2021 Electric Integrated Resource Plan

Technical Advisory Committee Meeting No. 2 Agenda

Thursday, August 6, 2020
Virtual Meeting- 9:00 AM PST

Topic	Time	Staff
Introductions & IRP Process Updates	9:00	Lyons
Natural Gas & RNG Market Overview	9:30	Pardee
Break	10:45	
Natural Gas Price Forecast	11:00	Brutocao
Lunch	11:30	
Upstream Natural Gas Emissions	12:30	Pardee
Break	1:30	
Regional Energy Policy Update	1:45	Lyons
Natural Gas and Electric Coordinated Study	2:15	Gall/Pardee
Highly Impacted & Vulnerable Populations Baseline Analysis	3:00	Gall
Adjourn	3:45	

2021 Electric and Natural Gas IRPs TAC Introductions and IRP Process Updates

John Lyons, Ph.D.

Second Technical Advisory Committee Meeting

August 6, 2020

Updated Meeting Guidelines

- Gas and electric IRP teams working remotely, but still available by email and phone for questions and comments
- Some processes are taking longer remotely
- Virtual IRP meetings until back in the office and able to hold large group meetings
- TAC presentations, notes, work plans and past IRPs are posted on joint IRP page for gas and electric: https://www.myavista.com/about-us/integrated-resource-planning

Virtual TAC Meeting Reminders

- Please mute mics unless speaking or asking a question
- Use the Skype chat box to write questions or comments or let us know you would like to say something
- Respect the pause
- Please try not to speak over the presenter or a speaker who is voicing a question or thought
- Remember to state your name before speaking for the note taker
- This is a public advisory meeting – presentations and comments will be recorded and documented

Integrated Resource Planning

- Required by Idaho, Oregon and Washington* every other year
- Guides resource strategy over the next twenty + years
- Current and projected load & resource position
- Resource strategies under different future policies
  - Resource choices
  - Conservation measures and programs
  - Transmission and distribution integration for electric
  - Gas distribution planning
  - Gas and electric market price forecasts
- Scenarios for uncertain future events and issues
- Key dates for modeling and IRP development are available in the Work Plans

Technical Advisory Committee

- The public process piece of the IRP – input on what to study, how to study, and review of assumptions and results

- Wide range of participants involved in all or parts of the process
  - Ask questions
  - Help with soliciting new members

- Open forum while balancing need to get through all of the topics

- Welcome requests for studies or different assumptions.
  - Time or resources may limit the number or type of studies
  - Earlier study requests allow us to be more accommodating
  - **August 1, 2020** was the electric study request deadline

- Planning teams are available by email or phone for questions or comments between the TAC meetings

2020 Electric IRP Meetings – IPUC

- AVU-E-19-01 https://puc.idaho.gov/case/Details/3633
- Telephonic public hearing on August 5, 2020
- August 19, 2020 comment deadline, September 2, 2020 response
- Overview of topics discussed at July 9, 2020 virtual public workshop:
  - Moving away from coal
  - Cost impacts for Idaho customers from Washington laws
  - IRP procedural questions about acknowledgment of the IRP
  - Climate change questions and timing of actions
  - Colstrip: decommissioning, other owners, cost sharing with Washington
  - Consideration of social costs/externalities and public health
  - Support for clean energy and Commission authority to require it
  - Resource timing
  - Risks considered in the IRP: economic, qualitative and climate
  - Idaho versus Montana wind locations
  - Maintaining Idaho RECs
  - Climate change law applicability and lawsuits

2021 Natural Gas IRP TAC Schedule

- TAC 1: Wednesday, June 17, 2020
- **TAC 2: Thursday, August 6, 2020 (Joint with Electric TAC)**
- TAC 3: Wednesday, September 30, 2020
- TAC 4: Wednesday, November 18, 2020
- TAC 5: February 2021 – TAC final review meeting if necessary
- Natural Gas TAC agendas, presentations and meeting minutes available at: https://myavista.com/about-us/integrated-resource-planning

2021 Electric IRP TAC Schedule

- TAC 1: Thursday, June 18, 2020
- **TAC 2: Thursday, August 6, 2020 (Joint with Natural Gas TAC)**
- Economic and Load Forecast, August 2020
- TAC 3: Tuesday, September 29, 2020
- TAC 4: Tuesday, November 17, 2020
- TAC 5: Thursday, January 21, 2021
- Public Outreach Meeting: February 2021
- TAC agendas, presentations and meeting minutes available at: https://myavista.com/about-us/integrated-resource-planning

Process Updates

Economic and load forecast delay

- Special meeting 1:00 – 3:30 pm PST on Tuesday, August 18 or Wednesday, August 19, 2020 to cover the forecasts

AEG Conservation Potential Assessment and Demand Response Studies – delayed from TAC 2

- AEG has developed baseline assumptions, market profiles and energy/gas use per customer
- Market data has been collected and compiled
- Measure Assumption development is complete
- Compiled 2021 Power Plan Assumptions
- Measure List is in-process and is expected to be available mid-September
- CPA discussion with TAC – September TAC meeting.

Today's TAC Agenda

9:00 – Introductions & IRP Process Updates, Lyons

9:30 – Natural Gas & RNG Market Overview, Pardee

10:45 – Break

11:00 – Natural Gas Price Forecast, Brutocao

11:30 – Lunch

12:30 – Upstream Natural Gas Emissions, Pardee

1:30 – Break

1:45 – Regional Energy Policy Update, Lyons

2:15 – Natural Gas and Electric Coordinated Study, Gall/Pardee

3:00 – Highly Impacted & Vulnerable Populations Baseline Analysis, Gall

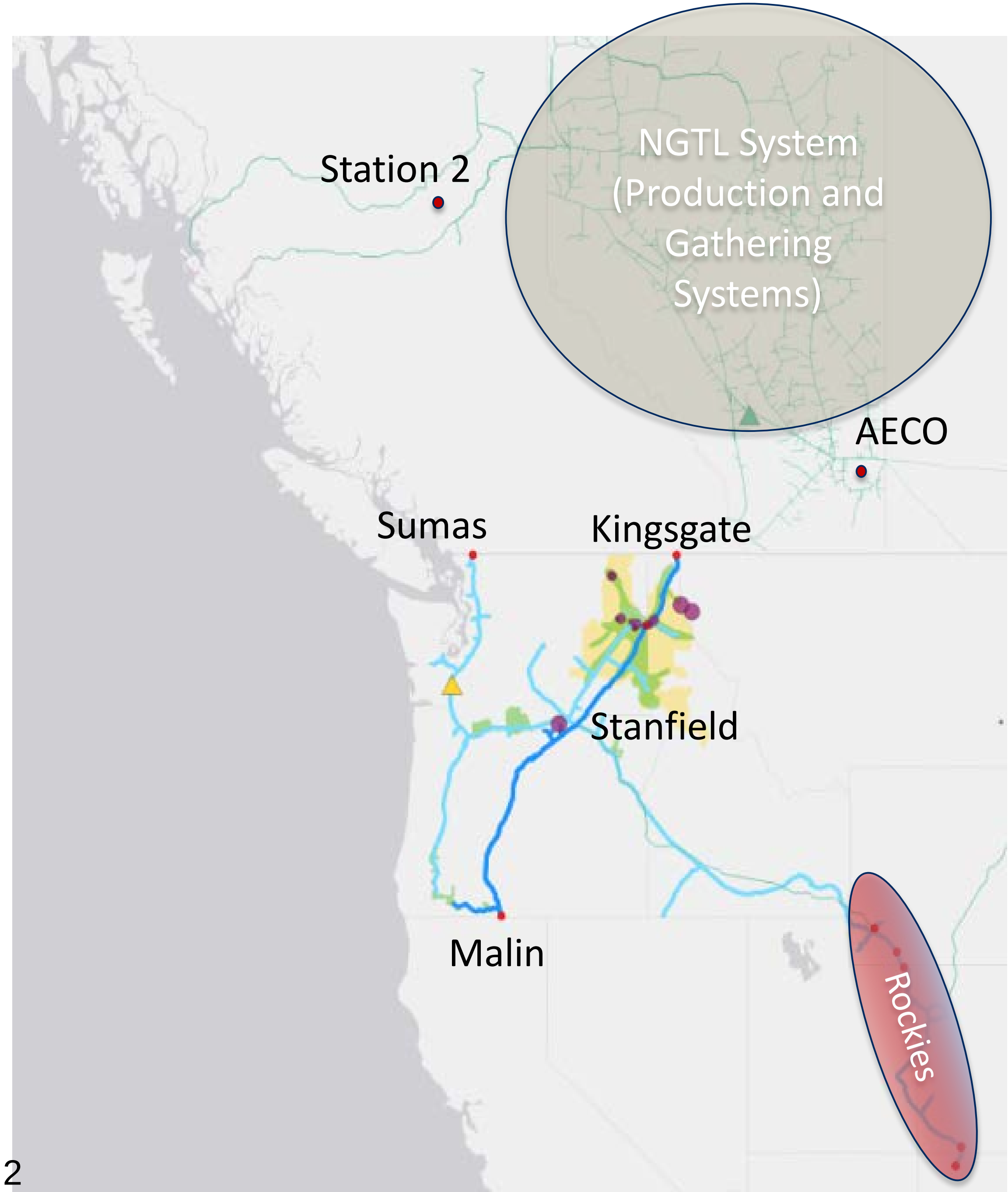
3:45 – Adjourn

Natural Gas Market Overview

Tom Pardee, Natural Gas Planning Manager
Second Technical Advisory Committee Meeting
August 6, 2020

Units

	Common Gas Units		
	1 Bcf	1 Dth	1 Therm
kWh	302,062,888	293.001	29.300
MWh	302,063	0.293	0.029



Avista Electric Territory

Avista Natural Gas Territory

Electric Power Plants

Gas Transmission Network

Northwest Pipeline

Receipt Point

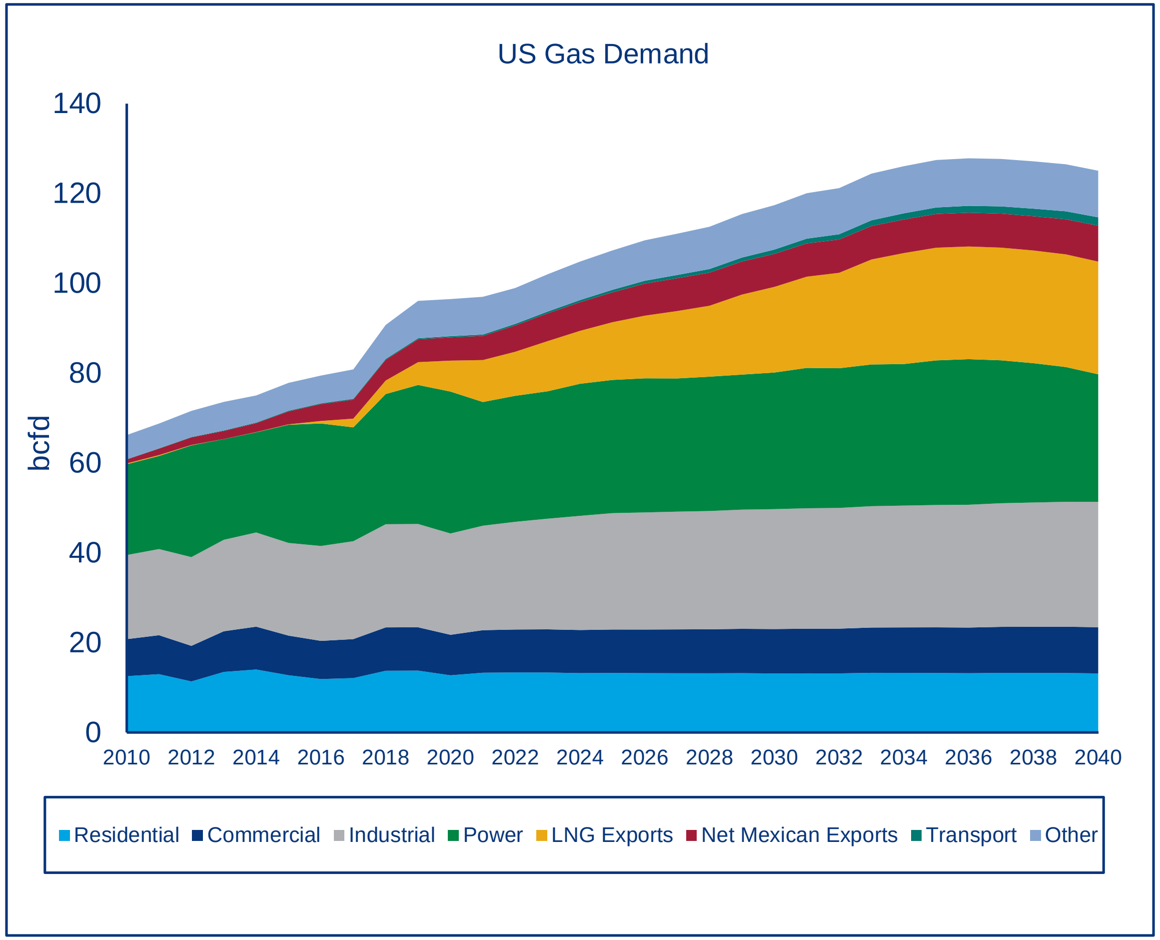
Jackson Prairie Storage (LDC Owned)

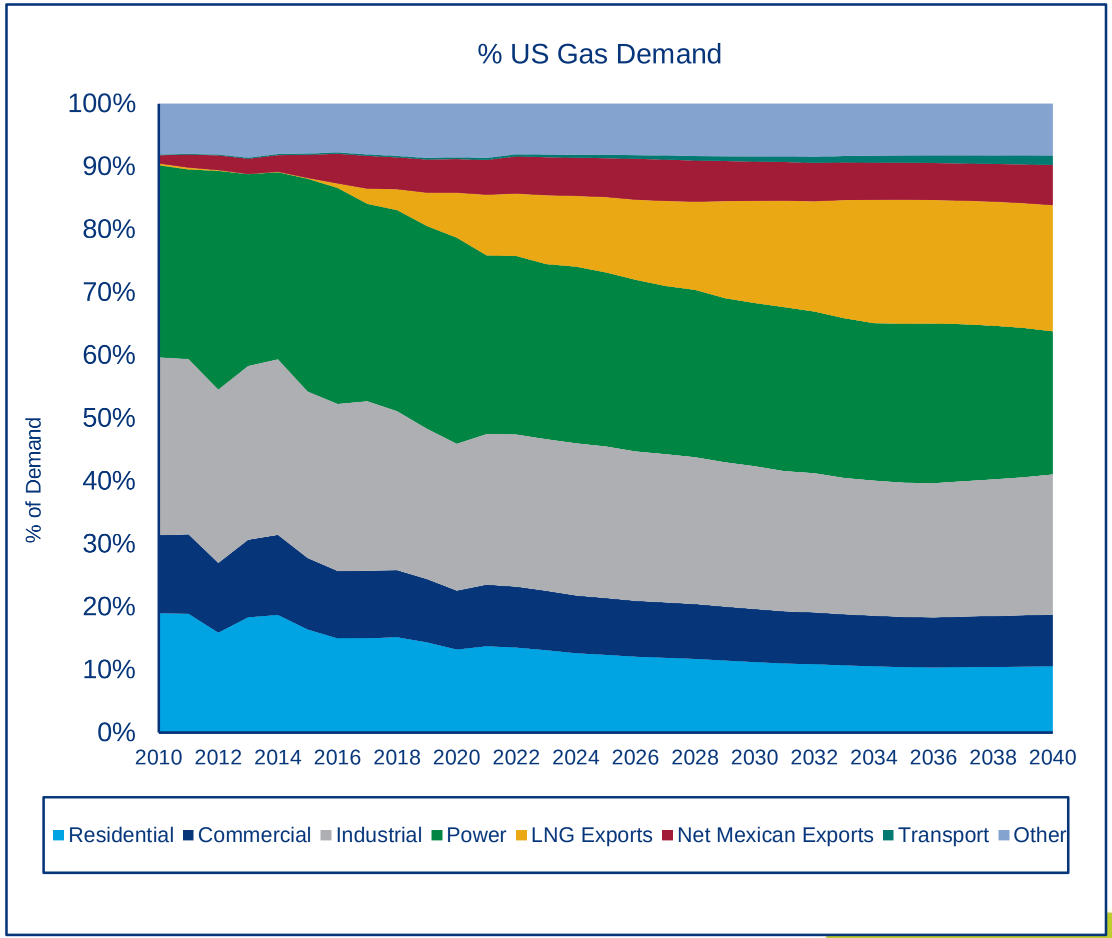
Avista's Supply

- Natural Gas LDC Side
  - 10% contracted from US supply basins
  - 90% contracted from Canadian supply basins

- Electric Side
  - 100% contracted from Canadian supply basins

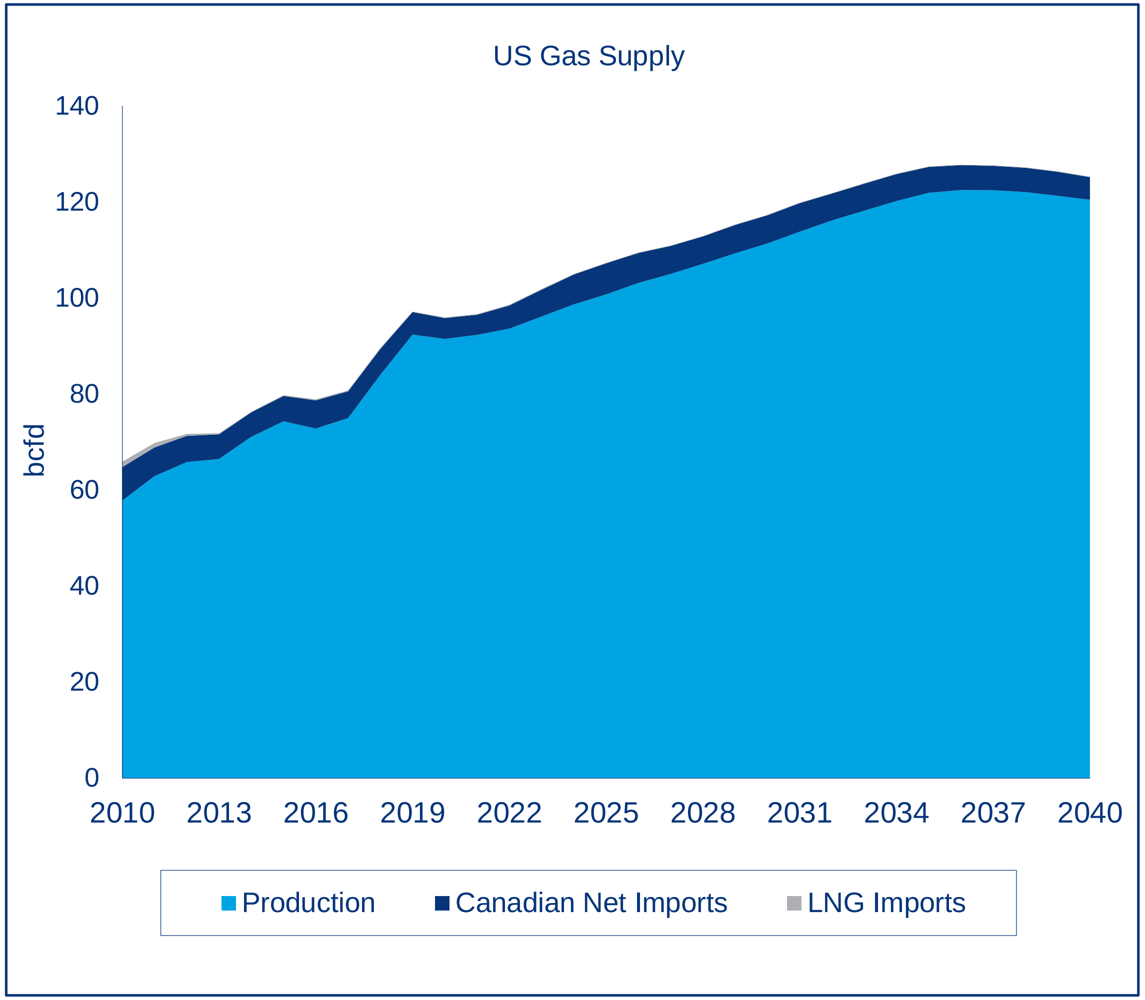
US Demand

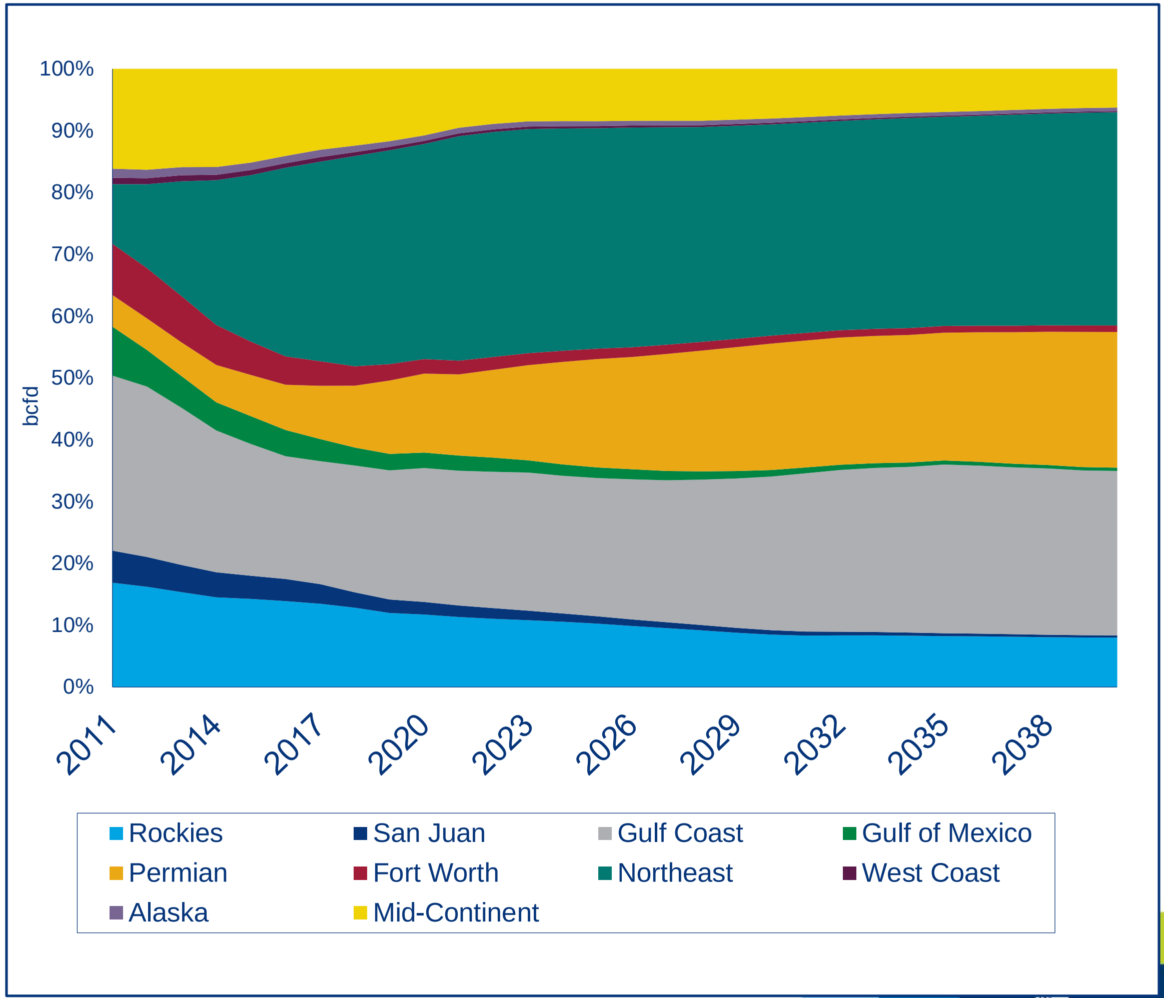




Source: Wood Mackenzie

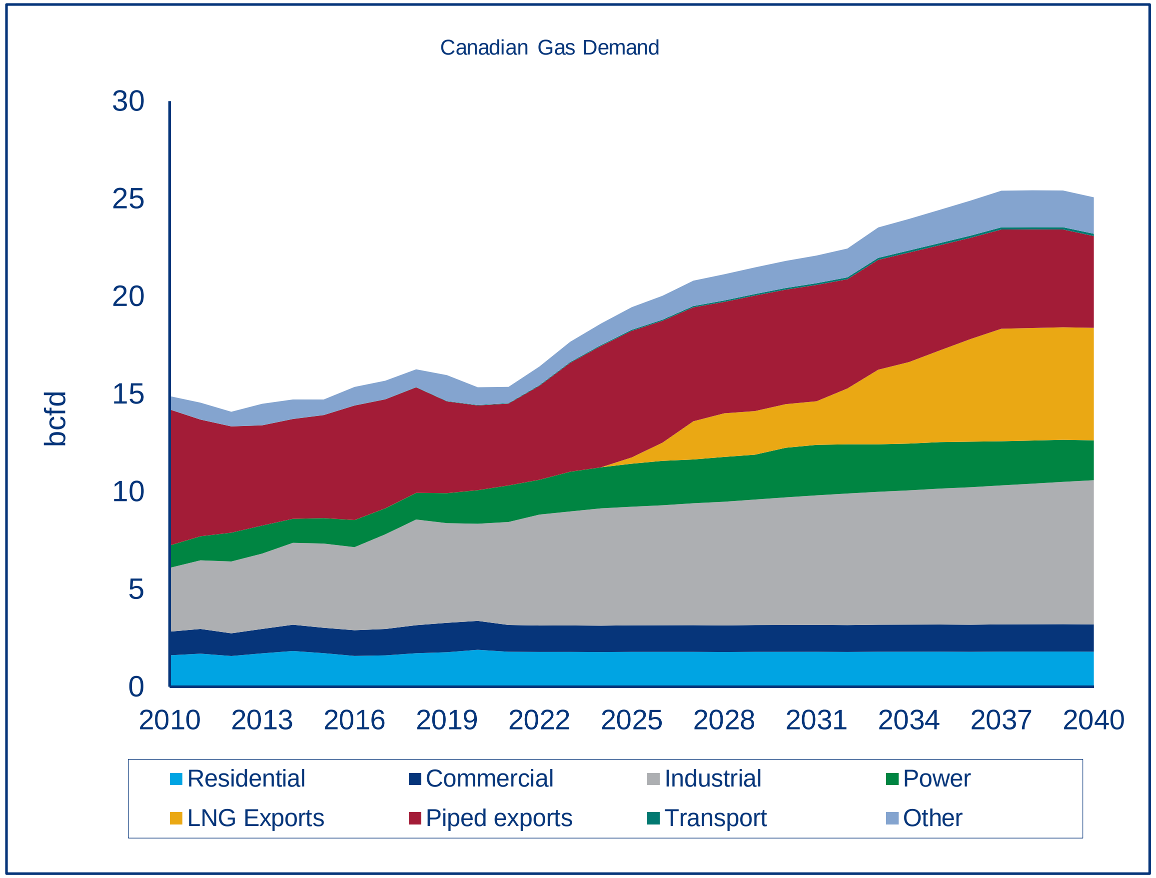
US Supply

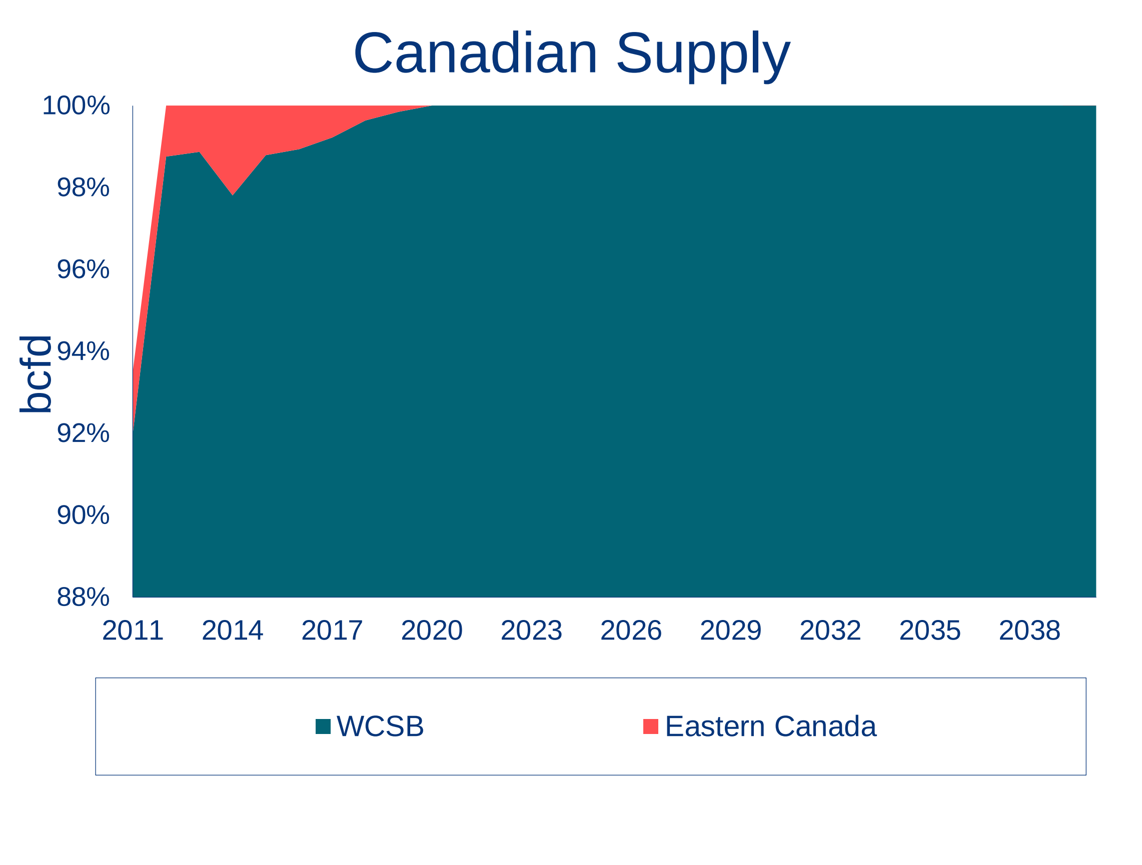




Source: Wood Mackenzie

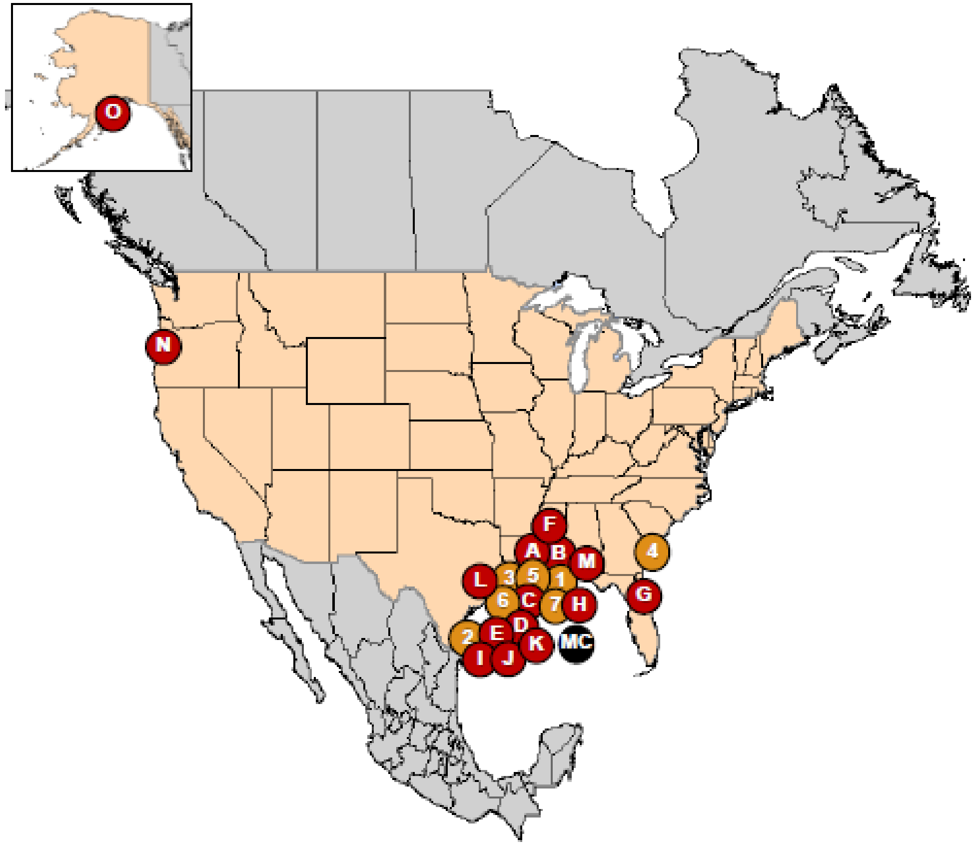
Canadian Supply and Demand





Source: Wood Mackenzie

North American LNG Export Terminals
Approved, Not Yet Built



U.S. Jurisdiction & Status

- FERC - Approved, Under Construction
- FERC - Approved, Not Under Construction
- MARAD / U.S. Coast Guard

Export Terminals

UNITED STATES

APPROVED - UNDER CONSTRUCTION - FERC

1. **Hackberry, LA:** .71 Bcfd (Sempra–Cameron LNG Train 3) (CP13-25)
2. **Corpus Christi, TX:** 0.72 Bcfd (Cheniere–Corpus Christi LNG Train 2) (CP12-507)
3. **Sabine Pass, LA:** 0.7 Bcfd Train 6 (Sabine Pass Liquefaction) (CP13-552)
4. **Elba Island, GA:** 140 MMcfd (Southern LNG Company Units 7-10) (CP14-103)
5. **Cameron Parish, LA:** 1.41 Bcfd (Venture Global Calcasieu Pass) (CP15-550)
6. **Sabine Pass, TX:** 2.1 Bcfd (ExxonMobil – Golden Pass) (CP14-517)
7. **Calcasieu Parish, LA:** 4.0 Bcfd (Driftwood LNG) (CP17-117)

APPROVED – NOT UNDER CONSTRUCTION - FERC

A. **Lake Charles, LA:** 2.2 Bcfd (Lake Charles LNG) (CP14-120)
B. **Lake Charles, LA:** 1.08 Bcfd (Magnolia LNG) (CP14-347)
C. **Hackberry, LA:** 1.41 Bcfd (Sempra - Cameron LNG Trains 4 & 5) (CP15-560)
D. **Port Arthur, TX:** 1.86 Bcfd (Port Arthur LNG Trains 1 & 2) (CP17-20)
E. **Freeport, TX:** 0.72 Bcfd (Freeport LNG Dev Train 4) (CP17-470)
F. **Pascagoula, MS:** 1.5 Bcfd (Gulf LNG Liquefaction) (CP15-521)
G. **Jacksonville, FL:** 0.132 Bcf/d (Eagle LNG Partners) (CP17-41)
H. **Plaquemines Parish, LA:** 3.40 Bcfd (Venture Global LNG) (CP17-66)
I. **Brownsville, TX:** 0.55 Bcfd (Texas LNG Brownsville) (CP16-116)
J. **Brownsville, TX:** 3.6 Bcfd (Rio Grande LNG – NextDecade) (CP16-454)
K. **Brownsville, TX:** 0.9 Bcfd (Annova LNG Brownsville) (CP16-480)
L. **Corpus Christi, TX:** 1.86 Bcfd (Cheniere Corpus Christi LNG) (CP18-512)
M. **Sabine Pass, LA:** NA Bcfd (Sabine Pass Liquefaction) (CP19-11)
N. **Coos Bay, OR:** 1.08 Bcfd (Jordan Cove) (CP17-494)
O. **Nikiski, AK:** 2.63 Bcfd (Alaska Gasline) (CP17-178)

APPROVED – NOT UNDER CONSTRUCTION – MARAD/Coast Guard

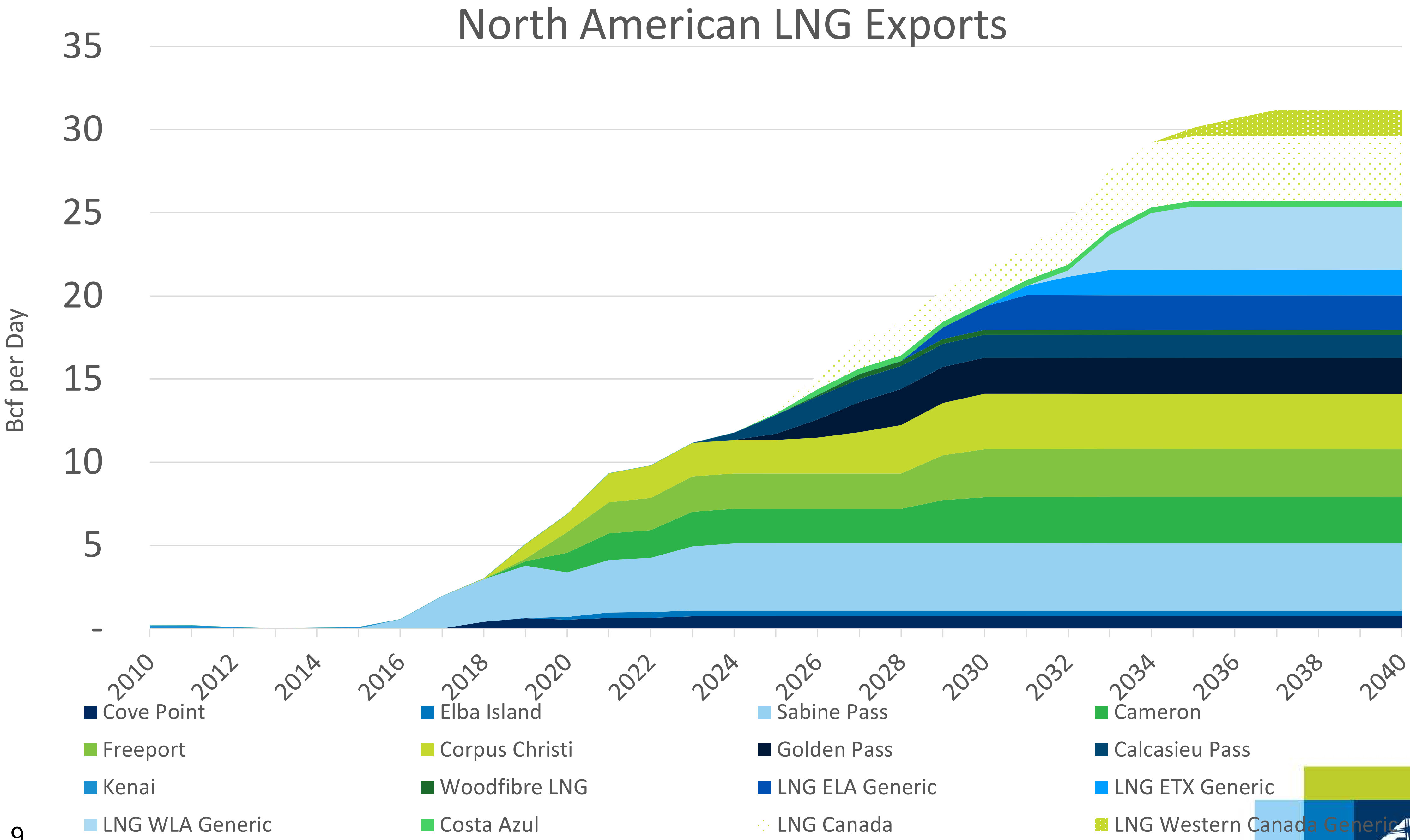
MC. **Gulf of Mexico:** 1.8 Bcfd (Delfin LNG)

CANADA

For Canadian LNG Import and Proposed Export Facilities:

https://www.nrcan.gc.ca/energy/natural-gas/5683

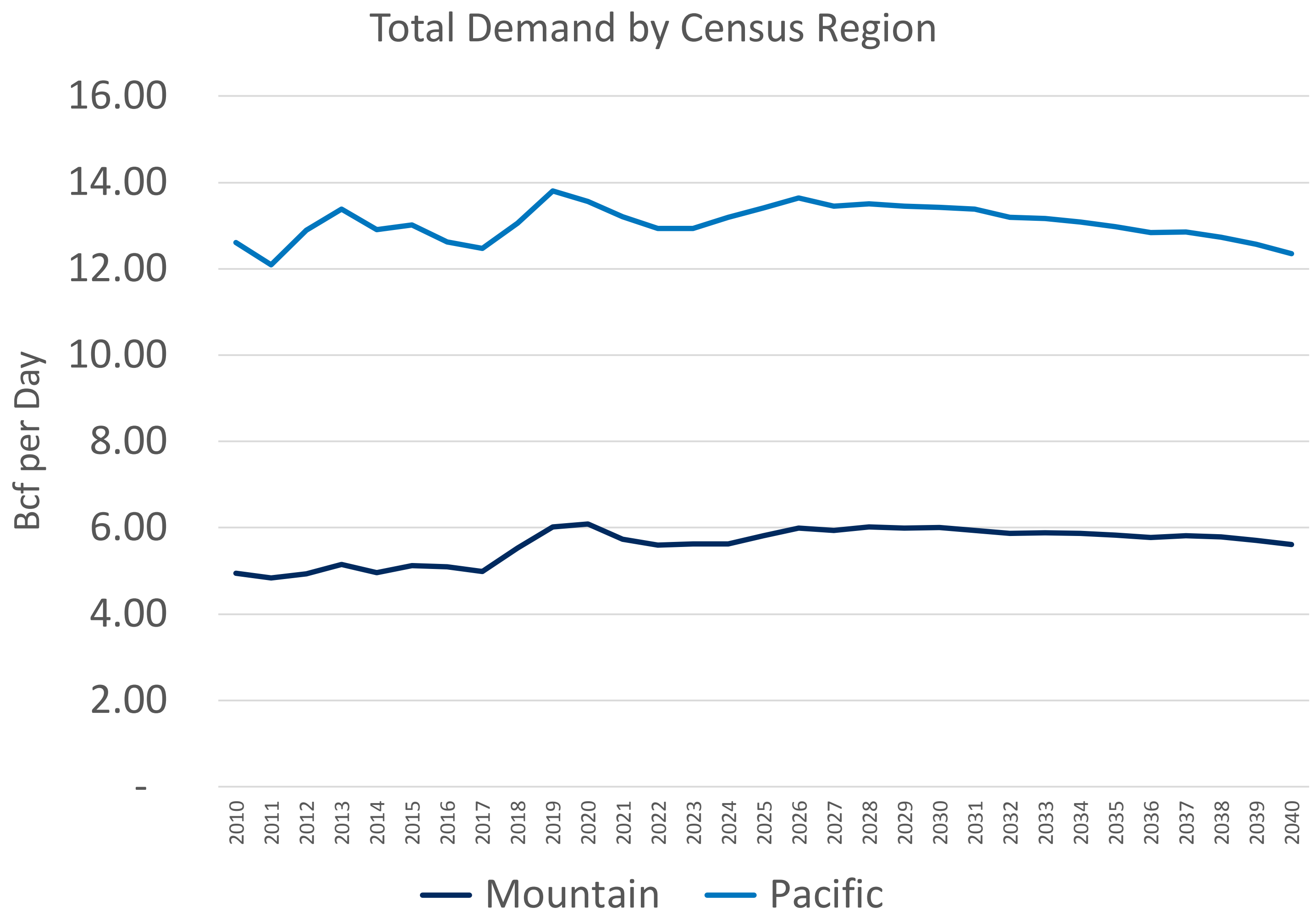
As of May 29, 2020



*WM does not assume Jordan Cove will enter service within forecasted period

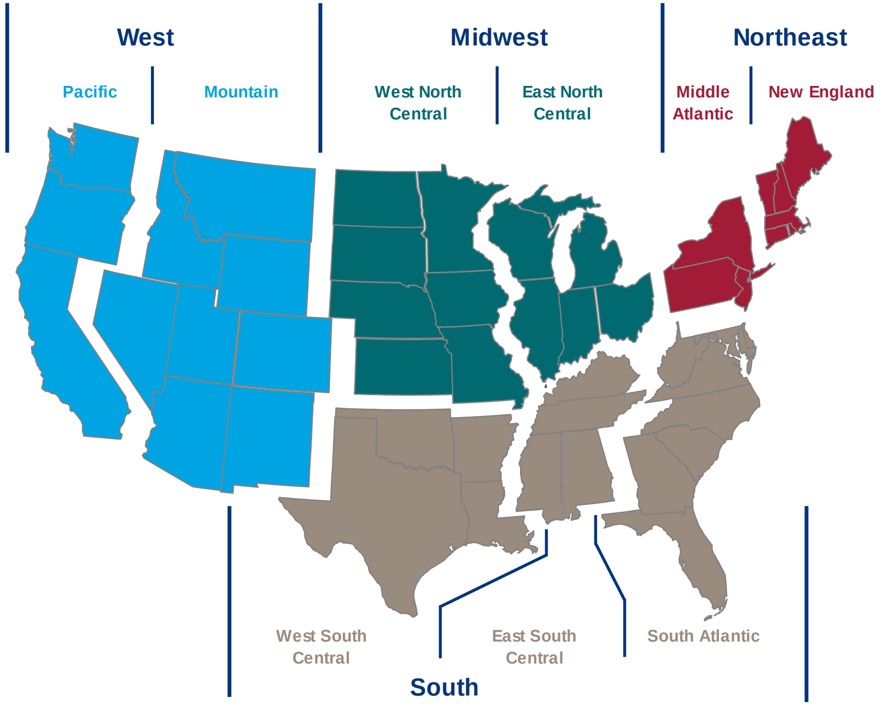
Source: Wood Mackenzie

West



Wood Mackenzie
North America Natural Gas Long-Term View
2020 H1

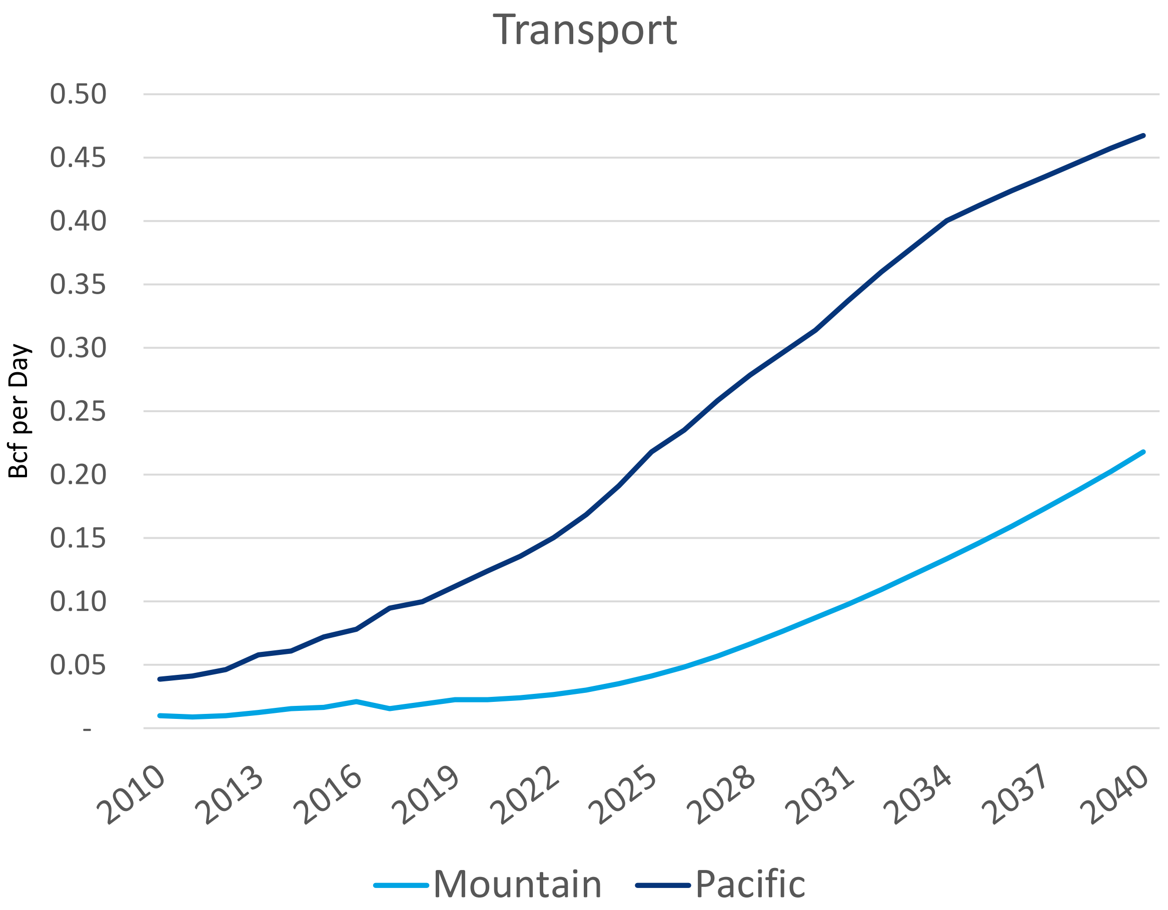
Census Region Map

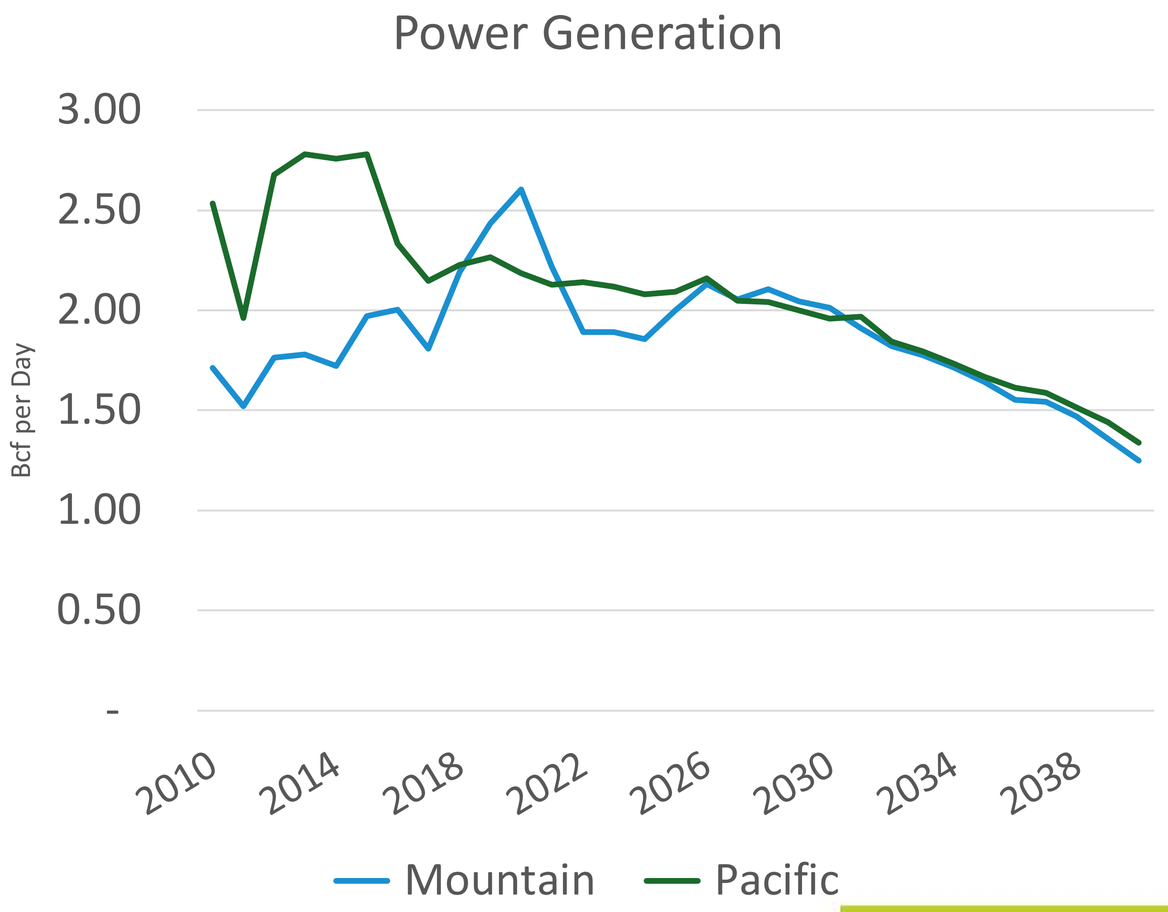


Note: Pacific does not include Alaska or Hawaii

Source: Wood Mackenzie

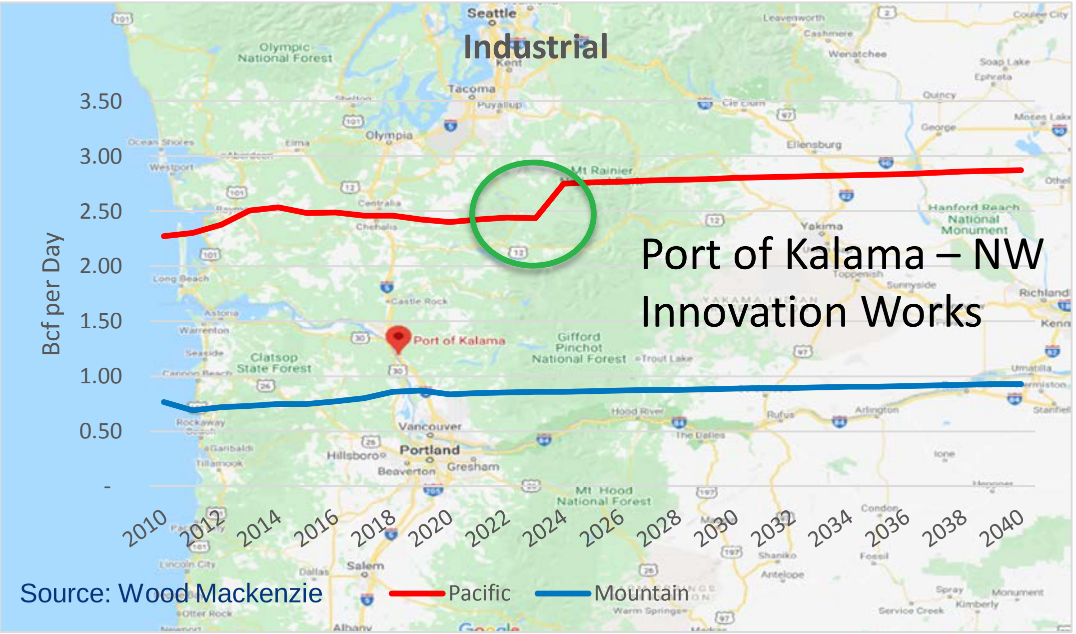
Power Generation and Transport demand

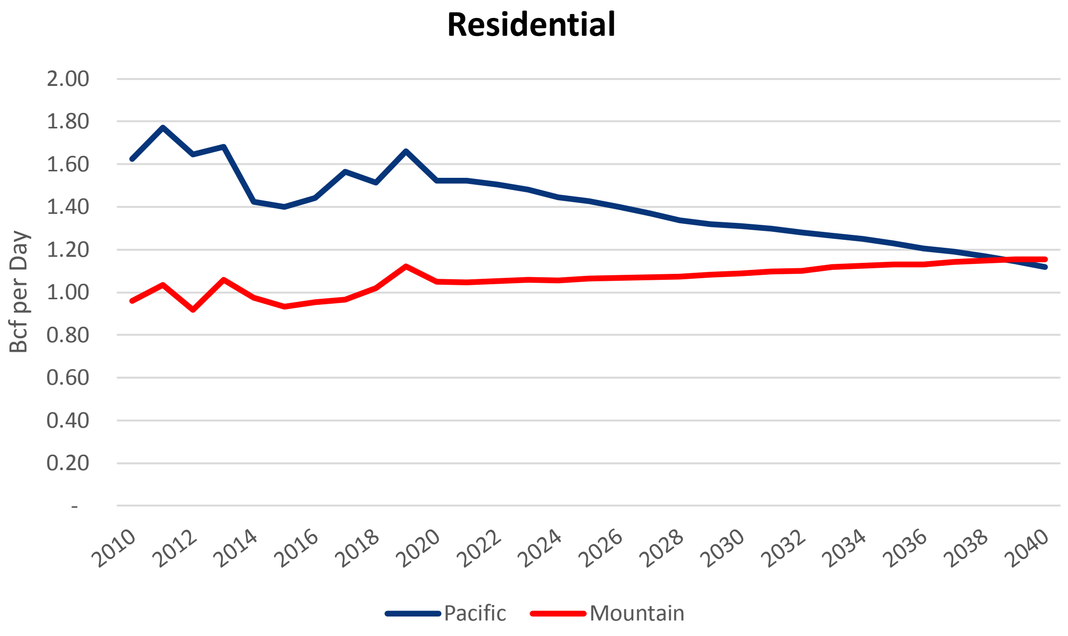


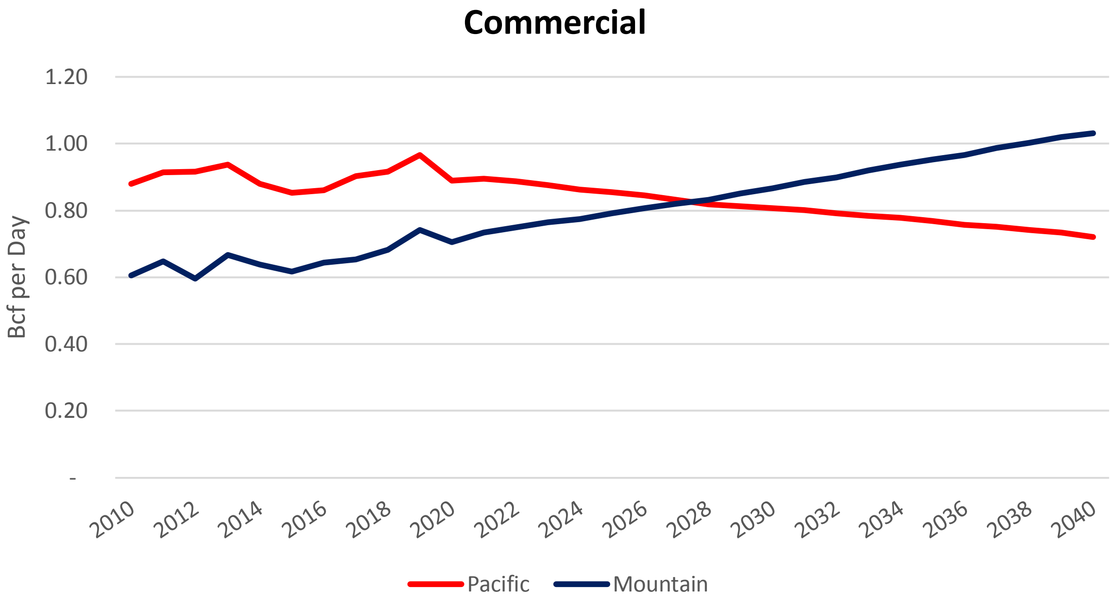


Source: Wood Mackenzie

West demand of Res-Com-Ind







Source: Wood Mackenzie

Wood Mackenzie Disclaimer

- The foregoing [chart/graph/table/information] was obtained from the [North America Gas Service]™, a product of Wood Mackenzie."
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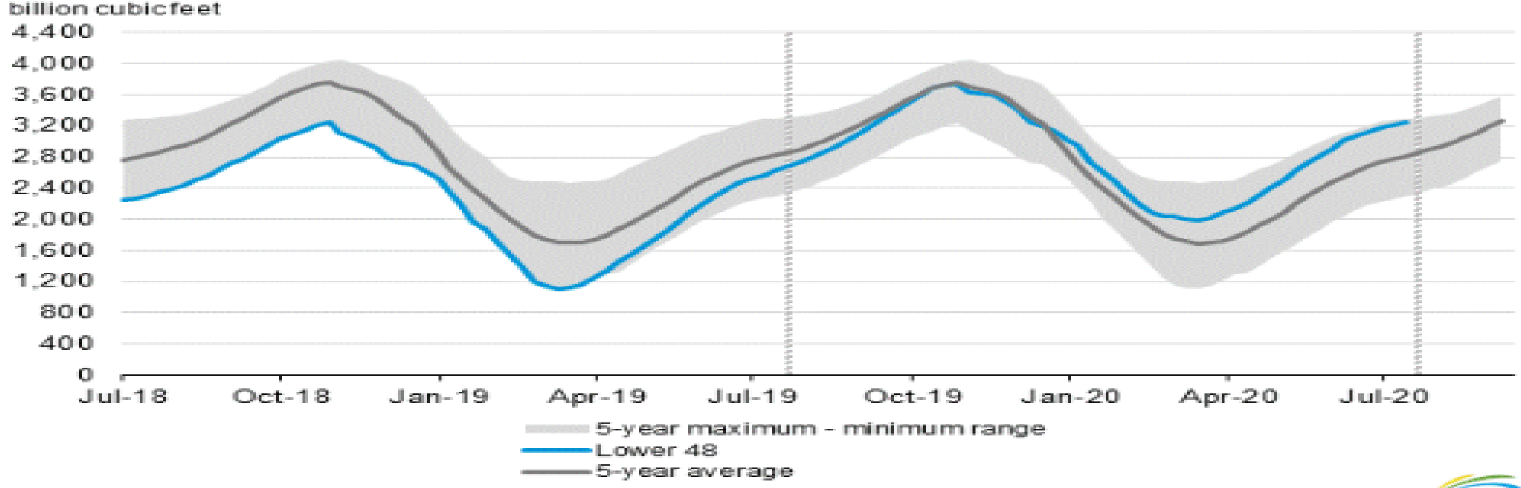
Us Natural Gas Storage

	Stocks billion cubic feet (Bcf)				Historical Comparisons: Year ago (07/24/19)		Historical Comparisons: 5-year average (2015-19)	
Region	07/24/20	07/17/20	net change	implied flow	Bcf	% change	Bcf	% change
East	706	693	13	13	591	19.5	626	12.8
Midwest	815	799	16	16	669	21.8	687	18.6
Mountain	196	190	6	6	155	26.5	176	11.4
Pacific	313	311	2	2	270	15.9	295	6.1
South Central	1,211	1,221	-10	-10	930	30.2	1,028	17.8
Salt	339	349	-10	-10	227	49.3	274	23.7
Nonsalt	872	872	0	0	703	24.0	754	15.6
Total	**3,241**	**3,215**	**26**	**26**	**2,615**	**23.9**	**2,812**	**15.3**

Totals may not equal sum of components because of independent rounding.

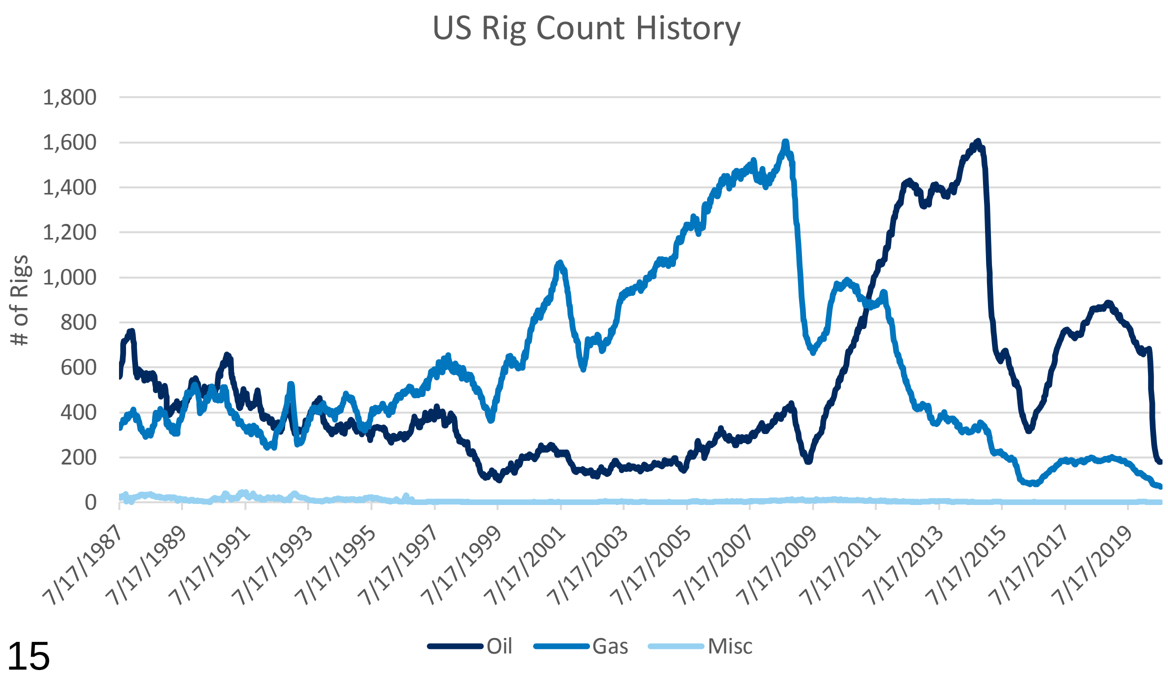
Working gas in underground storage compared with the 5-year maximum and minimum

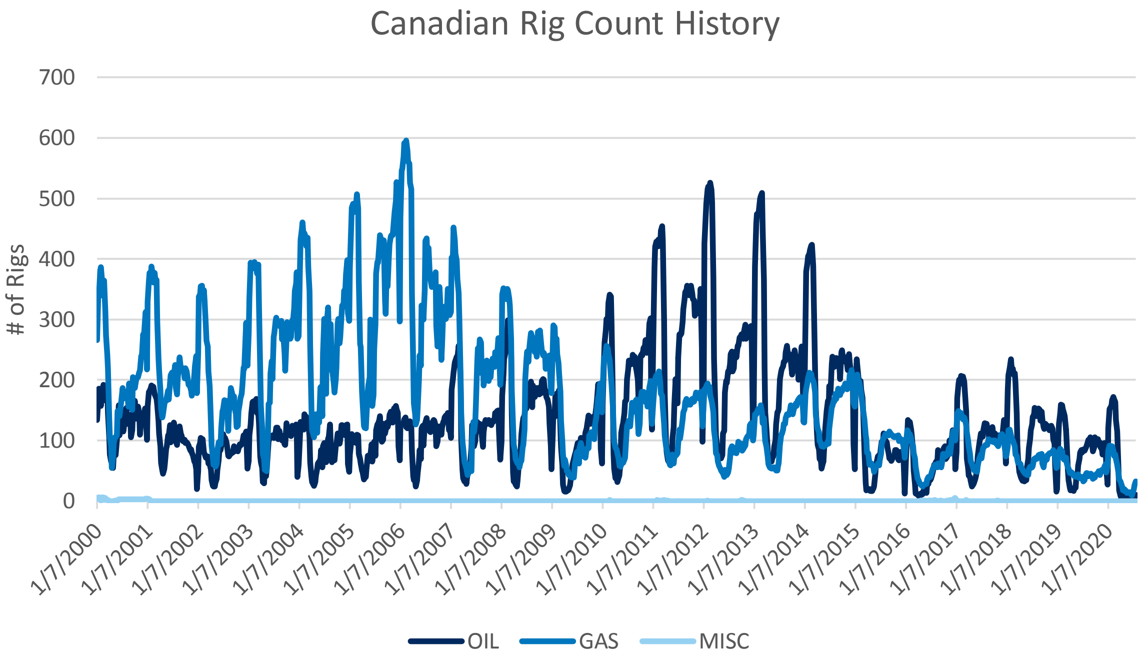


Source: U.S. Energy Information Administration

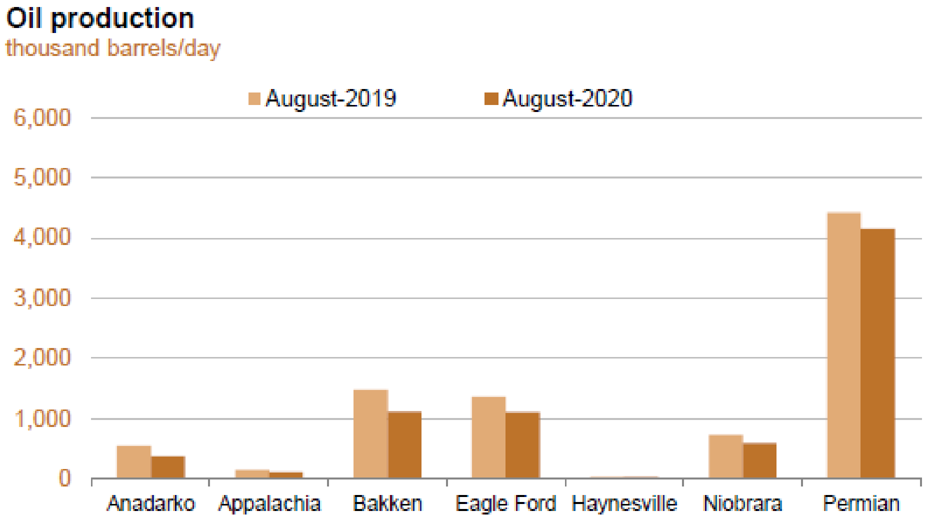
Rig Counts

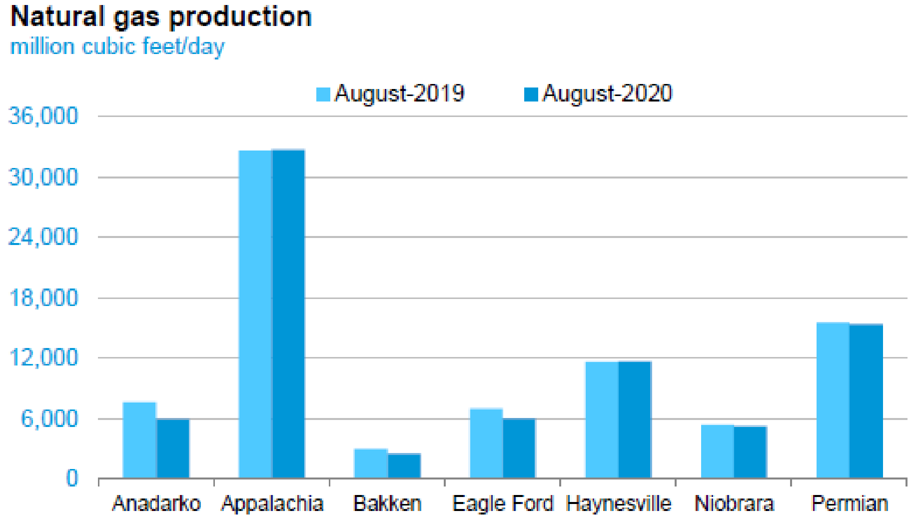
Area	Last Count	Count	Change from Prior Count	Date of Prior Count	Change from Last Year	Date of Last Year's Count
U.S.	24 July 2020	251	-2	17 July 2020	-695	26 July 2019
Canada	24 July 2020	42	+10	17 July 2020	-85	26 July 2019
International	June 2020	781	-24	May 2020	-357	June 2019

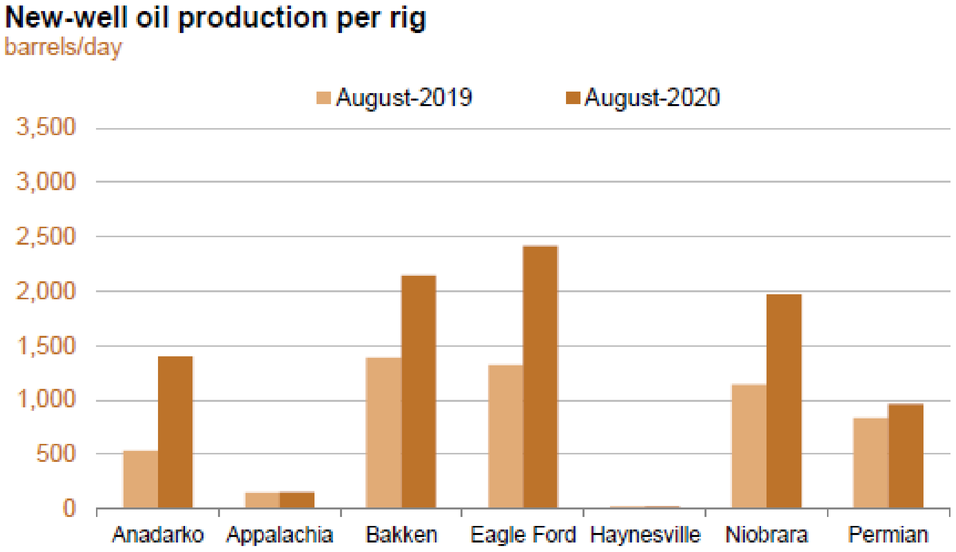


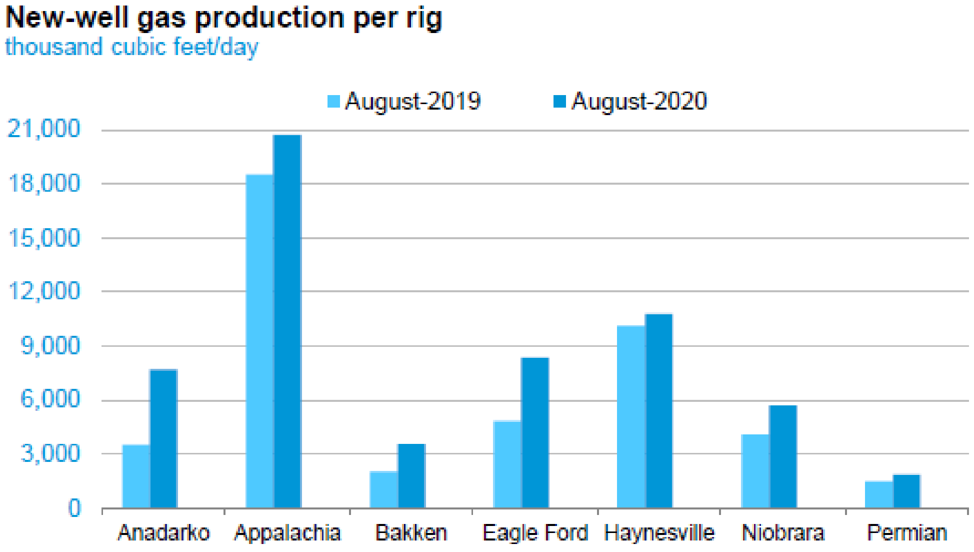


Production and Drilling efficiency

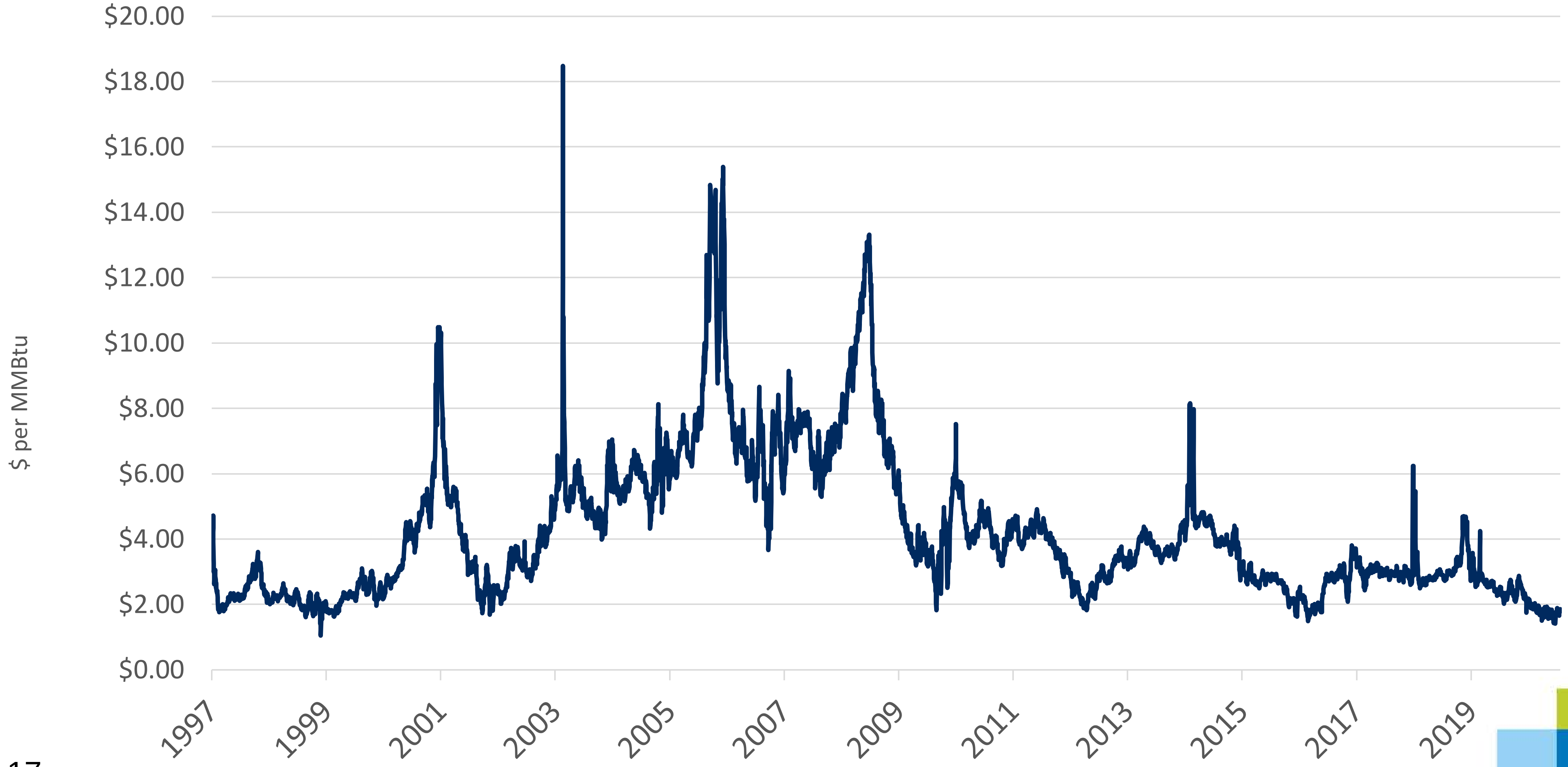








Historic Cash prices (Jan. 1997 – July 2020)



Upstream Emissions

Tom Pardee

Upstream Emissions

- Use based greenhouse gas emissions at the point of combustion and include upstream methane emissions
- Link for Natural Gas Advisory Committee information on upstream methane: https://www.nwcouncil.org/energy/energy-advisory-committees/natural-gas-advisory-committee

Global Warming Potential

5th Assessment of the Intergovernmental Panel on Climate Change		
Greenhouse Gas	**GWP – 100 Year**	**GWP – 20 Year**
CO_2	1	1
CH_4	34	86
N_2O	298	268

Global warming potential (GWP) factors for conversion to CO_2 equivalents (CO_2e)

https://www.c2es.org/content/ipcc-fifth-assessment-report/

Upstream Emissions Sources and Estimates

- Rockies emissions – The EPA estimates all leakage through a bottoms up analysis. It will estimate leaks based on equipment operated as designed and combines these values to determine an overall rate of 1%. The emissions and sinks study is published yearly and will capture emissions as they change.

- Canadian emissions (British Columbia and Alberta) – A value of 0.77% was developed from data pertaining to the recent environmental impact studies for the PSE Tacoma LNG plant, Kalama Manufacturing and Export Facility and the 2019 Puget Sound Energy IRP.

WSU Natural Gas Methane Study

- Sponsored by EDF and utilities to estimate the leakage of distribution systems
- National project and estimated a loss of **0.1 – 0.2** percent of the methane delivered nationwide
- Western region contributes much less as compared to the East
- "Out of **230 measurements, three large leaks accounted for 50%** of the total measured emissions from pipeline leaks. In these types of emission studies, a few leaks accounting for a large fraction of total emissions are not unusual."

AVISTA

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		

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

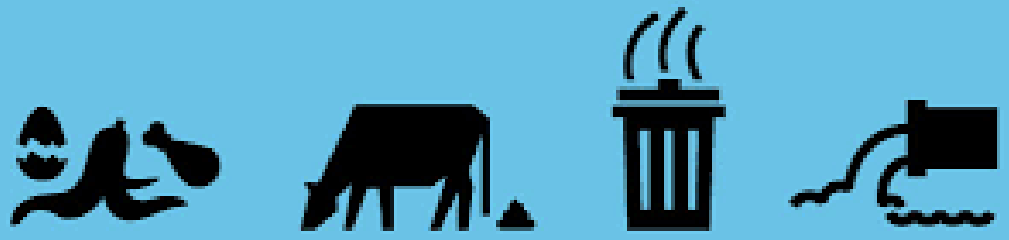
Electric Upstream Emissions

	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	0.304065693	10.34
Total		127.95
Upstream Emissions	Avista's Purchases	Emissions Location
0.77	100.00%	Canada
1.00	0.00%	Rockies
0.77		

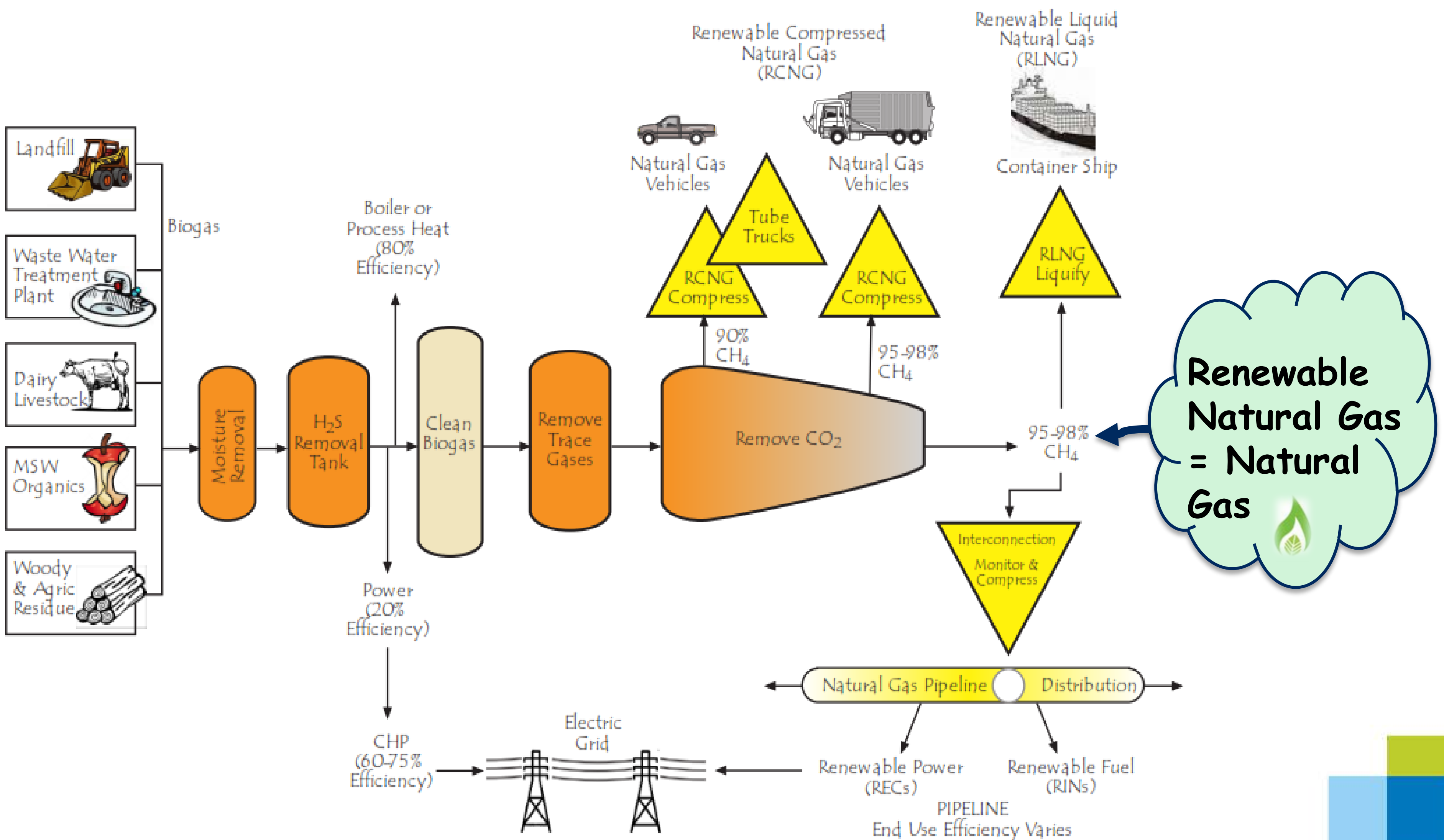
*Avista Purchases

All firm transportation to supply gas is located in Canada

Renewable Natural Gas (RNG)



What is Renewable Natural Gas (RNG)?



Why does RNG matter?

Climate Change Solution

- Natural gas plays critical role for meeting aggressive green house gas (GHG) reductions goals, RNG even more so!

- Utilizes existing infrastructure

- Advantages of RNG
  - “De-carbonizes” gas stream
  - Gives customers another renewable choice

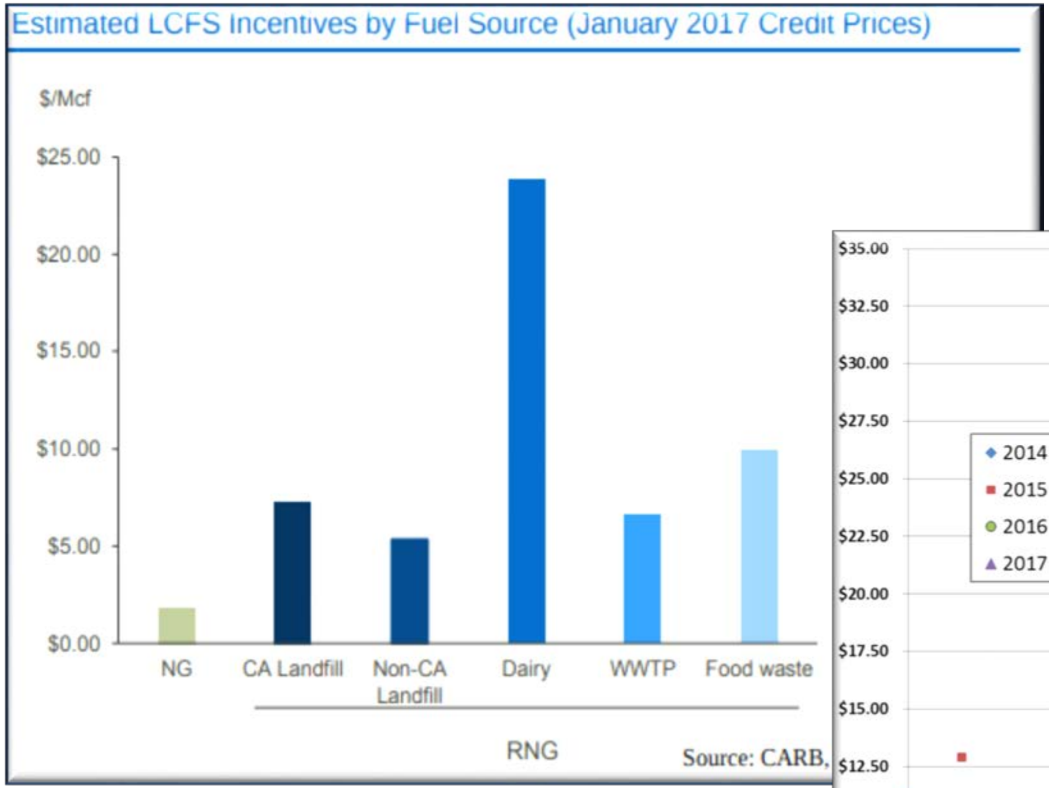
Carbon Intensity

Fuel Pathway	Carbon Intensity $\frac{gCO_2e}{MJ}$
Diesel*	102.01
Gasoline*	99.78
Fossil CNG†	78.37
Landfill CNG†	46.42
WWTP CNG*	19.34
MSW CNG*	-22.93
Dairy CNG‡	-276.24

*California Code of Regulation Title 17, §95488, Table 6. Carbon intensity for WWTP is the average of two WWTP pathways.
†California Code of Regulation Title 17, §95488, Table 7.

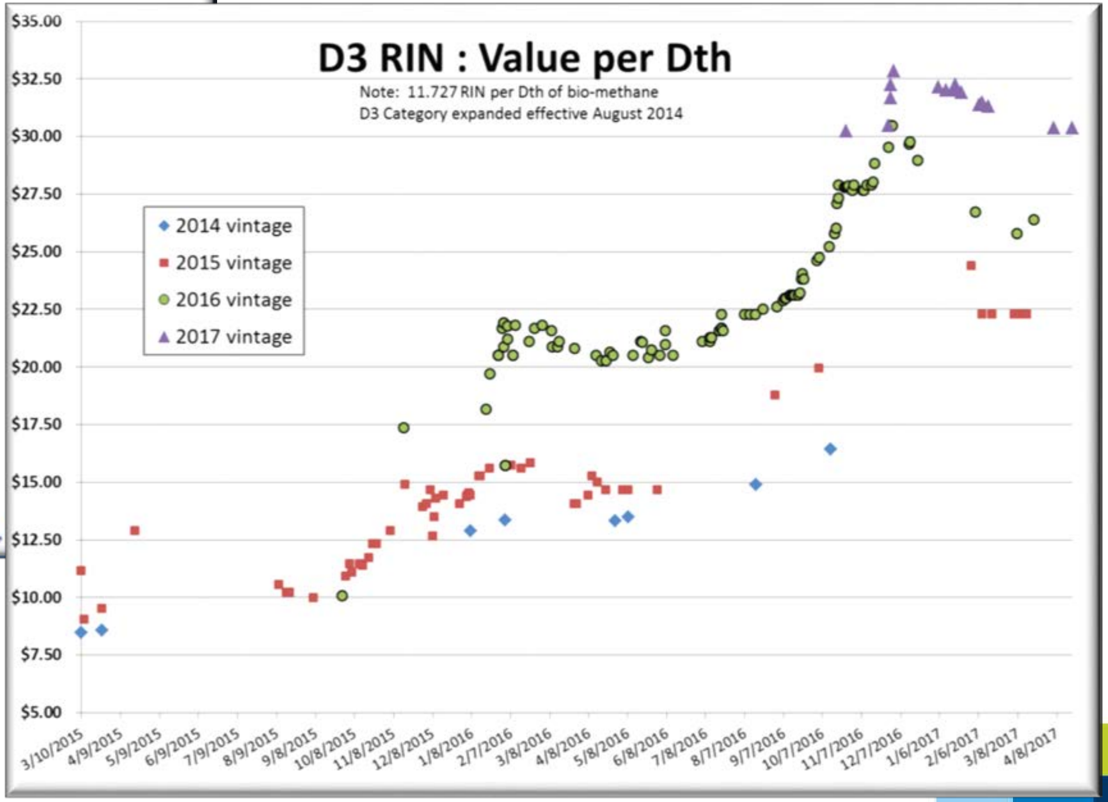
†Method 2B Application CalBio LLC, Dallas Texas, Dairy Digester Biogas to CNG.

RFS and LCFS Effect on RNG Value



Source: CARB

RIN = renewable identification number



Source: EPA

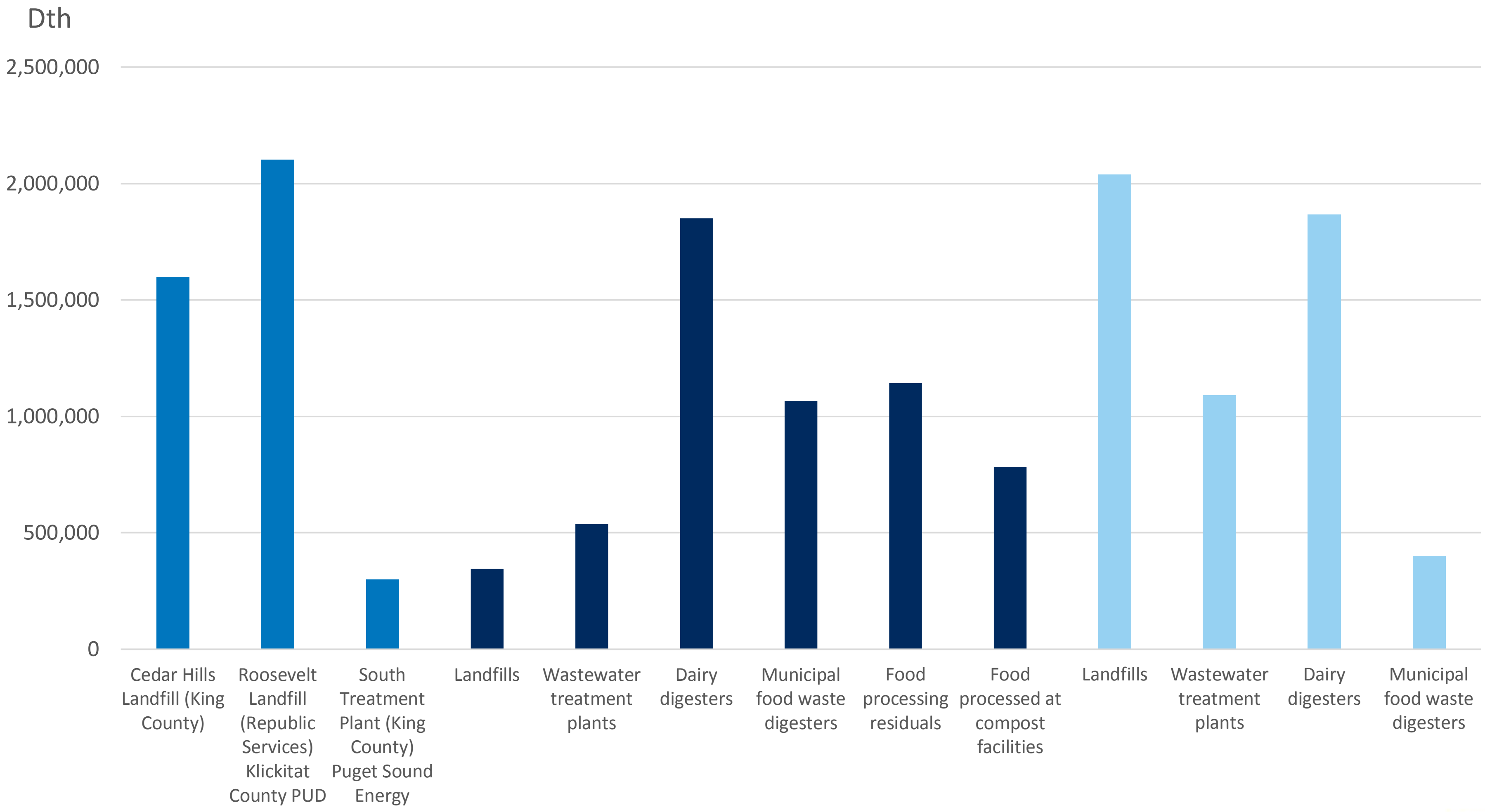
What are the challenges & barriers?

- California RNG market ($30+/Dth v. $2/Dth)
  - Vehicle emission incentives shut-out other potential end users
  - Producers see the pot of gold in California

- Financing for producers
  - RIN market is volatile
  - No forward pricing for RNG RINs in carbon market
  - Vehicle market may be approaching saturation in CA
  - Producer/LDC partnerships may make sense

WA RNG Report (HB 2580)

Existing Projects
Near Term Projects
Medium Term Projects



WSU Energy Program, Harnessing Renewable Natural Gas for Low-Carbon Fuel: A Roadmap for Washington State

*Released December 1, 2018

ID RNG NREL Estimates

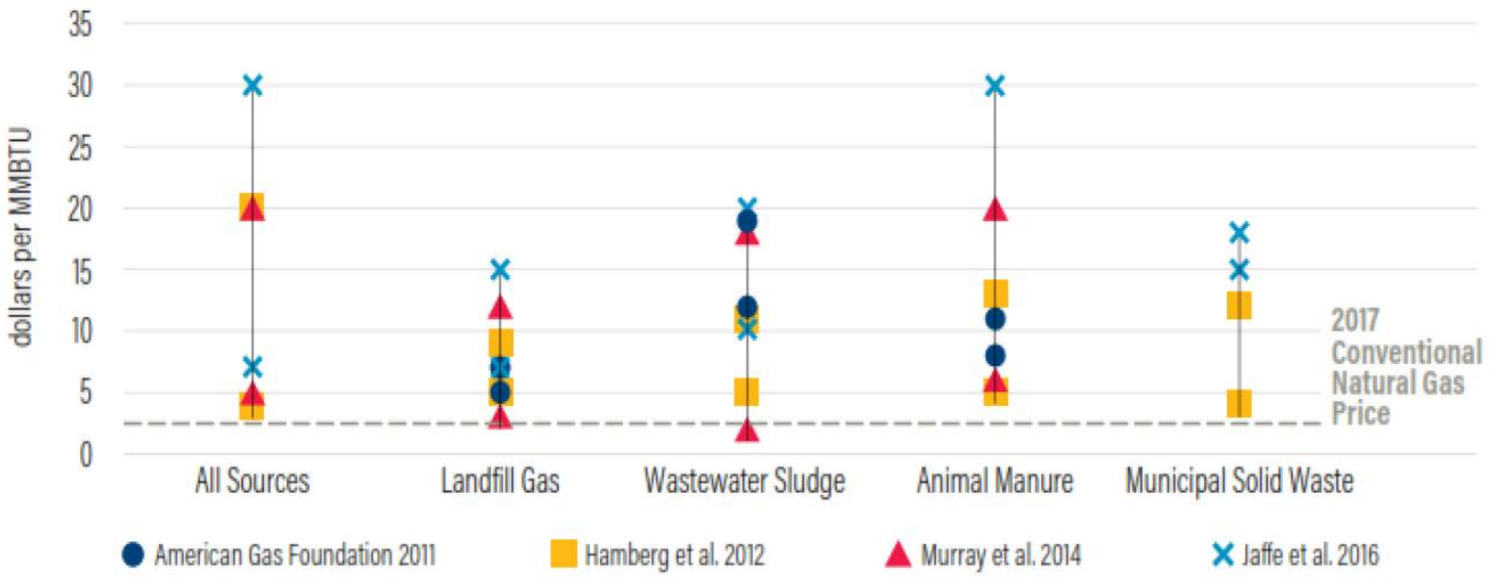
Total Potential Annual Production = 32 Bcf

Source - Anaerobic	MMBtu per Year
Landfills	3,712,221
Wastewater Treatment	6,196,531
Agriculture Manure	20,220,571
Source-Separated Organics (Solid Waste)	2,311,354
Total	**32,440,676**

National Renewable Energy Laboratory, NREL Biofuels Atlas

RNG $ per Dth/MMBtu

Avista Owned and Operated	ID - WA 2035 Premium Estimate ($ / Dth)
RNG - Landfills	$7 - $10
RNG - Waste Water Treatment Plants (WWTP)	$12 - $22
RNG - Agriculture Manure	$28 - $53
RNG - Food Waste	$29 - $53



Source: Promoting RNG in WA State

Natural Gas IRP

A detailed level of RNG understanding and evaluation process will be included in the Natural Gas IRP TAC #3 meeting on September 30, 2020

Natural Gas Price Forecast

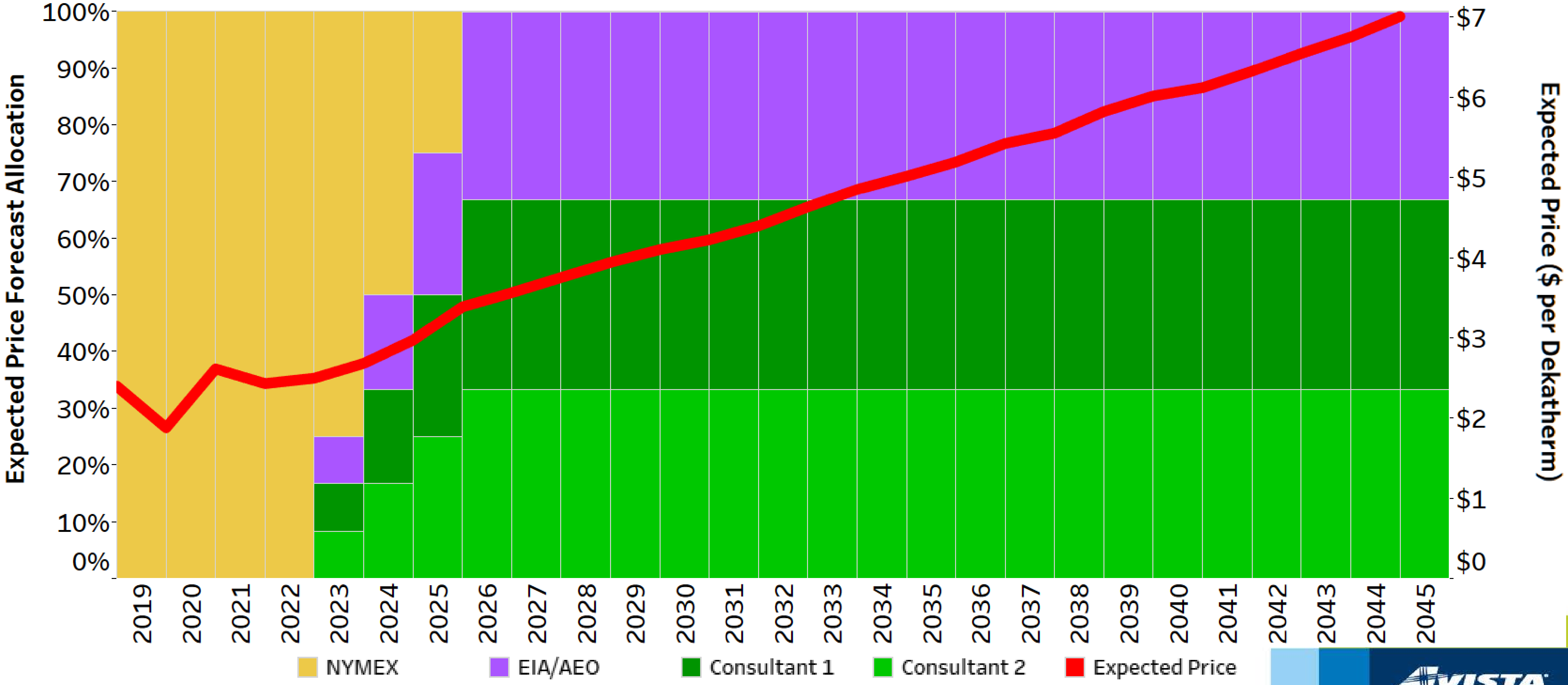
Michael Brutocao, Natural Gas Analyst
Second Technical Advisory Committee Meeting
August 6, 2020

Henry Hub Expected Price Methodology

- Expected Henry Hub prices derived from a blend of forward market prices on the NYMEX (as of 6/30/2020) and forecasted prices from the 2020 Annual Energy Outlook (EIA) and two consultants

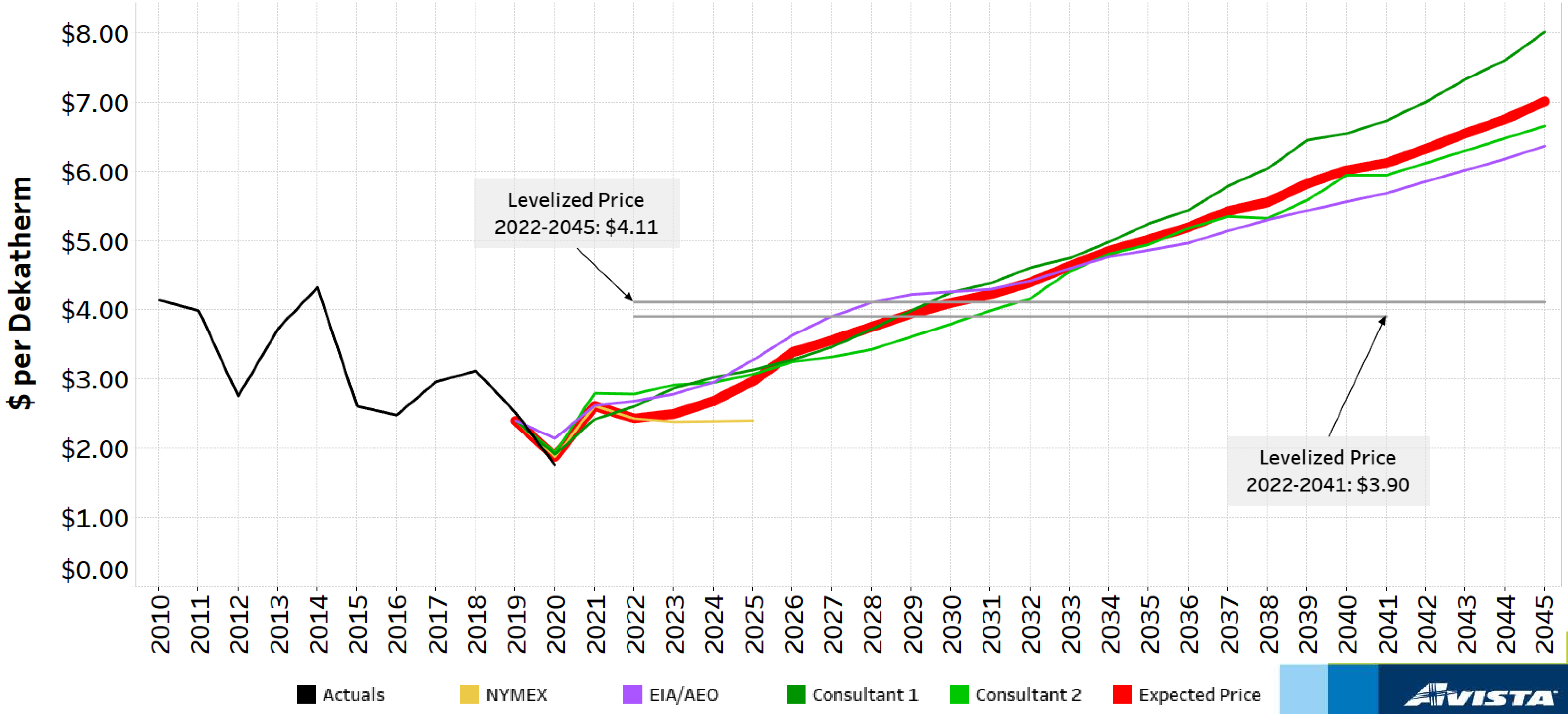
	2020 – 2022	2023	2024	2025	2026 – 2045
NYMEX	100%	75%	50%	25%	-
EIA/AEO	-	8.33%	16.66%	25%	33.33%
Consultant 1	-	8.33%	16.66%	25%	33.33%
Consultant 2	-	8.33%	16.66%	25%	33.33%

Henry Hub Expected Price and Forecast Blending



AVISTA

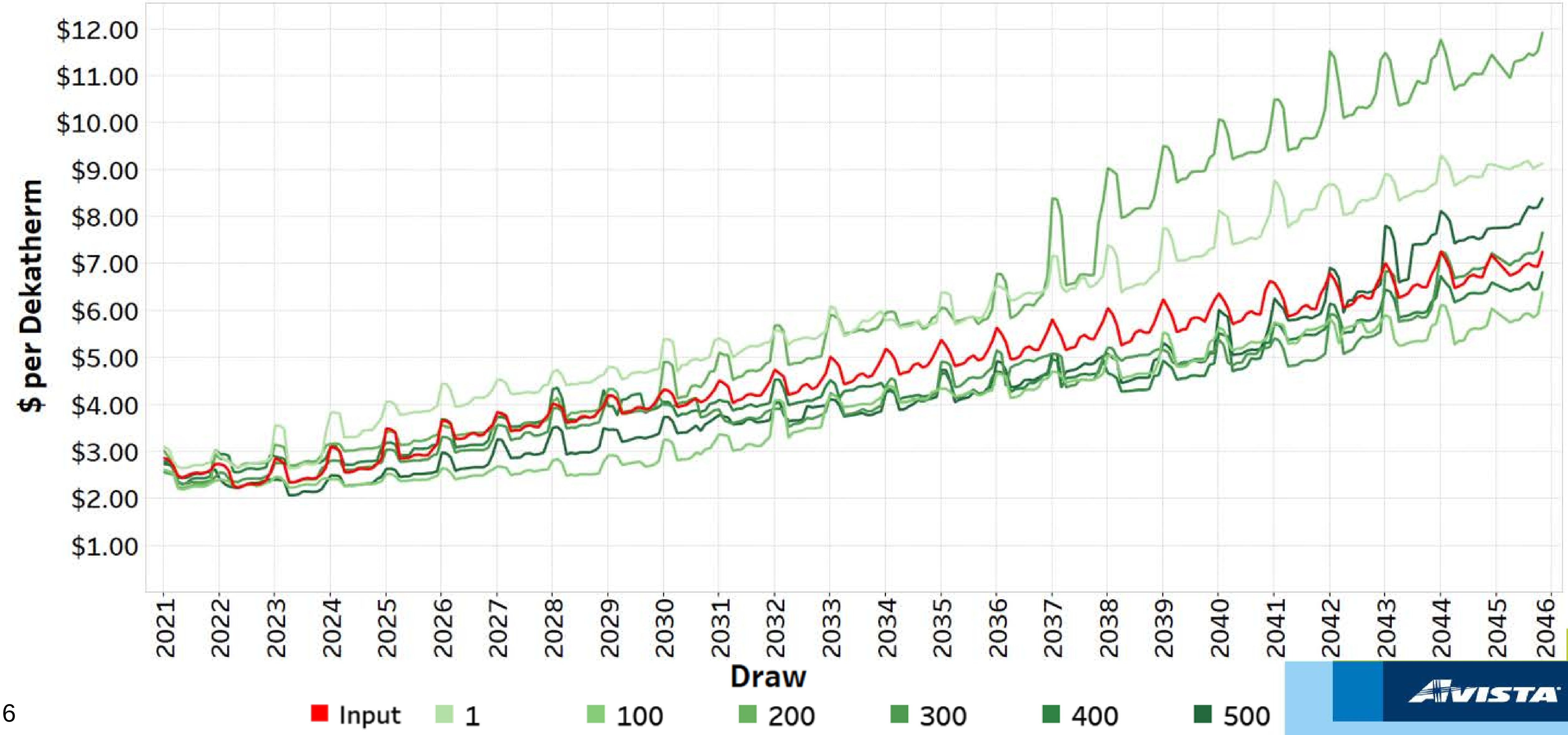
Henry Hub Expected Price and Average Annual Forecasts



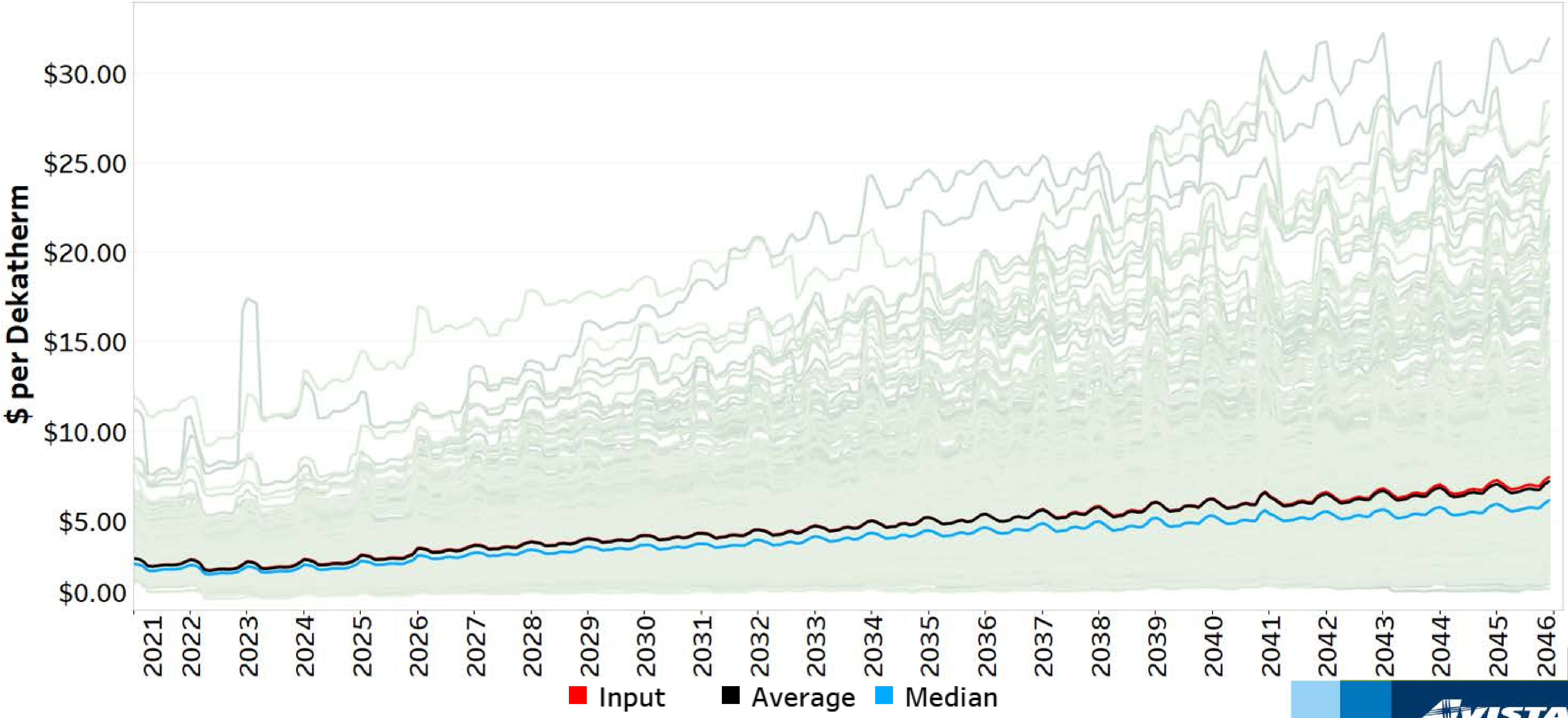
Stochastic Price Forecasting Methodology

- Evaluate a set of potential future outcomes based on the probability of occurrence
  - Expected Price used as the input
  - At each period, random price adjustments follow a lognormal distribution based on the Expected Price
    - It is common practice to use lognormal distributions in forecasting prices as they have no upward bound and should not fall below zero
- A single “draw” contains a set of unique price movements
- 500 (electric) and 1000 (gas) draws were evaluated

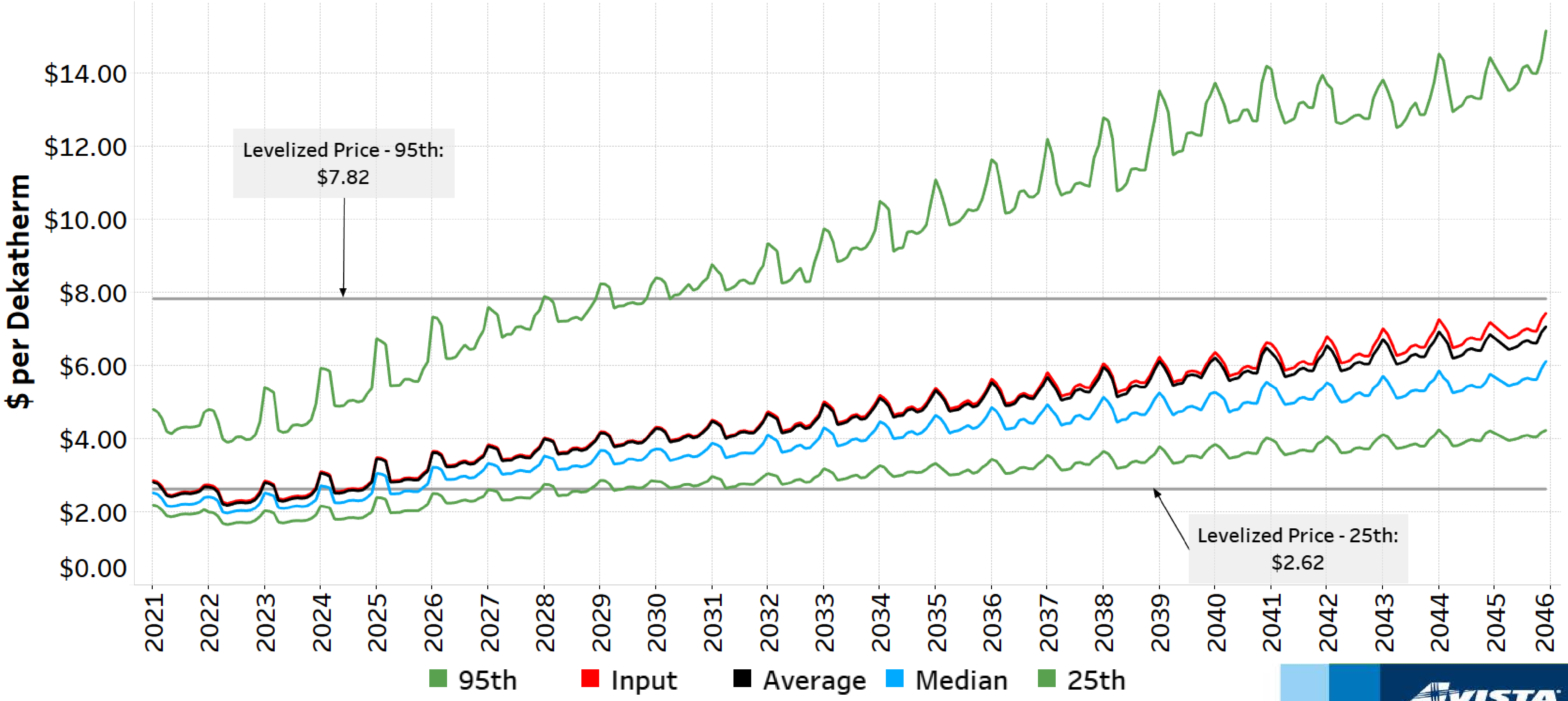
Sample Stochastic Price Draws



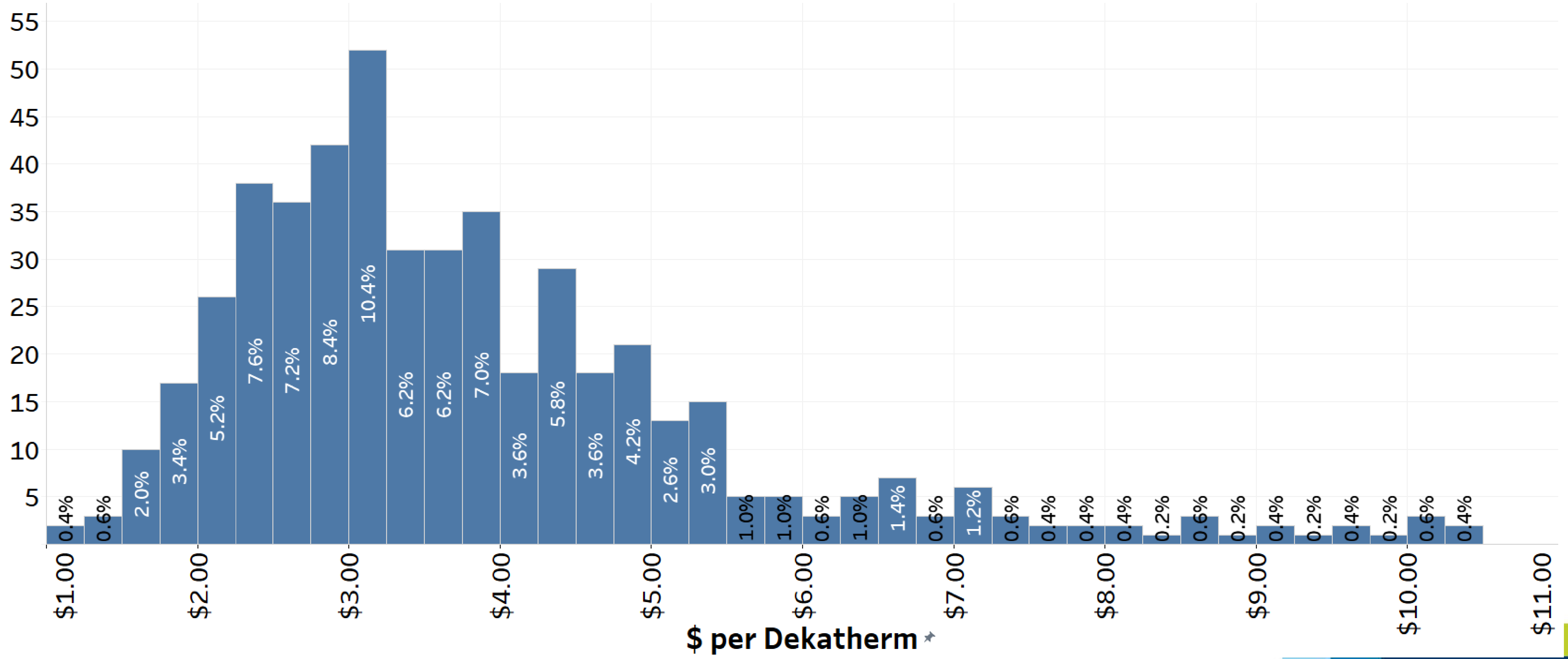
Stochastic Price Draws



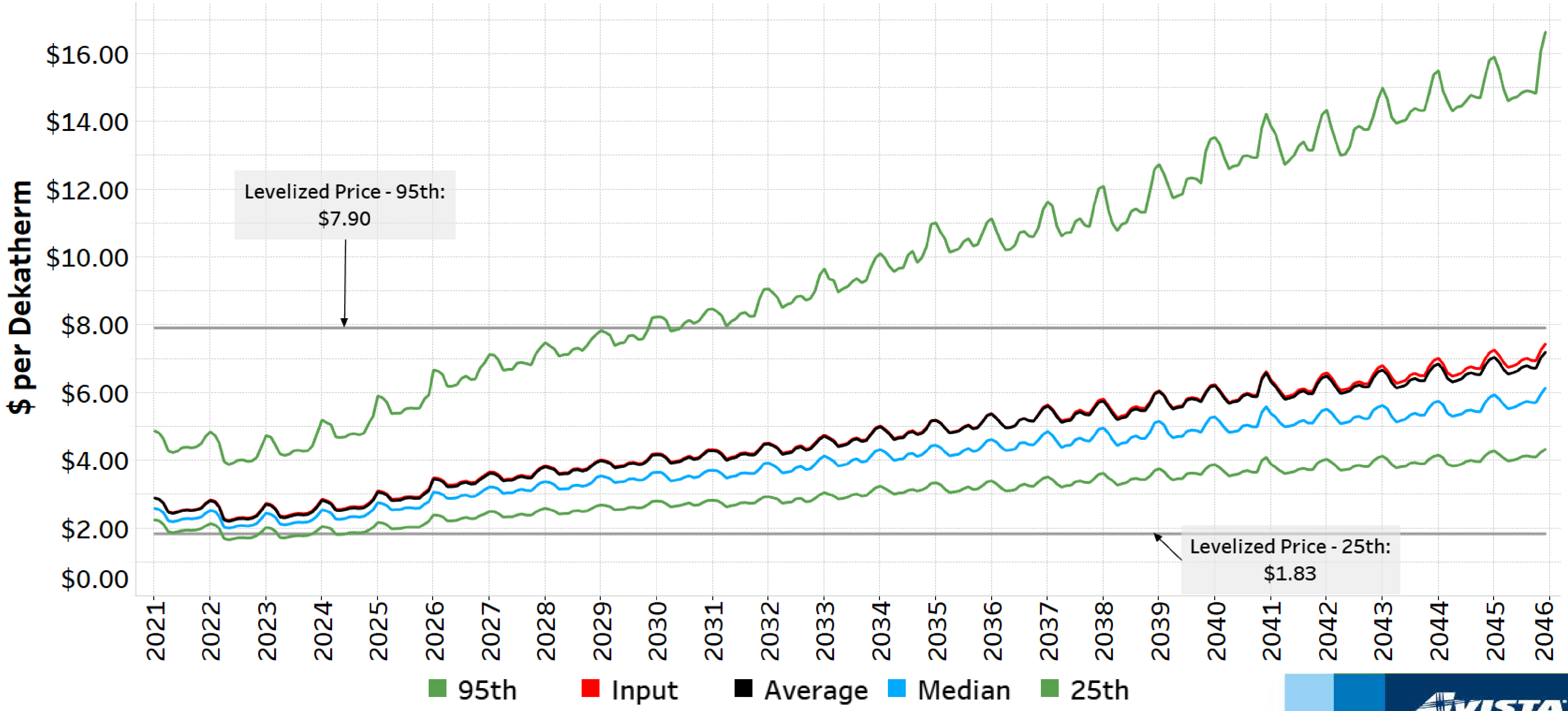
Stochastic Prices (Results from 500 Draws)



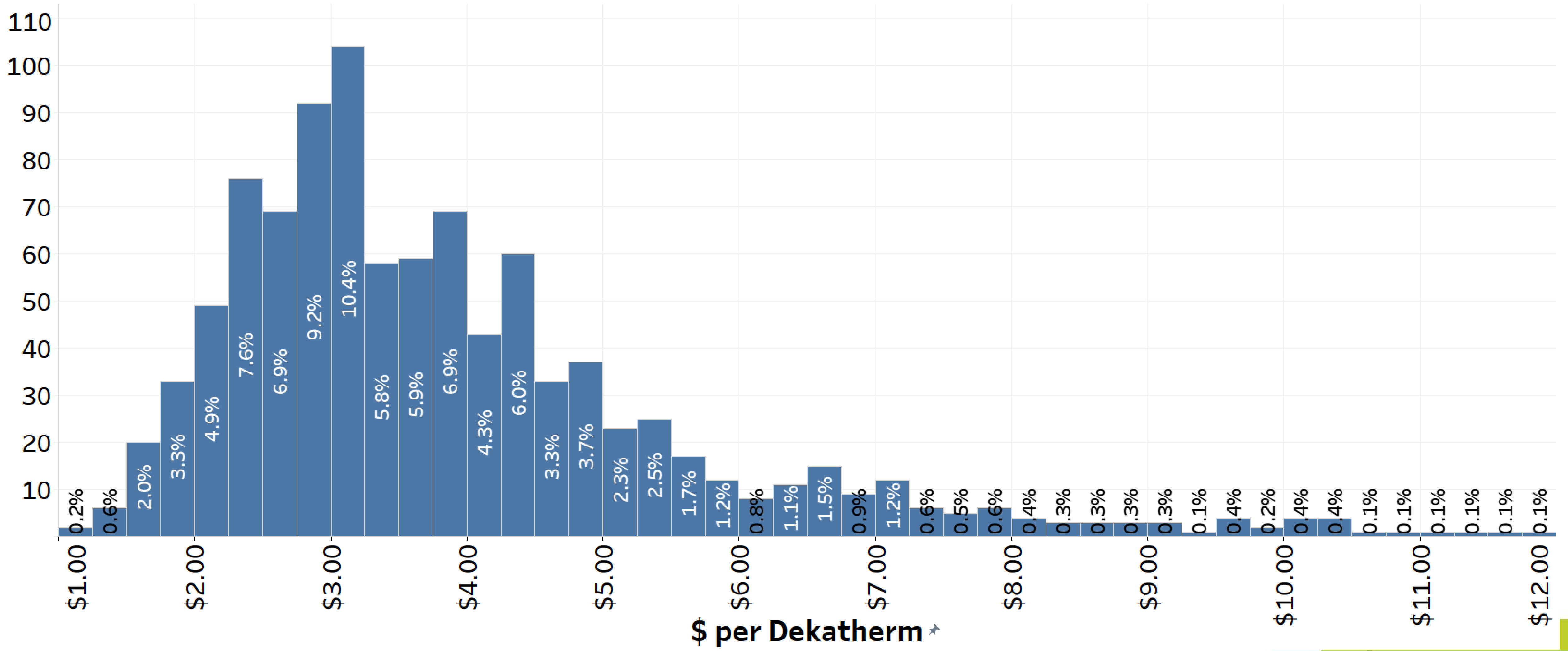
Levelized Stochastic Prices (Results from 500 Draws)



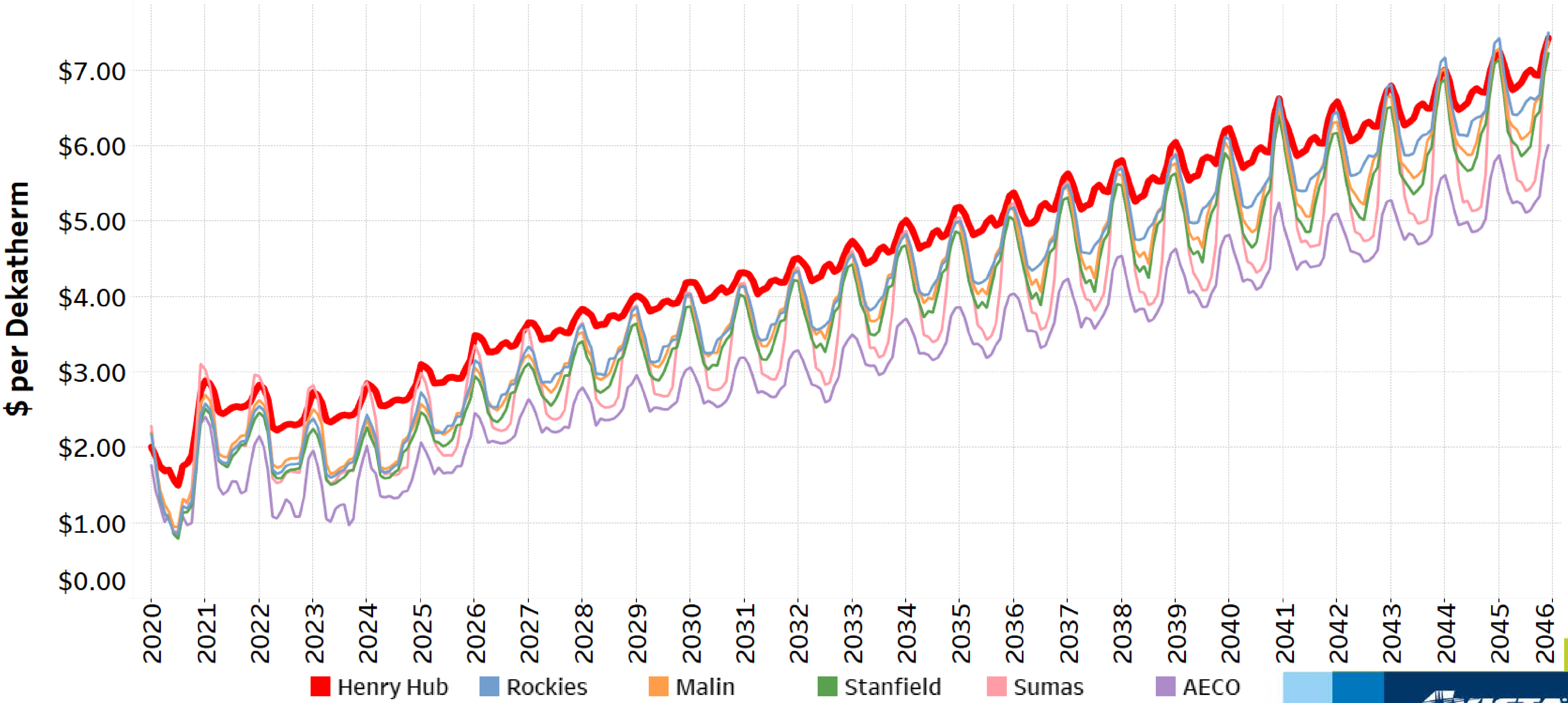
Stochastic Prices (Results from 1000 Draws)



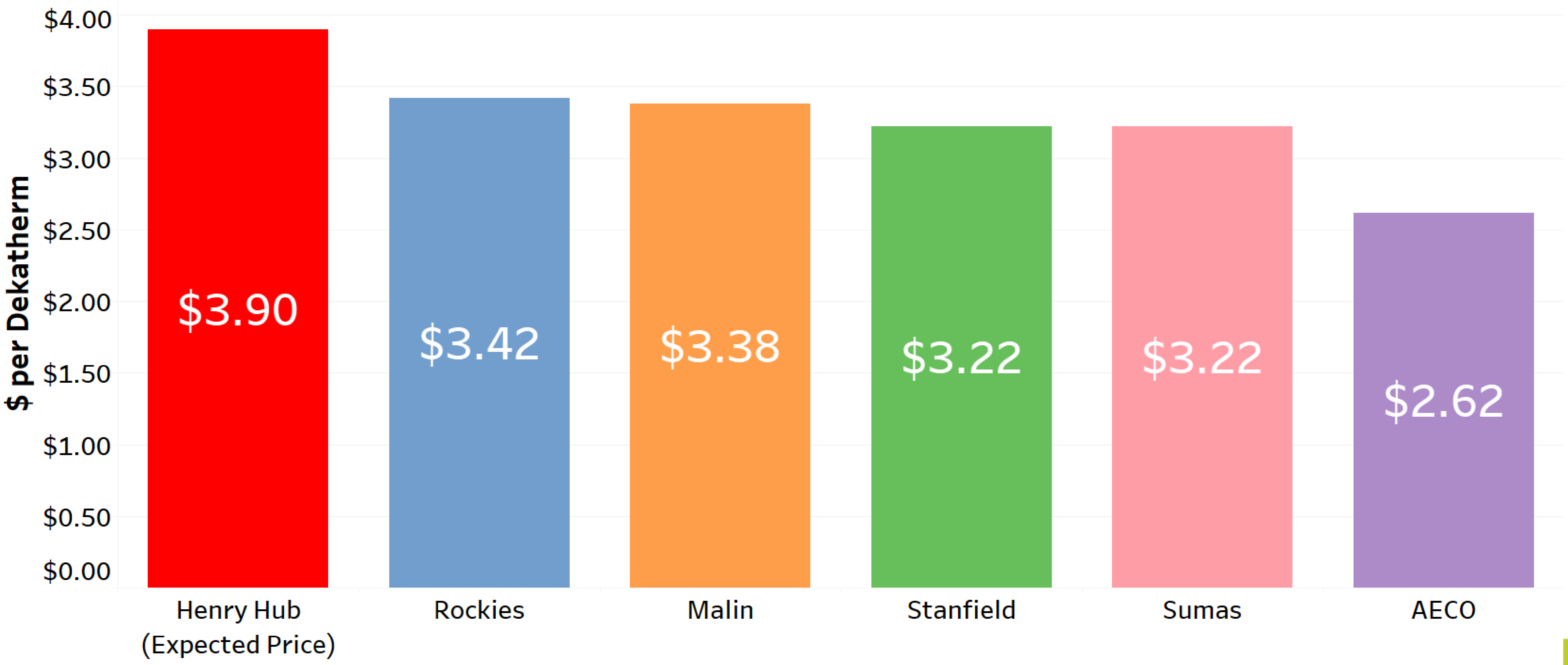
Levelized Stochastic Prices (Results from 1000 Draws)



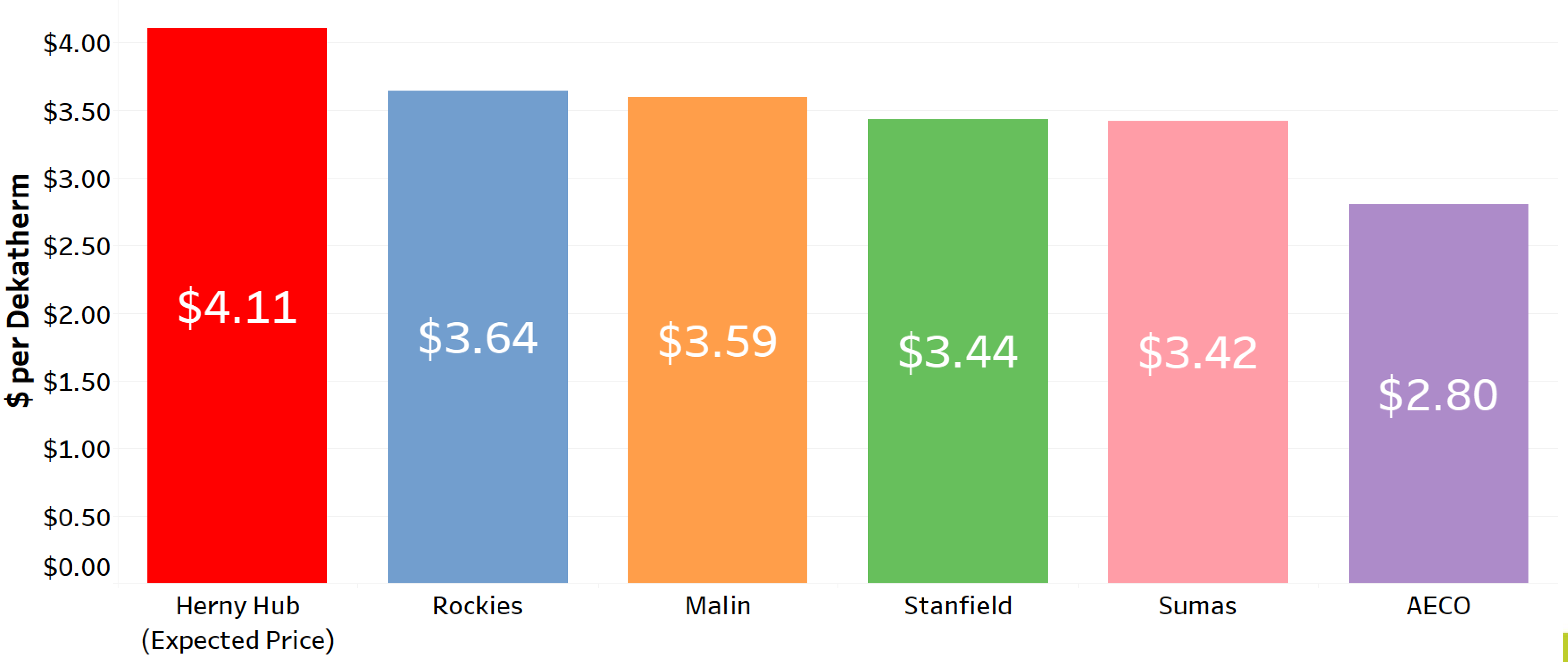
Prices by Gas Hub (Henry Hub Expected Price + Basis)



Levelized Prices 2022-2041



Levelized Prices 2022-2045



2021 Electric IRP
Regional Energy Policy Update

John Lyons, Ph.D.

Second Technical Advisory Committee Meeting

August 6, 2020

Production and Investment Tax Credits

- Production tax credit $15/MWh adjusted for inflation ($25/MWh for 2019) for 10 years for wind construction started by 12/31/20
- Investment tax credit for new solar construction drops from 30% in 2019
  - 26% in 2020
  - 22% in 2021
  - 10% from 2022 onward
- Will be watching for any possible extensions with all of the COVID-19 proposals

State and Provincial Policies

State/Province	No Coal	RPS	Clean Energy/Carbon Goal
Alberta	Yes	Yes	Yes
Arizona	No	Yes	No
British Columbia	Yes	Yes	Yes
California	Yes	Yes	Yes
Colorado	No	Yes	Yes
Idaho	No	No	No
Montana	No	Yes	No
Nevada	No	Yes	Goal
New Mexico	No	Yes	No
Oregon	Yes	Yes	Yes
Utah	No	Goal	No
Washington	Yes	Yes	Yes
Wyoming	No	No	No

Washington

- Clean Energy Transformation Act (CETA) SB 5116:
  - No coal serving Washington customers by end of 2025
  - Greenhouse gas neutral by 2030, up to 20% alternative compliance
  - 2% cost cap over four-year compliance period
  - 100% non-emitting by January 1, 2045
  - Social cost of carbon for new resources
  - Additional reporting and planning requirements
  - Highly impacted and vulnerable community identification and resource planning implications
  - Ongoing rulemaking in various stages for planning and reporting

Washington

- HB 1257: Clean Buildings for Washington Act
  - Develop energy performance standards for commercial buildings over 50,000 square feet (2020 – 2028) "… to maximize reductions of greenhouse gas emissions from the building sector"
  - By 2022, natural gas utilities must identify and acquire all available cost-effective conservation including a social cost of carbon at the 2.5% discount rate.(Section 11 and 15)
  - Natural gas utilities may propose renewable natural gas (RNG) programs for their customers and offer a voluntary RNG tariff
  - Building code updates to improve efficiency and develop electric vehicle charging infrastructure

Oregon

Executive Order 20-04

- New GHG reduction goal
  - 45% below 1990 levels by 2035
  - 80% below 1990 levels by 2050
- Directs 16 Oregon agencies to “exercise any and all authority and discretion” to reach GHG reduction goals and “prioritize and expedite” action on GHG reductions “to the full extent allowed by law.”
- Agencies are working on rulemaking and implementation

SB 98

- Development of utility renewable natural gas programs

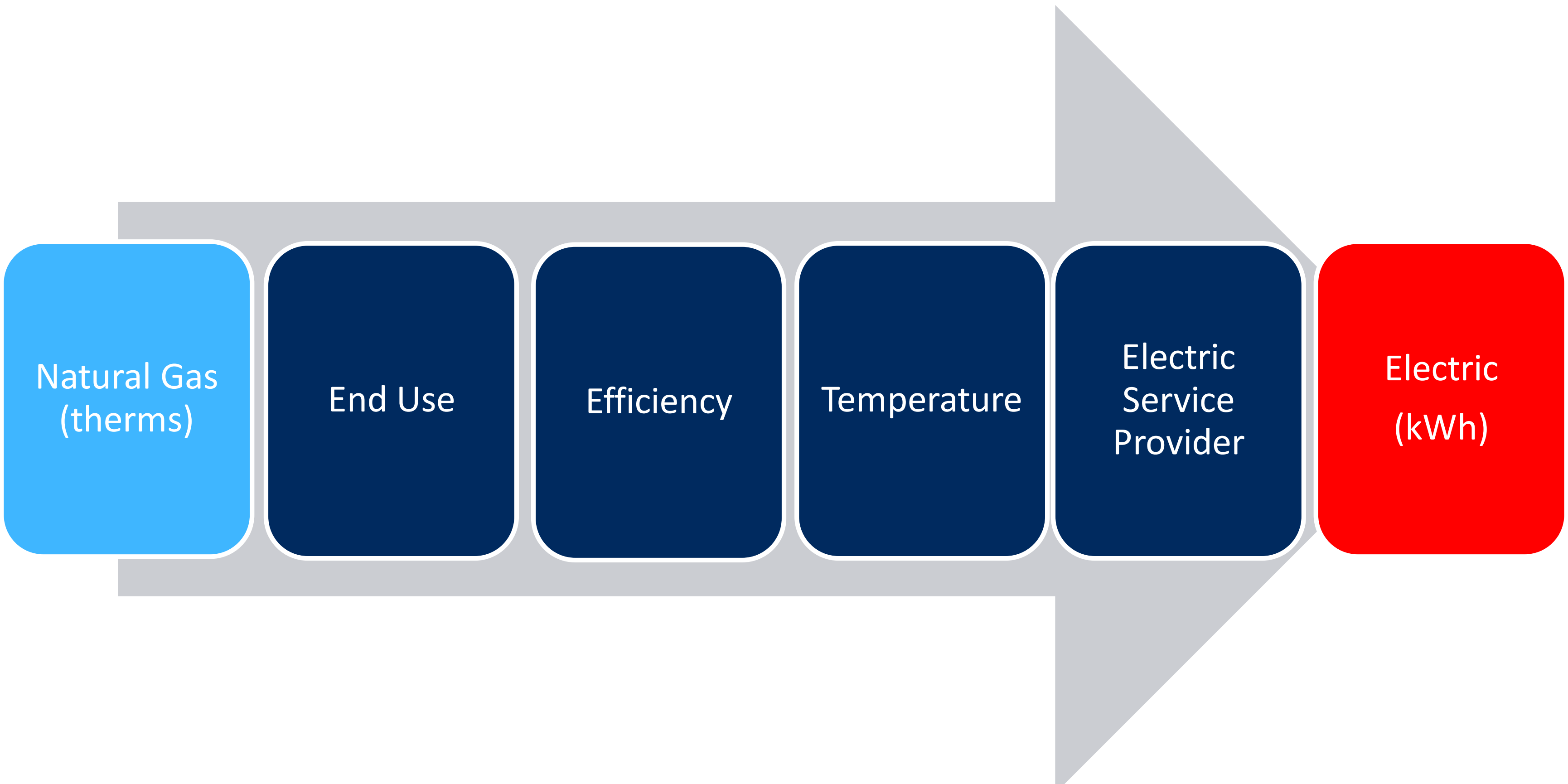
2021 Electric and Natural Gas IRPs
Natural Gas & Electric Coordinated Scenario

James Gall/Tom Pardee
Second Technical Advisory Committee Meeting
August 6, 2020

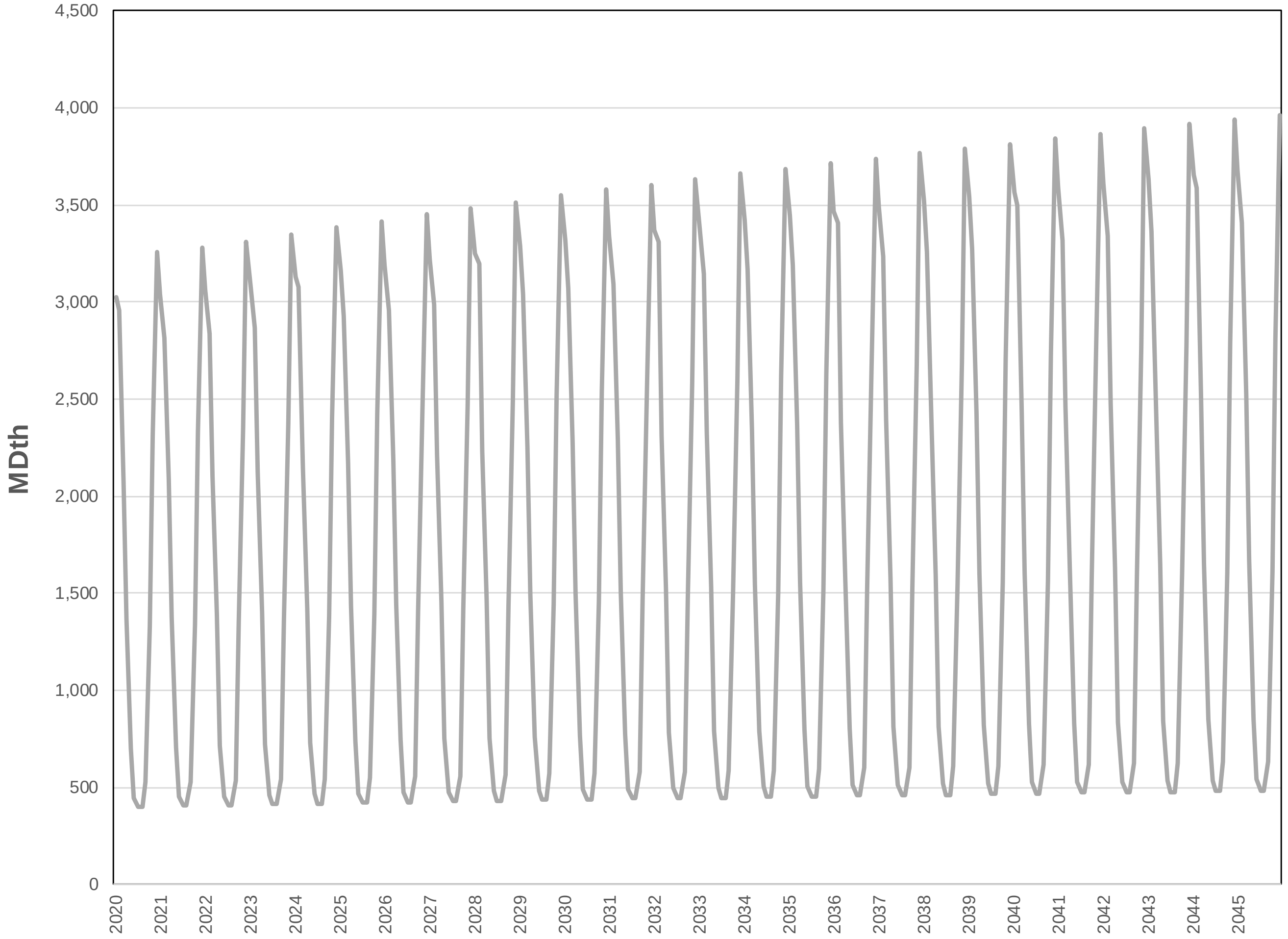
Scenario Goal

- Understand impact to electric resource planning if customers switch from natural gas to electric service
- Scenario Proposal:
  - By 2030: 50% of Washington Residential & Commercial customers
  - By 2045: 80% of Washington Residential & Commercial customers
- Potential Scenarios:
  - Hybrid natural gas/electric heat pumps
  - Highly efficient technology allows for cold temperature space heating

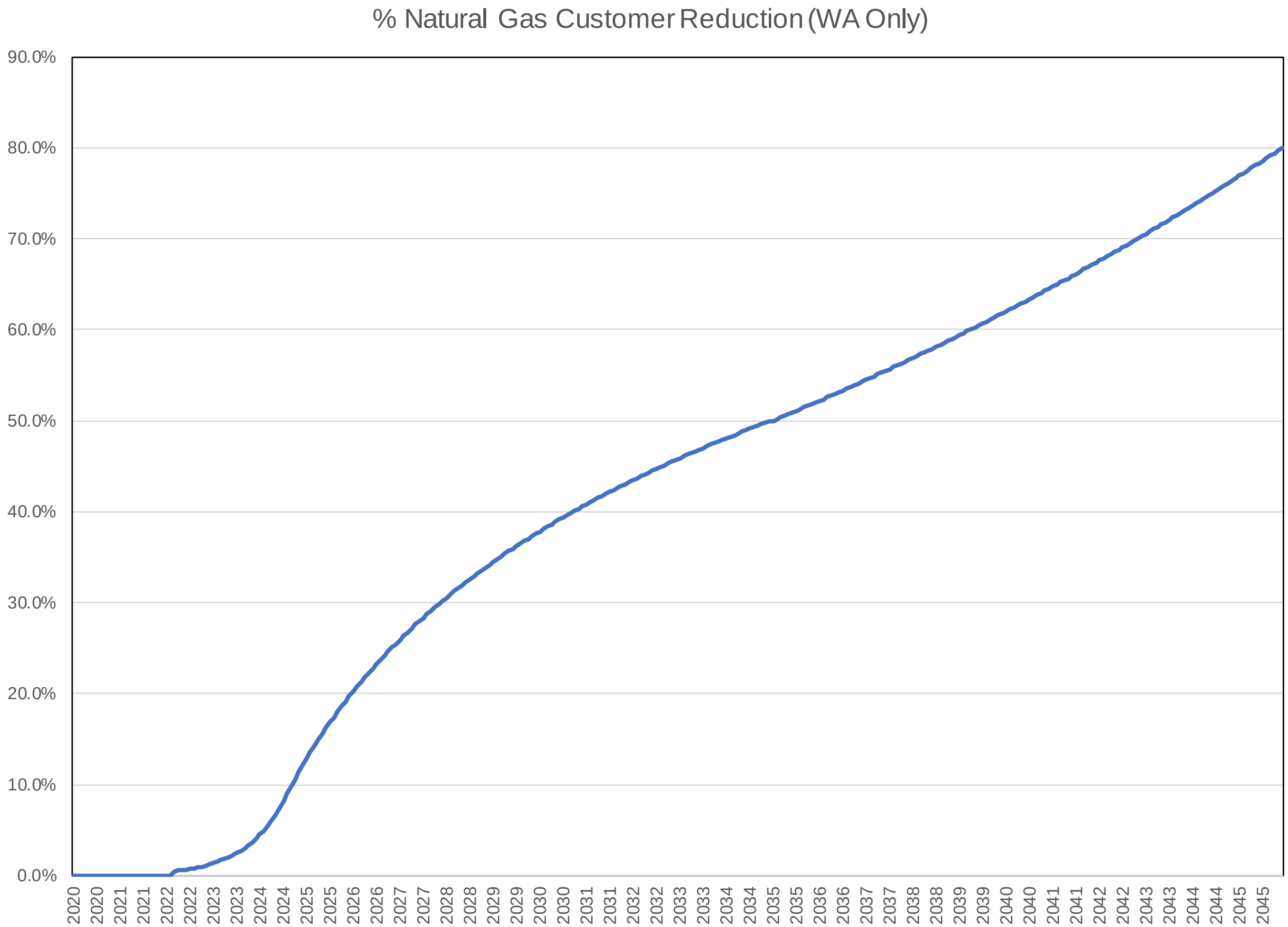
Converting Natural Gas Load to Electric Load



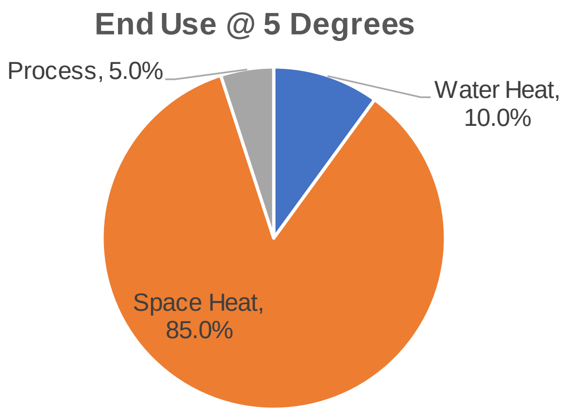
WA Res/Com Natural Gas Load Forecast

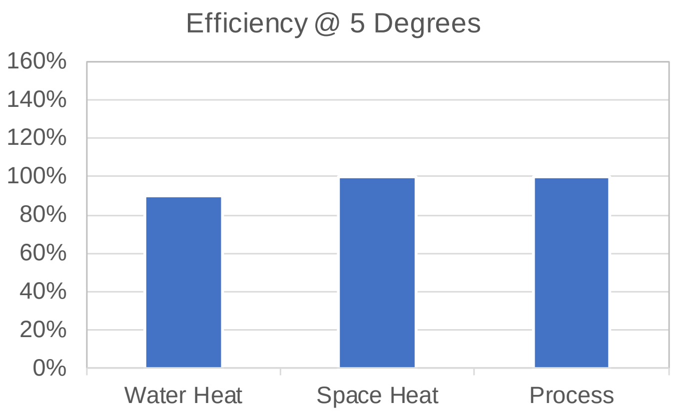


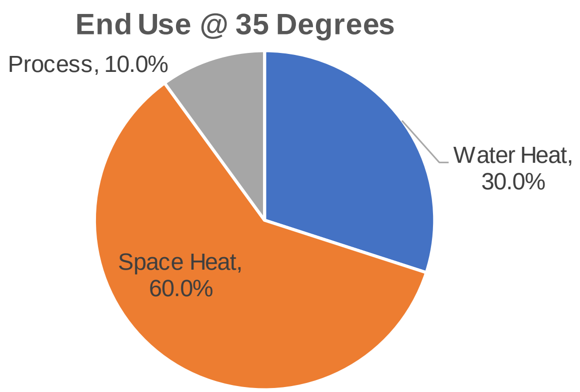
Customer Penetration Forecast

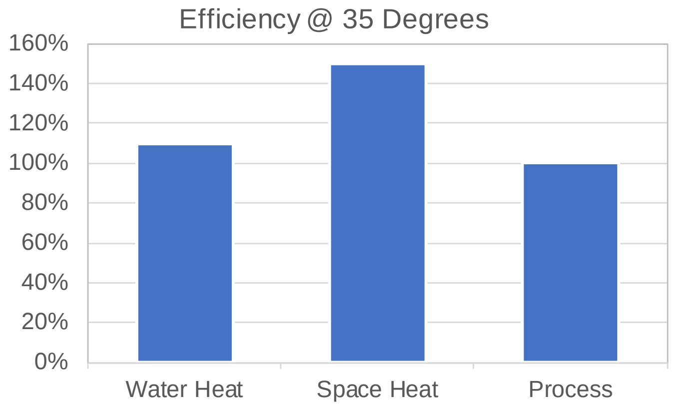


End Use Efficiency



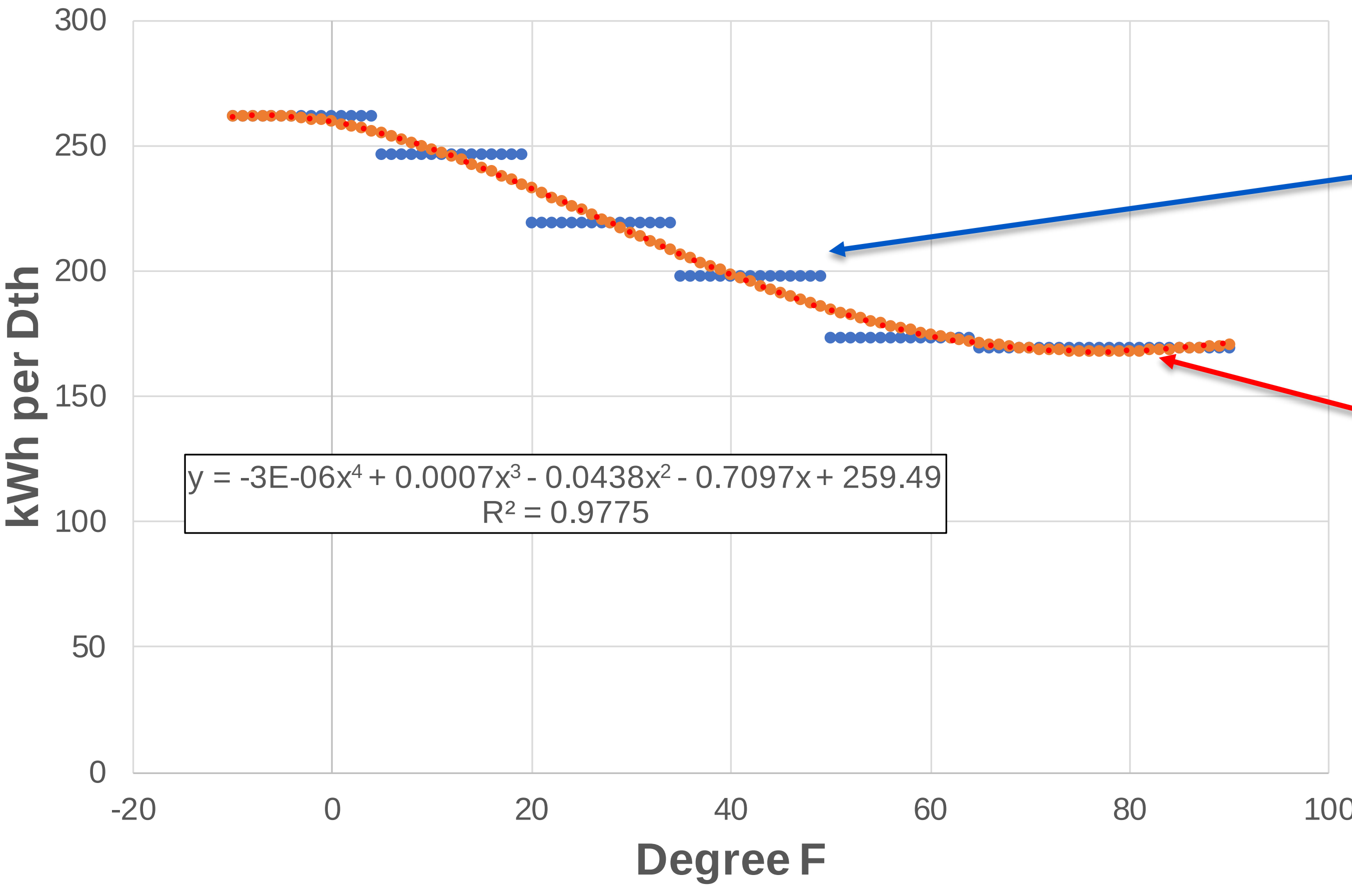






Note: All efficiency conversion use a 10% efficiency benefit to electric

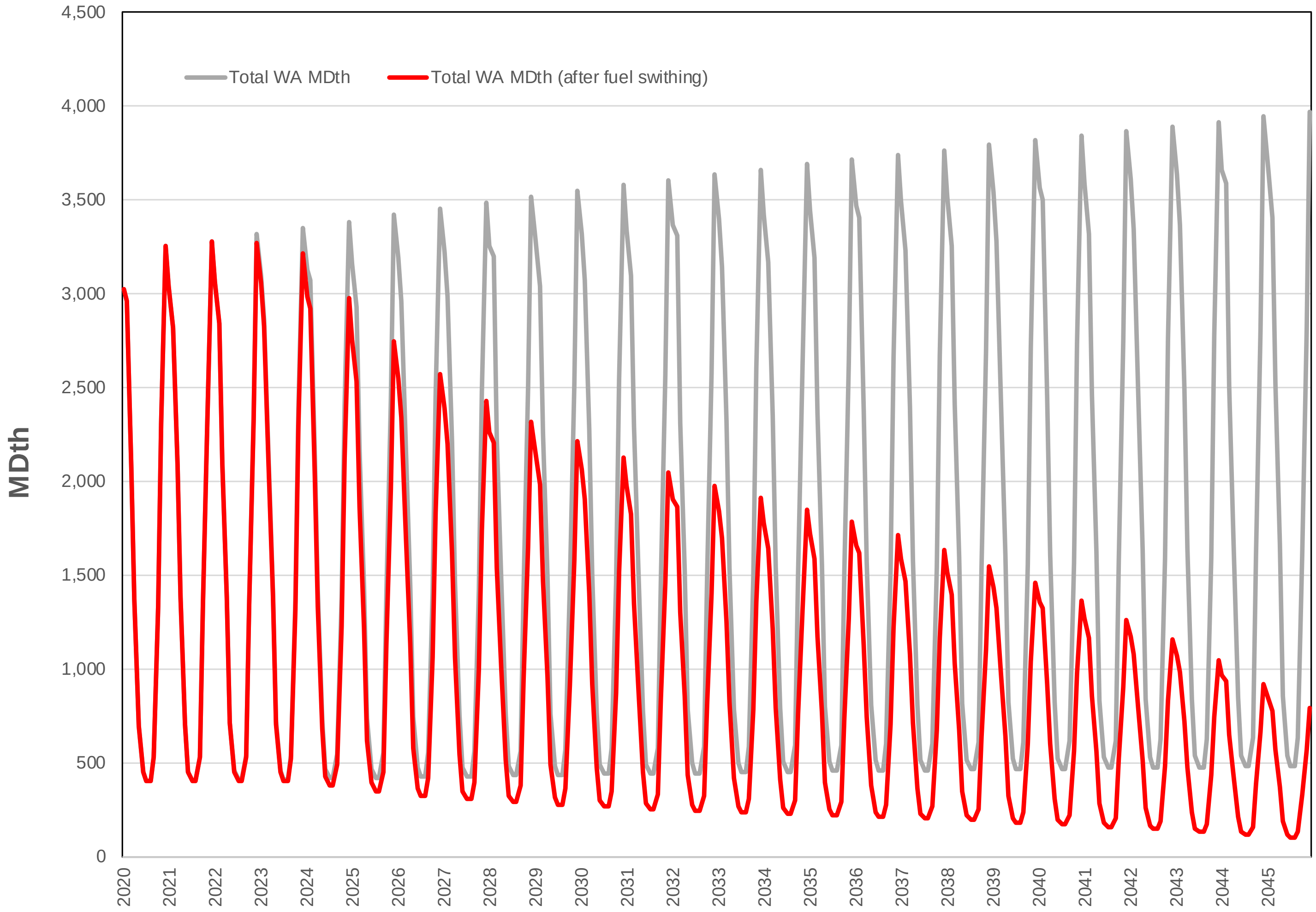
Energy Conversion Factor



Use temperature point estimates for conversion efficiency

Curve fit to smooth out steps

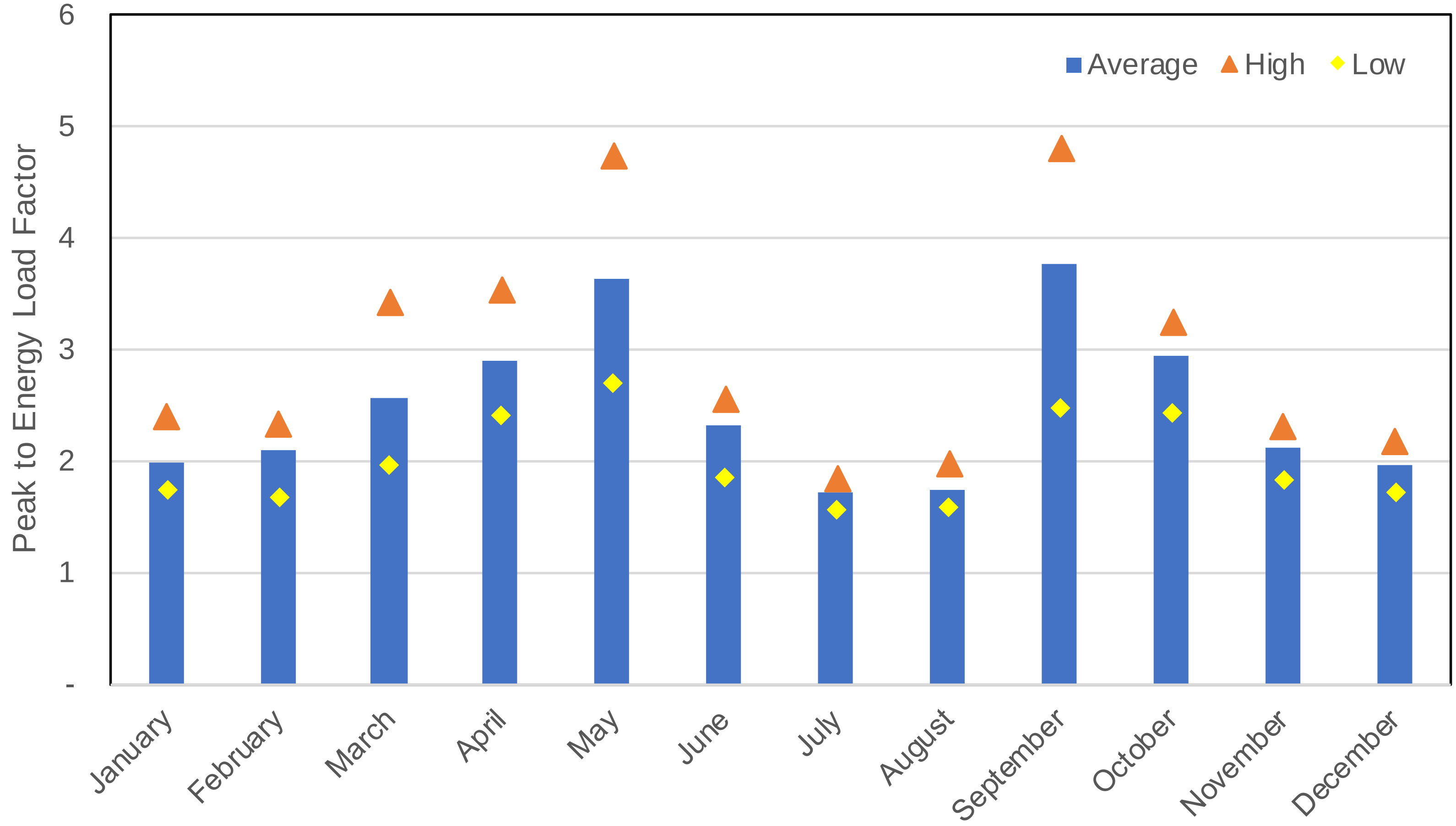
WA Res/Com Natural Gas Load Forecast



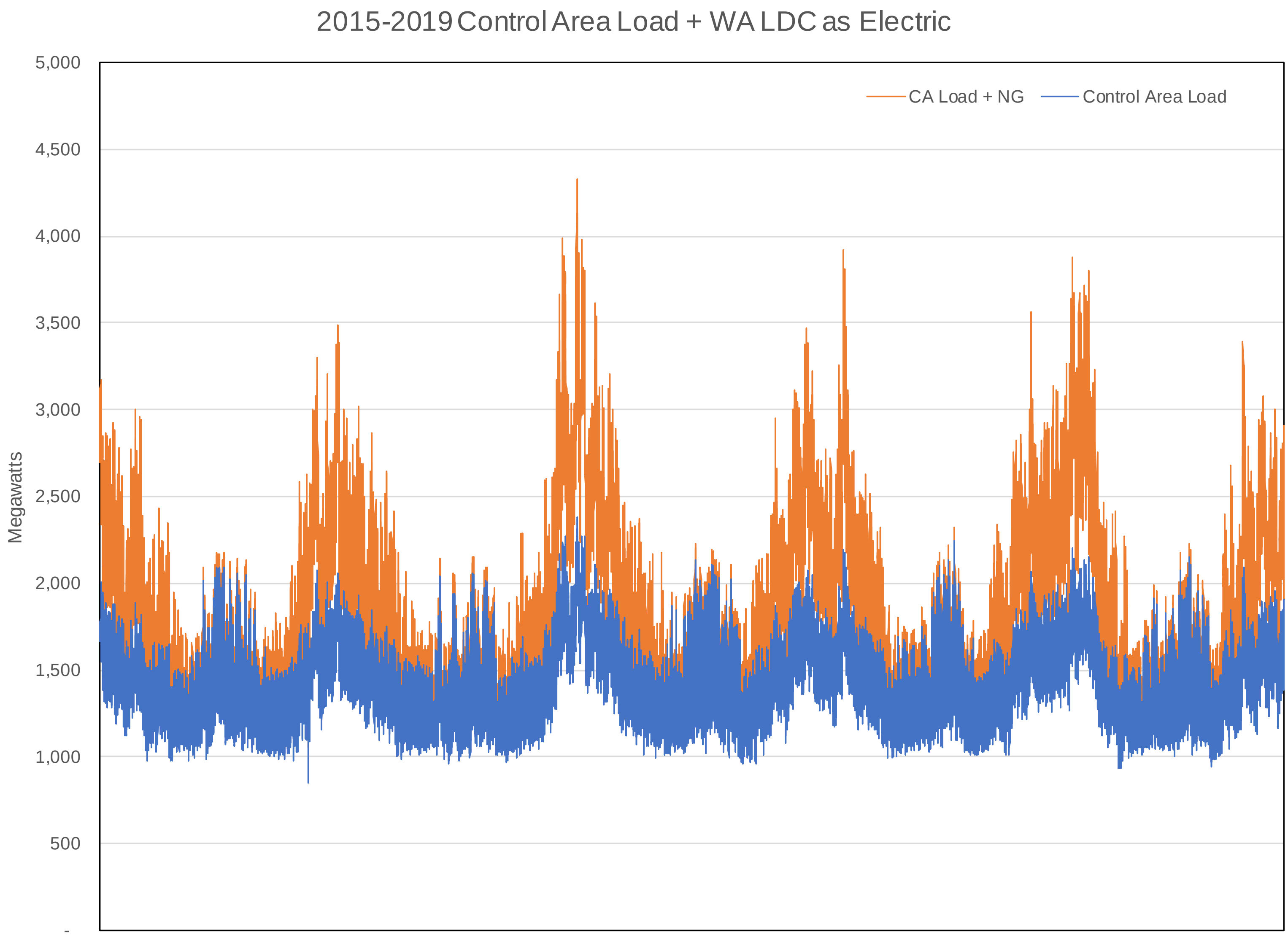
Electric Peak Estimation Methodology

- Natural gas is typically daily nominations, while electric is instantaneous.
  - Hourly flow metering is available for some areas
- Sampled large gate-station hourly instantaneous natural gas flow data
- Use sample data to estimate hourly natural gas load from 2015-2019
- Estimate Peak-to-Energy load factor for each historical month
- Use average monthly load factor for the peak adjustment

Estimated Load Factors (2015-19)



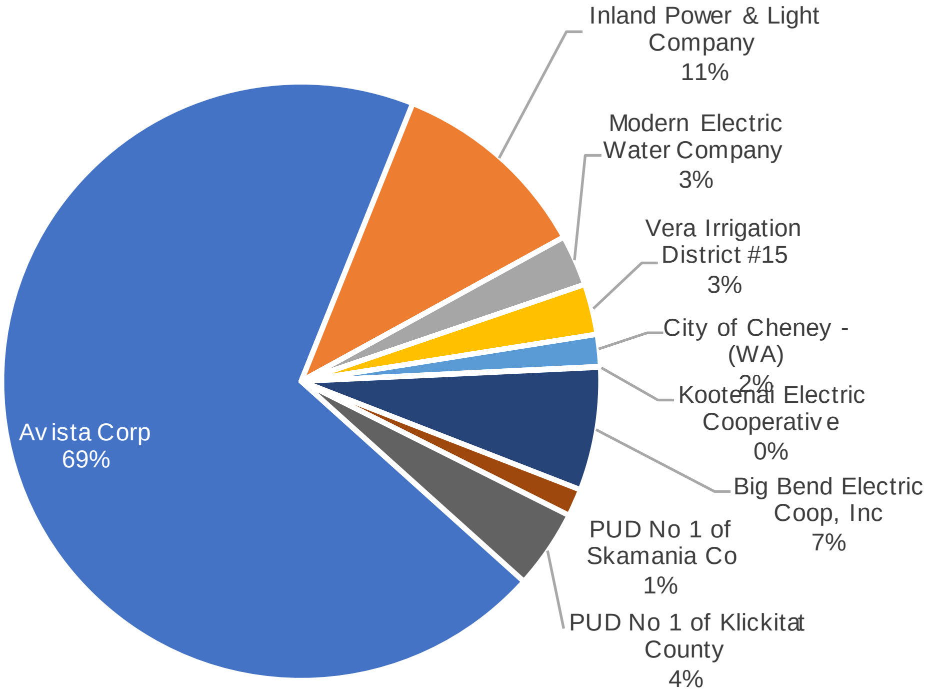
Hourly Electric Load History



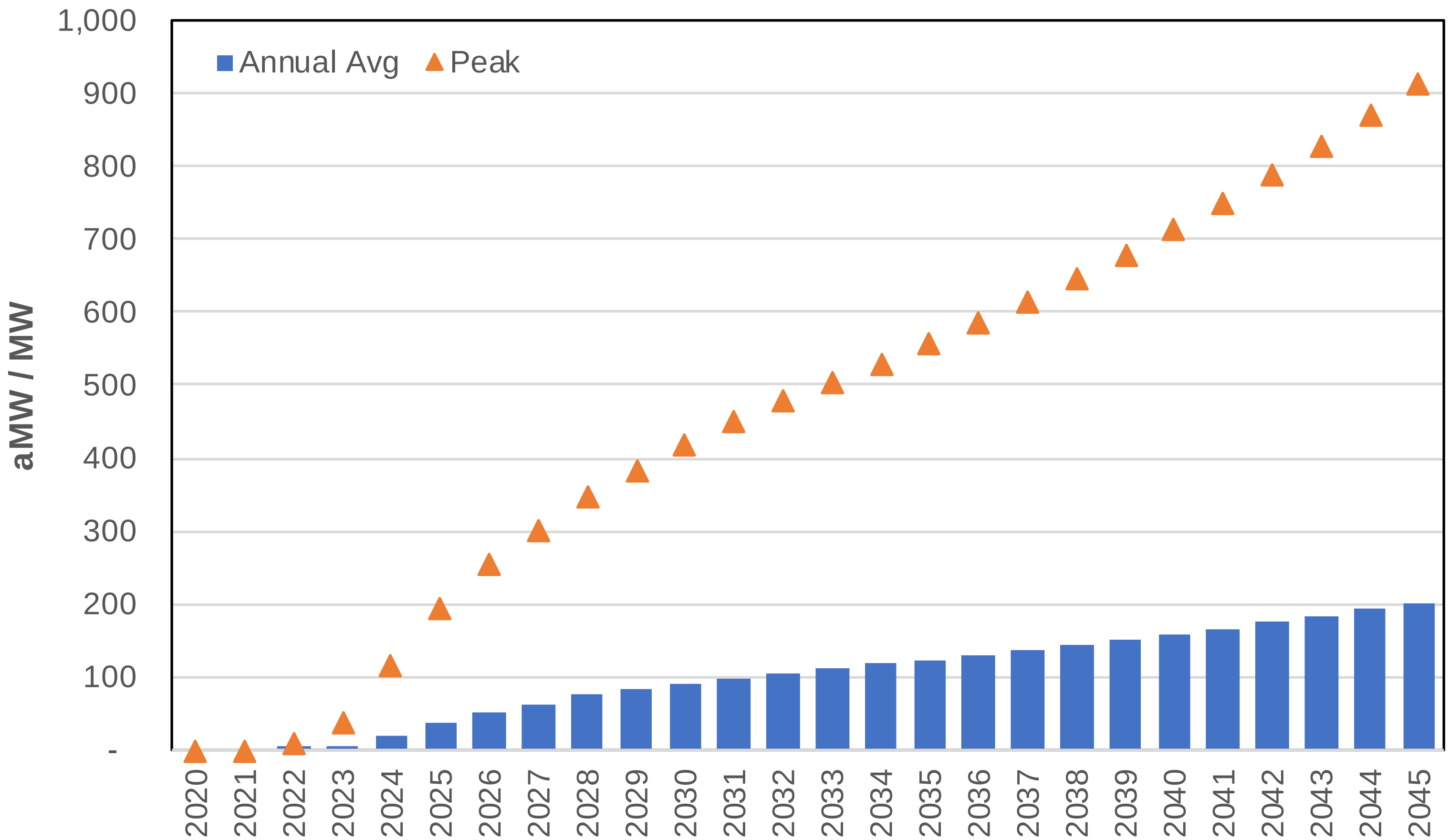
Eastern Washington Electric Service Providers

EIA reported retail sales for 2018

Scenario assumes Avista will receive 75 percent of electric conversions

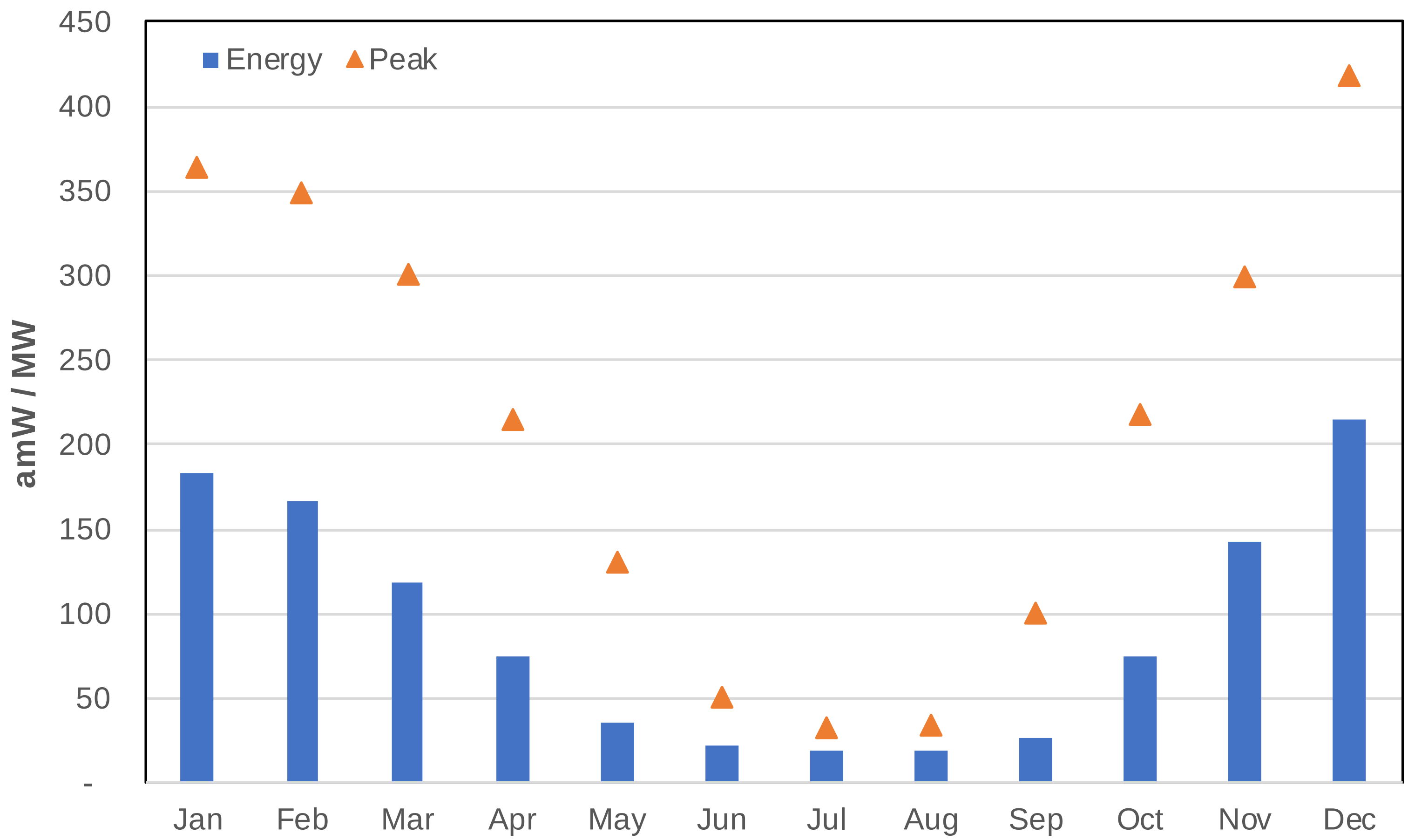


Annual Conversion Load Forecast

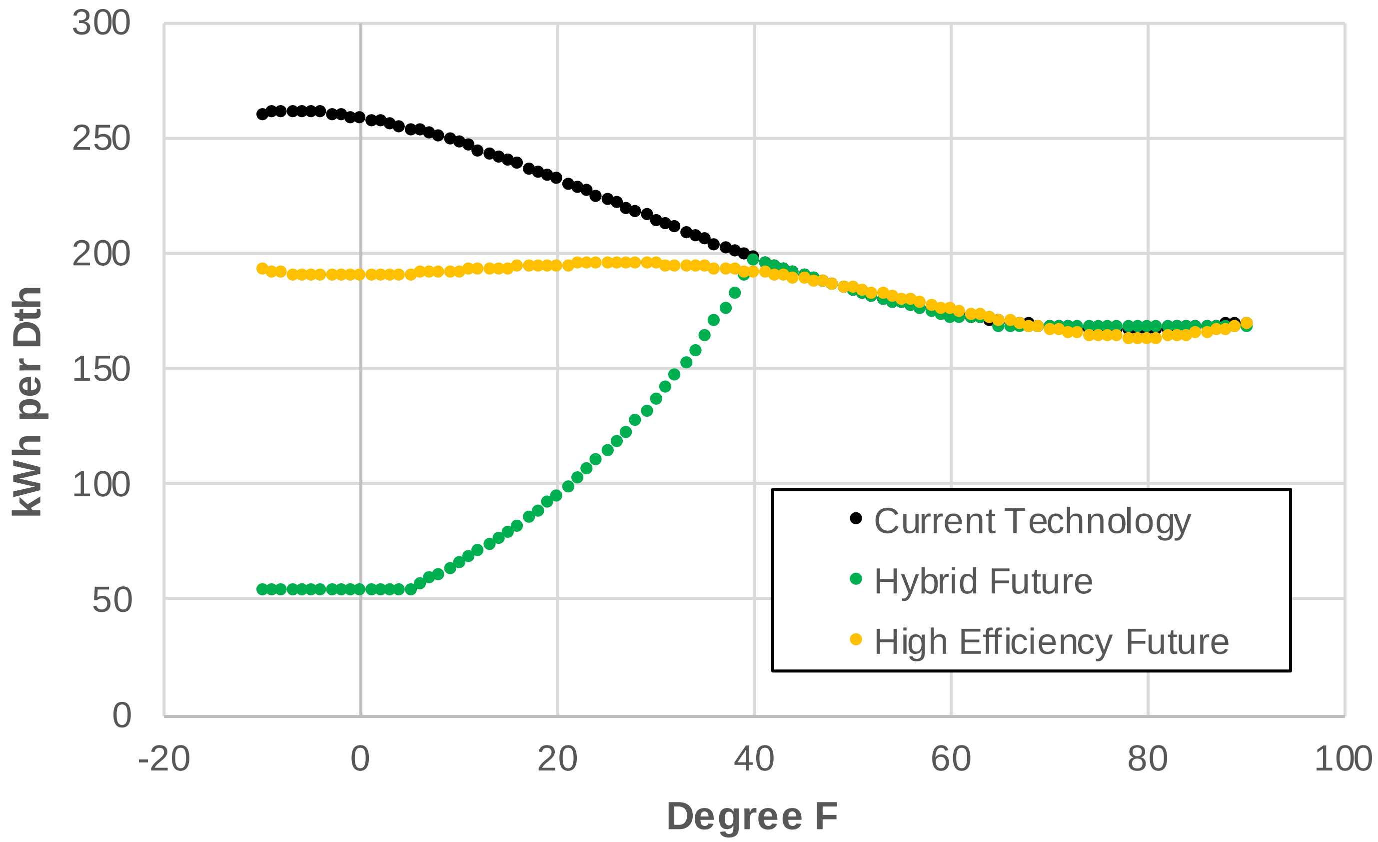


2020 IRP Forecast for 2030 absent fuel conversion:
Peak: 1,762 MW
Energy: 1,209 aMW

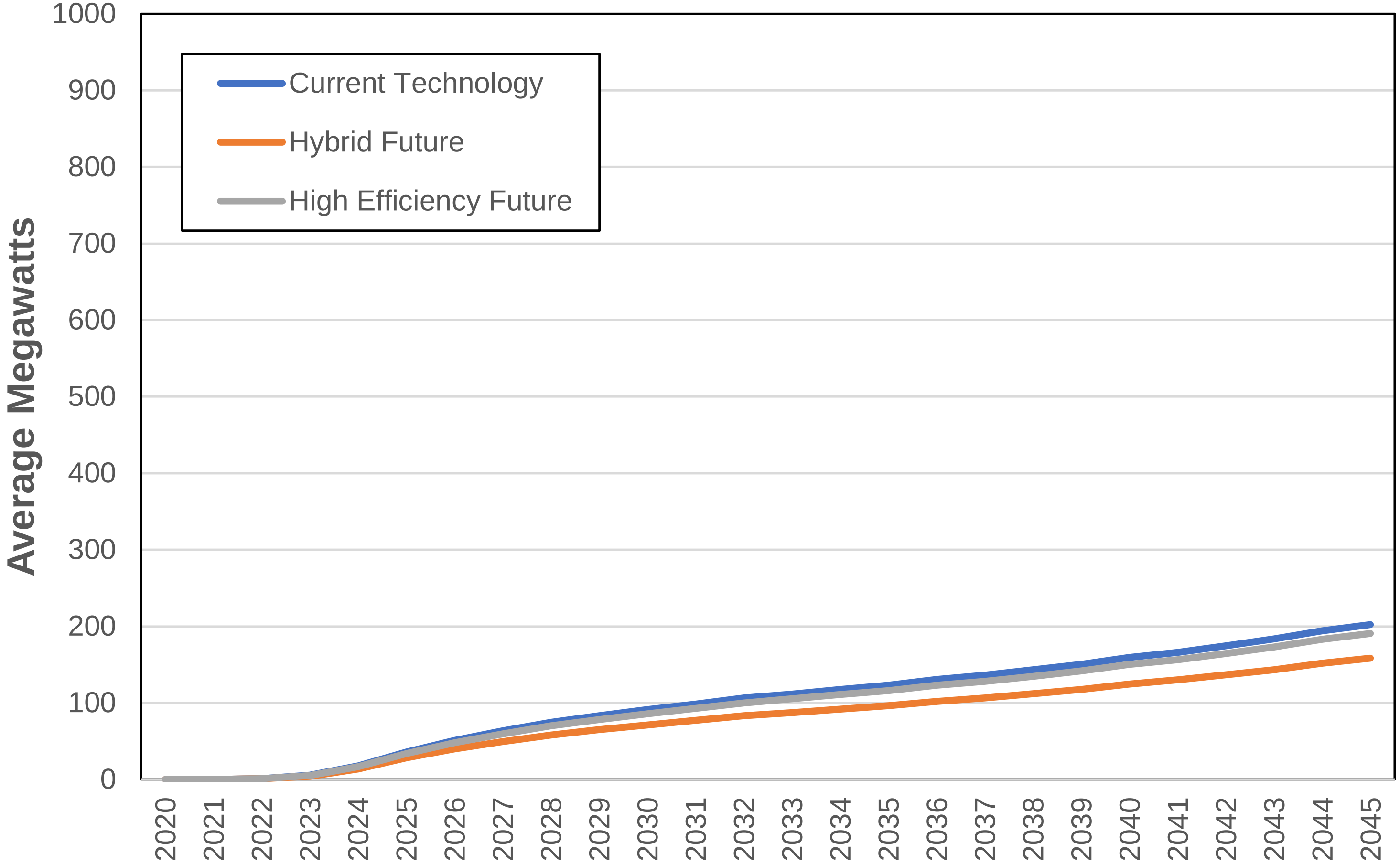
2030 Monthly Load Forecast



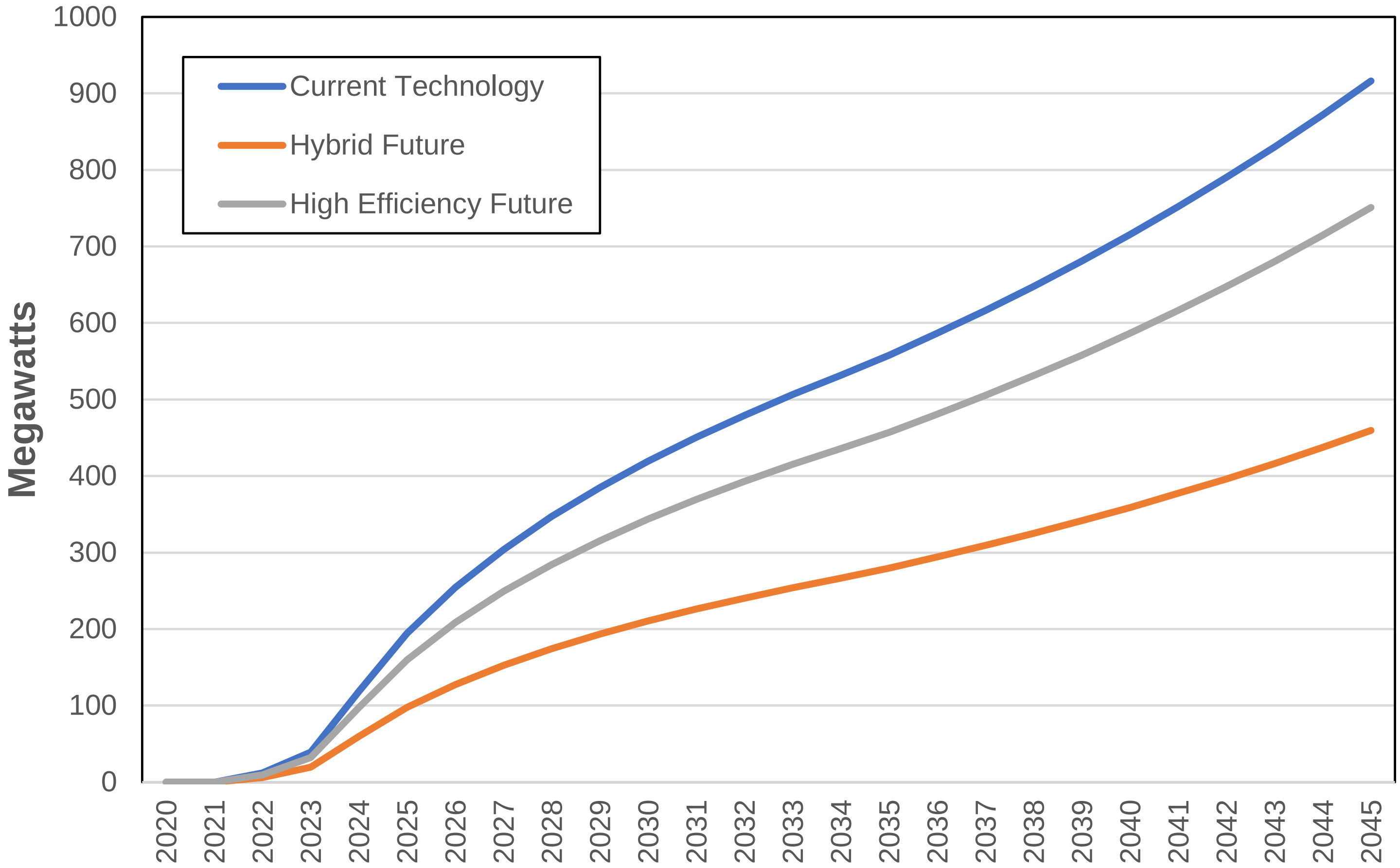
Scenario Analysis- Conversion Rates



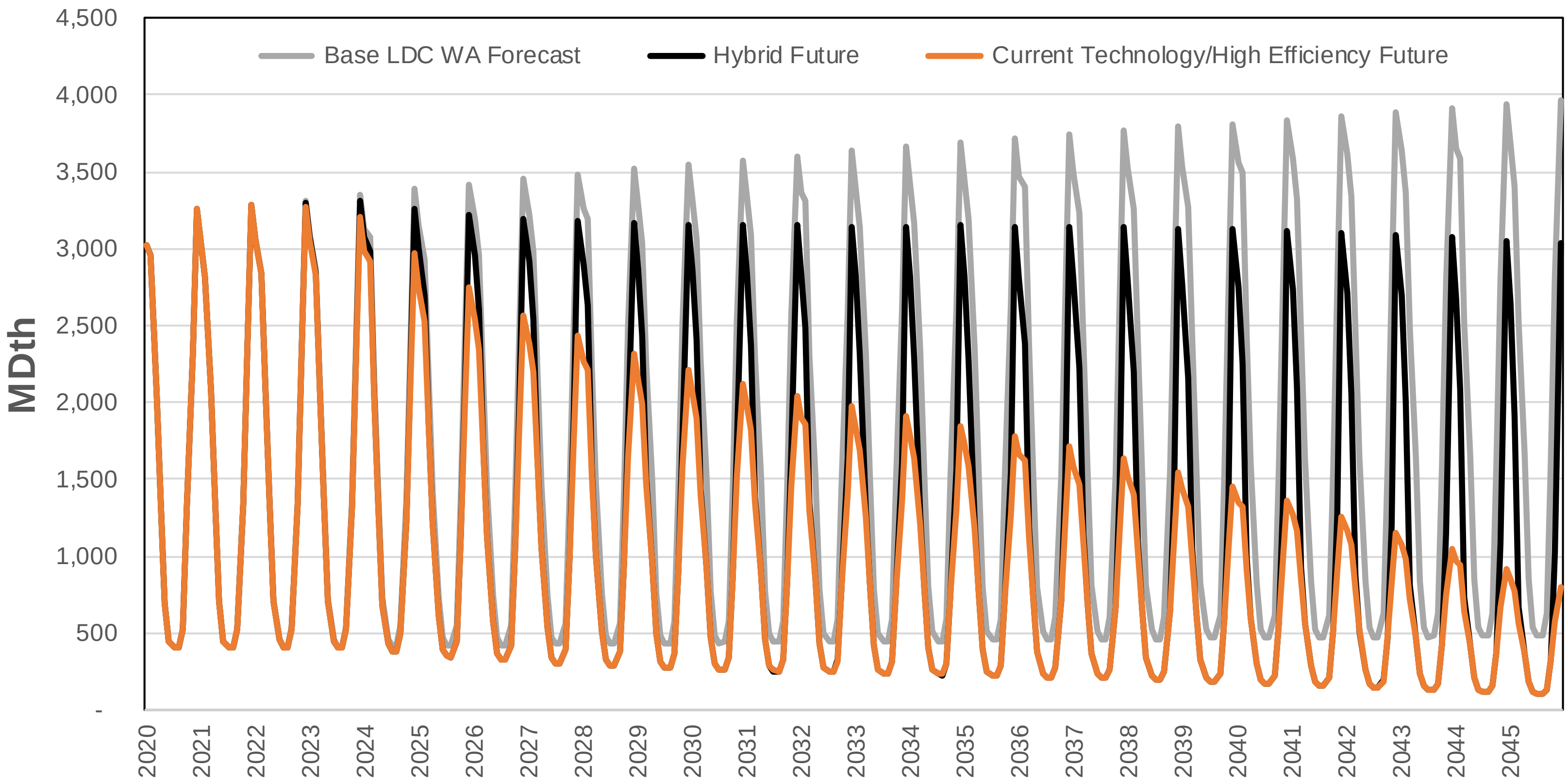
Scenario Analysis- Electric Energy



Scenario Analysis: Electric December Peak Load



Scenario Analysis: Natural Gas Demand



Next Steps

- Input into PRiSM model to determine resource selection and cost
  - Estimate cost meeting CETA requirements
  - Estimate cost using least cost methodology
  - Estimate emissions savings
  - Estimate $/tonne
- Conduct electric resource adequacy study if time permits

2021 Electric IRP
Washington Vulnerable Populations & Highly Impacted Communities

James Gall, IRP Manager
Second Technical Advisory Committee Meeting
August 6, 2020

Identifying Communities or "Customers"

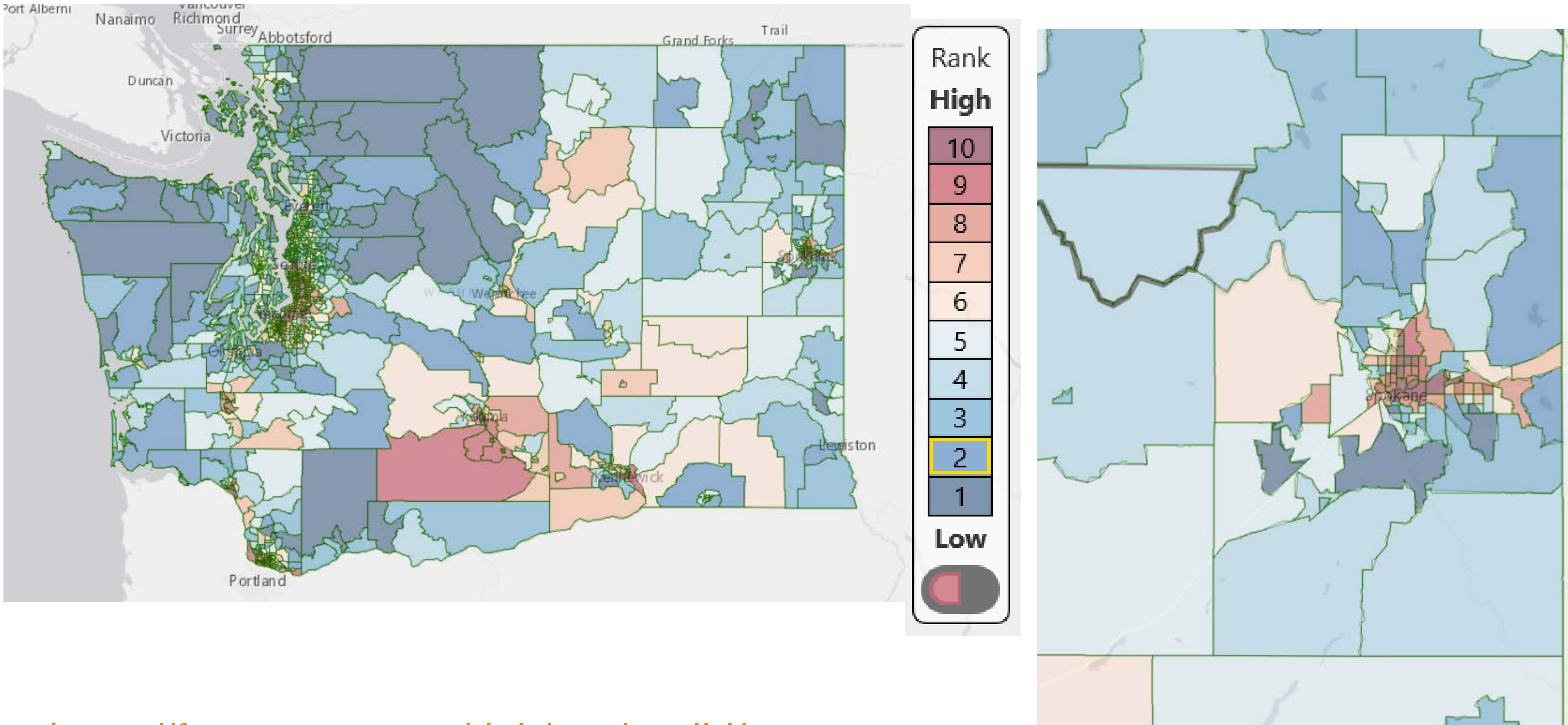
Highly Impacted Communities

- Cumulative Impact Analysis
- Tribal lands
  - Spokane
  - Colville
- Locations should be available by end of 2020
  - State held workshops in August & September 2019

Vulnerable Populations

- Use Washington State Health Disparities map
  - What is disproportionate on a scale of 1 to 10?
  - Avista proposes areas with a score 8 or higher in either Socioeconomic factors or Sensitive population metrics
- Should we include other metrics to identify these communities?

Environmental Health Disparities Map

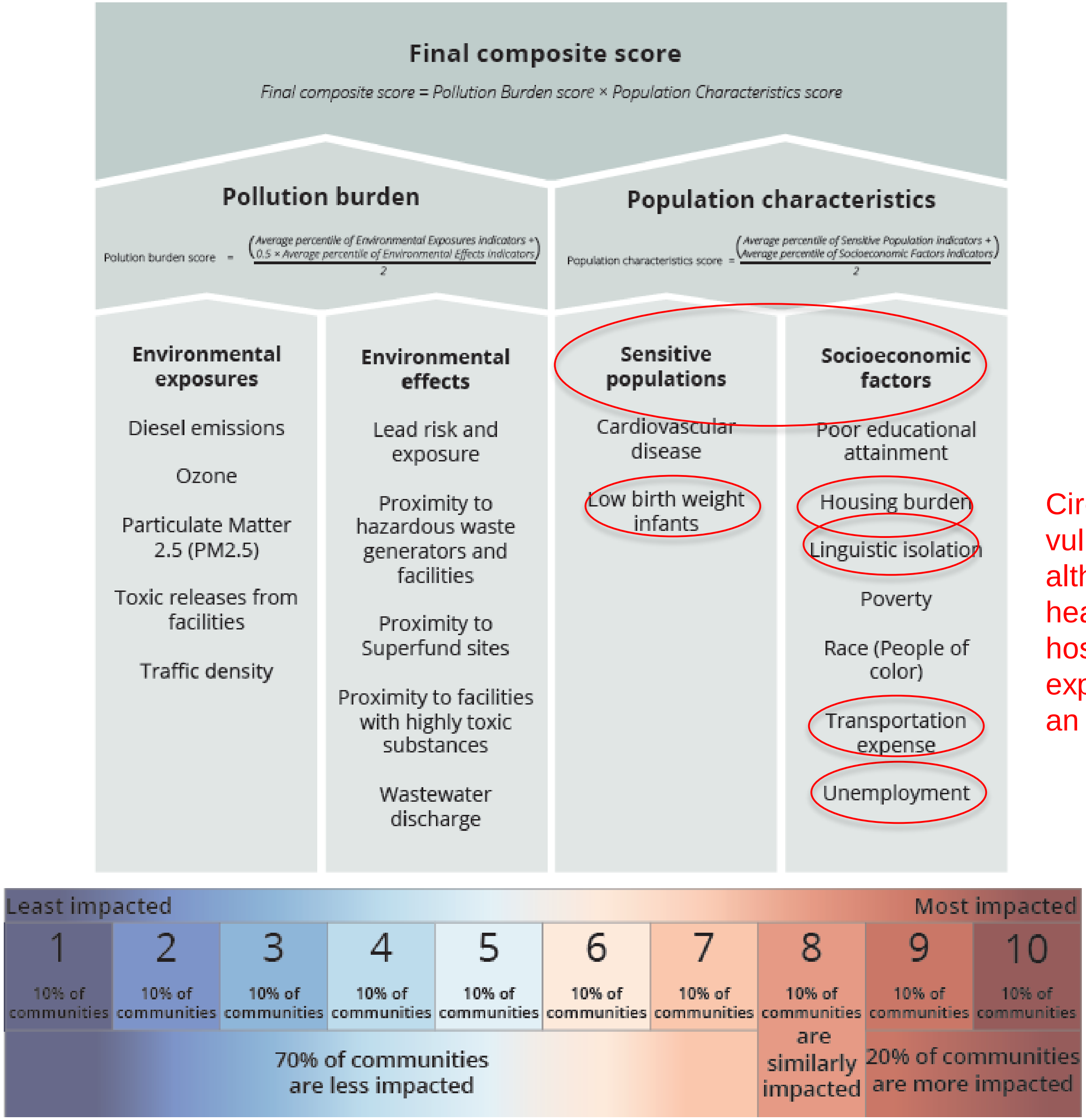


https://fortress.wa.gov/doh/wtn/wtnibl/

Department of Health data is divided up by Federal Information Processing Standards (FIPS) Code

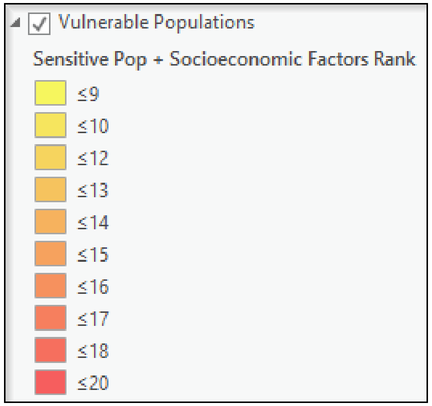
Environmental Health Scoring

From WA Department of Health

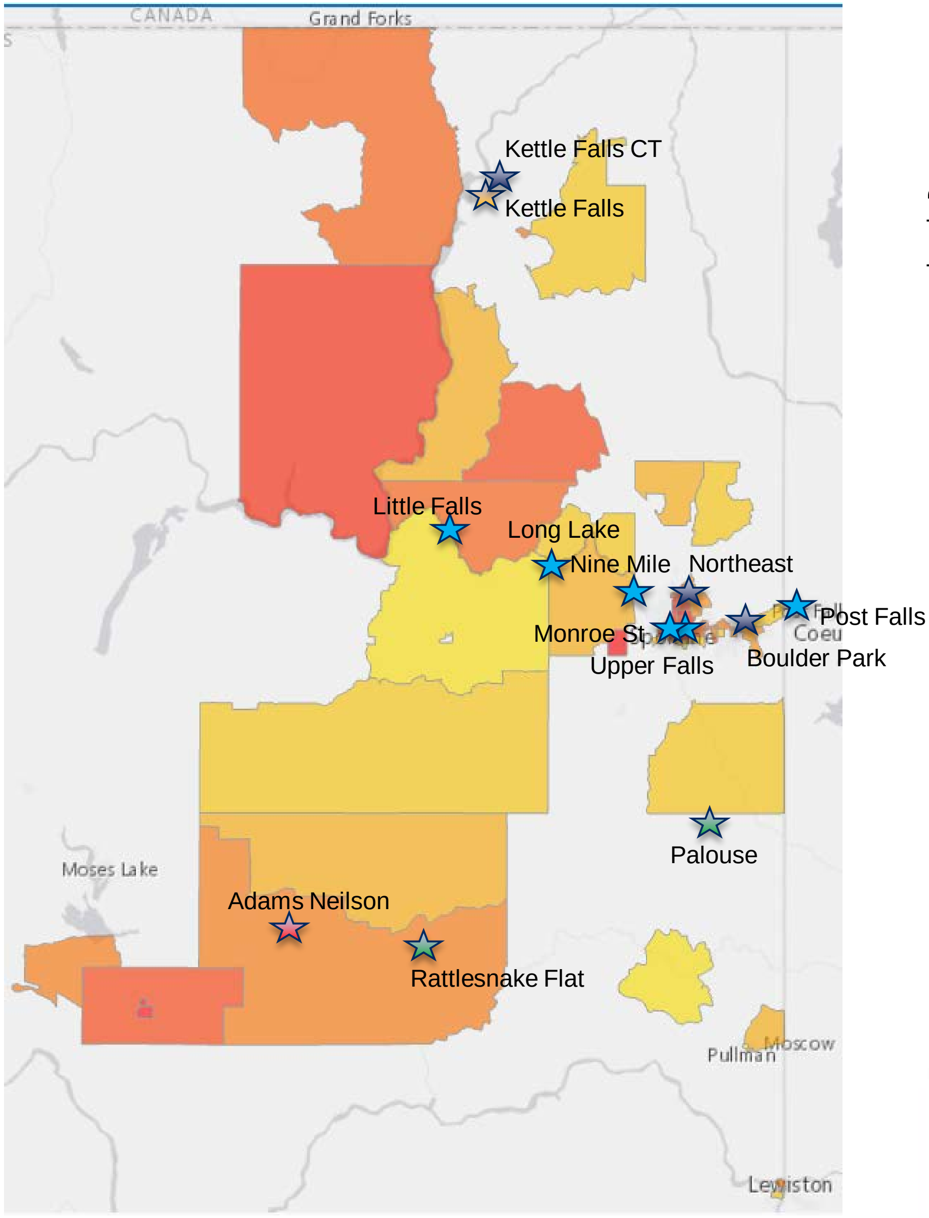


Circle areas match definition of vulnerable population, although access to food & health care, higher rates of hospitalization are not expressively included but are an indication of poverty

Selected Vulnerable Populations



Data is shown by combined score



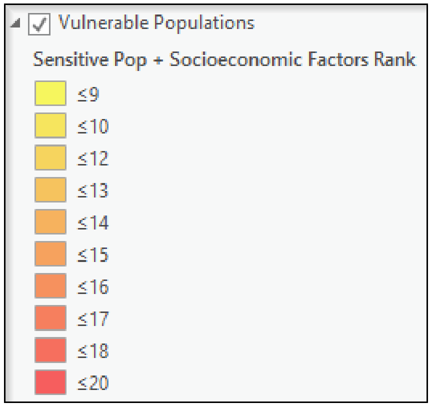
"Large" Resource Legend

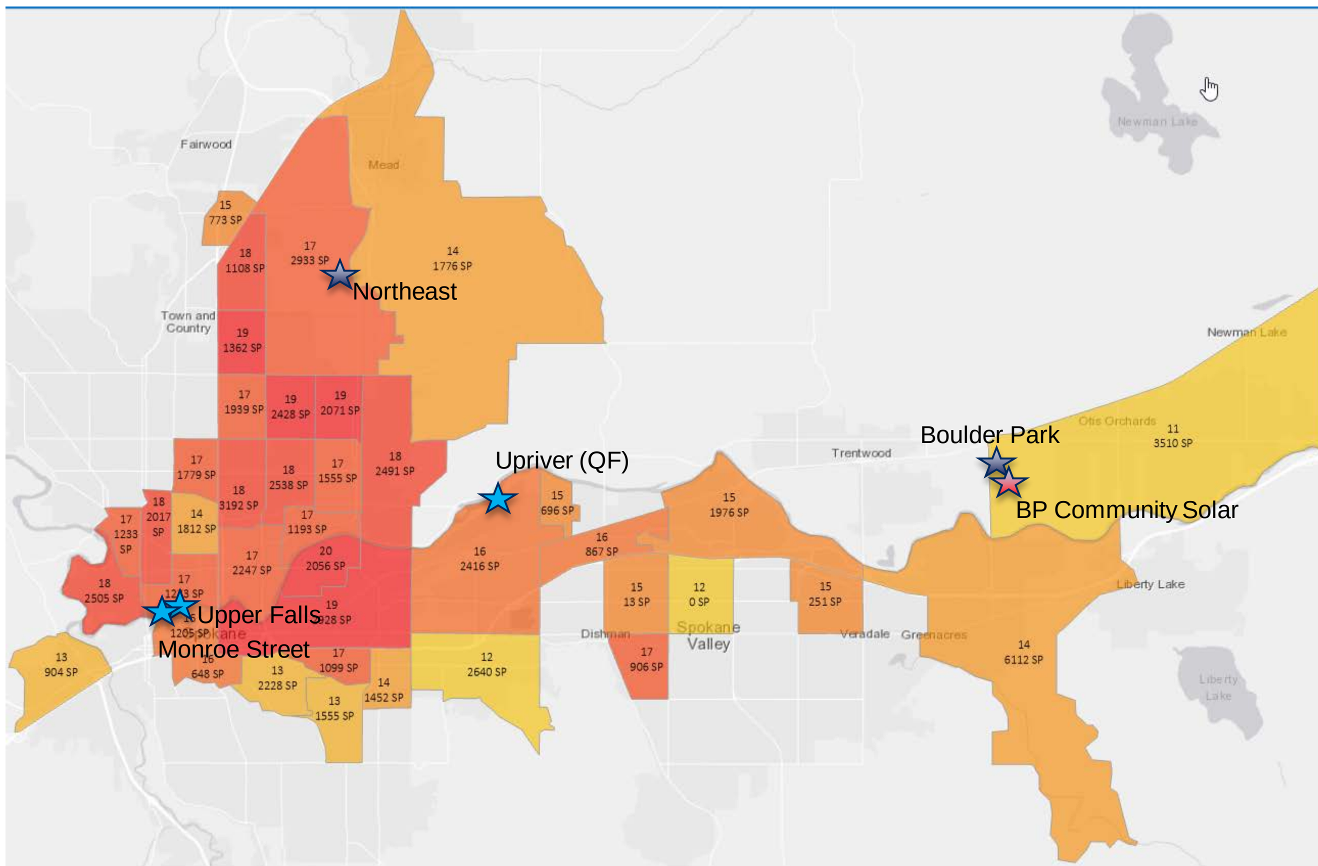
- Natural Gas
- Biomass
- Hydro
- Wind
- Solar

Spokane Area "Avista" Vulnerable Populations

<u>Resource Legend</u>

- Natural Gas
- Biomass/Other
- Hydro
- Wind
- Solar





Waste-to-Energy (QF)

Data is shown by combined score

N

IRP Metrics *(From Last TAC Meeting)*

Metric	IRP Relationship
Energy Usage per Customer	• Expected change taking into account selected energy efficiency then compare to remaining population. • EE includes low income programs and TRC based analysis which includes non-economic benefits.
Cost per Customer	• Estimate cost per customer then compare to remaining population. • How do IRP results compare to above 6% of income?

Preference	• Should the IRP have a monetary preference?
	  • For example- should all customers pay more to locate assets (or programs) in areas with vulnerable populations or highly impacted communities?
	  • If so, how much more?

IRP Metrics *(From Last TAC Meeting)*

Metric	IRP Relationship
Reliability • SAIFI: System Average Interruption Frequency Index • MAIFI: Momentary Average Interruption Frequency Index Resiliency: • SAIDI: System Average Interruption Duration Index • CAIDI: Customer Average Interruption Duration Index • CELID: Customer's Experiencing Long Duration Outages	• Calculate baseline for each distribution feeder and match with communities • Estimate benefits for area with potential IRP distribution projects • Compare to other communities as baseline • May be more appropriate in Distribution plan rather than IRP
Resource Analysis	• Estimate emissions (NO_X, SO_2, PM2.5, Hg) from power projects located in/near identified communities • Identify new resource or infrastructure project candidates with benefit to communities; i.e. economic benefit, reliability benefit • Identify how resource can benefit energy security

Energy Use Analysis Results

- Uses five years of customer billing data
- Median income over the same period is used to estimate affordability
- Separated electric only vs electric/gas customers
  - Future enhancement include single/multi family homes, and manufactured homes

Energy/Cost Analysis

Electric Only Customers

Area	Fuel Type	Energy Use	Avg Bill	Income	% Income
Vulnerable Population Areas	Electric	998 KWh	$98	$42,730	2.8%
Other Areas	Electric	1,010 KWh	$100	$58,834	2.0%

Note: Mean energy use is statistically significantly different when removing energy use data below 100 kWh per month (1,049 kWh vs 1,082 kWh)

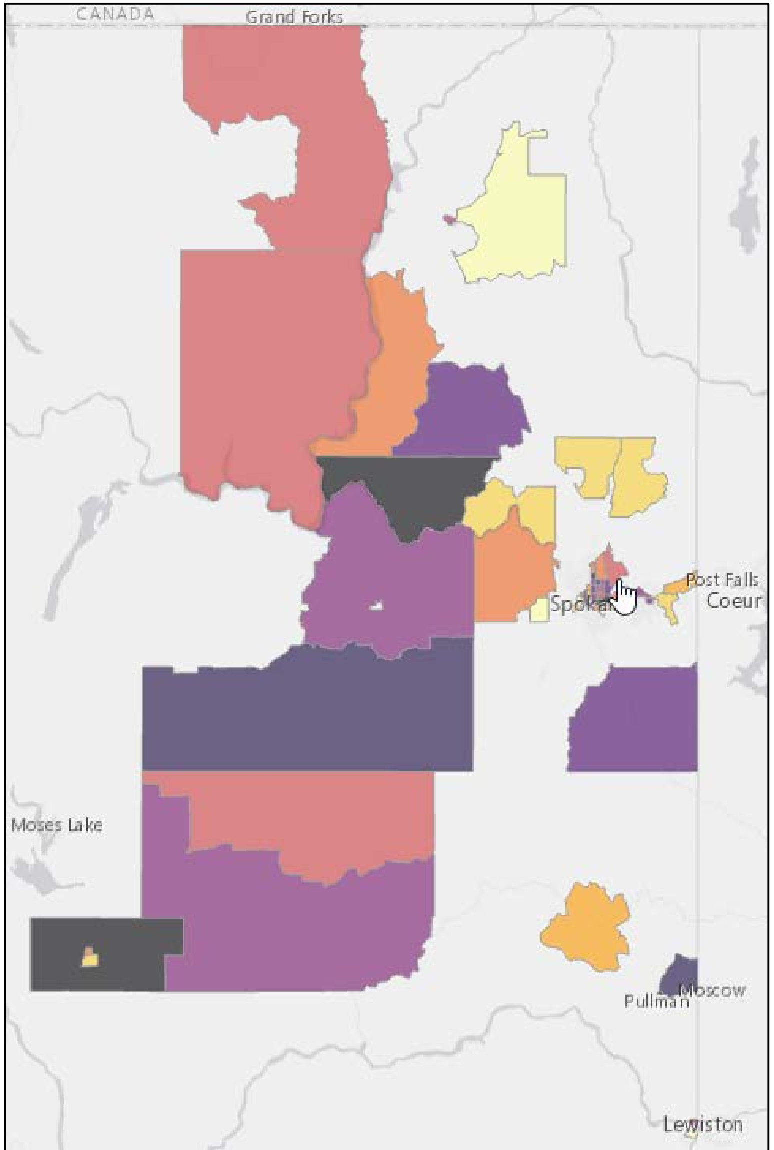
Natural Gas/Electric Customers

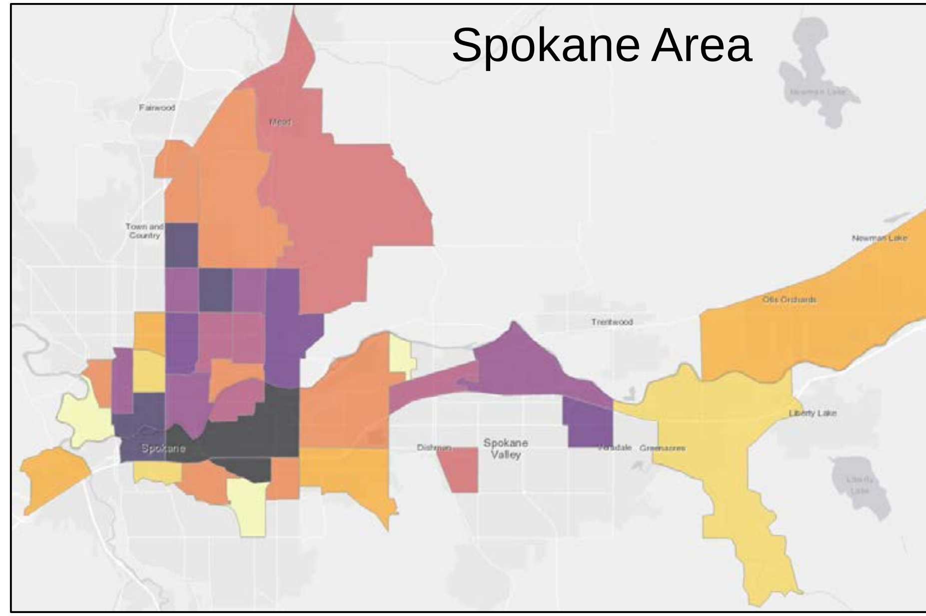
Area	Fuel Type	Energy Use	Avg Bill	Income	% Income
Vulnerable Population Areas	Electric	820 KWh	$80		
Other Areas	Electric	875 KWh	$84		
Vulnerable Population Areas	Gas	52 Therms	$47	$44,889	3.4%
Other Areas	Gas	62 Therms	$56	$68,250	2.5%

Note: Combined natural gas/electric homes have higher energy burden due to fewer multifamily homes included in the population or all electric home including homes with alternative heat such as wood, propane, oil, pellets. Future analysis needed to validate this hypothesis.

Vulnerable Populations

Electric Only Customers- Energy % of Income





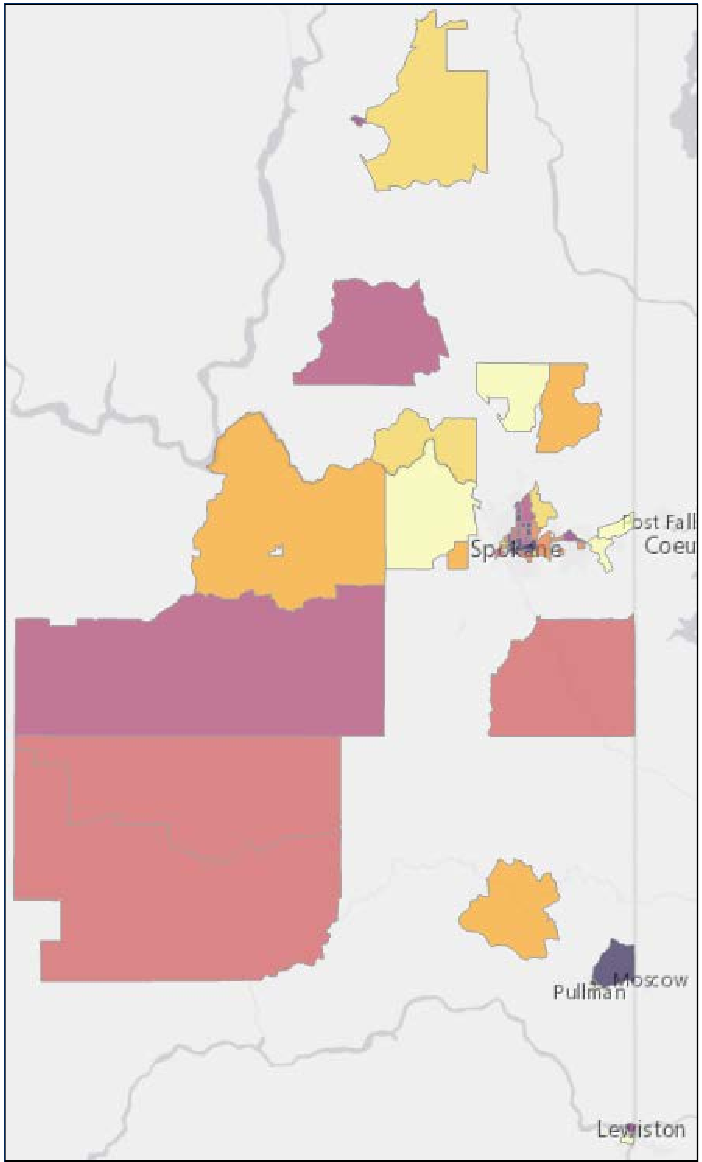
Energy Cost as % of Income - Electric Only

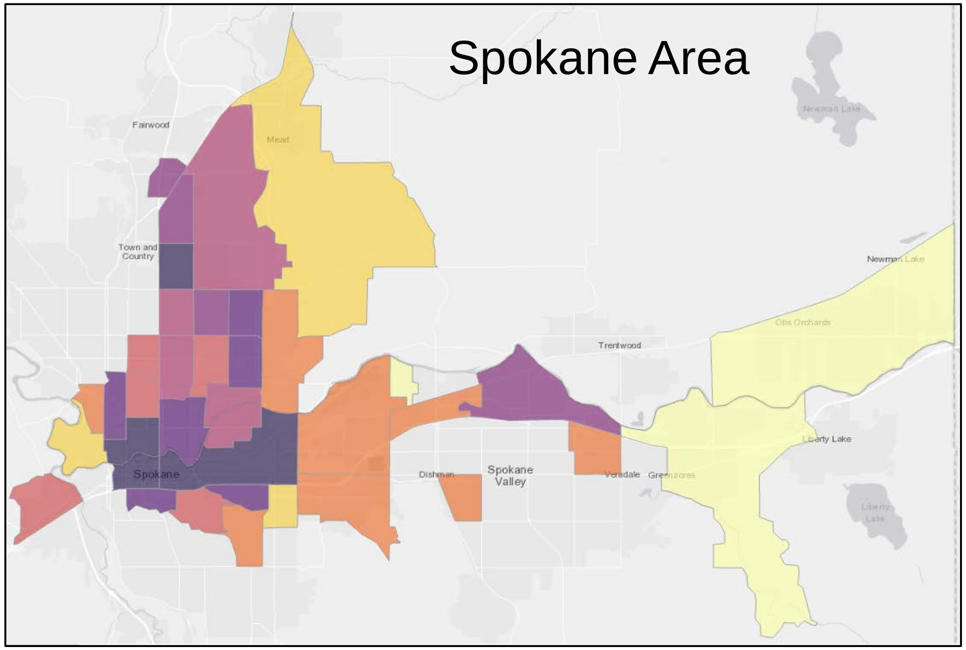
5 Year Avg for Electric Only Customers

- ≤ 2.08 %
- ≤ 2.24 %
- ≤ 2.41 %
- ≤ 2.56 %
- ≤ 2.69 %
- ≤ 2.95 %
- ≤ 3.12 %
- ≤ 3.34 %
- ≤ 3.84 %
- ≤ 4.27 %

Vulnerable Populations

Gas/Electric Only Customers- Energy % of Income





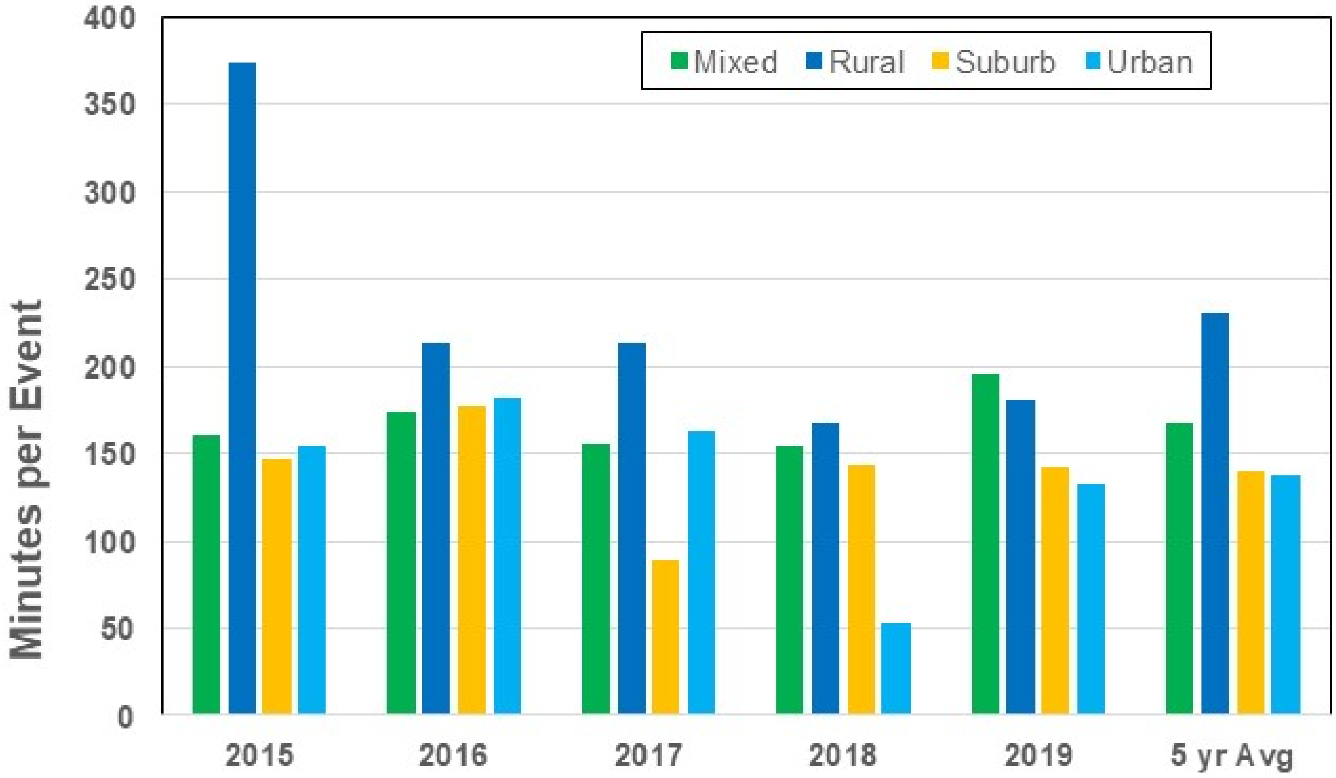
Energy Cost as % of Income - Electric & Gas

5 Year Avg for Customers with Both

- ≤ 2.64 %
- ≤ 2.81 %
- ≤ 3.04 %
- ≤ 3.32 %
- ≤ 3.66 %
- ≤ 4.01 %
- ≤ 4.49 %
- ≤ 5.10 %
- ≤ 7.92 %
- ≤ 11.07 %

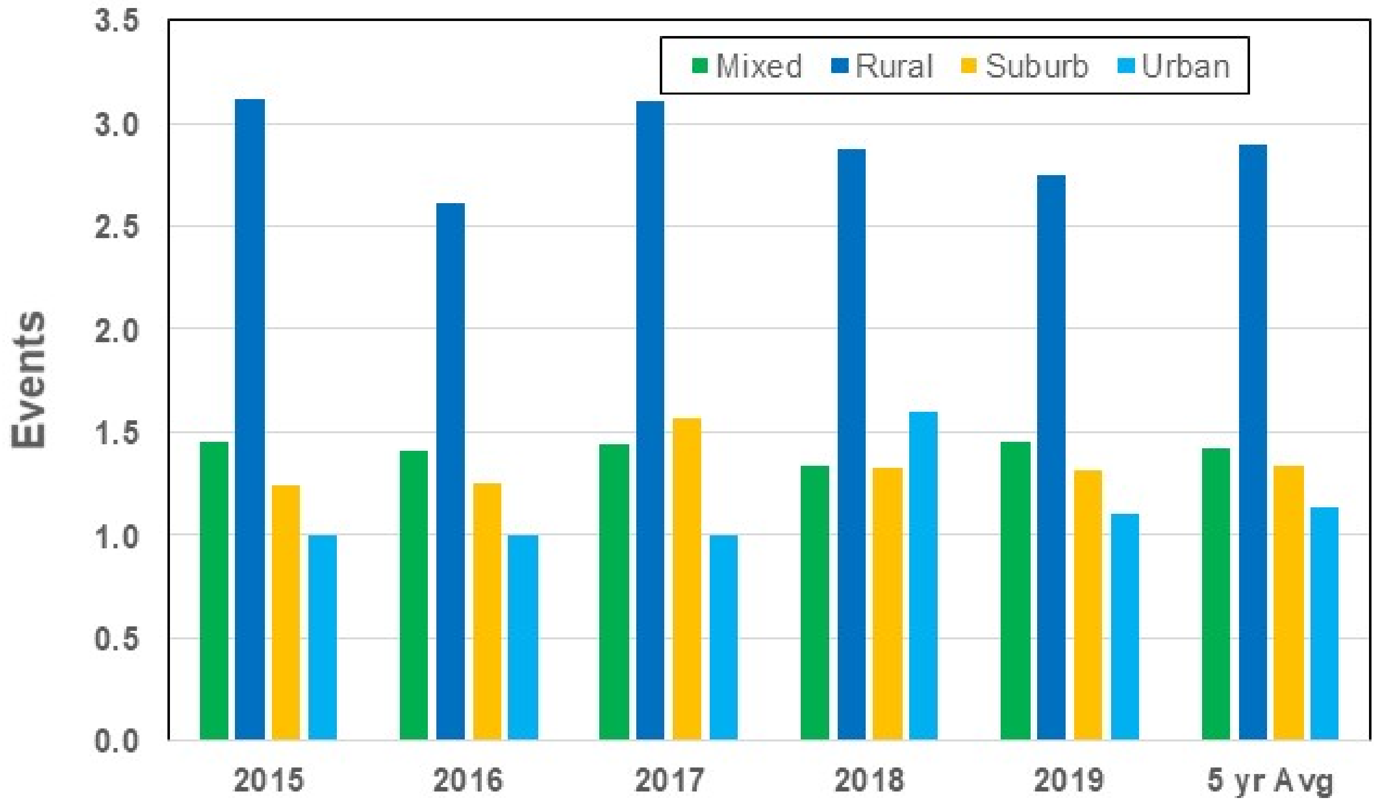
Reliability Data- CAIDI

Measure of resilience- minutes of outages per event
Excludes Major Event Days (MED)



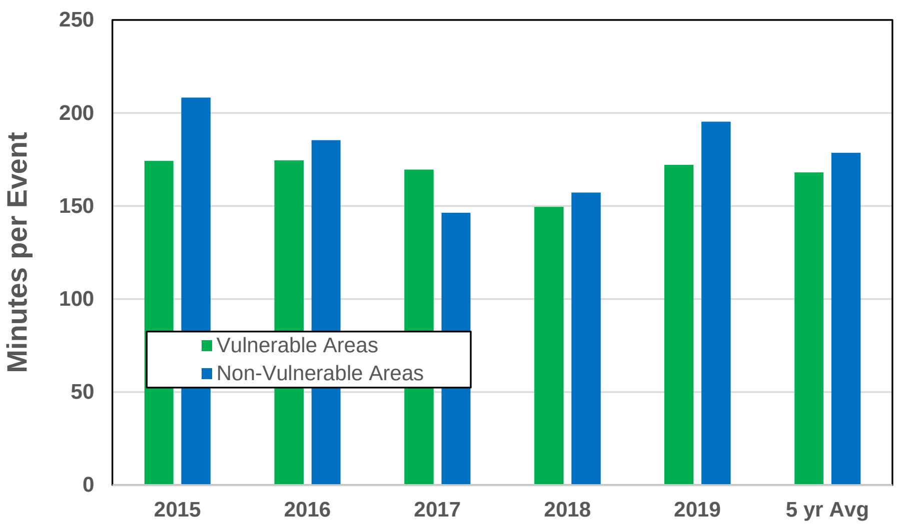
Reliability Data- CEMI

Measure of reliability- Events per Customer

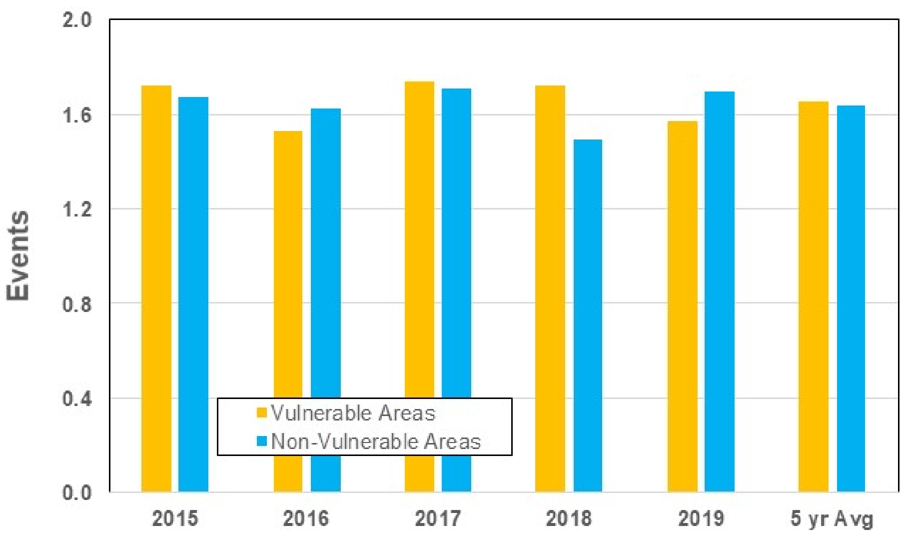


Vulnerable Area vs Non Vulnerable Areas

CAIDI

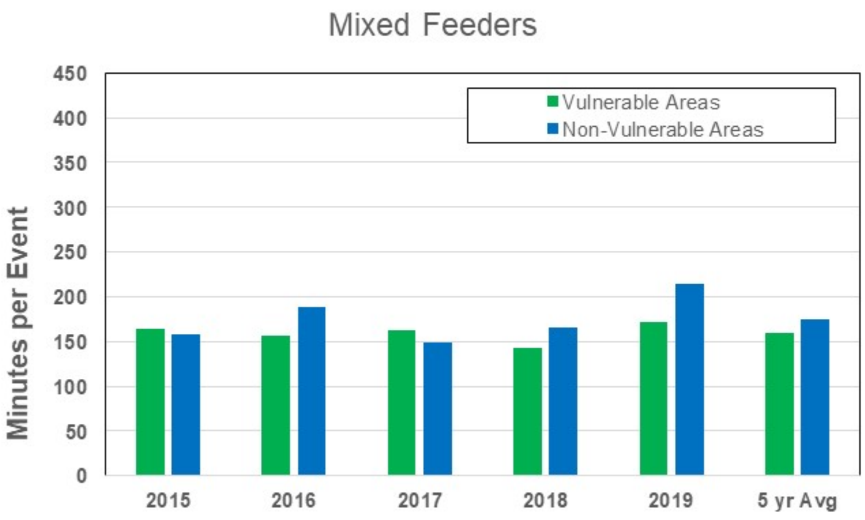


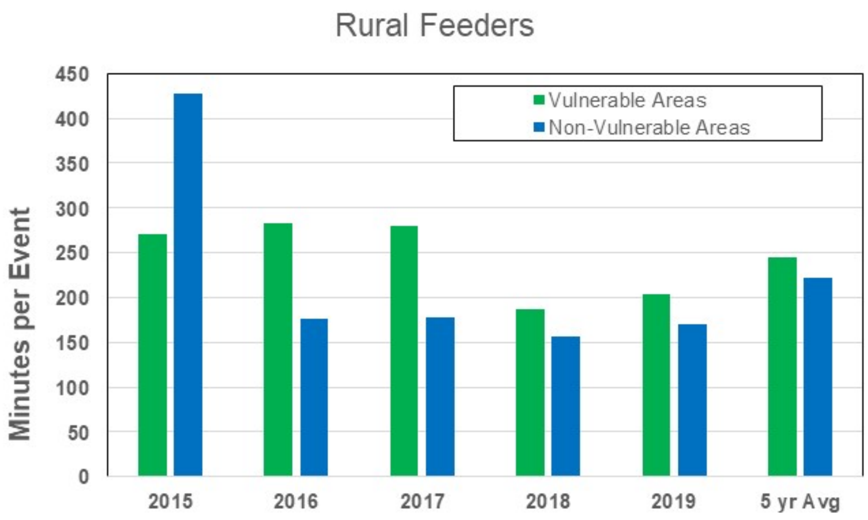
CEMI

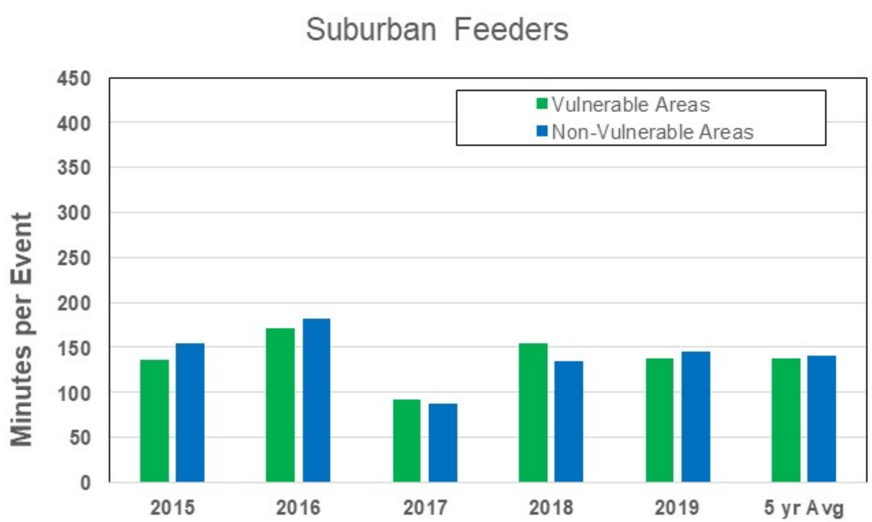


Note: 5 yr Average differences are statistically significantly different

CAIDI- By Feeder Type



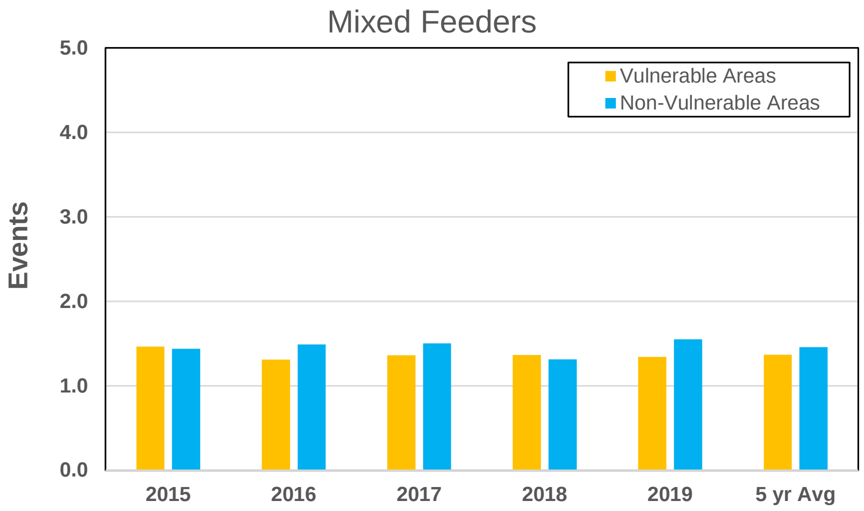


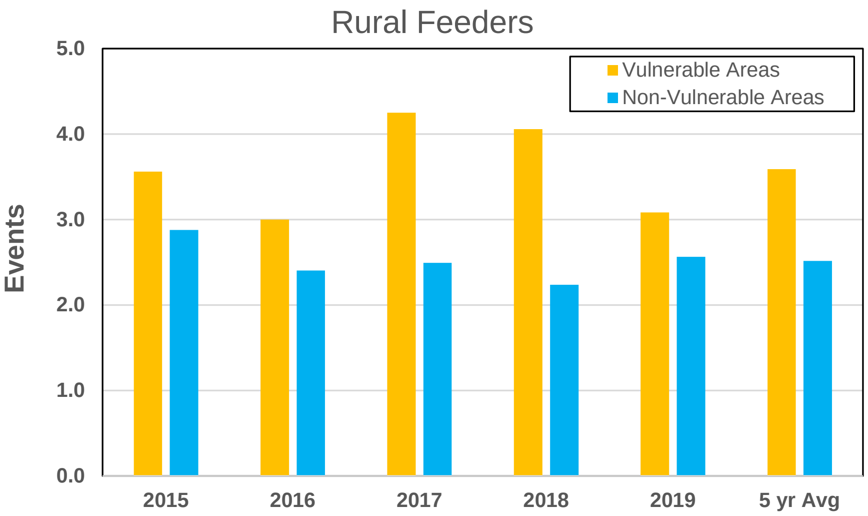


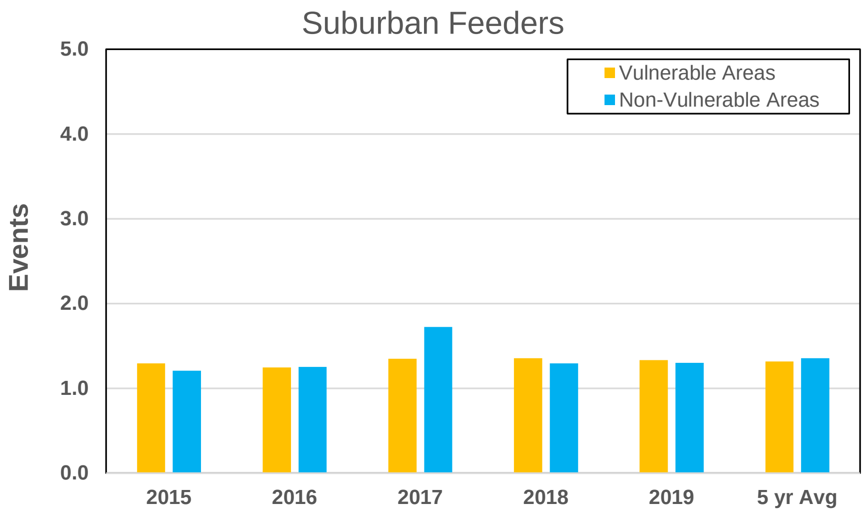
Note: Avista has no vulnerable areas with urban feeders

AVISTA

CEMI- By Feeder Type

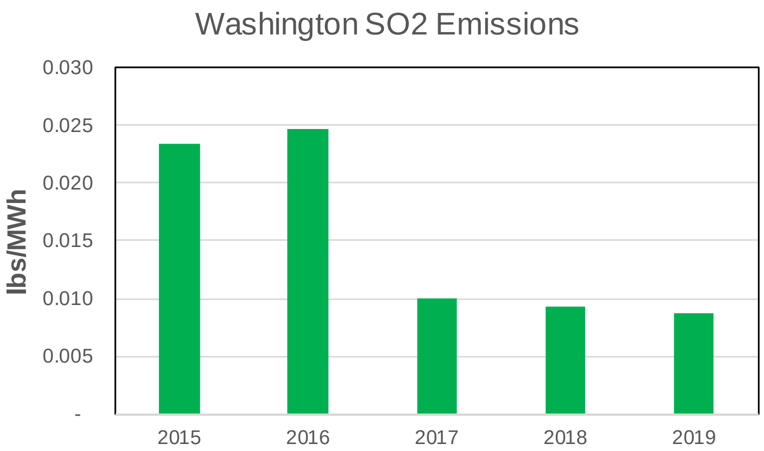


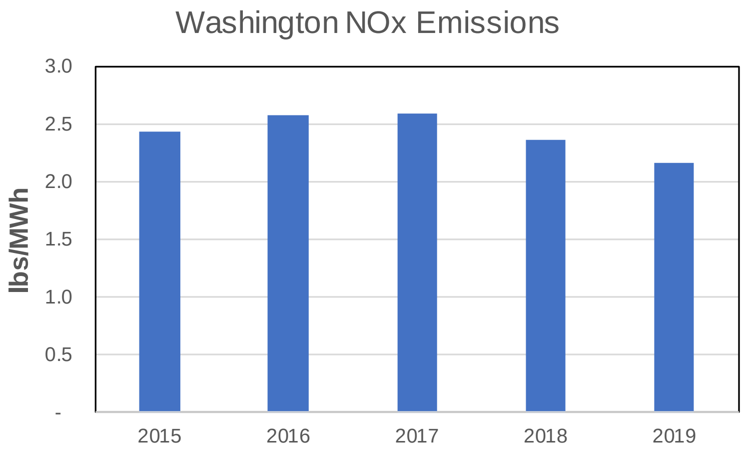


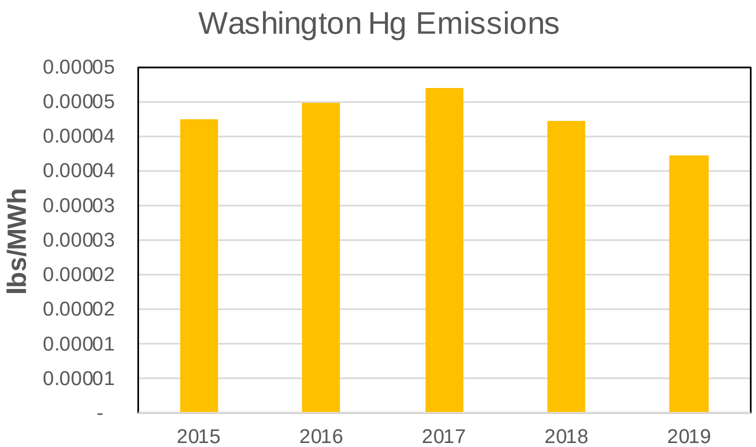


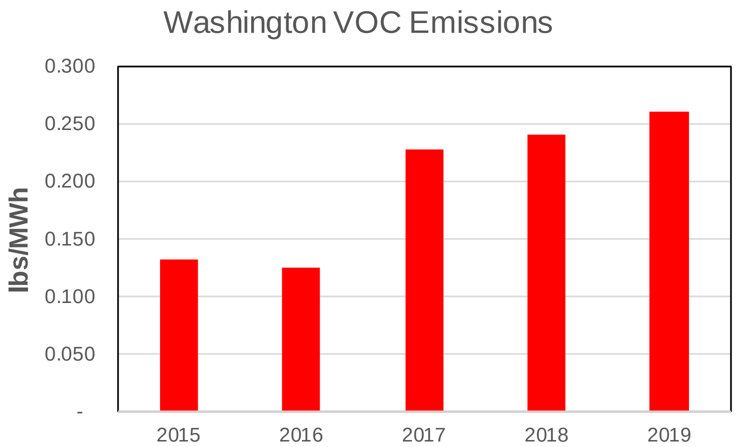
Note: Avista has no vulnerable areas with urban feeders

Avista's Washington Power Plant Air Emissions









TAC Input

- What other metrics can we provide in an IRP to show vulnerable populations and highly impacted communities are not harmed by the transition to clean energy