Northwest **Power** and **Conservation** Council

March 6, 2018

MEMORANDUM

TO: **Council Members**

FROM: **Elizabeth Osborne, Washington staff**

SUBJECT: **Snohomish PUD 2017 Integrated Resource Plan**

BACKGROUND:

Presenter: Anna Berg, Senior Manager, Power Supply, Snohomish Public Utility District No. 1

Summary: Snohomish PUD's most recent Integrated Resource Plan was completed at the end of 2017, and outlines the PUD's long-term resource strategy and near term action plan. Anna Berg manages the IRP process at the PUD, and will summarize the IRP process and resulting resource strategy, which relies heavily on energy conservation and includes further exploration of demand response and other low cost, low emissions alternatives for dispatchable capacity resources.

Background: Snohomish PUD is the second largest publicly owned utility in Washington state and the largest public utility district. It serves almost 350,000 electric customers with a hydro-dominant fuel mix that also includes smaller amounts of nuclear, coal, and natural gas.

More Info: Snohomish PUD Integrated Resource Planning

851 S.W. Sixth Avenue, Suite 1100
Portland, Oregon 97204-1348
www.nwcouncil.org

Steve Crow
Executive Director

503-222-5161
800-452-5161
Fax: 503-820-2370

2017 IRP Highlights

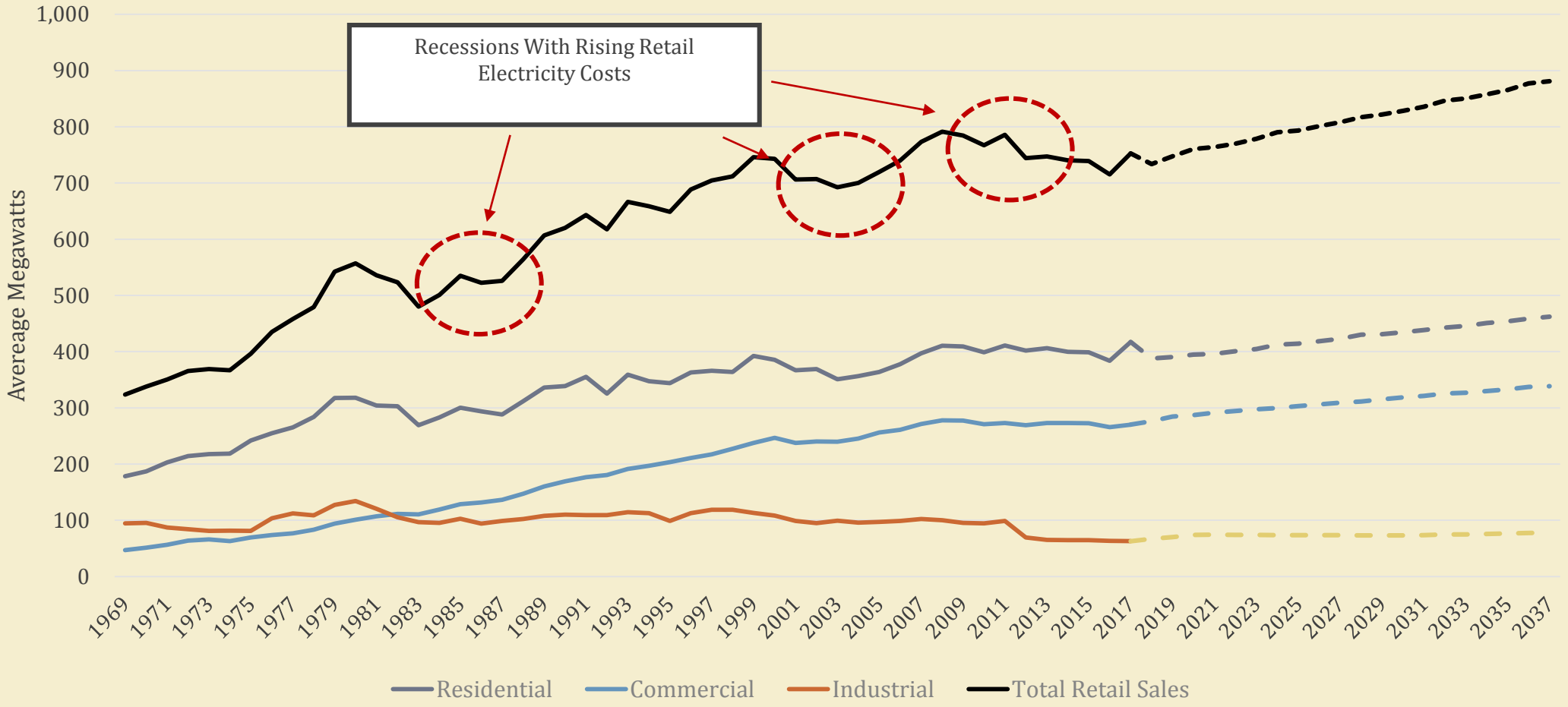
Northwest Power & Conservation Council
Power Committee
March 13, 2018

Pre-Decisional & Informational Discussion

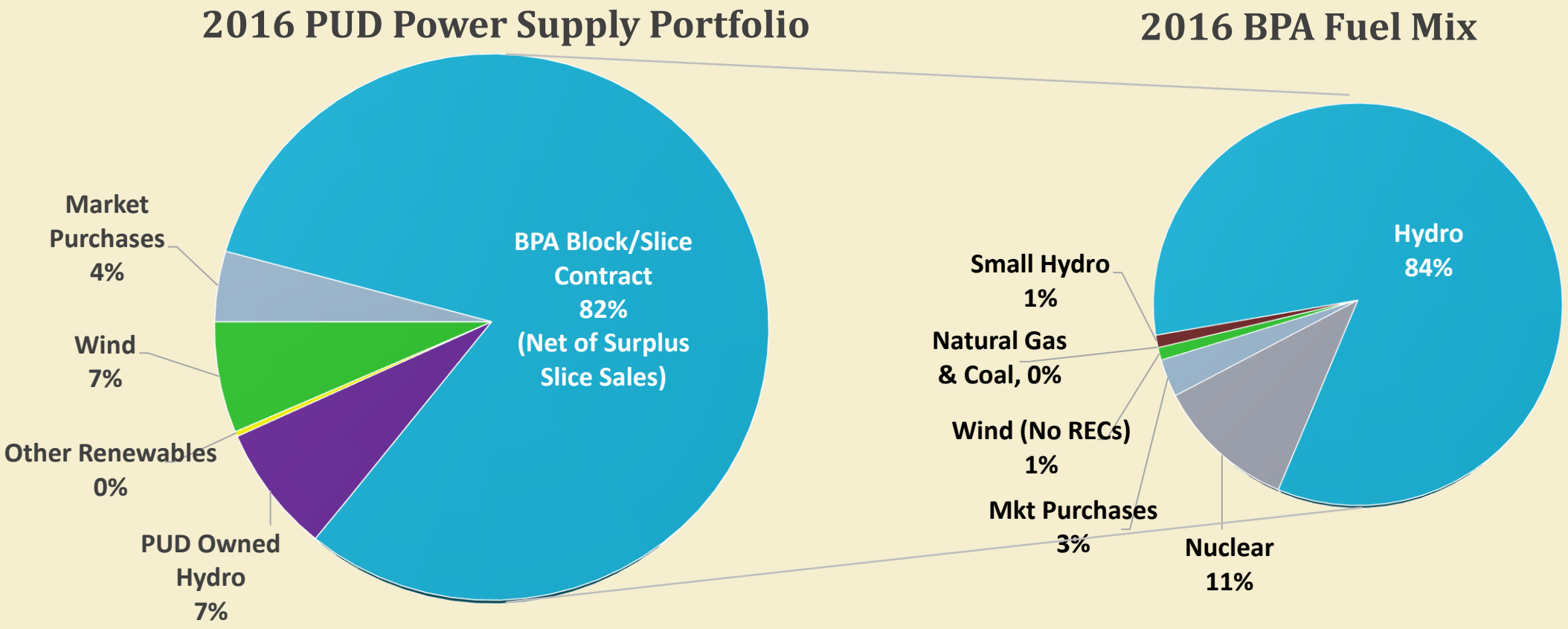
Today

- **Who We Are**
- **Scenarios & Planning Assumptions**
- **Resource Need**
- **Demand & Supply Side Options**
- **Portfolio Results**
- **Proposed Resource Strategy & Action Plan**
- **Schedule**

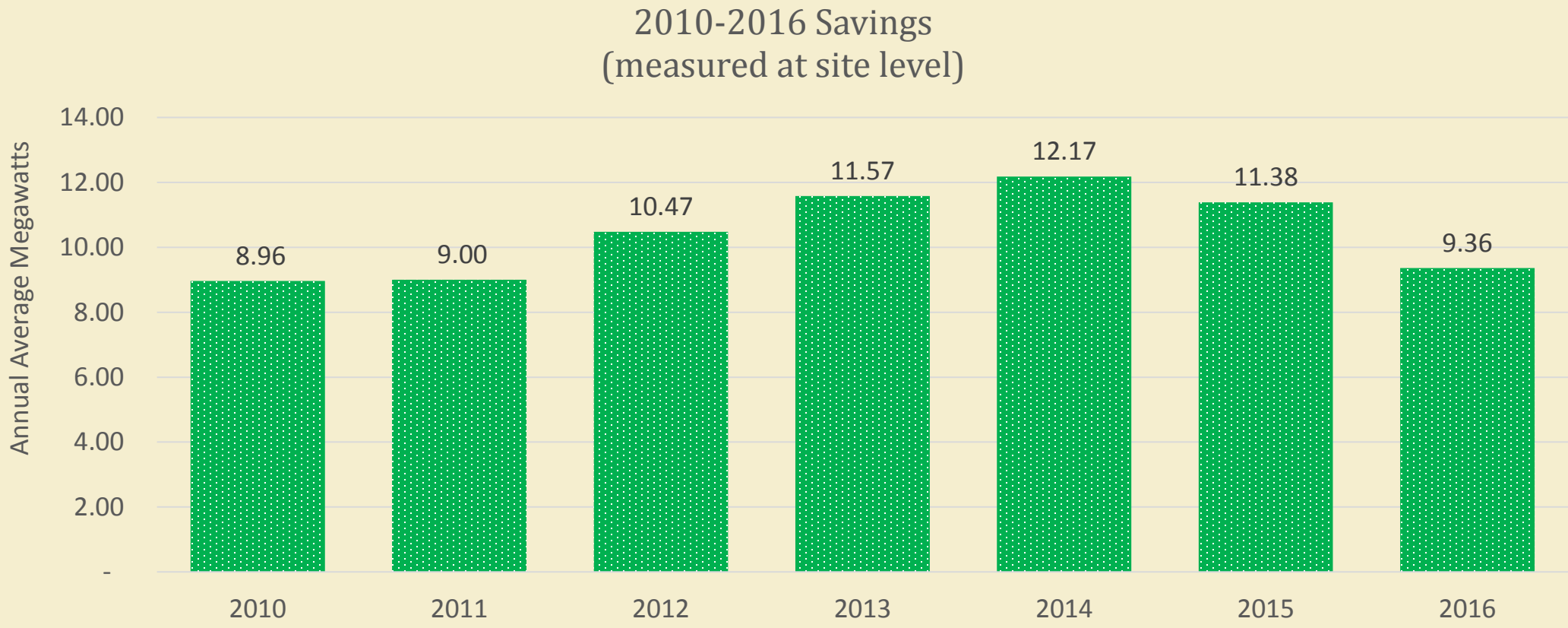
Historical and Forecast Annual Retail Sales
(before New Conservation)



Snohomish PUD's Resource Mix



Historical Conservation Achievements



Guiding Principles

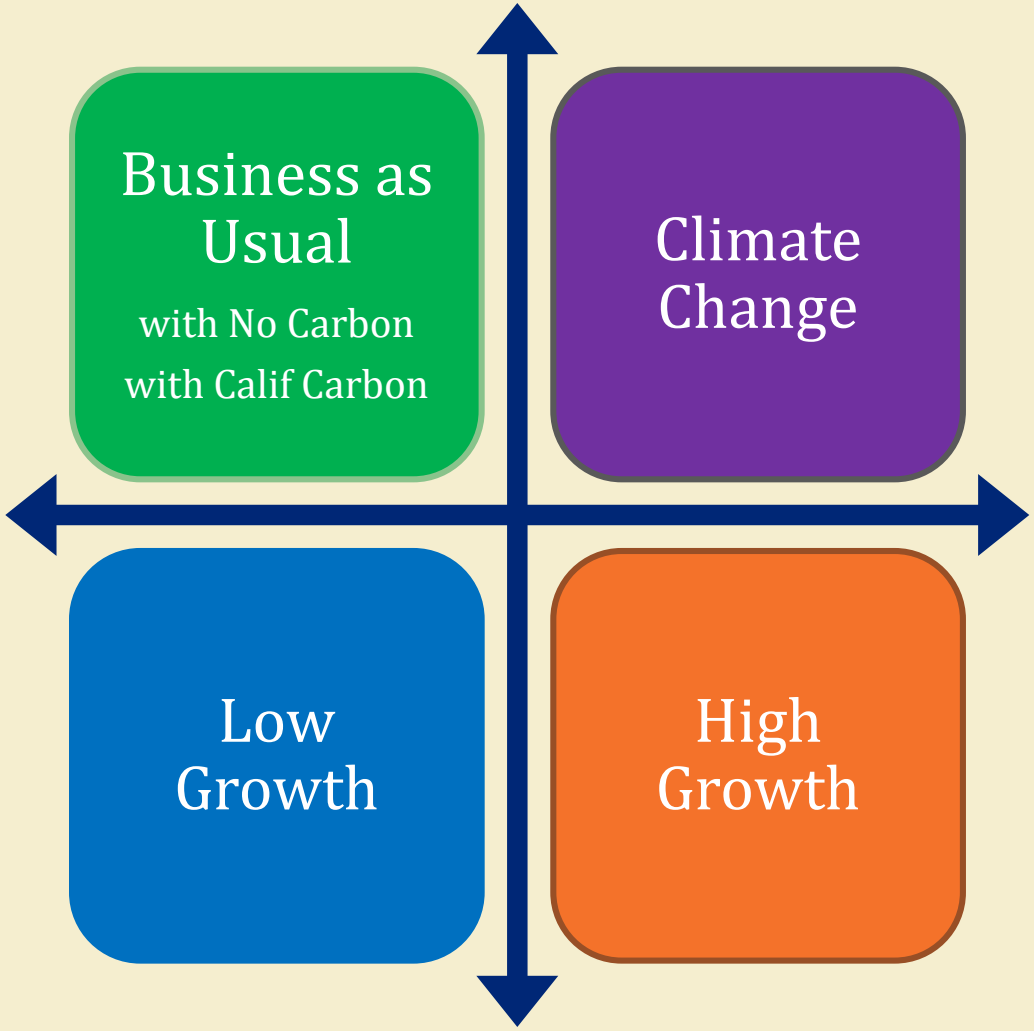
1. Pursue all cost effective conservation.
2. For load growth not met by conservation, consider "… a diversity in resource options that provide the optimum balance of environmental and economic elements."*
3. Comply with Board policies and all applicable policies, regulations, state laws.
4. Preserve PUD flexibility.

*"*Climate Change Policy and Strategies," adopted by Snohomish PUD Board of Commissioners, March 6, 2007*

Scenarios and Planning Assumptions

2017 IRP Scenarios

IRP Study Period 2018-2037



Sensitivities

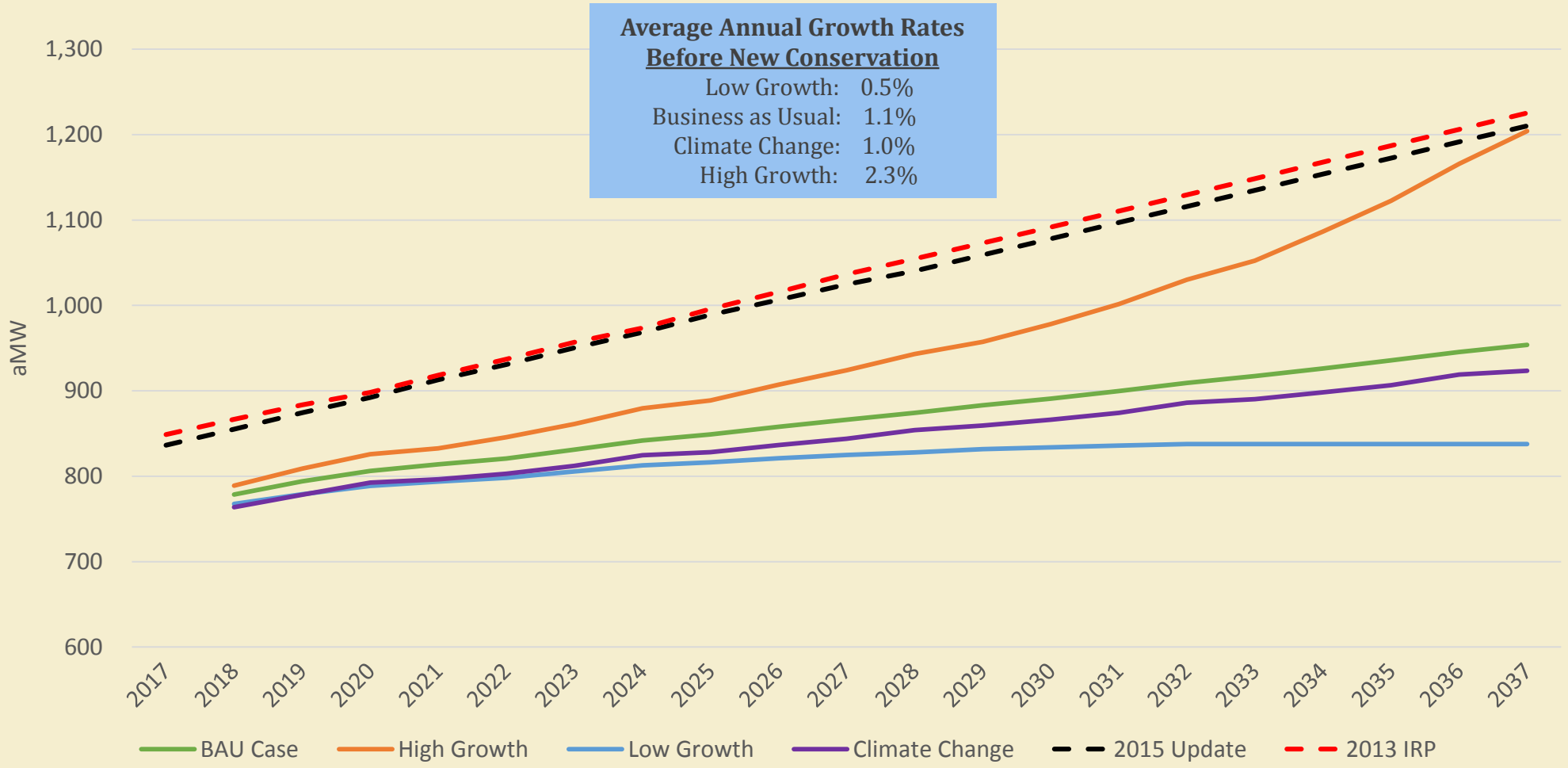
- No Snake River Dams
- Renewables Only

Planning Assumptions by Scenario

Scenario	Load Growth Rate[1]	Natural Gas Price Forecast	Carbon Costs[2]
Low Growth	.5%	$2.89 to $5.80 per MMBtu	EPA Low Societal Cost of Carbon 2018 $12 to 30/ton
BAU with No Carbon	1.1%	$3.00 to $6.64 per MMBtu	Current Law 2018 through 2037 ($.32/MWh)
BAU with Calif Carbon	1.1%	$3.00 to $6.64 per MMBtu	California Carbon Costs beginning 2022 $14 to $60/ton
Climate Change	1.0%	$2.89 to $5.80 per MMBtu	EPA Low Societal Cost of Carbon 2018 $12 to 30/ton
High Growth	2.3%	$3.21 to $10.56 per MMBtu	EPA Mid-High Societal Cost of Carbon 2018 $42 to $90/ton

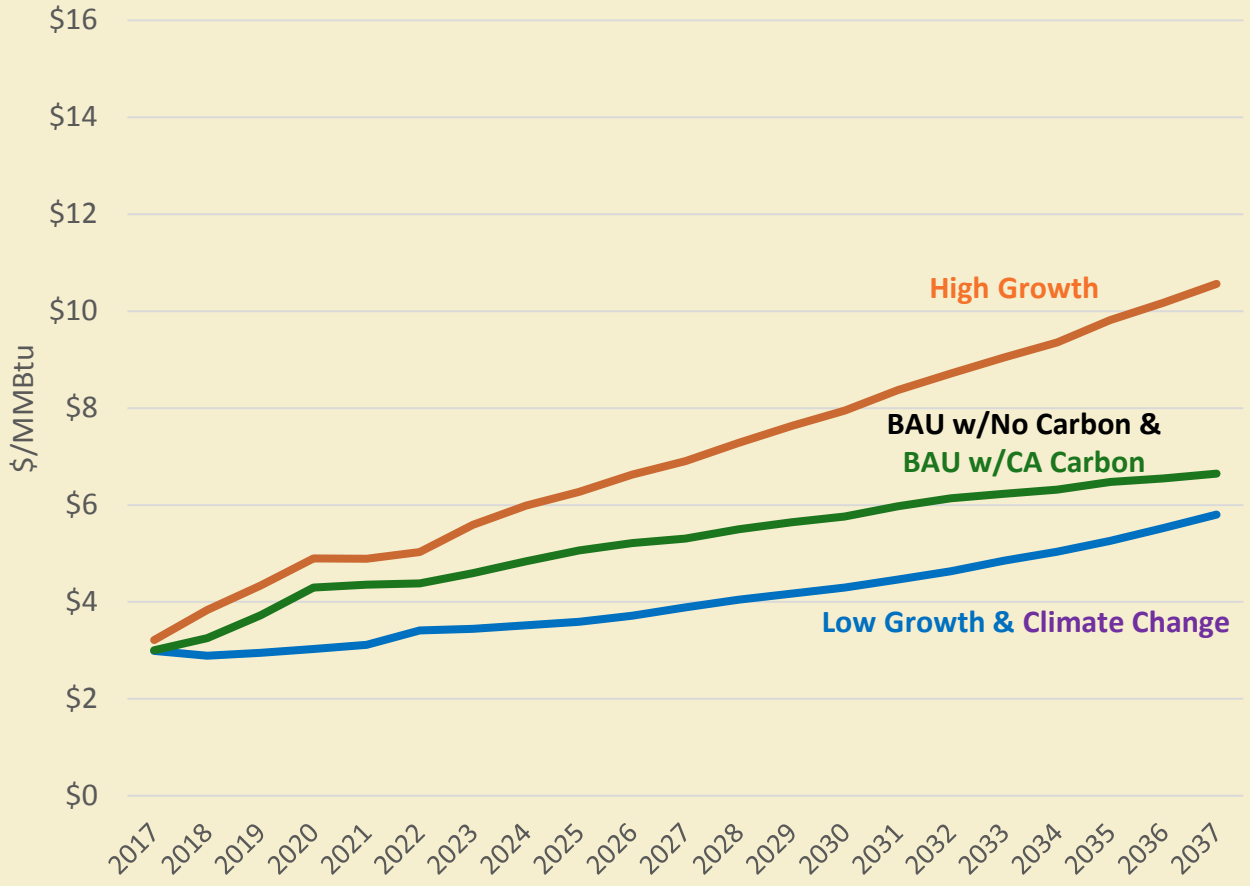
[1] Reflects forecast average annual load growth rate over the 20 year IRP study period, *before* new conservation.
[2] Low and Mid-High Societal Cost of Carbon from EPA's **Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866,** dated August 2016.

Scenario Assumptions: Load Forecasts

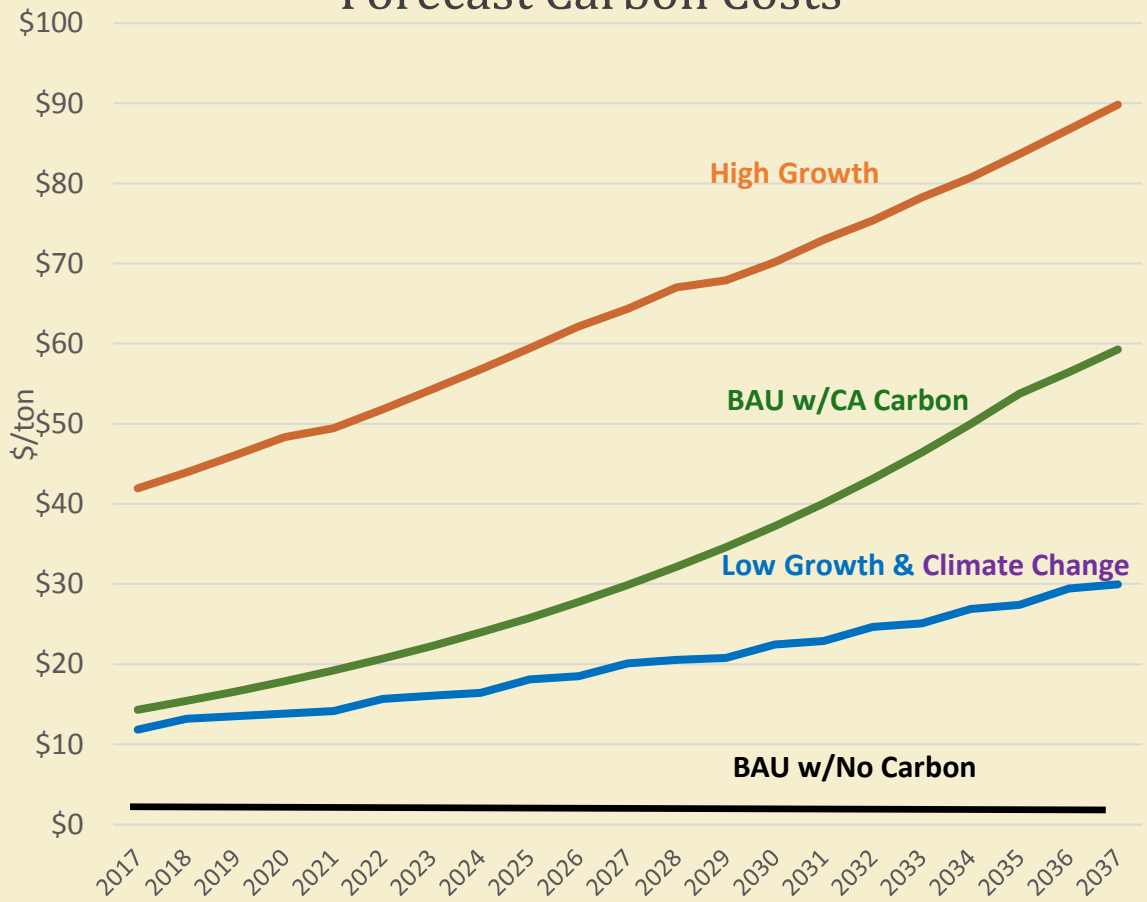


Scenario Assumptions: Natural Gas & Carbon

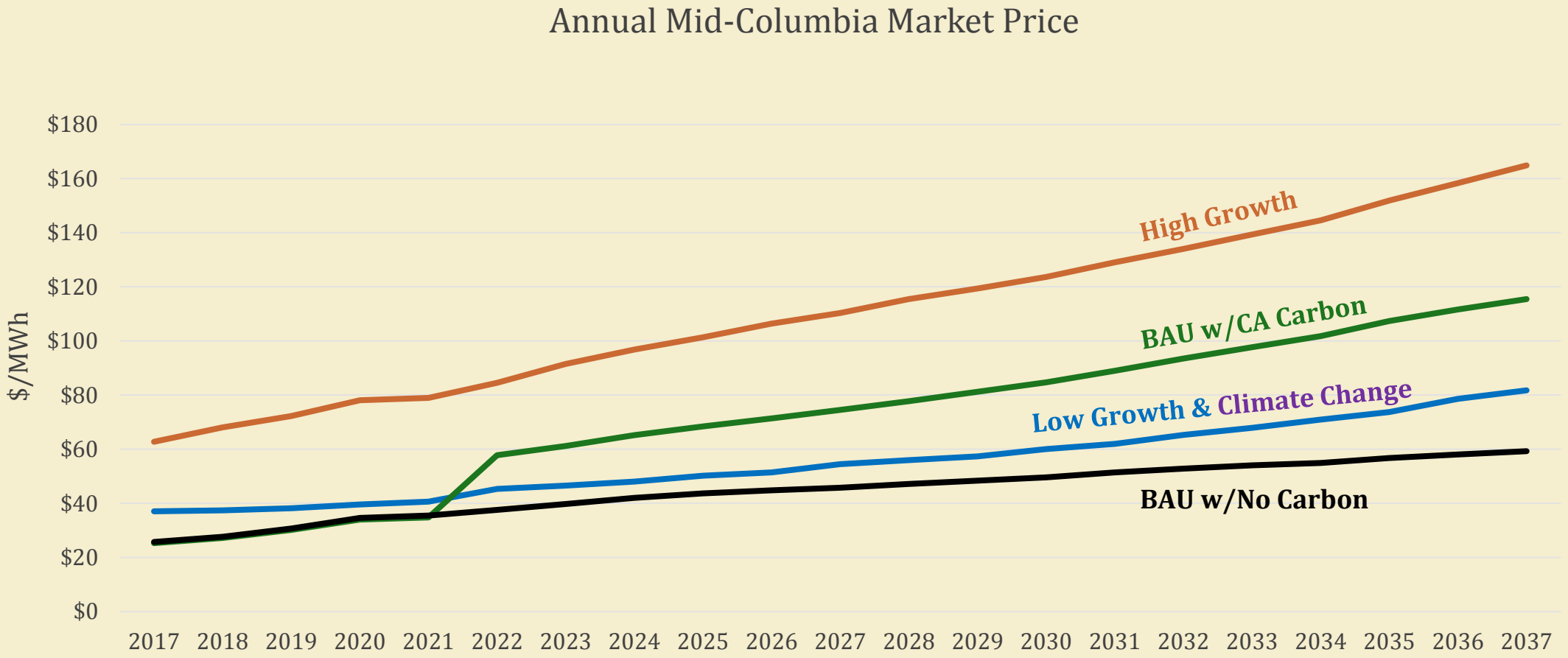
Forecast Natural Gas Prices



Forecast Carbon Costs



Scenario Assumptions: Market Price Forecast



Planning Standards Crosswalk

Annual

- **2013 & 2015:** Hydro measured under critical water conditions and average load under normal weather.
- **2017:** Probabilistic measure of Load Resource Balance at P50

Winter

- **2013 & 2015:** Hydro at "blend water" and average load under normal weather.
- **2017:** Probabilistic measure of Load Resource Balance for every month and within month, with 95% probability.

Regulatory

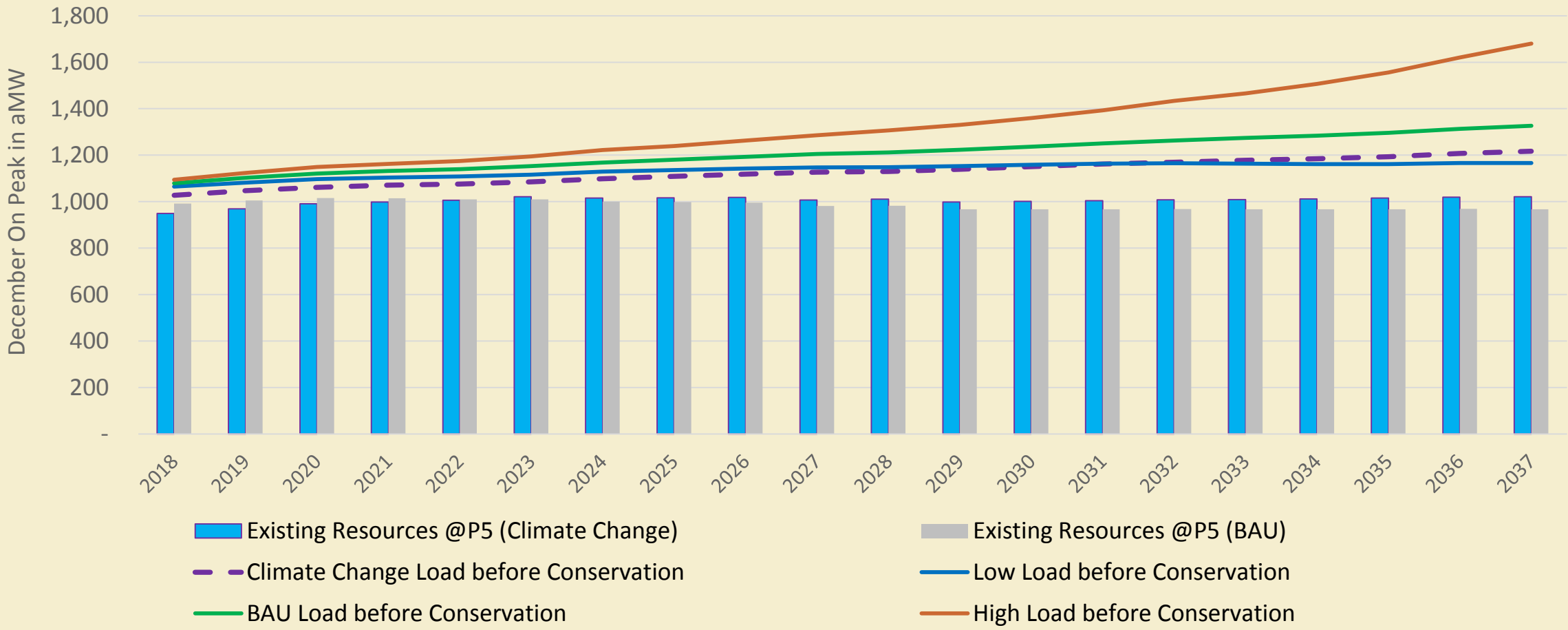
- Energy Independence Act (Initiative 937).
- PUD Board of Commissioners' Climate Change Policy/Strategies.

Monthly On-Peak (Energy)

Peak Week (Capacity)

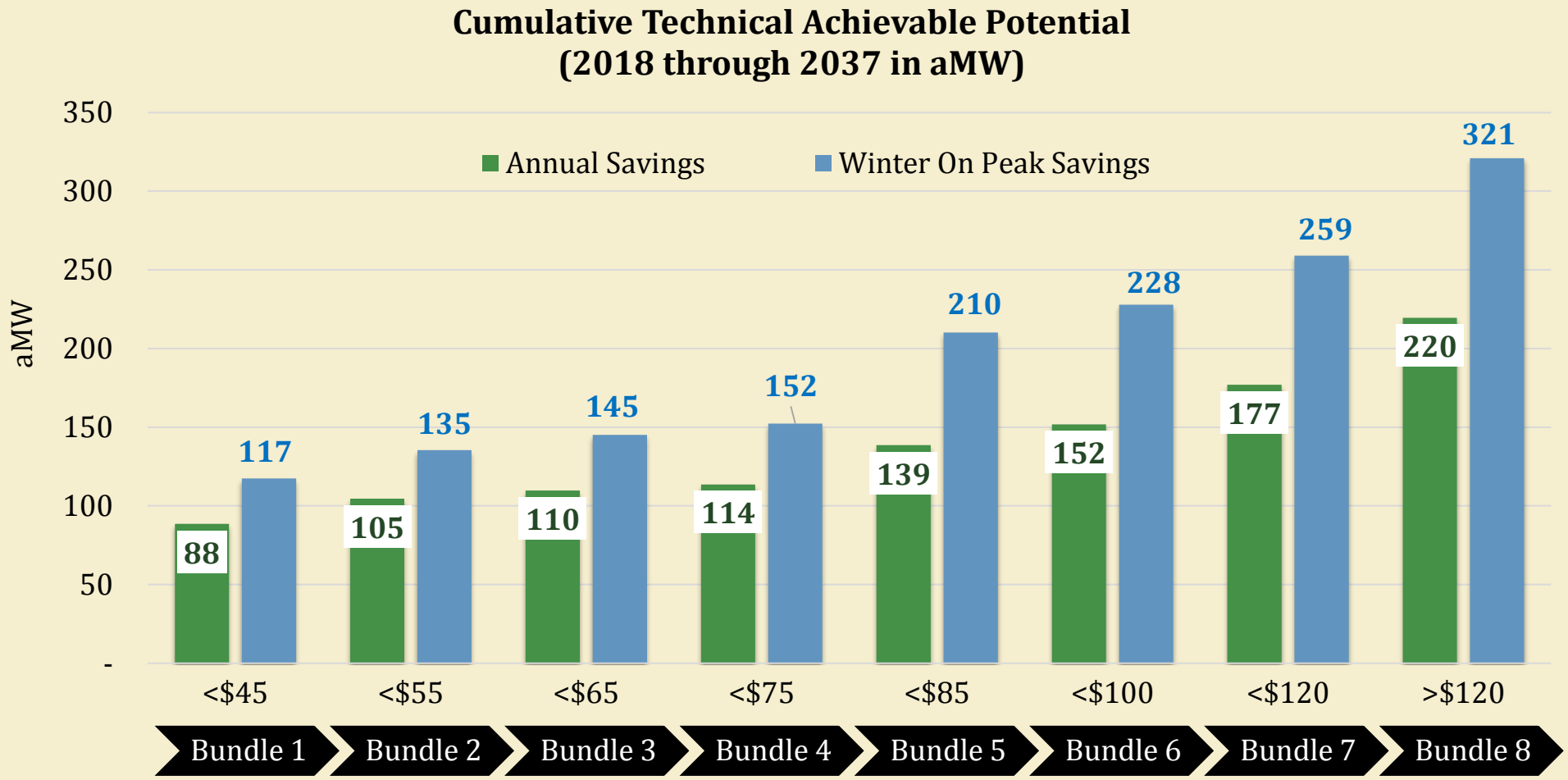
Resource Need

December On-Peak Position before New Conservation with Existing/Committed Resources



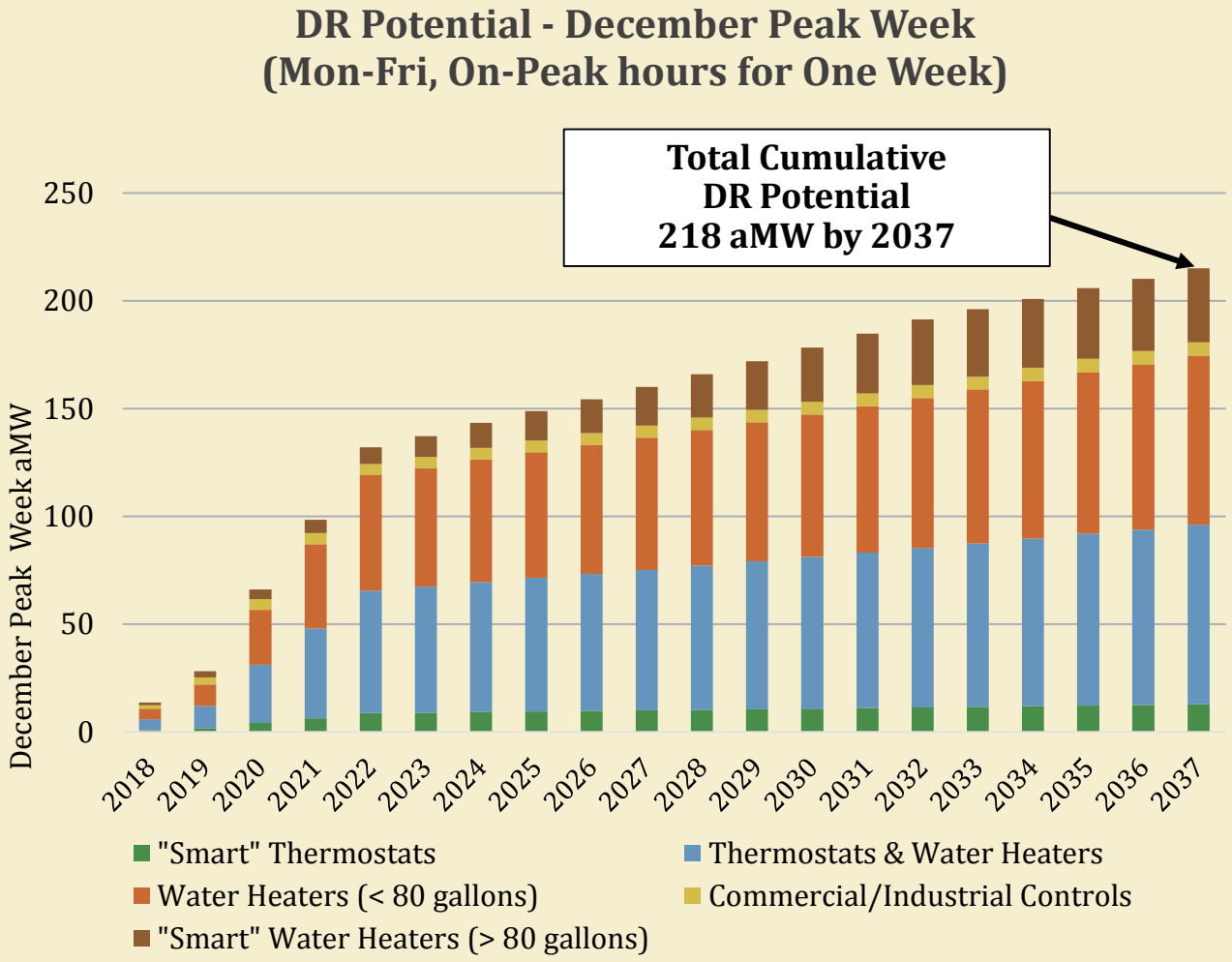
Demand-Side & Supply-Side Resource Options

20-Year Conservation Potential Supply Curve



* 2017 CPA indicated Snohomish's ratio of annual to winter on peak contribution varies slightly by scenario, but is approximately **1:1.4**.

Demand Response Potential



Demand Response (DR) Program	Cumulative Potential through 2037 for December Peak Week (in aMW)
"Smart" Thermostats	12.8
Commercial/Industrial Controls	6.3
Thermostats & Water Heaters	83.3
Water Heaters (<80 gallons)	78.4
"Smart" Water Heaters (>80 gallons)	34.3

Supply-Side Resource Options

Renewable Resources*

- WA/OR New Wind**
- Montana New Wind
- Run of River New Hydro
- W Wash Utility Scale Solar
- E Wash Utility Scale Solar
- Biomass
- Landfill Gas
- Geothermal

Short Term Capacity Product

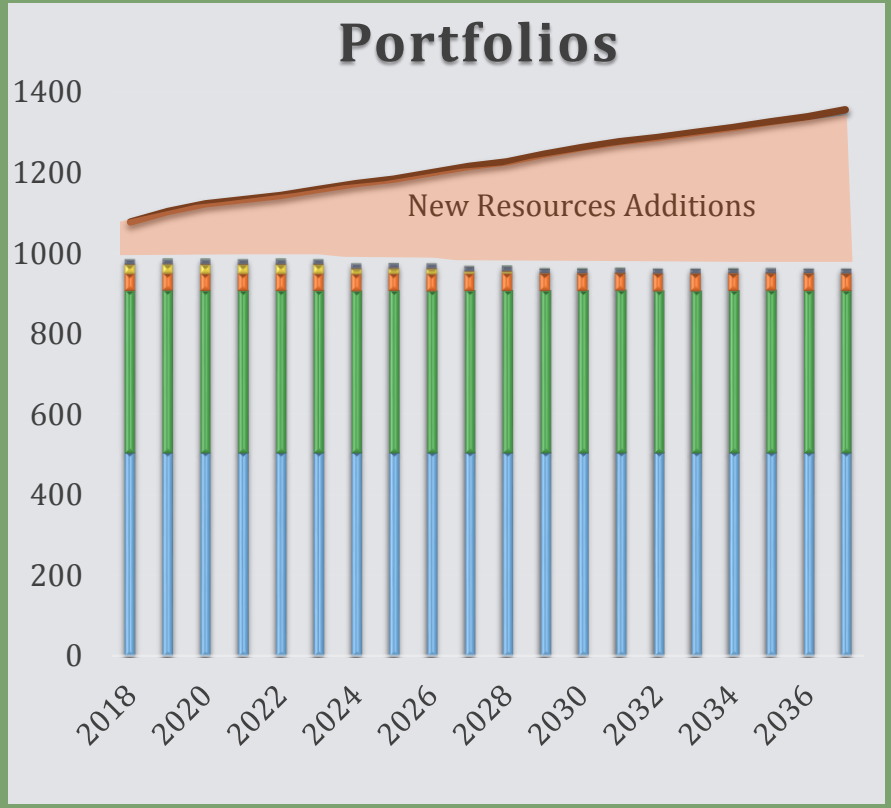
- Resource specific contract

Long Term Capacity Resources

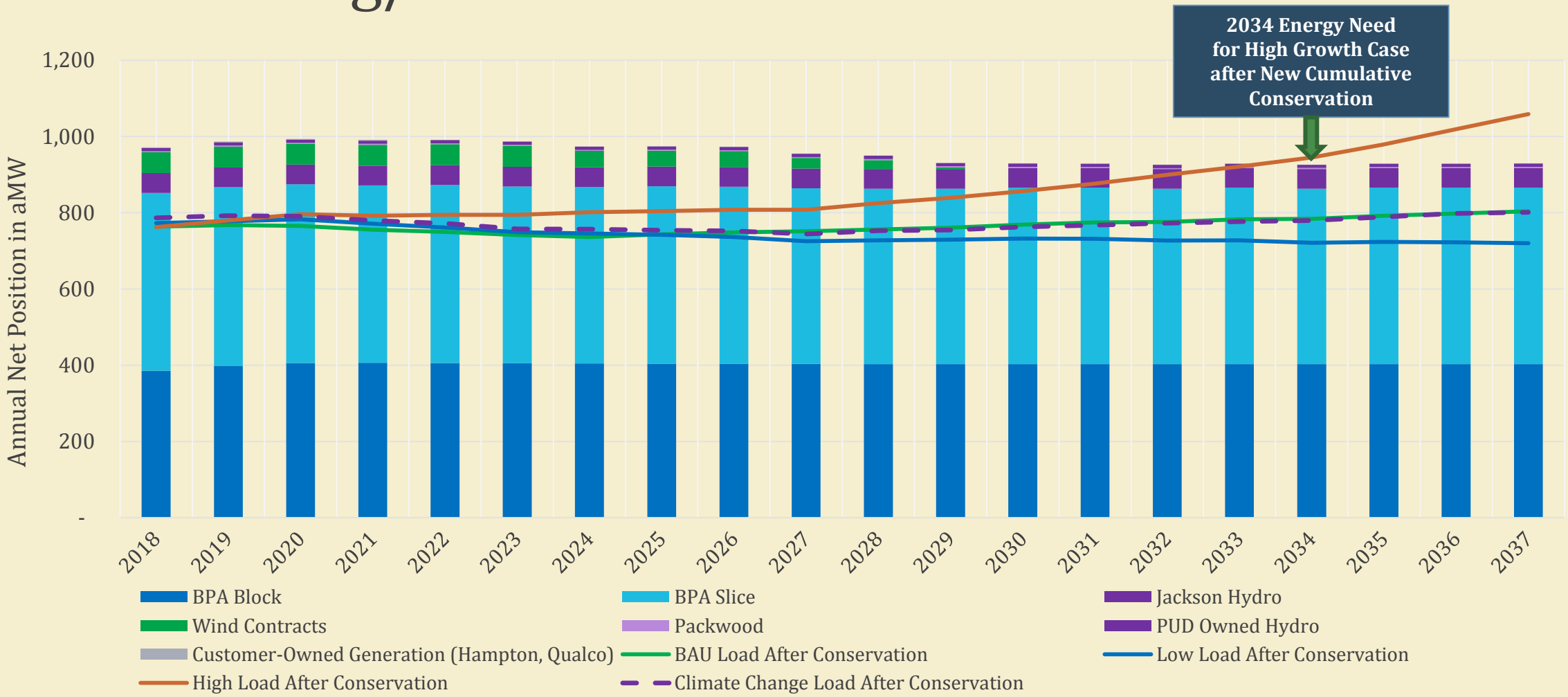
- Simple Cycle Combustion Turbine
- Reciprocating Engines
- Regional Pumped Storage Hydro
- Local Pumped Storage Hydro
- Battery Storage

* Renewable resource costs assume the Federal production tax (PTC) and investment tax (ITC) credits are not extended or renewed post 2020.
** Repowered wind projects (replacement and upgrade of turbines after useful life) at an existing wind project were not evaluated in the 2017 IRP.

Portfolio Results



Annual Net Position after New Cumulative Conservation with Existing/Committed Resources



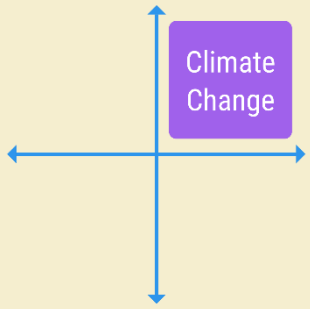
Summary of Resource Additions by Scenario

Scenario	20 year New Cumulative Conservation Annual aMW	Short Term Capacity Contract Dec HLH aMW	Long Term Capacity Resource Dec HLH aMW	Renewables Annual aMW	RECs Annual aMW
BAU with No Carbon	92	25	232	0	78
Climate Change w/Low Carbon	114	50	116	3	68
Low Growth w/Low Carbon	121	25	0	0	68
BAU with CA Carbon 2022	152	0	97	1	72
High Growth w/Mid-High Carbon	152	0	396	68	22

New conservation is single largest resource addition for every portfolio.

Proposed Long Term Resource Strategy*

*Presented December 5, 2017 to PUD Board of Commissioners



Climate Change Over IRP Study Period

Forecast Climate Change Impacts on Existing/Committed Resources
Monthly On-Peak Net Position

Net On-Peak Position at P5 (in aMW)

200.0
100.0
-
(100.0)
(200.0)
(300.0)
(400.0)

Increasing summer demand with reduced hydro supply from expected declines to seasonal snowpack

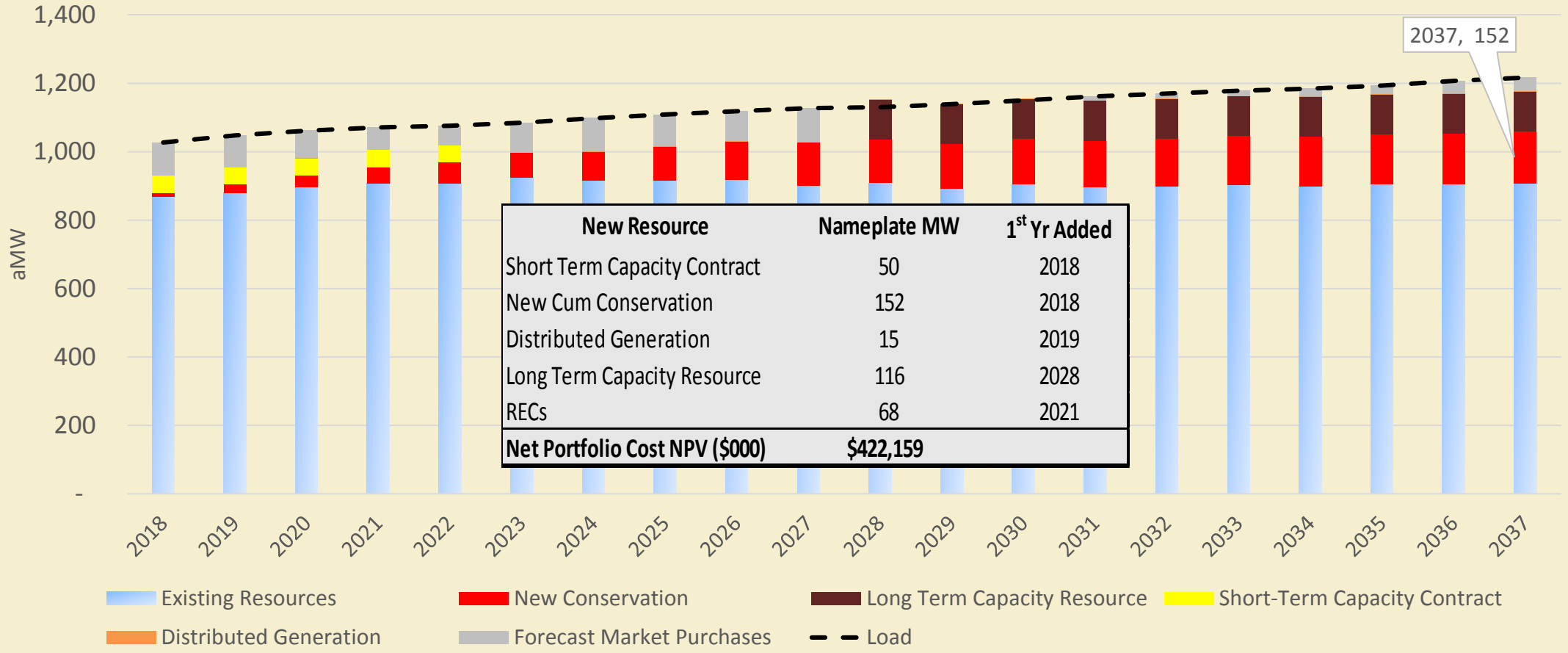
Increasing hydro production from increased precipitation, more winter precipitation as rain, more moderate winter demand

June July August September October November December January February March April May

2017 HLH @P5
2027 HLH LRB @P5
2037 HLH LRB @P5

Climate Change

Climate Change w/Low Carbon – Dec On Peak



New Resource	Nameplate MW	1st Yr Added
Short Term Capacity Contract	50	2018
New Cum Conservation	152	2018
Distributed Generation	15	2019
Long Term Capacity Resource	116	2028
RECs	68	2021
Net Portfolio Cost NPV ($000)	**$422,159**	

Proposed Action Plan

Resource Strategies

1. **Pursue all cost effective conservation and further explore peak benefits.**
   - Explore feasibility of Demand Response as a utility scale capacity resource for the PUD
2. **Explore low cost, low emissions alternatives for dispatchable capacity resources.**
   - Continue evaluating battery and pumped hydro storage
   - Explore opportunities for addressing capacity as part of BPA Post-2028 product discussions
3. **Ensure customer owned and distributed renewable strategies complement portfolio strategy.**
4. **Develop a renewables compliance strategy that results in a least-cost EIA compliance approach.**
   - Monitor alternate compliance options, actively participate in rulemaking

Non-Resource Strategies

5. **Expand short and long-term resource portfolio modeling capabilities to assess cost and risk tradeoffs.**
6. **Conduct an internal survey about the IRP to determine how the reference document is used**; validate key findings and incorporate into District's current process.
7. **Continue to participate in regional forums and assess impacts associated with climate change, emissions, and regional power, capacity and transmission planning efforts.**

Schedule

- Public meeting with Board and release of Draft IRP - March 27, 2018
  - Initiate SEPA Checklist with release of Draft IRP Document
  - Conclude SEPA process (15 business days)
- Public meeting with Board ~April 24, 2018
- Public meeting/public hearing ~May 8, 2018
- Potential consideration of 2017 IRP adoption ~May 8, 2018

Questions?

2017 IRP presentations and materials to available at:

http://www.snopud.com/PowerSupply/irp.ashx?p=1161

Draft 2017 IRP Document included in March 27, 2018 Board Packet at:

http://www.snopud.com/PowerSupply/irp.ashx?p=1161

Contact:
Anna Berg, Senior Manager Power Supply
ajberg@snopud.com
425-783-1604

Supplemental Slides

Summary of Regulatory Requirements

Comprehensive IRP required every four years; progress report every two years (RCW 19.280) and must:

- ✓ Include a range of load forecasts for at least 10 years;
- ✓ Assess commercially available conservation and energy efficiency resources and utility-scale generating technologies;
- ✓ Consider oversupply and mitigation for resource additions;
- ✓ Identify an action plan to implement long range IRP; and
- ✓ Public hearing required to adopt the IRP.

A utility-specific analysis must be conducted every two years to establish the utility's biennial conservation target (RCW 19.285).

- ✓ The biennial conservation target and 10-year potential estimate must be filed with Department of Commerce by December 31 of the odd years.
- ✓ Public meeting required to adopt biennial target.

Renewables compliance method for EIA (I-937) must be elected by January 1 each year; midyear report filed with Commerce by June 1 each year.

2018/2019 Biennial Target

On December 19, 2017 following a public hearing, the Board adopted the 2018/2019 Biennial Target and 10 Year Potential:

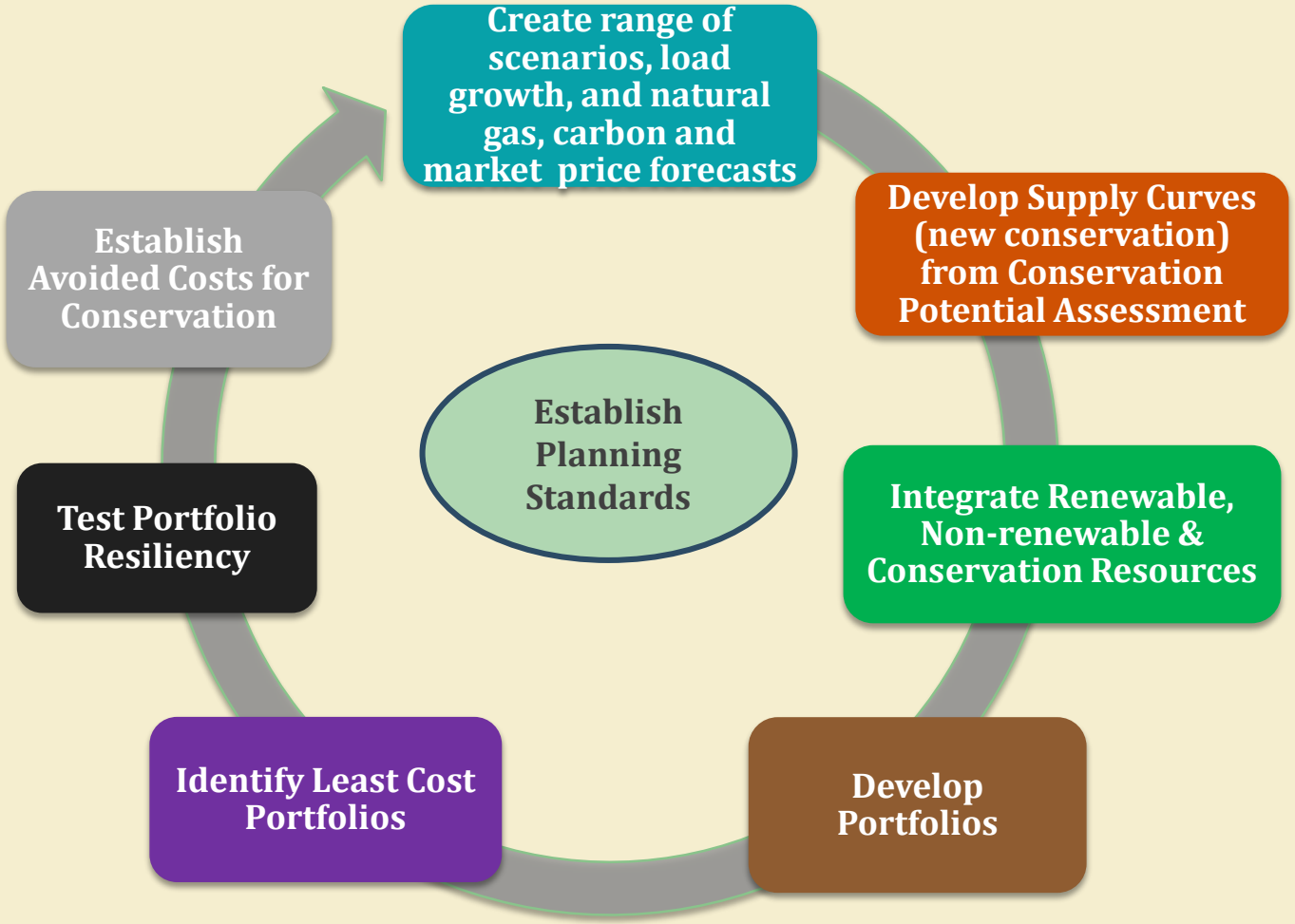
	10-Year Potential	2-Year Biennial Target	Target Years
2017 IRP	**92.70 aMW** (812,051 MWh)	**14.61 aMW** (127,020 MWh)	**2018-2019**

Biennial conservation target and potential informed by the Climate Change with Low Societal Carbon Cost (proposed Long Term Resources Strategy).

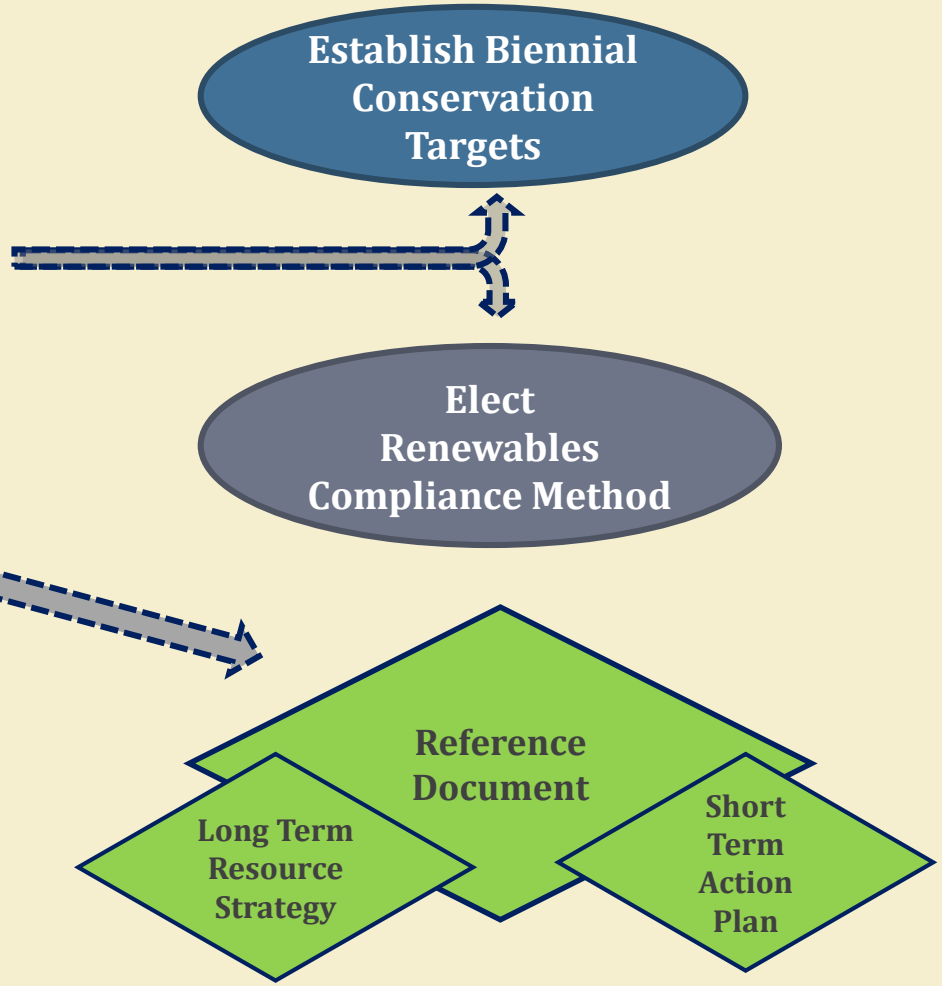
2017 IRP Process

IRP Study Period 2018-2037

IRP Inputs



IRP Outputs



Portfolio Modeling Process

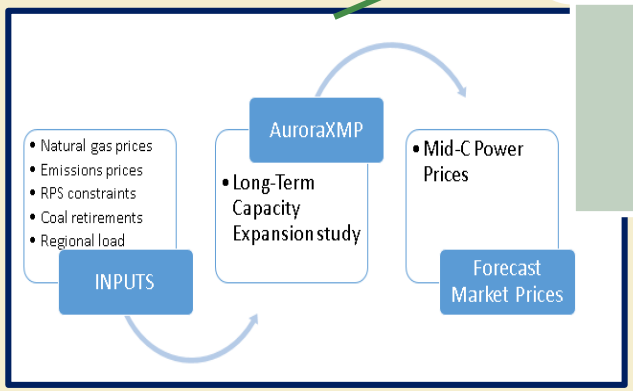
Establish Planning Standards

- Annual energy
- Winter On-Peak
- Peak Week
- Regulatory (I-937)

Establish Parameters for Procuring Unbundled RECs

Optimize Portfolios by Scenario

- Select from available Demand- and Supply-side Resource options
- Derive optimal combination of new resource additions within modeling constraints and satisfy Planning Standards (Annual, Winter, Peak, I-937)



Generate Lowest Cost Portfolio by Scenario

- Lowest cost portfolio has lowest Net Portfolio Cost (net present value)
- Incremental Emissions
- 10-Yr Conservation Potential

Same Process Followed for Sensitivities

- No Snake River Dams
- Renewables Only

List & Cost of Resource Options

Resource	Nameplate (MW)	Levelized Cost ($/MWh)	Levelized Cost Peak Week Capacity ($/MW)
Simple Cycle Combustion Turbine (SCCT)	239	$ 137	$ 118,163
25 MW Short Term Capacity Contract (5 year)	25	$ 155	$ 129,496
DR – Direct Load Control Smart Stat	20.5	$ 1,854	$ 148,347
Dual Fuel Reciprocating Engine	50	$ 199	$ 170,841
DR - C&I Curtailment	0.1	$ 2,239	$ 179,086
DR – Direct Load Control Air & H20 Heat	0.8	$ 2,703	$ 216,233
Pumped Storage Hydro Low	100	$ 248	$ 286,148
DR – Direct Load Control H20 Heat	0.7	$ 4,647	$ 371,788
Pumped Storage Hydro High	100	$ 330	$ 381,559
Landfill Gas	10	$ 75	$ 545,327
Biomass	15	$ 91	$ 572,799
Geothermal (traditional)	25	$ 87	$ 578,937
DR - Smart H20 & Heat	34.3	N/A	$ 728,778
Battery Storage	25	$ 373	$ 764,313
Long Distance Wind (Montana)	50	$ 69	$ 881,933
Run of River Hydro (small hydro)	30	$ 113	$ 2,451,503
WA/OR Wind*	50	$ 77	$ 6,685,044
Lower Cost Utility Scale Solar (E Wash)	25	$ 94	$ 8,229,719
Customer Owned DG	15	$ 125	$ 8,304,656
Utility Scale Solar (U/S Solar E Wash)	25	$ 97	$ 13,912,590
Utility Scale Solar (U/S Solar W Wash)	5	$ 182	$ 39,824,048

* Repowered wind projects (replacement and upgrade of turbines after useful life) at an existing wind project were not evaluated in the 2017 IRP.
** The federal investment tax credit (ITC) or production tax incentive (PTC) is set to expire in 2020. Renewable resource costs assume tax credit is not continued.

Modeled Resource Output Characteristics

	Resource	Nameplate (in MW)	Average Annual Energy (in aMW)	Winter December On-Peak (in aMW)	Winter December Peak Week (in aMW)	Summer August On-Peak (in aMW)	Summer August Peak Week (in aMW)
Long Term Capacity Resources	Simple Cycle Combustion Turbine (SCCT)	239	23.9	231.8	231.8	231.8	231.8
	25 MW Short Term Capacity Contract (5 year)	25	2.5	25.0	25.0	25.0	25.0
	Dual Fuel Reciprocating Engine	50	5	48.5	48.5	48.5	48.5
	Pumped Storage Hydro	100	18	95.0	97.0	97.0	97.0
	Energy Storage – Battery	25	5	12.5	12.5	12.5	12.5
Demand Response	DR – Direct Load Control Smart Stat	20.5	0.1	2.5*	12.8*	-	-
	DR - C&I Curtailment	0.1	0.1	1.2*	6.3*	-	-
	DR – Direct Load Control Air & H20 Heat	0.8	0.8	16.0*	83.3*	-	-
	DR – Direct Load Control H20 Heat	0.7	0.7	15.1*	78.4*	-	-
	DR - Smart H20 & Heat	34.3	34.3	34.3	34.3	34.3	34.3
Baseload Renewables	Landfill Gas	10	8.5	8.5	9.7	8.5	9.7
	Biomass	15	12.8	12.8	14.6	12.8	14.6
	Geothermal (traditional)	25	22.5	22.5	24.3	22.5	24.3
Variable Renewables	Long Distance Wind (Montana)	50	21.8	11.6	11.6	11.6	11.6
	Run of River Hydro (small hydro)	30	13.6	4.3	4.3	-	-
	WA/OR Wind	50	17.5	5.9	1.7	16.1	5.2
	Customer Owned Distributed Generation	15	1.7	0.4	0.2	2.4	1.2
	Utility Scale Solar (U/S Solar E Wash)	25	6.8	0.8	0.4	2.8	1.4
	Utility Scale Solar (U/S Solar W Wash)	5	0.6	0.1	0	0.3	0.2

***Quantities for Demand Response reflect total cumulative potential over the 20-year study period.**

EIA Compliance

- Under the Energy Independence Act (EIA or I-937), utilities with over 25,000 customers must use eligible renewable energy, renewable energy credits (RECs) or a combination of both to serve their retail load as follows:
  - **3% of Load by 2012**
  - **9% of Load by 2016**
  - **15% of load by 2020**

- The District is currently satisfying annual EIA requirements with:
  - **RECs and renewable energy**
  - **Incremental hydro**
  - **BPA Contract allocation of RECs**

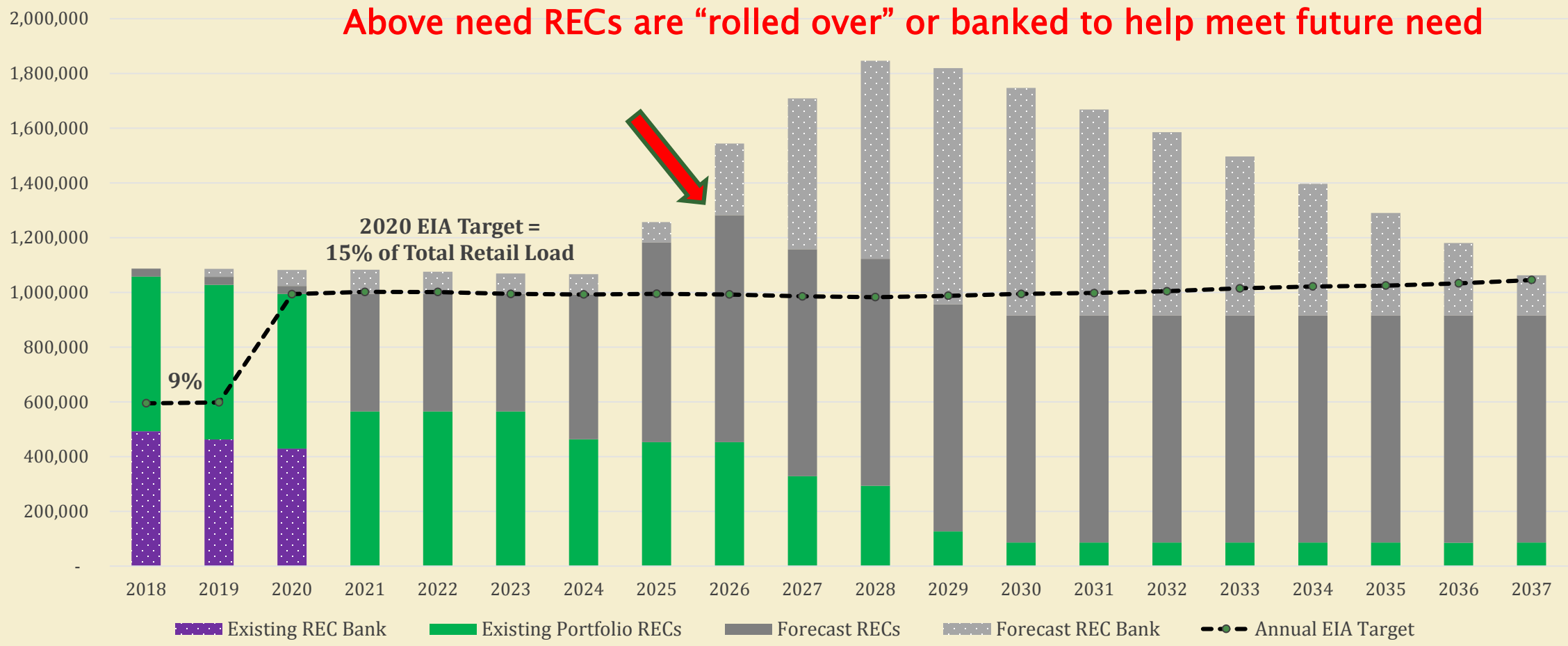
EIA Compliance & Assumptions

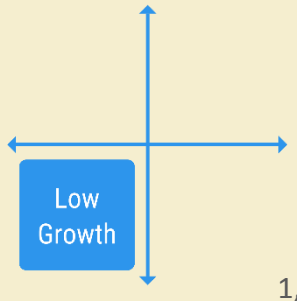
- Today's REC market is liquid and prices are at/below $5-$6.
- 2017 IRP analysis did not assume these REC prices would persist across the 20 year study period.
- REC prices were conservatively modeled based on the cost to build a new wind resource:

$ REC Price = Levelized Cost of Wind – Levelized Cost of Energy

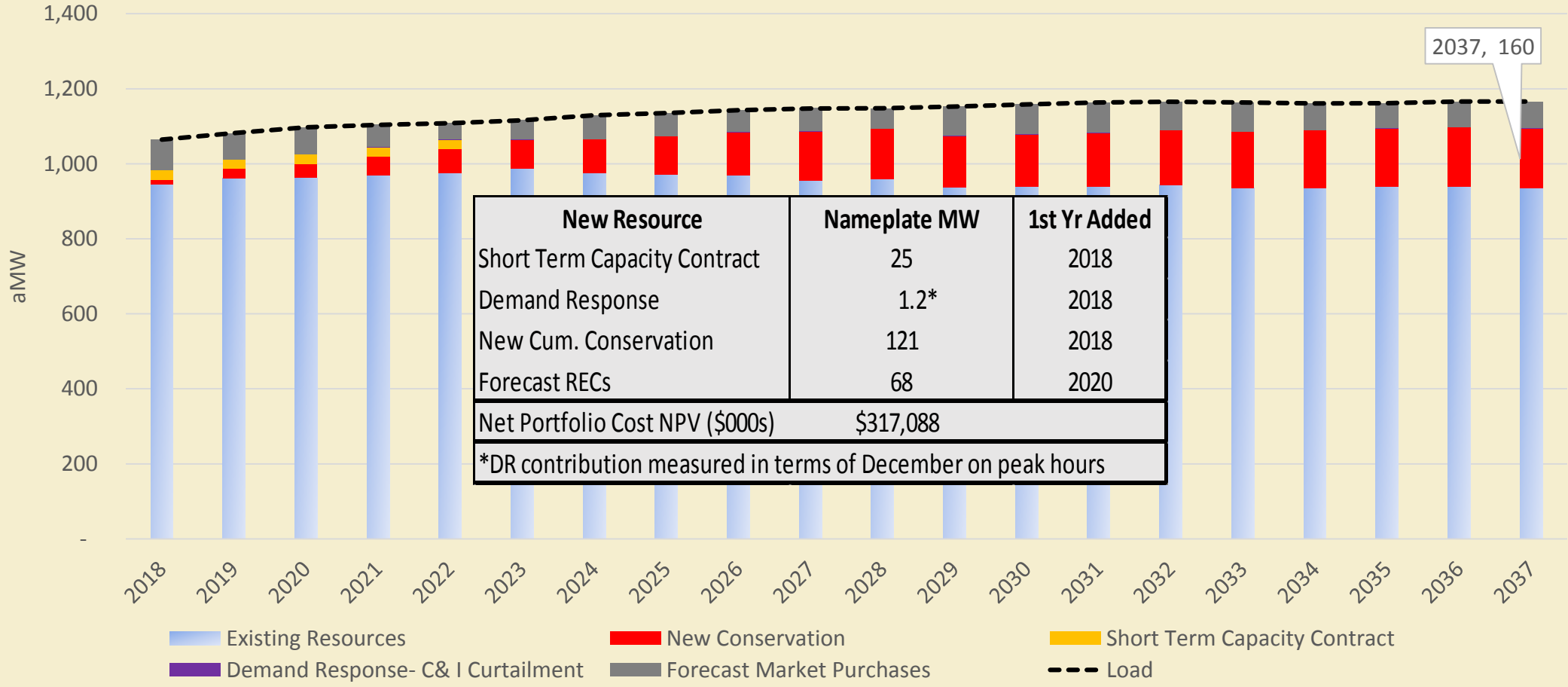
$ REC Price = ~$43 in 2018 to ~$53 in 2037

EIA Compliance (continued)





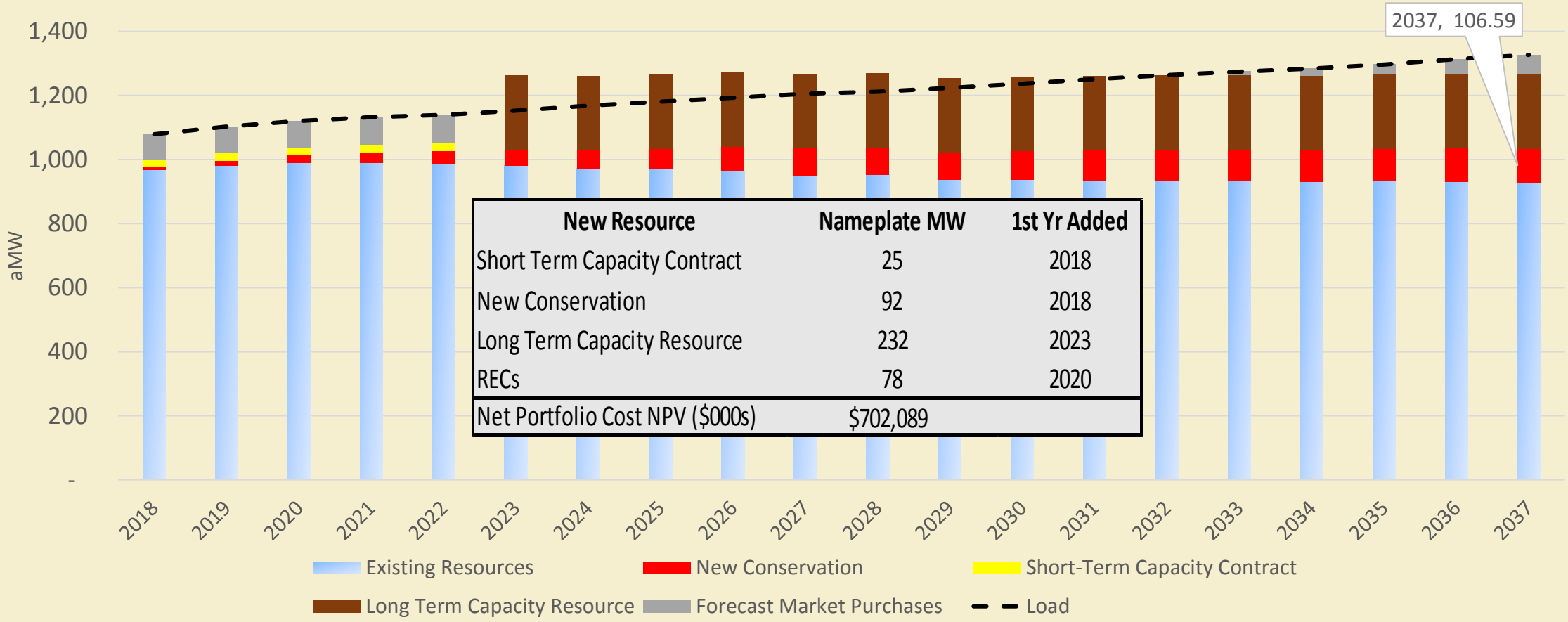
Low Growth – December On Peak



New Resource	Nameplate MW	1st Yr Added
Short Term Capacity Contract	25	2018
Demand Response	1.2*	2018
New Cum. Conservation	121	2018
Forecast RECs	68	2020
Net Portfolio Cost NPV ($000s)	$317,088	
*DR contribution measured in terms of December on peak hours		

BAU

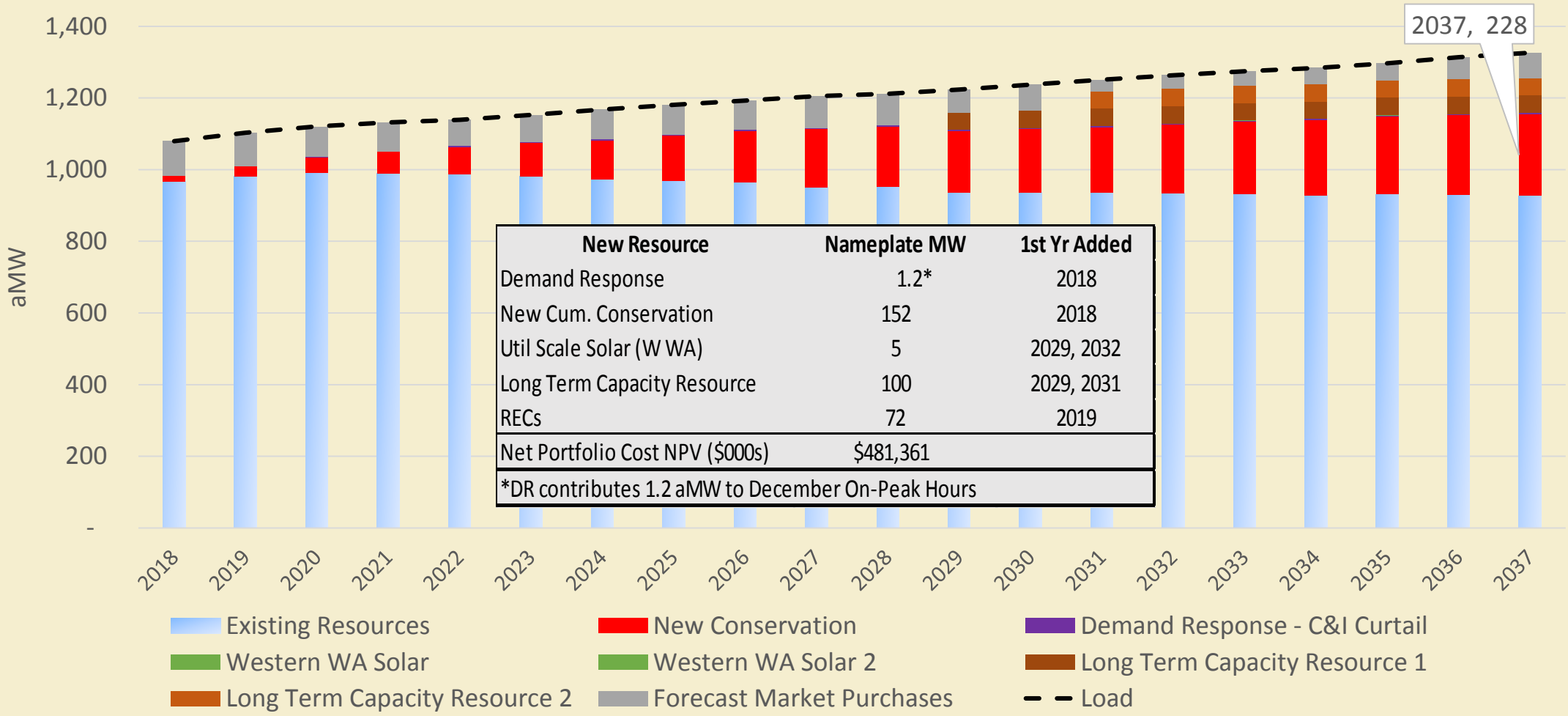
BAU w/ No Carbon – December On-Peak



New Resource	Nameplate MW	1st Yr Added
Short Term Capacity Contract	25	2018
New Conservation	92	2018
Long Term Capacity Resource	232	2023
RECs	78	2020
Net Portfolio Cost NPV ($000s)	$702,089	

BAU

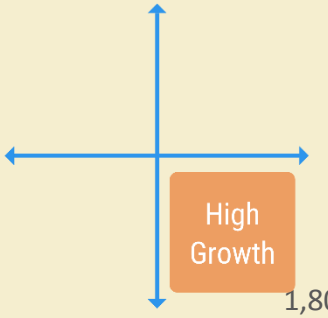
BAU w/ CA Carbon – December On-Peak

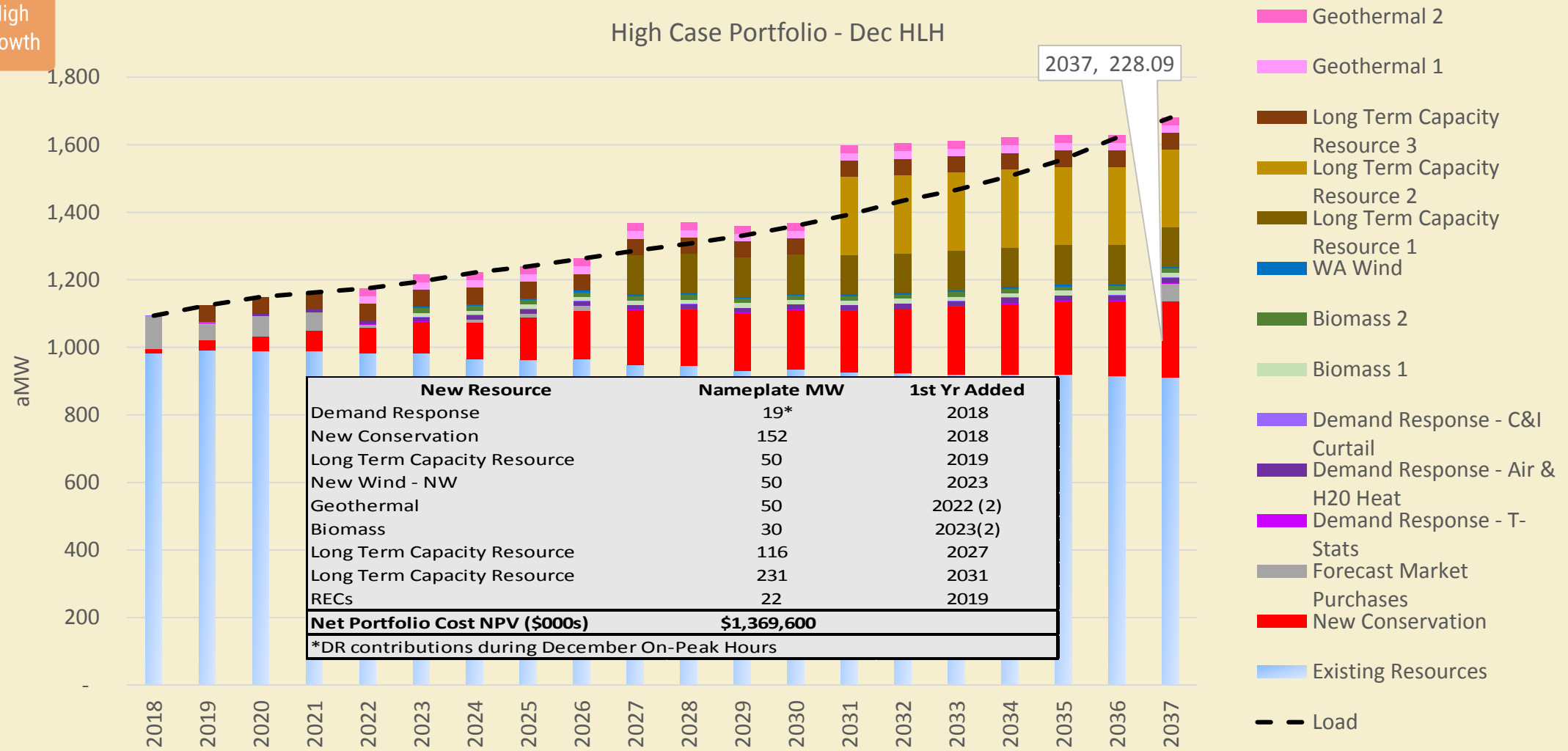


New Resource	Nameplate MW	1st Yr Added
Demand Response	1.2*	2018
New Cum. Conservation	152	2018
Util Scale Solar (W WA)	5	2029, 2032
Long Term Capacity Resource	100	2029, 2031
RECs	72	2019
Net Portfolio Cost NPV ($000s)	$481,361	

*DR contributes 1.2 aMW to December On-Peak Hours

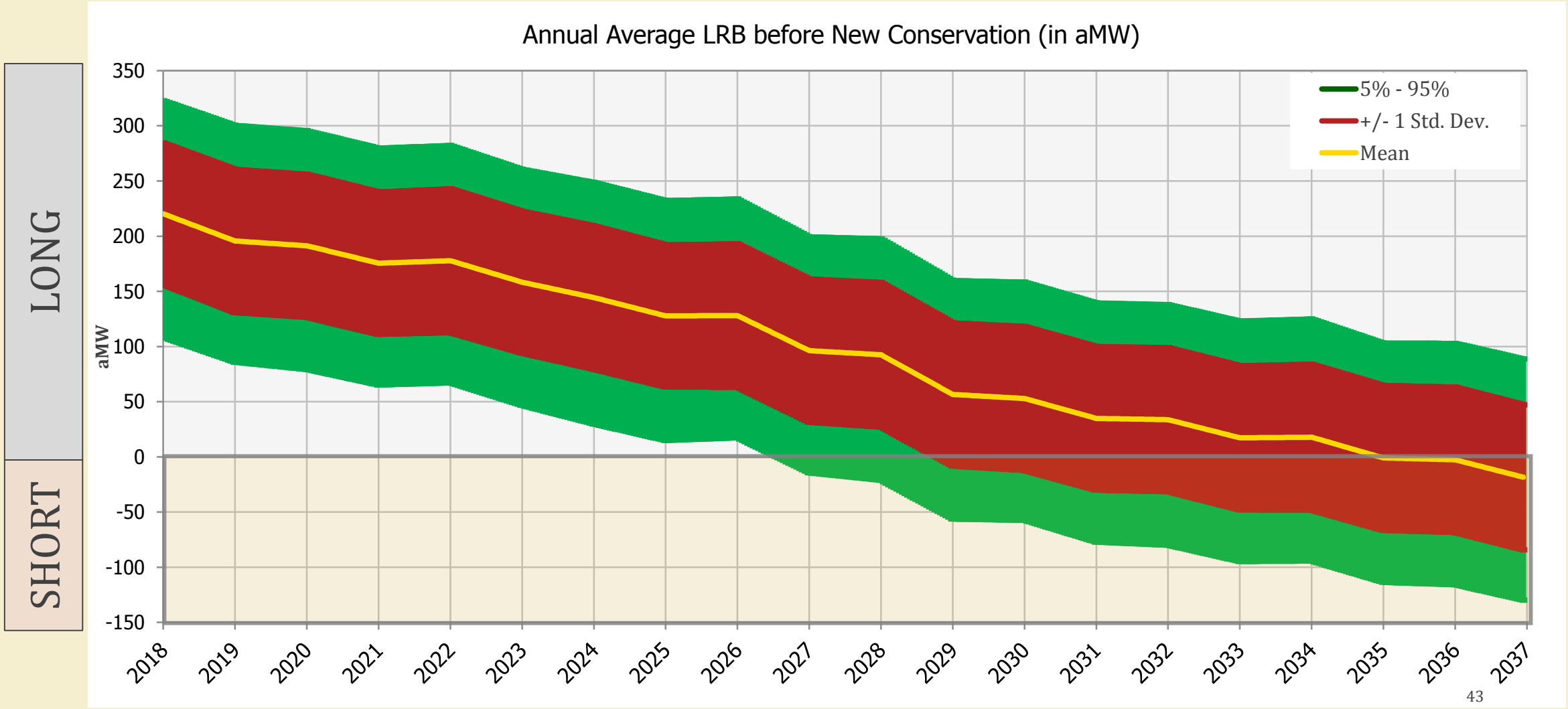
High Growth – December On-Peak





New Resource	Nameplate MW	1st Yr Added
Demand Response	19*	2018
New Conservation	152	2018
Long Term Capacity Resource	50	2019
New Wind - NW	50	2023
Geothermal	50	2022 (2)
Biomass	30	2023(2)
Long Term Capacity Resource	116	2027
Long Term Capacity Resource	231	2031
RECs	22	2019
Net Portfolio Cost NPV ($000s)	**$1,369,600**	
*DR contributions during December On-Peak Hours		

Probabilistic Annual Net Position
Load Resource Balance (LRB) w/Existing Resources



Snapshot 2027: On-Peak Net Position by Month
(with PUD's Existing/Committed Resources at P5)