative based contract, 10-year forward strip, and natural gas reserves.
  - Result: After exploring the opportunity of some type of reserves ownership, it was determined the price as compared to risk of ownership was inappropriate to go forward with at this time. As an ongoing aspect of managing the business, Avista will continue to look for opportunities to help stabilize rates and/or reduce risk to our customers.
- Monitor actual demand for accelerated growth to address resource deficiencies arising from exposure to "flat demand" risk. This will include providing Commission Staff with IRP demand forecast-to-actual variance analysis on customer growth and use-per-customer at least bi-annually.
  - Result: actual demand was closely tracked and shared with Commissions in semi-annual or quarterly meetings.

Avista’s 2020 IRP Action Plan

- Avista’s 2020 IRP will contain a dynamic DSM program structure in its analytics. In prior IRP’s, it was a deterministic method based on based on Expected Case assumptions. In the 2020 IRP, each portfolio will have the ability to select conservation to meet unserved customer demand. Avista will explore methods to enable a dynamic analytical process for the evaluation of conservation potential within individual portfolios.
- Work with Staff to get clarification on types of natural gas distribution system analyses for possible inclusion in the 2020 IRP
- Work with Staff to clarify types of distribution system costs for possible inclusion in our avoided cost calculation

Highlights of the 2018 IRP

- No resource needs in the Expected Case
- Higher long term customer growth rates
- Increased DSM potential and resultant avoided costs
- Carbon costs broken out by jurisdiction
  - Higher for WA and OR as compared to the 2016 IRP
- Washington and Idaho separated in Sendout
- Lower use per customer

2018 IRP Timeline

- **August 31, 2017** – Work Plan filed with WUTC
- **January through May 2018** – Technical Advisory Committee meetings. Meeting topics will include:
  - **TAC 1: Thursday, January 25, 2018: TAC meeting expectations, review of 2016 IRP acknowledgement letters, customer forecast, and demand-side management (DSM) update.**
  - **TAC 2: Thursday, February 22, 2018: Weather analysis, environmental policies, market dynamics, price forecasts, cost of carbon.**
  - **TAC 3: Thursday, March 29, 2018 :** Distribution, supply-side resources overview, overview of the major interstate pipelines, RNG overview and future potential resources.
  - **TAC 4: Thursday, May 10, 2018:** DSM results, stochastic modeling and supply-side options, final portfolio results, and 2020 Action Items.
  - **June 21, 2018–** TAC final review meeting to review final stochastics (if necessary)
- **July 2, 2018 –** Draft of IRP document to TAC
- **July 13, 2018 –** Comments on draft due back to Avista
- **August 31, 2018 –** File finalized IRP document