2015 Electric Integrated Resource Plan

Appendix A – 2015 Technical Advisory Committee Presentations

2015 Electric Integrated Resource Plan

Technical Advisory Committee Meeting No. 1 Agenda

Thursday, May 29, 2014

Conference Room 428

Topic	Time	Staff
Introductions	8:30	Kalich
TAC Meeting Expectations	8:35	Lyons
2013 IRP Commission Acknowledgements	9:00	Kalich
Break	10:00	
2013 Action Plan Update	10:15	Gall
Energy Independence Act Compliance	11:30	Gall/Lyons
Lunch	12:00	
Pullman Energy Storage Project	1:00	Gibson
Demand Response Study Discussion	1:30	Kalich
Break	2:00	
Draft 2015 Electric IRP Work Plan	2:15	Lyons
Adjourn	3:00	

2015 Electric IRP
TAC Meeting Expectations

John Lyons, Ph.D.
First Technical Advisory Committee Meeting
May 29, 2014

Integrated Resource Planning

- The Integrated Resource Plan (IRP):
- Required by Idaho and Washington every other year
- Guides resource strategy over the next two years
- Resource procurements over the next 20 years – Preferred Resource Strategy (PRS)
- Snapshot of the current and projected load & resource position

Integrated Resource Planning (Cont)

- Based on significant modeling and many assumptions
  - Fuel prices
  - Economic activity
  - Policy considerations
  - Resource costs
  - Energy efficiency
- Action Items – areas for more research in the next IRP
- This is not an advocacy forum
- Not a forum on a particular resource or resource type
- Supports rate recovery, but not a preapproval process

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 in all or some of the process
- Open forum, but we need to stay on topic to get through the agenda
- Welcome requests for studies or different assumptions.
  - Time or resources may limit the amount of studies we can do
  - The earlier study requests are made, the more accommodating we can be
- Planning team is also available by email or phone for questions or comments between the TAC meetings

Expectations

- Avista:
  - Input about assumptions and areas to study
  - Six TAC meetings with set agendas that can change based on input. Topics will be covered later today in the Draft Work Plan.
- TAC Members: What are your expectations?

2013 IRP Commission Acknowledgements

Clint Kalich
First Technical Advisory Committee Meeting
May 29, 2014

Idaho Acceptance Order (32980)

- No Public Comments
- Comments by ICL, SRA, and SC/MEIC
  - Concerns with Colstrip costs and risk analysis
    - Regional haze, GHG regulation, prevention of significant deterioration, ambient air quality standards, mercury and air toxics, coal combustion waste, coal costs
  - Request more analysis of Colstrip replacement options
  - Too much natural gas in the plan
  - Changes to net metering rules are not necessary

Idaho Acceptance Order (32980)

- Comments by IPUC Staff
  - Accept IRP as filed
  - Additional analysis of net metering and impacts on system
  - Closely monitor load growth for 2015 IRP given significant decrease between 2011 and 2013 IRPs
  - More detailed analysis around selected planning margin
  - More description of rationale for arriving at Conservation Achievable Potential Savings

Idaho Acceptance Order (32980)

- Idaho Commission Order
  - Accept 2013 IRP as filed
  - Encourage commenters to actively participate in 2015 IRP
  - Consider and discuss concerns and suggestions offered by commenters
  - Continue exploring demand response
  - Continue to monitor federal environmental regulations, and their impacts on planning
  - Monitor actual load growth for 2015 IRP

Washington Acceptance Letter

- No Public Comments
- Commission
  - Evaluate value of risk mitigation when choosing among competing resource strategies. Provide justification of the choice of the PRS, including desired level of portfolio risk
  - Re-evaluate planning margin
  - Investigate modeling energy efficiency as a selectable and scalable resource within the IRP (PRiSM)
  - Incorporate a non-zero carbon value in the Expected Case
  - Continue evaluating Colstrip, including rate impacts of a hypothetical portfolio absent them
  - Evaluate the benefits of storage to Avista's generation portfolio

Idaho Acknowledgement Order Specifics

COMMISSION FINDINGS AND DECISION

The Commission has jurisdiction over Avista, an electric utility, and the issues in this case under Title 61 of the Idaho Code and the Commission Rules of Procedure, IDAPA 31.01.01.000 *et seq*. The Commission has reviewed the filings in this case, including the 2013 Electric IRP, the comments, and the Company's reply. Based on that review, the Commission finds that the Company's 2013 Electric IRP contains the required information and is in the appropriate format as established in Commission Order Nos. 22299 and 25260. Accordingly, we find it reasonable to accept the Company's 2013 Electric IRP.

We appreciate the written comments submitted in this case. We encourage the commenters and other interested persons to participate in the IRP process and to provide further input to the Company as it develops its 2015 IRP. We expect the Company to consider and discuss at the TAC meetings the various concerns and suggestions that are and have been offered. In particular, we expect the Company to monitor federal developments, such as the promulgation of federal environmental regulations, and to account for their impact in its resource planning. We also encourage the Company to continue exploring the use of DR as a resource, and to be actively involved in and apprise us of matters relating to Colstrip. Lastly, given the decrease in load growth forecasts—a phenomenon that other utilities have reported—we encourage the Company to closely monitor actual load growth as it prepares its 2015 IRP.

As always, our acceptance of the Company's IRP should not be interpreted as an endorsement of any particular element of the plan or of any proposed resource acquisition contained in the plan. An IRP is a utility planning document that incorporates many assumptions and projections at a specific point in time. By accepting the Company's filing, we acknowledge only the Company's ongoing planning process, not the conclusions or results reached through that process.

Washington Acceptance Letter Specifics

While specific comments regarding its filed IRP are attached, the Commission provides Avista with the following guidance for its next IRP filing:

- With input from the Technical Advisory Committee, evaluate the value of risk mitigation when choosing among competing resource strategies. Avista should provide justification of its choice of a preferred resource strategy, including justification of its desired level of portfolio risk.
- With input from the Technical Advisory Committee, re-evaluate Avista's choice of basic planning margin.
- With input from the Technical Advisory Committee, investigate modeling energy efficiency as a selectable and scalable resource within the IRP.
- Incorporate a non-zero expected value cost of carbon into the Expected Case. Avista should also work with the Technical Advisory Committee to investigate incorporating a range of prospective carbon policies into the Expected Case stochastic analysis.
- Continue to evaluate scenarios related to the continued operation of units 3 and 4 of the coal-fired generating facility in Colstrip, Montana. As a component of this evaluation, Avista should provide an assessment of the impact on rates of a hypothetical portfolio that does not include these units.
- Use the Company's new modeling capabilities to evaluate the benefits of storage resources to Avista's generation portfolio.

2013 IRP Action Plan Update

James Gall
First Technical Advisory Committee Meeting
May 29, 2014

Action Items- A Progress Report

Demand Forecasting

- Review and update the energy forecast methodology to better integrate economic, regional, and weather drivers of energy use.
  - Move from 30-year average temperatures to 20-year moving average
  - Integration of U.S. industrial production as an economic driver
  - Discuss the relationship between energy demand and population, energy pricing, income, and family size

Existing Resources

- Continue to evaluate scenarios related to Colstrip and how each scenario may impact power supply costs.
  - Avista will update its 2013 IRP scenarios and consider other scenarios later in the process
- Evaluate options to integrate intermittent resources.
  - As part of the storage RFP, we will get information regarding demand side options (to be discussed later)
  - Avista is part of the Energy Imbalance Market (EIM) process
  - Avista is developing a 1 MW storage project to test this benefit (to be discussed later)

Identifying Need

- Evaluate the benefits of a short-term (up to 24-months) capacity position report.
  - Avista will implement this report this summer for single hour and sustained peak events
  - Report will integrate short-term planning and long-term capacity planning
- Revisit with the TAC the benefits and costs of the Company's 2013 IRP planning margin target to determine if a different level is warranted in the 2015 IRP.
  - Current method is 14% of peak load plus operating reserves & regulation
  - To be discussed at future TAC meeting

Policy Implications

- Continue monitoring state and federal climate change policies and report work from Avista's Climate Change Council.
  - Gov. Inslee's executive order and the EPA's Emission Performance Standards are current climate change initiatives
- Evaluate and explicitly document various options for quantifying carbon costs in the IRP
  - For discussion at future TAC meeting
- Work with TAC to determine which carbon quantification method should be employed in the Expected Case of the 2015 IRP
  - Washington Order requires a non-zero carbon cost
  - For discussion at future TAC meeting

Supply Side Options

- Consider Spokane and Clark Fork River hydro upgrade options in the next IRP as potential resource options to meet energy, capacity and environmental requirements.
  - To be included as resource options in 2015 plan
- Continue to evaluate potential locations for the natural gas-fired resource identified to be online by the end of 2019, including environmental reviews, transmission studies, and potential land acquisition.
  - Avista is working to identify potential locations
- Use Avista's new modeling capabilities to further evaluate the benefits of storage resources to its generation portfolio, including the impacts on ancillary services needs.
  - Avista is in process of modeling storage in its new portfolio optimization tool

Demand Side

- Work with NPCC, commissions, and others to resolve adjusted market baseline issues for setting energy efficiency target setting and acquisition claims in Washington
  - Completed in December 2013 and is discussed in the 2014-15 WA Biennial Conservation Plan
- Update processes and protocols for conservation measurement, evaluation and verification
  - The third party evaluator "Cadmus" completed the study and will be filed May 30th as part of the 2012-13 compliance/ cost recovery/ prudence case in Washington

Demand Side (Continued)

- Commission a demand response potential and cost assessment of commercial and industrial customers per its inclusion in the middle of the PRS action plan
  - RFP to be released in June, to be discussed this afternoon
- Assess energy efficiency potential on Avista's generation facilities
  - This study is in process of this study and will be a presentation on the findings at a future TAC meeting

Transmission

- Work to maintain Avista's existing transmission rights, under applicable FERC policies, for transmission service to bundled retail native load
- Continue to participate in BPA transmission processes and rate proceedings to minimize costs of integrating existing resources outside of Avista's service area
- Continue to participate in regional and sub-regional efforts to establish new regional transmission structures to facilitate long-term expansion of the regional transmission system
- Study and quantify transmission and distribution efficiency projects as they apply to EIA goals
  - Navigant completed the study and will be filed May 30th as part of the 2012-13 compliance/ cost recovery/ prudence case in Washington

Evaluation

- Continue participation in regional IRP and regional planning processes and monitor regional surplus capacity and continue to participate in regional capacity planning processes.
  - We participate in the NPCC's 7th Plan, PNUCC, Regional IRPs
- Evaluate the impacts of targeting individual or groups of energy efficiency options within PRiSM instead of targeting quantities using avoided cost
  - A test will be completed this summer using the 2013 IRP data to compare the methodologies.
  - The results will be discussed at a future TAC meeting along with a decision whether or not to use PRiSM or the current avoided cost methodology for the 2015 plan

Evaluation (Continued)

- Evaluate with the TAC the impacts of different points along the efficient frontier.
  - For discussion at future TAC meeting

Energy Independence Act Compliance (Renewable Energy)

James Gall and John Lyons, Ph.D.
First Technical Advisory Committee Meeting
May 29, 2014

The Energy Independence Act

- RCW 19.285 or Initiative Measure No. 937
  - Voted into Washington law November 2006
  - Utilities with more than 25,000 customers qualify
  - Requires acquisition of all cost-effective conservation
- Renewable energy goals
  - Based on a percentage of the two year average of Washington state retail sales
  - 3% by January 1, 2012 (166,047 MWh or 19 aMW)
  - 9% by January 1, 2016 (506,000 MWh or 57.8 aMW)
  - 15% by January 1, 2020 (867,000 MWh or 99 aMW)

Energy Independence Act

- RCW 19.285 – The Energy Independence Act (EIA) or Initiative Measure No. 937 (I-937)
  - Requires utilities with over 25,000 customers to obtain 15% of their electricity from qualified renewable resources by 2020.
  - Qualified resources include solar, wind, hydro upgrades, biomass, and wave/ocean/tidal power.
  - Requires the acquisition of all cost-effective energy conservation.
- I-937 approved by Washington voters on November 6, 2006.

Reporting Requirements

Annual compliance report (WAC 480-109-040) is due annually by June 1st:

- Report includes: background, alternative compliance (cost or low load growth), annual loads, renewable energy target for last year, current year progress, WREGIS certificates, incremental cost, and appendices

- Appendix A – UTC Compliance Report Spreadsheet: details about eligible resources and renewable resource credits (RECs)

- Appendix B – Incremental Cost Calculations

- Appendices C, D and E – Clark Fork River, Spokane River and Wanapum Hydro Upgrade Calculations

- Appendix F – Department of Commerce EIA Renewables Report

Ongoing Issues

Active rulemaking by the Washington Commission and the Department of Commerce

- Reporting issues – WREGIS and attestations
- Incremental hydro quantities
- Incremental cost calculation

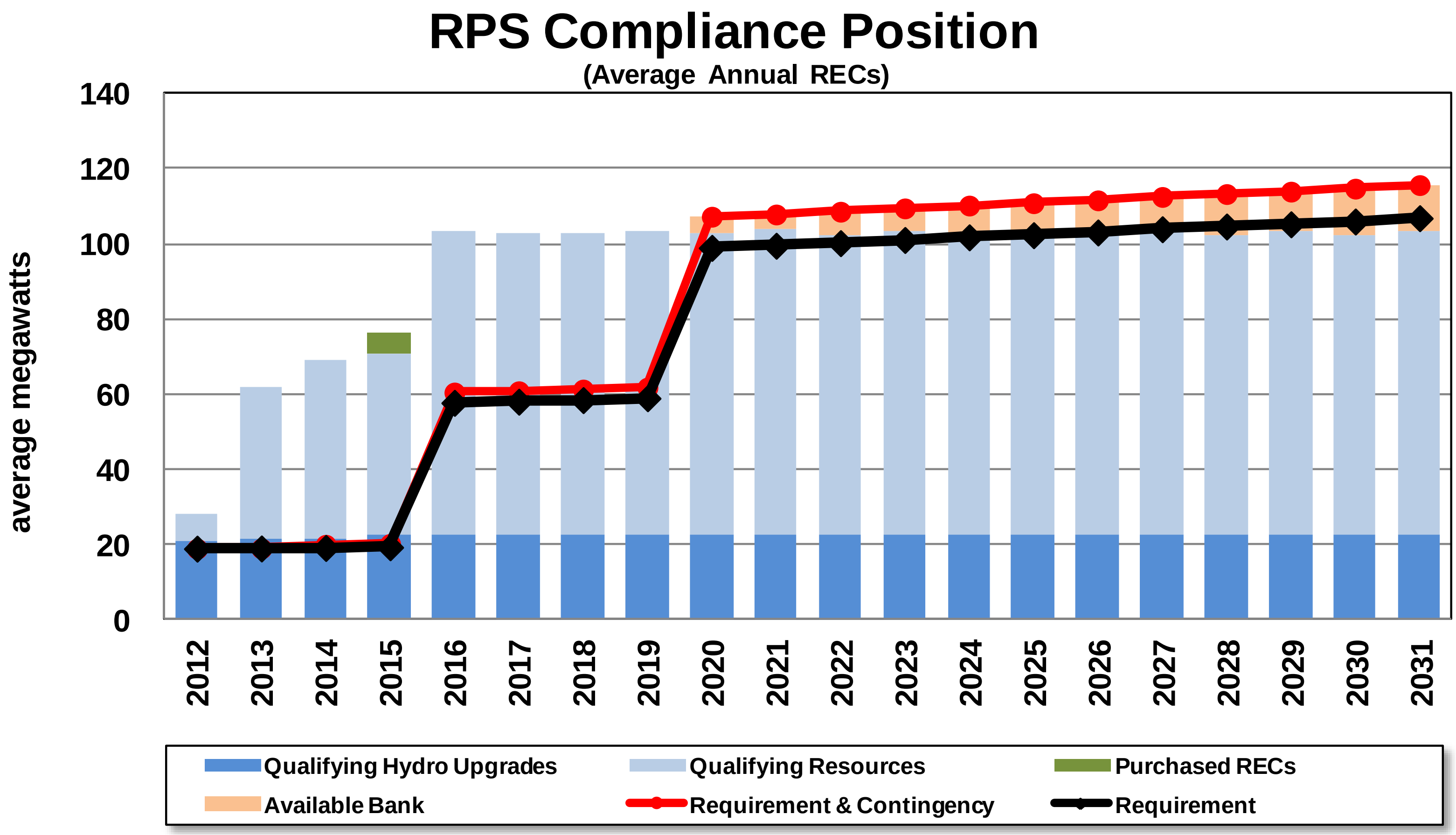
Incremental Cost Calculation

- Incremental hydro filed as a zero incremental cost
- Palouse wind: Incremental system cost- $8.2m
  - Washington Share: $5.4m
- Idaho REC transfer: $350k
- Total Washington Incremental Cost: $5.7m
- 1.22% of Washington Revenue Requirement

2013 EIA Compliance

	MWh	aMW
Required Renewable Energy	**166,740**	**19.0**
Spokane River		
Long Lake #3	14,197	1.6
Little Falls #4	4,862	0.6
Clark Fork River		
Cabinet Gorge 2-4	95,333	10.8
Noxon Rapids 1-4	55,697	6.4
Wanapum Fish Bypass	21,927	2.5
Total Hydro Upgrades	**192,016**	**21.9**
Palouse Wind (Includes apprentice credit)	356,432	40.7

Avista's Projected EIA Compliance



Energy Storage Proposal for Washington State Clean Energy Fund

John Gibson
First Technical Advisory Committee Meeting
May 29, 2014

Agenda

Washington Clean Energy Fund

- Target Categories
- Schedule
- Avista Consortium

Vanadium Flow Battery

Energy Storage System Architecture

Use Case Value Streams

Washington Clean Energy Fund

Target Categories

$15 Million in Total Funding:

Preliminary discussions on funding: Avista; PSE; Snohomish PUD

✓ **Integrate intermittent renewable energy projects through energy storage and information technology (IT)**

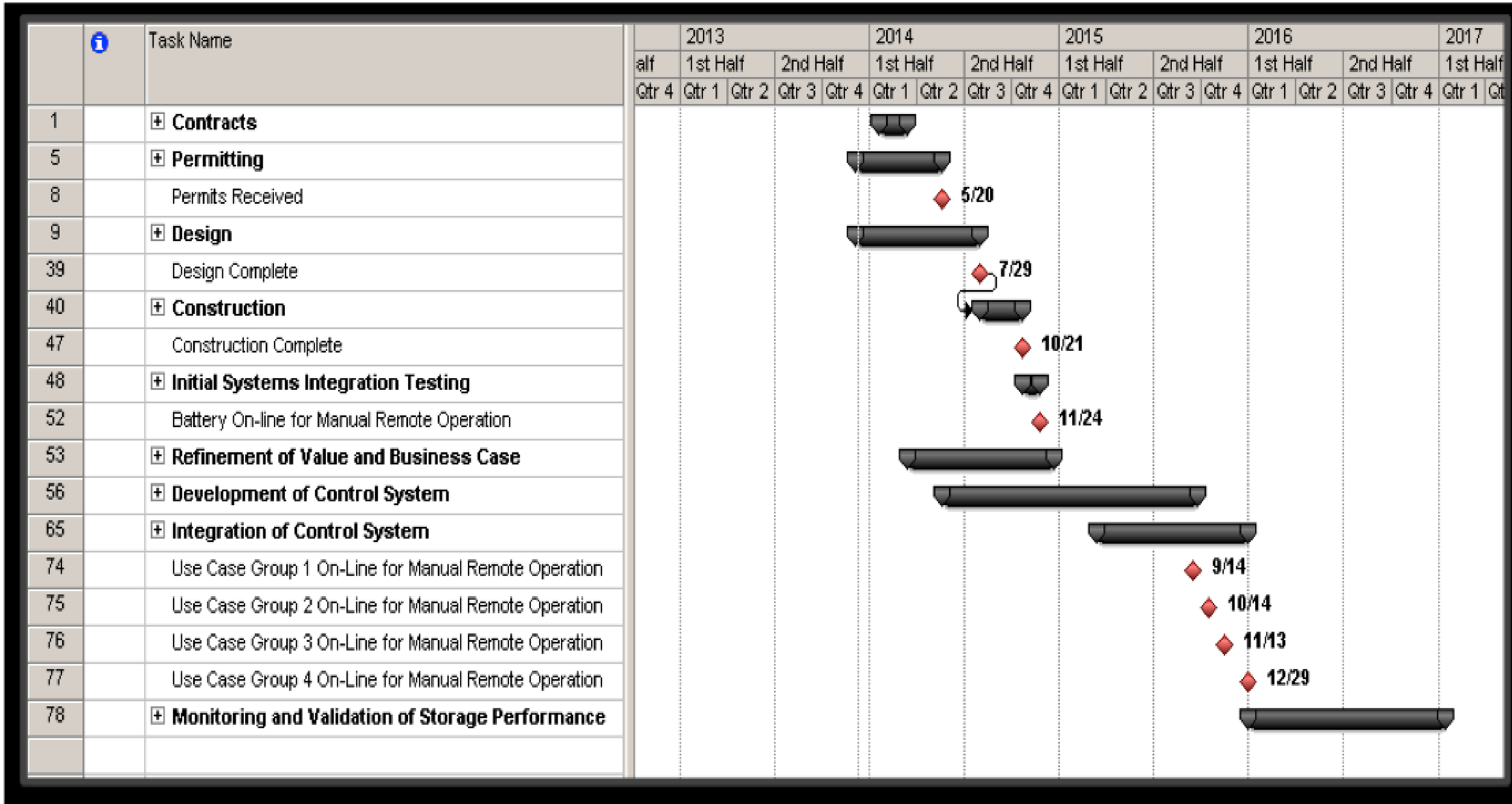
✓ **Demonstrate dispatch of energy storage resources from utility energy control centers**

- **Use thermal properties and electric load of buildings or district energy systems to store energy**

✓ **Improve reliability and reduce cost of intermittent or distributed energy resources**

Washington Clean Energy Fund

Schedule



Washington State Clean Energy Fund

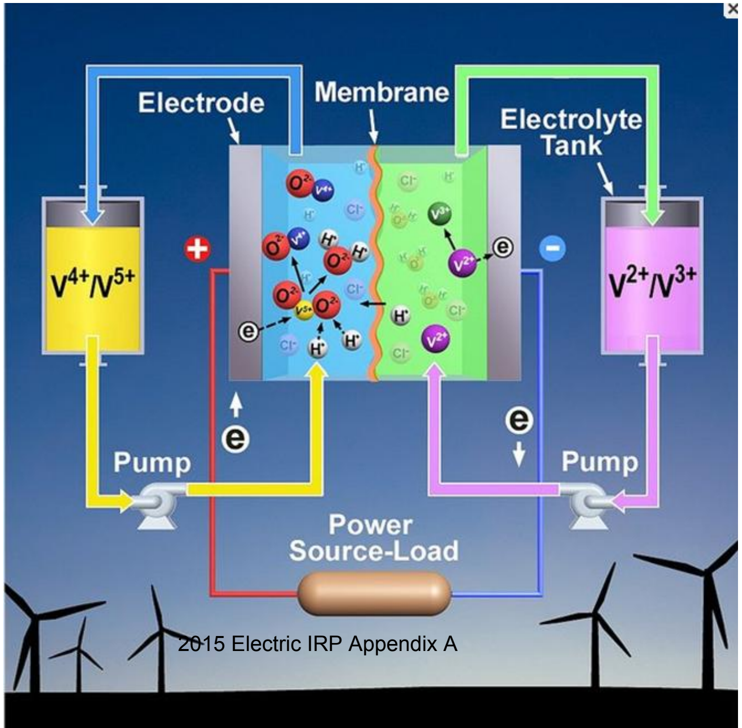
Avista Team

Avista Consortium

- UniEnergy Technologies – Vanadium Flow Battery
- Pacific Northwest National Laboratory – Value Stream Methodology
- Washington State University – Optimization Value Stream Algorithm

Vanadium Flow Battery
Chemistry

- **Charging the Battery:**
  - The electrical energy is converted into chemical energy stored in the vanadium ion tanks
- **Discharging the Battery:**
  - The vanadium electrolytes are pumped into battery central stack
  - The chemical energy is converted into electrical energy by transferring electrons



Vanadium Flow Battery
Performance

- Can be quickly brought up to full power when needed
  - response time charge to discharge (50ms)
- Offers a long cycle life > (UET: 10,000 cycles)
- Energy efficiencies charge to discharge AC to AC 70%
- Does not present a fire hazard and uses no highly reactive or toxic substances
- Can sit idle for long periods of time without losing storage capacity

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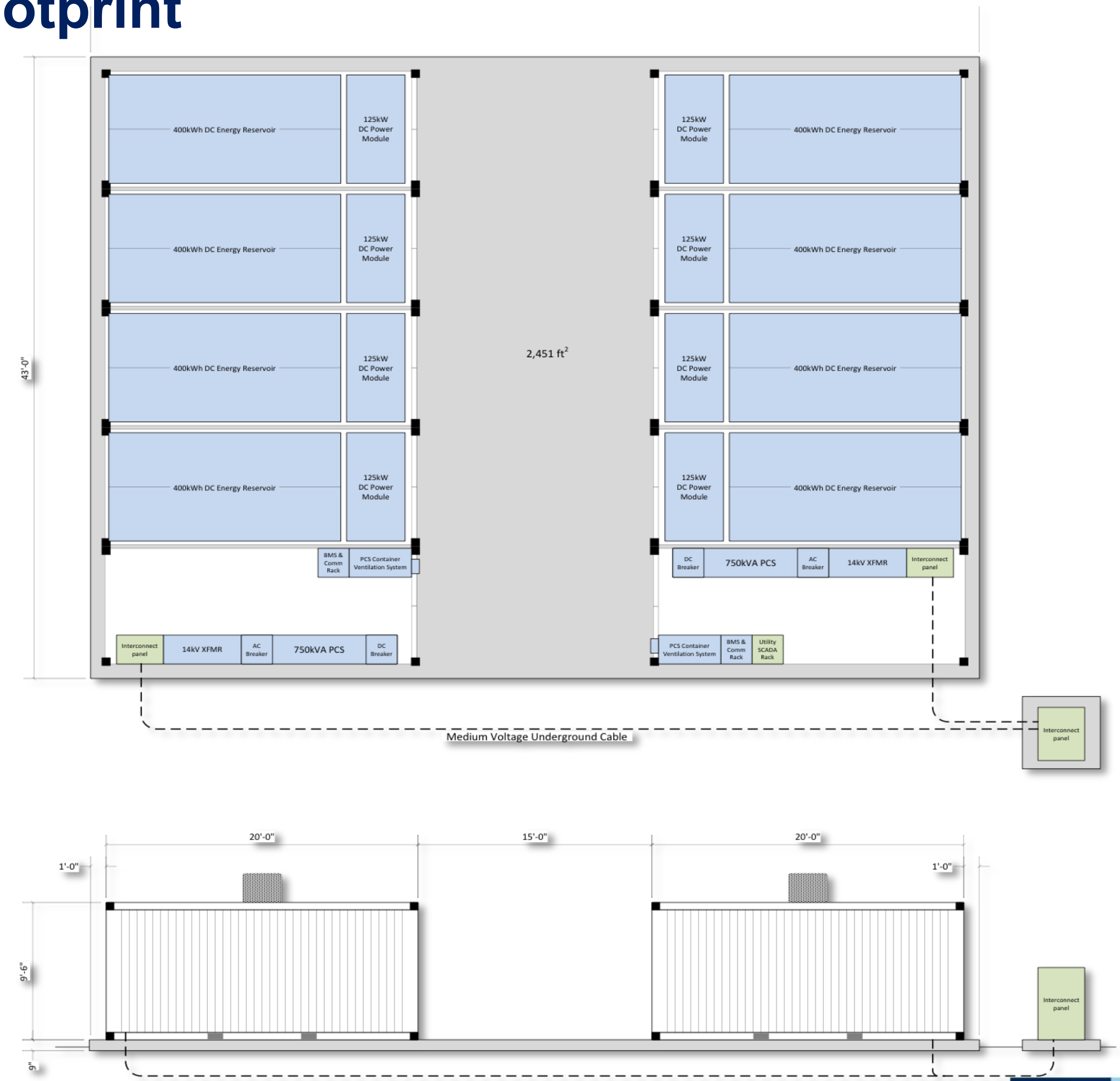
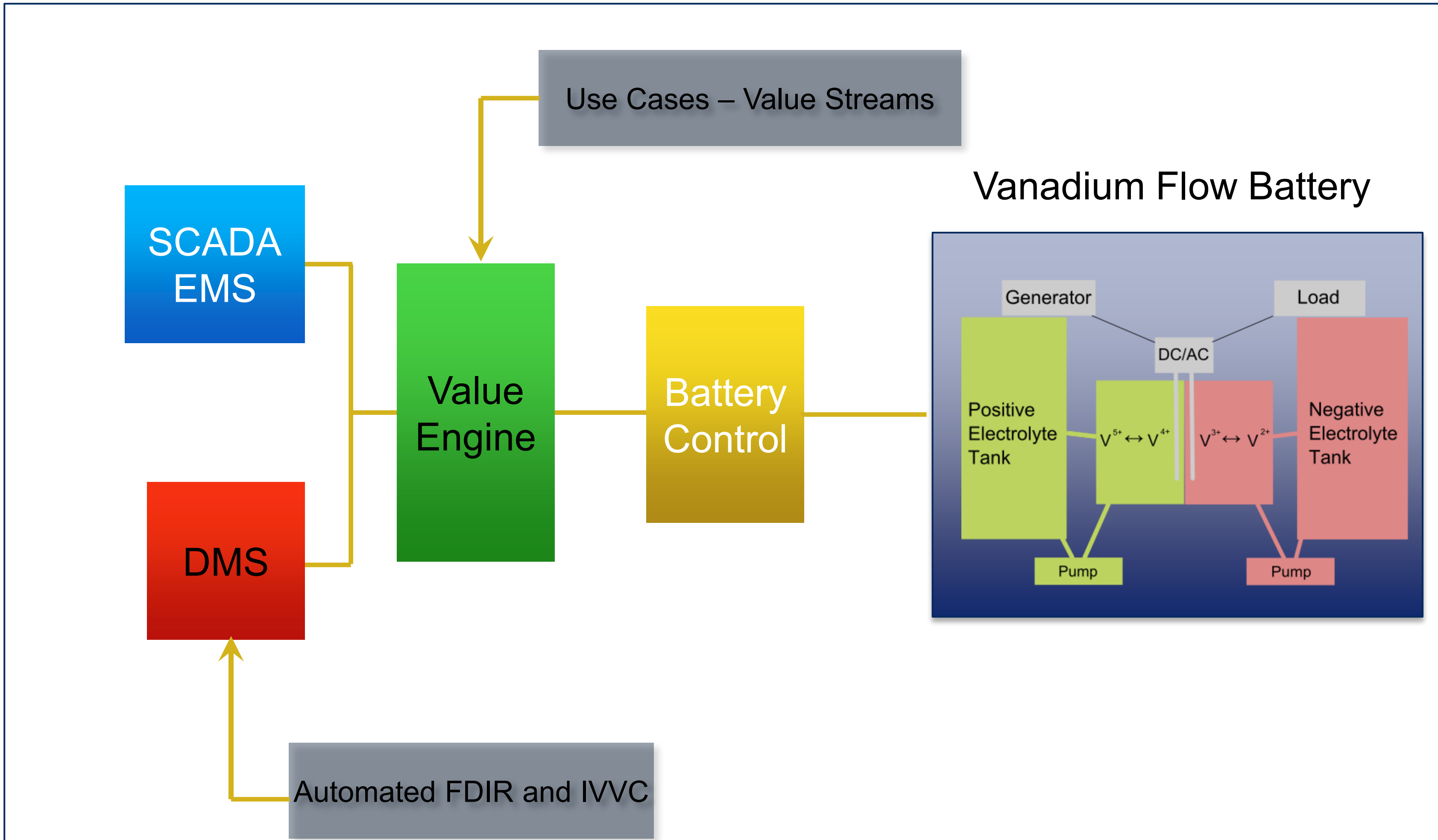
Vanadium Flow Battery
Container

Vanadium Flow Battery

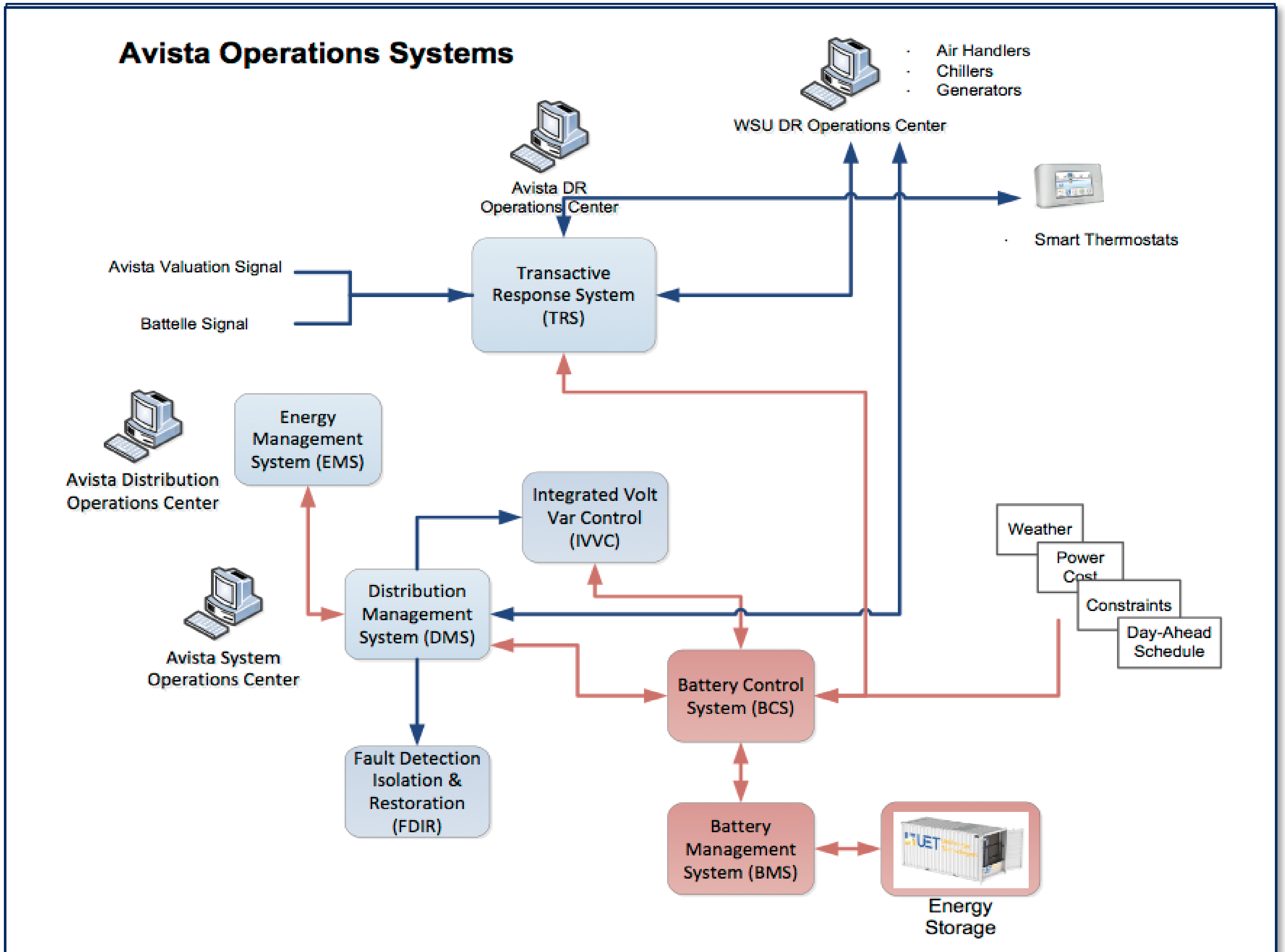
System Footprint



Energy Storage System
Architecture



Avista Smart Grid System
Integration



Washington State Clean Energy Fund

Use Cases - Value Streams

- Transmission System
- Distribution System
- Micro-grid Operations
- Maximizing the Total Value of Storage
- Demand Response and Energy Storage

Use Case
Bulk Power /Transmission System

- **Energy Shifting**
  - **The use case will demonstrate the following grid services:**
    - **Near-zero energy pricing market – abundant wind and water resource**
    - **General arbitrage instrument – charging during low-price discharging during high price**
- **Provide Grid Flexibility**
  - **The use case will demonstrate the following grid services:**
    - **Regulation services and load following grid services – battery operational boundaries**
    - **Services for ramping and flex rate markets**

Use Case
Distribution System

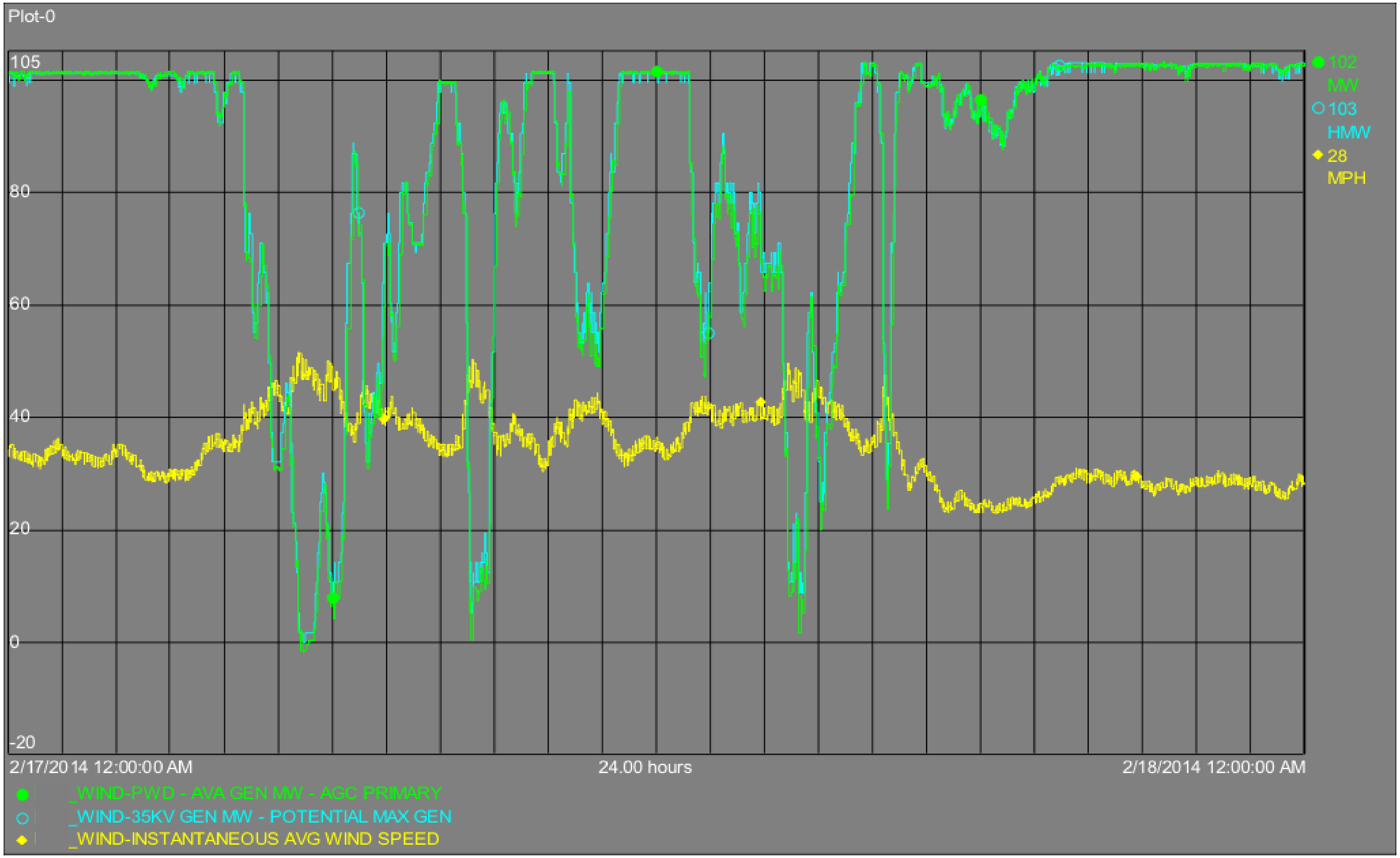
- **Improved Distribution Systems Efficiency**
  - **The use case will demonstrate the following grid services:**
    - **Volt/Var control with local and/or remote information**
      - **4-quadrant inverter controller to perform Volt/Var control**
    - **Load shaping service**
      - **Demand limiting strategy – demand threshold**
      - **Deferment of distribution system upgrades**
- **Outage Management of Critical Loads**
  - **The use case will demonstrate the following grid services:**
    - **Critical load support for one customer or several customer load components**
- **Enhanced Voltage Control**
  - **The use case will demonstrate the following grid services:**
    - **Expand the voltage control strategy to support enhanced CVR**

Use Case

Micro-grid, Optimal Utilization of Energy Storage, Demand Response

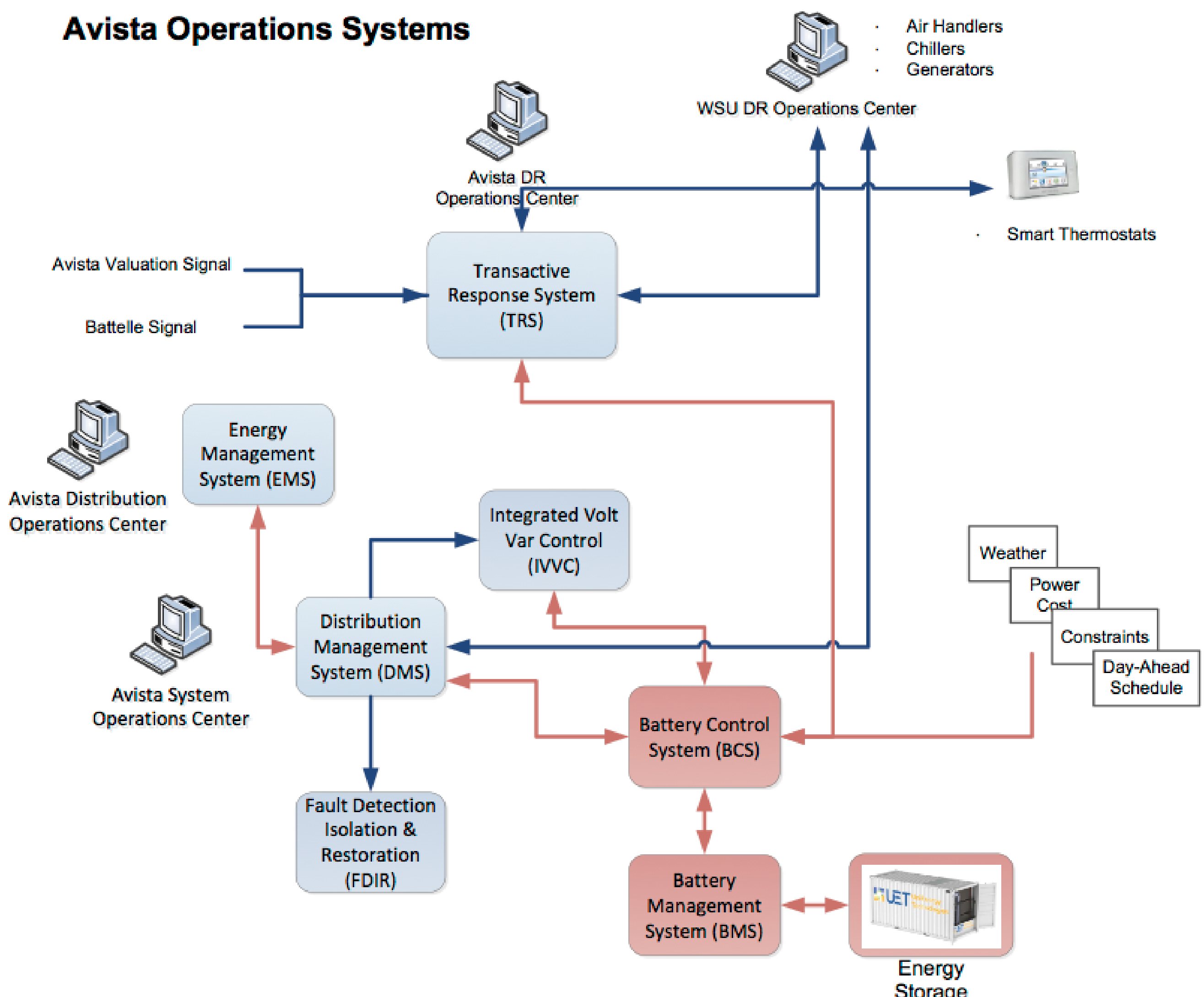
- Grid-connected and islanded micro-grid operations
  - The use case will demonstrate the following grid services:
    - Micro-grid operation while grid-connected
    - Micro-grid operation in islanded mode
- Optimal Utilization of Energy Storage
  - The use case will demonstrate the following grid services:
    - The use-case must demonstrate the optimization of multiple use cases
- Demand Response and Energy Storage
  - The use case will demonstrate the following grid services:
    - The demand response can be coupled to storage to optimize the use of battery

Example: Wind Generation

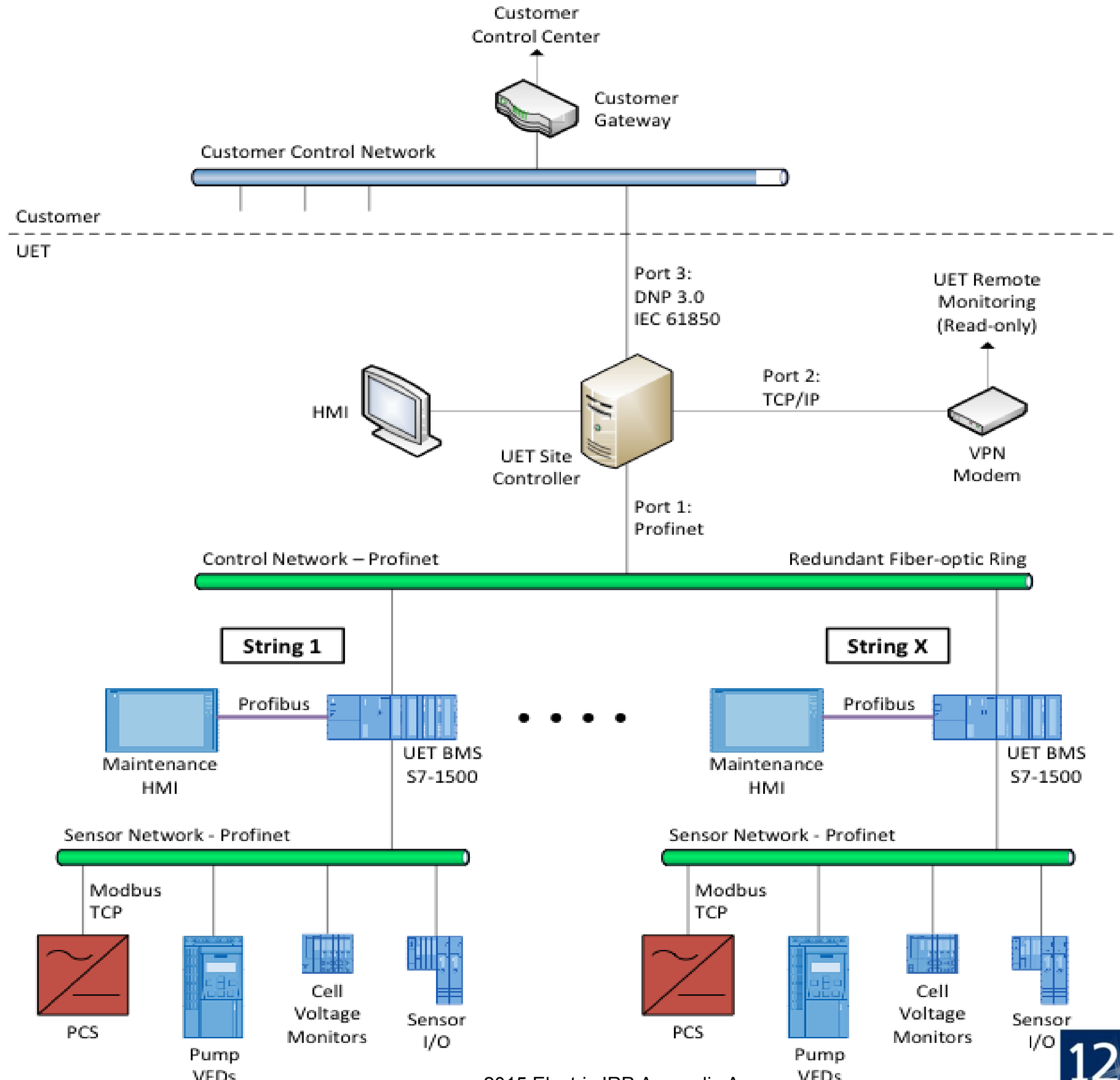


Questions

CEF - Systems Overview



Battery Network Diagram



WA State Clean Energy Fund - Grant

Schedule:

Project Award: June 20, 2014

Installation: 2nd Qtr 2015

Use Case Testing: All of 2015

All Use Cases In Service: 3rd Qtr 2016

Avista Consortium

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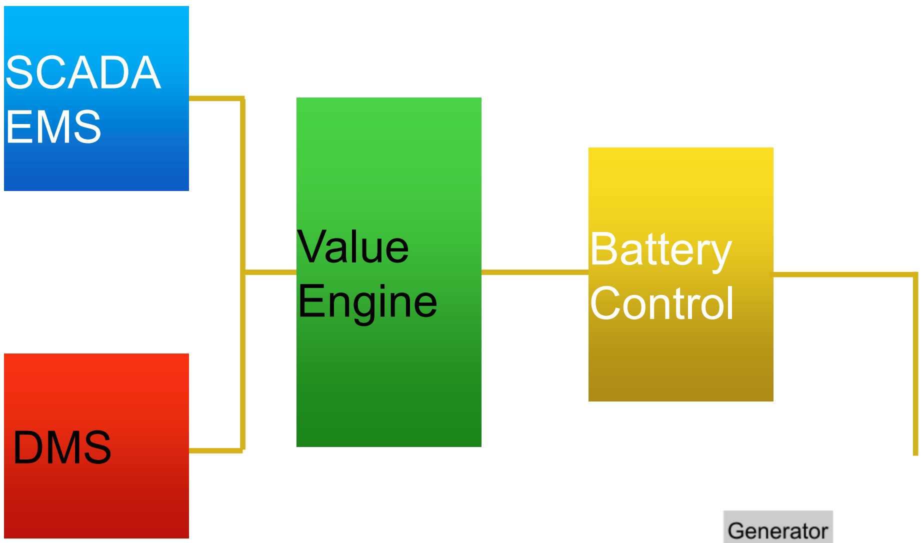
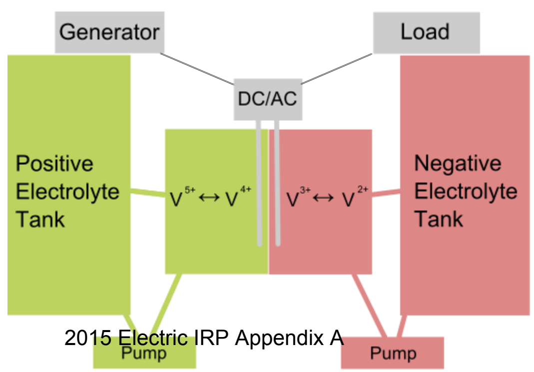


1.2 MW, 3.6MWh Capacity

Vanadium Flow Battery



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WA State Clean Energy Fund - Grant

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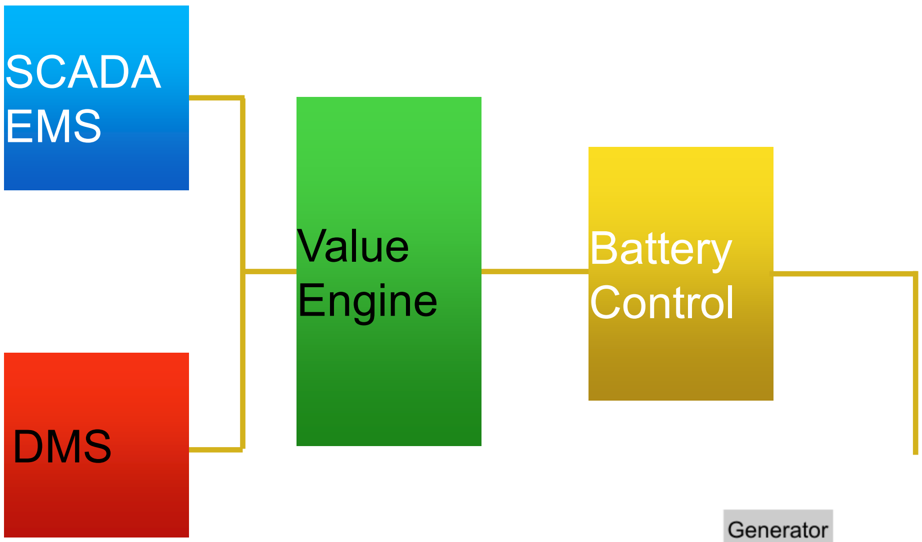

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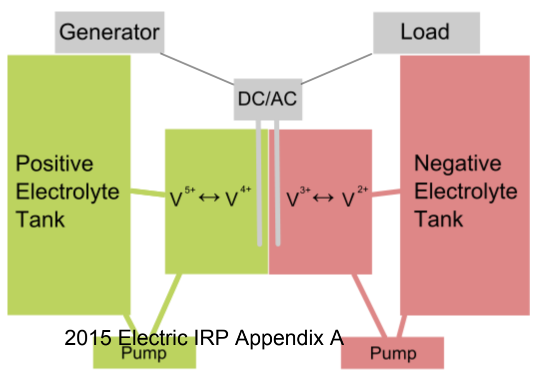

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Spokane, WA 99220

Exhibit A
Avista Statement of Work
Demand Response Potential Assessment

1. Project Overview

Avista requires a study ("Study") that provides an assessment of potential demand response within its commercial and industrial sectors in Washington and Idaho as described in Avista's attached 2013 Electric Integrated Resource Plan. For informational purposes, Avista is also seeking a survey of residential demand response programs and their statuses across the nation.

2. Background and Purpose

DRAFT

Avista's has offered a variety of temporary emergency demand response programs for residential, commercial and industrial customers since 2001 and more recently offered (2) two residential demand response pilot programs, and has gained a good understanding of residential demand response programs and their costs and benefits in the Avista service territory. The purpose of this Statement of Work ("SOW") is to set forth the various analyses required to develop a Study (the "Services"), which should enable Avista to gain a better understanding of demand response in the commercial and industrial sectors, and the corresponding cost and benefits.

3. Scope of Services

Consultant shall provide the labor and materials required to develop the Study including, without limitation:

3.1 National Overview of Demand Response Programs

Consultant shall provide a high level assessment of existing Demand Response programs for commercial, industrial and residential sectors across the United States, excluding pilot demand response programs. The Study shall:

- Summarize rate structures and contracts in place for each general program category;
- Provide methods used for calculating capacity and energy reduction and possible snapback values for each program (i.e., how to avoid gaming or falsely paying for phantom kW and kWh);
- Describe penalties (if any) and rules for each program;
- Identify all costs of each program
    - Demand Response vendor/contractor costs
    - Internal Program costs, administration, marketing, training etc.
    - Other program costs such as damage claims, maintenance, etc.
- Analyze peak clipping verses load shifting implied with each program;
- Analyze the pros/cons of RFP vs tariff vs contracts;
- Describe valuation used for effectiveness
    - Breakeven point
    - Avoided cost
- Identify commercial and industrial loads and processes that are used for demand response.
    - Describe how these loads/processes impact peak shifting or load reduction when used for demand response
    - Describe how these loads/processes stack in a supply curve when used for demand response
    - Describe ancillary service benefits, if any, gained from the demand response programs
    - Describe the reliability of the resource
- Identify any barriers to higher levels of program participation and the design and actions of the program that made it a success.

Avista Corp.
East 1411 Mission Ave.
Spokane, WA 99220

AVISTA

Exhibit A
Avista Statement of Work
Demand Response Potential Assessment

3.2 Analysis of the Timing of Implementing New Demand Response Programs

Consultant shall analyze and include in the Study the benefits and risks of offering Demand Response ahead of need versus waiting for the need. Special focus should be given to the uniqueness of the Pacific Northwest region's customers and their attitudes, and power market.

3.3 Determination of Adequate Customer Incentive Levels for various Commercial and Industrial Demand Response

Consultant shall identify and include in the Study, commercial and industrial loads and processes used for demand response and the levels of incentives needed to encourage each of those loads to participate in demand response, and determine if Avista's energy and capacity rates are adequate to meet those incentive requirements.

3.4 Analysis of Avista's Customer Mix and Associated Expected Demand Response Capability from Commercial and Industrial Loads

- Consultant shall include in the Study:
  - A break down and description of Avista's customer sectors by size, revenue class, demand and usage using Avista's Conservation Potential Assessment.
  - A break-down of expected demand and energy savings from possible demand response loads and processes (off-peak, on-peak, time of day, and ancillary services).
- Consultant shall meet with Avista's staff from the areas set forth below to get their perspectives for the analyses:
  - Account Executive team
  - Power Supply team
  - Conservation team
  - Other key utility staff

3.5 Analysis of the Costs and Benefits to Implement a Commercial and/or Industrial Demand Response Program for Avista

Consultant shall apply the knowledge gained in providing the Services applicable under this SOW to analyze the expected cost to operate a commercial or commercial/industrial demand response program at Avista to determine:

- Program mix and costs for 5 MW, 10 MW, 15 MW, 20 MW, 25 MW and 50 MW acquisition scenarios;
- Potential acquisition scenarios across the supply curve for spring, summer and winter seasons;
- Pros/cons of using a 3rd party aggregator;
- Pros/cons of using a mix of 3rd party aggregator and utility staff;
- Pros/cons of implementing a utility sponsored demand response program without an outside vendor. Examine aspects across the spectrum from Utility direct load control to interruptible rates.

4. Attachment:

Attachment A – 2013 Electric Integrated Resource Plan

Draft 2015 Electric IRP Work Plan

John Lyons, Ph.D.
First Technical Advisory Committee Meeting
May 29, 2014

Technical Advisory Committee Meetings

- **TAC 1 (May 29, 2014):** TAC Meeting Expectations, 2013 IRP Acknowledgement Letters, 2015 Action Plan Update, Pullman Energy Storage Project, Energy Independence Act Compliance & Forecast, Demand Response Study Discussion, and draft 2015 Electric IRP Work Plan.
- **September 2014:** Review conservation selection methodology, energy and economic forecasts, generation options, and 2014 Shared Value Report.
- **November 2014:** Peak load forecast, reliability planning, Colstrip discussion, energy storage technologies, 2015 IRP modeling, and energy efficiency.
- **February 2015:** Electric and natural gas price forecasts, transmission planning, resource needs assessment, and market portfolio scenario development.
- **March 2015:** Draft Preferred Resource Strategy (PRS), review of scenarios and futures, and portfolio analysis.
- **June 2015:** Review of the final PRS and Action Items.

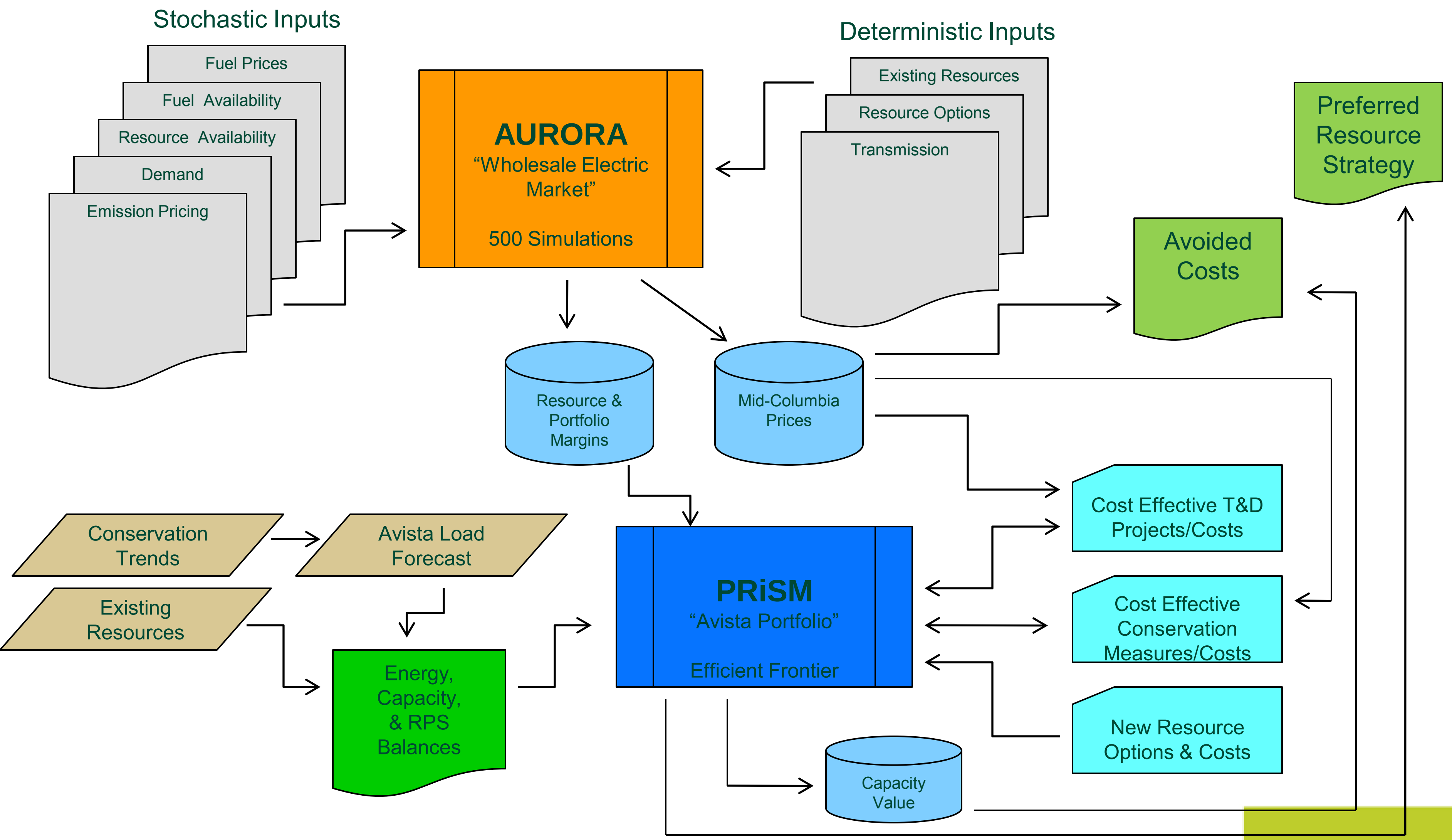
2015 Draft Electric IRP Timeline

Preferred Resource Strategy (PRS) Tasks	Target Date
Finalize energy demand forecast	July 2014
Identify regional resource options for electric market price forecast	September 2014
Identify Avista's supply & conservation resource options	September 2014
Finalize Peak Load Forecast	September 2014
Update AURORA^{xmp} database for electric market price forecast	October 2014
Finalize data sets/statistics variables for risk studies	October 2014
Energy efficiency load shapes input into AURORA^{xmp}	October 2014
Draft transmission study due	October 2014
Energy efficiency load shapes input into AURORA^{xmp}	October 2014
Final transmission study due	December 2014
Finalize Distribution Feeder Forecast	December 2014
Select natural gas price forecast	December 2014
Finalize deterministic base case	December 2014
Due date for study requests	January 15,2015
Base case stochastic study complete	January 2015
Finalize PRiSM model	January 2015
Develop efficient frontier and PRS	January 2015
Simulation of risk studies "futures' complete	February 2015
Simulate market scenarios in AURORA^{xmp}	February 2015
Evaluate resource strategies against market futures and scenarios	March 2015
Present preliminary study and PRS to TAC	March 2015

2015 Draft Electric IRP Timeline

Writing Tasks	Target Date
File 2015 IRP Work Plan	August 29, 2014
Prepare report and appendix outline	October 2014
Prepare text drafts	April 2015
Prepare charts and tables	April 2015
Internal drafts released at Avista	May 2015
External draft released to the TAC	June 2015
Final editing and printing	August 2015
Final IRP submission to Commissions and distribution to TAC	August 31, 2015

2015 IRP Modeling Process



2015 Electric IRP Draft Outline

- Executive Summary
- Introduction and Stakeholder Involvement
- Economic and Load Forecast
  - Economic Conditions
  - Avista Energy and Peak Load Forecast
  - Load Forecast Scenarios
- Existing Resources
  - Avista Resources
  - Contractual Resources and Obligations

2015 Electric IRP Draft Outline

- Energy Efficiency and Demand Response
  - Conservation Potential Assessment
  - Demand Response Opportunities
- Long-Term Position
  - Reliability Planning and Reserve Margins
  - Resource Requirements
  - Reserves and Flexibility Assessment
- Policy Considerations
  - Environmental Concerns
  - Greenhouse Gas Issues
  - State and Federal Policies

2015 Electric IRP Draft Outline

- Transmission Planning
  - Avista's Transmission System
  - Future Upgrades and Interconnections
  - Transmission Construction Costs and Integration
  - Transmission and Distribution Efficiencies
- Generation Resource Options
  - New Resource Options
  - Avista Plant Upgrades

2015 Electric IRP Draft Outline

- Market Analysis
  - Marketplace
  - Fuel Price Forecasts
  - Market Price Forecast
  - Scenario Analysis
- Preferred Resource Strategy
  - Resource Selection Process
  - 2015 Preferred Resource Strategy
  - Efficient Frontier Analysis
  - Avoided Cost

2015 Electric IRP Draft Outline

- Portfolio Scenarios
  - Portfolio Scenarios
  - Tipping Point Analysis
- Action Plan
  - 2013 Action Plan Summary
  - 2015 Action Plan

2015 Electric Integrated Resource Plan

Technical Advisory Committee Meeting No. 2 Agenda

Tuesday, September 23, 2014
Conference Room 130

Topic	Time	Staff
1. Introduction & TAC 1 Recap	8:30	Lyons
2. Conservation Selection Methodology	8:35	Gall
3. Load and Economic Forecasts	9:15	Forsyth
4. Shared Value Report	10:45	Fielder
5. Lunch	11:30	
6. Generation Options	12:30	Gall/Dempsey
7. Clean Power Plan Proposal Discussion	1:45	Lyons/Kalich
8. Adjourn	3:00	

2015 Electric IRP
TAC Meeting Expectations and Schedule

John Lyons, Ph.D.
Second Technical Advisory Committee Meeting
September 23, 2014

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 in all or some of the process
- Open forum, but we need to stay on topic to get through the agenda
- Welcome requests for studies or different assumptions.
  - Time or resources may limit the amount of studies we can do
  - The earlier study requests are made, the more accommodating we can be
  - January 15, 2015 is the final date to receive study requests
- Action Items – areas for more research in the next IRP
- This is not an advocacy forum
- Not a forum on a particular resource or resource type
- Supports rate recovery, but not a preapproval process
- Planning team is available by email or phone for questions or comments between the TAC meetings

Remaining TAC Meetings

- **TAC 3 – Friday, November 21, 2014:** Planning margin, Colstrip discussion, cost of carbon, modeling overview and conservation potential assessment methodology.
- **TAC 4 – February 2015:** Electric and natural gas price forecasts, transmission planning, resource needs assessment, market and portfolio scenario development, energy storage and ancillary service evaluation
- **TAC 5 – March 2015:** Completed conservation potential assessment, draft PRS, review of scenarios and futures and portfolio analysis
- **TAC 6 – June 2015:** Review of final PRS and action items.

2015 IRP Tasks for the PRS

Exhibit 1: 2015 Electric IRP Timeline

Task	Target Date
Preferred Resource Strategy (PRS)	
Finalize energy demand forecast	July 2014
Identify Avista's supply & conservation resource options	September 2014
Finalize peak load forecast	September 2014
Update AURORA^{xmp} database for market price forecast	October 2014
Energy efficiency load shapes input into AURORA^{xmp}	October 2014
Finalize datasets/statistics variables for risk studies	November 2014
Transmission study due	December 2014
Finalize distribution feeder forecast	December 2014
Select natural gas price forecast	December 2014
Finalize deterministic base case	January 2015
Due date for study requests	Jan. 15, 2015
Base case stochastic study complete	January 2015
Develop efficient frontier and PRS	January 2015
Finalize PRiSM model	February 2015
Simulation of risk studies "futures" complete	February 2015
Simulate market scenarios in AURORA^{xmp}	February 2015
Evaluate resource strategies against market futures and scenarios	March 2015
Present preliminary study and PRS to TAC	March 2015

2015 IRP Writing Tasks – Work Plan

Writing Tasks	
File 2015 IRP work plan	August 2014
Prepare report and appendix outline	October 2014
Prepare text drafts	April 2015
Prepare charts and tables	April 2015
Internal draft released at Avista	May 2015
External draft released to the TAC	June 2015
Final editing and printing	August 2015
Final IRP submission and TAC	August 31, 2015

Conservation Modeling Options

James Gall
Second Technical Advisory Committee Meeting
September 23, 2014

2013 IRP WUTC Acknowledgement Request

….the Commission requests that Avista, together with input from the TAC, investigate incorporating energy efficiency into its 2015 IRP as a selectable resource within PRiSM.

1. The model cannot readily adapt to new scenarios, changes in model assumptions, or the different avoided costs generated under various resource strategies.
2. The model cannot choose to accelerate acquisition of conservation, even in cases where the acceleration of acquisition is the least-cost resource or provides substantial risk mitigation value. Instead, the acquisition rate is defined by the ramp rates within the CPA.

Avista's 2005-2013 IRP Conservation Selection Methodology

1. Develop a Conservation Potential Assessment (CPA) study
2. Identify resource requirements prior to conservation
3. PRiSM selects generating resources to meet resource deficits
4. Avoided energy, capacity, and risk costs are derived from resource selection
5. Potential conservation measures are compared to Avoided Costs and the economic conservation is selected (uses 10% premium on all avoided costs, including losses and T&D savings)
6. New resource requirements are developed based on selected conservation
7. PRiSM develops an efficient frontier and the PRS is selected

Pros & Cons with Avista's Conservation Selection Methodology

- Pros
  - Generation resources selection is faster, allowing more scenarios
  - Conservation resources with capacity contribution can get a 10% avoided cost premium
    - Power Council's proposed RPM model only includes conservation adder on the avoided market prices for energy savings.
  - Third party conservation resource selection
- Cons
  - When selecting different portfolios along the efficient frontier, conservation remains unchanged, unless scenario analysis is used
  - Third party conservation resource selection

Lessons from Modeling Conservation in PRiSM- Analysis Perspective

- Model produces conservation acquisition consistent with 2013 IRP.
- Short lived conservation measures get free energy savings after life (due to code or other reasons), modeling this in PRiSM bias more short term conservation because of long term free benefits. To avoid this, levelized costs have to be included after the resource life.
- Ramp rates for each program year are required, but the model can select a program to begin earlier than CPA, with more detail on program population, costs, and constraints.
- Levelized program costs have to be used rather than upfront cost to avoid detailed modeling beyond 20 years. This bias higher cost programs as it doesn't see any benefits beyond 20 years. End effects may be required to be modeled.

Lessons from Modeling Conservation in PRiSM- Technical Perspective

- PRiSM currently resides in Excel with Lindo System’s What’s Best as the optimization engine.
  - The optimization is a MIP- Mixed Integer Program
  - MIP’s solution time increases exponentially with additional variables
- Solution time without adjustable conservation is ~2 minutes.
- Adding conservation causes solution time issues, some simulations are ~7 minutes, some go forever- typically on lower risk scenarios along efficient frontier.
- Alternatives for resolving solution times.
  1. Use existing method
  2. Try alternative optimization engines
  3. Re-write program into a programing language and use Gurobi as a solver
  4. Use LP for efficient frontier analysis, and MIP for scenario and PRS selection

Load and Economic Forecasts

Grant D. Forsyth, Ph.D.
Chief Economist
September 23, 2014
Second Technical Advisory Committee Meeting

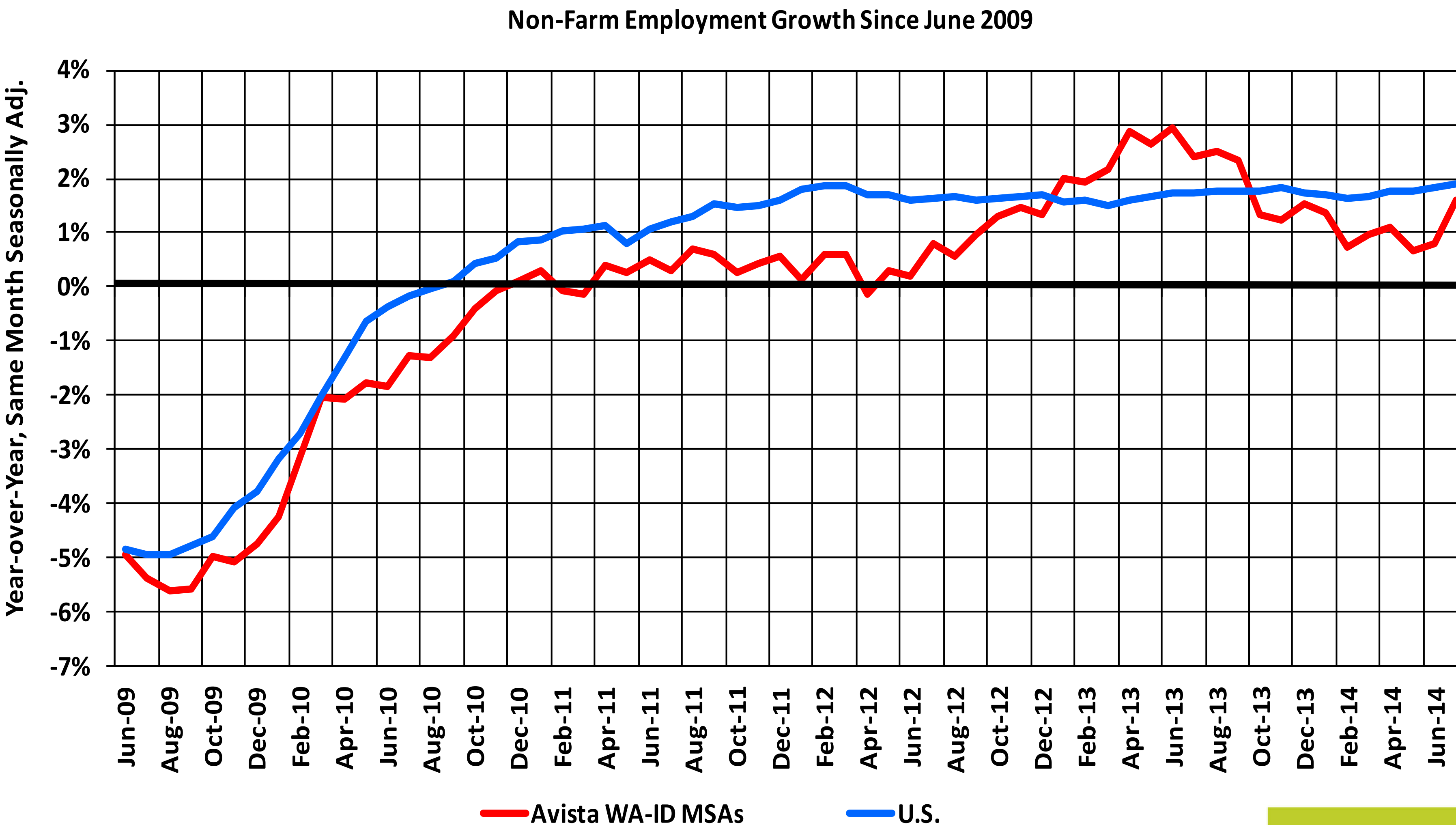
Main Topic Areas

- **Service Area Economy**
- **Peak Load Forecast**
- **Long-run Forecast and Load Impacts of Residential Solar Penetration**

Service Area Economy

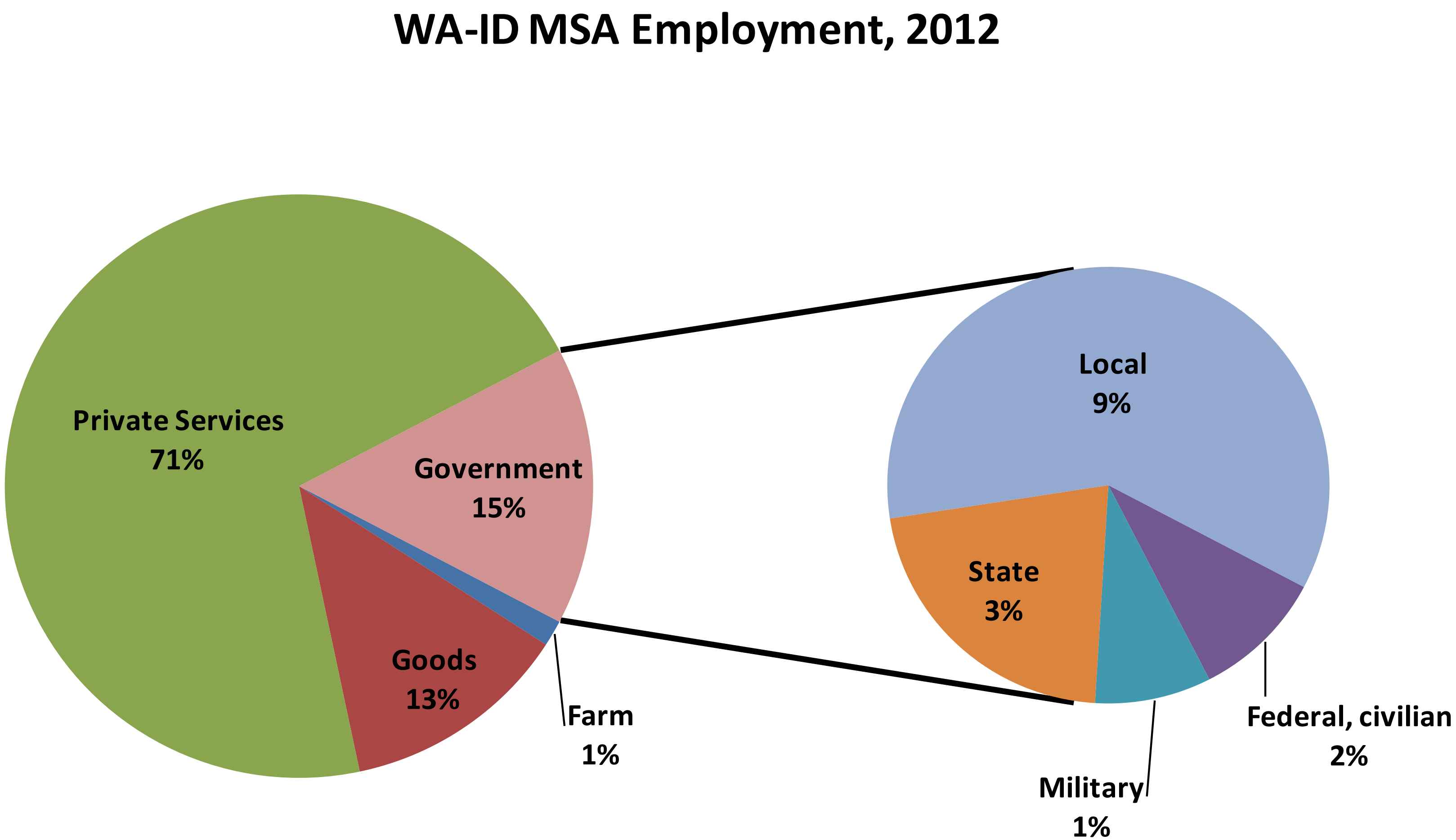
Grant D. Forsyth, Ph.D.
Chief Economist
Grant.Forsyth@avistacorp.com

Non-Farm Employment: A Long, Slow Recovery



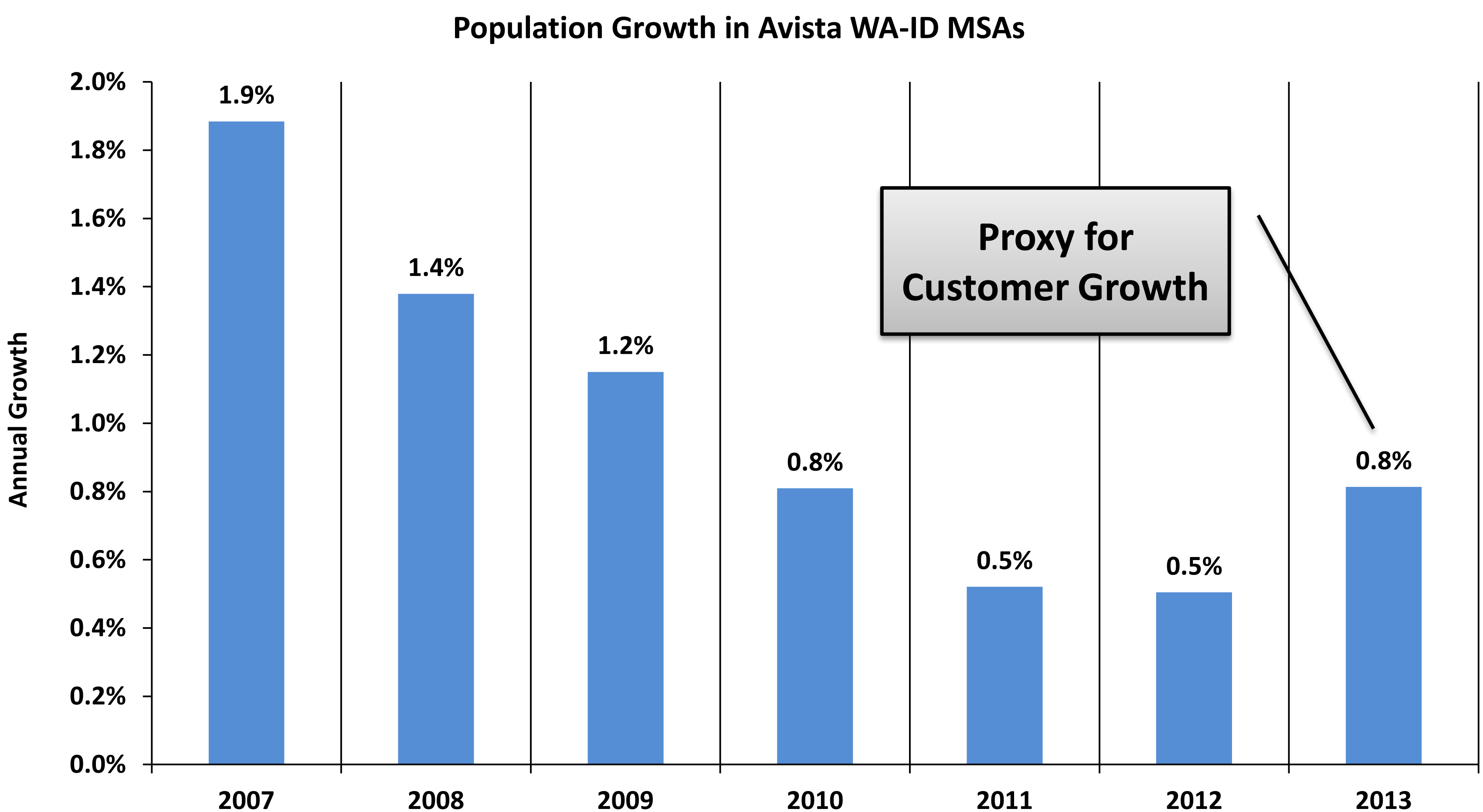
Source: BLS and author's calculations.

Distribution of Employment: Services and Government are Dominant



Source: BEA and author's calculations.

Population Growth: Slowly Recovering with Employment Growth



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

Peak Load Forecast

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

The Basic Model

- **Monthly time-series regression model that initially excludes certain industrial loads.**

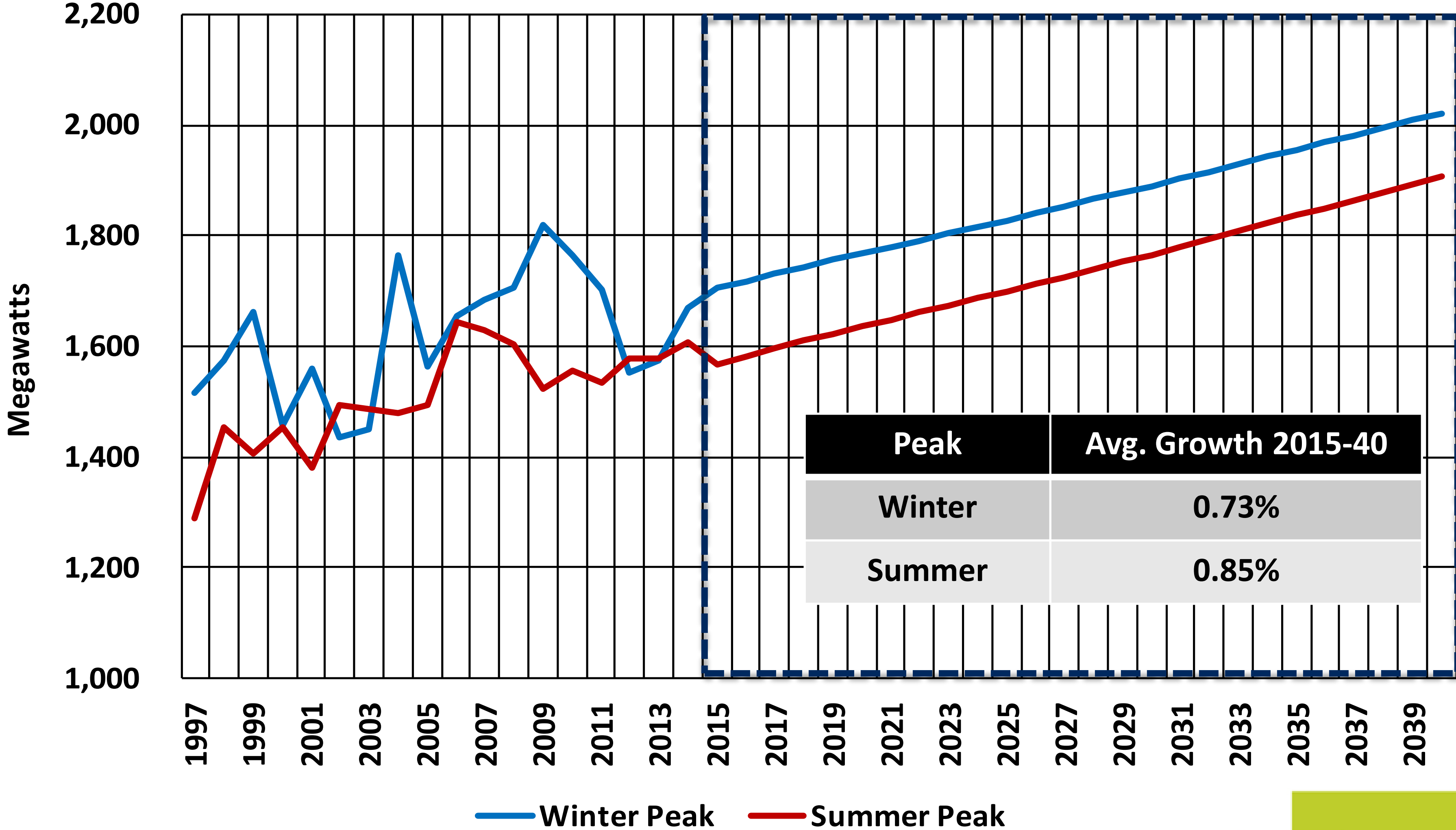
- **Based on monthly peak MW loads since 2004. The peak is pulled from hourly load data for each day for each month.**

- **Explanatory variables include HDD-CDD and monthly and day-of-week dummy variables. The level of real U.S. GDP is the primary economic driver in the model—the higher GDP, the higher peak loads. The historical impacts of DSM programs are "trended" into the forecast.**

- **The coefficients of the model are used to generate a distribution of peak loads by month based on historical max/min temperatures, holding GDP constant. An expected peak load can then be calculated for the current year (e.g., 2014). Model confirms Avista is a winter peaking utility for the forecast period; however, the summer peak is growing faster than the winter peak.**

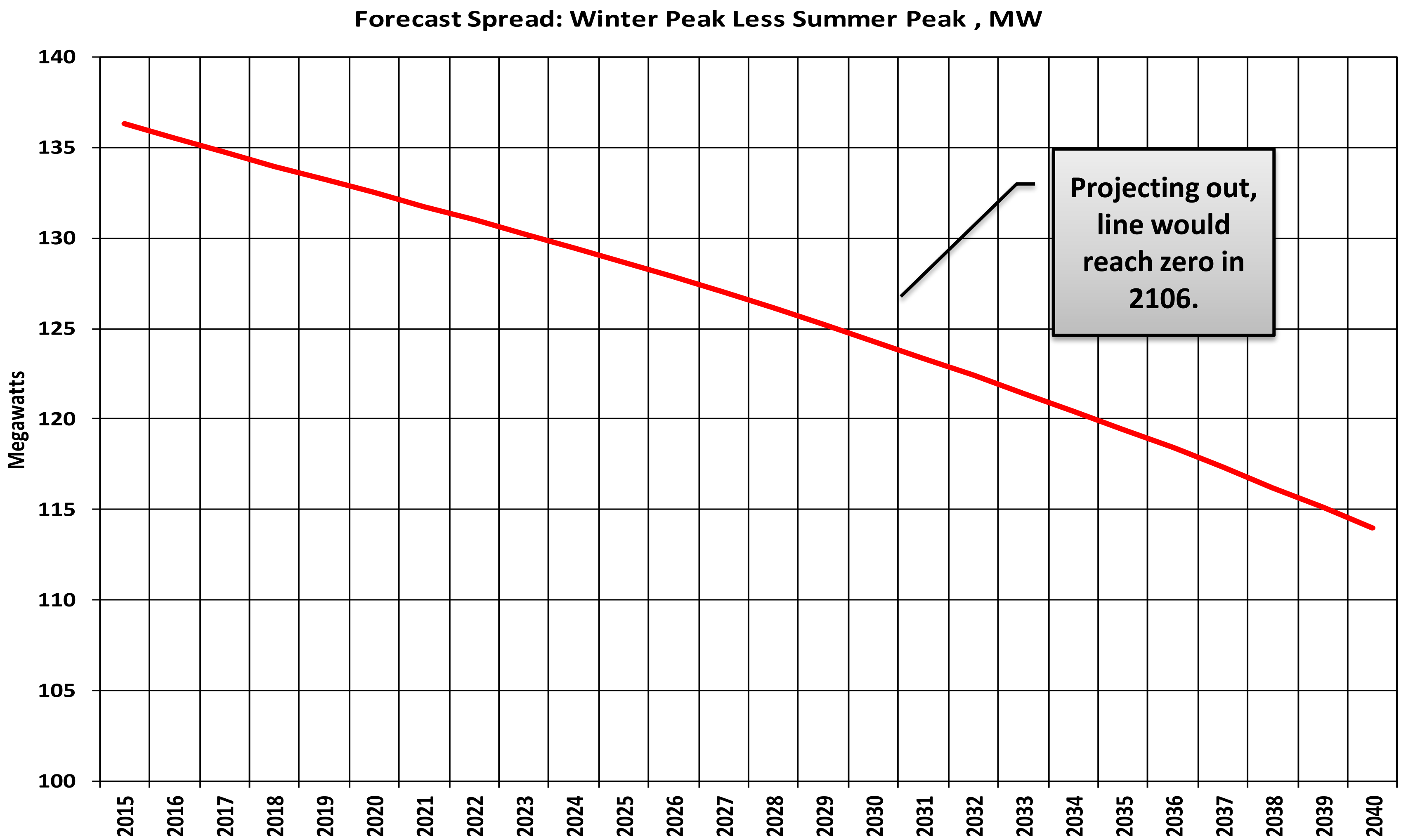
- **The model is also used to calculate the long-run growth rate of peak loads for summer and winter using a forecast of GDP growth under the "ceteris paribus" assumption for weather and other factors.**

Current Peak Load Forecasts for Winter and Summer, 2015-2040

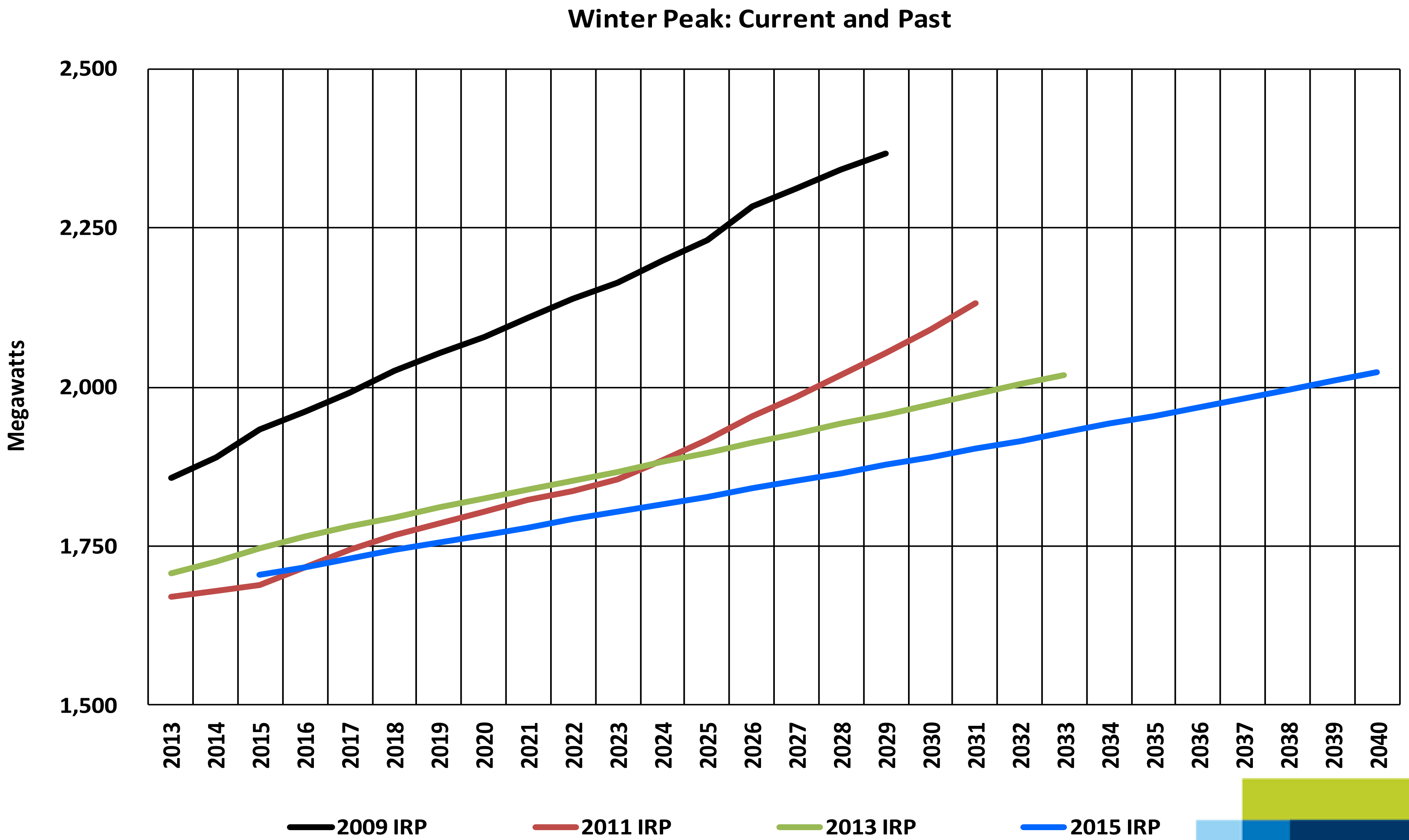


Peak	Avg. Growth 2015-40
Winter	0.73%
Summer	0.85%

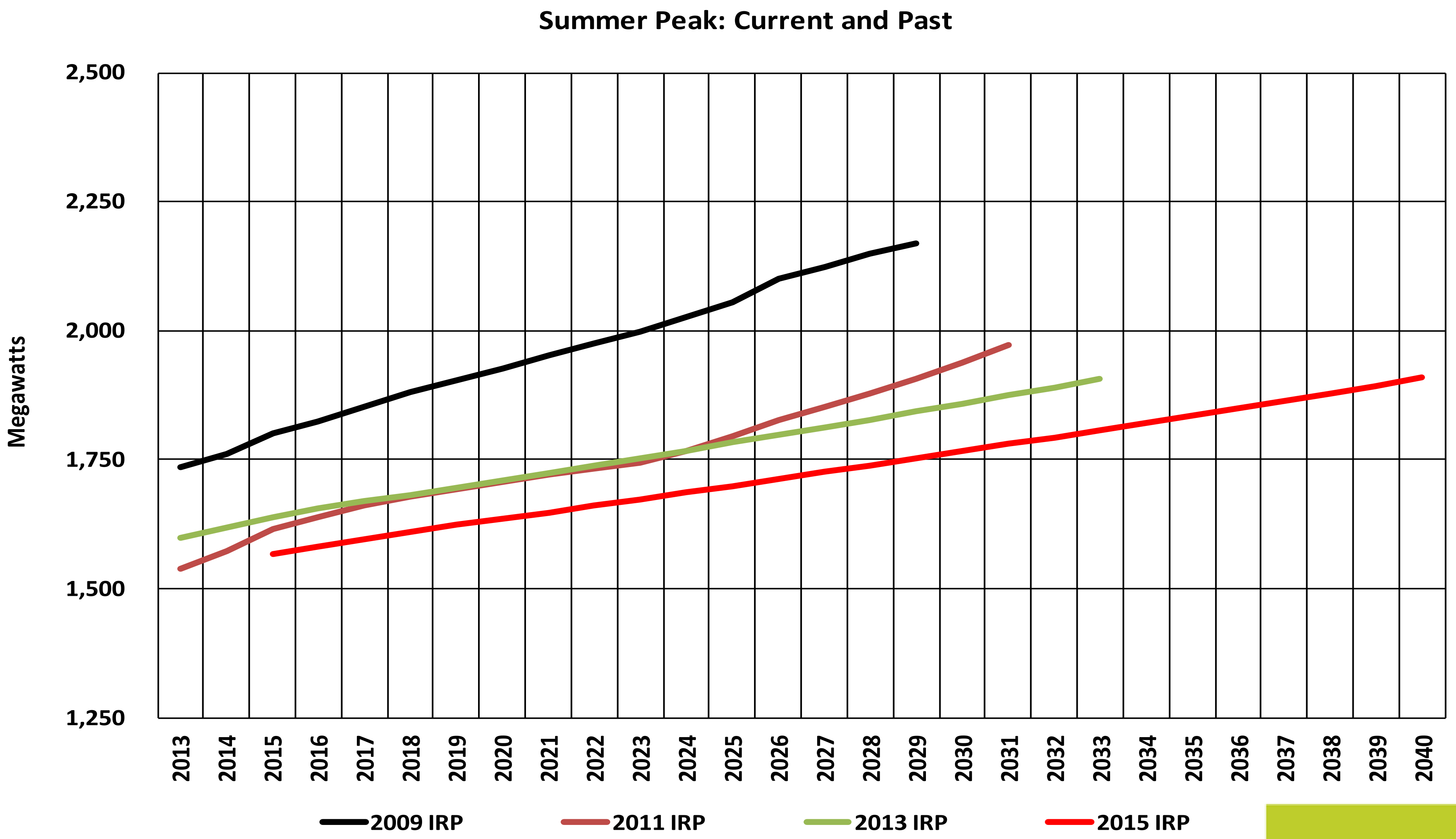
MW Spread Between Peak Forecasts for Winter and Summer, 2015-2040



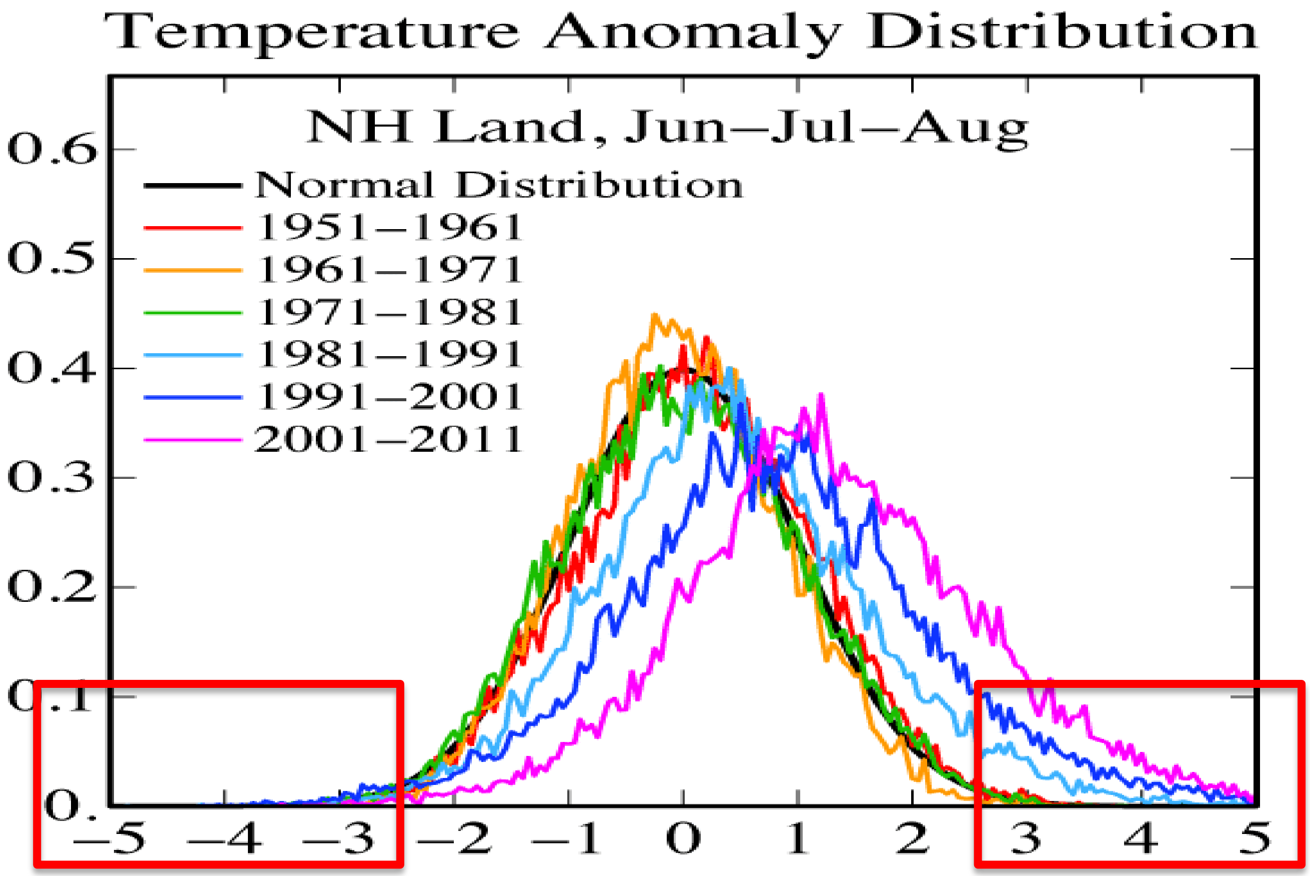
Current and Past Peak Load Forecasts for Winter Peak, 2013-2040



Current and Past Peak Load Forecasts for Summer Peak, 2015-2014

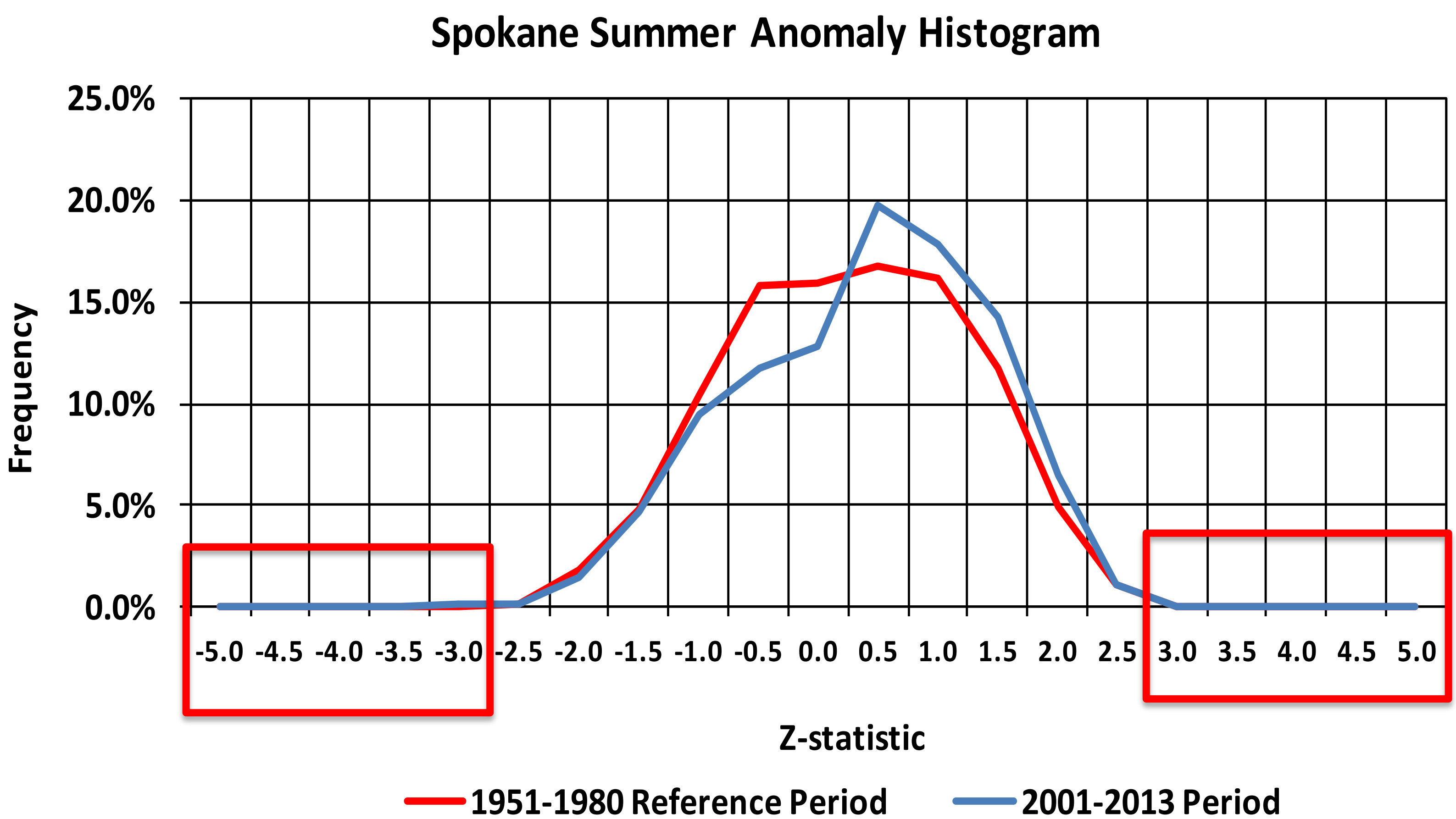


Distribution of Summer Temperature Anomalies in the Northern Hemisphere



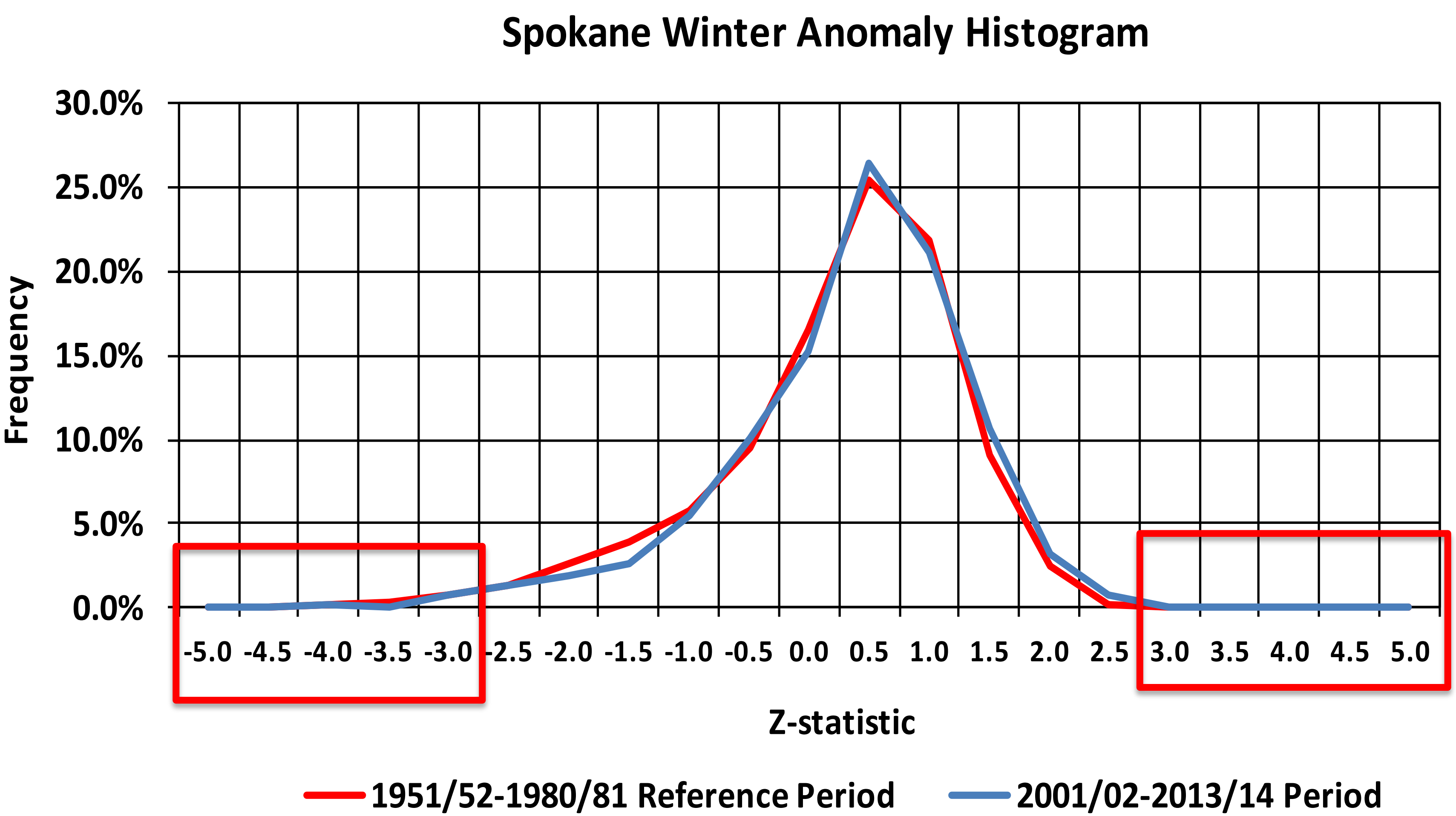
Temperature anomaly distribution: The frequency of occurrence (vertical axis) of local temperature anomalies (relative to 1951-1980 mean) in units of local standard deviation (horizontal axis). Area under each curve is unity. Image credit: NASA/GISS. See also NASA/GISS *Science Brief* , by James Hansen, Makiko Sato, Reto Ruedy (August 2012) at http://www.giss.nasa.gov/research/briefs/hansen_17/#fn1

Distribution of Summer Temperature Anomalies in the Spokane Region



Note: Due to the movement of the Spokane temperature gage to the Spokane International Airport in 1947, this anomaly analysis was restricted to the 1947-2013/14 period.

Distribution of Winter Temperature Anomalies in the Spokane Region

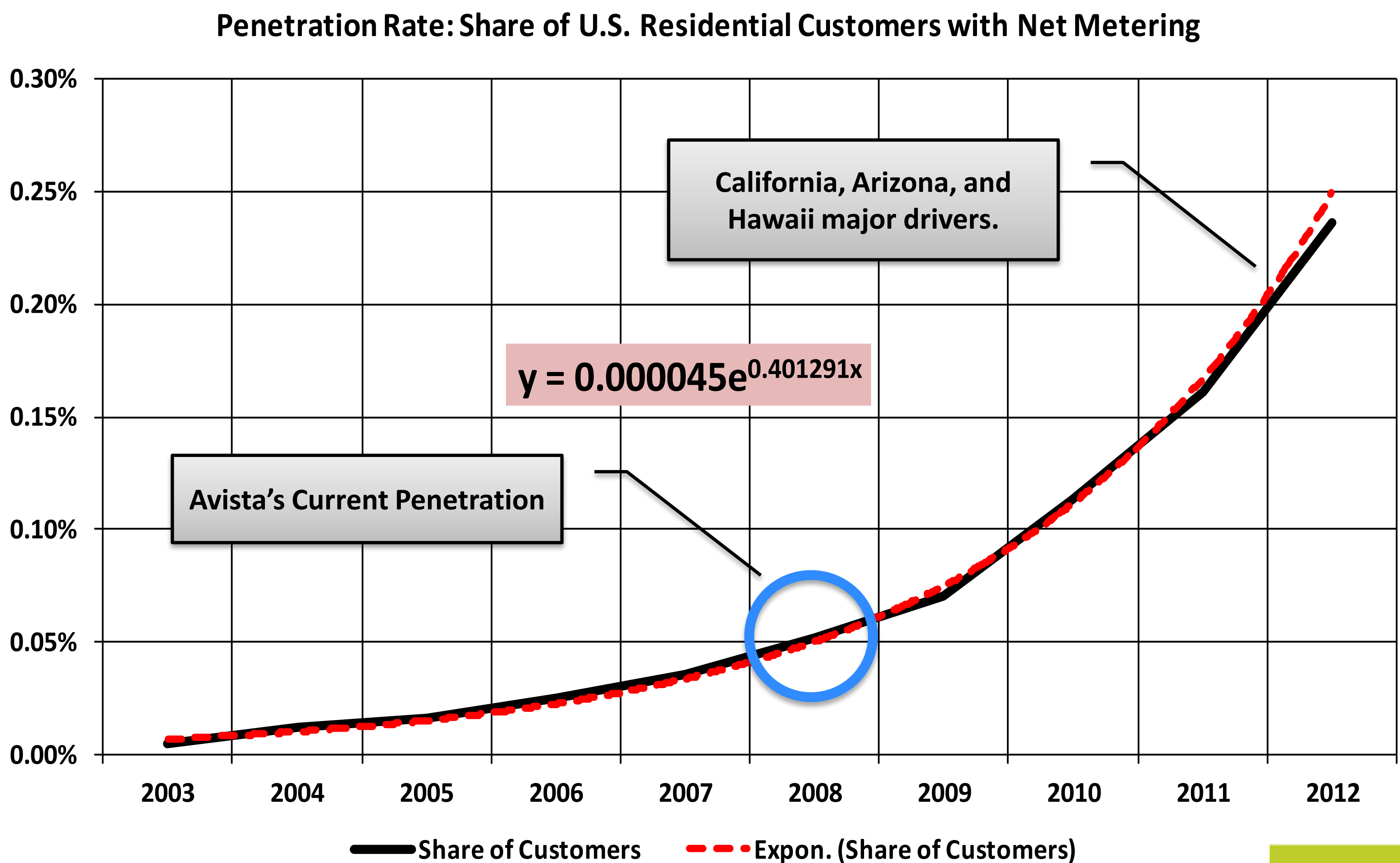


Note: Due to the movement of the Spokane temperature gage to the Spokane International Airport in 1947, this anomaly analysis was restricted to the 1947-2013/14 period.

Long-Term Load Forecast and the Time Dynamics of Residential Solar Penetration

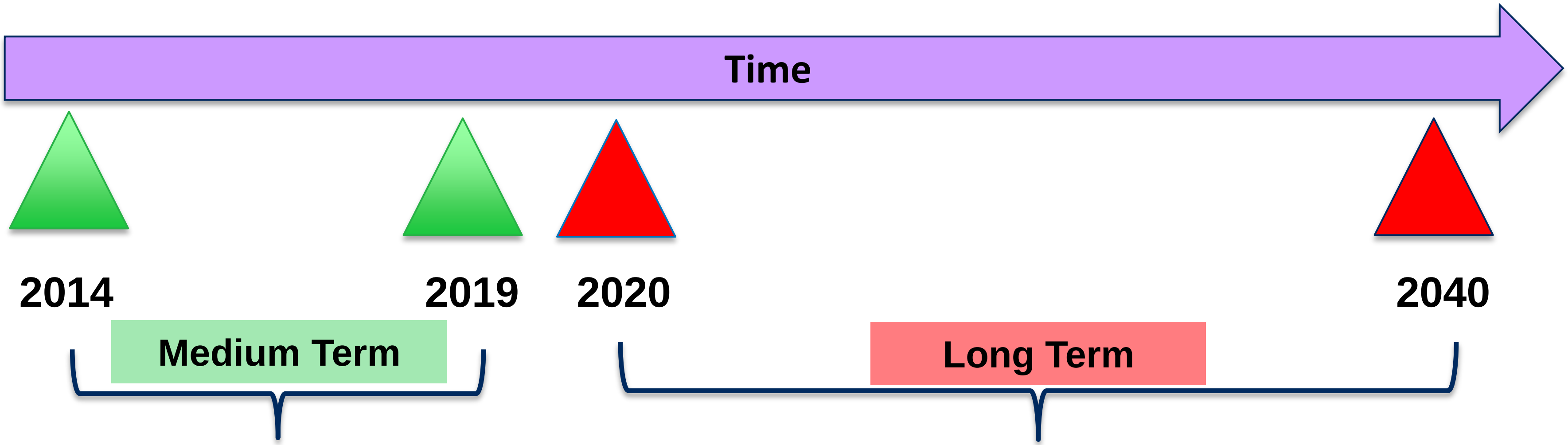
Grant D. Forsyth, Ph.D.
Chief Economist
Grant.Forsyth@avistacorp.com

U.S. Penetration Rate for Residential Net Metering



Source: EIA and author's calculations.

Basic Forecast Approach



1) Monthly econometric model by schedule for each class.
2) Customer and UPC forecasts.
3) 20-yr MA for "normal weather."
4) Economic drivers: GDP, industrial production, employment growth, population, price, household size.
5) ARIMA error correction.
6) Native load (energy) forecast derived from retail load forecast.

1) Boot strap off medium term forecast.
2) Apply long-run load growth relationships to develop simulation model for high/low scenarios.
3) Include different scenarios for renewable penetration with controls for price elasticity, average household size, and EV/PHEVs.

The Long-Term Residential Relationship, 2020-2040

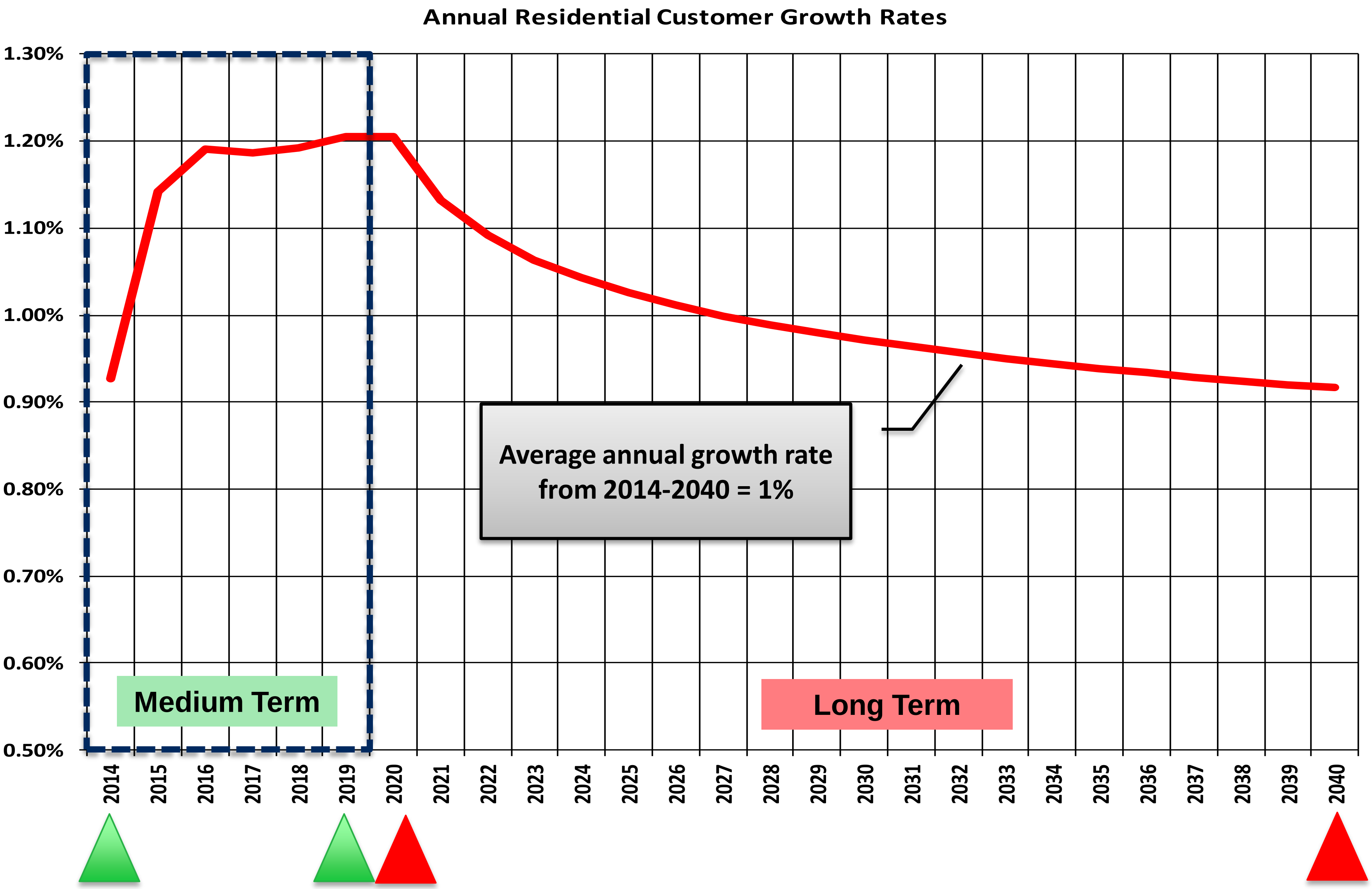
Load = Customers X Use Per Customer (UPC)

Load Growth ≈ Customer Growth + UPC Growth

Assumed to be same as population growth, commercial growth will follow residential, and no real change in industrial.

Assumed to be a function of multiple factors including renewable penetration.

The Basic Idea: Base-Line Residential Customer Growth Starting in 2020



2015 Electric IRP Appendix A

Assumptions for Residential UPC Growth

- The Time-Path of Renewable Penetration Rate (Share of Customers with PV)
- Starting PV size, generation per Customer, capacity factor, and the time-path of PV size
- Own Price Elasticity
- Average Household Size Elasticity
- Long-Run Trend for EV/PHEV adoption.

Scenario analysis assuming 1% p.a. residential customer growth and a solar capacity factor of 0.13:

- **Base-Line Scenario: Residential penetration continues to grow in a linear fashion from 0.06% to 0.30% by 2040. PV system size does not change from the current average of 3,000 watts.**

- **Low-Shock Scenario: Residential penetration at an exponential rate from 0.06% to 1% by 2025, and thereafter. PV additions grow to 6,000 watts by 2040.**

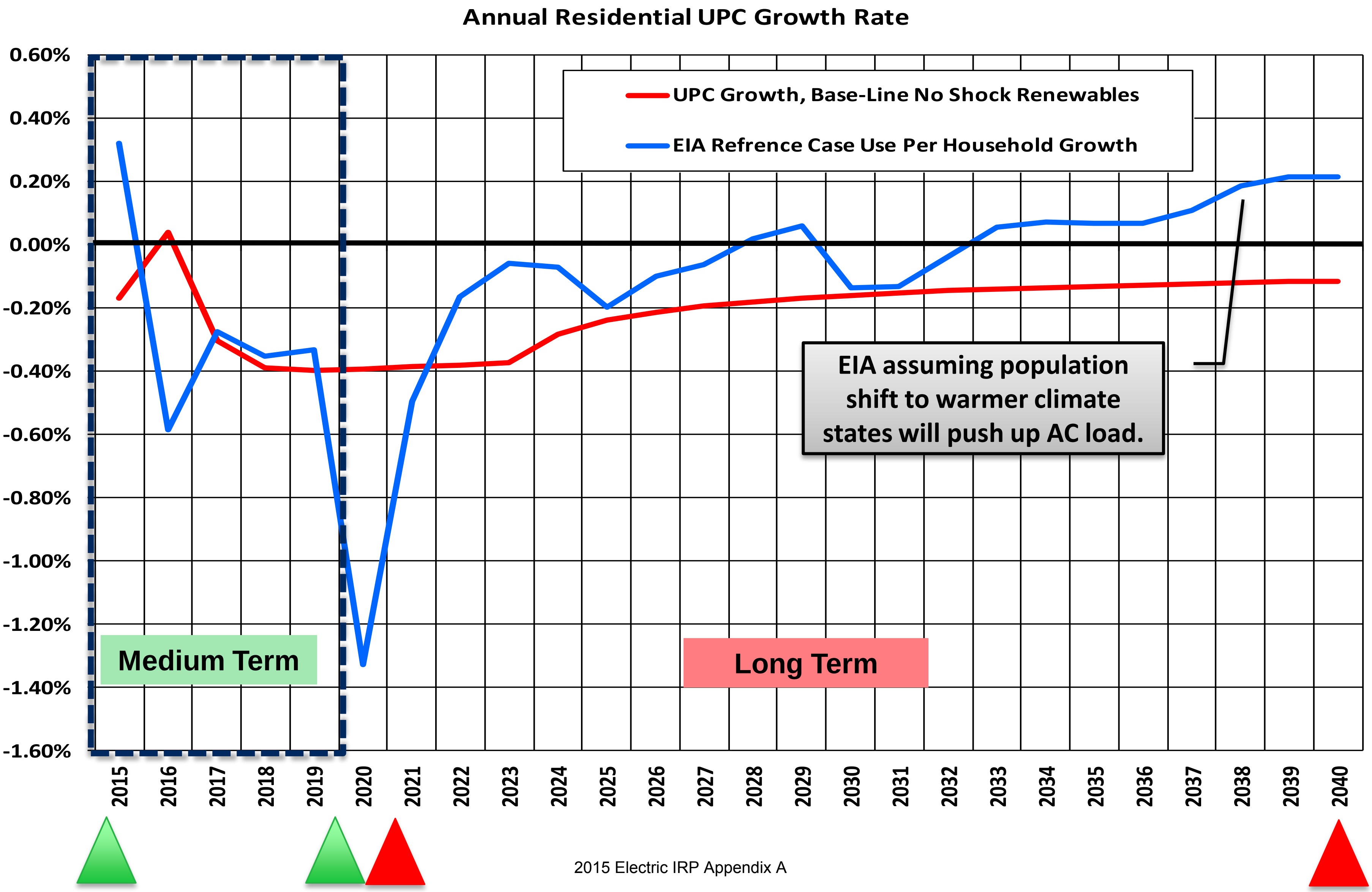
- **Medium-Shock Scenario: Residential penetration at an exponential rate from 0.06% to 5% by 2025, and thereafter. PV additions grow to 6,000 watts by 2040.**

- **High-Shock Scenario: Residential penetration at an exponential rate from 0.06% to 10% by 2025, and thereafter. PV additions grow to 6,000 watts by 2040.**

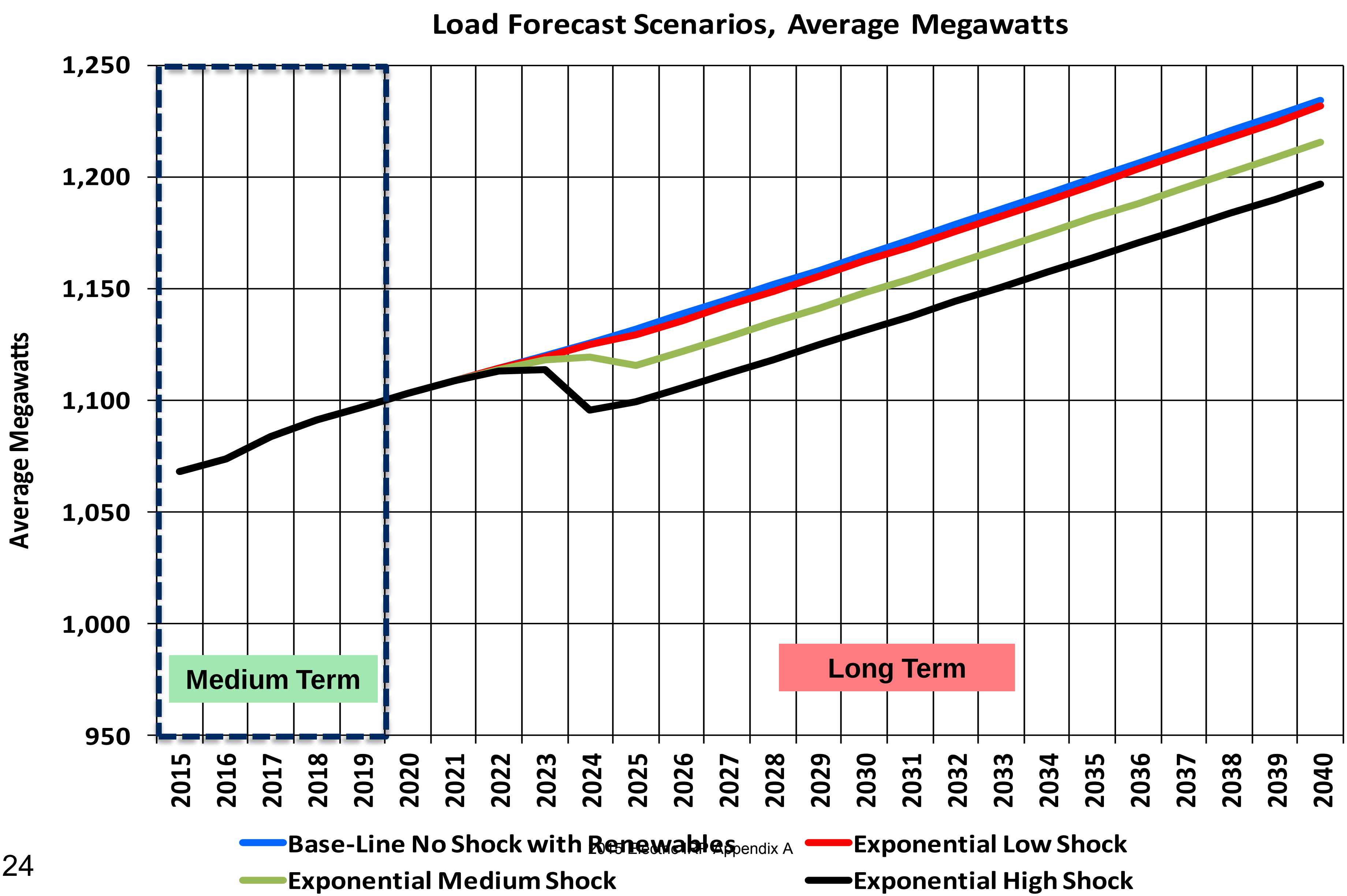
Based on historical norms, the following assumptions are also made:

1. **Residential and commercial customer growth will be the same in the long-run.**
2. **Commercial load growth and residential load growth will follow each other based on a historical spread. This assumption is a proxy for commercial price impacts and renewable penetration.**
3. **Industrial load and customer growth are low and industrial load and customer growth are not strongly correlated with residential or commercial loads.**

Base-Line Residential UPC Growth Compared with EIA's Residential Reference Case

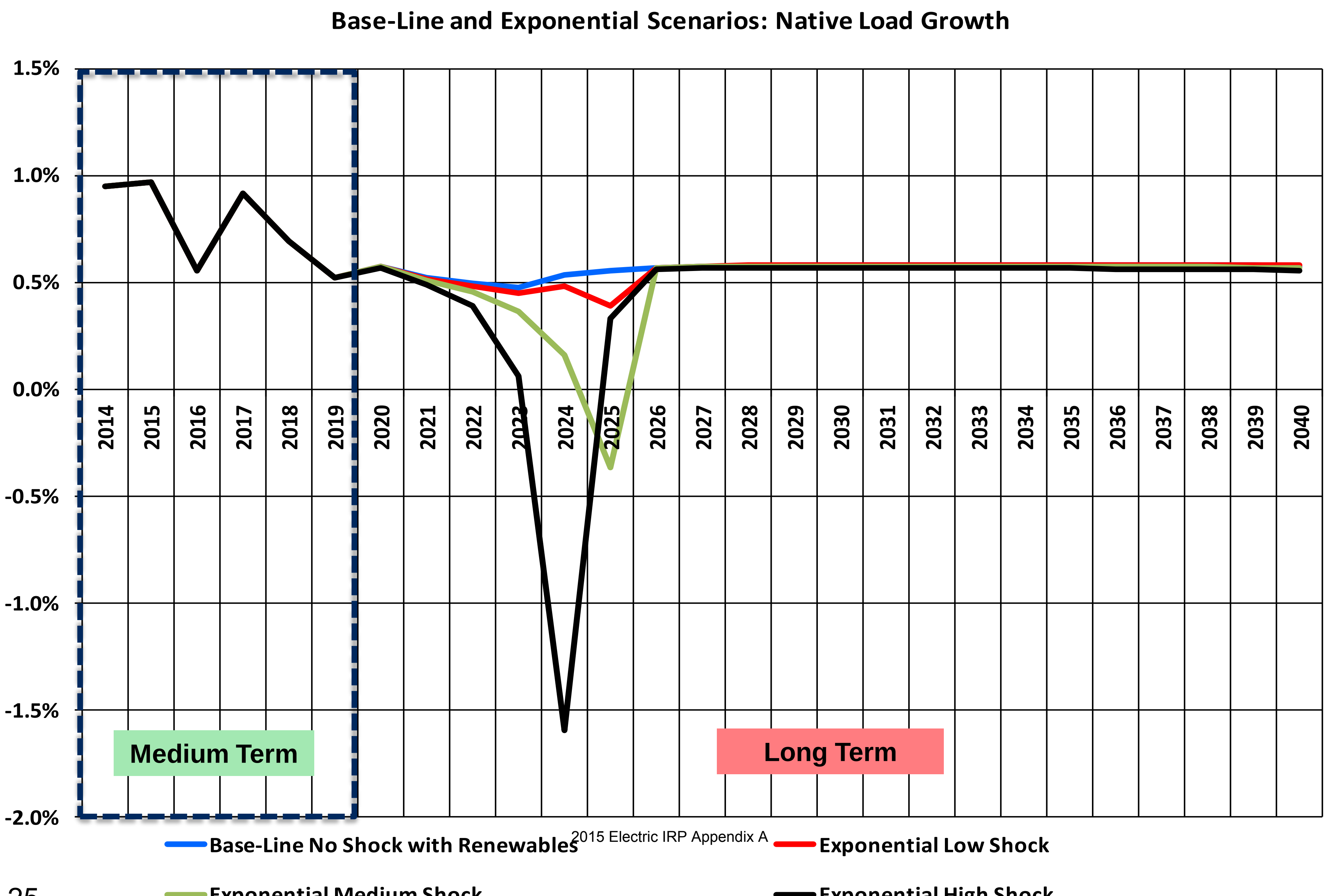


Native Load Scenarios, 2020-2040

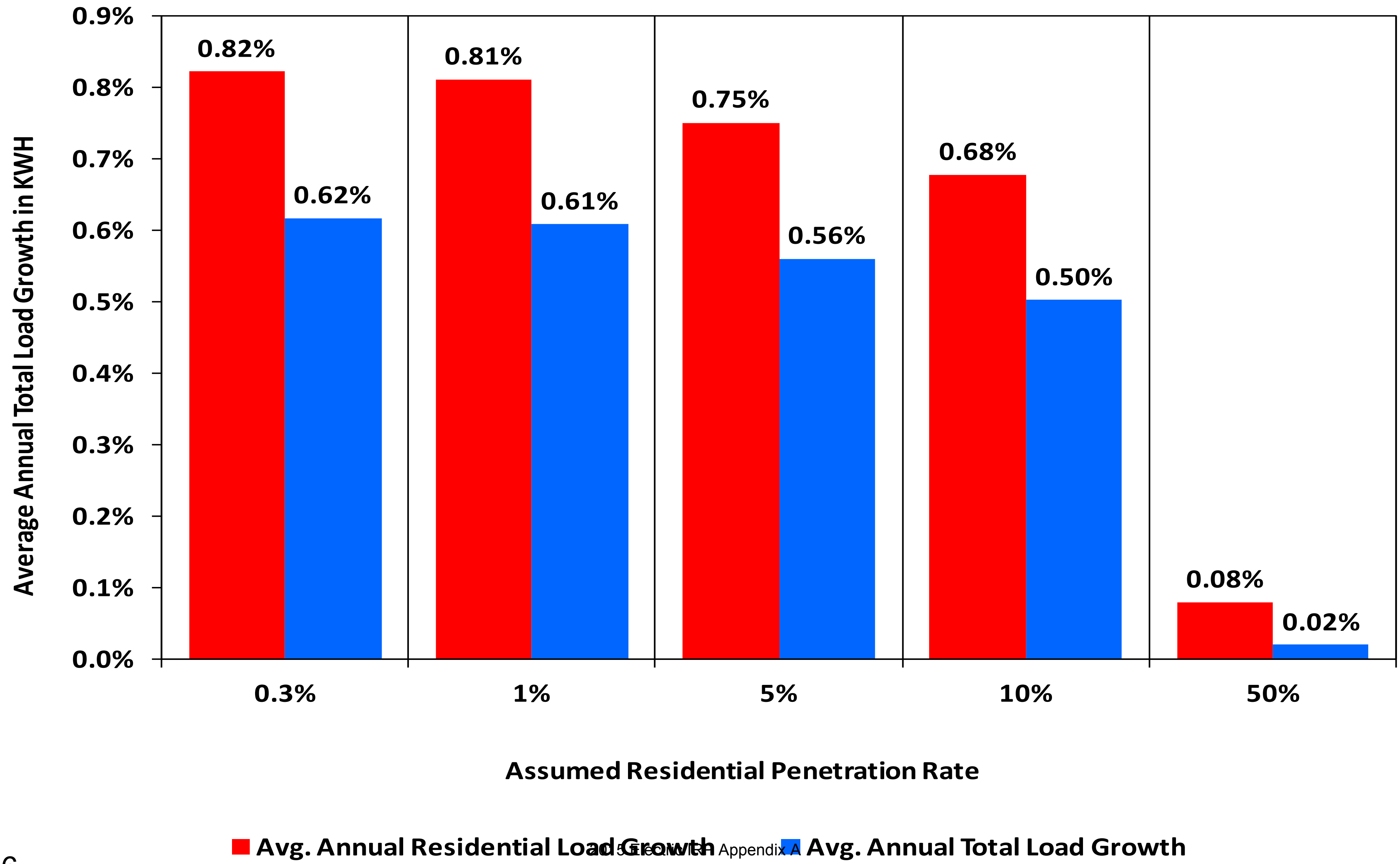


2015 Electric IRP Appendix A

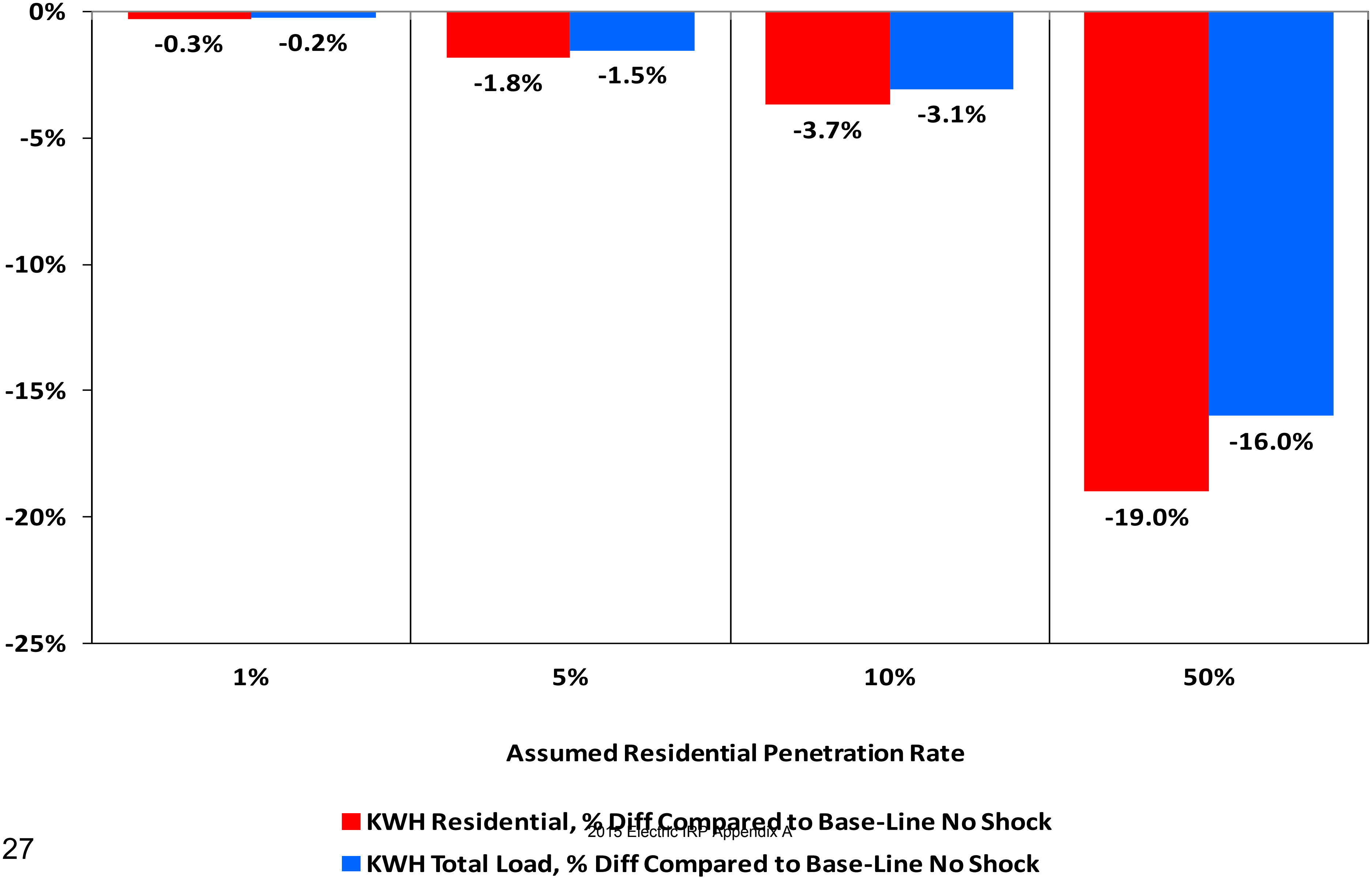
Native Load Growth Scenarios, 2020-2040



KWH Average Annual Load Growth by Scenario, 2014-2040



KWH Load Changes Compared to the Base-Line Scenario, 2020-2040



2015 Electric IRP Appendix A

Final Comment on EV/PHEV Penetration: Large Forecast Variation

Forecast Source	Forecasted Penetration Rate as Share of Vehicles by 2030-2050 Period
U.C. Berkley	65% by 2030 for EVs
EPRI	60% to 65% by 2035 for PHEVs
ORNL	40% by 2035 for PHEVs, 10% by 2050 for EVs
PNNL	30% by 2035-2045 for PHEVs
UMTRI	5% to 25% by 2040 for PHEVs
U.S. DOE	5% to 20% by 2035 for PEVs

Source: From 2013 presentation by Patrick J. Balducci, Pacific Northwest National Laboratory, at the 2013 Pacific Northwest Regional Economic Conference.

Creating Shared Value
Avista's 2014 Report on Our Operations

Casey Fielder

Second Technical Advisory Committee Meeting

September 23, 2014

Our Approach

- Engage with stakeholders throughout the company
- Cross-company Shared Value Action Team

Consumer Affairs	Generation & Production
Customer Service	Health & Safety
Electric Operations	Human Resources
Energy Solutions/DSM	Rates
Environmental	Resource Planning
Facilities	Supply Chain
Gas Operations	

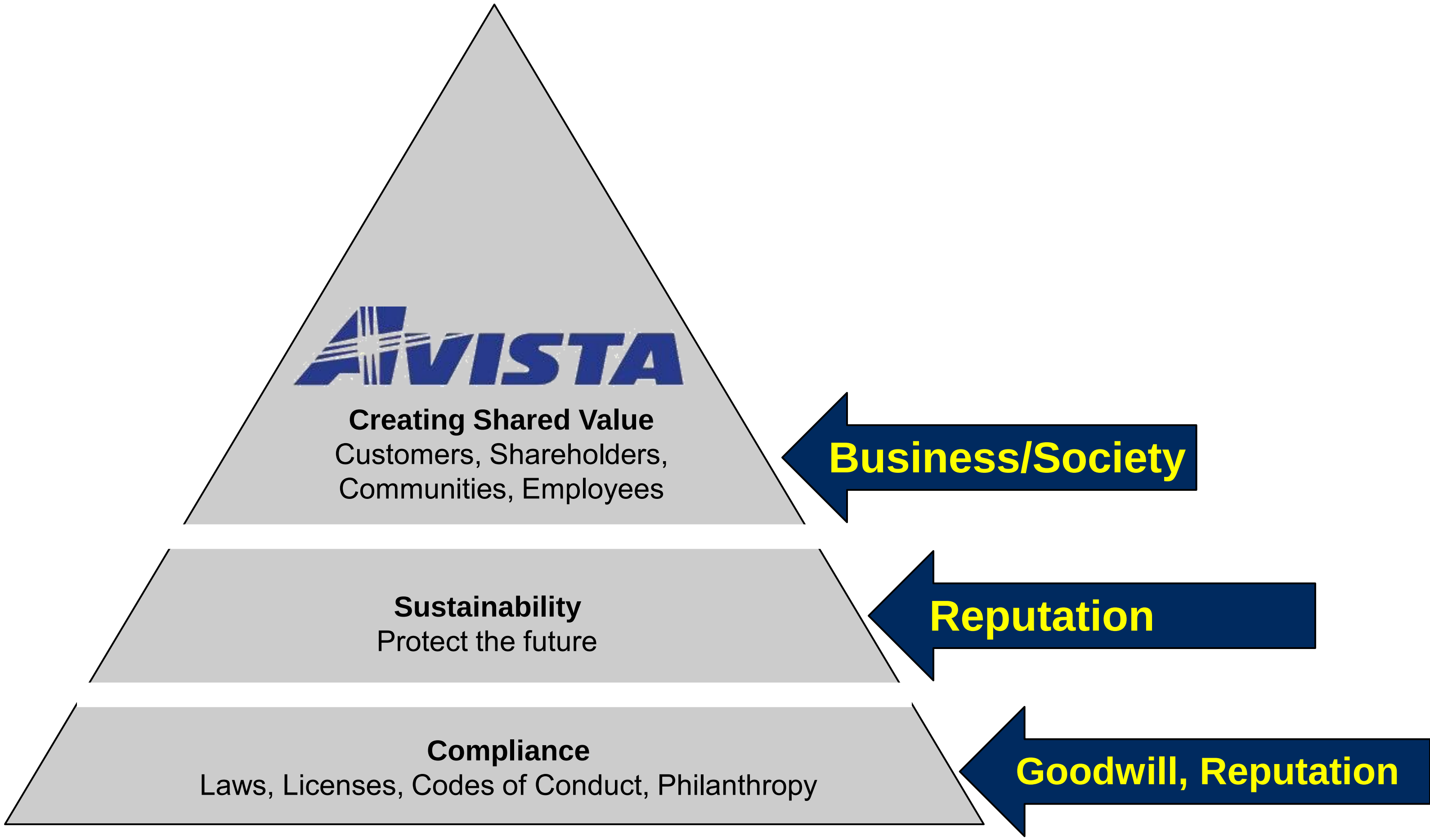
125 Years of Shared Value

Avista's Report On Our Performance 2014

Why Report?

- Tell our story
- Educate about our operations
- Communicate the information our stakeholders want to know
- Enhance transparency

The "Shared Value" Pyramid



Defining Shared Value

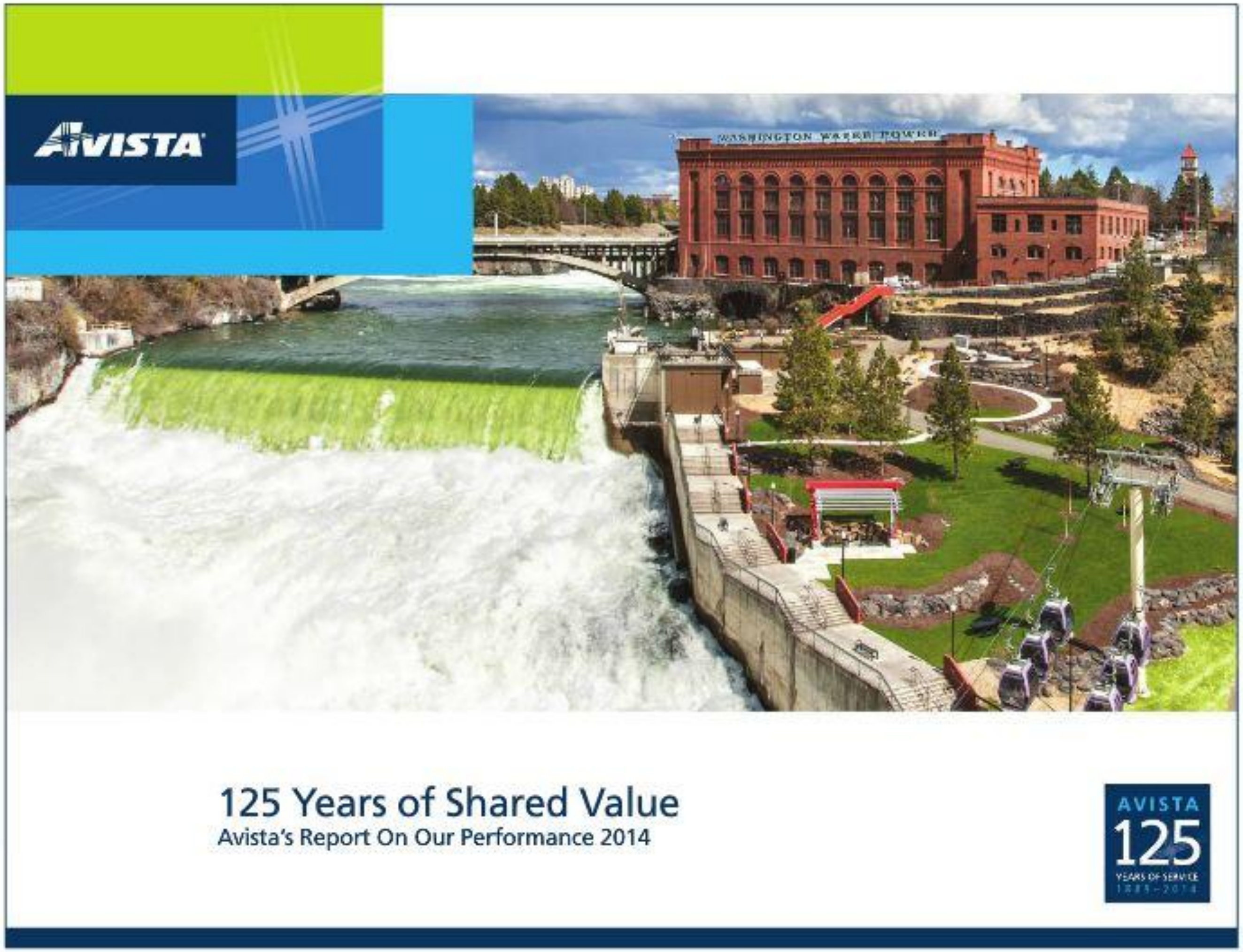
Harvard Business Review – Jan. 2011

The principle of shared value…involves creating economic value in a way that *also* creates value for society by addressing its needs and challenges. Businesses must reconnect company success with social progress. Shared value is not social responsibility, philanthropy, or even sustainability, but a new way to achieve economic success.

Shared Value – The Opportunity

A snapshot in time of what Avista does well that grows our business and at the same time provides "social" value

Highlights from 2014 Report



Highlights from 2014 Report

Shared Value In Action

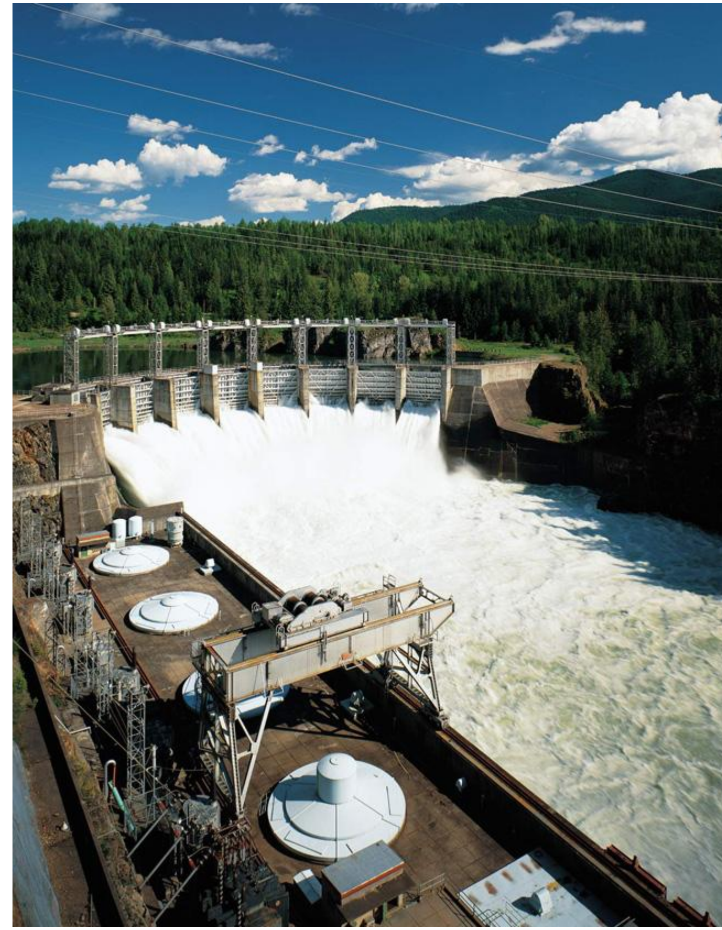
Palouse Wind Event

Highlights from 2014 Report

Shared Value In Action

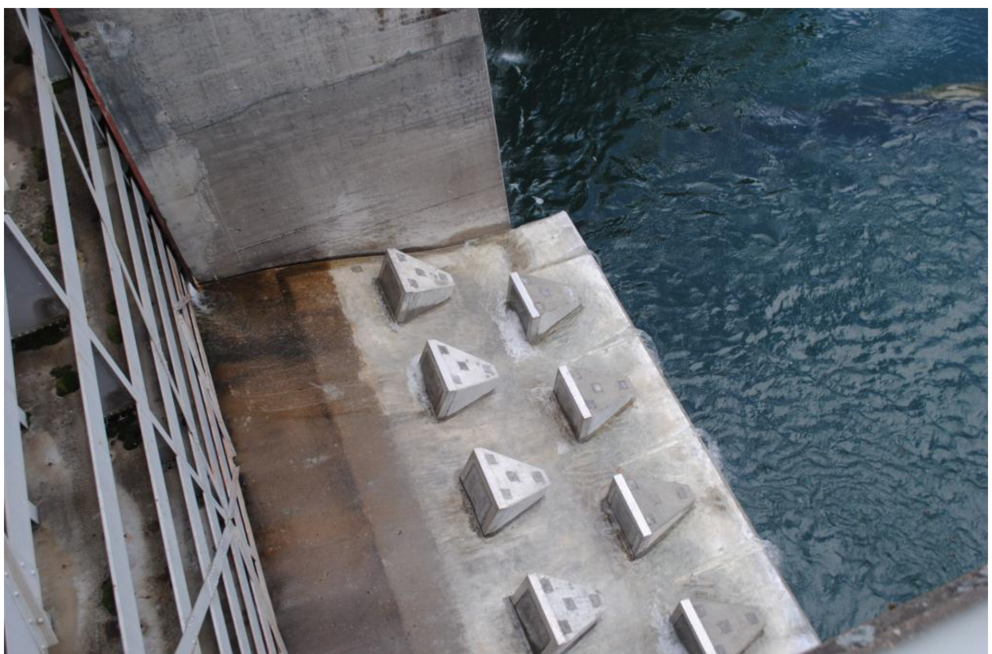
Smart Technology At Work
In Real Situation

Highlights from 2014 Report



Shared Value In Action

Cabinet Gorge Dam Reaches New Milestone In 2013 With Total Dissolved Gas Abatement Project



Highlights from 2014 Report

Shared Value In Action

Energy Resource Team Van

Materiality

CORPORATE CITIZENSHIP
Community relations, volunteerism, philanthropy, sponsorships

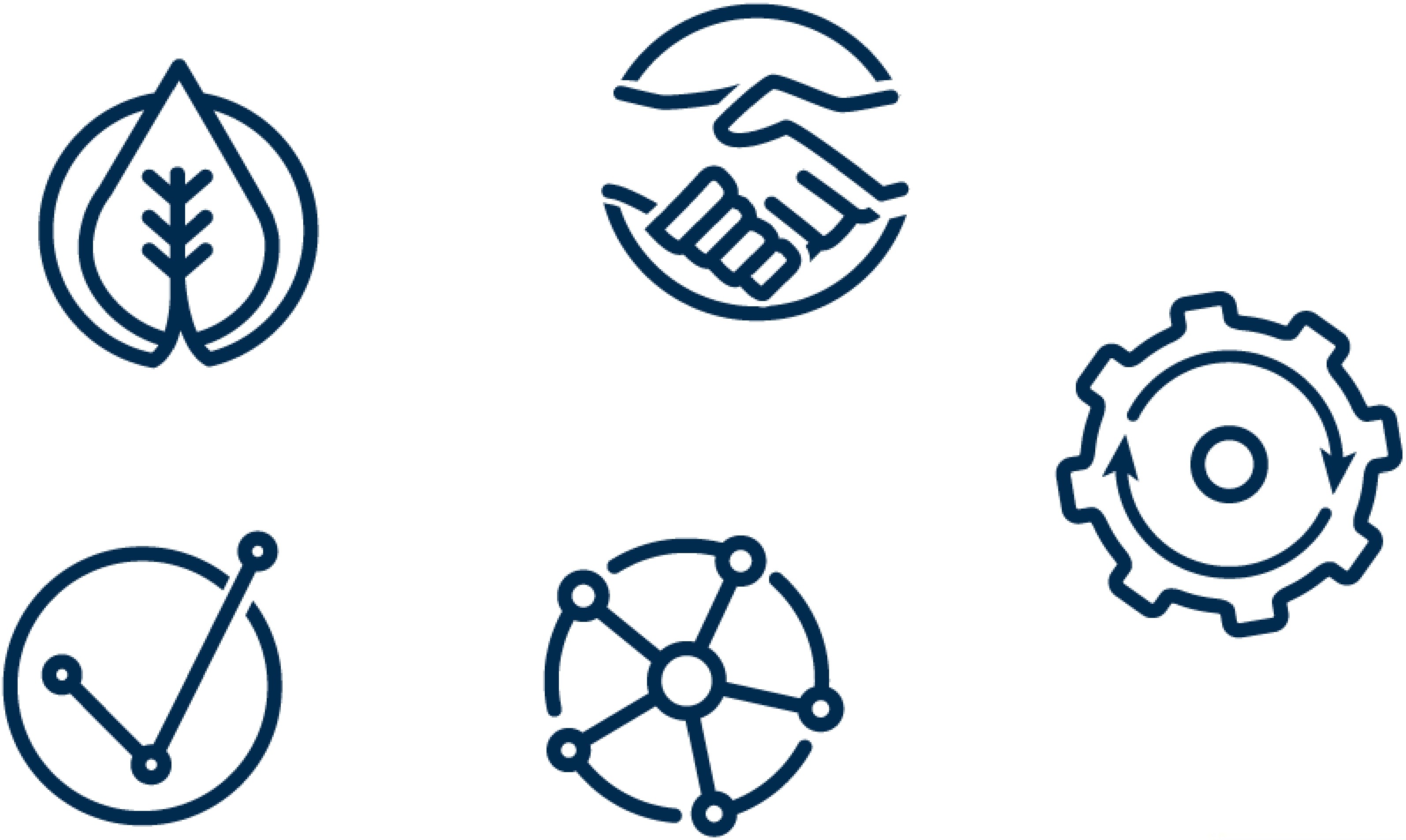
ENVIRONMENTAL PERFORMANCE
Stewardship of environmental elements impacted by operations

SYSTEM RELIABILITY
Consistency of energy delivery

CUSTOMER SATISFACTION
Company performance in ways that meet customer needs

RESOURCE PLANNING
Short and long-term outlook to meet customers' energy needs

Materiality



The Role of Our Stakeholders

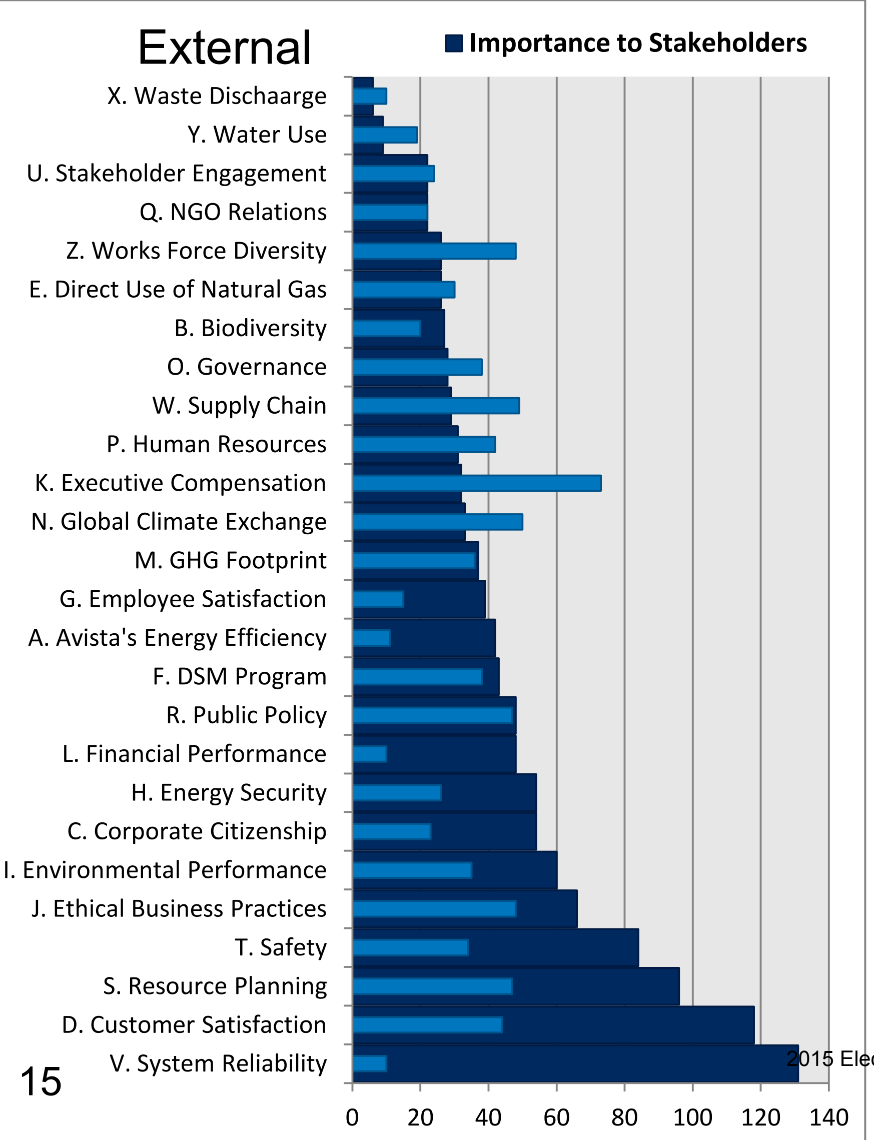
Engaging Our Stakeholders

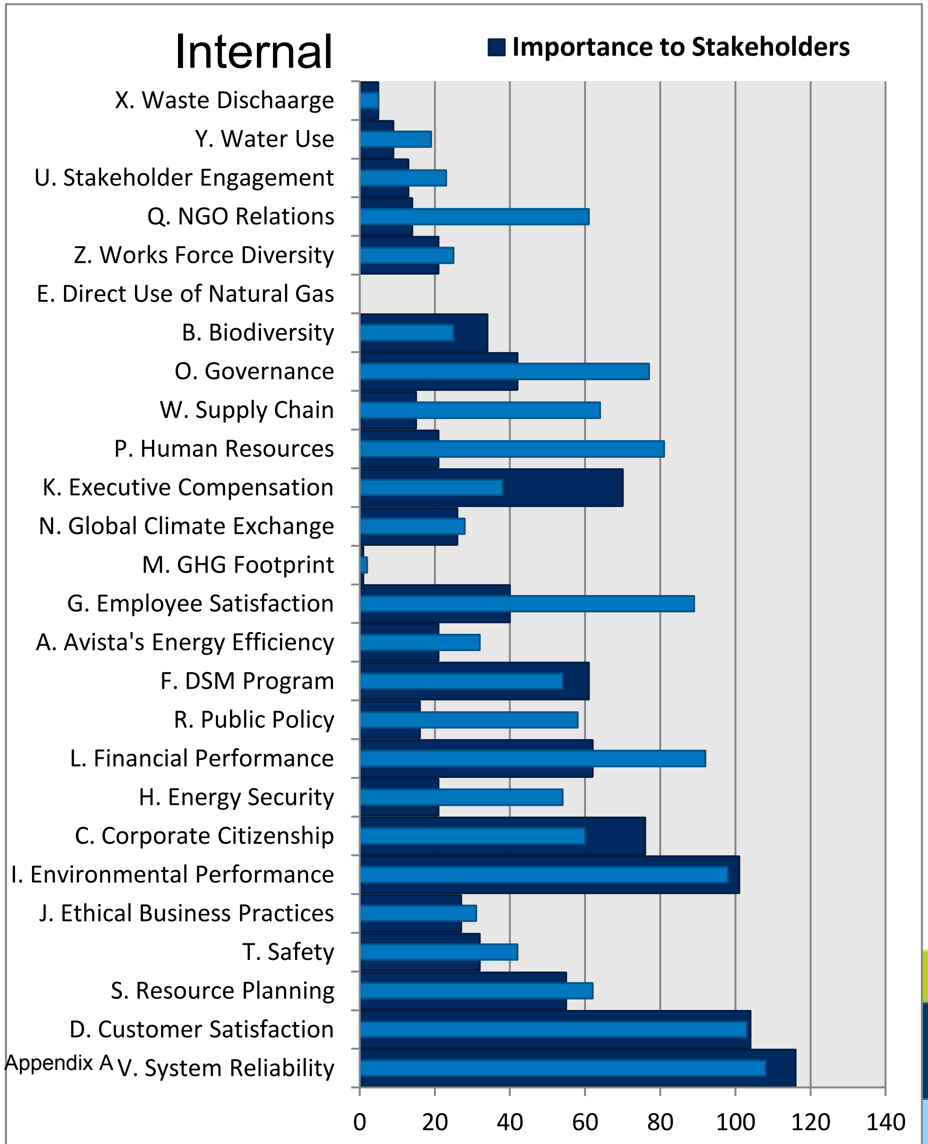
Approaches To Stakeholder Engagement

Identification Of Stakeholders

Key Topics Raised By Stakeholders

Determining Content Materiality





Materiality Exercise

Consider each of the topics on the list for:

-- The importance you think each has for the stakeholders of Avista
-- The relevance or impact each could have for Avista

Plot the letter of each topic on the grid depending on the intersection of the values of importance to stakeholders and relevance for Avista

125 Years of Shared Value Available at avistautilities.com

Feedback: SharedValue@avistacorp.com

Generation Options

Thomas Dempsey, P.E. and James Gall
Second Technical Advisory Committee Meeting
September 23, 2014

Natural Gas Generation Options

- Existing site vs. new site (“Brownfield” vs. “Greenfield”)
- Simple cycle combustion turbines (peaking)
- Simple cycle piston engines (peaking/hybrid, operation/load following)
- Combined cycle (base load/load following)
- Simple cycle combustion turbine with subsequent conversion to combined cycle

Natural Gas Generation Options Considerations

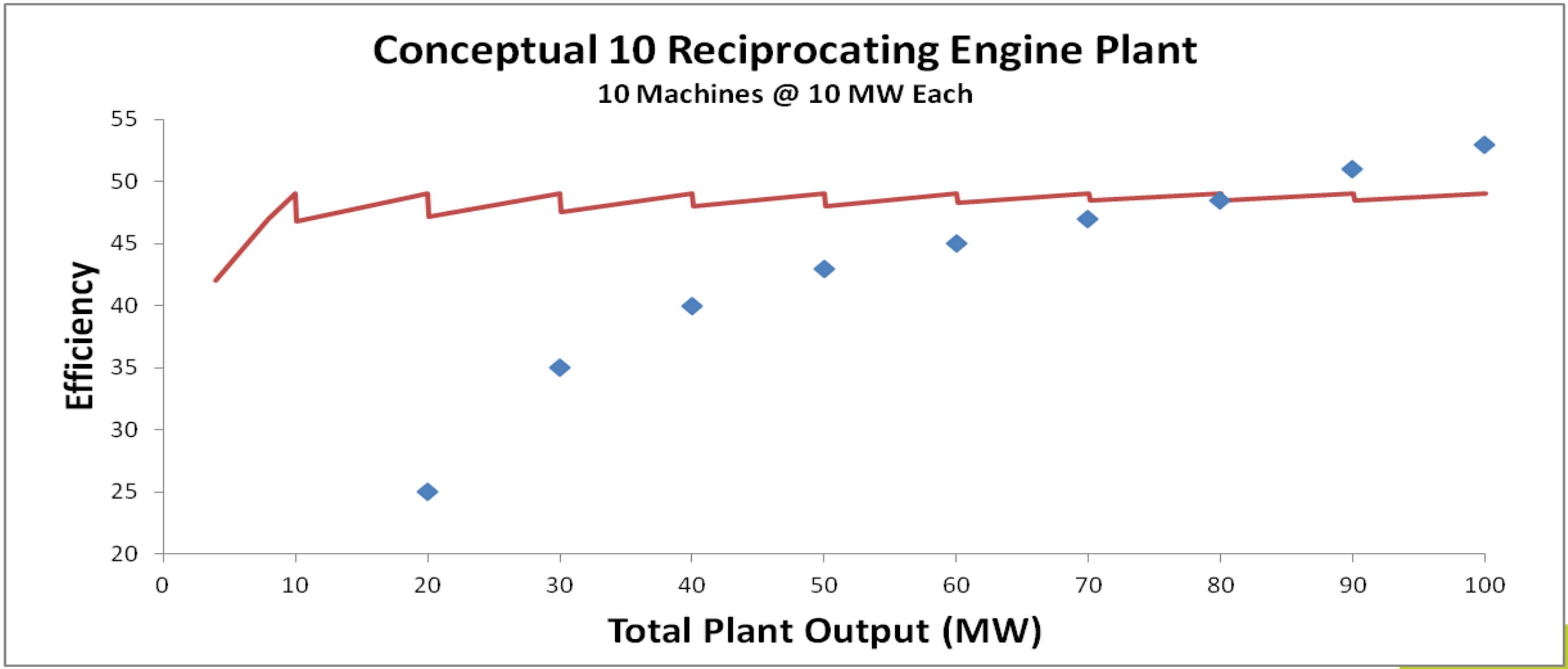
- Efficiency
  - Fuel efficiency
  - Responsible use of resources
  - Environmental impacts
- Flexibility- meets operational requirements
  - Start time
  - Part load efficiency
  - Ability to, and speed of, cycling
- Costs
  - Upfront installation
  - Fuel
  - Ongoing operations & maintenance

Efficiency

- Greater efficiency means lower fuel costs
- Greater efficiency means lower emissions
  - NOx, $SO_{2,}$ VOC's, CO, CO_2
- Efficiency is very important for options expected to have many run hours, but less important for options selected for peaking service or reserves
- Other considerations, such as water or other consumable use is also considered

Flexibility

- A flexible plant is quick to start, quick to full load, can withstand large frequent load swings (i.e., backing up variable resources), has low emissions across its operational range, and can be operated with minimal staff.



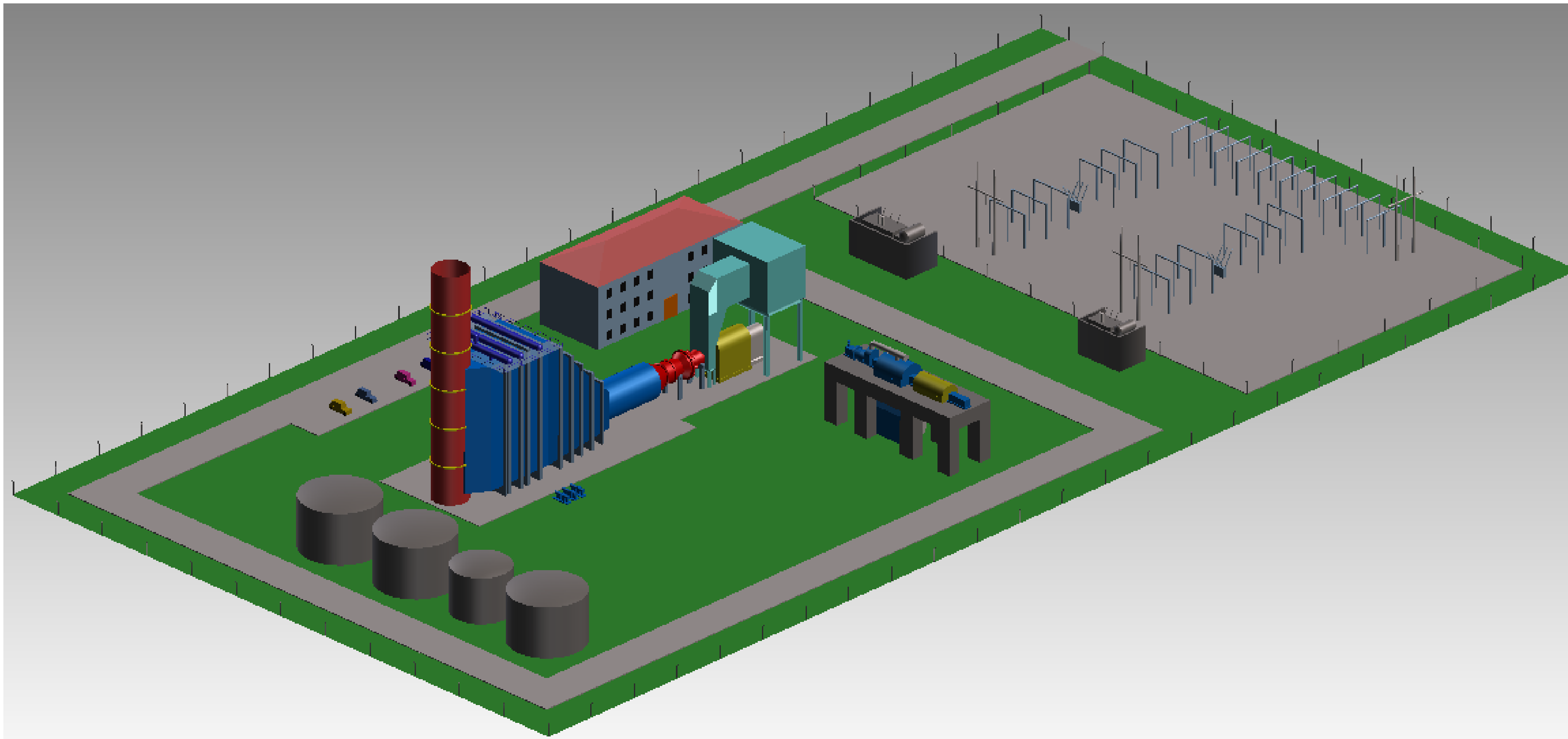
Costs

- Avista has access to an extensive turbine database including machine price data that allows us to choose more effective cost options.
- Initial capital cost
  - Brownfield vs. Greenfield
  - Economies of scale
- Ongoing operations & maintenance costs
- Fuel costs

Thermoflow

- Sophisticated program allowing Avista to create preliminary plant designs
- Allows for detailed initial cost estimates
- Initial plant layouts
- Site specific performance modeling
- Plant Engineering And Cost Estimation (PEACE)

Thermoflow PEACE Output



Thermoflow PEACE Output

Project Cost Summary	Reference Cost	Estimated Cost	
Power Plant:			
I Specialized Equipment	122,940,000	130,316,000	USD
II Other Equipment	10,993,000	11,652,000	USD
III Civil	19,827,000	25,879,000	USD
IV Mechanical	20,516,000	28,135,000	USD
V Electrical Assembly & Wiring	5,711,000	7,946,000	USD
VI Buildings & Structures	11,842,000	15,631,000	USD
VII Engineering & Plant Startup	15,063,000	15,104,000	USD
Gasification Plant	NA	NA	
Desalination Plant	NA	NA	
CO2 Capture Plant	NA	NA	
Subtotal - Contractor's Internal Cost	206,891,000	234,664,000	USD
VIII Contractor's Soft & Miscellaneous Costs	43,676,000	53,971,000	USD
Contractor's Price	250,567,000	288,635,000	USD
IX Owner's Soft & Miscellaneous Costs	10,109,000	11,522,000	USD
Total - Owner's Cost (1 USD per US Dollar)	260,676,000	300,157,000	USD
Nameplate Net Plant Output	343	343	MW
Price per kW - Contractor's	730.2	841.1	USD per kW
Cost per kW - Owner's	759.7	874.7	USD per kW
* Cost estimates as of April 2014.			

Available Gas Turbine Upgrades For Avista Plants

- Supplemental Compression- enhances capability of simple cycle 7EA machines at the Rathdrum CT
- Inlet Evaporation System- increases summer capability
- High efficiency turbine blades
- Water injected NOx control to allow for firing temperature increase

Kettle Falls Efficiency Improvements

- Fuel stabilization- fuel drying or conditioning to keep the boiler operating at a continuously efficient point
- Turbine and generator efficiency improvements to achieve greater output using the same amount of fuel

Hydro Upgrades

- Same assumptions and options as 2013 IRP, adjusted for cost inflation
- Post Falls- A detailed study is being performed to study long-term options for the 104 year old project- results will not be available for this IRP cycle

Project	MW	Capacity Factor	Winter Peak Credit	Summer Peak Credit	Capital Cost (Mil $)	$/MWh-Levelized
Long Lake 2nd Powerhouse	68	34%	100%	100%	$140	$108
Monroe Street/Upper Falls 2nd Powerhouse	80	34%	31%	0%	$152	$93
Cabinet Gorge 2nd Powerhouse*	110	17%	0%	0%	$231	$197

* Project is limited to water rights

DRAFT

Natural Gas Turbine Resource Options

Resource Option	Technology	Plant Size (MW) (59F)	Capital Cost Excludes AFUDC (2014$/kW)	Fixed O&M (2014$/kW/Yr)	Variable Costs (2014$/MWh)	Net HHV Heat Rate(s) (Btu/kWh)
Advanced Large Frame CT	Frame SC	203	608	2	3.50	9,931
Modern Large Frame CT	Frame SC	171	636	2	2.50	10,007
Modern Large Frame CT with HRSG Option	Frame SC	170	710	3	2.50	10,009
Advanced Small Frame CT	Frame SC	96	814	3	2.50	11,265
Frame/Aero Hybrid CT	Advanced Aero SC	101	965	3	3.00	8,916
Large Reciprocating Engine Facility	NG Recip	184	1,048	7	3.00	8,427
Small Reciprocating Engine Facility (Option 1)	NG Recip	110	1,072	8	3.00	8,427
Small Reciprocating Engine Facility (Option 2)	NG Recip	93	1,075	8	3.00	7,700
Modern Small Frame CT	Frame SC	45	1,206	4	2.50	10,252
Aero CT option 1	2 on 1 SS	45	1,221	6	2.50	10,392
Aero CT option 2	Aero SS	42	1,255	6	2.50	9,359
1 on 1 Advanced CCCT option 1	1 on 1 CC	341	1,045	18	3.75	6,631
1 on 1 Advanced CCCT option 2	1 on 1 CC	343	1,045	18	3.75	6,895
1 on 1 Advanced CCCT option 3	1 on 1 CC	294	1,091	19	3.50	6,790
1 on 1 modern CCCT option 3	1 on 1 CC	286	1,099	15	3.00	6,720
3 x 2 small CCCT	3 on 2 CC	225	1,601	27	3.50	6,980
2 x 1 small CCCT	2 on 1 CC	150	1,645	34	3.50	6,968
Add HRSG to Large Frame CT	1 on 1 CC	286	635	20	3.50	6,720

Levelized costs for Natural Gas-Fired Resources

- In past IRP's, Avista communicated levelized costs for all resources.
- Levelized costs work well for energy only resources, but do not communicate the cost of capacity
- Rather than showing levelized costs for capacity resources, the following slide shows capacity cost vs. energy costs for capacity resources
- Least cost resources represent the right mix of cost between low cost capacity and energy

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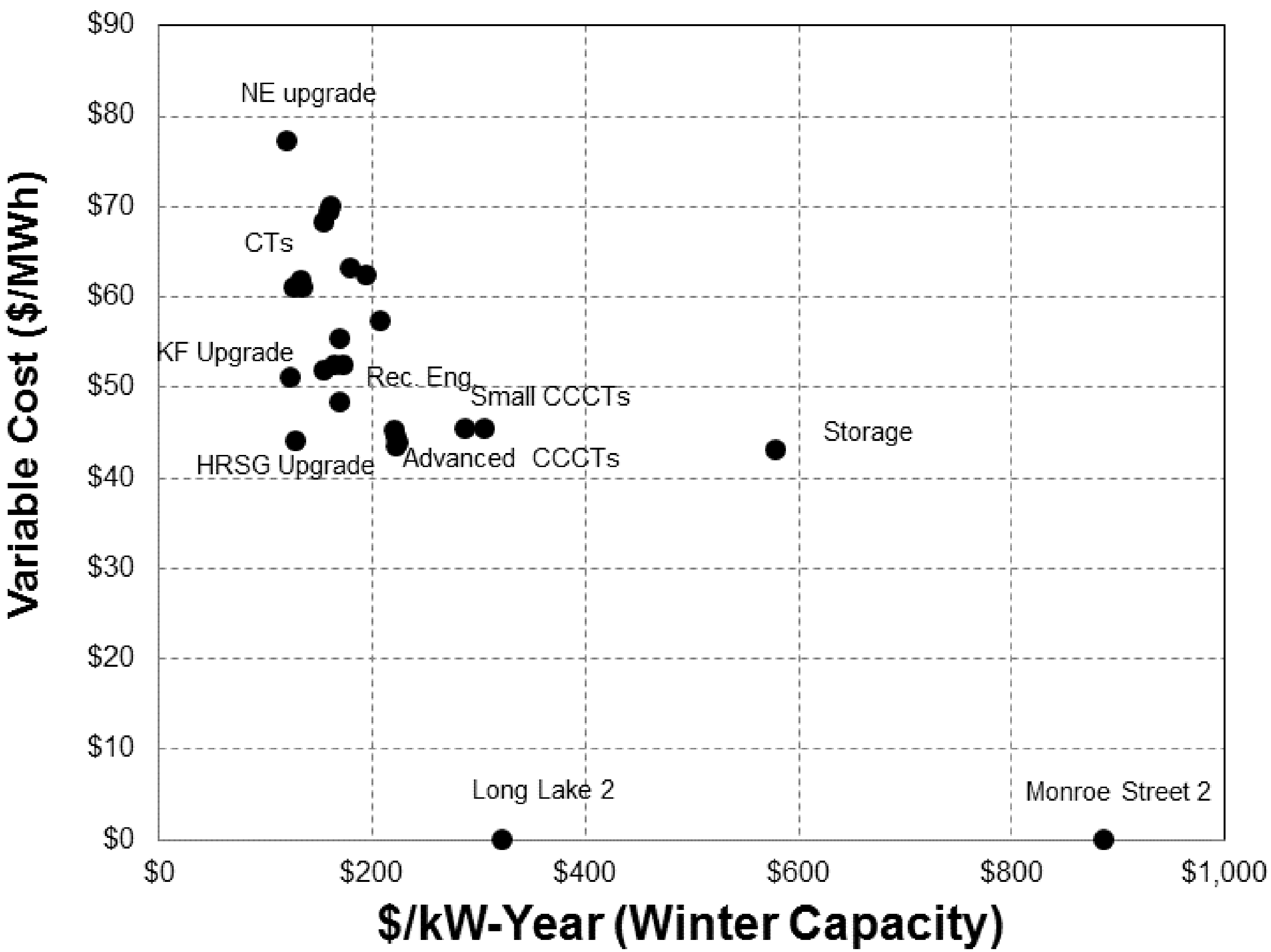
Fixed vs. Variable Costs



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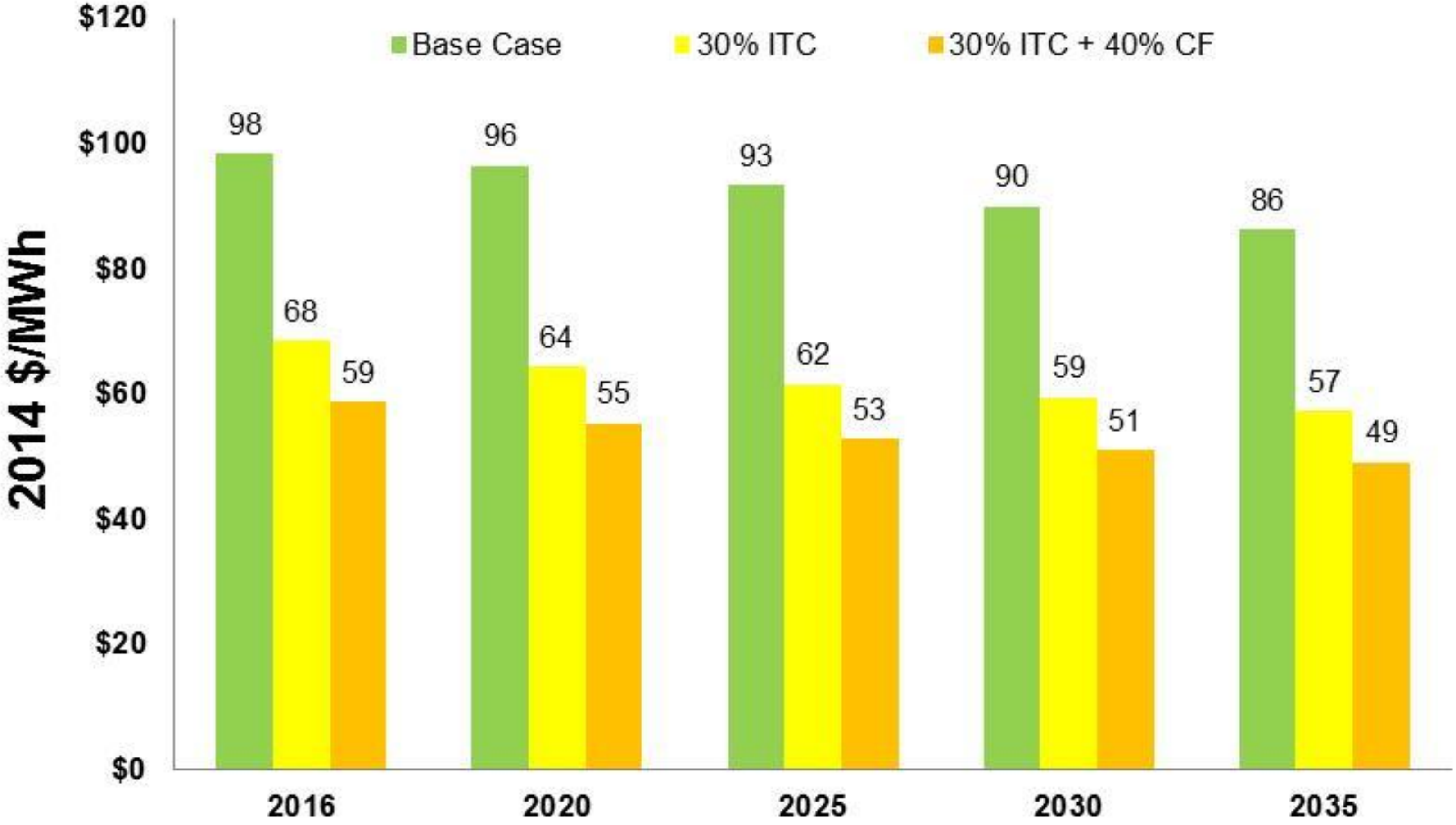
Renewables & Storage

Resource	MW	Capacity Factor	Winter Peak Credit	Summer Peak Credit	Capital Cost * (2014$/kW)	$2015/MWh-Levelized
Wind On-System	99	35%	0%	0%	$2,050	$102
Solar Photovoltaic Fixed Array	5.0	14%	0%	60%	$2,100	$197
Solar Photovoltaic Fixed Array	25.0	14%	0%	60%	$2,000	$180
Solar Photovoltaic with Single Axis Tracking	25.0	18%	0%	70%	$2,500	$185
Battery Storage	25.0	N/A	100%	100%	$4,000	N/A

** Capital Costs excludes AFUDC*

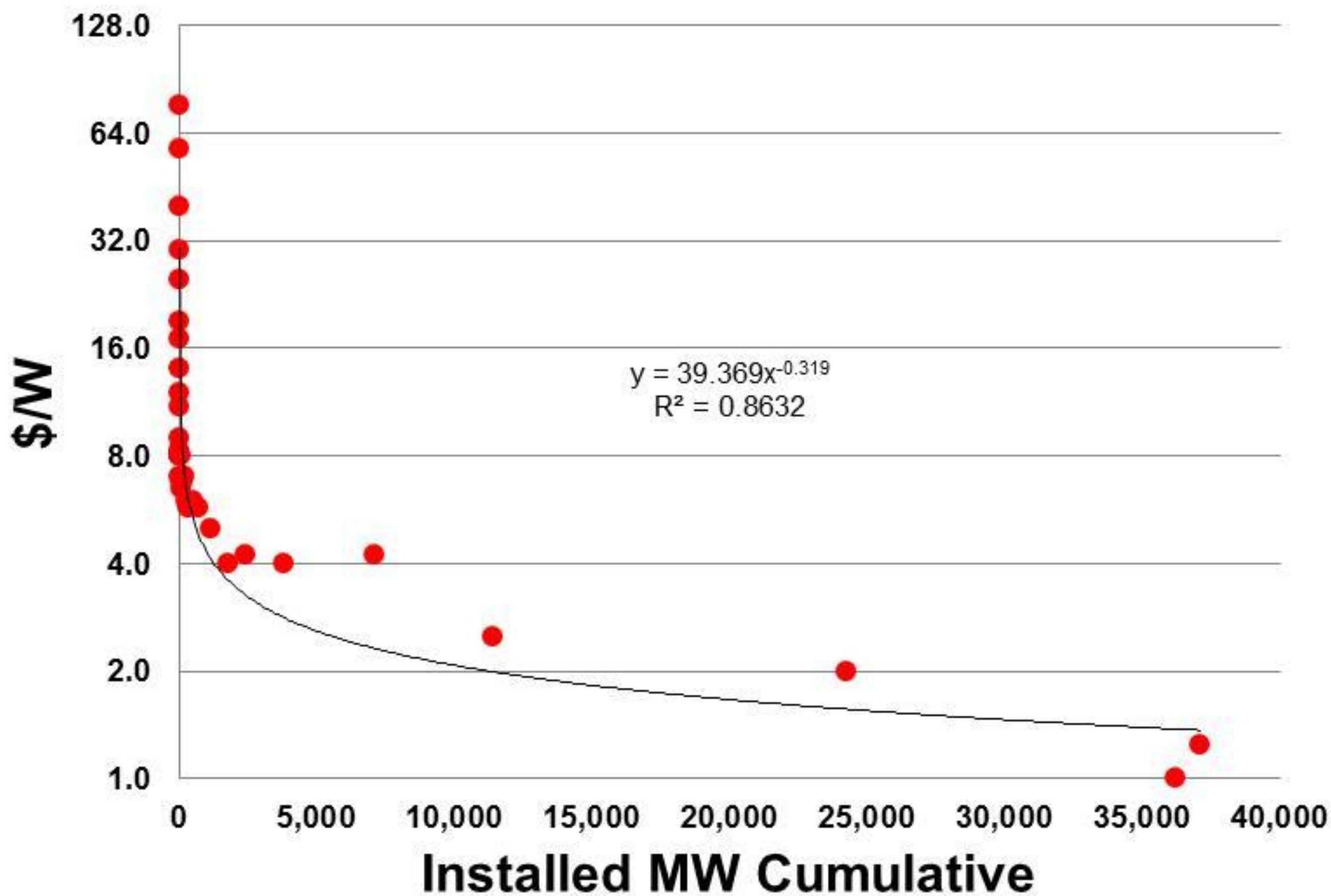
Wind Levelized Costs Forecast



Assumptions:
1) Cost shown are 2014 dollars levelized for first 20 years of asset life
2) ITC benefit taken up front, rather than utility amortization method

Solar Experience Curve (Past)

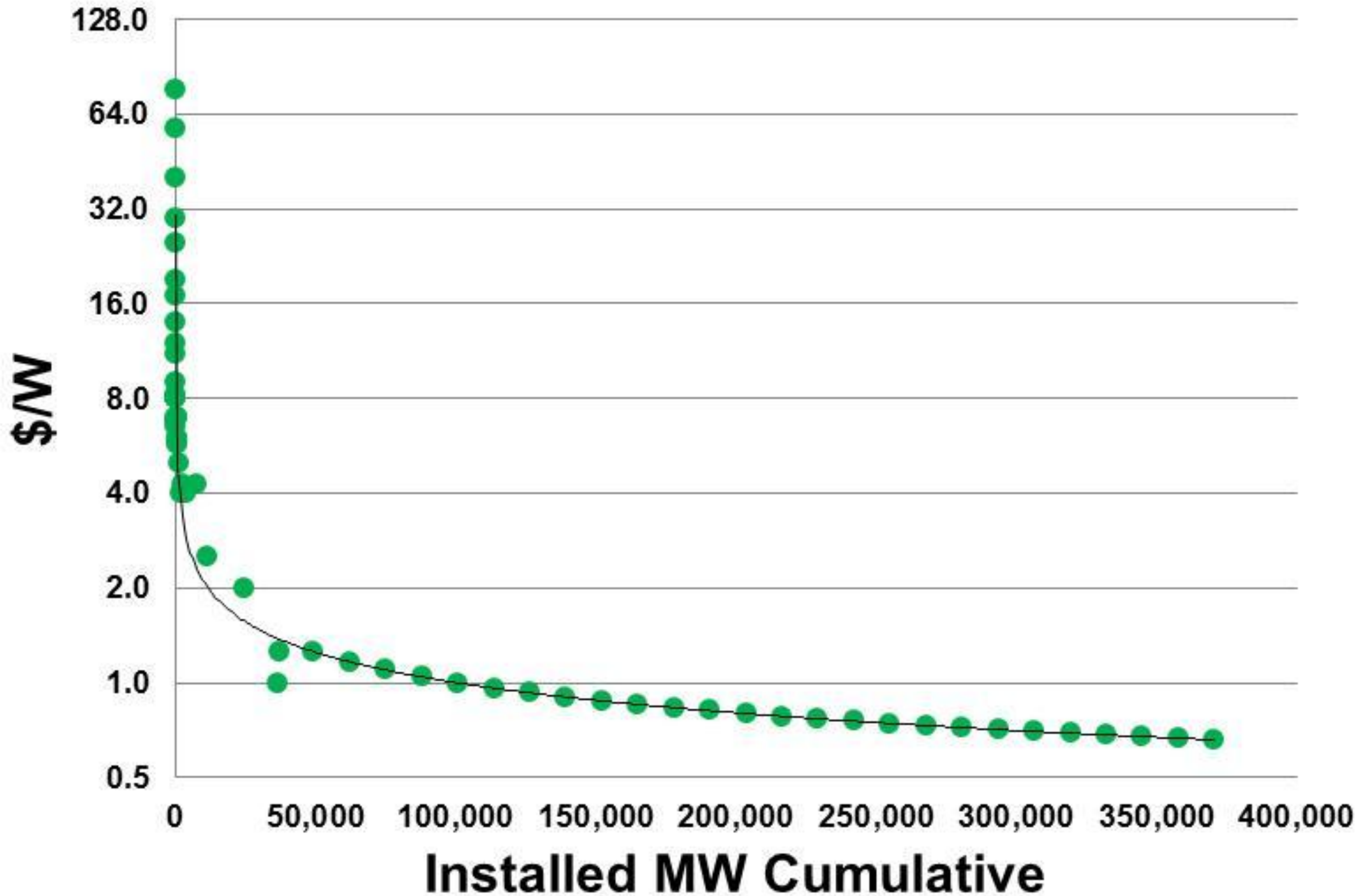
As production increase, costs fall



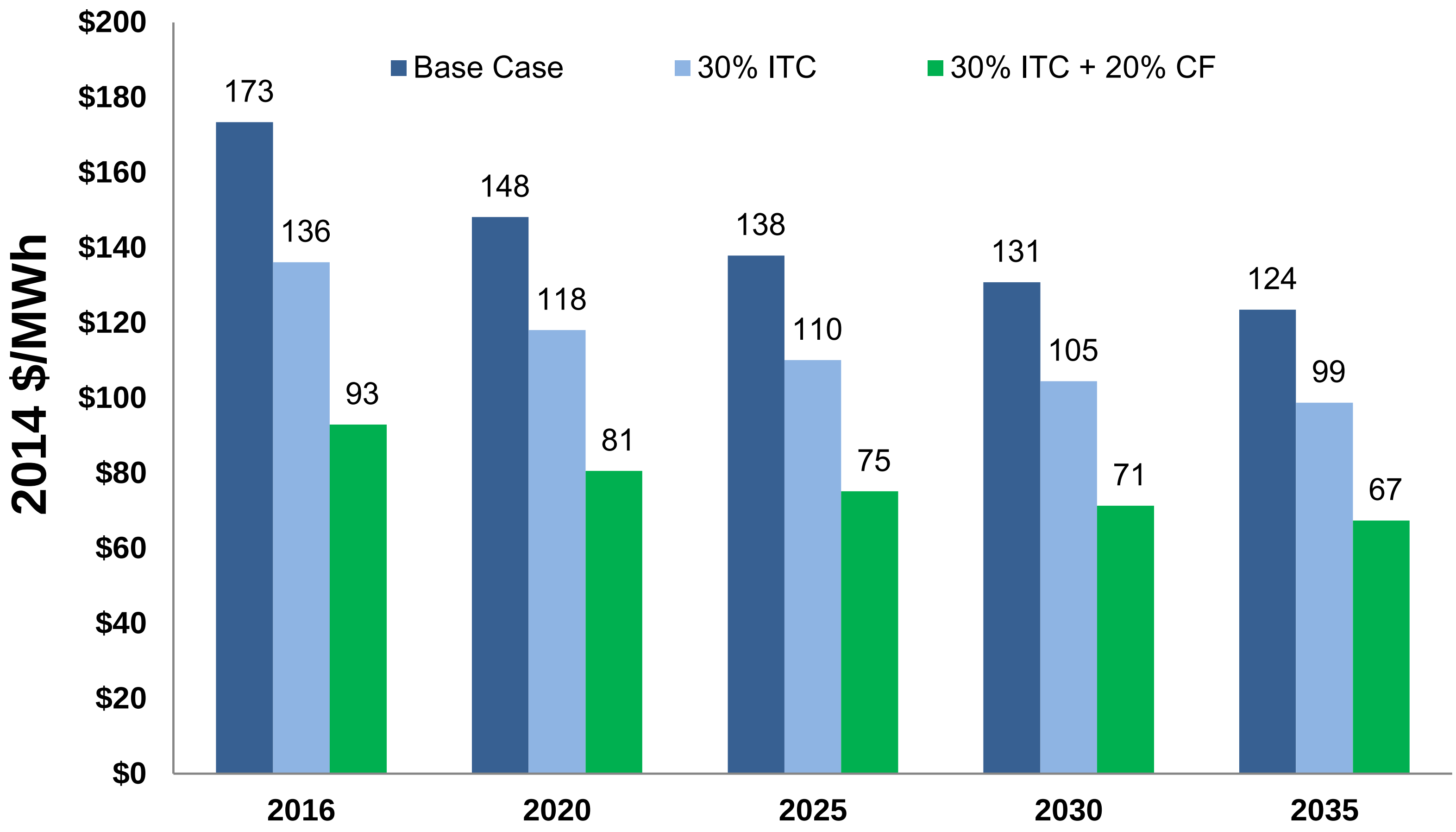
World Solar Photovoltaic Production,1975-2012
Data from Earth Policy Institute and Bloomberg

Solar Experience Curve (Future)

How could costs change with 10 times the cumulative installation



Solar Levelized Costs Forecast

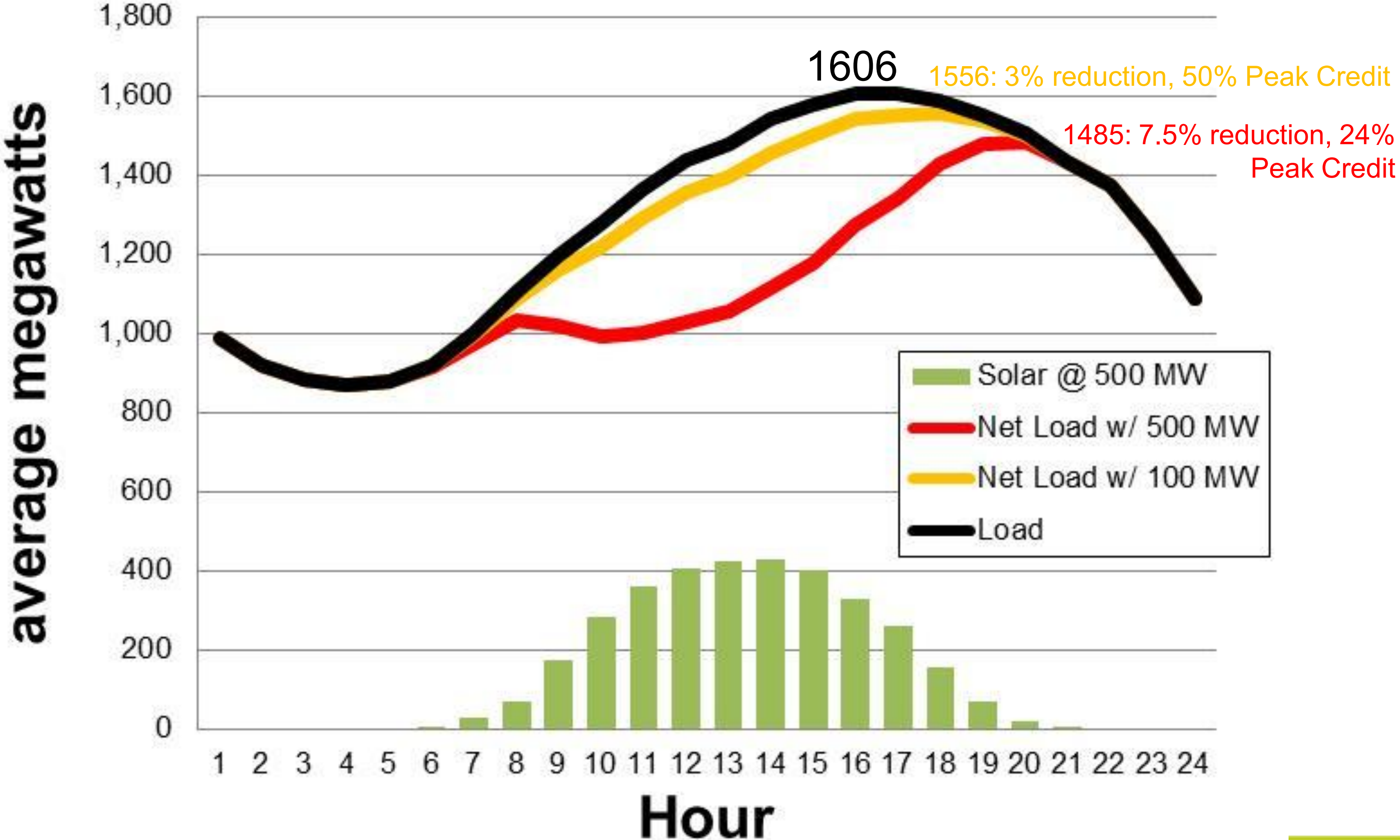


Assumptions:

1) Cost shown are 2014 dollars levelized for first 20 years of asset life

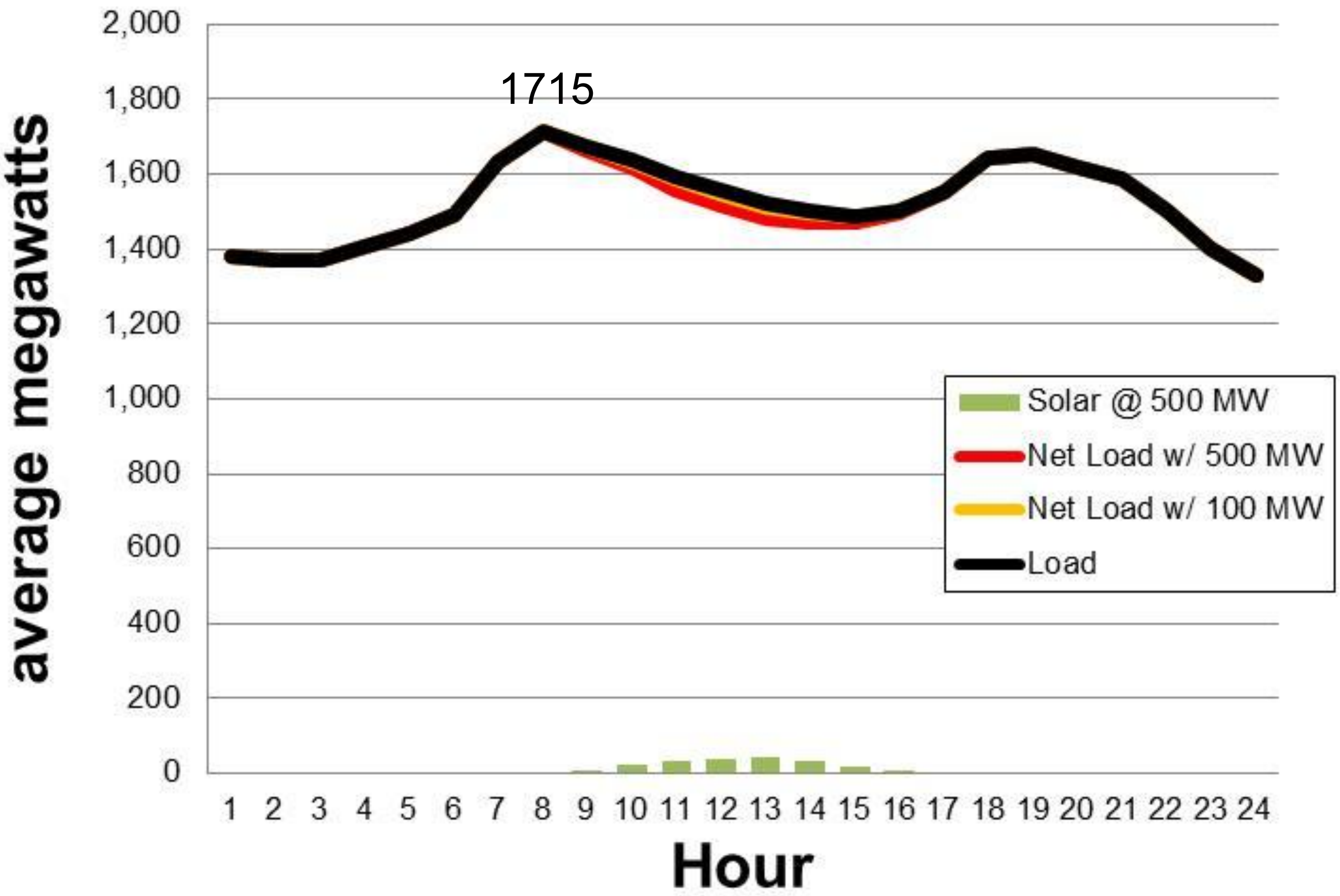
2) ITC benefit taken up front, rather than utility amortization method

Fixed Solar on Summer Peak (7/16/14)



25 MW would get 60% peak credit

Fixed Solar on Winter Peak (1/21/14)



25 MW would get 0% peak credit

Standby Generation

- Avista is exploring the use of customer's standby generation for meeting peak and non-spinning reserve requirements
- Portland General Electric currently has a similar program with over 100 MW enrolled in the program
- 30 MW of capability is required to have a viable program (e.g. 60 customers with 500 kW generators)
- Feasibility study is expected to be finished by the end of the year – update will be made at a future TAC meeting

Clean Power Plan Discussion

John Lyons, Ph.D. and Clint Kalich

Second Technical Advisory Committee Meeting

September 23, 2014

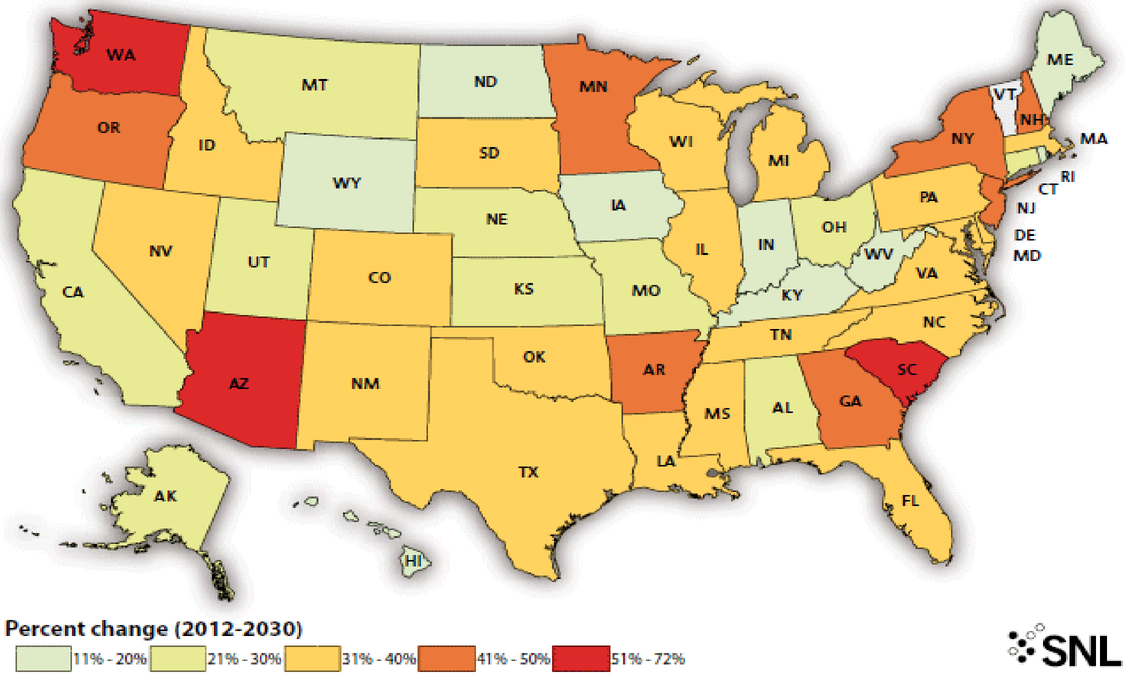
Introduction

- Clean Power Plan Overview
- Avista 111(d) Model
- Clean Power Plan Modeling Inputs Discussion

Clean Power Plan

- June 2, 2014 proposal covers certain existing fossil-fueled resources under 111(d) of the Clean Air Act
- Goal is about a 30% reduction in CO_2 emissions intensity from 2005 by 2030
- Goals set using 2012 base year data
- Comments are now due by December 1, 2014
- http://www2.epa.gov/carbon-pollution-standards/clean-power-plan-proposed-rule
- EPA anticipates final rule in June 2015
- Proposal includes state-by-state CO_2 emissions intensity reduction goals
- States submit a compliance plan one year after the final rule, or two years if a multi-state plan is proposed

EPA's proposed carbon emissions rates for existing power plants (lbs/MWh)



State	Historical emissions rate (2012)	Avg. interim emissions rate goal (2020 - 2029)	Final emissions rate goal (2030+)	Required change (2012-2030)
Alabama	1,444	1,147	1,059	27%
Alaska	1,351	1,097	1,003	26%
Arizona	1,453	735	702	52%
Arkansas	1,640	968	910	45%
California	698	556	537	23%
Colorado	1,714	1,159	1,108	35%
Connecticut	765	597	540	29%
Delaware	1,234	913	841	32%
Florida	1,200	794	740	38%
Georgia	1,500	891	834	44%
Hawaii	1,540	1,378	1,306	15%
Idaho	339	244	228	33%
Illinois	1,895	1,366	1,271	33%
Indiana	1,923	1,607	1,531	20%
Iowa	1,552	1,341	1,301	16%
Kansas	1,940	1,578	1,499	23%
Kentucky	2,158	1,844	1,763	18%
Louisiana	1,466	948	883	40%
Maine	437	393	378	14%
Maryland	1,870	1,347	1,187	37%
Massachusetts	925	655	576	38%
Michigan	1,696	1,227	1,161	32%
Minnesota	1,470	911	873	41%
Mississippi	1,130	732	692	[illegible]
Missouri	1,963	1,621	1,544	21%

State	Historical emissions rate (2012)	Avg. interim emissions rate goal (2020 - 2029)	Final emissions rate goal (2030+)	Required change (2012-2030)
Montana	2,245	1,882	1,771	21%
Nebraska	2,009	1,596	1,479	26%
Nevada	988	697	647	34%
New Hampshire	905	546	486	46%
New Jersey	932	647	531	43%
New Mexico	1,586	1,107	1,048	34%
New York	983	635	549	44%
North Carolina	1,646	1,077	992	40%
North Dakota	1,994	1,817	1,783	11%
Ohio	1,850	1,452	1,338	28%
Oklahoma	1,397	931	895	36%
Oregon	717	407	372	48%
Pennsylvania	1,540	1,179	1,052	32%
Rhode Island	907	822	782	14%
South Carolina	1,597	840	772	52%
South Dakota	1,135	800	741	35%
Tennessee	1,903	1,254	1,163	39%
Texas	1,298	853	791	39%
Utah	1,813	1,378	1,322	27%
Virginia	1,297	884	810	38%
Washington	763	264	215	72%
West Virginia	2,019	1,748	1,620	20%
Wisconsin	1,827	1,281	1,203	34%
Wyoming	2,115	1,808	1,714	19%

Sources: U.S. EPA Clean Power Plan, CleanPowerPlanmaps.epa.gov
Map credit: Whit Varner

Resources Covered

Washington (Coal/Gas)

- Centralia Coal
- Big Hanaford
- Chehalis
- Encogen
- Ferndale
- Frederickson
- Goldendale
- Grays Harbor
- March Point
- Mint Farm
- River Road
- Sumas

Oregon (Coal/Gas)

- Boardman Coal
- Beaver
- Coyote Springs 1
- ***Coyote Springs 2***
- Hermiston
- Klamath Cogen
- Port Westward

Montana (All Coal)

- Colstrip 1 & 2
- ***Colstrip 3 & 4***
- Hardin
- J E Corette
- Lewis & Clark
- Yellowstone

Idaho (All Gas)

- ***Rathdrum, LLC (aka Lancaster)***
- Langley Gulch

*Plants in ***bold italics*** serve Avista customer load

Building Blocks

- Block 1: Heat Rate Improvement – 6% improvement on coal plants
- Block 2: Re-dispatch to Existing Natural Gas Combined Cycle Plants (NGCC) – dispatch NGCC in place of coal up to 70%
- Block 3: Renewable and Nuclear – maintain nuclear at risk and increase renewables up to 21% in the western region by 2030
- Block 4: End-use Energy Efficiency – 10.7% cumulative savings by 2030

Avista 111(d) Modeling Discussion Agenda

- Disclaimers and Contact Information
- Purpose of Model
- External Release of Model
- Data and Assumptions
- Future of Model, Including Upgrades
- Model Introduction
- Observations

Disclaimers and Contact Information

- The Avista 111(d) model (and this presentation) is based on preliminary analysis and subject to change
- Parties using the Avista 111(d) model should independently verify its results
- No warranty of the Avista 111(d) model is made or implied
- Users must holds Avista harmless for any and all uses of the Avista 111(d) model
- Use of the Avista 111(d) model is free; simply notify Avista of your use, or who you pass the model along to
  - ensures you and others receive any offered updates
  - email clint.kalich@avistacorp.com

The Purpose of Avista's 111(d) Model

- To emulate the draft EPA rule 111(d)
- Decipher the EPA math
- Focus on the building blocks discussed by EPA, as well as potential other blocks that Avista believes may provide similar impacts
- Help Avista make decisions with regard to EPA's draft rules

Purpose of Avista's 111(d) Model, Cont.

- Inform its potential comments on the draft rule
- Support policy-level recommendations
- Integrated resource (and other) planning
- Quantify potential compliance costs
- Assist with external party communication

External Release of Avista 111(d) Model

- There is a lot of confusion about the EPA rule
- Model may assist in understanding/quantifying 111(d) proposal
- Avista provides its model for free use
- Avista cannot provide passwords to allow reverse engineering
- No warranty is granted or implied

Data and Assumptions

- Most data from EPA worksheets *
- Minor other “behind-the-scenes” assumptions
- Some assumptions can be changed by the user
- All regulated states are included in the model
- User can combine states to perform a regional view
- Default choices are already built into the model

* See http://www2.epa.gov/sites/production/files/2014-06/20140602tsd-state-goal-data-computation_1.xlsx and http://www2.epa.gov/sites/production/files/2014-06/20140602tsd-plant-level-data-unit-level-inventory_0.xlsx

Future of Model and Upgrades

- Updates will be provided as deemed necessary by Avista
- Updates will include enhancements and new features
- User feedback will help dictate much of the future release features and frequency
- Changes to the proposed rule will be incorporated in future releases as more information becomes known
- Model may be revised by Avista without notification

Model Introduction

Preliminary Analysis Prepared by Avista and Subject to Change. Parties Should Independently Verify Results Before Use.

All Of United States

$0.0 billion in new investment
0.0 millions of metric tons CO2 reduced per year (from 2012)
$0 per capita (2010 census)
$0 levelized cost ($2015/ton)

Instructions and Release Notes

Model v2.1
8/20/14

	GWh	Growth (GWh)	% of 2012
2012 Load	3,954,089		0.0%
2020 Load	4,197,656	243,567	6.2%
2030 Load	4,523,321	569,232	14.4%
Pre-Conservation Load Growth Rate			0.75%

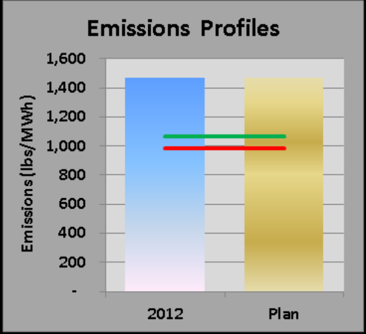
Reset States and Plants

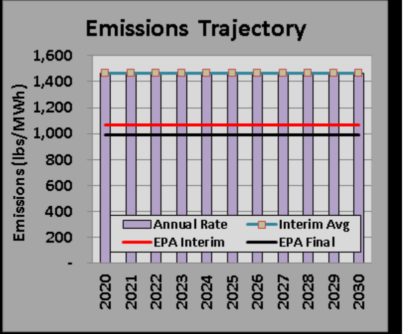
Modify States & Plants

Rate Based
Mass Based

Emissions Rates (lbs/MWh)

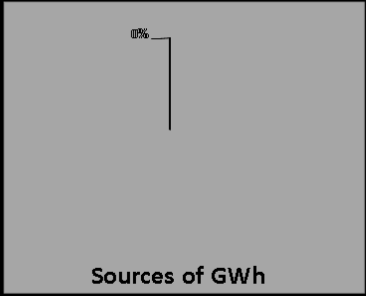
2012 Base	2012 EPA	Modeled Plan
1,464.7	1,156.4	
Interim EPA	2030 EPA	
1,064.5	986.6	1,464.7





Federal Compliance Path Option	Action	2020 Generic Retired/ Modified	User-Specific Retired by 2030	2030 GWh	2030 aMW	Estimated 2030 New Build MW	Assumed NCF of New Resource	Assumed 2015 Cost ($/kW)
1	Coal Heat Rate Improvement	0.00%					85.0%	500
2	New Renewables (30% NCF) as % of Load Growth	0.00%		-	-	-	30.0%	3,000
2	New Nuclear as % of 2012-30 Load Growth	0.00%		-	-	-	85.0%	7,500
3	Coal % to Existing Gas (no new capacity)	0.00%	0.0%	-	-	-	60.0%	250
3	Coal % to New Nuclear	0.00%	0.0%	-	-	-	85.0%	7,750
3	Coal % to New Gas	0.00%	0.0%	-	-	-	60.0%	2,750
3	Coal % to New Renewables (30% NCF)	0.00%	0.0%	-	-	-	30.0%	1,500
4	Conservation % of Load (AARG through 2017-30)	0.00%		-	-	-	100.0%	2,205

Other Possible Compliance Options	Action	2020 Generic Retired/ Modified	User-Specific Retired by 2030	2030 GWh	2030 aMW	Estimated 2030 New Build MW	Assumed NCF of New Resource	Assumed 2015 Cost ($/kW)
5	Existing Gas Heat Rate Improvement	0.00%					50.0%	500
6	Retire Existing CCCT Plants w/o Replacing	0.00%	0.0%	-	-	-	60.0%	250
6	Existing Gas % to New Nuclear	0.00%	0.0%	-	-	-	85.0%	6,500
6	Existing Gas % to New Renewables (30% NCF)	0.00%	0.0%	-	-	-	30.0%	1,500
6	Existing Gas % to New Gas	0.00%	0.0%	-	-	-	60.0%	1,500
7	End-Use Fuel Switching to Gas % of Load (AARG 2017-30)	0.00%		-	-	-	15.0%	3,000



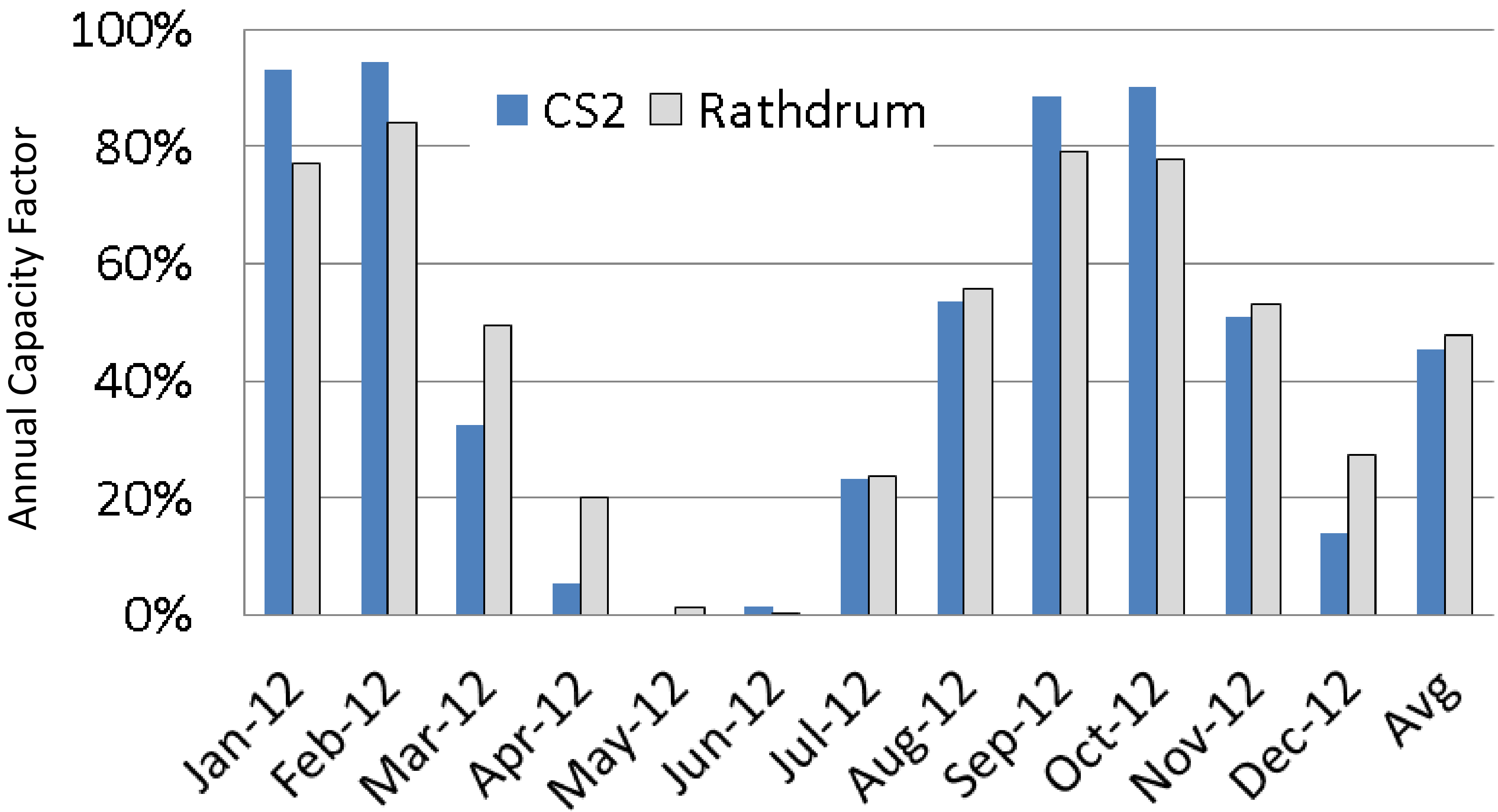
Some Observations

- Compliance costs appear much higher than EPA estimates
- Retirement without replacing with qualifying non-carbon resources is much less impactful on the emissions rate than building replacement resources
- Higher conservation or renewables means fewer mass-based emissions reduction
- EPA rule does not appear focused on electricity system reliability
- 2012 base year has very high hydro generation
  - and a correlated low carbon emissions level

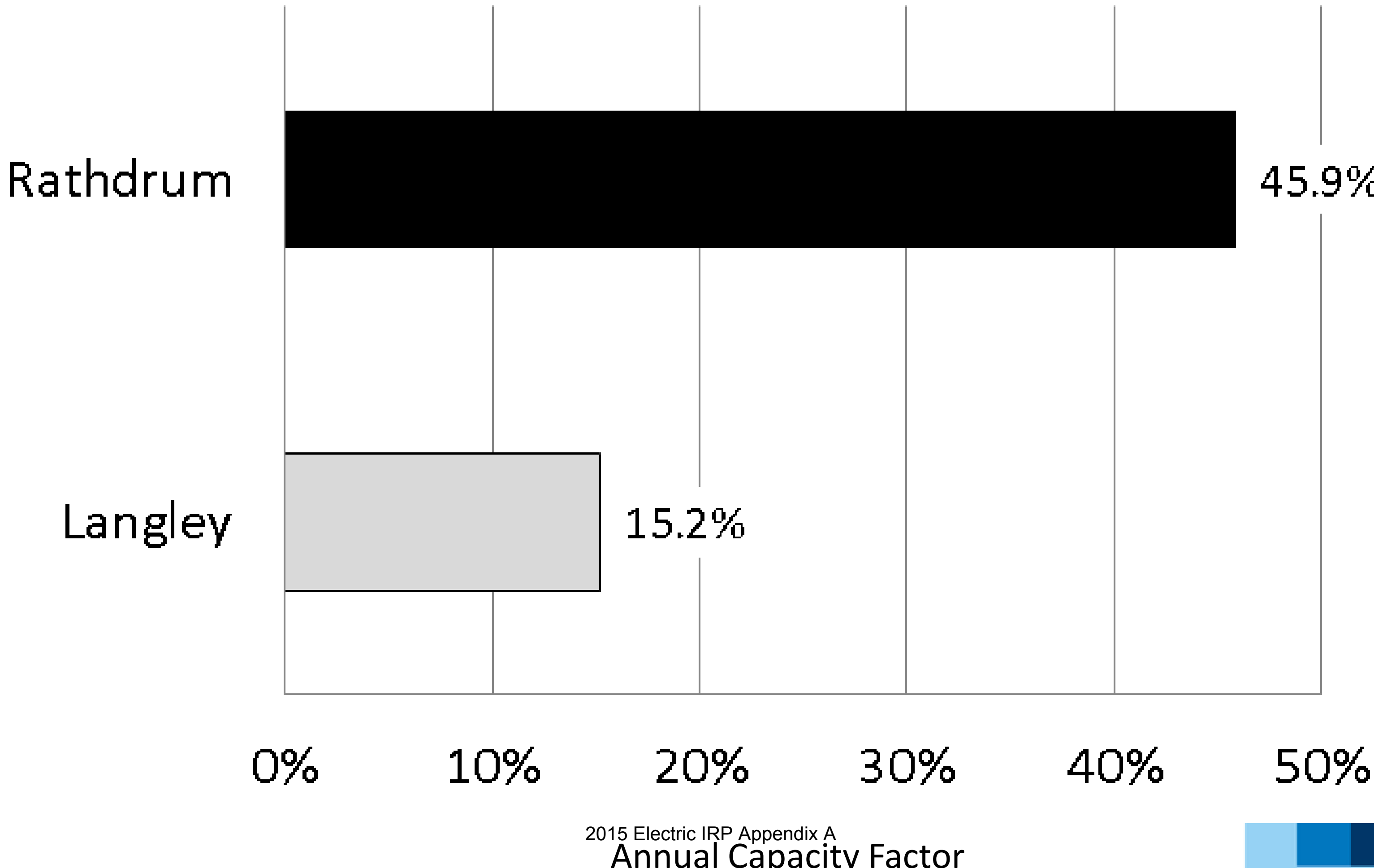
Some Observations, Cont.

- Hydro/renewables variability is ignored in the math
- States receive no credit for early action (e.g., Centralia, aggressive conservation)
- Idaho has only two gas-fired plants regulated by 111(d), one of which operated only half of the 2012 base year
- For Oregon and Washington the only EPA options are conservation and renewables, as coal plants already are in the baseline
- In Montana, retiring coal for gas does not reduce emissions rate

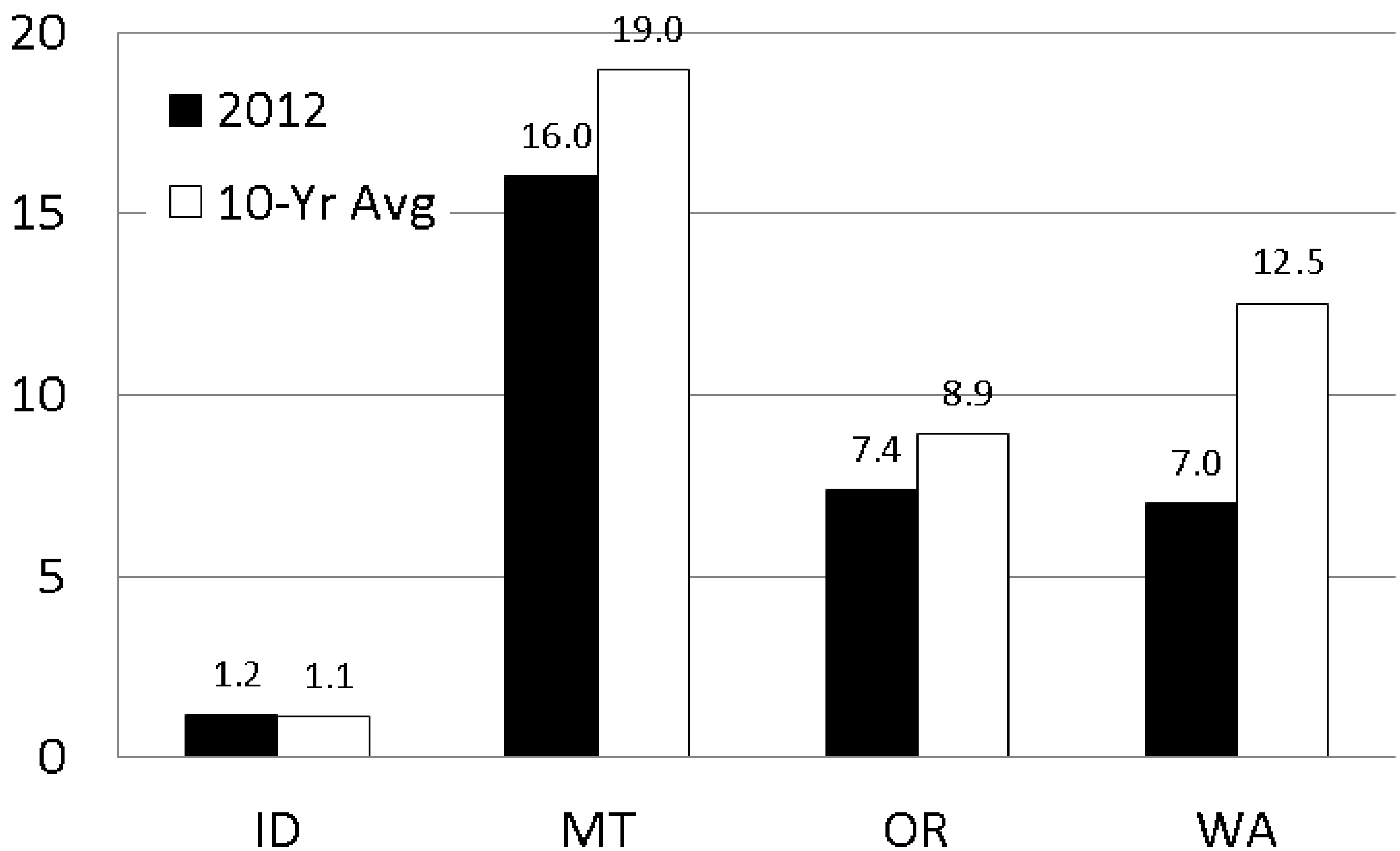
2012 Operations at Coyote Springs 2 (OR) and Rathdrum LLC (ID)



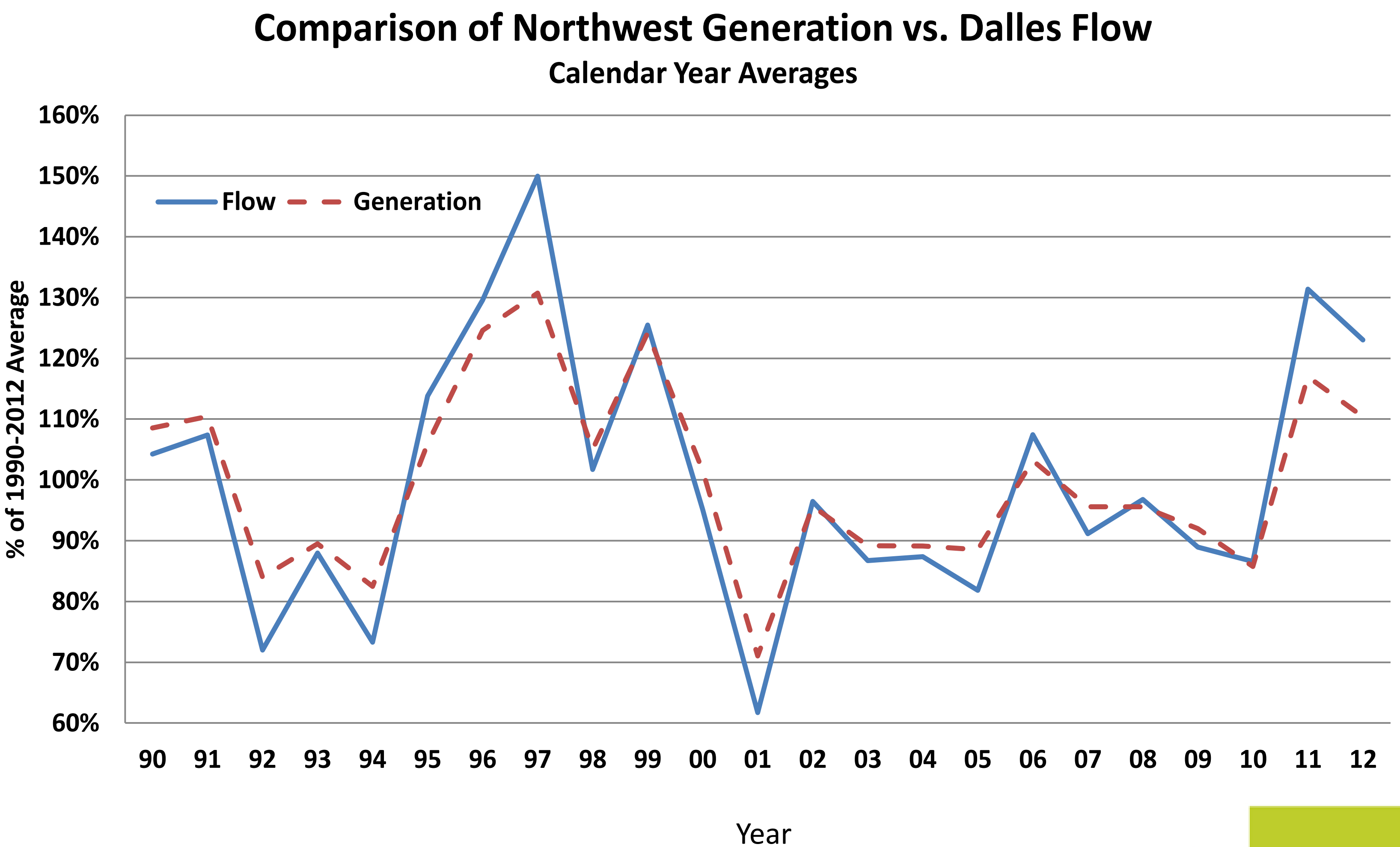
Idaho Comparison: 2012 Langley Gulch and Rathdrum Power LLC Plant Operations



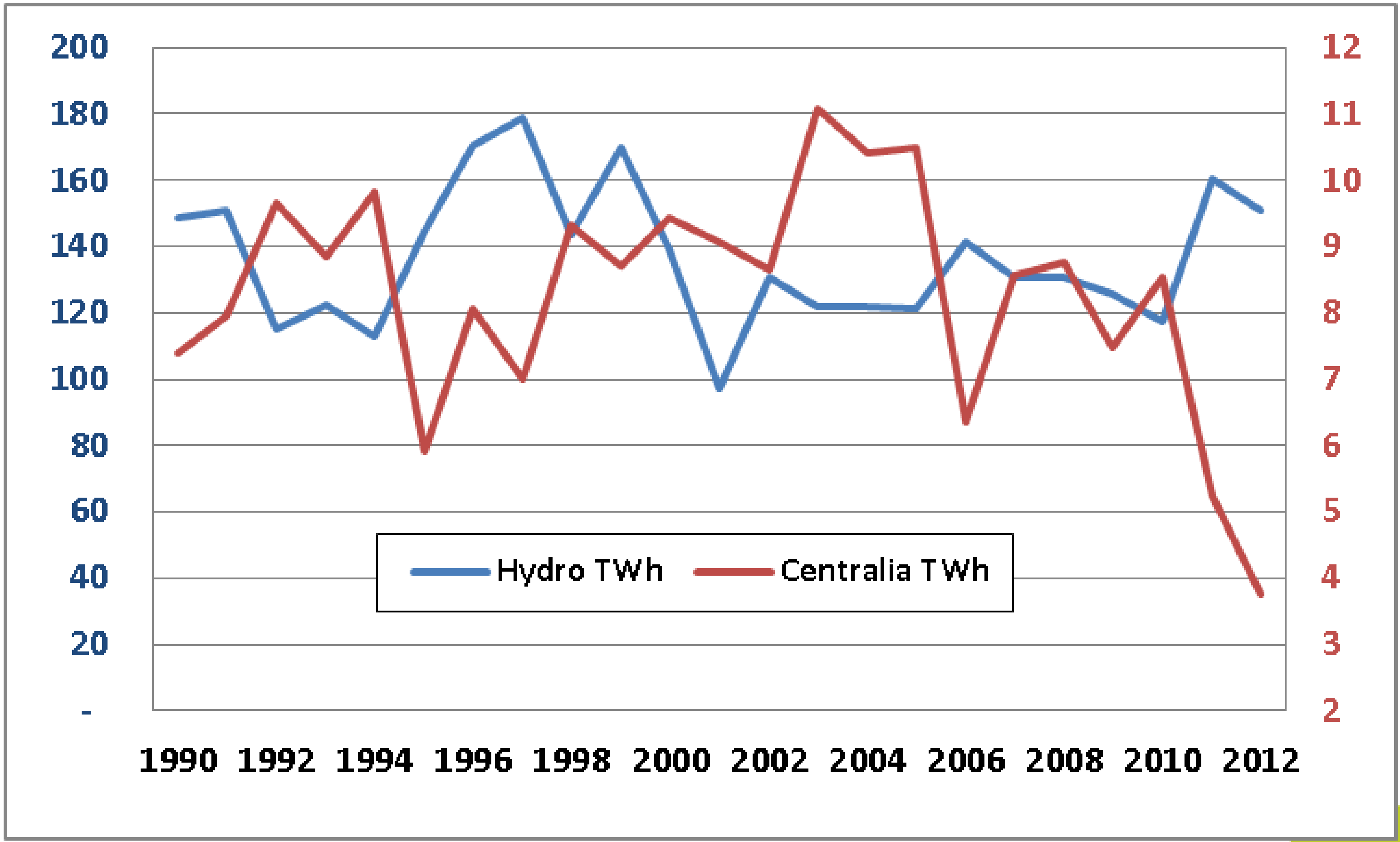
Historical Carbon Emissions (millions of CO_2 tons)



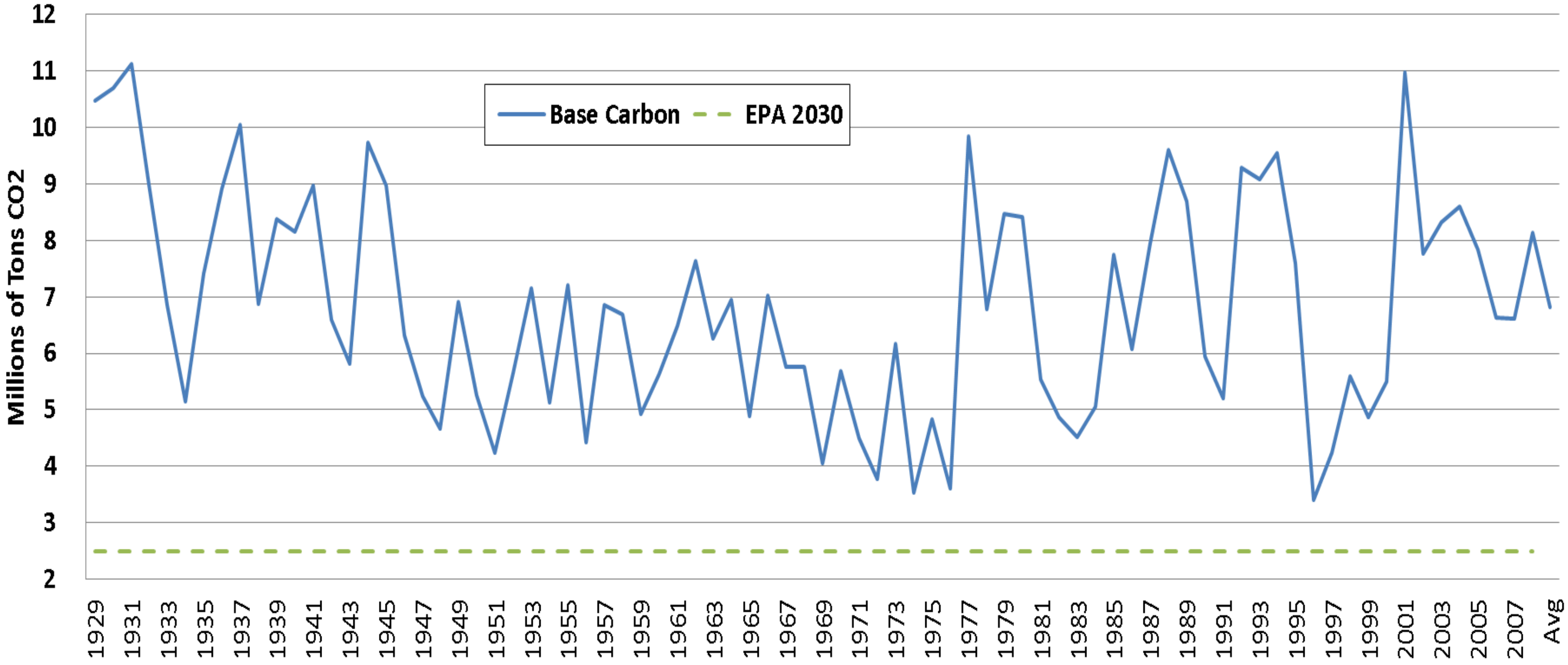
Pacific Northwest Hydroelectricity vs. Dalles Inflow Variability



Pacific Northwest Hydroelectricity vs. Coal Emissions (Centralia)



Hydro Variability in WA



Clean Power Plan Modeling Inputs Discussion

- Base Case assumptions
- Scenarios

2015 Electric Integrated Resource Plan

Technical Advisory Committee Meeting No. 3 Agenda
Friday, November 21, 2014
Conference Room 130

Topic	Time	Staff
1. Introduction & TAC 2 Recap	8:30	Lyons
2. Planning Margin	8:35	Gall
3. Colstrip Discussion	9:15	Lyons
4. Cost of Carbon	10:45	Lyons
5. Lunch	11:30	
6. IRP Modeling Overview	12:30	Gall
7. Conservation Potential Assessment	1:45	Kester
8. Adjourn	3:00	

2015 Electric IRP
TAC Meeting Expectations and Schedule

John Lyons, Ph.D.
Second Technical Advisory Committee Meeting
November 21, 2014

Technical Advisory Committee

- The public process of the IRP – input on what to study, how to study, and review of assumptions and results
- Technical forum with a range of participants with different areas of input and expertise
- Open forum, but we need to stay on topic to get through the agenda and allow all participants to ask questions and make comments
- Welcome requests for studies or different assumptions.
  - Time or resources may limit the amount of studies
  - The earlier study requests are made, the more accommodating we can be
  - January 15, 2015 is the final date to receive study requests
- Action Items – areas for more research in the next IRP

Technical Advisory Committee

- Technical forum on inputs and assumptions, not an advocacy forum
- Focus is on developing a resource strategy based on sound assumptions and inputs, instead of a forum on a particular resource or resource type
- We request that everyone maintain a high level of respect and professional demeanor to encourage an ongoing conversation about the IRP process
- Supports rate recovery, but not a preapproval process
- Planning team is available by email or phone for questions or comments between the TAC meetings

Remaining TAC Meetings

- **TAC 4 – February 2015:** Electric and natural gas price forecasts, transmission planning, resource needs assessment, market and portfolio scenario development, energy storage and ancillary service evaluation
- **TAC 5 – March 2015:** Completed conservation potential assessment, draft preferred resource strategy (PRS), review of scenarios, market futures, and portfolio analysis
- **TAC 6 – June 2015:** Review of final PRS and action items.

2015 IRP Tasks for the PRS

Exhibit 1: 2015 Electric IRP Timeline	
Task	**Target Date**
Preferred Resource Strategy (PRS)	
Finalize energy demand forecast	July 2014
Identify Avista's supply & conservation resource options	September 2014
Finalize peak load forecast	September 2014
Update AURORA^{xmp} database for market price forecast	October 2014
Energy efficiency load shapes input into AURORA^{xmp}	October 2014
Finalize datasets/statistics variables for risk studies	November 2014
Transmission study due	December 2014
Finalize distribution feeder forecast	December 2014
Select natural gas price forecast	December 2014
Finalize deterministic base case	January 2015
Due date for study requests	Jan. 15, 2015
Base case stochastic study complete	January 2015
Develop efficient frontier and PRS	January 2015
Finalize PRiSM model	February 2015
Simulation of risk studies "futures" complete	February 2015
Simulate market scenarios in AURORA^{xmp}	February 2015
Evaluate resource strategies against market futures and scenarios	March 2015
Present preliminary study and PRS to TAC	March 2015

2015 IRP Writing Tasks – Work Plan

Writing Tasks	
File 2015 IRP work plan	August 2014
Prepare report and appendix outline	October 2014
Prepare text drafts	April 2015
Prepare charts and tables	April 2015
Internal draft released at Avista	May 2015
External draft released to the TAC	June 2015
Final editing and printing	August 2015
Final IRP submission and TAC	August 31, 2015

TAC #2 Recap

- Introduction & TAC 1 Recap – Lyons
- Conservation Selection Methodology – Gall
- Load and Economic Forecasts – Forsyth
- Shared Value Report – Fielder
- Generation Options – Gall/Dempsey
- Clean Power Plan Proposal Discussion – Lyons/Kalich

Today's Agenda

- Introduction & TAC 2 Recap (8:30) – Lyons
- Planning Margin (8:35) – Gall
- Colstrip Discussion (9:15) – Lyons
- Cost of Carbon (10:45) – Lyons
- Lunch (11:30)
- IRP Modeling Overview (12:30) – Gall
- Conservation Potential Assessment (1:45) – Kester
- Adjourn 3:00
- Reminders: restrooms are across the hall and all visitors need Avista escorts to the lobby to leave the building

Planning Margin (Reserve Planning)

James Gall
Third Technical Advisory Committee Meeting
November 21, 2014

What is the role of reserves for peak planning

- **Planning Margin[1]:** Generally, the projected demand is based on a 50/50 forecast. Based on experience, for Bulk Power Systems that are not energy-constrained, reserve margin is the difference between available capacity and peak demand, normalized by peak demand shown as a percentage to maintain reliable operation while meeting unforeseen increases in demand (e.g. extreme weather) and unexpected outages of existing capacity
- **Operating Reserves:** is required capacity to meet an instantaneous loss of generation.
  - New rule in WECC, 3% of load and 3% of operating generation is carried. Half of the capacity must be "synced" to the grid (spinning) and the other half must be available to sync within 10 minutes (non-spinning/supplemental).
- **Regulation** is required intra hour capacity to meet instantaneous load changes instantly

1. http://www.nerc.com/pa/RAPA/ri/Pages/PlanningReserveMargin.aspx. 50/50 is also referred to as a 1-in-2 forecast

NERC's Reference Reserve Margin

- is equivalent to the Target Reserve Margin Level provided by the Regional/subregion’s own specific margin based on load, generation, and transmission characteristics as well as regulatory requirements. If not provided, NERC assigned 15 percent Reserve Margin for predominately thermal systems and 10 percent for predominately hydro systems. As the planning reserve margin is a capacity based metric, it does not provide an accurate assessment of performance in energy limited systems, e.g., hydro capacity with limited water resources.

http://www.nerc.com/pa/RAPA/ri/Pages/PlanningReserveMargin.aspx

2013 IRP WUTC Acknowledgement Request

- *In its updated action plan, Avista committed to re-assess with the TAC the benefits and costs of the Company's 2013 IRP planning margin to determine if a different level is warranted in the 2015 IRP. The Commission supports this approach.*
- The 2013 IRP used the following planning margin
  - Greater of 1 hour or 18 hour sustained peak deficit
    - Includes the top six load hours of three consecutive days
  - Winter: 14% adder to the 1 in 2 peak forecast + Ancillary Services Requirement (~6% operating reserves + 1.3% regulation reserve) = 21% – 22 %
  - Summer: 0% adder to the 1 in 2 peak forecast + Ancillary Services Requirement (~6% operating reserves + 1.3% regulation reserve) = 7% - 8%

North American Planning Margin Survey

- Planning margin added to peak load is most common
- Some plan for 5% LOLP, others 1 in 10 years
- Operating reserves is often included in estimates
- Organized market have firm requirements
- Northwest utilities/organizations recommend higher planning margins

Regional Planning Margins

- Organized systems

PJM	15.7%
MISO	14.8%
TVA	15.0%
SPP	13.6%
NYISO	17.1%
ISO New England	15.0%
ERCOT	13.8%
California PUC	15.0%

- Non Northwest Utilities

New Brunswick Power	22.0%
Hydro Quebec	8.0%
Nova Scotia Power	20.0%
Hydro One	20.0%
FPL	20.0%
Progress Energy	20.0%
Entergy- New Orleans	12.0%
Sunflower Coop	12.0%
Kansas City B of PU	12.0%
Basin Electric	15.0%
LADWP	25.0%
San Diego Gas & Electric	15.0%
Roseville Electric	15.0%

Dominion	15.6%
Minnesota Power	11.3%
Indianoplis Light & Power	12.7%
Duke- Indiana	13.9%
Duke- Carolina's	14.5%
Oklahoma Gas & Electric	12.0%
Platte River Power Authority	15.0%
XCEL- Colorado	16.3%
XCEL- New Mexico	13.6%
Colorado Springs Utilities	18.0%
Salt River Project	12.0%
APS	15.0%
UNS Electric	15.0%

El Paso Electric	15.0%
Sierra Pacific	15.0%
Nevada Power	12.0%
Public Service Co of NM	13.0%
Tri-State G&T	15.0%

Northwest Planning Margins

- Northwest Utilities

PSE (2018-19)	14.0%
PSE (2020+)	16.0%
PacifiCorp	13.0%
PGE	12.0%
Clark PUD	18.0%
Cowlitz PUD	23.0%
EWEB	17.0%
Northwestern	0.0%
Idaho Power	10.3%
Fortis	10.0%
BC Hydro	20.0%

- Northwest Organizations

WECC- PNW Summer	17.9%
WECC- PNW Winter	19.9%
WECC- PNW Summer	18.8%
WECC- PNW Winter	21.6%
NPCC- Summer	24.0%
NPCC- Winter	23.0%
NWPP (NPCC)	<28.0%
WECC (NPCC)	18.0%
PNUCC	12.0%-20%

AVISTA

Single Largest Resource Contingency

Largest shaft as a percent of 2014 forecast peak load
Western Interconnect utilities with a control area

Utility	%	Resource (MW)
Public Service of CO	9%	Comanche- 525
Public Service of NM	13%	San Juan- 248
LADWP	8%	Scattergood- 450
Salt River Project	6%	Springerville- 415
Arizona Public Service	7%	Redhawk- 500
El Paso Electric	12%	Palo Verde- 207
Sierra Pacific	33%	Tracy CCCT- 553
Nevada Power	10%	Lenzie- 551

Utility	%	Resource (MW)
Puget Sound Energy	6%	Mint Farm- 297
PacifiCorp- West	15%	Chehalis- 477
PacifiCorp- East	9%	Lake Side 2- 628
Portland General Electric	16%	Boardman- 517
Bonneville Power Admin	7%	Coulee- 805
Idaho Power	10%	Langley Gultch-318
BC Hydro	5%	Various- 500
Avista- Summer	16%	Coyote Springs 2- 277
Avista- Winter	20%	Coyote Springs 2- 312

Planning Margins Contrasts Between Interconnected and Electrical Islands

- Since Avista is part of a larger power system it can leverage assets of the system to help meet peaks rather than rely entirely on its only system keeping planning margins low
- This is the opposite from Avista's newly acquired Alaska Electric Light & Power subsidiary; AELP must provide all its own reserves for reliability and plans on a 100% planning margin + largest single contingency within its core system.
- The Northwest Planning Conservation Council (NPCC) attempts provide direction on system reliability on a regional basis for northwest interconnect utilities.

Northwest Power Conservation Council's LOLP Results for 2019

LOLP Results for 2019 (%)

(Effects of Load and Import Uncertainties)

Load / Import	-2.5%	-1.5%	Medium	+1.5%	+2.5%
0 (MW)	7.5	8.6	10.5	12.9	14.9
1700	4.5	5.3	6.5	8.0	9.3
2000	4.3	4.9	6.2	7.7	9.0
2500	4.0	4.7	5.9	7.2	8.5
3000	3.8	4.5	5.4	6.7	7.9
3400	3.7	4.4	5.3	6.4	7.7

http://www.nwcouncil.org/media/7148382/100914-raac-tech-2019-review.pdf

Northwest Market Depth

Assumptions:

- 1% load growth rate to match NPCC's peak load forecast
- Uses NPCC's assumptions for shares of borderline resources contributing to NW
- Centralia, Boardman, Big Hanaford, Corette offline as forecasted
- Only new resources under construction are assumed
- Excludes wind resources
- Operating reserves and regulation requirements are satisfied ~8% of load
- Winter import is 2,500 MW, summer exports IPP resources

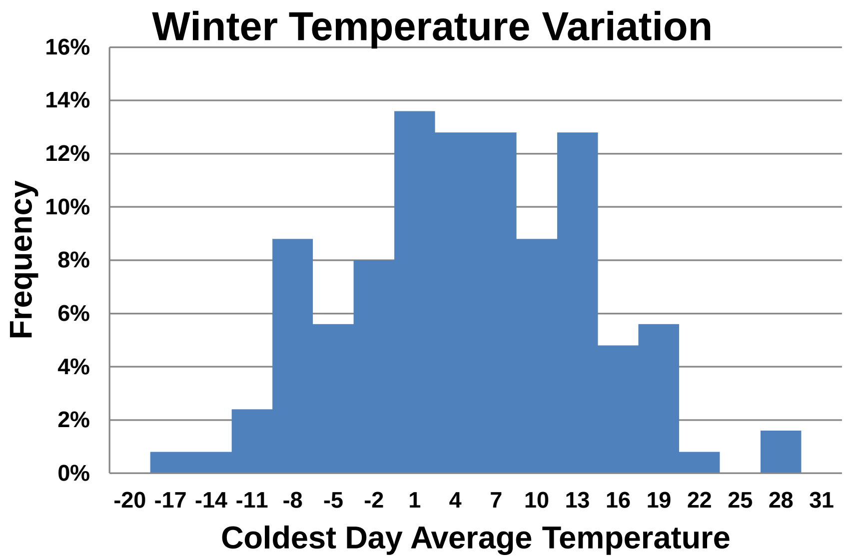
	January	January	January	July	July	July	Jan	July
Year	1 Hour	4 Hour	10 Hour	1 Hour	4 Hour	10 Hour	Margin	Margin
2017	12,222	8,014	5,315	11,323	10,740	9,829	28%	50%
2018	11,864	7,663	4,979	11,034	10,457	9,557	27%	49%
2019	11,503	7,309	4,639	10,742	10,170	9,283	26%	47%
2020	11,138	6,951	4,296	10,447	9,881	9,006	24%	46%
2021	9,514	5,334	2,694	9,182	8,623	7,759	20%	41%
2022	9,014	4,842	2,217	8,754	8,201	7,349	19%	39%
2023	8,638	4,474	1,863	8,450	7,903	7,063	18%	38%
2024	8,258	4,101	1,506	8,143	7,602	6,775	16%	36%
2025	7,875	3,725	1,145	7,833	7,298	6,483	15%	35%
2026	6,683	2,541	(23)	7,386	6,857	6,055	14%	33%
2027	6,291	2,158	(391)	7,070	6,548	5,758	13%	32%
2028	5,896	1,770	(763)	6,750	6,234	5,457	11%	31%
2029	5,497	1,379	(1,138)	6,428	5,918	5,154	10%	29%
2030	5,093	984	(1,517)	6,102	5,599	4,848	9%	28%

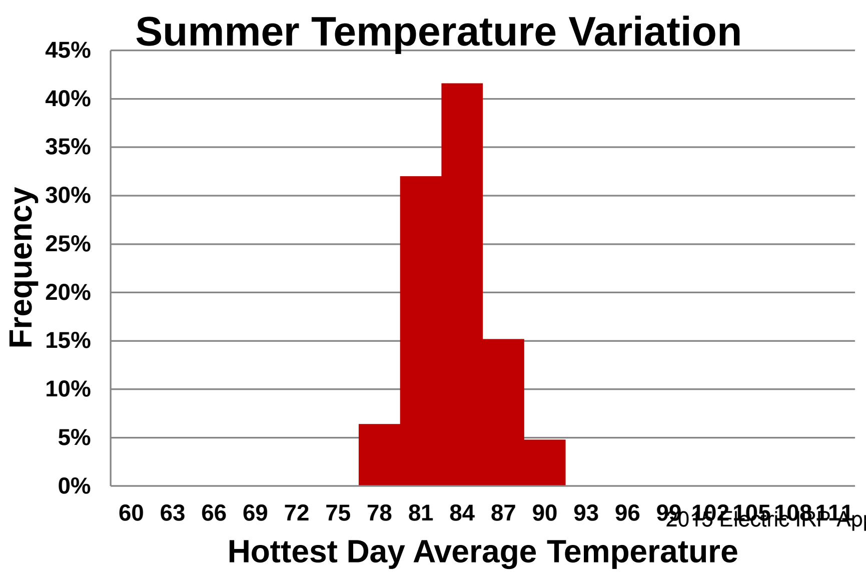
Violation of 5% LOLP

Avista's Peak Situation

- Peak can occur in summer or winter, but winter peak predominate concern
- Large single largest contingency
- Peak load is 5 percent of the Northwest's peak load
- Well connected to other utilities
- Equal mix of hydro and thermal resources
- Have mix of flexible hydro and flexible natural gas fired units to meet flexibility requirements

Spokane Temperature Volatility

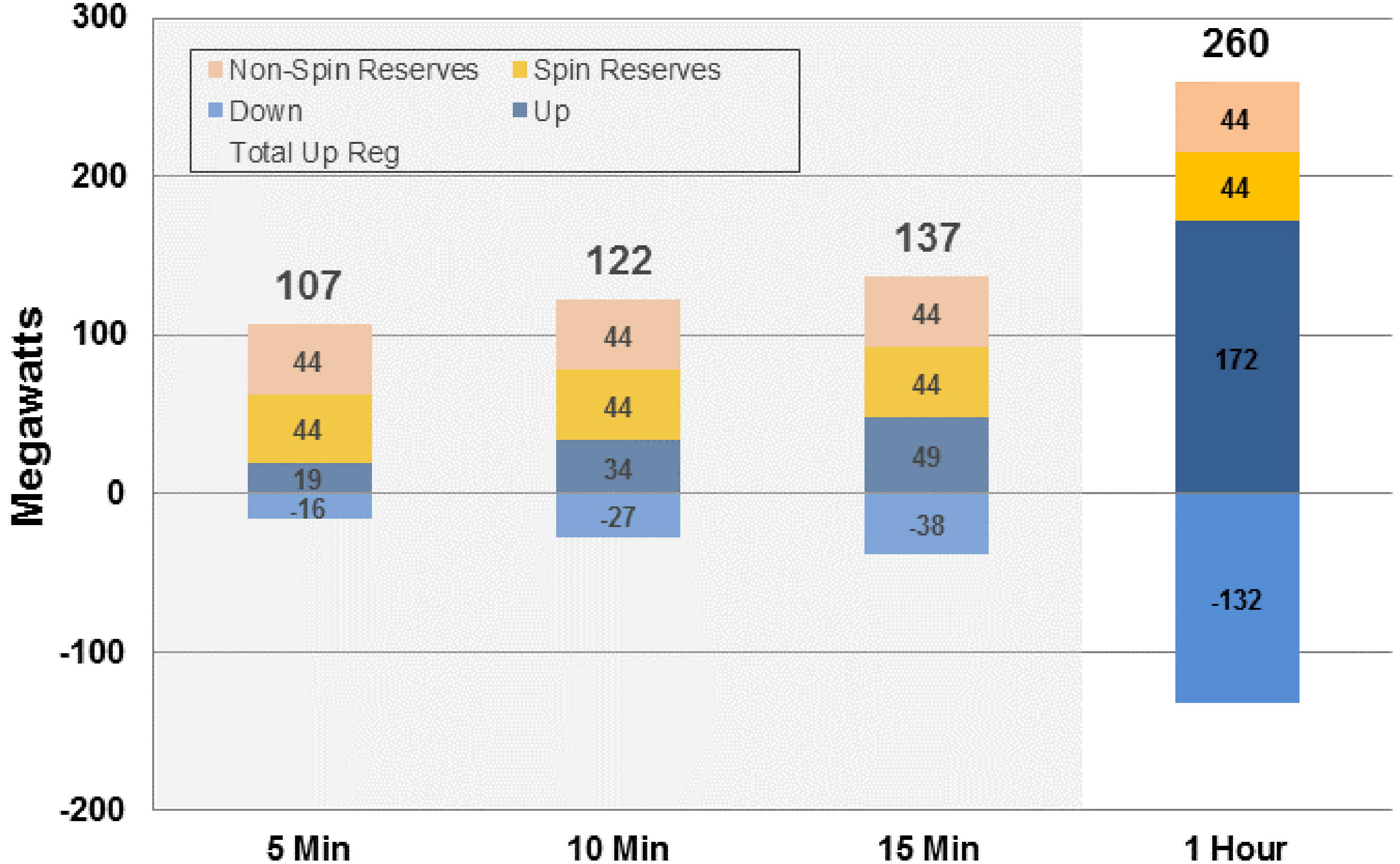




Temperature Statistics

	Winter	Summer
Mean	4	82
Tail (10%)	-9	86
Extreme	-17	90
Stdev	9	3
Recent Events	2014: 5 2008: -7 2004: -9	2014: 84 2008: 86 2006: 87

Flexibility Requirements (99^{th} Percentile) 2013 CY Data



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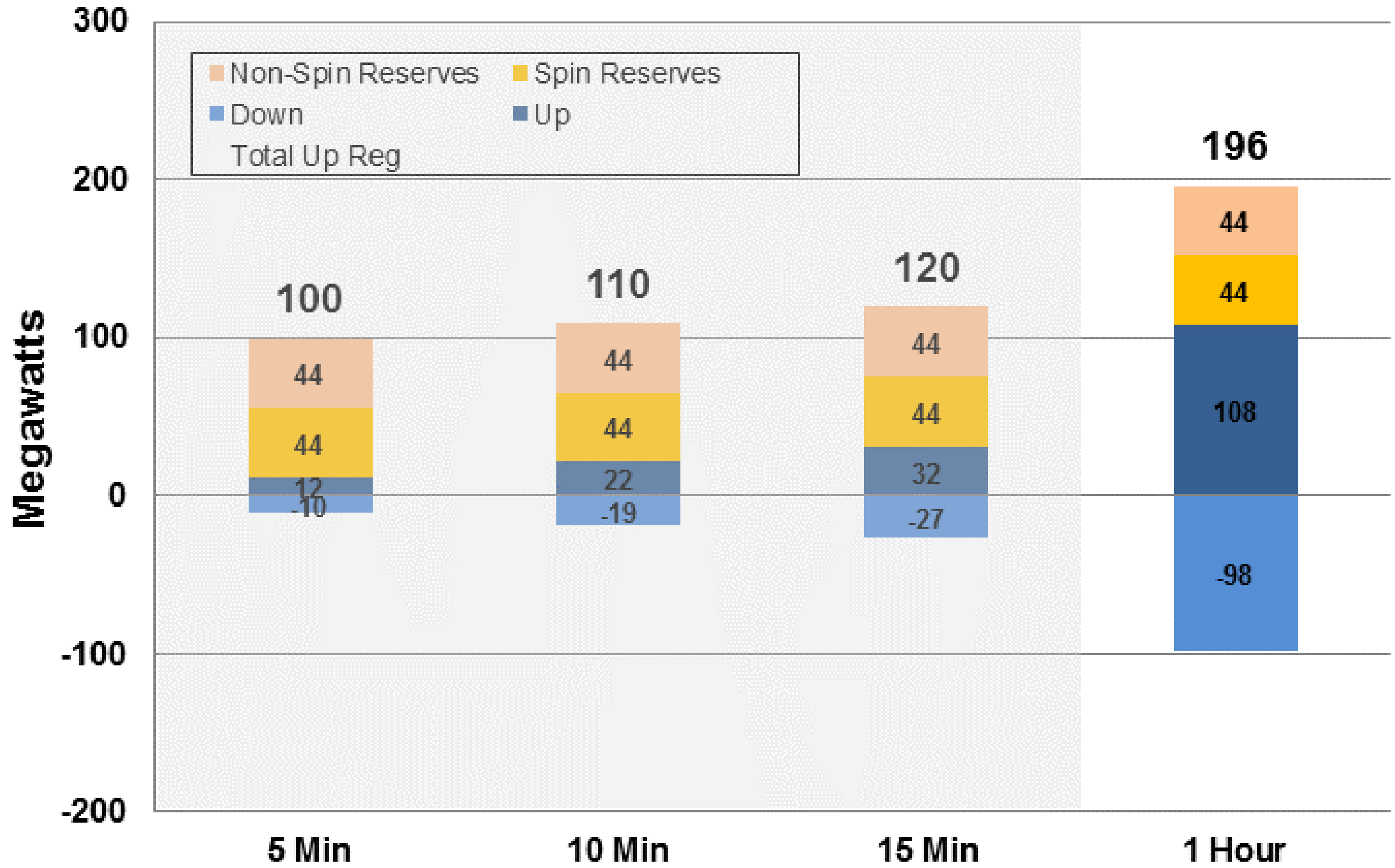
Flexibility Requirements (95th Percentile) 2013 CY Data



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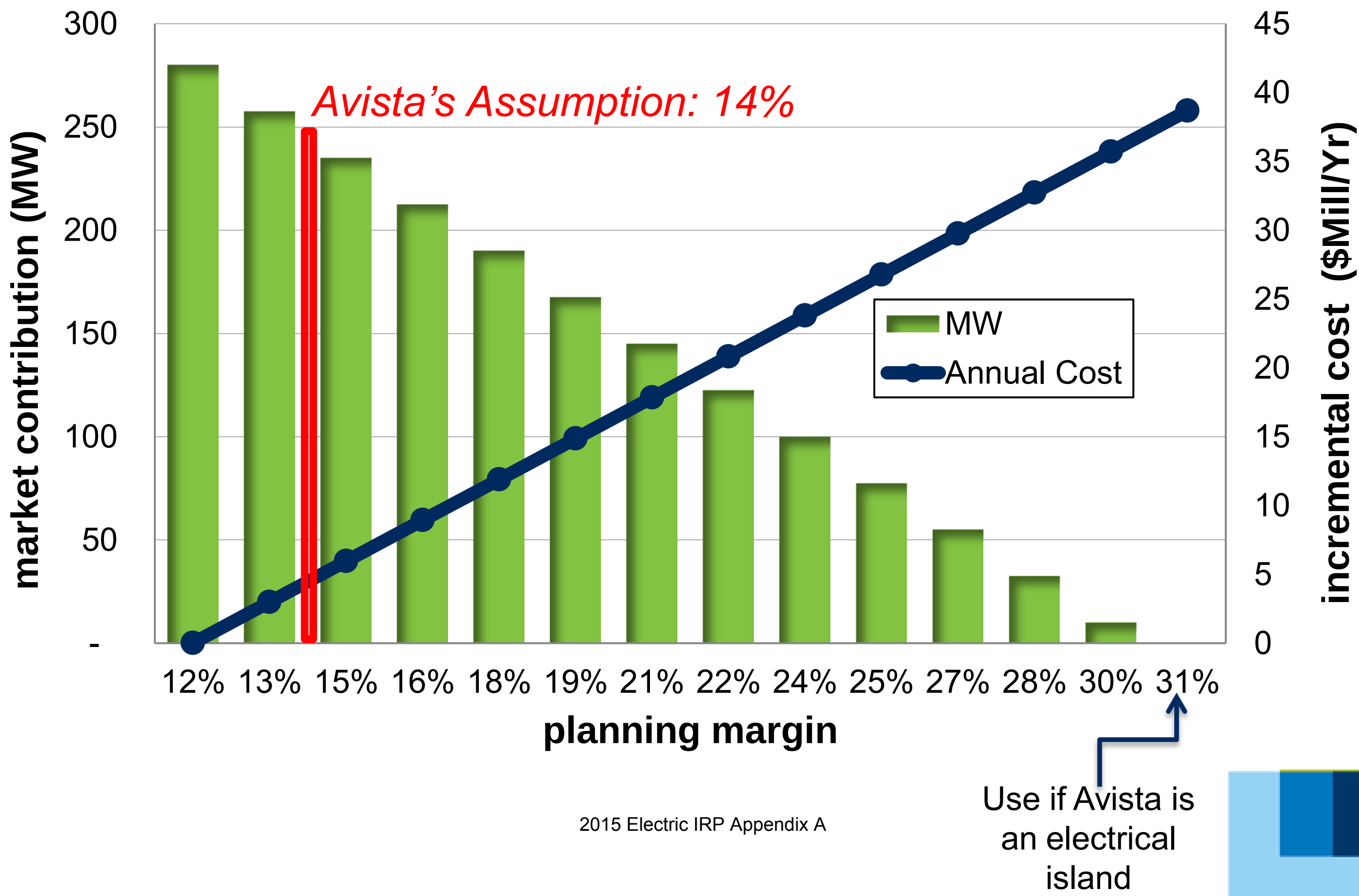
2013 IRP Planning Margin vs Market Reliance Cost Trade-Off

Winter Planning Margin in addition to Ancillary Services Requirements

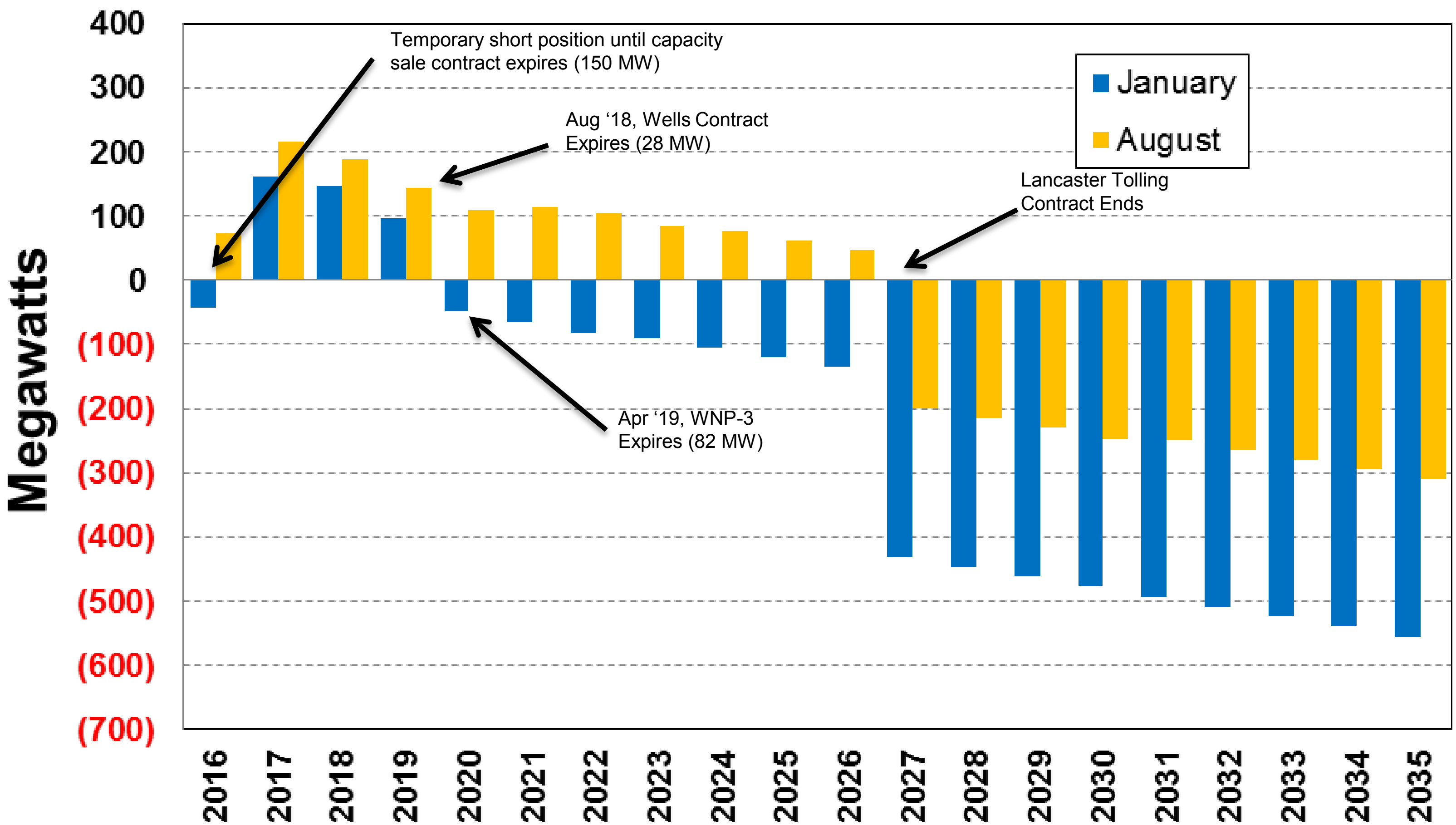


2015 IRP Planning Margin Proposal

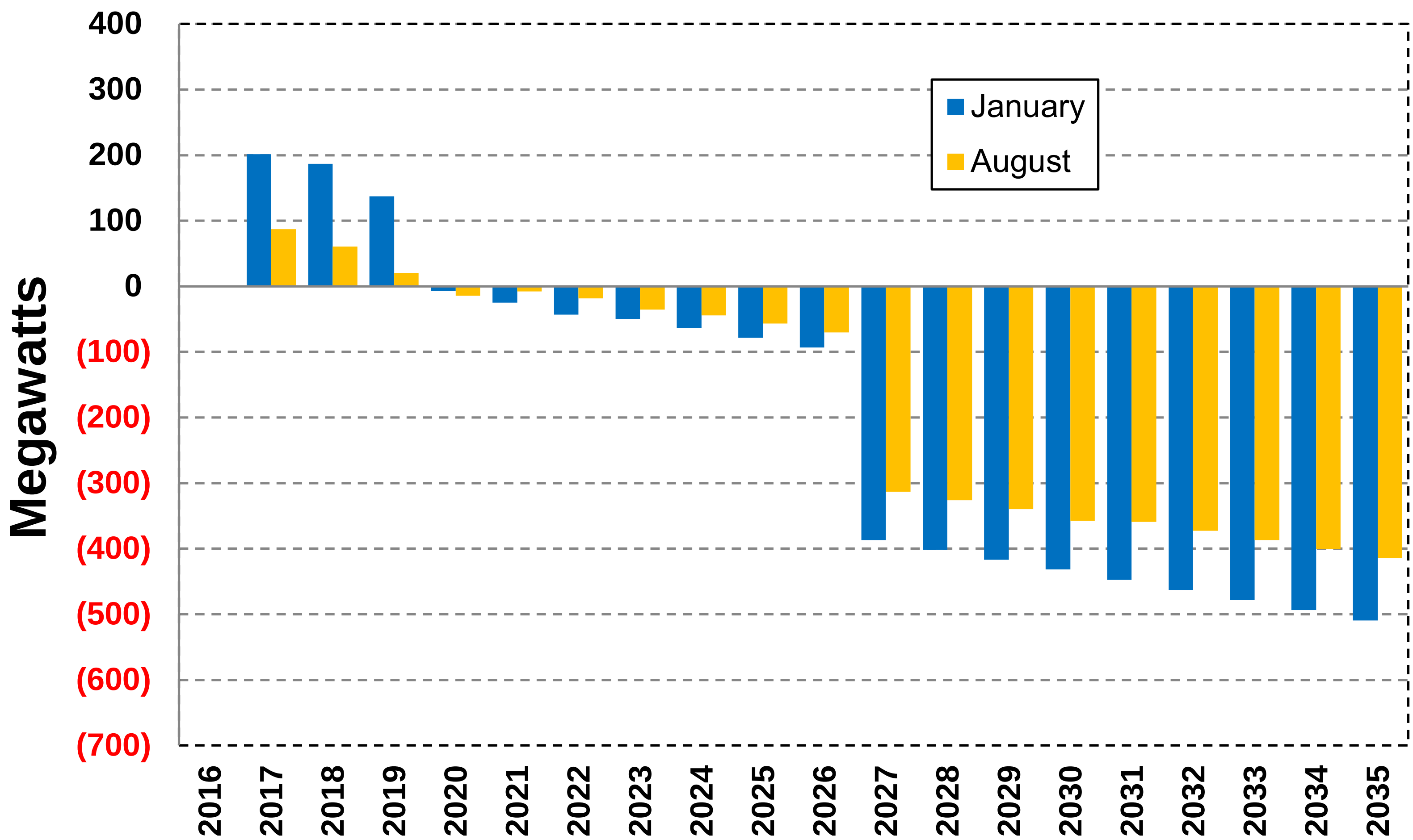
- Greater of 1 Hour or 18 Hour sustained peak deficit
- Winter
  - 14% Planning Margin +
  - Control Area Operating Reserves +
  - Regulation (16 MW)
- Summer
  - 0% Planning Margin +
  - Control Area Operating Reserves +
  - Regulation (16 MW)
- Market Power Available
  - Winter: Through 2018
  - Summer: Available throughout the study

22.6% Planning Margin for January 2015

1 Hour Net Load/Resource Position (No Short-Term Market)



18 Hour Net Load/Resource Position (No Short-Term Market)



Colstrip Discussion

John Lyons, Ph.D.
Third Technical Advisory Committee Meeting
November 21, 2014

Future of Colstrip – Planning

- Direction from the Washington Commission Acknowledgement of the 2013 IRP:
  - "Continue to evaluate scenarios related to the continued operation of units 3 and 4 of the coal-fired generating facility in Colstrip, Montana. As a component of this evaluation, Avista should provide an assessment of the impact on rates of a hypothetical portfolio that does not include these units." (Docket No. UE-121421)

- Idaho Commission Acknowledgement
  - "We expect the Company to consider and discuss at the TAC meetings the various concerns and suggestions that are and have been offered. In particular, we expect the Company to monitor federal developments, such as the promulgation of federal environmental regulations, and to account for their impact in its resource planning. We also encourage the Company to continue exploring the use of DR as a resource, and to be actively involved in and apprise us of matters relating to Colstrip." (Order No. 32997)

2013 IRP Comments Regarding Colstrip

- No public comments received in Washington

- Summary comments to the Idaho PUC
  - Colstrip risks regarding continued operation:
    - Regional Haze
    - Greenhouse gas regulations
    - Permitting for prevention of significant deterioration
    - National Ambient Air Quality Standards
    - Mercury and Air Toxics Rule
    - Coal combustion wastes
    - Coal costs and the Rosebud mine
  - Colstrip retirement

Colstrip Ownership Information

Colstrip Basic Data			Colstrip Ownership Percentages					
Colstrip Unit #	Size (MW)	Year Online	Avista	NorthWestern Energy, LLC	PacifiCorp	Portland General Electric	PPL Montana, LLC	Puget Sound Energy
Unit #1	307	1975	0%	0%	0%	0%	50%	50%
Unit #2	307	1976	0%	0%	0%	0%	50%	50%
Unit #3	740	1984	15%	0%	10%	20%	30%	25%
Unit #4	740	1986	15%	30%	10%	20%	0%	25%
Total	2,094		11%	11%	7%	14%	25%	32%

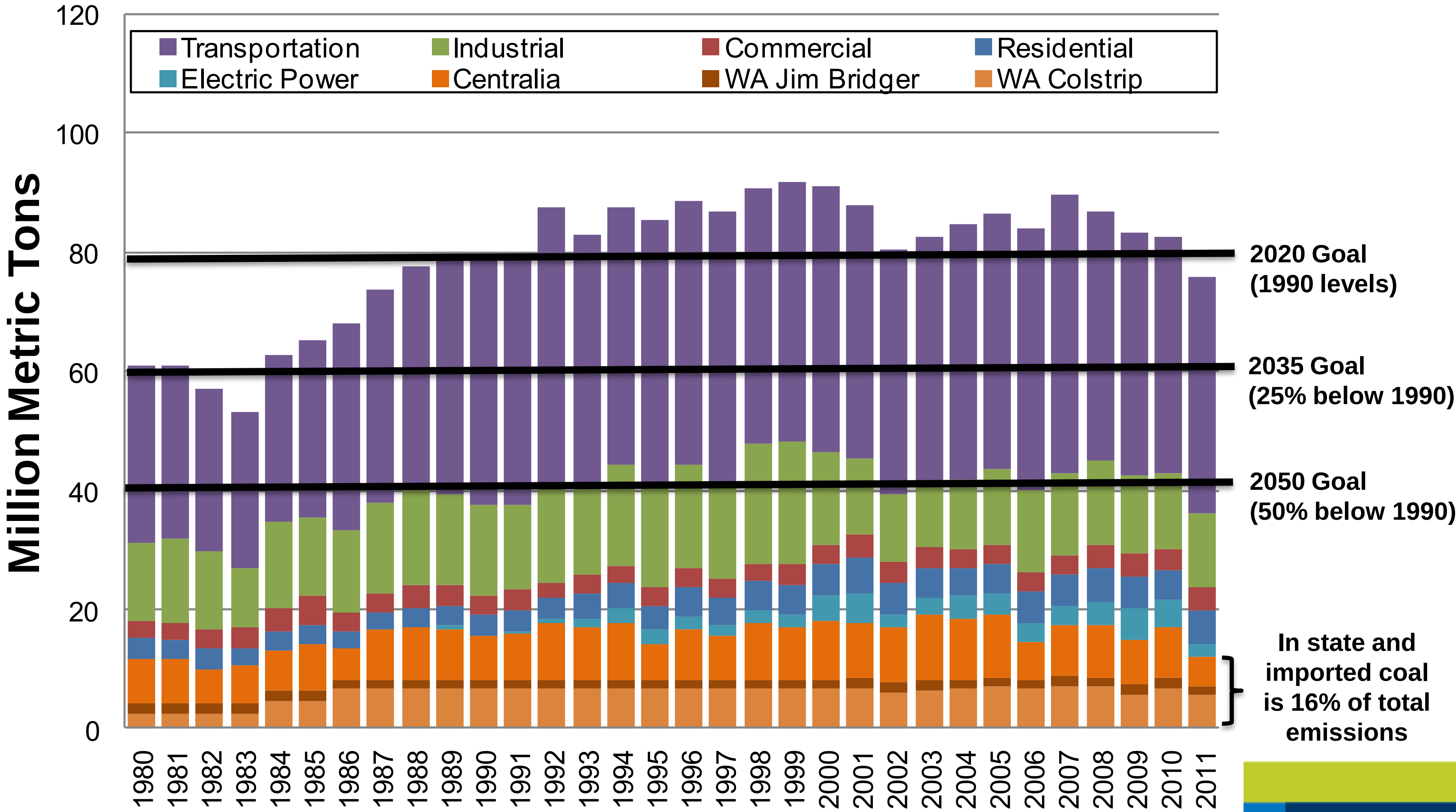
- 9% of Avista's owned and contracted capacity
- 14.86% of 2013 energy profile (Draft 2014 Washington Department of Commerce Fuel Mix Report)

Colstrip Economic Benefits

- The plant employs 360 people and the mine has 373 employees
- $104 million in annual Montana state and local taxes (4.5% of all state revenue collections)
- 3,740 additional jobs and 7,700 more residents in Montana
- $360 million in additional personal income
- $638 million more in additional Montana economic output
- Second lowest cost resource after hydroelectric for Avista
- Baseload resource with stable fuel price

Data from *The Economic Contribution of Colstrip Steam Electric Station Units 1-4,* November 2010.

Washington State Carbon Emissions & Goals



Source: EIA- does not include agriculture and waste management and estimates differ than WA Ecology

2015 Electric IRP Appendix A

Issues Related to Colstrip in this IRP

Modeling Assumptions:

- Greenhouse gas regulations:
  - emissions performance standards (CA, OR and WA)
  - 30% WECC-wide reduction identified pursuant to 111(d)
- National Ambient Air Quality Standards
- Mercury and Air Toxics Rule (HAPs)
- Regional Haze

Emerging Issues:

- Finalization of the 111(d) rule at the federal and state levels
- Coal combustion residuals
- Washington Executive Order 14-04
- Cost of closing the plant and continued use of the site

Colstrip Modeling in the 2015 IRP

Expected Case Assumptions:

- Assumes compliance with known environmental regulations (discussed in the previous slide)
- Expected Case assumptions do not speculate – alternatives considered under futures/scenarios studies
- Colstrip Units #3 – 4 in service through IRP modeling period
- Cost of carbon (to be discussed in the next presentation)

Draft Alternative Colstrip Scenarios:

- SCR on units 3 and 4 in 2025 and 2026
- No SCR, shut down units 3 and 4 by end of 2026

Carbon Prices in the 2015 Electric IRP

John Lyons, Ph.D.
Third Technical Advisory Committee Meeting
November 21, 2014

Background

- Washington:
  - "Incorporate a non-zero expected value cost of carbon into the Expected Case. Avista should also work with the Technical Advisory Committee to investigate incorporating a range of prospective carbon policies into the Expected Case stochastic analysis." (UE-121421 – 2013 IRP Acknowledgement Letter)
- Forms of carbon regulation:
  - Cap and trade: an example is AB 32 in California
  - Direct regulation: EPA proposal under 111(d), RCW 80.80
  - Carbon tax: British Columbia
  - Indirectly through an RPS
- Four cases plus two others selected by the TAC (Expected Case, Benchmark Case, 111(d) Case and No Colstrip Case)

State of Carbon Regulation

- No carbon prices for resources in our jurisdictions
- Washington goal of 50 percent below 1990 emissions by 2050, but no implementation strategy.
  - 970 pounds/MWh for new baseload resources (RCW 80.80)
- Emissions offset requirements for new baseload thermal resources in Oregon and Washington
- No carbon prices in Idaho
- Federal: 111(b) and 111(d) proposals
- Other jurisdictions modeled in WECC includes their applicable prices: British Columbia's carbon tax and California's AB32.

2013 IRP Expected Case Carbon Assumptions

- In the 2013 IRP, the implied cost of carbon in the expected case was $95.33 per metric ton.
  - Implied cost to the whole region from coal plant retirements and the cost to replace the lost capacity.
  - Avista's implied cost was much lower than the region because of no expected lost capacity from coal. Avista's implied cost included higher electric market prices ($1.79/MWh or 3.5%) due to the lost capacity between 2020-2033.
- Assuming the price adder is from a 7,000 heat rate natural gas-fired plant the implied 2013 IRP carbon price is $4.70/metric ton levelized between 2020-2033.

Draft 2015 Expected Case Assumptions

- Target 30% minimum reduction in carbon emissions rate from 2005 for plants covered under 111(d)
- Adjust load forecast assumption to include additional conservation
- 21% RPS for the region (not necessarily state-by-state)
- 10% probability of carbon cost adder to generation ($12 nominal in 2020 with 5% escalation)
- Options:
  - Will determine actionable measures needed to reduce existing plant emissions (rate or mass based)
  - Retire enough plants to hit 30% and calculate carbon price necessary to force retirement
  - Increased energy efficiency above utility forecasts
  - 2020 start date, but not the same EPA glide path
- Scenario Purpose: provides market prices and conditions used to determine the Preferred Resource Strategy

Benchmarking Case

- Assumes that 111(d) does not occur so we have a benchmark to show the costs of the 111(d) proposal and other carbon scenarios
- Maintains existing RPS, emissions performance standards, plant retirements and existing energy efficiency programs
- Scenario Purpose: only used to show costs and effects of the 111(d) proposal and regional haze programs

EPA 111(d) Draft Rule Case

- Assumes suggested adoption of EPA building blocks for each state in the WECC
- 21% RPS – state-level requirement
- 10.7% DSM – state-level requirement
- 6% heat rate improvements at coal plants
- Shut down of planned/announced coal retirements
- Caps EGU output to EPA level, with the exception of an adjustment for Langley Gulch to show a full year of output
- Scenario Purpose: shows the impacts of the 111(d) draft rule

No Colstrip Case

- Uses Expected Case assumptions, but removes Colstrip from the resource stack in 2026
- Does not make assumptions about why the plant is no longer available, but shows the costs and how it would be replaced
- Scenario Purpose: answers question posed by the Washington Commission in the 2013 IRP acknowledgement letter

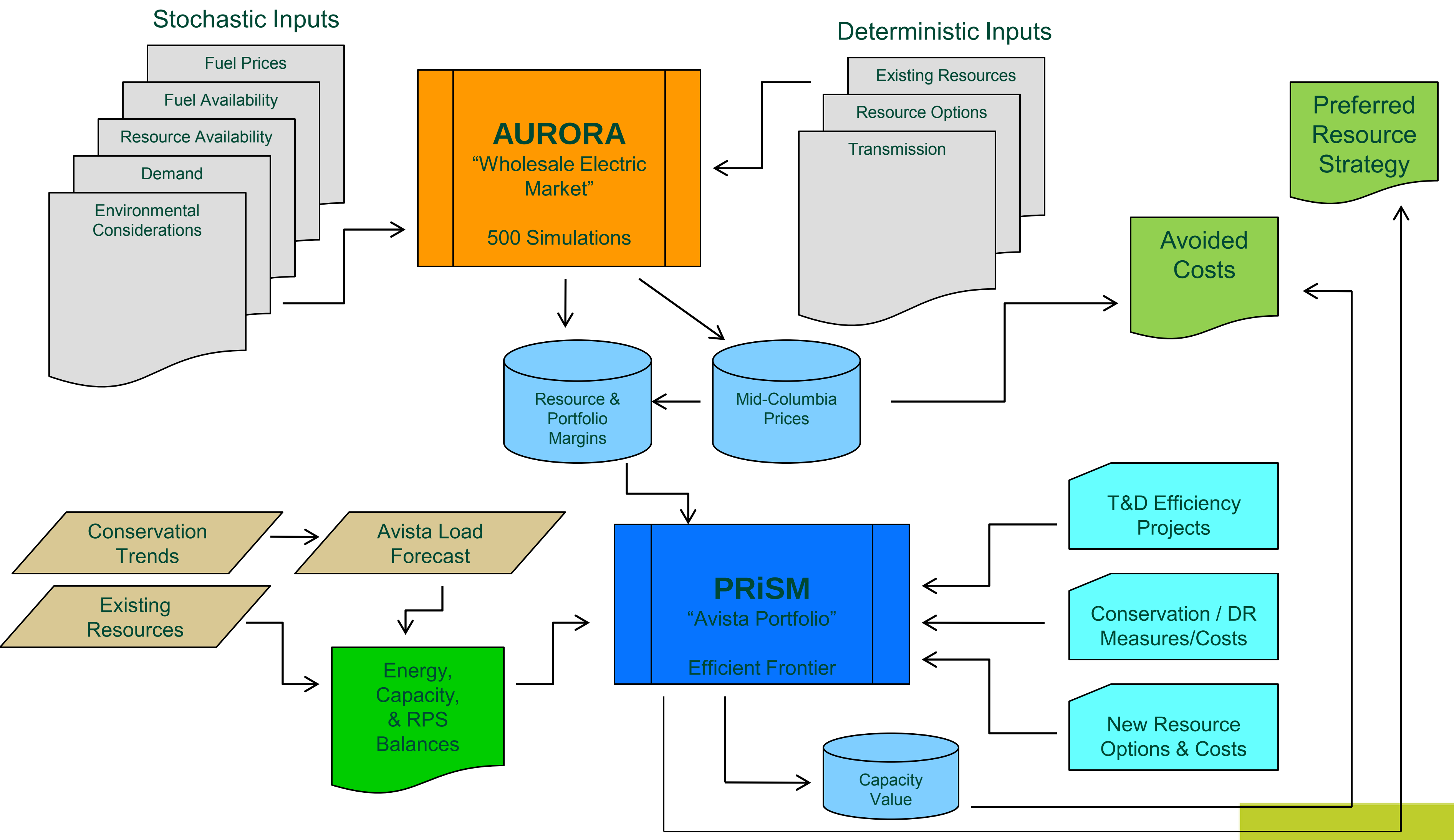
Other Potential Cases for Discussion

- Regional cap and trade for carbon emissions
- Coal limitations without retirement
- All U.S. WECC coal retires by a certain date
- Social cost of carbon as a price adder

2013 IRP Modeling Approach

James Gall
Third Technical Advisory Committee Meeting
November 21, 2014

2015 IRP Modeling Process



Electric Market Modeling

AURORAxmp by EPIS, Inc.
COMPREHENSIVE POWER FORECASTING

- 3rd party software- EPIS, Inc.
- Electric market fundamentals- production cost model
- Simulates generation dispatch to meet load
- Outputs:
  - Market prices
  - Regional energy mix
  - Transmission usage
  - Greenhouse gas emissions
  - Power plant margins, generation levels, fuel costs
  - Avista's variable power supply costs

AVISTA

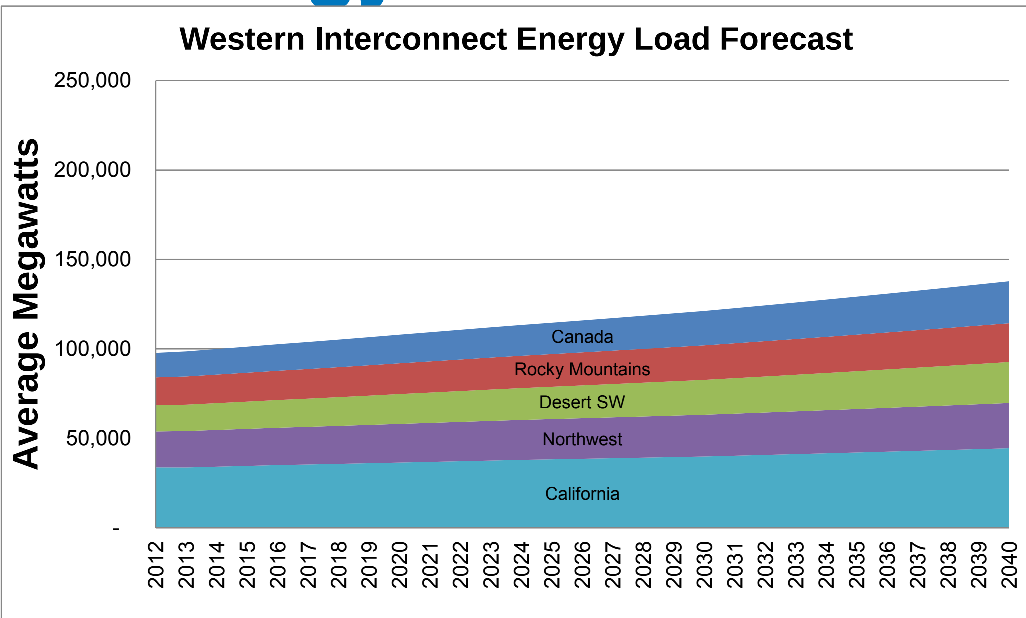
AURORA Inputs

- Regional loads
- Fuel prices
- Hydro levels
- Wind variation
- Environmental resolutions
- Resource availability
- Transmission

Regional Loads

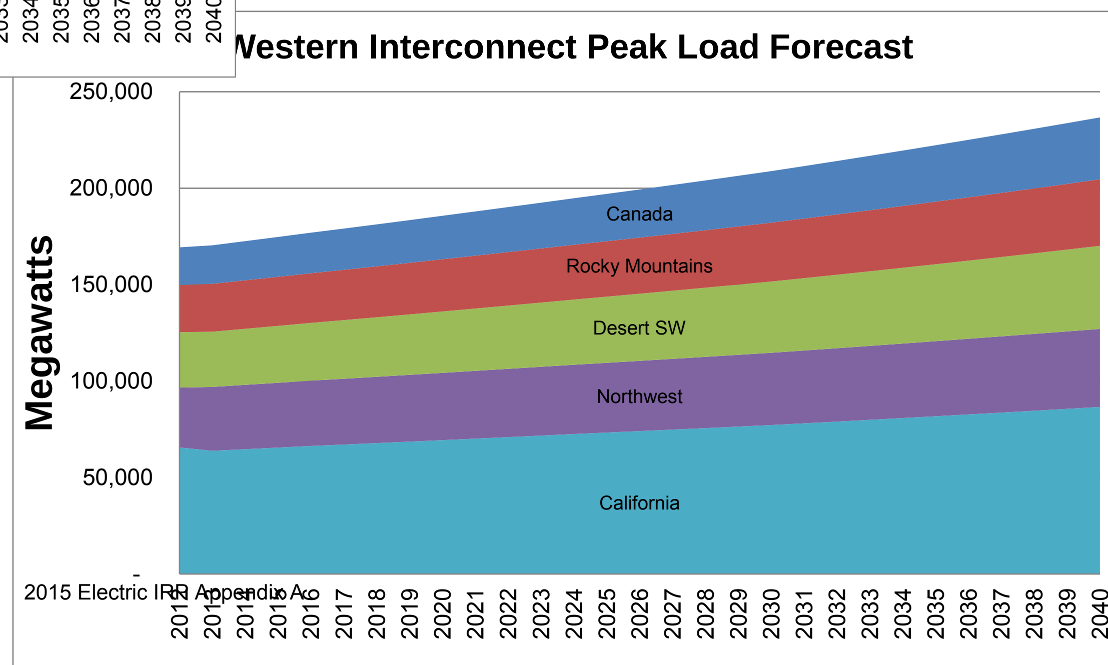
- Forecast load growth for all regions in the Western Interconnect
- Consider both peak and energy
- Use regional published studies and public IRP's
- Stochastic modeling simulates load changes due to weather and considers regional correlation of weather patterns
- Load changes due to economic reasons are difficult to quantify and are usually picked up as IRP's are published every two years
- Peak load is becoming more difficult to quantify as "Demand Response" programs my cause data integrity issues
- Energy demand forecasts need to be net of conservation

Energy & Peak Forecast (draft)



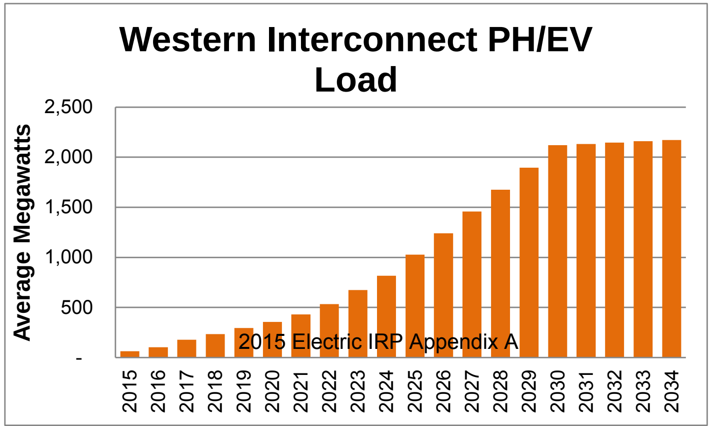
Energy	AAGR
Canada	1.95%
Rocky Mtns.	1.18%
Desert SW	1.61%
California	0.99%
Northwest	0.82%

Peak	AAGR
Canada	1.80%
Rocky Mtns.	1.23%
Desert SW	1.46%
California	1.00%
Northwest	0.95%



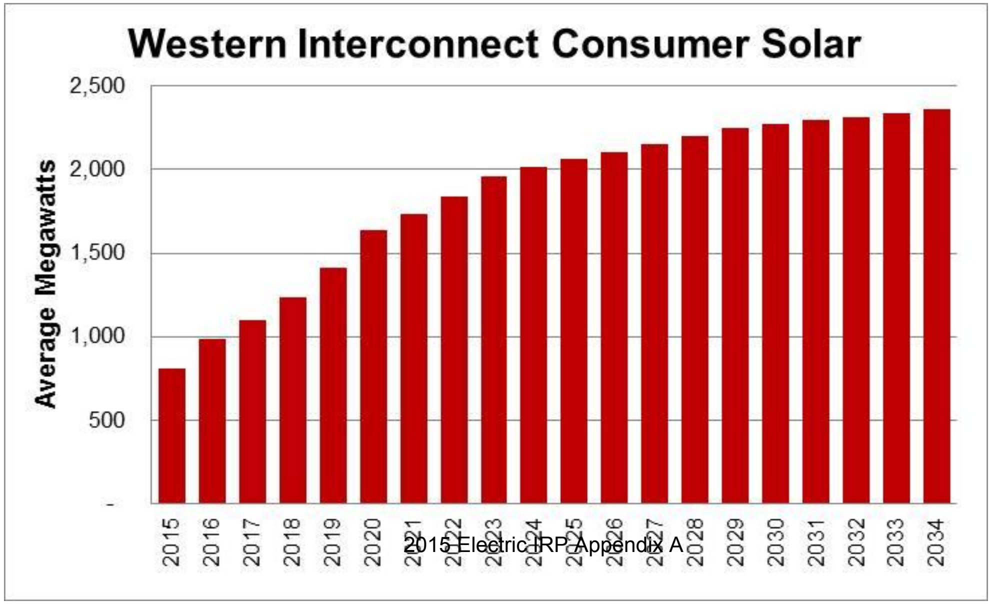
Electric Vehicles (PH/EV)

- Customer load shapes will be a result of PHEV
- To address this- a load adder will be applied to reflect new demand with a majority of load added in off peak hours
- By 2030 the following are the percent of vehicle sales,
  - 25%: CA
  - 15%: AZ, CO, OR, WA
  - 10%: NM, NV,UT
  - 5%: WY, MT, ID
- Beyond 2030 growth is equal to traditional vehicle growth (1/2 of population growth)



Rooftop Solar

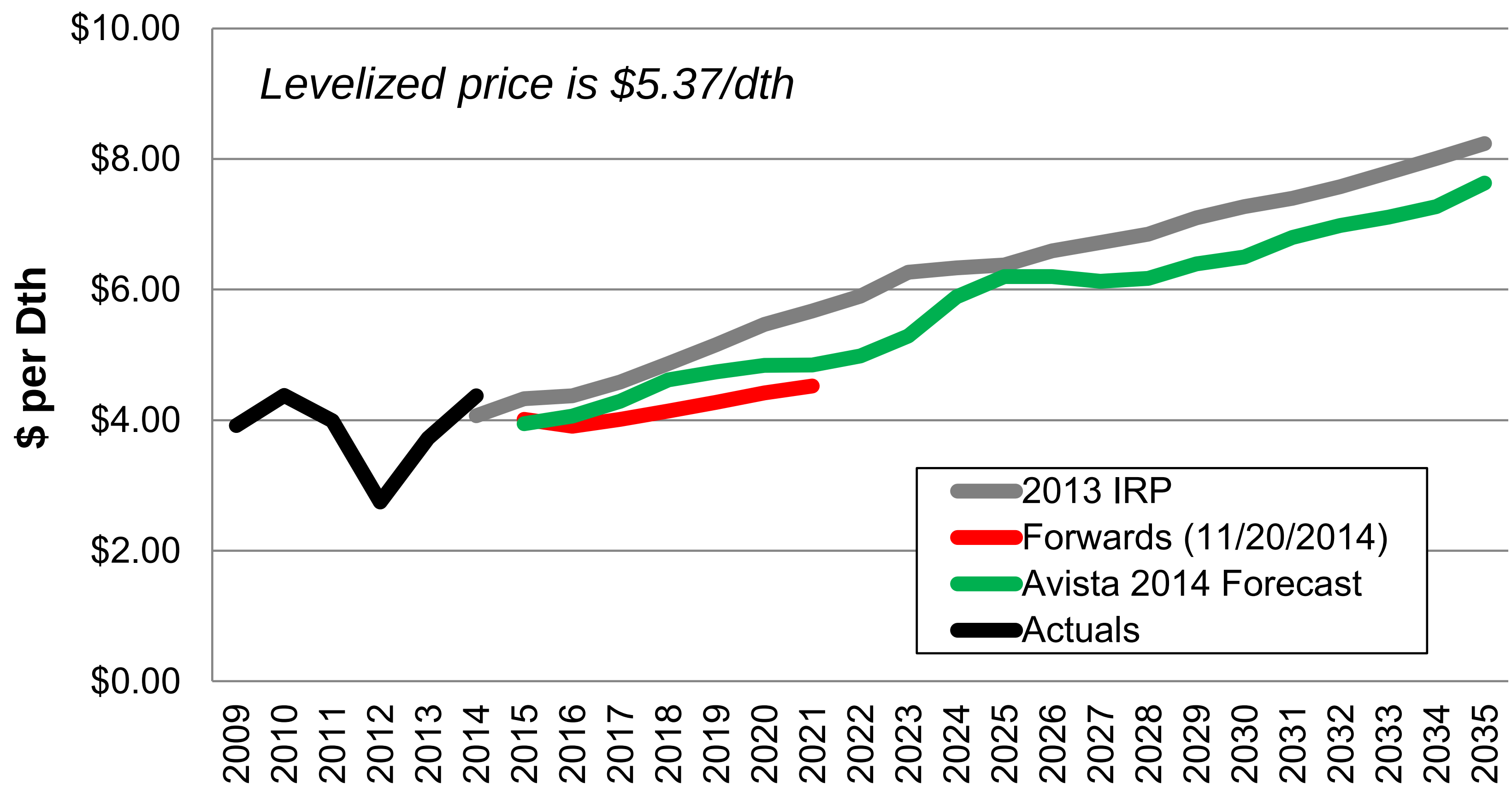
- As with PH/EV, rooftop solar will impact future load growth and its hourly profile
- Future growth will be dependent upon policy choices
- Assumes 20-40% growth, before leveling off to long run growth 1-3% in 2020's



Natural Gas Prices

- Natural gas prices are one of the most difficult inputs to quantify
- A combination of forward prices and consultant studies will be used as the “Expected Case” for this IRP. This work should be complete by December 2014
- 500 different prices using an auto regressive technique will be modeled, the mean value of the 500 simulations will be equal to the “Expected Case” forecast
- A controversial input for these prices is the amount of variance within the 500 simulation.
  - Historically prices were highly volatile, recent history is more stable
  - Final variance estimates will look at current market volatility and implied variance from options contracts

Henry Hub Natural Gas Prices *



* Based on methodology described above, to be updated

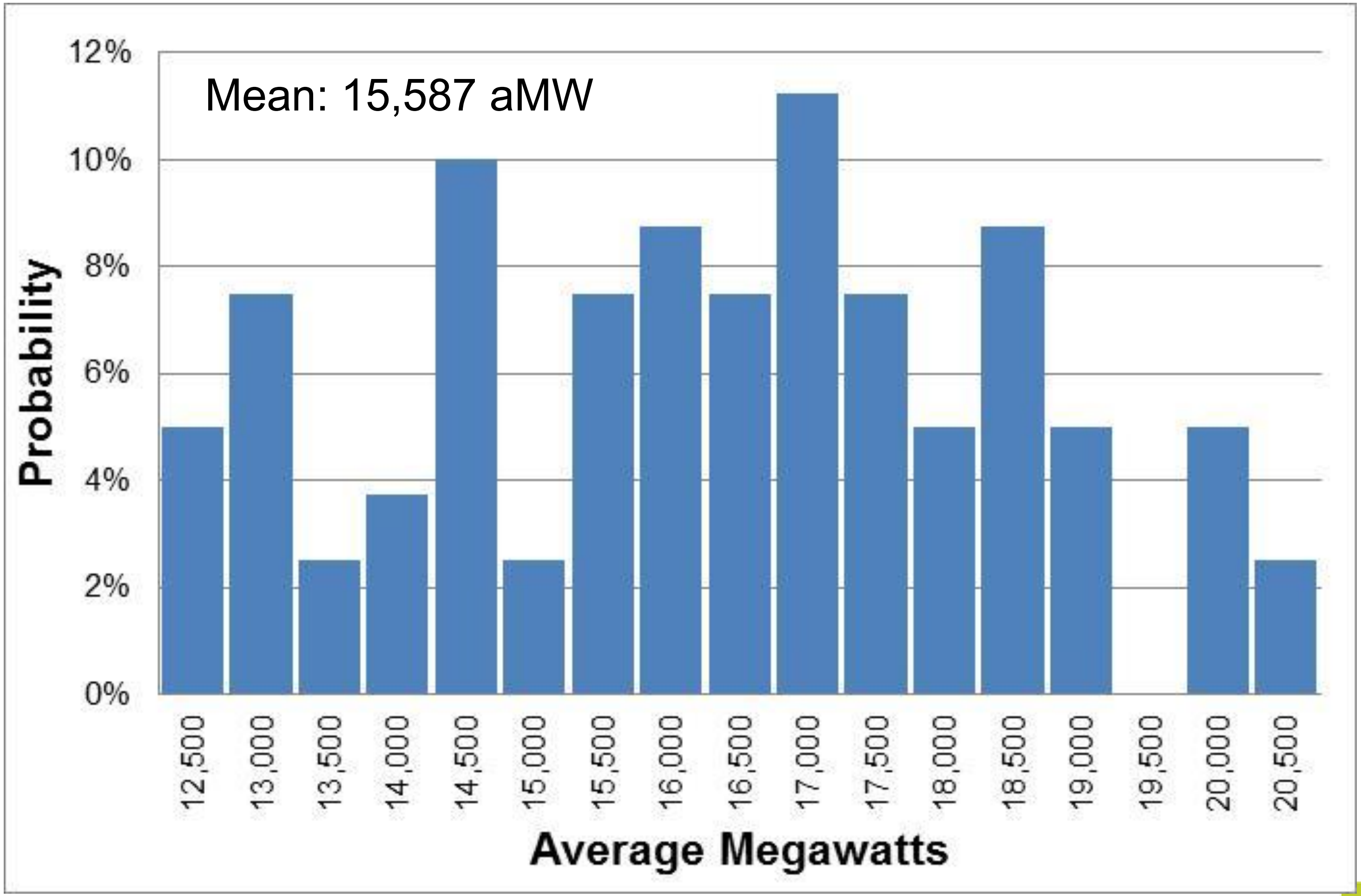
Coal Prices

- With lower natural gas prices and EPA regulations the demand for US based coal is lower, but potential exports may stabilize the industry
- Western US coal plants typically have long-term contracts and many are mine mouth
- Rail coal projects are subject to diesel price risk
- Prices will be based on review of coal plant publically available prices and EIA mine mouth and rail forecasts

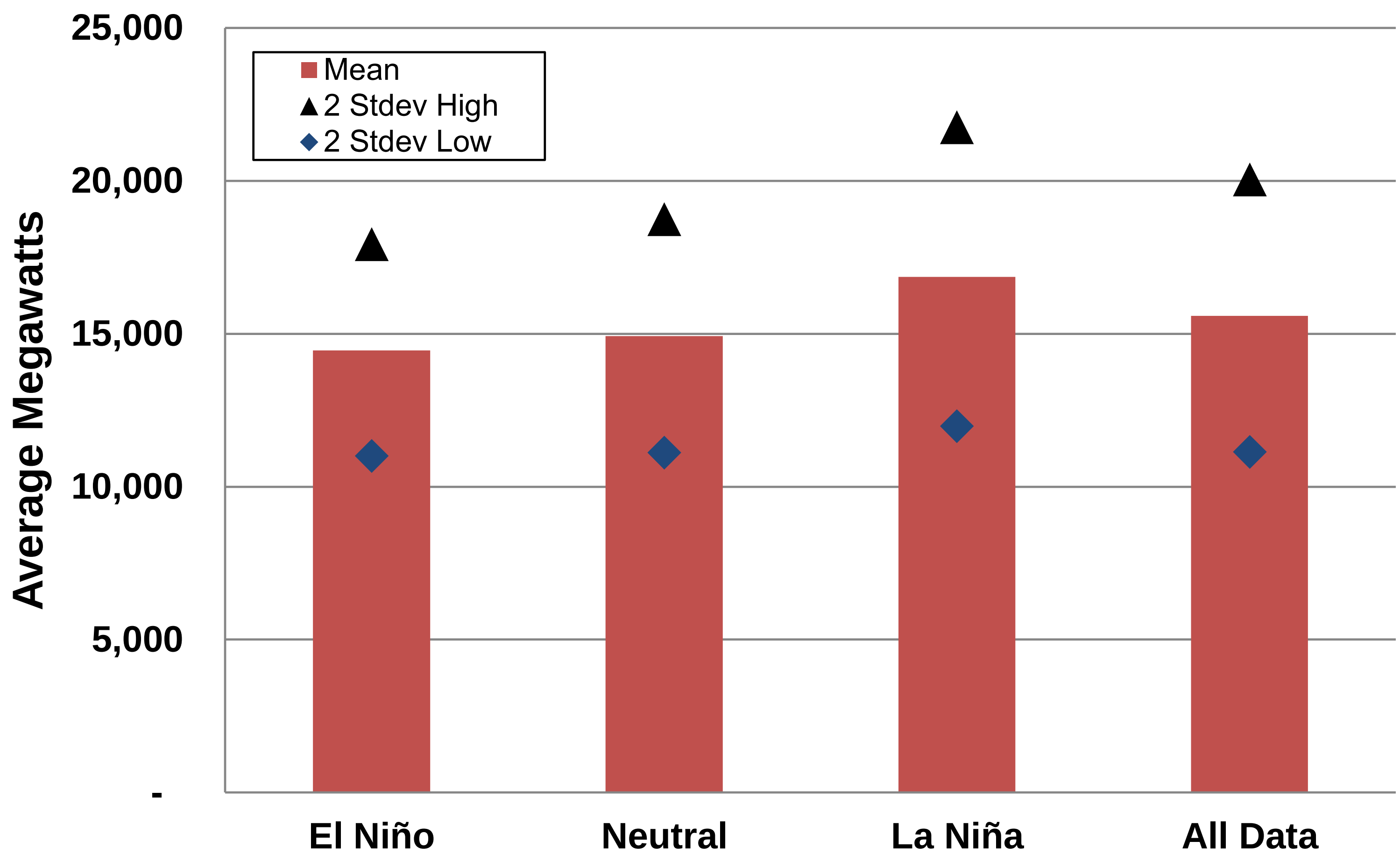
Hydro

- 80 years of hydro conditions are used for the Northwest states, British Columbia and California provided by BPA
  - Hydro levels change monthly
  - AURORA dispatches the monthly hydro based on whether its run-of-river or storage.
- For stochastic studies the hydro levels will be randomly drawn from the 80-year record
- A new Columbia River Treaty could change regional hydro patterns, but until there is resolution, no changes will be included

Northwest State Hydro Volatility



Northwest Hydro Variability (1929-2008)

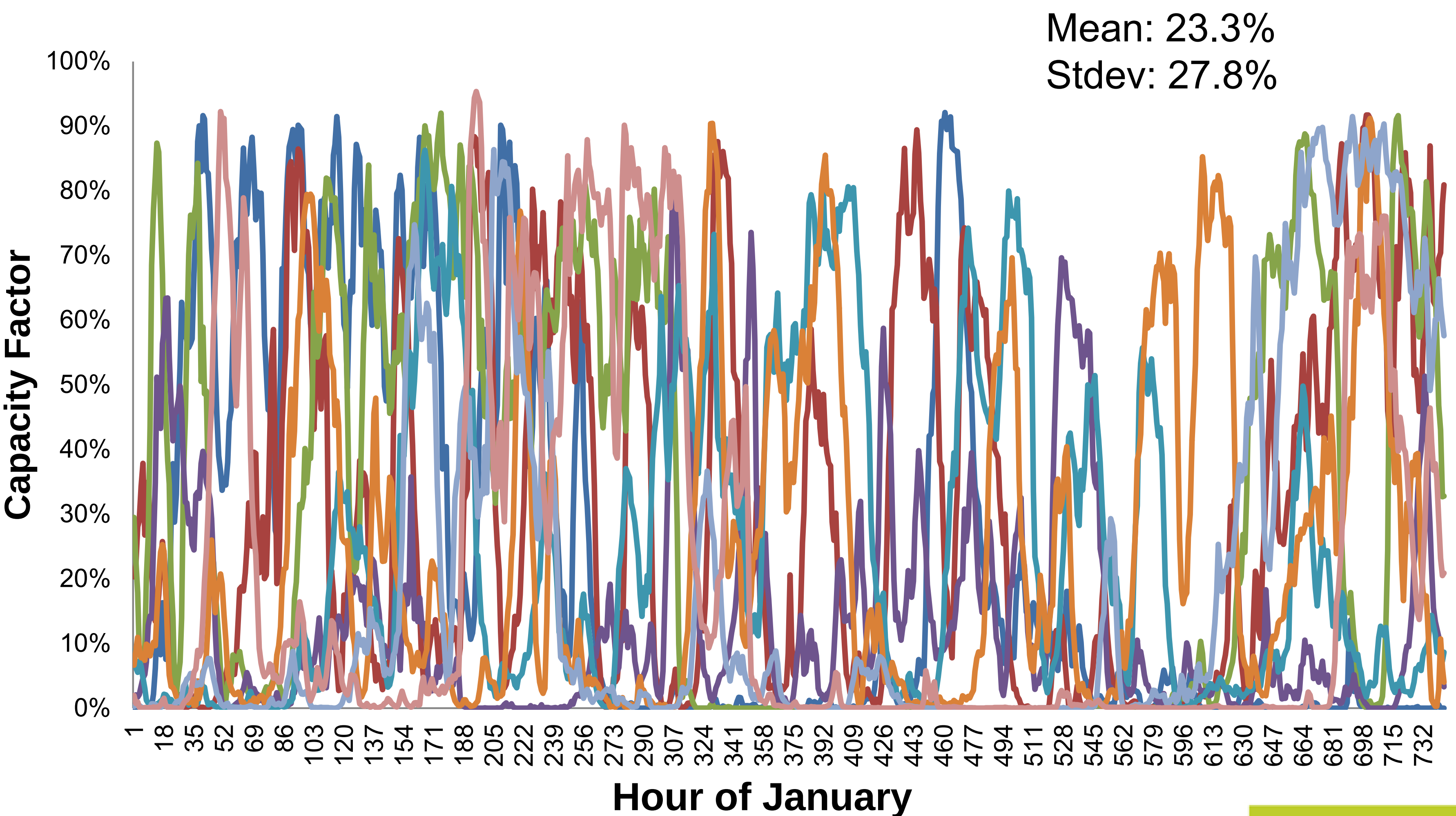


Annual Probability	28%	52%	20%

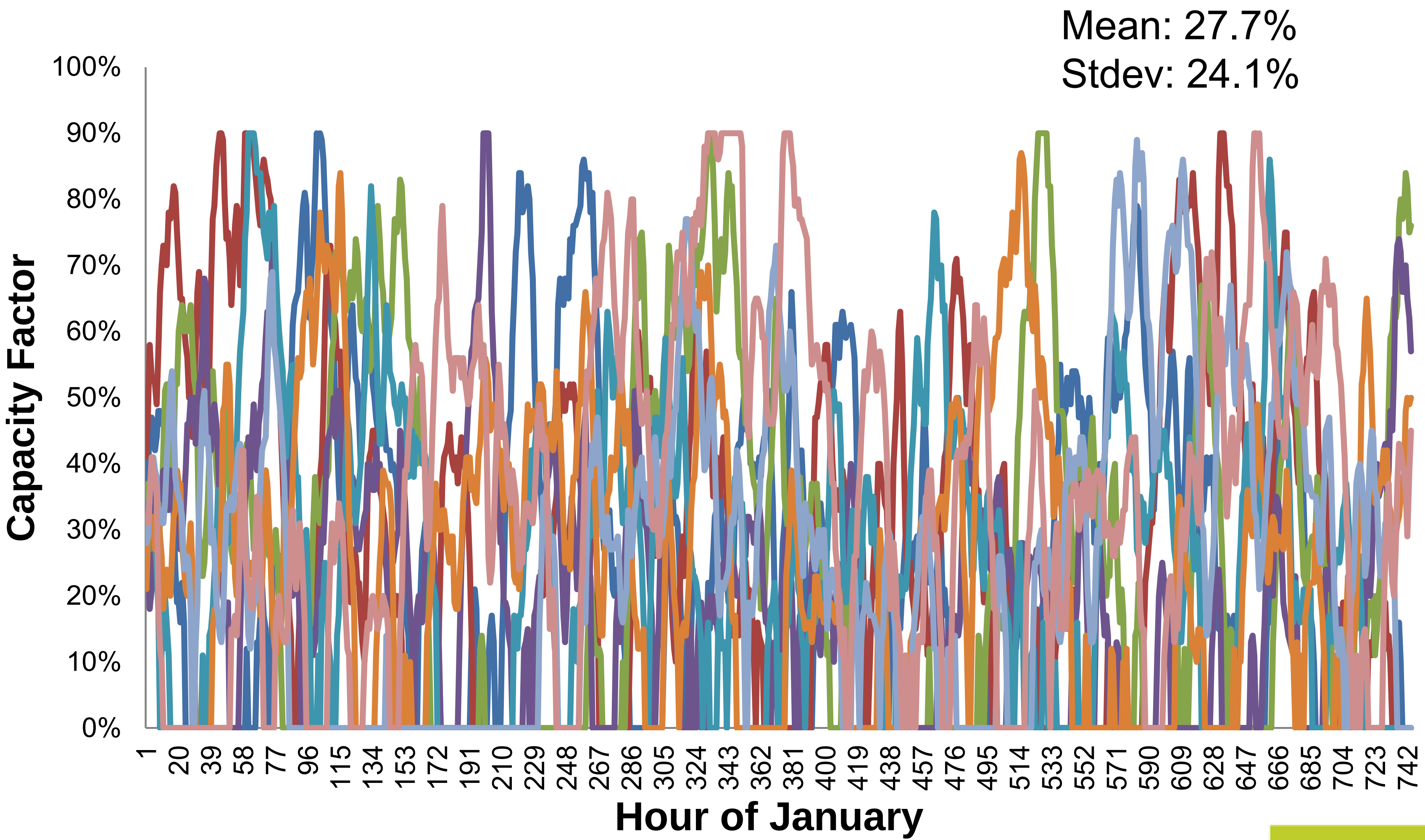
Wind

- Wind generation in the Northwest's is the fastest growing resource type
- RECs and PTC's have caused wind facilities to economically generate in oversupply periods in the Northwest- particularly in the spring months
- Wind is modeled using an autoregressive technique to simulate output in similar to reported data available from BPA, CAISO, and other publically available data sources- also considers correlation between regions
- For stochastic studies several wind curves, will be drawn from to simulate variation in wind output each year

Wind Generation Profile (January 2007-14 from BPA)

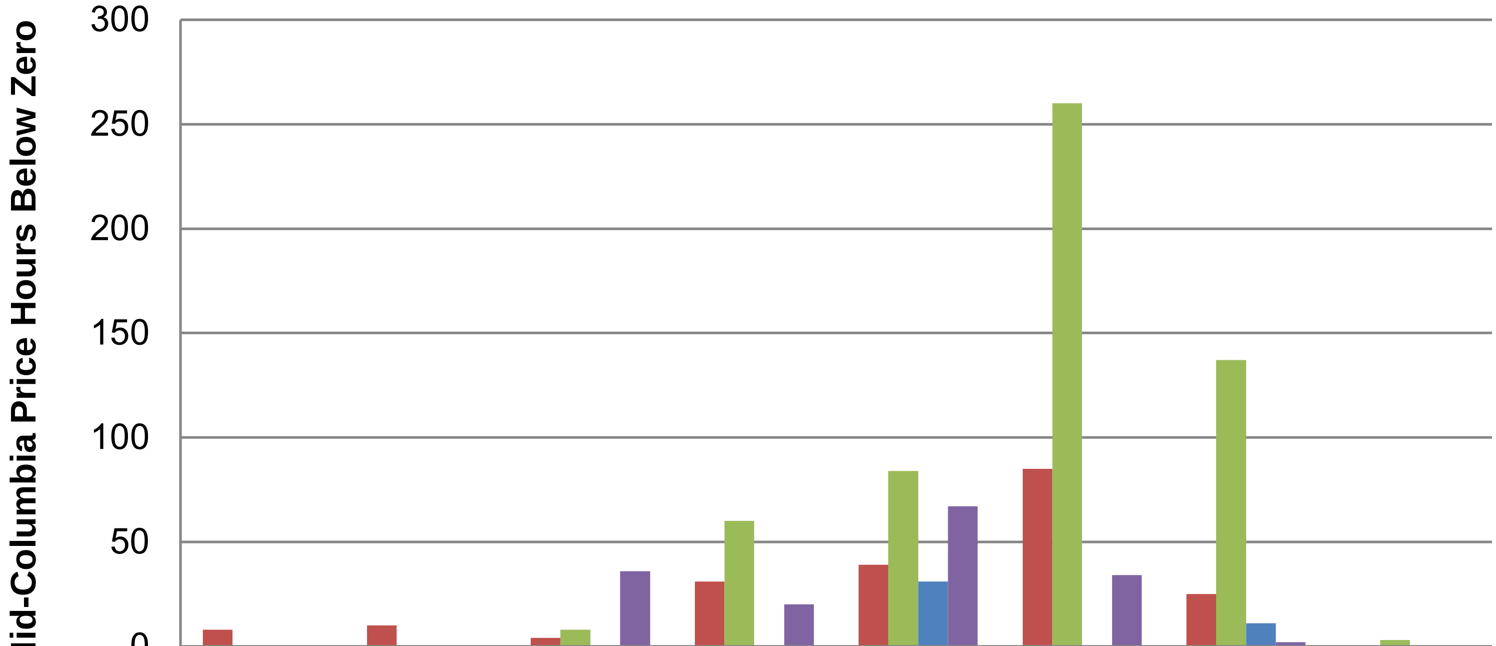


Modeled Wind Generation Profile



Oversupply

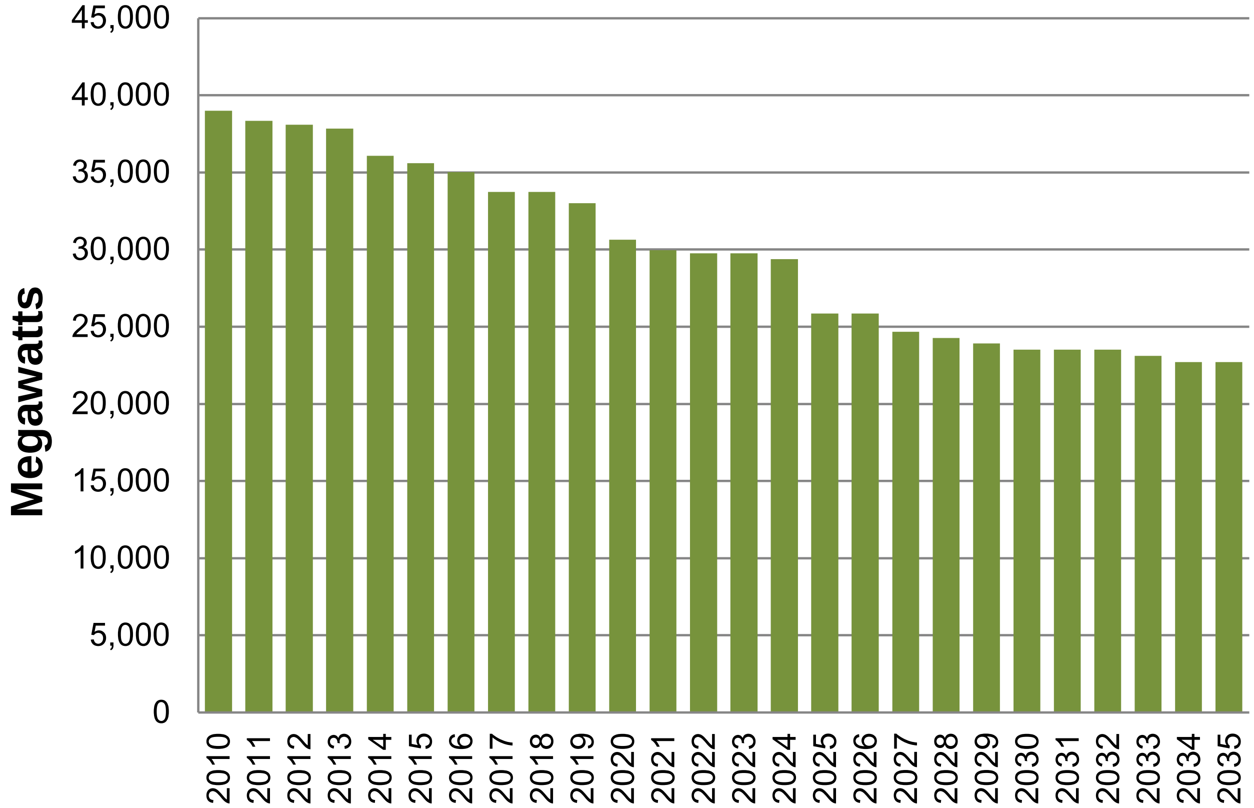
Hours Mid-Columbia Prices Were Less Than $0/MWh



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
2011	8	10	4	31	39	85	25	0	202
2012	0	0	8	60	84	260	137	3	552
2013	0	0	0	0	31	0	11	0	42
2014	0	0	36	20	67	34	2	0	159

Source: Powerdex daily average prices- substantially more hours had trades with negative pricing

Western Interconnect Coal Capacity Forecast

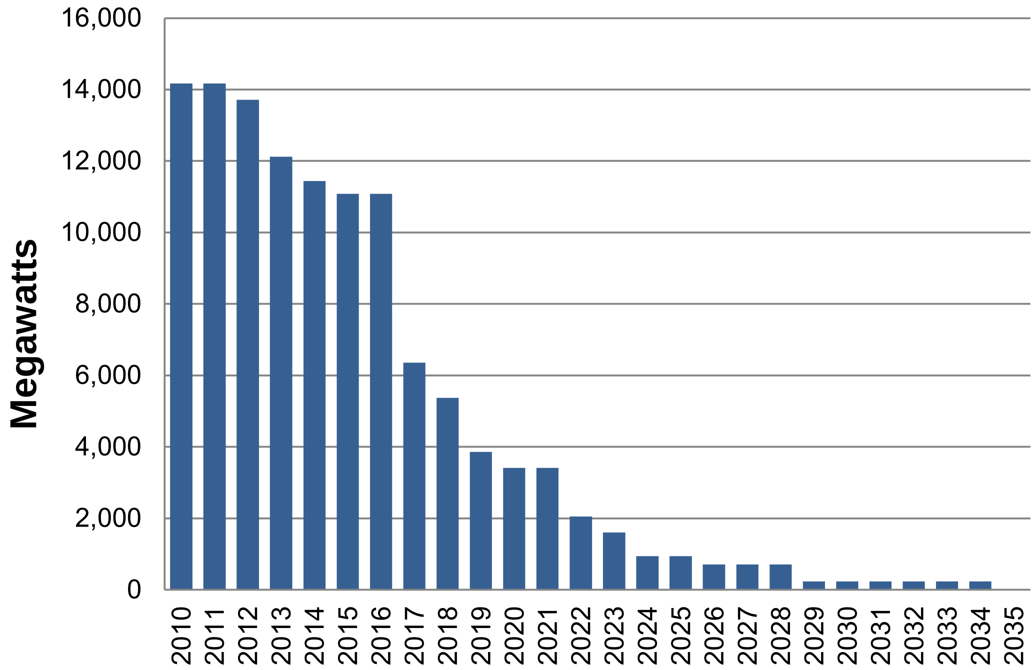


- Announced retirements are 42% of coal plant capacity in the west between 2010 and 2035

Cooling Water Issues

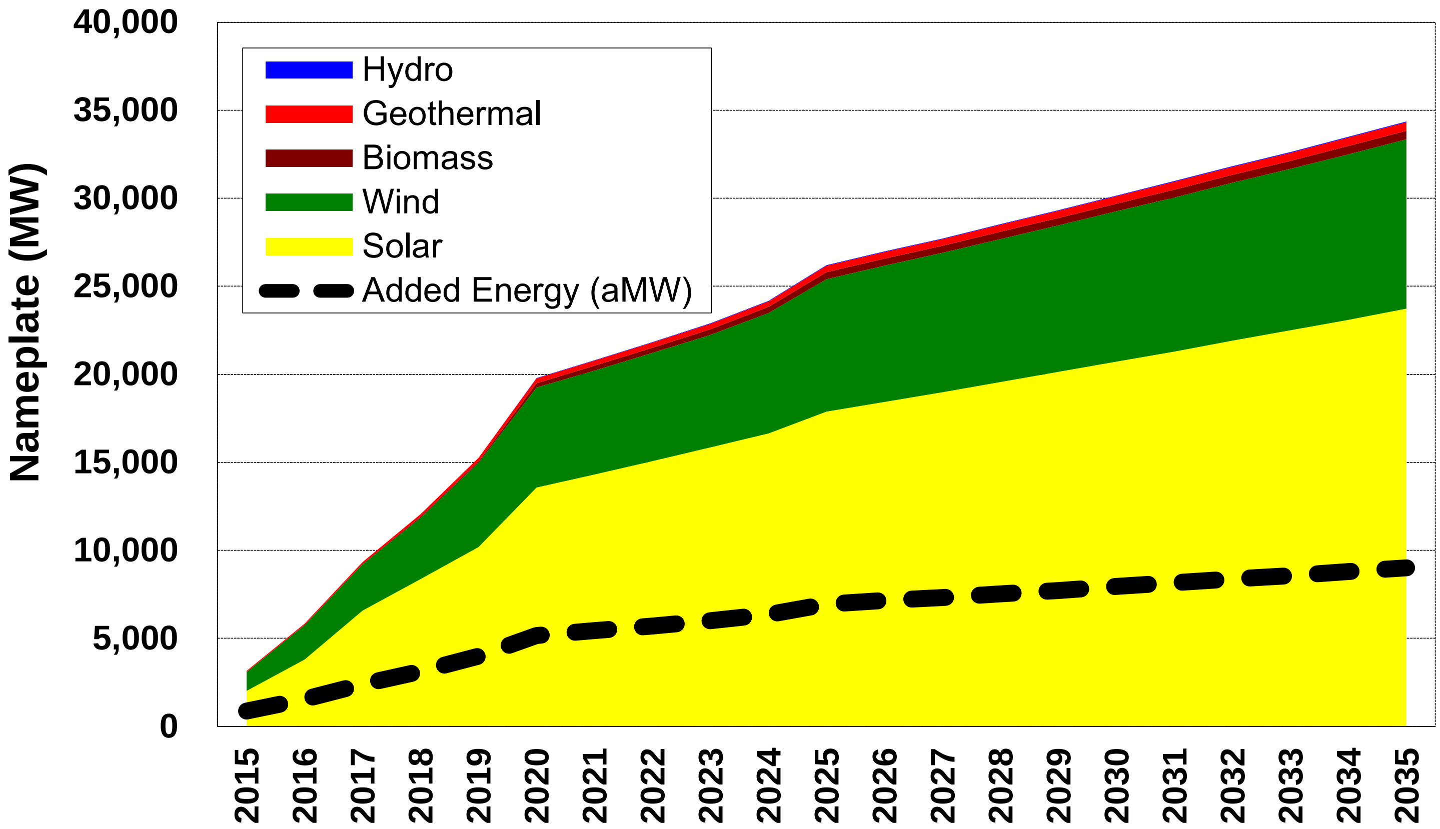
- Once-through cooling
  - California plants with this cooling technology must be converted to alternative cooling methods or retired
  - For modeling purposes: older natural gas units will be retired and Diablo Canyon will be retrofitted
- Traditional water cooling
  - New NG resources are finding it more difficult to use water cooling- for new resources air cooling will be assumed

Once-Through Cooling Affect



- 14,167 MW of natural gas plants in California are affected by once-through-cooling rules
- Represents 29% of California's natural gas fleet

Western State's Renewable Portfolio Standards Capacity/Energy Forecast



PRiSM- Preferred Resource Strategy Model

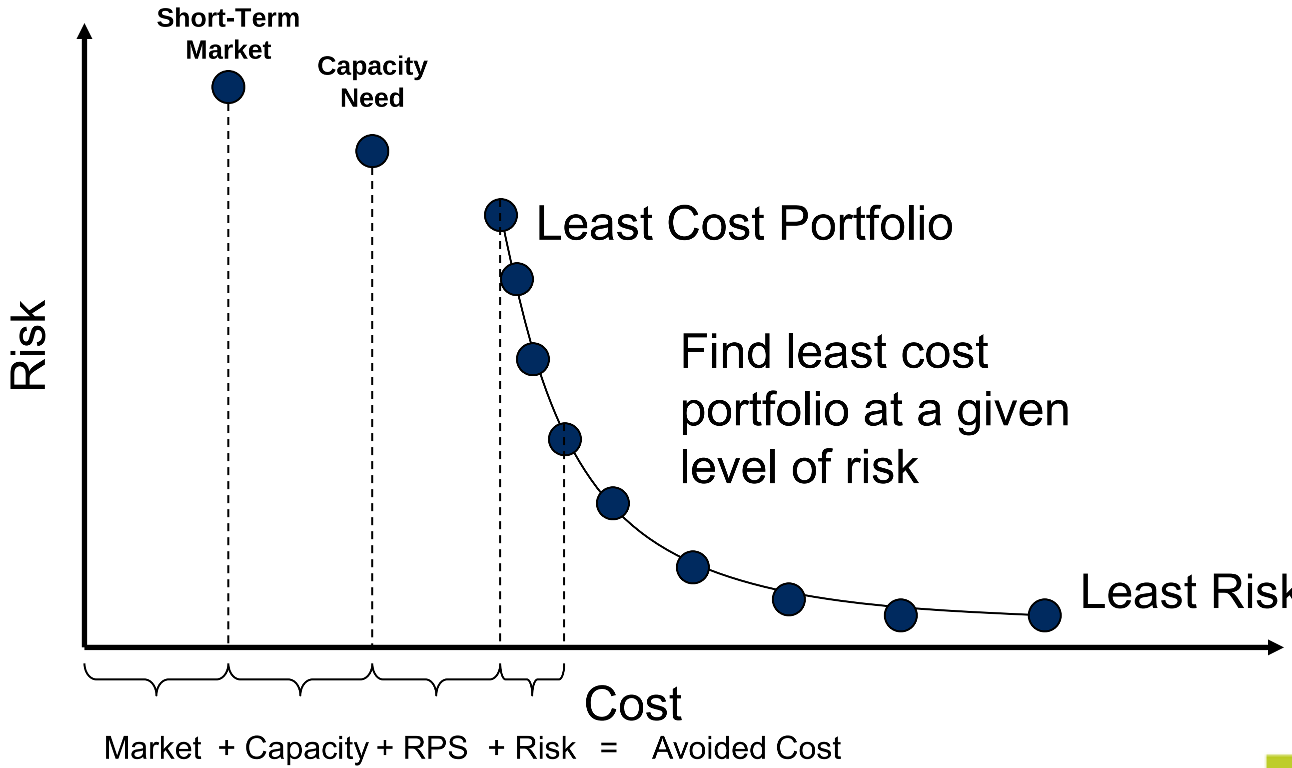
- Internally developed using Excel based linear/mixed integer program model (What's Best)
- Selects new resources to meet Avista's capacity, energy, and renewable energy requirements
- Outputs:
  - Power supply costs (variable and fixed)
  - Power supply costs variation
  - New resource selection (generation/conservation)
  - Emissions
  - Capital requirements

PRiSM

- Find optimal resource strategy to meet resource deficits over planning horizon
- Model selects its resources to reduce cost, risk, or both.
- Objective Function:
  - Minimize: Total Power Supply Cost on NPV basis (2016-2054)- Focus on first 20 years of the plan
  - Subject to:
    - Risk level
    - Capacity need +/- deviation
    - Energy need +/- deviation
    - Renewable portfolio standards
    - Resource limitations, sizes, and timing

Efficient Frontier

- Demonstrates the trade off of cost and risk
- Avoided Cost Calculation



Conservation Potential Assessment

Technical Advisory Committee Meeting

November 21, 2014

Outline

Study Approach

LoadMAP Overview

Market Characterization

Baseline Projection

Measure Development

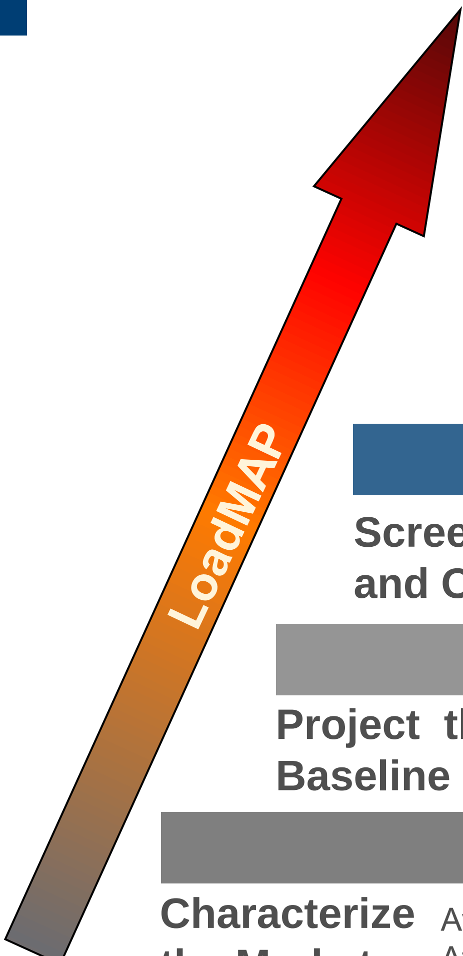
Ramp Rate Development

Economic Screening

Potential Results

Consistency with Council Methodology

Study approach



Study results

Synthesize Sensitivity analysis

Achievable potential

Establish Customer Acceptance
Avista programs Other studies
Market acceptance/ramp rates

Technical and economic potential

Screen Measures and Options
Measure descriptions
Avista avoided costs
Avista program data
NWPCC/RTF workbooks

End-use forecast by segment

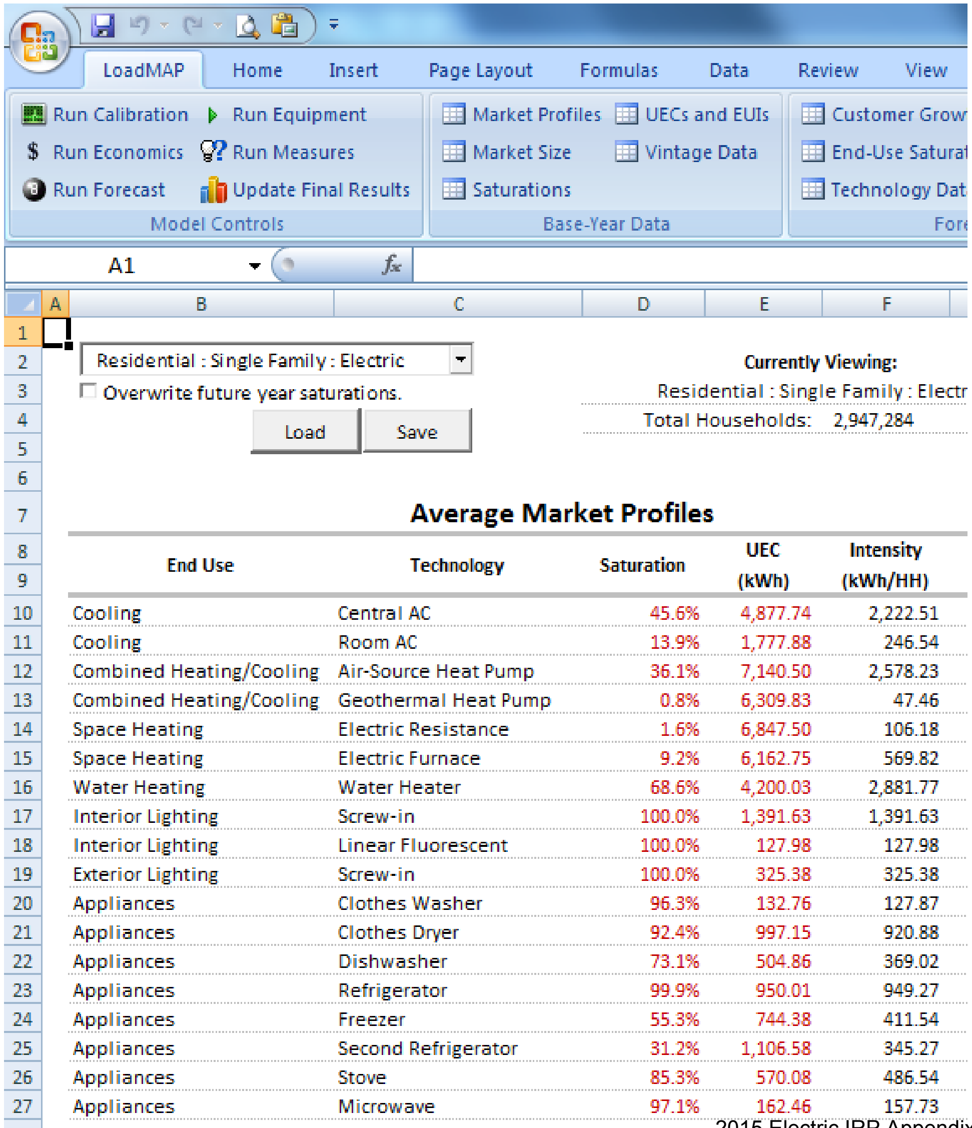
Project the Baseline
Prototypes and energy analysis (***BEST***)
Codes and standards
RTF data
Avista forecast data
Secondary data

Base-year energy use by segment

Characterize the Market
Avista billing data
Avista GenPOP, RBSA, CBSA
Avista program data and other surveys
Energy Market Profiles
Secondary data
Previous study results

Study objectives

LoadMAP™ analysis tool



Average Market Profiles

End Use	Technology	Saturation	UEC (kWh)	Intensity (kWh/HH)
Cooling	Central AC	45.6%	4,877.74	2,222.51
Cooling	Room AC	13.9%	1,777.88	246.54
Combined Heating/Cooling	Air-Source Heat Pump	36.1%	7,140.50	2,578.23
Combined Heating/Cooling	Geothermal Heat Pump	0.8%	6,309.83	47.46
Space Heating	Electric Resistance	1.6%	6,847.50	106.18
Space Heating	Electric Furnace	9.2%	6,162.75	569.82
Water Heating	Water Heater	68.6%	4,200.03	2,881.77
Interior Lighting	Screw-in	100.0%	1,391.63	1,391.63
Interior Lighting	Linear Fluorescent	100.0%	127.98	127.98
Exterior Lighting	Screw-in	100.0%	325.38	325.38
Appliances	Clothes Washer	96.3%	132.76	127.87
Appliances	Clothes Dryer	92.4%	997.15	920.88
Appliances	Dishwasher	73.1%	504.86	369.02
Appliances	Refrigerator	99.9%	950.01	949.27
Appliances	Freezer	55.3%	744.38	411.54
Appliances	Second Refrigerator	31.2%	1,106.58	345.27
Appliances	Stove	85.3%	570.08	486.54
Appliances	Microwave	97.1%	162.46	157.73

- **LoadMAP stands for Load Management, Analysis and Planning**
  - Analyzes EE, DR, distributed generation/renewables and electricification trends
  - Used for more than 40 potential assessments in last six years
- **LoadMAP modeling features**
  - Embodies principles of rigorous end-use models (like EPRI's REEPS and COMMEND)
  - Uses stock-accounting
  - Uses a simple decision logic
  - Models are customized by end use
- **User friendly and transparent algorithms:**
  - Excel-based model
  - Can easily update all assumptions and results flow through to pre-formatted charts and tables
  - Conduct sensitivity analysis
  - Answer what-if questions from senior management

Segmentation for the CPA

Dimension	Segmentation Variable	Dimension Examples
1	State	Washington and Idaho
2	Sector	Residential, Commercial, Industrial
3	Segment	Residential: by housing type and income
		Commercial: by building type
		Industrial: as a whole
4	Vintage	Existing and new construction
5	End uses	Cooling, heating, ventilation, lighting, water heat, refrigeration, motors, etc. (customized for each sector)
6	Appliances/end uses and technologies	Technologies such as lamp type, air conditioning equipment, motors by size, etc.
7	Equipment efficiency levels for new purchases	Baseline efficiency and an array of higher-efficiency options as appropriate for each technology

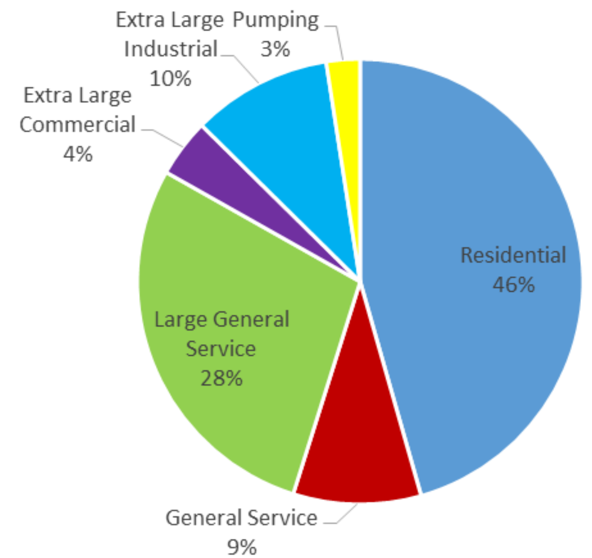
We begin with a high-level market characterization

Source: Avista 2012 CPA

Washington	Customers	2013 Electricity Sales (GWh)
Residential	200,134	2,452
General Service	27,142	416
Large General Service	3,352	1,557
Extra Large Commercial	9	266
Extra Large Industrial	13	614
Pumping	2,361	136
Total	**233,011**	**5,440**

Idaho	Customers	2013 Electricity Sales (GWh)
Residential	99,580	1,182
General Service	19,245	323
Large General Service	1,456	700
Extra Large Commercial	3	70
Extra Large Industrial	6	196
Pumping	1,312	59
Total	**121,602**	**2,530**

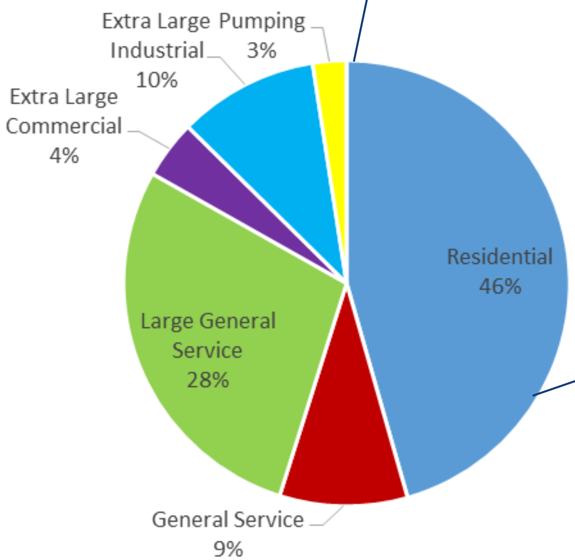
Avista (WA and ID)	Customers	2013 Electricity Sales (GWh)
Residential	299,714	3,634
General Service	46,387	739
Large General Service	4,808	2,257
Extra Large Commercial	12	336
Extra Large Industrial	19	810
Pumping	3,673	195
Total	**354,613**	**7,970**



We disaggregate sectors into most important segments

Source: Avista 2012 CPA

Residential Avista Total	Number of Customers	Annual Use (GWh)	% of Sales	Intensity (kWh/HH)
Single Family	168,339	2,399	66%	14,251
Multi Family	23,456	202	6%	8,612
Mobile Home	10,022	128	4%	12,772
Low Income	97,896	905	25%	9,245
Total	299,714	3,634	100%	12,125



We develop energy market profiles for each sector

Source: Avista 2012 CPA

Market profiles characterize how customers use energy in the base year.

- All buildings/dwellings
- New construction

Basic Equation:

$$Energy = \sum_{e} (N \times Sat_e \times UEC_e)$$

where

Energy	=	annual energy use
e	=	equipment technology
N	=	number of homes
Sat_e	=	saturation of homes with the equip
UEC_e	=	unit energy consump in homes with the equipment present

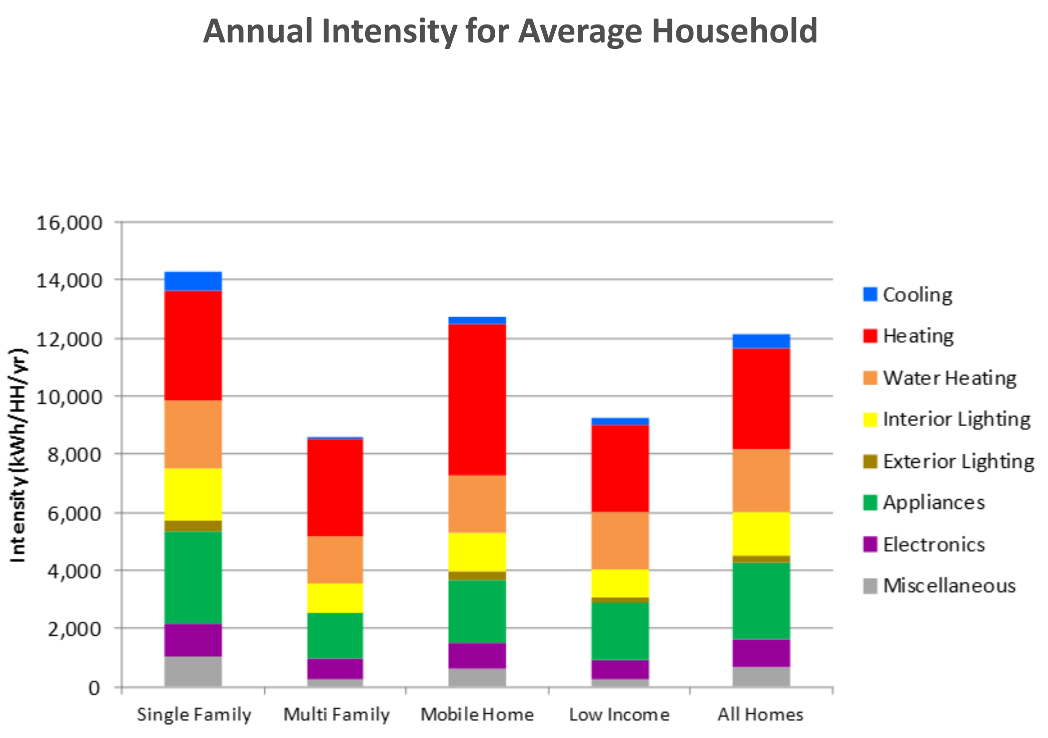
This sample market profile is captured from LoadMAP. Saturations and UECs are inputs to the model. LoadMAP calculates the intensity and usage. Values shown in the Total line match the market characterization control totals.

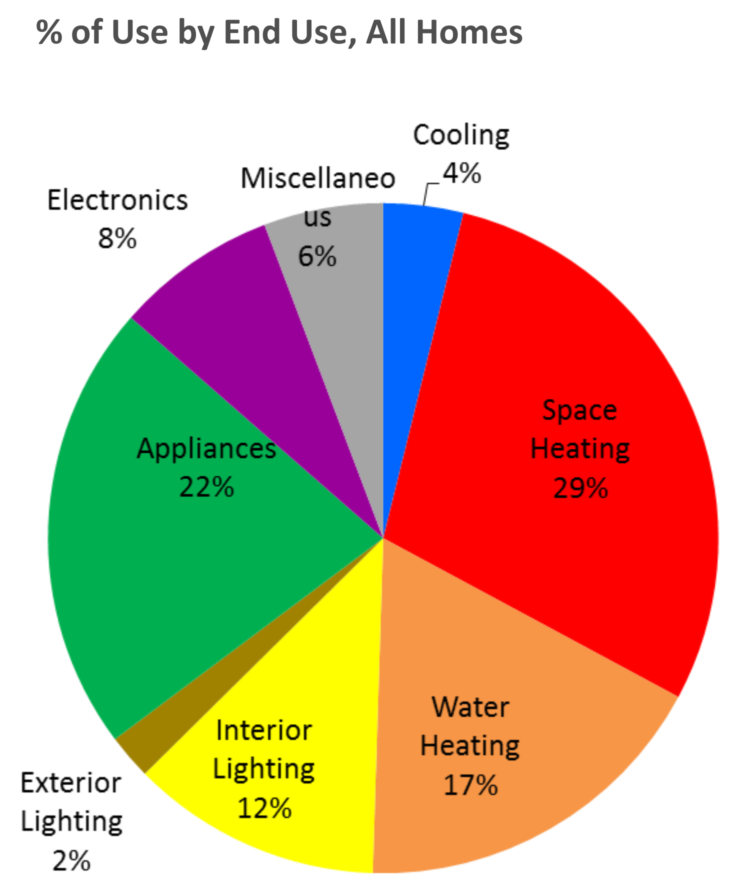
Average Market Profiles - Washington

End Use	Technology	Saturation	UEC (kWh)	Intensity (kWh/HH)	Usage (GWh)
Cooling	Central AC	28.6%	1,150	330	66
Cooling	Room AC	20.7%	360	75	15
Cooling	Air Source Heat Pump	16.3%	735	120	24
Cooling	Geothermal Heat Pump	0.2%	730	2	0
Space Heating	Electric Resistance	20.4%	6,624	1,350	270
Space Heating	Electric Furnace	10.7%	9,173	980	196
Space Heating	Air Source Heat Pump	16.3%	7,498	1,222	245
Space Heating	Geothermal Heat Pump	0.2%	4,833	11	2
Space Heating	Supplemental	7.8%	260	20	4
Water Heating	Water Heater <= 55 Gal	66.3%	3,074	2,038	408
Water Heating	Water Heater > 55 Gal	3.1%	4,552	140	28
Interior Lighting	Screw-in	100.0%	1,060	1,060	212
Interior Lighting	Linear Fluorescent	100.0%	107	107	21
Interior Lighting	Specialty	100.0%	275	275	55
Exterior Lighting	Screw-in	100.0%	254	254	51
Appliances	Clothes Washer	82.7%	114	94	19
Appliances	Clothes Dryer	78.8%	493	389	78
Appliances	Dishwasher	85.6%	386	330	66
Appliances	Refrigerator	100.0%	694	694	139
Appliances	Freezer	56.1%	774	434	87
Appliances	Second Refrigerator	25.9%	977	253	51
Appliances	Stove	87.7%	386	338	68
Appliances	Microwave	95.6%	114	109	22
Electronics	Personal Computers	119.0%	205	244	49
Electronics	TVs	204.4%	221	452	90
Electronics	Set-top Boxes/DVR	155.2%	128	198	40
Electronics	Devices and Gadgets	100.0%	55	55	11
Miscellaneous	Pool Pump	3.6%	1,415	52	10
Miscellaneous	Furnace Fan	43.7%	577	252	50
Miscellaneous	Miscellaneous	100.0%	373	373	75
	Total			**12,250**	**2,452**

Energy market profiles summarized

Source: Avista 2012 CPA





Data sources for energy market profiles

Model Inputs	Description	Key Sources
Market size	Base-year residential dwellings, commercial floor space, and industrial employment	Avista billing data, GenPOP survey, American Community Survey, NEEA surveys and reports, NPCC Sixth Plan
Annual intensity	Residential: Annual energy use (kWh/household) Commercial: Annual energy use (kWh/ sq ft) Industrial: Annual energy use (kWh/employee)	Avista billing data, AEG Energy Market Profiles database , NEEA surveys and reports, AEO, previous studies
Appliance/equipment saturations	Fraction of dwellings with an appliance/technology; Percentage of commercial floor space or industrial employment with equipment/technology	GenPOP survey, NEAA surveys and reports, RECS, AEG Energy Market Profiles, and other secondary data
UEC/EUI for each end-use technology	UEC: Annual electricity use for a technology in dwellings that have the technology EUI: Annual electricity use per square foot/employee for a technology in floor space that has the technology	NEAA surveys and reports, RTF/SEEM data, RTF UES workbooks, engineering analysis, BEST prototype simulations, engineering analysis
Appliance/equipment vintage distribution	Age distribution for each technology	NEEA surveys and reports, secondary data (DEEM, EIA, EPRI, DEER, etc.)
Efficiency options for each technology	List of available efficiency options and annual energy use for each technology	RTF, Council workbooks, prototype simulations, engineering analysis, appliance/equipment standards, secondary data, previous studies

We develop a baseline projection

Projects energy market profiles into the future

- Baseline projection is an end-use forecast of energy usage absent the effects of future conservation programs. Includes the effects of appliance standards and building codes, but holds efficiency purchasing trends at current levels (assumes no naturally-occurring conservation).

Model Inputs	Description	Key Sources
Customer growth forecasts	Forecasts of new construction in residential and C&I sectors	Data provided by Avista's Forecasting Department
Equipment purchase shares for baseline projection	For each equipment/technology, purchase shares for each efficiency level; specified separately for existing equipment replacement and new construction	Avista program results Shipments data from AEO AEO regional forecast assumptions RTF data on current market baseline NEEA surveys and reports Appliance/efficiency standards analysis
Exogenous forecast drivers	Retail price forecasts Personal income forecasts Other	Avista forecasts AEO
Utilization model parameters	Elasticities for each forecast driver	EPRI's REEPS and COMMEND models AEO Avista's historical weather data and normal weather data (cooling & heating degree days)

Timeline of current residential appliance standards

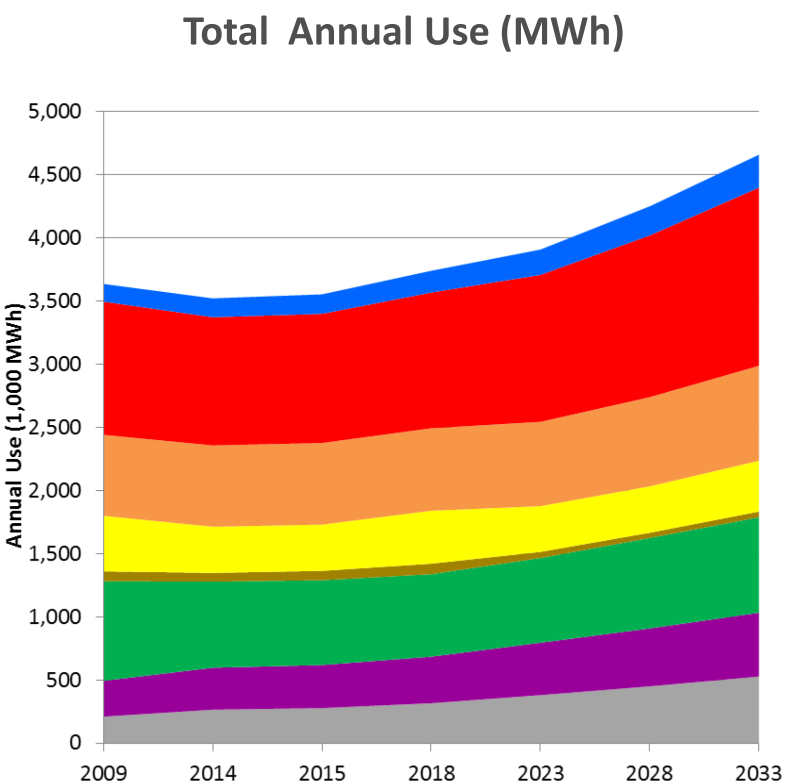
Legend: Today's Efficiency or Standard Assumption | 1st Standard (relative to today's standard) | 2nd Standard (relative to today's standard)

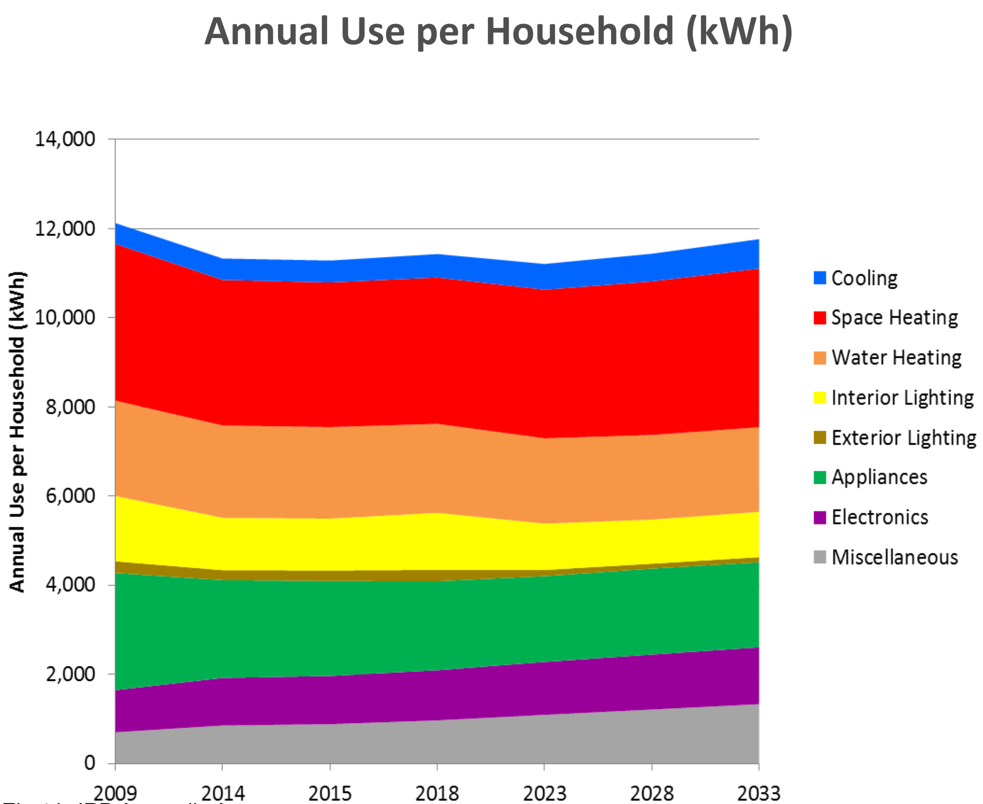
End Use	Technology	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Cooling	Central AC	SEER 13													
	Room AC	EER 9.8		EER 11.0											
	Evaporative Central AC	Conventional													
	Evaporative Room AC	Conventional													
Cooling/Heating	Heat Pump	SEER 13.0/HSPF 7.7			SEER 14.0/HSPF 8.0										
Space Heating	Electric Resistance	Electric Resistance													
Water Heating	Water Heater (<=55 gallons)	EF 0.90			EF 0.95										
	Water Heater (>55 gallons)	EF 0.90			Heat Pump Water Heater										
Lighting	Screw-in/Pin Lamps	Incandescent		Advanced Incandescent - tier 1 (20 lumens/watt)						Advanced Incandescent - tier 2 (45 lumens/watt)					
	Linear Fluorescent	T12	T8												
Appliances	Refrigerator/2nd Refrigerator	NAECA Standard		25% more efficient											
	Freezer	NAECA Standard		25% more efficient											
	Dishwasher	Conventional (355kWh/yr)	14% more efficient (307 kWh/yr)												
	Clothes Washer	Conventional (MEF 1.26 for top loader)			MEF 1.72 for top loader			MEF 2.0 for top loader							
	Clothes Dryer	Conventional (EF 3.01)			5% more efficient (EF 3.17)										

Example of a residential baseline projection

Source: Avista 2012 CPA

- Growth of 32% from ‘09 to '33, or 1.5% per year on average.
- Per household basis, use is increasing slightly at 4% for the forecast period, or 0.2% per year.





ECM identification & characterization

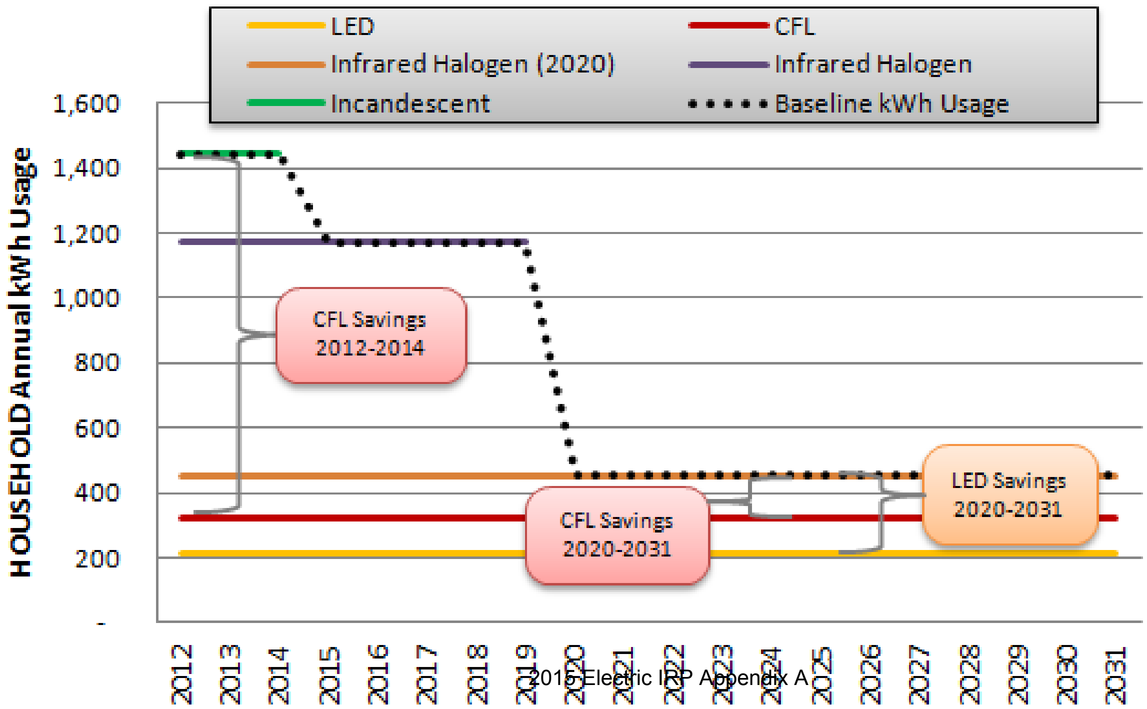
- Develop measure list using
  - Council workbooks
  - Existing programs
  - AEG databases
- Characterization
  - Description
  - Costs
  - Savings
  - Applicability
  - Lifetime
- Data sources
  - RTF
  - Avista data
  - AEG's database
  - BEST simulations
- Measure Crosswalk

Example: Water heating measures
Conventional (EF 0.95)
Heat pump water heater (EF 2.3)
Solar water heater
Low-flow showerheads
Timer / Thermostat setback
Tank blanket

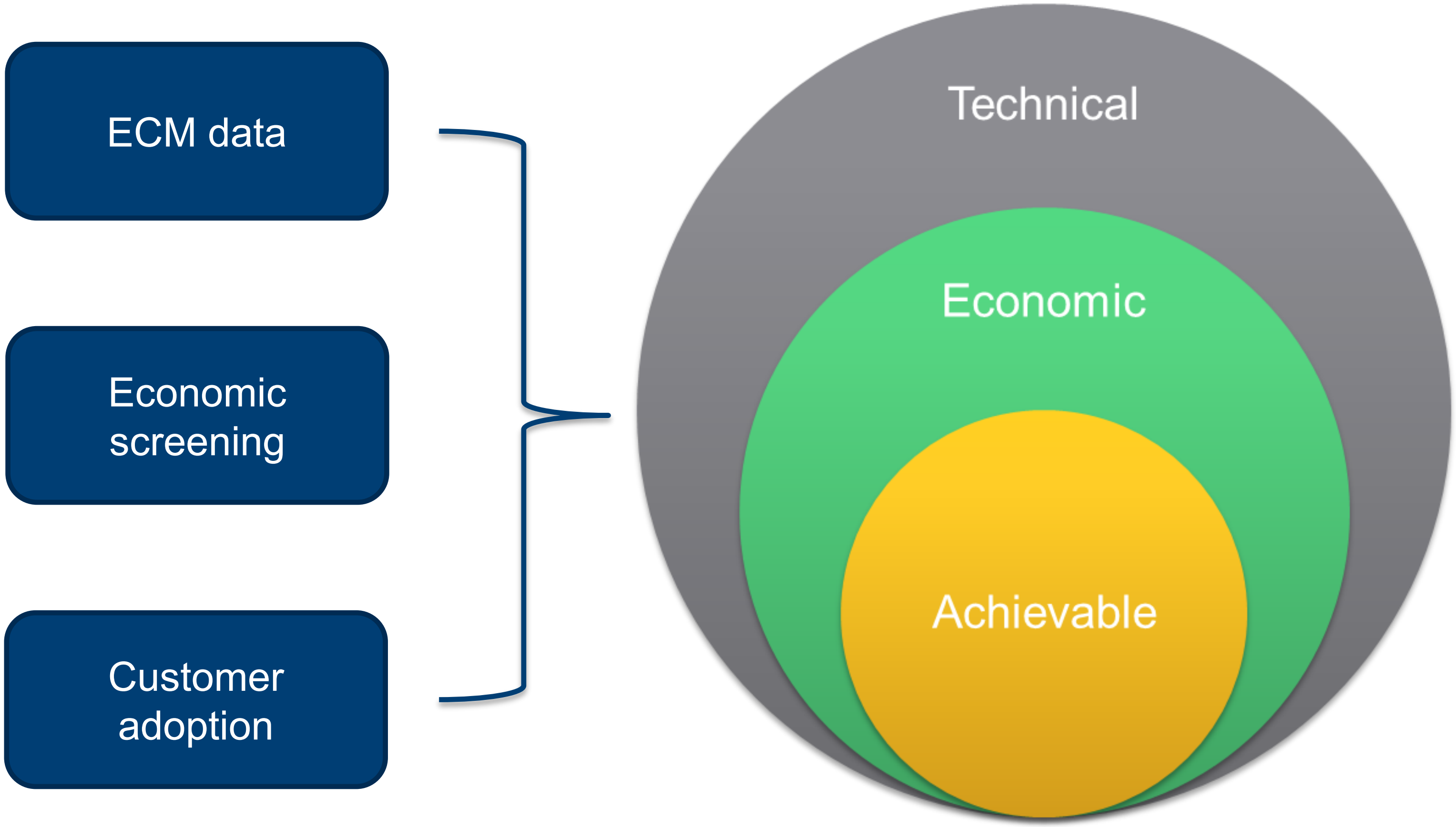
ECM savings and costs

- Measure savings change relative to baseline throughout study (as shown)
- We use a market baseline, consistent with RTF/Council
- Measure costs change with market projections and expectations

Example of Savings Calculation for Screw-in Lighting Technologies



Calculating the three levels of potential



Estimating potential and ramp rates

Technical potential assumes most efficient option is chosen by all customers

Economic potential assumes all customers choose the highest-efficiency option that passes economic screen

- Use TRC and Avista's avoided cost to perform economic screen

Achievable potential is a subset of economic potential

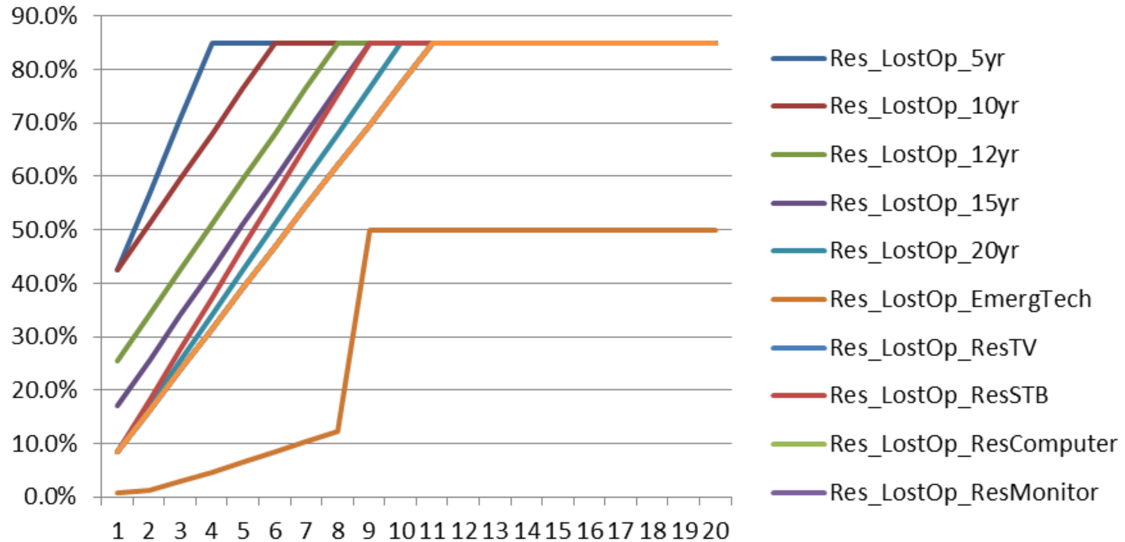
- Calculated by applying ramp rates to economic potential
- Our approach for Avista:
  - Start with ramp rates from the 6th Power Plan
  - Map the Council ramp rates to ECMs in our analysis
  - Adjust the starting point for each measure's ramp rate to align with Avista's recent program accomplishments

Customer adoption (ramp) rates

Residential ramp rates from NWPCC

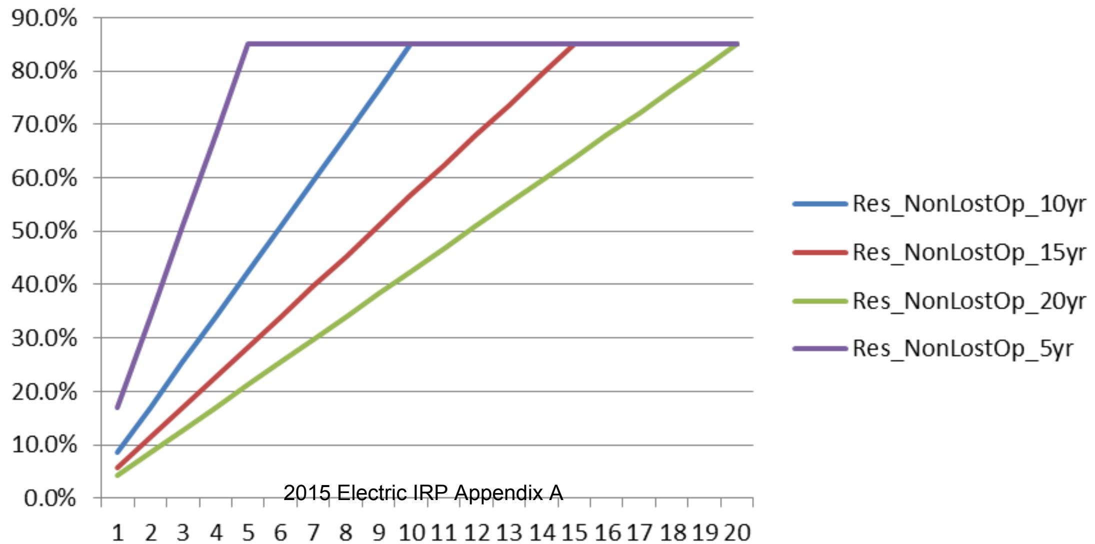
Lost Opportunity Ramp Rates:

Applied to equipment units each year that are turning over into a new purchase decision.



Non-Lost Opportunity Ramp Rates:

Applied cumulatively to all applicable opportunities in the market over time.

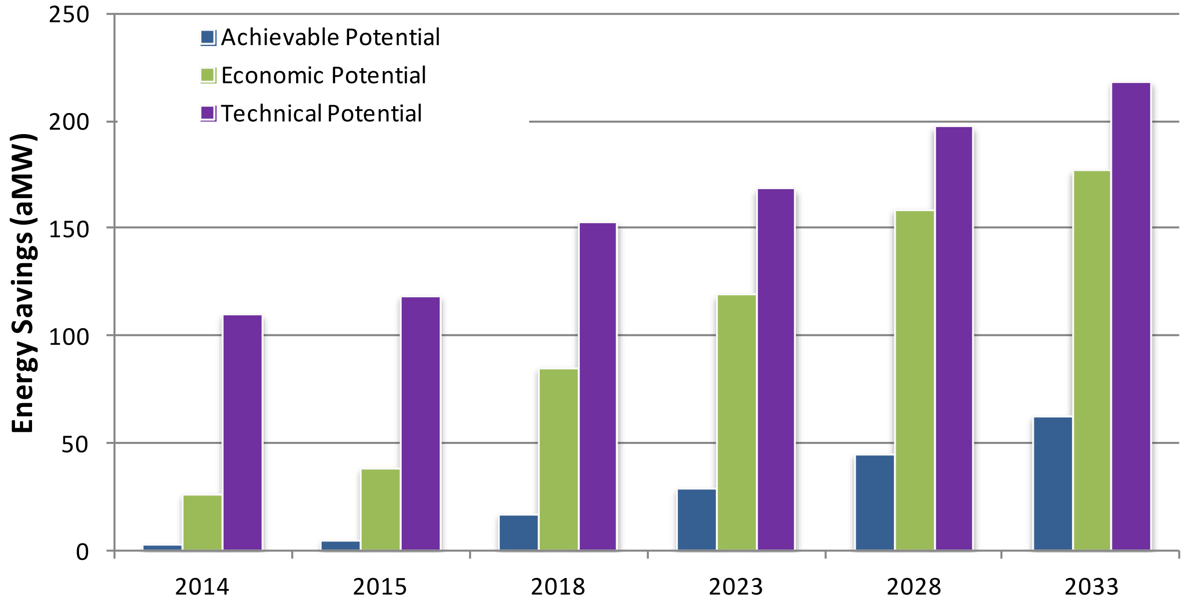


Residential conservation potential

Example from Avista 2012 CPA

For 2014 to 2023, ten-year achievable potential savings are about 252 GWh.

This is 28.8 aMW.



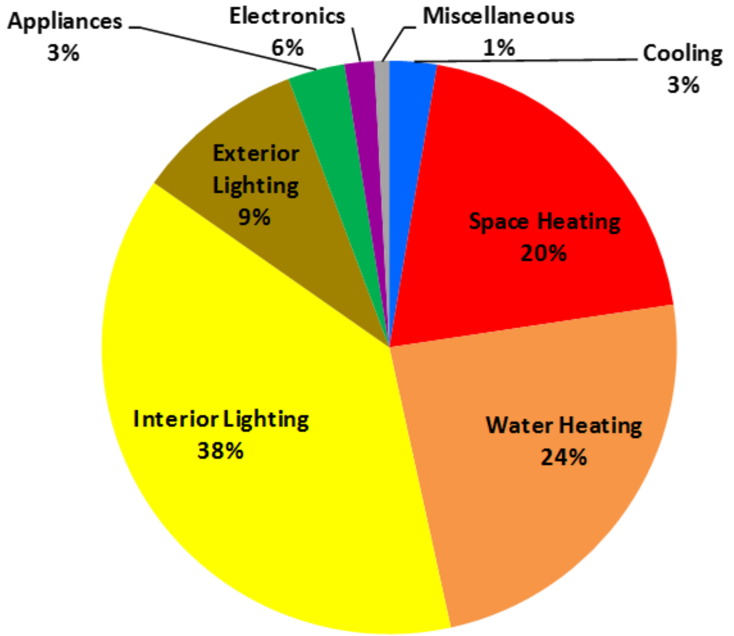
	2014	2015	2018	2023	2028	2033
Cumulative WA and ID Savings (MWh)						
Achievable Potential	21,848	42,786	147,588	251,961	392,098	547,119
Economic Potential	231,078	335,111	744,684	1,041,719	1,390,377	1,549,252
Technical Potential	963,411	1,037,905	1,338,457	1,473,324	1,727,383	1,911,746
Cumulative Savings (aMW)						
Achievable Potential	2.5	4.9	16.8	28.8	44.8	62.5
Economic Potential	26.4	38.3	85.0	118.9	158.7	176.9
Technical Potential	110.0	118.5	152.8	168.2	197.2	218.2

Top measures in the residential sector

Example from Avista 2012 CPA

Measure/Technology	2018 Cumulative Savings (MWh)	% of Total
Interior Lighting Screw-in	39,805	27%
Electric Furnace	17,175	12%
Interior Specialty Lighting	16,484	11%
Exterior Screw-in Lighting	14,121	10%
Water Heater <= 55 Gal	11,129	8%
Water Heater - Tank Blanket/Insulation	7,317	5%
Thermostat - Clock/Programmable	6,783	5%
Water Heater - Low Flow Showerheads	5,885	4%
Water Heater - Pipe Insulation	4,790	3%
Electric Resistance	3,738	3%
Water Heater - Faucet Aerators	3,244	2%
Central AC	2,687	2%
Water Heater - Thermostat Setback	2,626	2%
Refrigerator	2,187	1%
Insulation - Infiltration Control	1,692	1%
Furnace Fan	1,170	1%
Personal Computers	1,111	1%
Insulation - Foundation	791	1%
Freezer	789	1%
TVs	745	1%

Achievable Potential in 2018



AEG Consistency with Council Methodology

End-use model — bottom-up

- Building characteristics, fuel and equipment saturations
- Stock accounting based on measure life
- Codes and standards that have been enacted are included in baseline
- Lost- and non-lost opportunities treated differently

Measures – comprehensive list

- RTF measure workbooks
- BPA data
- AEG databases, which draw upon same sources used by RTF

Economic potential, total resource cost (TRC) test

- Considers HVAC interactions, non-energy benefits
- Avoided costs include 10% credit based on Conservation Act

Achievable potential – ramp rates

- Based on Sixth Plan ramps rates, but modified to reflect Avista's program history

Thank You!

Ingrid Rohmund
irohmund@appliedenergygroup.com

Bridget Kester
bkester@appliedenergygroup.com

Fuong Nguyen
fnguyen@appliedenergygroup.com

Sharon Yoshida
syoshida@appliedenergygroup.com

2015 Electric Integrated Resource Plan

Technical Advisory Committee Meeting No. 4 Agenda
Tuesday, February 24, 2015
Red Lion River Inn – Shoreline Ballroom A, Spokane, WA

Topic	Time	Staff
1. Introduction & TAC 3 Recap	8:30	Lyons
2. Demand Response Study	8:45	Doege
3. Natural Gas Price Forecast	9:15	Dorr
Break		
4. Electric Price Forecast	10:30	Gall
5. Lunch	11:30	
6. Resource Requirements	12:30	Kalich
Break		
7. Interconnection Studies	1:15	Maguire
8. Market Scenarios and Portfolio Analysis	2:15	Lyons
9. Adjourn	3:00	

TAC meeting location: Red Lion River Inn Spokane
Shoreline Ballroom A
700 N. Division
Spokane, WA 99202

Directions: http://www.redlion.com/river-inn-spokane/map-directions

2015 Electric IRP
TAC Meeting Expectations and Schedule

John Lyons, Ph.D.
Fourth Technical Advisory Committee Meeting
February 24, 2015

Technical Advisory Committee

- The public process of the IRP – input on what to study, how to study, and review assumptions and results
- Technical forum with a range of participants with different areas of input and expertise
- Open forum, but we need to stay on topic to get through the agenda and allow all participants to ask questions and make comments
- Welcome requests for studies or different assumptions.
  - Time or resources may limit the amount of studies
  - The earlier study requests are made, the more accommodating we can be
  - January 15, 2015 was the final date to receive study requests
- Action Items – areas for more research in the next IRP

Technical Advisory Committee

- Technical forum on inputs and assumptions, not an advocacy forum
- Focus is on developing a resource strategy based on sound assumptions and inputs, instead of a forum on a particular resource or resource type
- We request that everyone maintain a high level of respect and professional demeanor to encourage an ongoing conversation about the IRP process
- Supports rate recovery, but not a preapproval process
- Planning team is available by email or phone for questions or comments between the TAC meetings

Remaining TAC Meetings

- **TAC 5 – March 24, 2015:** Completed conservation potential assessment, draft preferred resource strategy (PRS), review of scenarios, market futures, and portfolio analysis
- **TAC 6 – June 24, 2015:** Review of final PRS and action items.

TAC #3 Recap

- Introduction & TAC 2 Recap – Lyons
- Planning Margin – Gall
- Colstrip Discussion – Lyons
- Cost of Carbon – Lyons
- IRP Modeling Overview – Gall
- Conservation Potential Assessment – Kester

Today's Agenda

- Introduction & TAC 3 Recap (8:30) – Lyons
- Demand Response Study (8:45) – Doege
- Natural Gas Price Forecast (9:15) – Scott
  - Break
- Electric Price Forecast (10:30) – Gall
- Lunch (11:30)
- Resource Requirements (12:30) – Kalich
  - Break
- Interconnection Studies (1:15) – Maguire
- Market Scenarios and Portfolio Analysis (2:15) – Lyons
- Adjourn 3:00

Demand Response Potential Assessment Study

Study & Report by: Applied Energy Group & Avista

Prepared by Leona Doege
Fourth Technical Advisory Committee Meeting
February 24, 2015

Purpose of Study

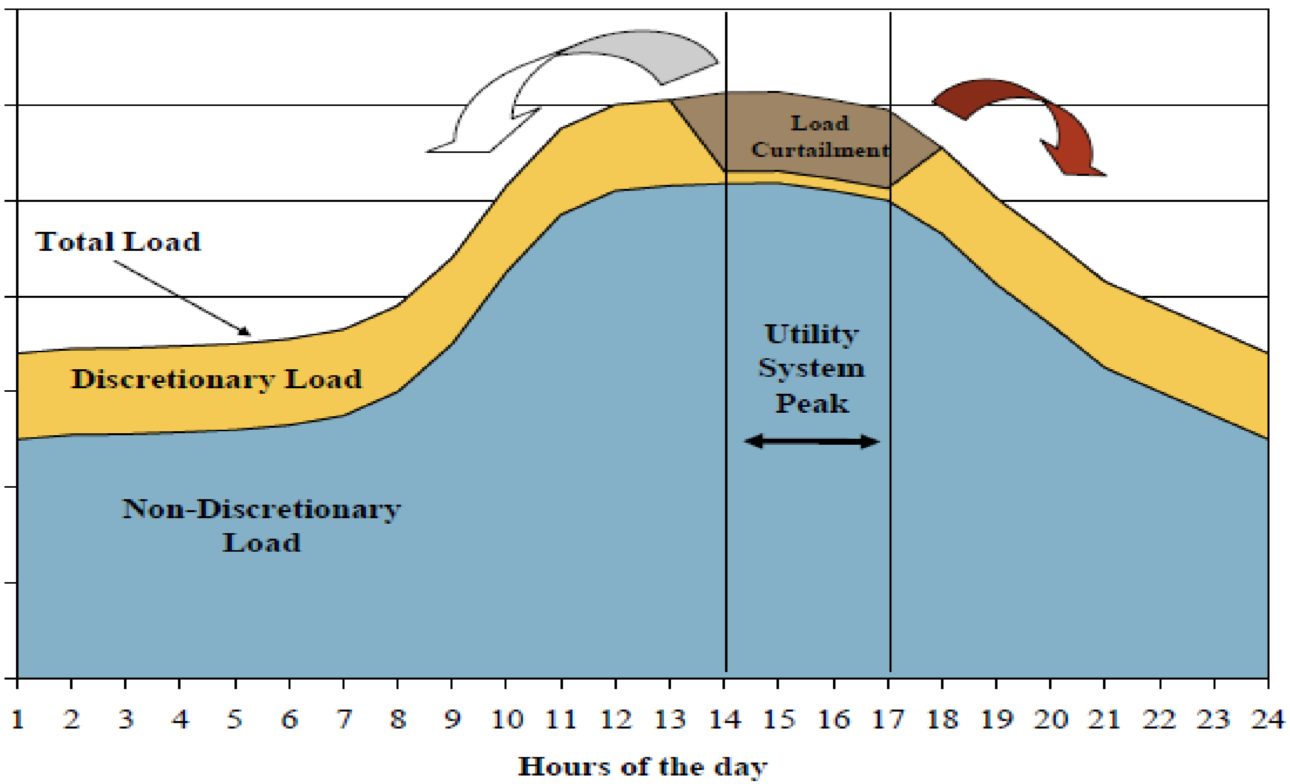
2013 Electric IRP Action Item

Answer the following questions:

- How much capacity for DR?
- How long will it take to reach it (ramp rate)?
- How much will it cost?

Demand Response

Customers making a change to their consumption in response to a price or incentive signal.

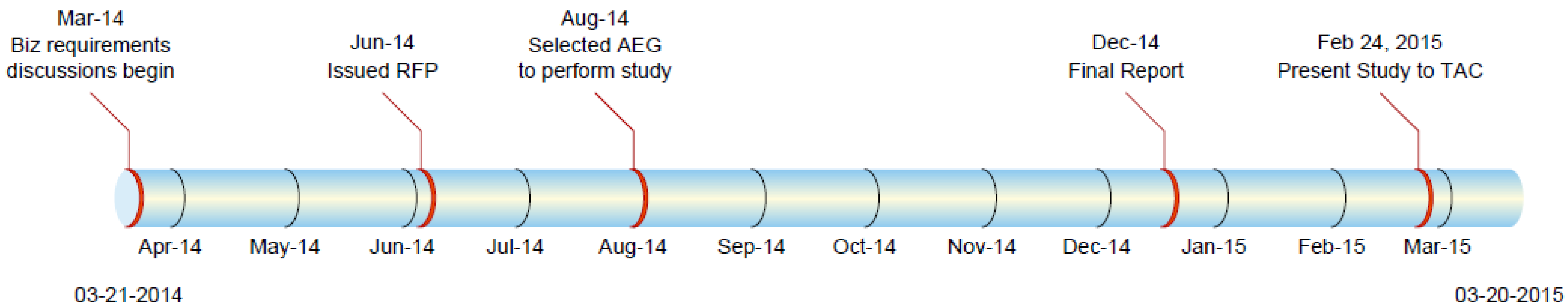


Graph Source: FERC Demand Response Report 2006

Demand Response History at Avista

- **2001:** Nickel buyback program
- **2006:** Public plea, & bilateral agreements (emergency load shedding)
- **2007-2009:** Idaho 2-year residential direct load control pilot
- **2012-2014**: Washington: 2.5-year residential & WSU direct load control demonstration (SGDP- Pullman)

Study Approach



- Review U.S. Demand Response Programs
    - Categorized DR Programs
- Segmented Avista C&I customers
- Identify DR Programs relevant to Avista & C&I customers
- Develop & discuss assumptions
- Develop framework

Demand Response Programs Relevant to Avista

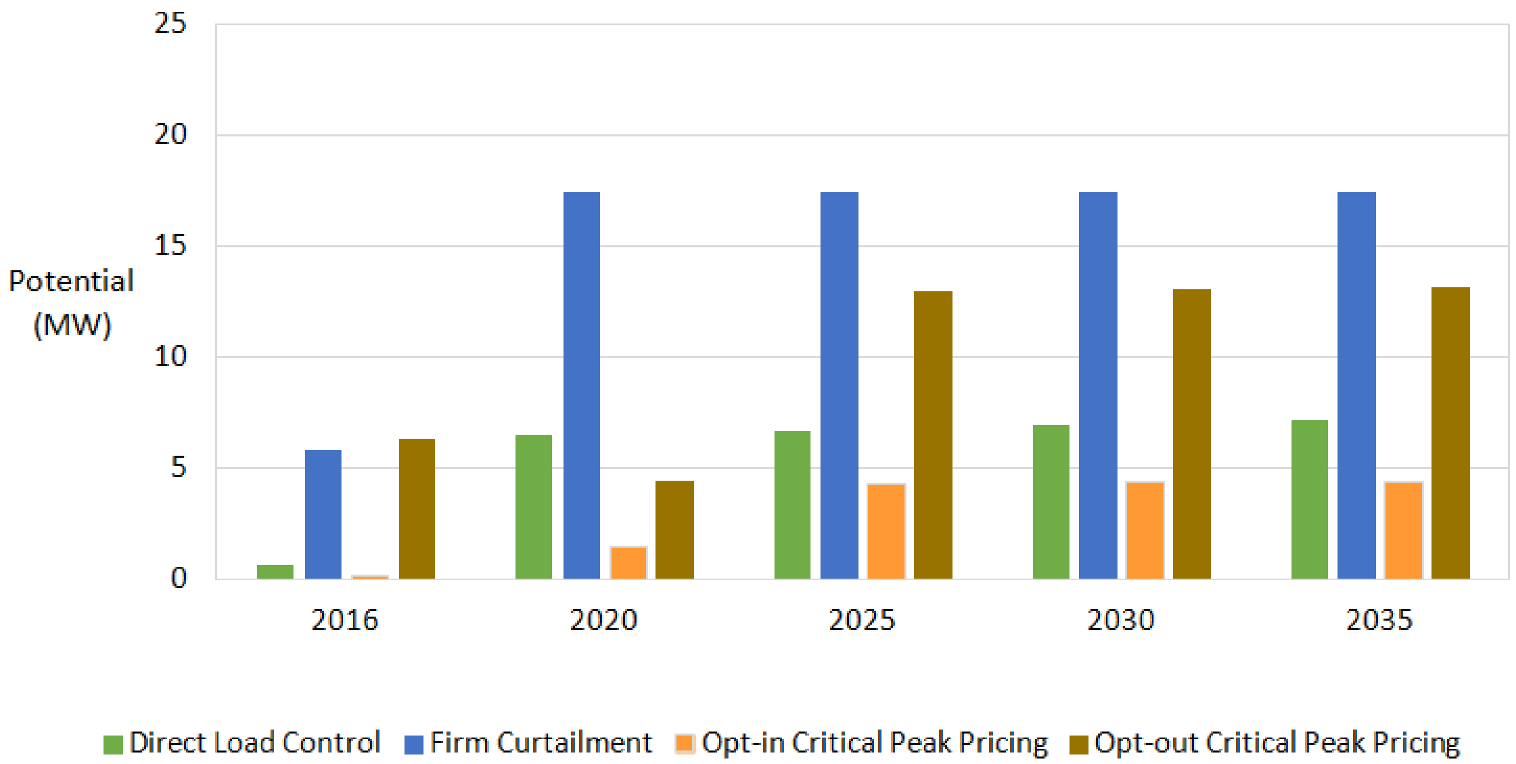
Category	Program	Applicable Customer Class
Non-pricing	Direct Load Control	General Service (GS)
		Large General Service (LGS)
	Firm Curtailment	Large General Service (LGS)
		Extra Large General Service (XLGS)
Pricing	Critical Peak Pricing	General Service (GS)
		Large General Service (LGS)
		Extra Large General Service (XLGS)

Load Aggregator

Demand Response Options Overview

	DLC	Firm	RTP
Targeted Segment	Sch 11 & 21	Sch 21 & 25	Sch 11, 21 & 25
Resource Availability	Varies	Year Around	Year Around
Event Notification	Day Ahead	Day ahead – preferred or 30 min	Day Ahead
Max Event Hrs/YR	60 hours	60 hours	60 Hours
Event Duration	4 to 6 hours each	1 to 8 hours each	4 hours each
Type of Response	Space & water heat	Non-essential loads or **back-up gen.**	Load curtailment or back-up gen.
Participant Incentive	$60 annually SH $50 annually WH	Determined & paid by 3rd party	On-Off peak price differential
Other	Directly admin by Avista	Admin by 3rd party Need AMI	10-15 max events per year. Need AMI

Summary of Results



Graph from page 30 of report

DR Potential by Option

	2016	2020	2025	2030	2035
Total System Peak (MW)	**1,718**	**1,768**	**1,828**	**1,891**	**1,995**
Weather Sensitive Peak (MW)	**1,590**	**1,640**	**1,700**	**1,763**	**1,827**
Estimated C&I Peak (MW)	**610**	**622**	**630**	**638**	**649**
Achievable Potential (MW)					
Direct Load Control	0.64	6.48	6.68	6.91	7.16
Firm Curtailment	5.80	17.46	17.42	17.42	17.46
Opt-in Critical Peak Pricing	0.13	1.40	4.30	4.33	4.38
Opt-out Critical Peak Pricing	6.27	4.38	12.93	13.01	13.12
Achievable Potential (% of C&I Peak)					
Direct Load Control	*0.10%*	*1.04%*	*1.06%*	*1.08%*	*1.10%*
Firm Curtailment	*0.95%*	*2.81%*	*2.77%*	*2.73%*	*2.69%*
Opt-in Critical Peak Pricing	*0.02%*	*0.23%*	*0.68%*	*0.68%*	*0.68%*
Opt-out Critical Peak Pricing	*1.03%*	*0.70%*	*2.05%*	*2.04%*	*2.02%*

from page 30 of report

Program Costs & Potential

Stand Alone

Table 5-4 DR Program Costs and Potential

DR Option	2035 MW Potential	2016 – 2035 Cumulative Utility Spend (Million $)	2016 – 2035 Average Spend per Year (Million $)	2016 – 2035 Levelized Cost ($/kW-year)
Direct Load Control	7.16	$16.07	$0.80	$143.82
Firm Curtailment	17.46	$40.68	$2.03	$118.59
Opt-in Critical Peak Pricing	4.38	$25.61	$1.28	$432.65
Opt-out Critical Peak Pricing	13.12	$26.69	$1.33	$109.86

Interactive

Table 5-5 DR Program Costs and Potential - Interactive

DR Option	2035 MW Potential	2016 – 2035 Cumulative Utility Spend (Million $)	2016 – 2035 Average Spend per Year (Million $)	2016 – 2035 Levelized Cost ($/kW-year)
Direct Load Control	7.16	$16.07	$0.80	$143.82
Firm Curtailment	16.57	$38.65	$1.93	$118.52
Opt-in Critical Peak Pricing	3.35	$25.27	$1.26	$555.77
Opt-out Critical Peak Pricing	9.90	$26.32	$1.32	$141.03

Charts from pages 32 & 33 of report
Firm Curtailment and standby generation have overlapping capacity

Standby Generation Partnership

Prepared by Marc Schaffner
Fourth Technical Advisory Committee Meeting
February 24, 2015

What is Standby Generation Partnership?

A prospective partnership between customers and Avista to meet future peak load needs utilizing existing and future standby distributed generation.

Standby Generation Opportunities

- Interconnect customers diesel or natural gas-powered generators to Avista's distribution system
- Utilize standby generator output as a peak resource and to improve voltage regulation on Avista's electric distribution system
- Introduce natural gas blending to diesel-powered generators for cleaner, more economical operation
- Utilize standby generators as a cost-effective non-spinning reserve
- Conduct an in-house pilot by interconnecting Avista's standby generators at its headquarters in Spokane

2015 Electric IRP
Natural Gas Price Forecast

Eric Scott, Manager of Natural Gas Resources
Fourth Technical Advisory Committee Meeting
February 24, 2015

North American Pipeline Infrastructure

Pacific Northwest Supply and Infrastructure

SUPPLY

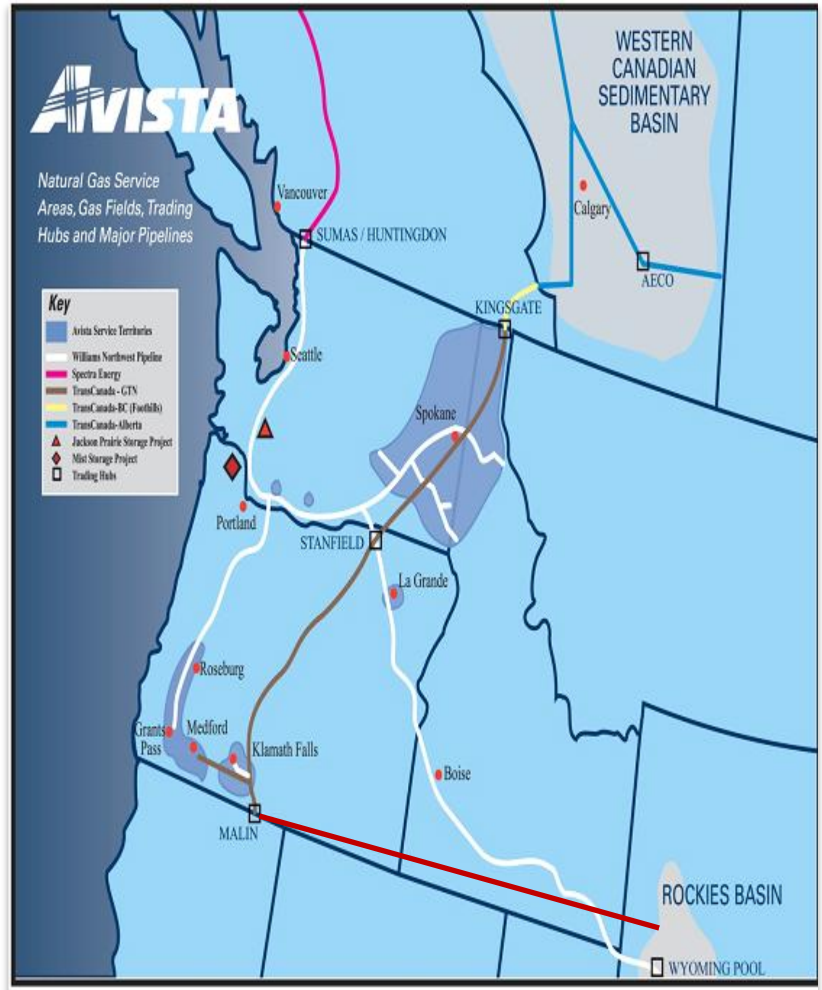
- **AECO**
  Canadian gas coming out of Alberta, Canada
- **Rockies**
  U.S. domestic gas coming from Wyoming and Colorado
- **Sumas**
  Canadian gas coming out of British Columbia, Canada
- **Malin**
  South central at the Oregon and California border
- **Stanfield**
  Intersection of two major pipelines in North Central Oregon

PIPELINES

- **Williams Northwest Pipeline**
- **TransCanada Gas Transmission Northwest**
- **TransCanada Foothills**
- **TransCanada Alberta**
- **Spectra Energy**
- **Ruby Pipeline**

STORAGE

- **Jackson Prairie Storage**
- **Mist Storage**



Types of Pipeline Contracts

Firm Transport

- Contractual rights to:
  - Receive
  - Transport
  - Deliver
- From point A to point B

Interruptible Transport

- Contractual rights to:
- Receive
- Transport
- Deliver
- From point A to Point B *AFTER FIRM TRANSPORT HAS BEEN SCHEDULED*

Seasonal Transport

- Firm service available for limited periods (Nov-Mar) or for a limited amount (TF2 on NWP)

Alternate Firm Transport

- The use of firm transport outside of the primary path
- Priority rights below firm
- Priority rights above interruptible

Pipeline Rate Structure

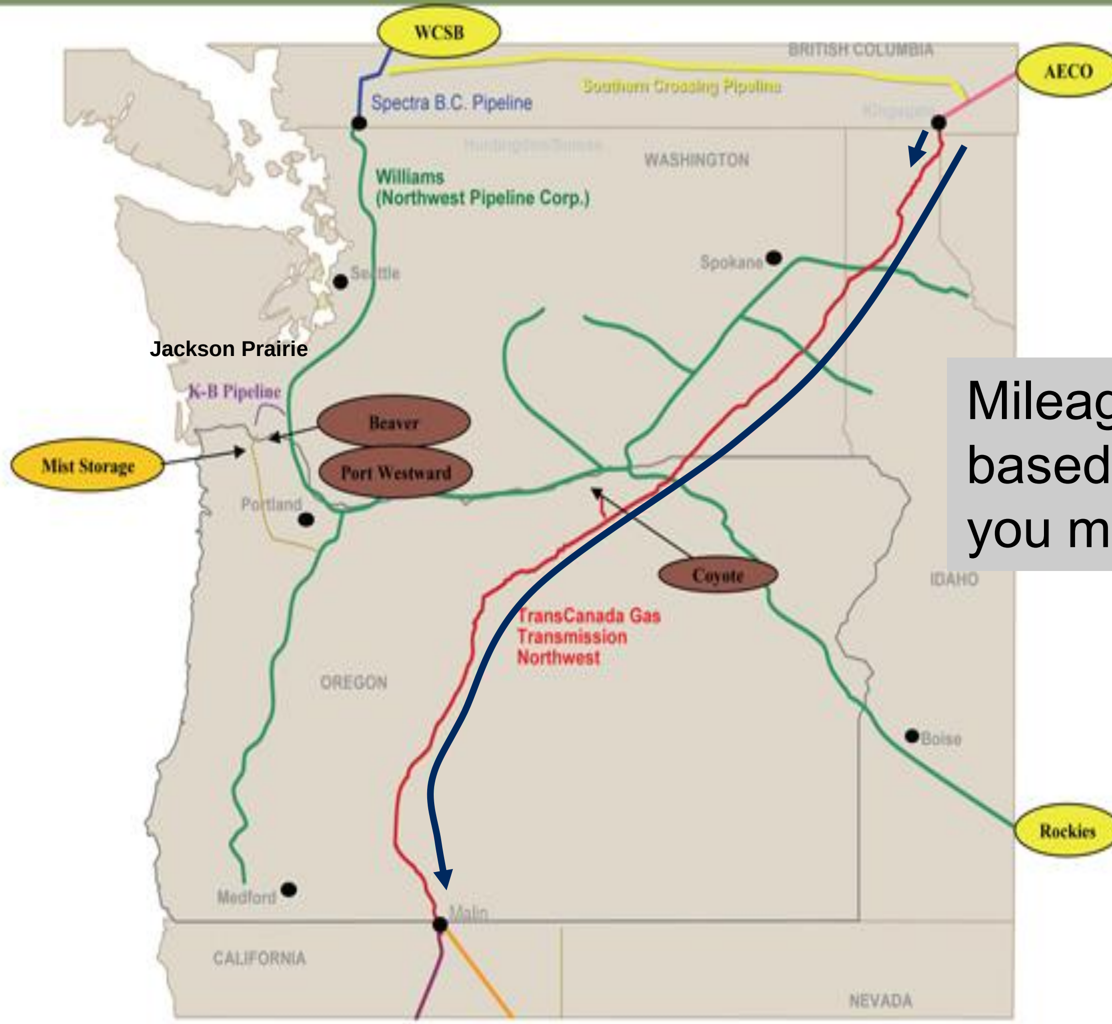
Straight Fixed Variable (SFV)	• Pipeline charges a higher demand charge and a lower variable or commodity charge
Enhanced fixed variable	• Pipeline charges a lower demand charge and a higher variable or commodity charge
Postage Stamp Rate	• Pay the same demand and variable costs regardless of how far the gas is transported
Mileage Based	• Pay a variable and demand charge based on how far the gas is transported

AVISTA

TransCanada Gas Transmission Northwest (GTN)

- Mileage Based
- Point to Point
- Alternate firm allowed in path
- Mostly – demand based with a couple Nomination based points
  - Demand based refers to gas that will be taken off the pipeline based on the demand behind the delivery point.
  - Nomination based refers to the pipeline only delivering what was nominated (requested).
- Usually requires upstream transportation

Natural Gas Transportation

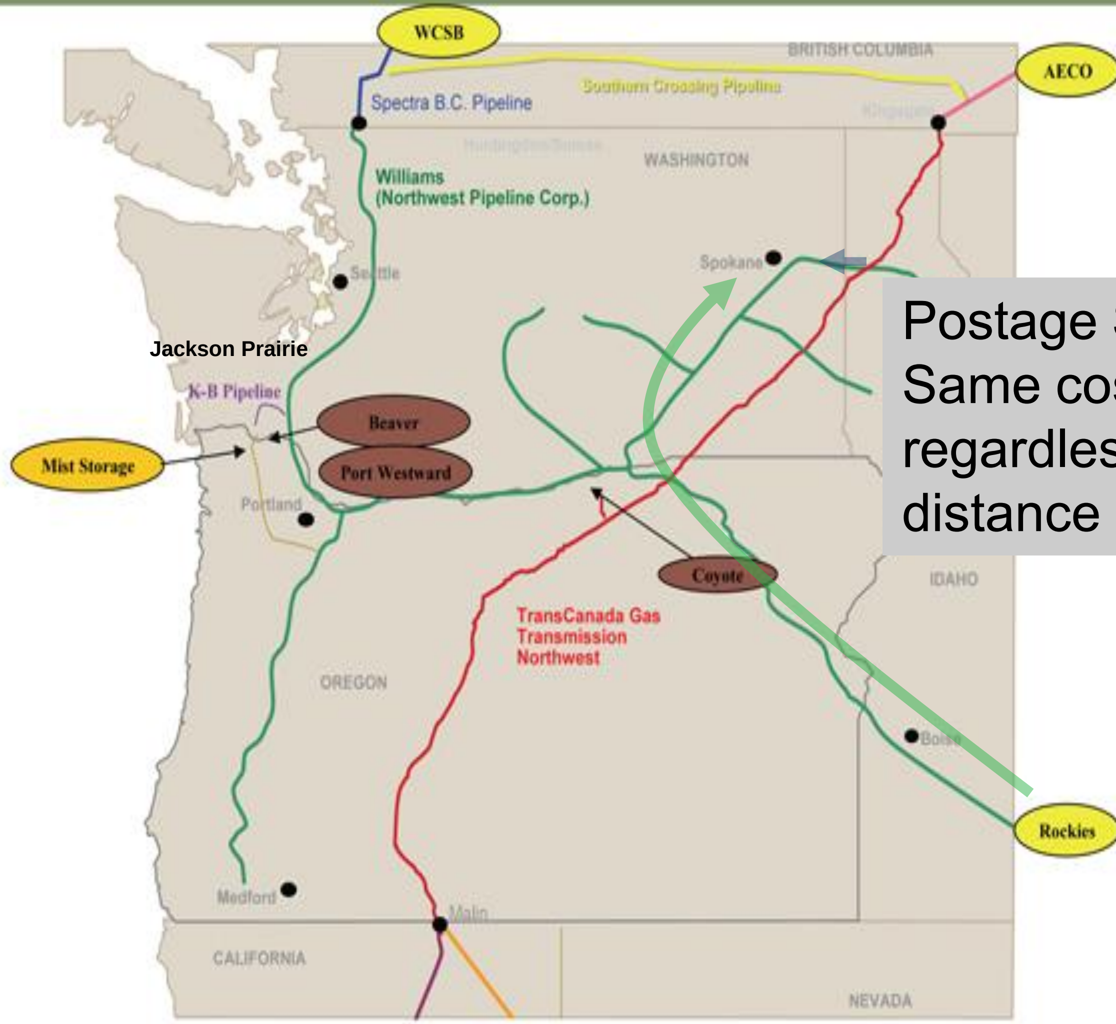


Mileage Base: Pay based on how far you move the gas

Williams Northwest Pipeline (NWP)

- Postage Stamp Based
- Point to Point
    - Delivery to ‘zones’ allowed
- Alternate firm allowed in and out of path
- Demand based delivery
    - Demand based refers to gas that will be taken off the pipeline based on the demand behind the delivery point.
    - Nomination based refers to the pipeline only delivering what was nominated (requested).
- May or may not require upstream transportation
- Enhanced fixed variable structure

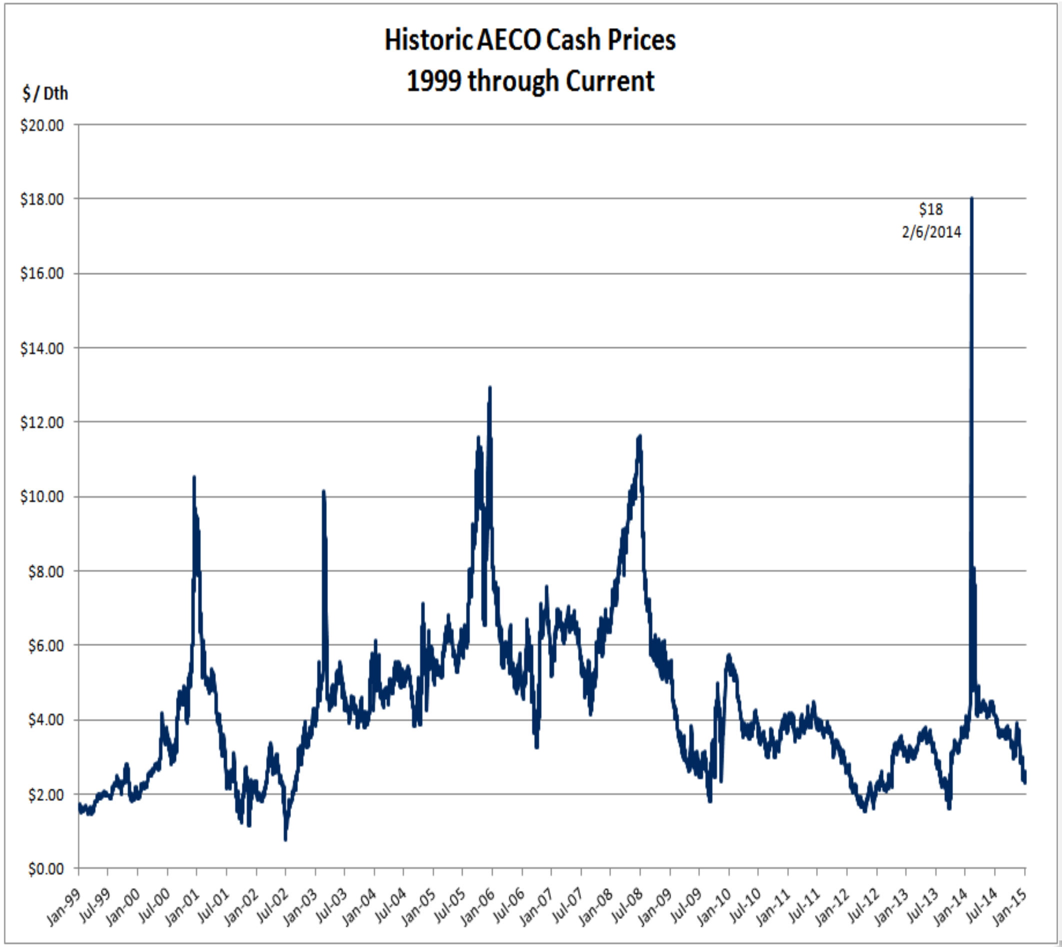
Natural Gas Transportation



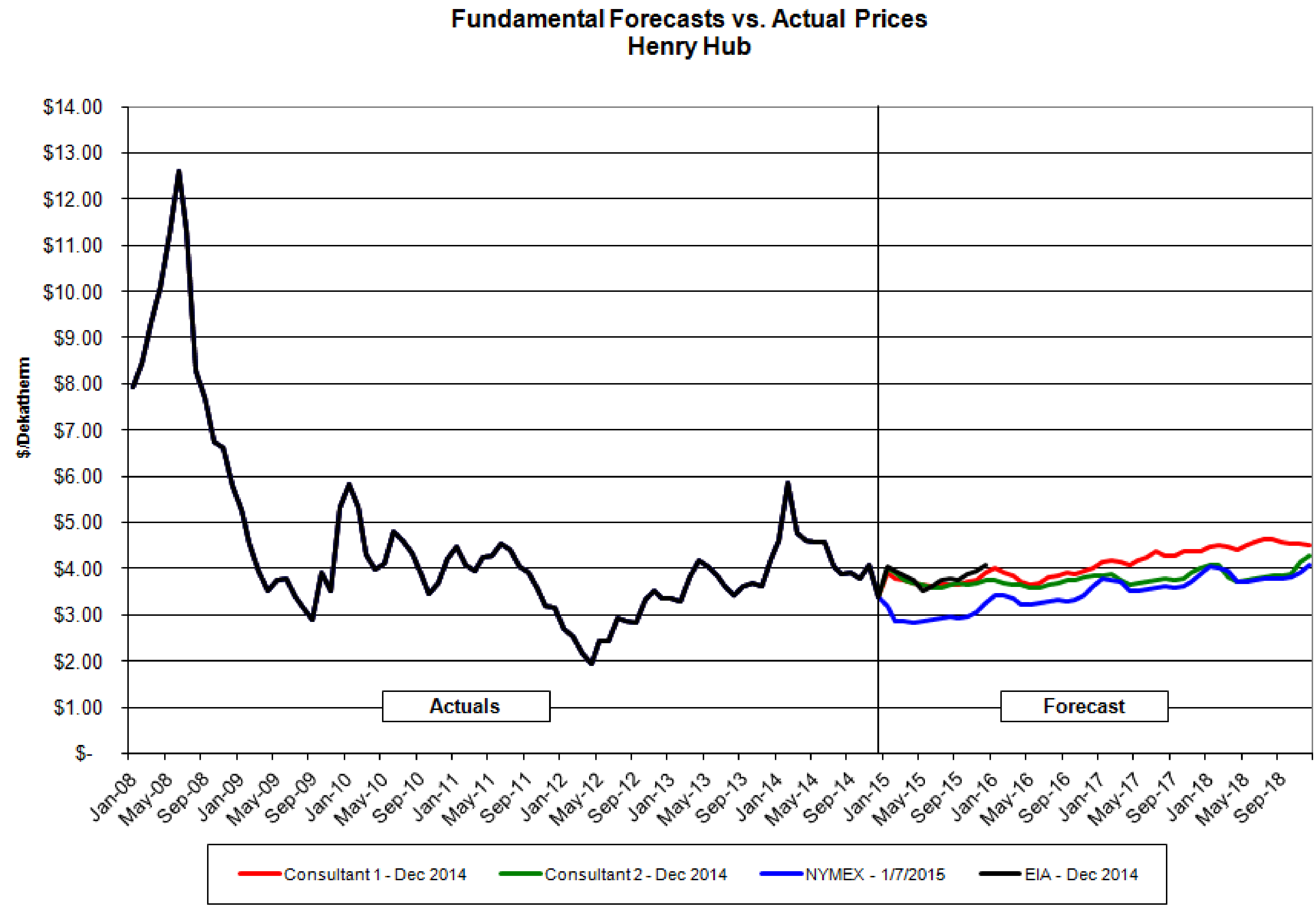
Postage Stamp:
Same costs
regardless of
distance or locations

Natural Gas Pricing Fundamentals

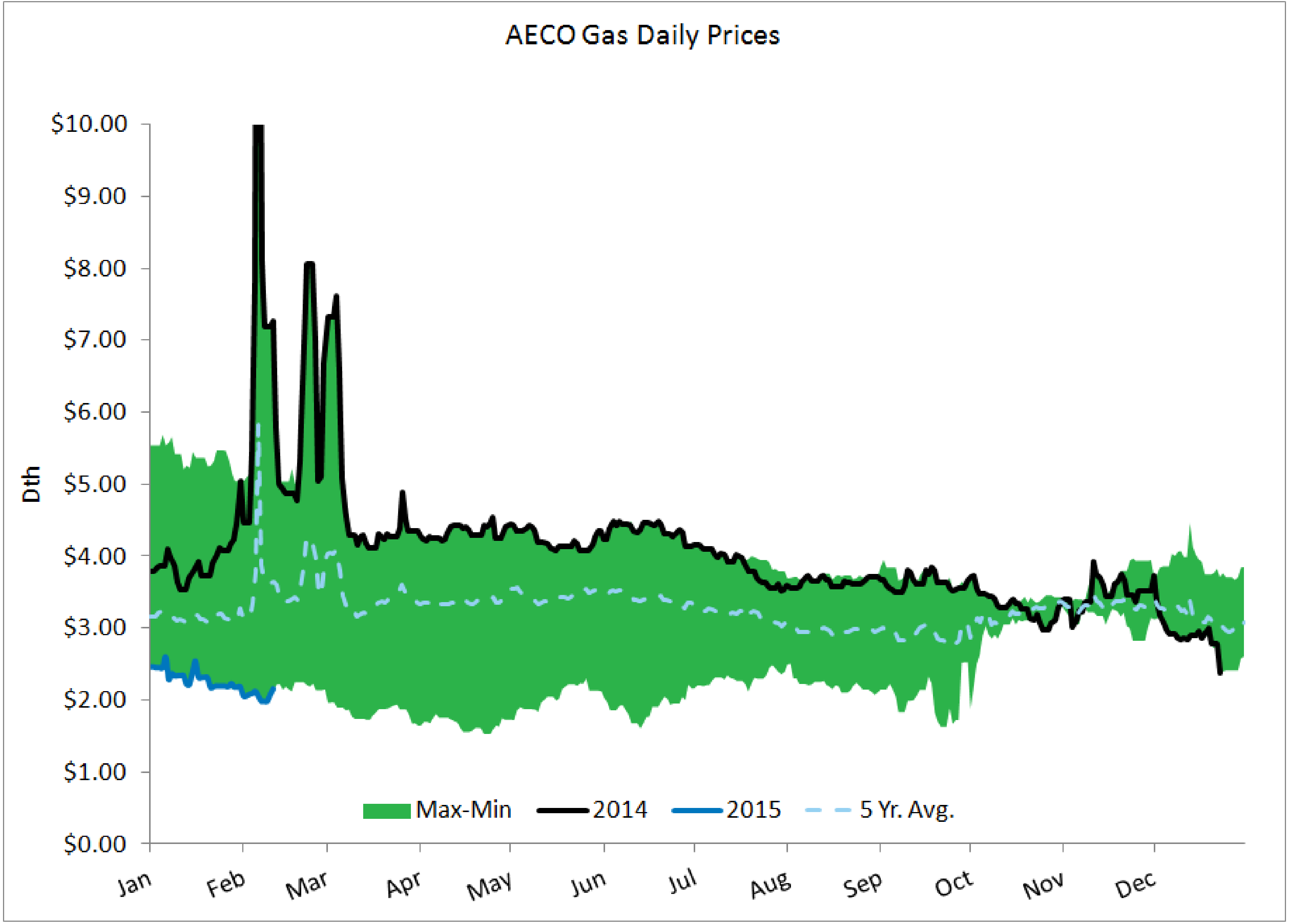
What Drives the Natural Gas Market?
Natural Gas Spot Prices

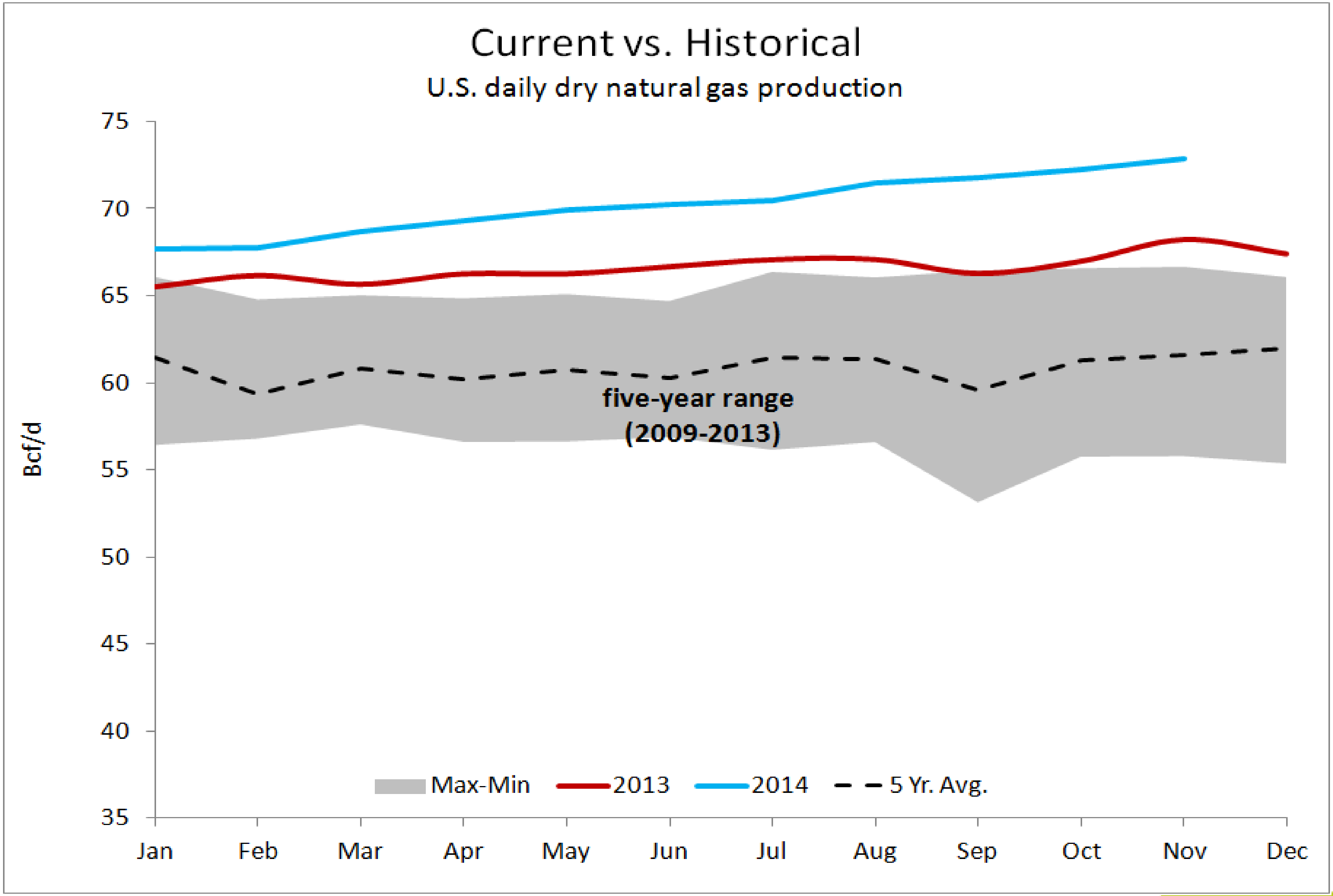


- **Supply**
  - Type: Conventional vs. Non-conventional
  - Location
  - Cost
- **Demand**
  - Residential/Commercial/Industrial
  - Power Generation
  - Natural Gas Vehicles
- **Legislation**
  - Environmental
- **Energy Correlations**
  - Oil vs. Gas
  - Coal vs. Gas
  - Natural Gas Liquids
- **Weather**
- **Storage**



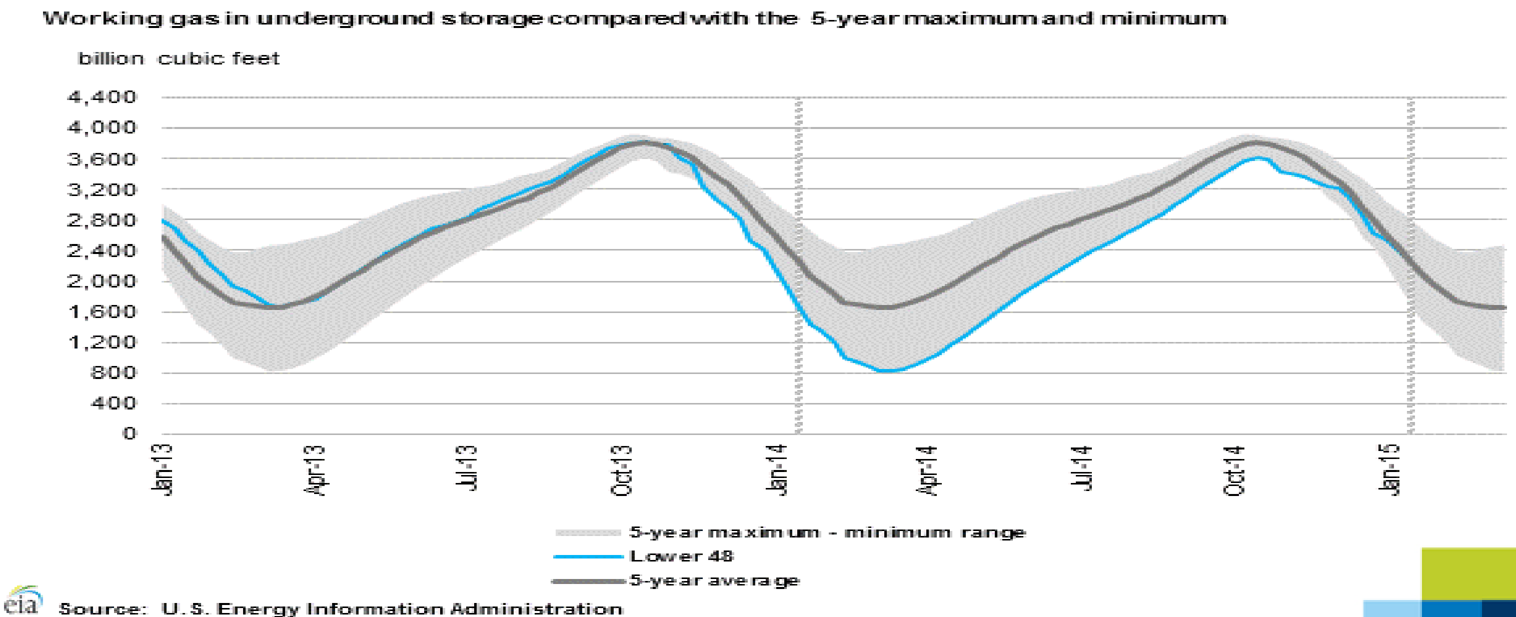
Fundamental Forecasts vs. Actual Prices
Henry Hub
$14.00
$13.00
$12.00
$11.00
$10.00
$9.00
$8.00
$7.00
$6.00
$5.00
$4.00
$3.00
$2.00
$1.00
$-
$/Dekatherm
Actuals
Forecast
Jan-08
May-08
Sep-08
Jan-09
May-09
Sep-09
Jan-10
May-10
Sep-10
Jan-11
May-11
Sep-11
Jan-12
May-12
Sep-12
Jan-13
May-13
Sep-13
Jan-14
May-14
Sep-14
Jan-15
May-15
Sep-15
Jan-16
May-16
Sep-16
Jan-17
May-17
Sep-17
Jan-18
May-18
Sep-18
Consultant 1 - Dec 2014
Consultant 2 - Dec 2014
NYMEX - 1/7/2015
EIA - Dec 2014


AECO Gas Daily Prices
$10.00
$9.00
$8.00
$7.00
$6.00
$5.00
$4.00
$3.00
$2.00
$1.00
$0.00
Dth
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Max-Min
2014
2015
5 Yr. Avg.


Current vs. Historical
U.S. daily dry natural gas production
75
70
65
60
55
50
45
40
35
Bcf/d
five-year range
(2009-2013)
Max-Min
2013
2014
5 Yr. Avg.
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

Natural Gas Storage

Region	2/6/2015	1/30/2015	change (Bcf)	Year Ago (02/06/14) "Stocks (Bcf)	% change	5-Year average (2010-2014) Stocks (Bcf)	% change
East	1081	1,194	-113	829	30.4	1,113	-2.9
West	371	371	0	265	40	333	11.4
Producing	816	863	-47	632	29.1	833	-2
Salt	231	247	-16	113	104.4	160	44.4
Nonsalt	585	616	-31	518	12.9	672	-12.9
Total	**2,268**	**2,428**	**-160**	**1,726**	**31.4**	**2,279**	**-0.5**



The Short Term Fundamentals

Bulls

Dwindling rig counts

Economic recovery

LNG & Ethanol Plants

Weather – Normal is now bullish

Bears

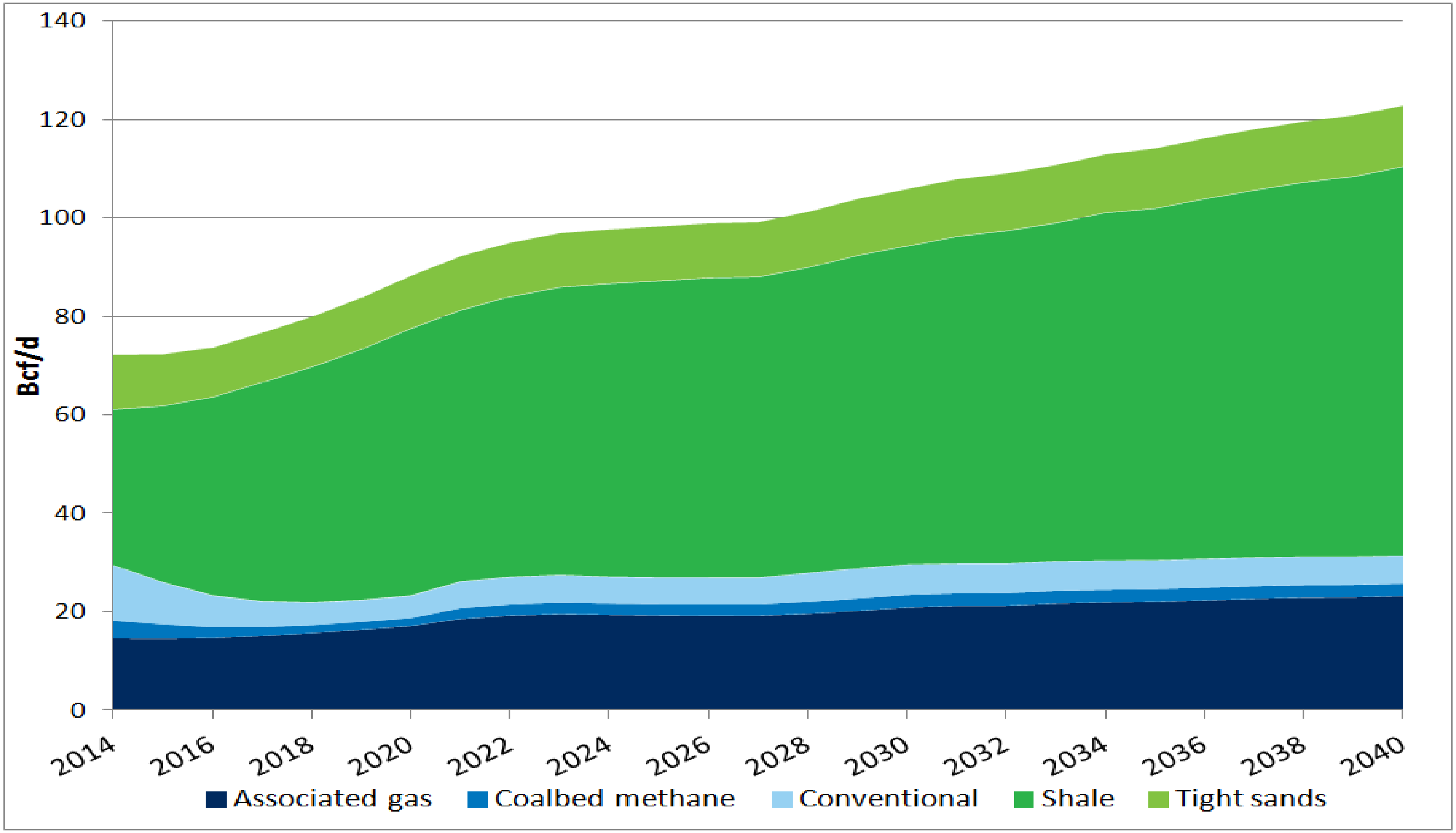
Demand is weak

Storage is full

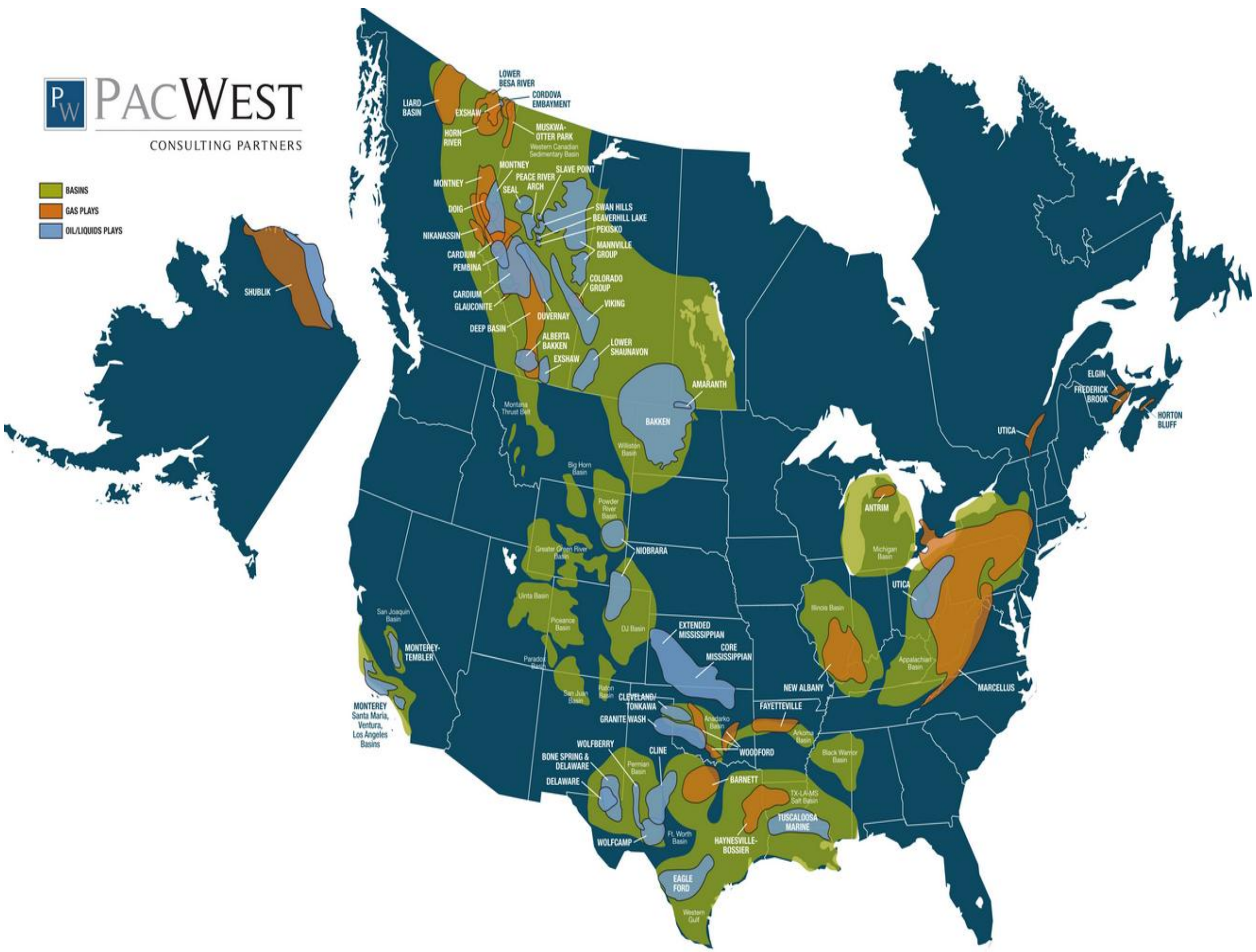
Oil Prices are near 5 year lows

Record Production

US Production – Where will it come from?



What is Shale Gas?

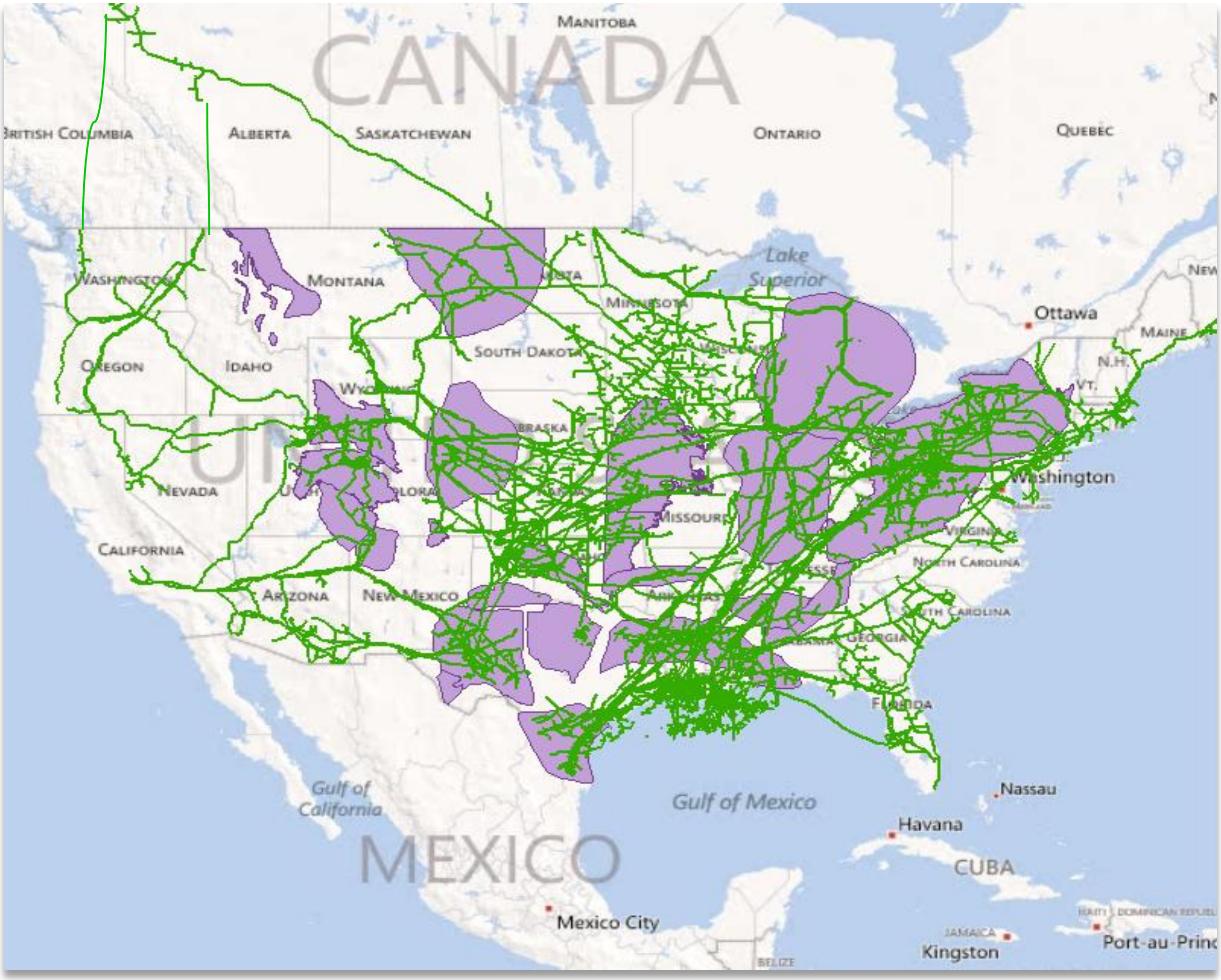


Shale gas refers to natural gas that is trapped within shale formations.

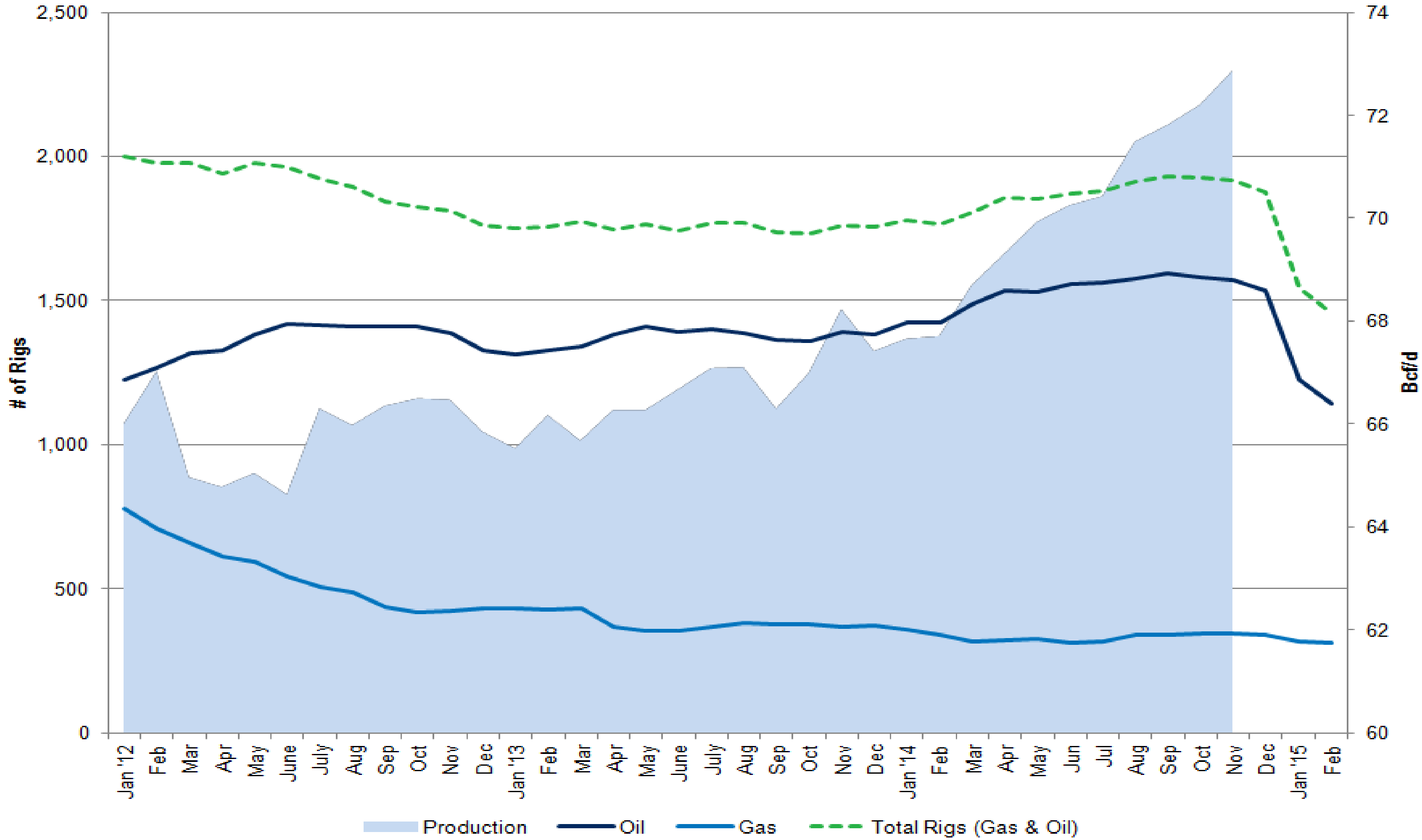
Shales are fine-grained sedimentary rocks that can be rich sources of petroleum and natural gas.

Over the past decade, the combination of horizontal drilling and hydraulic fracturing has allowed access to large volumes of shale gas that were previously uneconomical to produce.

Evolving Flow Dynamics

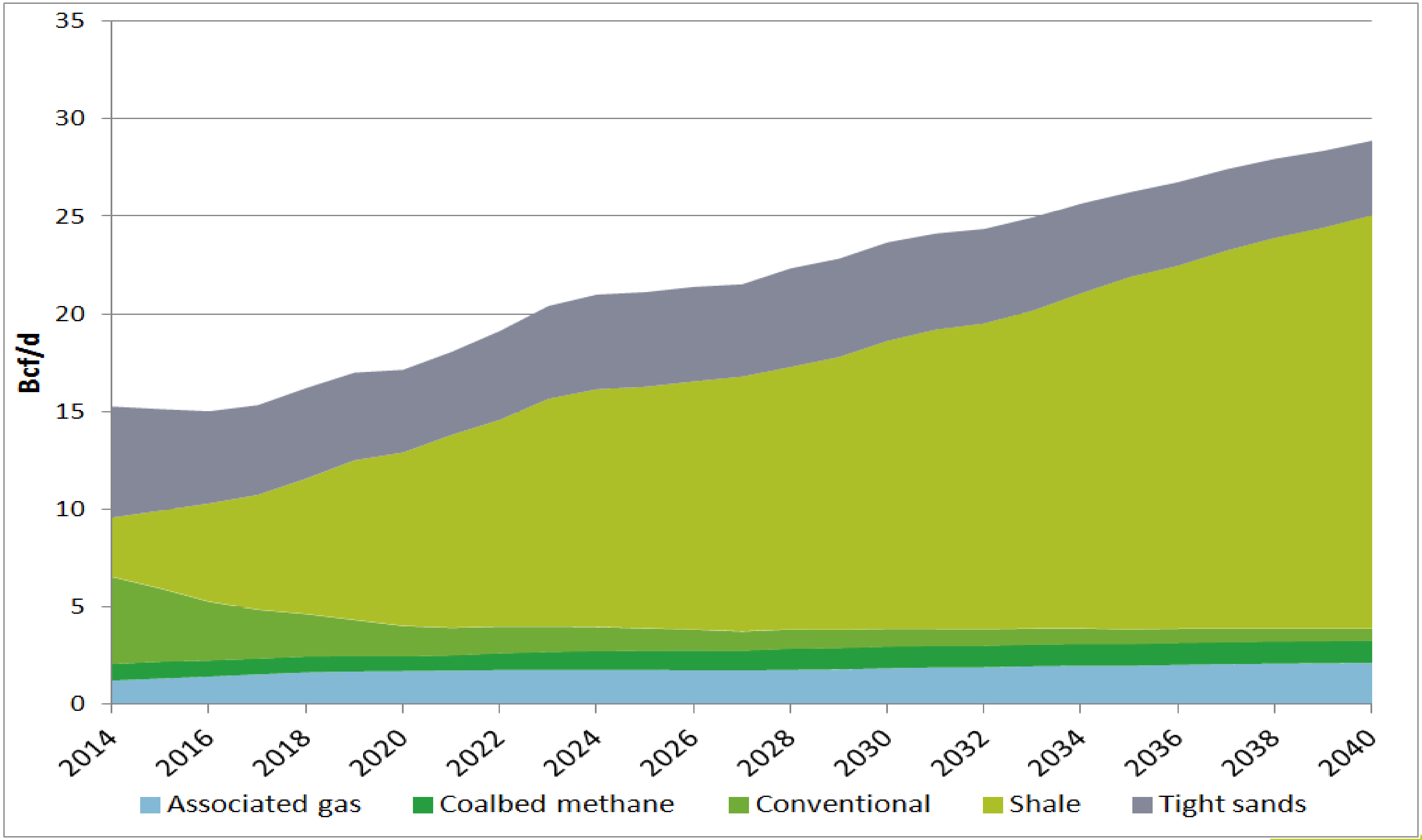


The Link Between Rig Counts and Production



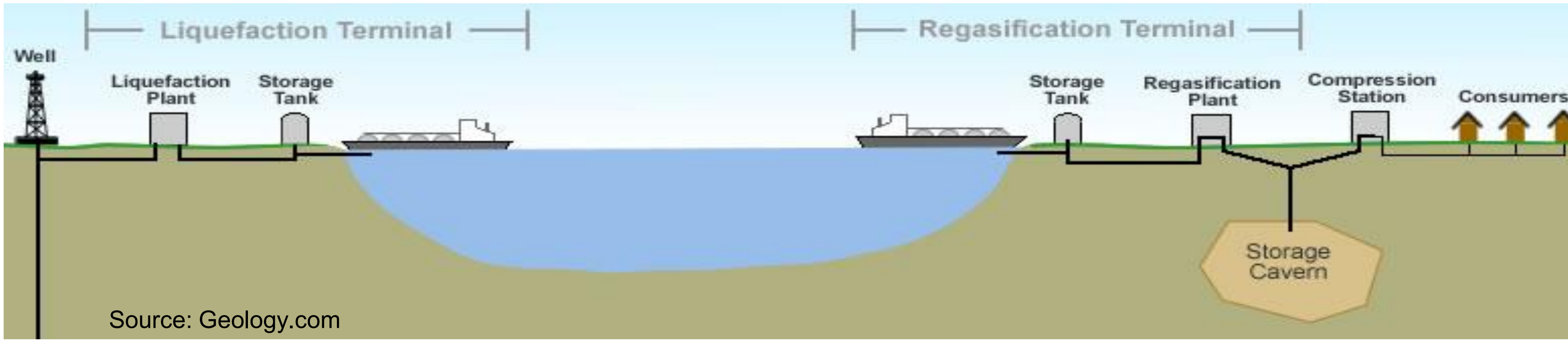
2015 Electric IRP Appendix A

Our friends to the North - Production



LNG Export is the New Import

LNG traditionally flows to North America after other higher-priced markets receive their share



Source: Geology.com

Source: Apache LNG

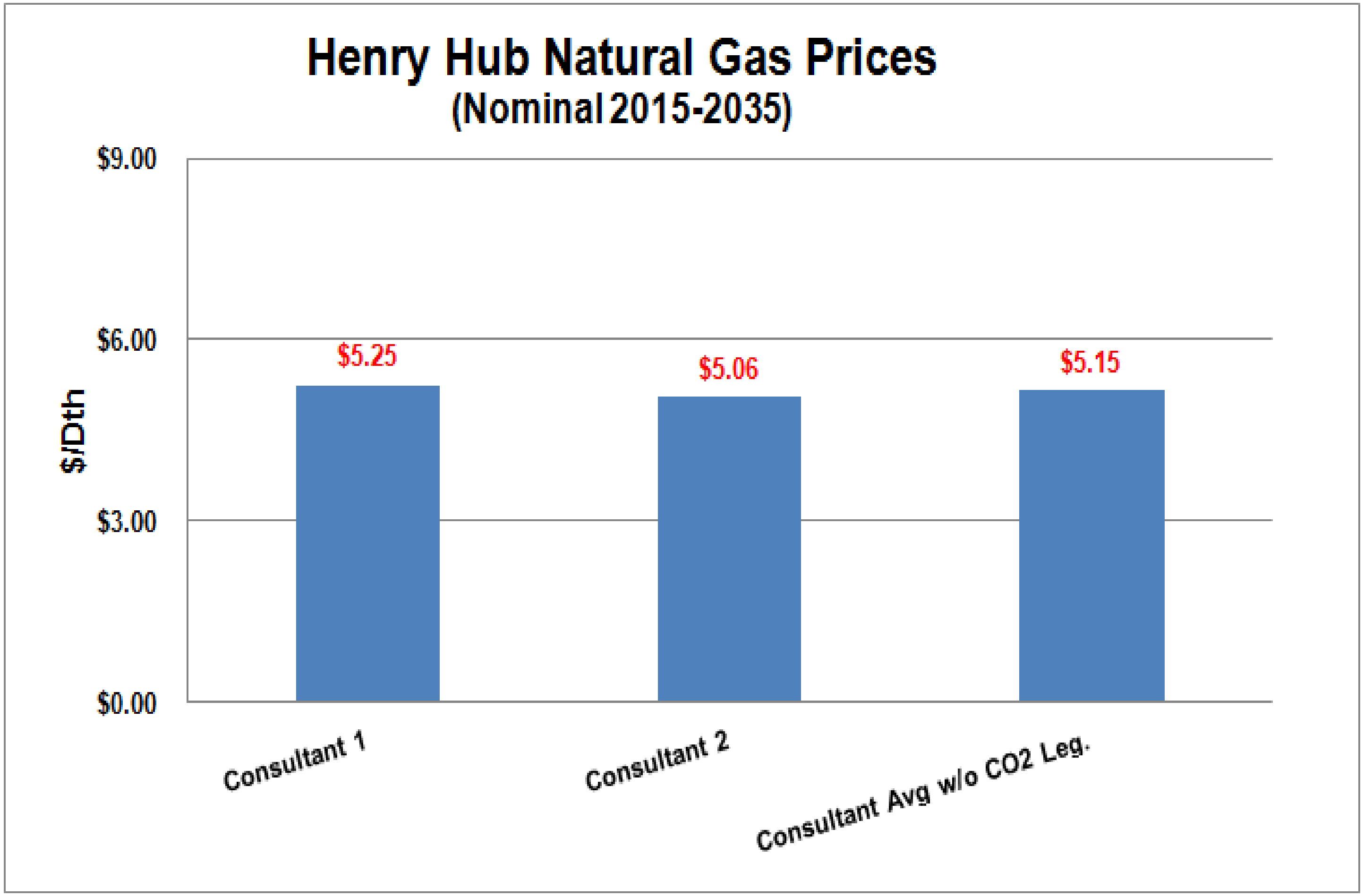
Source: Federal Energy Regulatory Commission

*As of January 8th, 2015

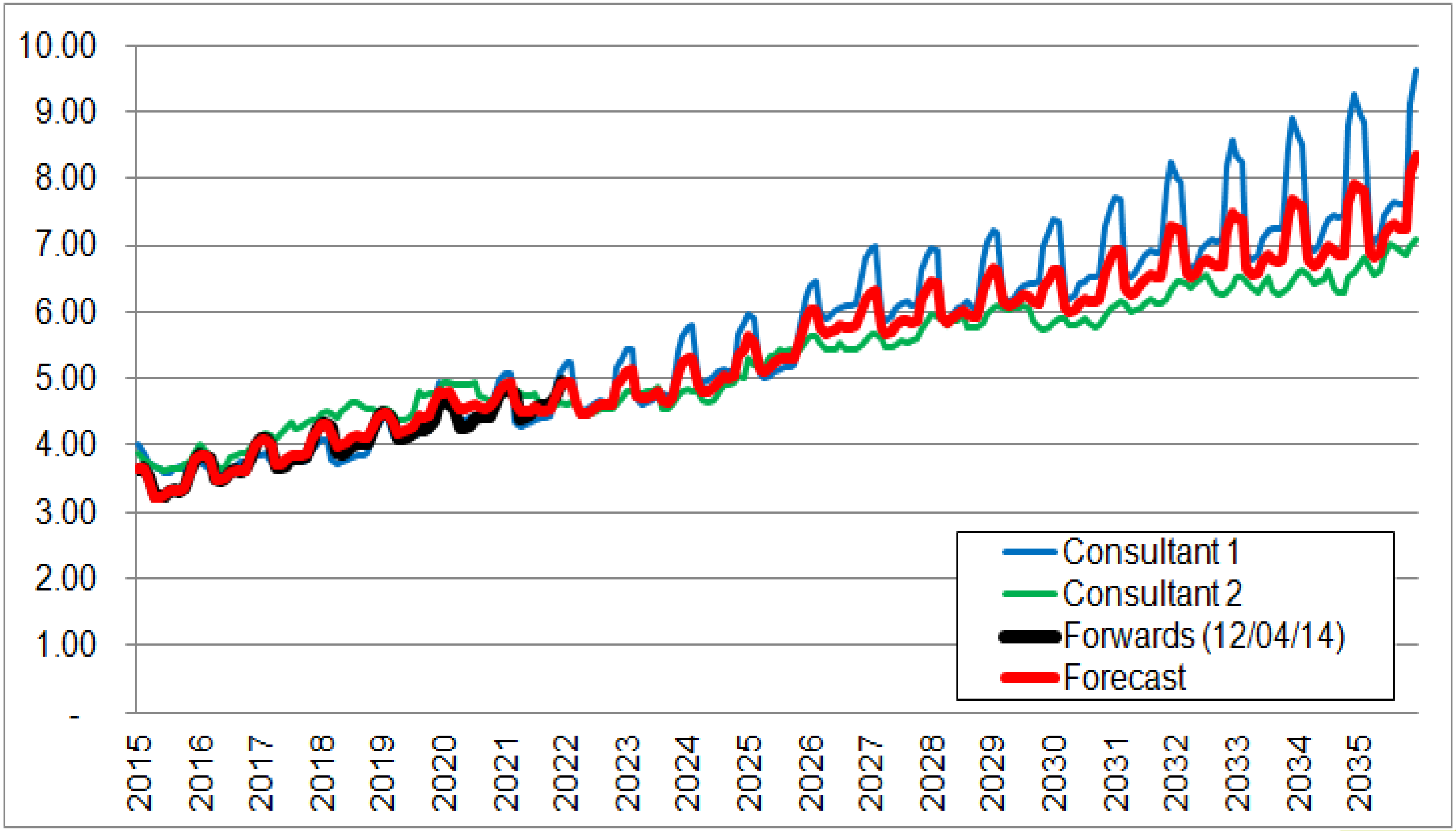
IRP Natural Gas Price Forecast Methodology

1. Two fundamental forecasts (Consultant #1 & Consultant #2)
2. Forward prices
3. Year 1: forward price only
4. Year 2: 75% forward price / 25% average consultant forecasts
5. Year 3: 50% forward price / 50% average consultant forecasts
6. Year 4 – 6: 25% forward price / 75% average consultant forecasts
7. Year 7+: 50% average consultant without CO_2 / 50% average consultant with CO_2

Forecasted Levelized Price



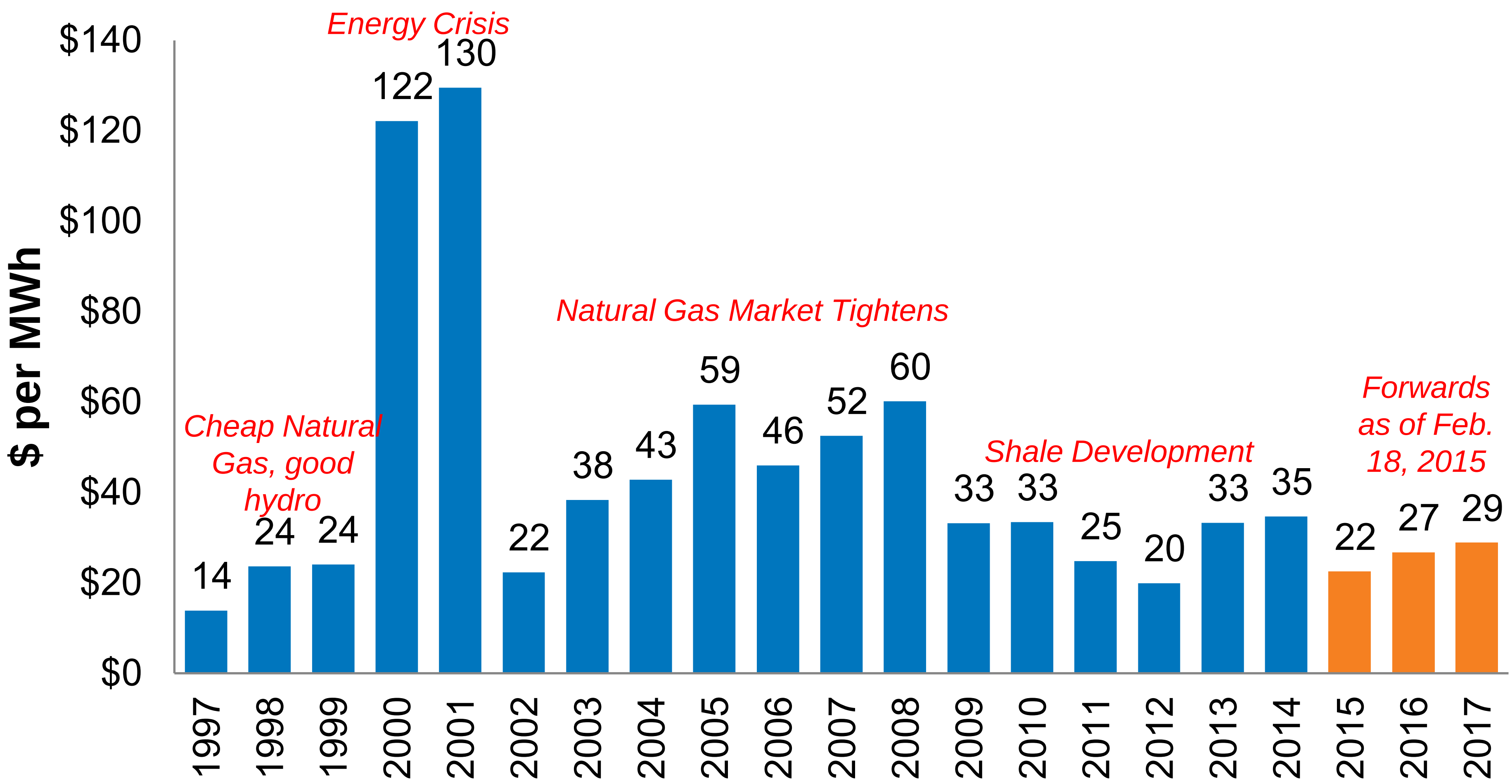
Henry Hub Forecasted Prices



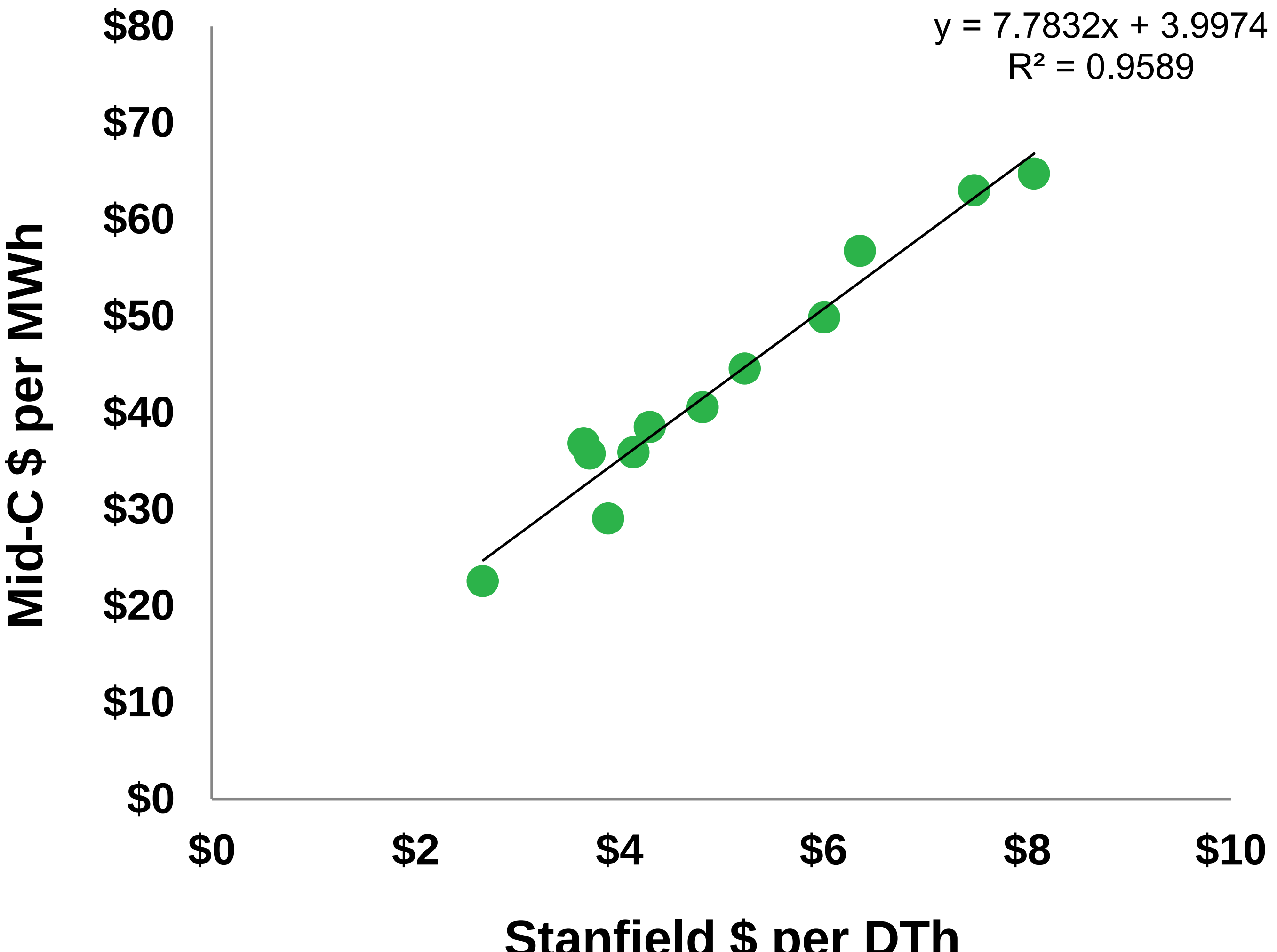
2015 Electric IRP
Electric Market Forecast

James Gall, Senior Power Supply Analyst
Fourth Technical Advisory Committee Meeting
February 24, 2015

Mid-Columbia Flat Firm Price Index History

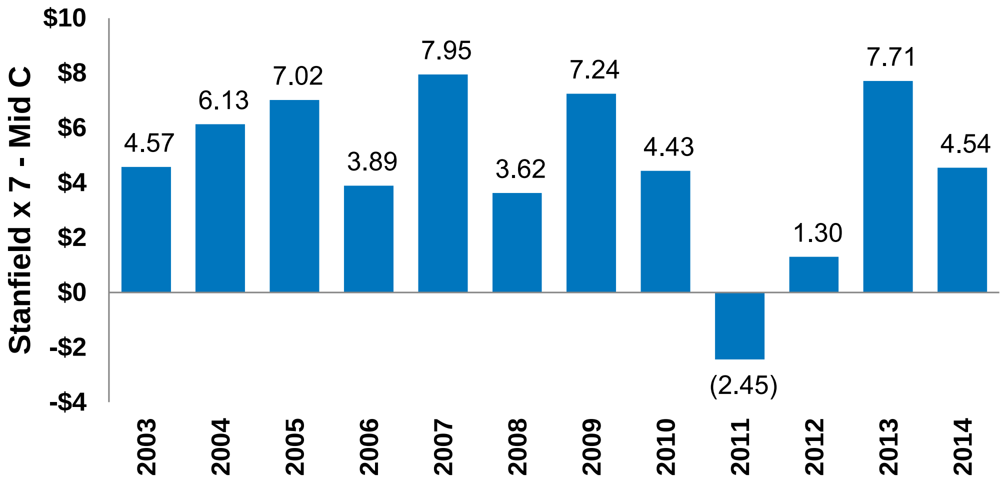


Natural Gas vs. Electric Prices (2003-14)

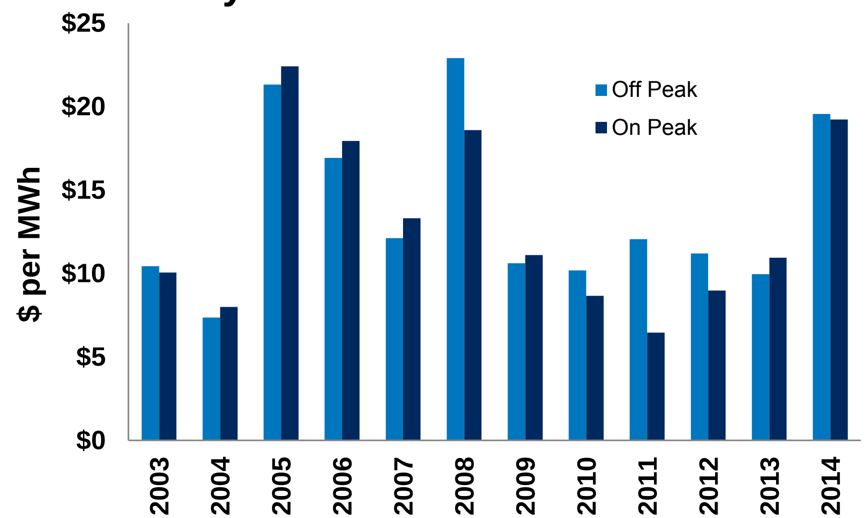


Market Indicators

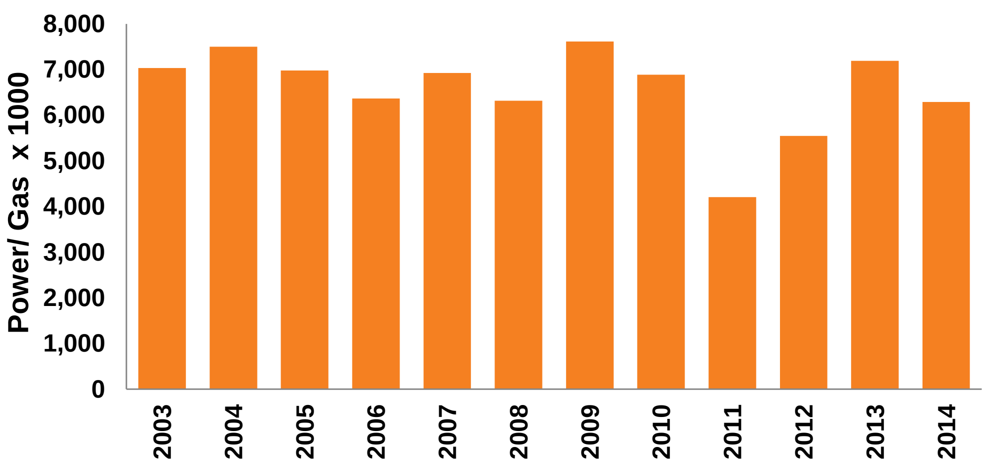
Spark Spread



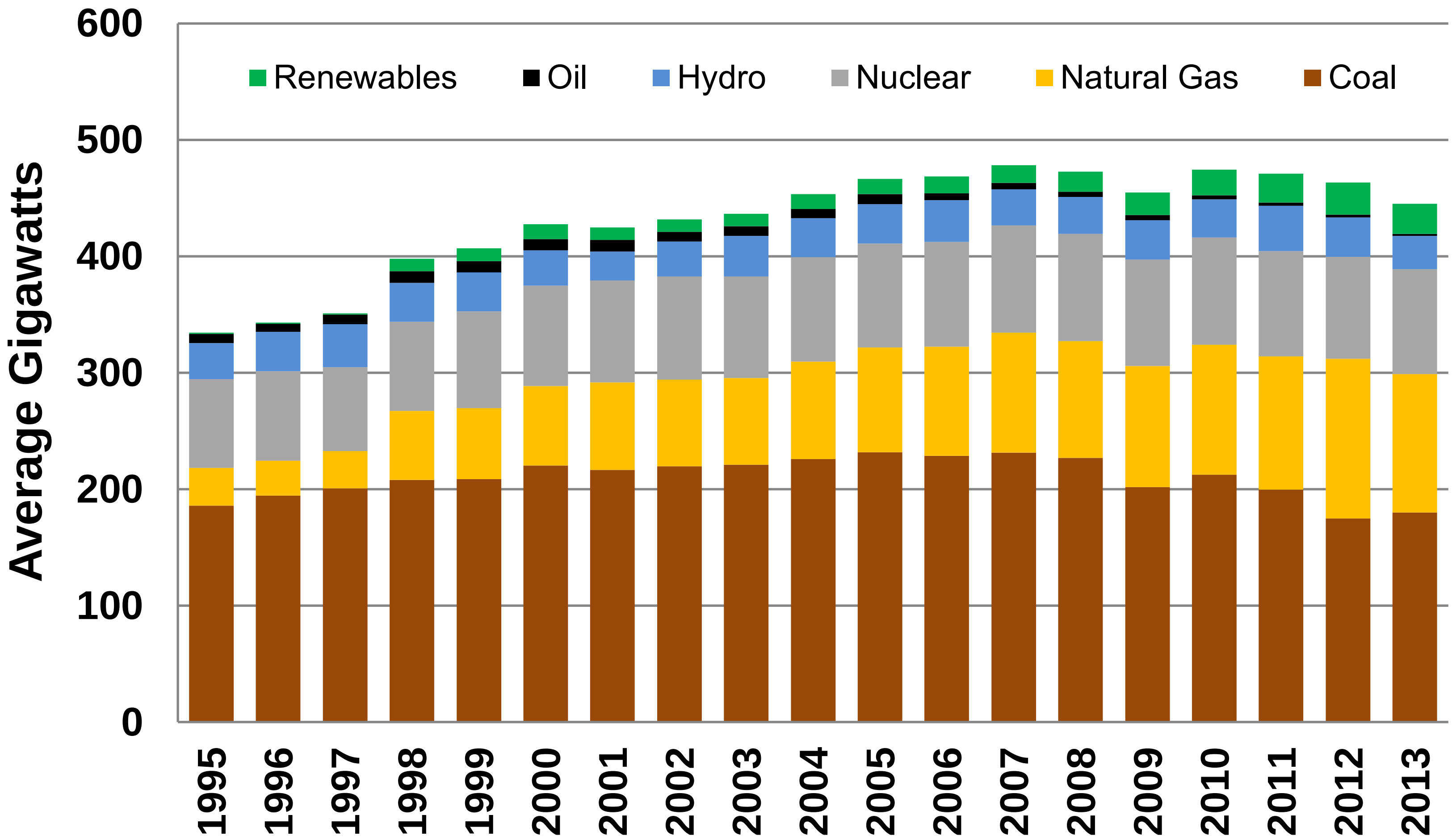
Daily Price Standard Deviation



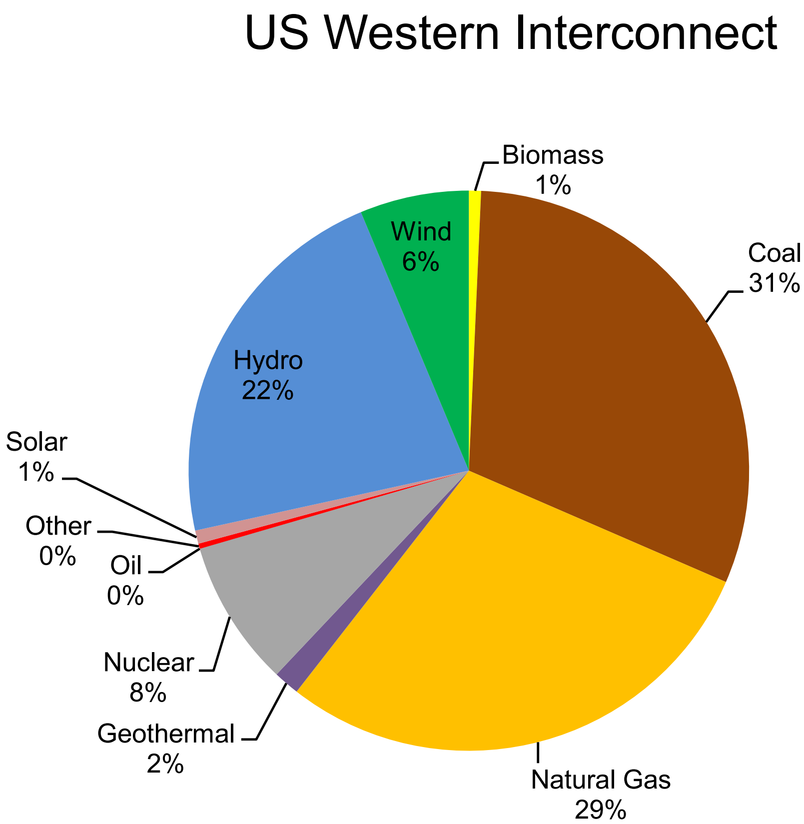
Implied Market Heat Rate

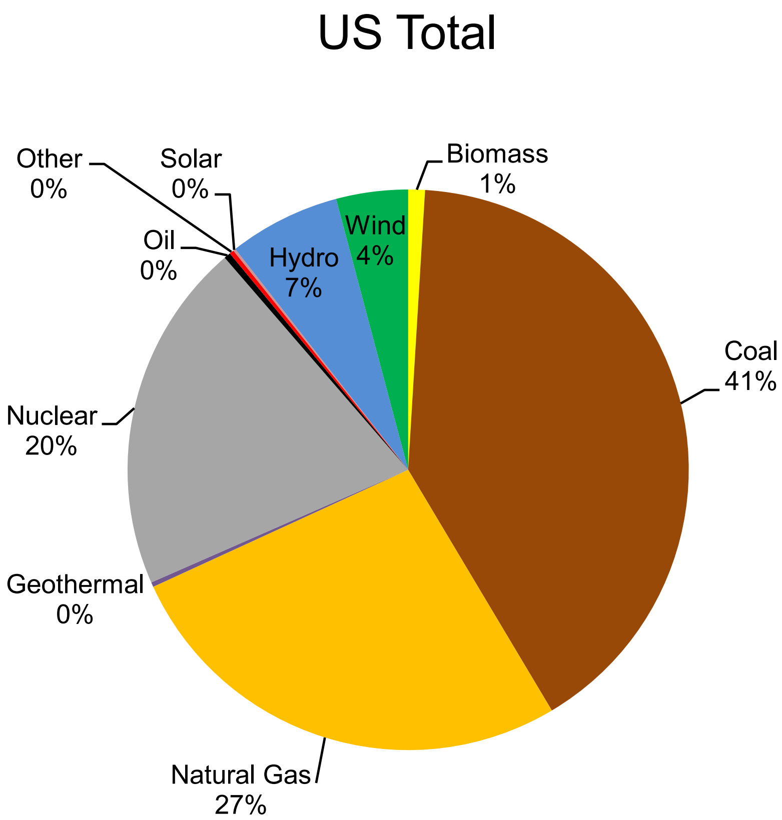


US Power Generation

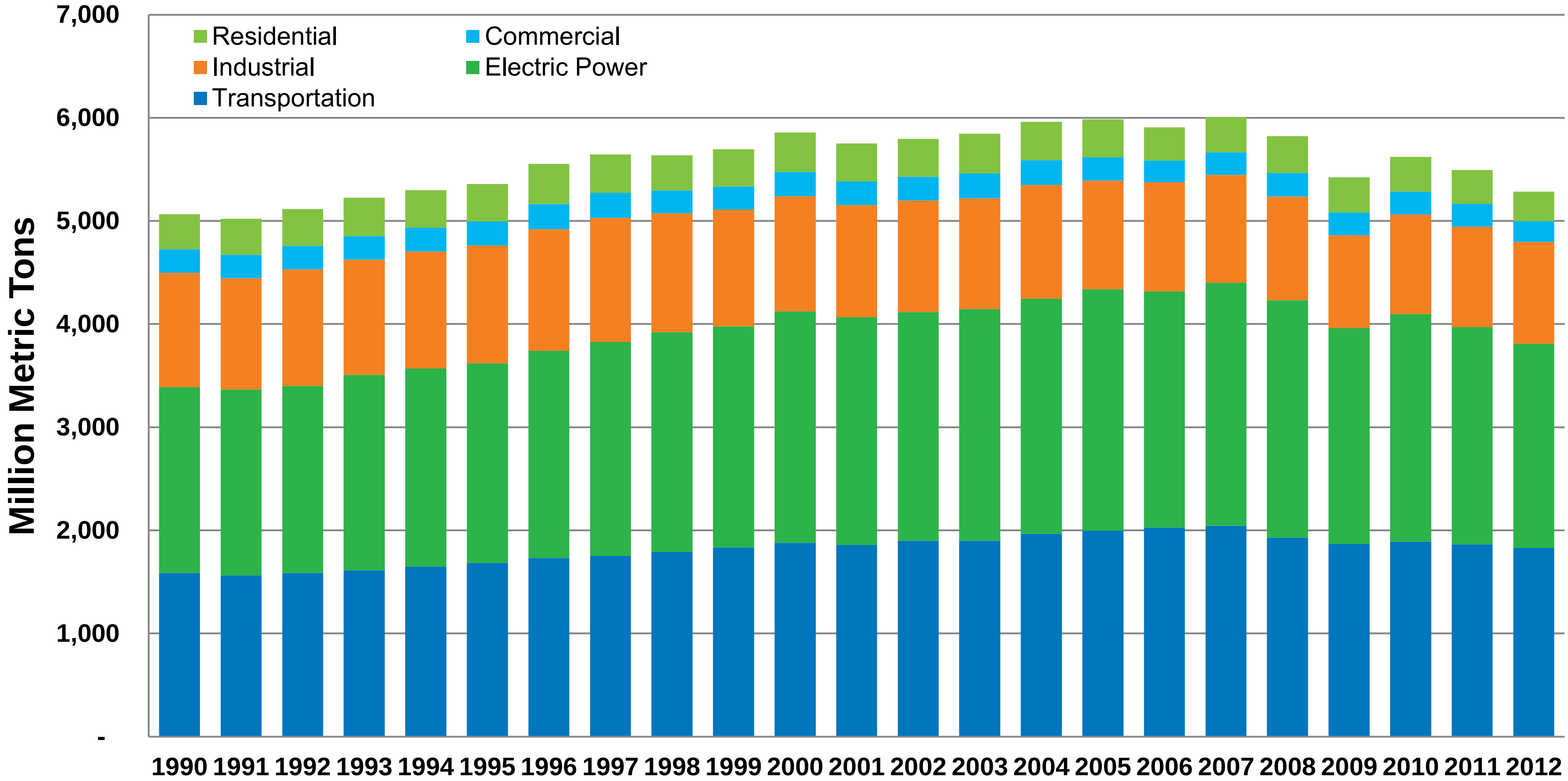


Fuel Mix Comparison



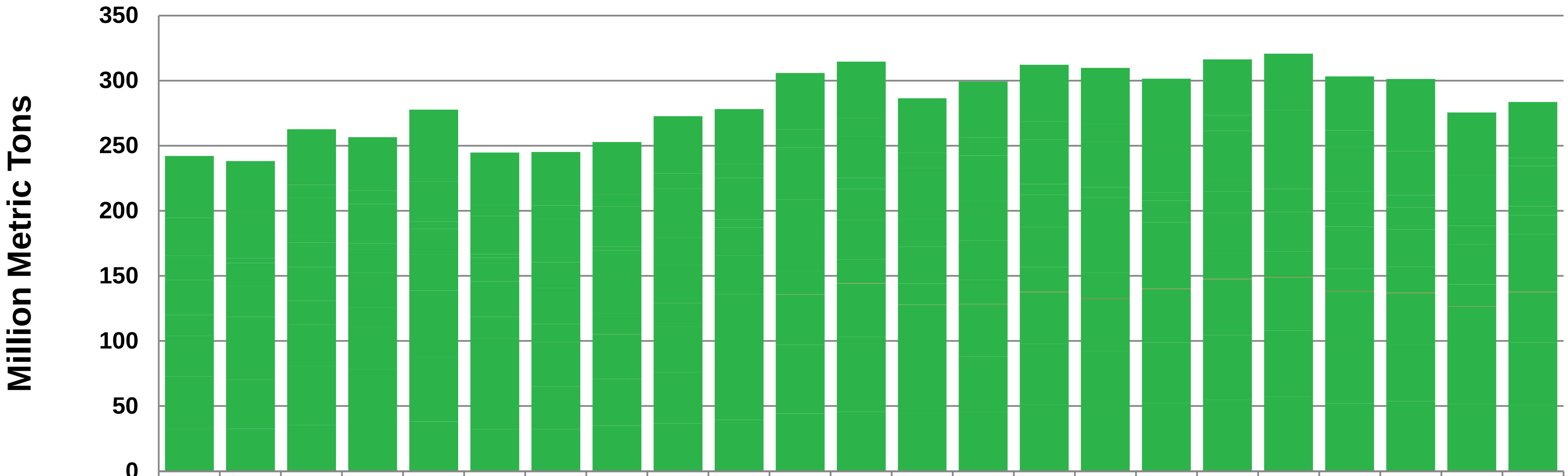


US Greenhouse Gas Emissions
All Sources



Source: http://epa.gov/statelocalclimate/resources/state_energyco2inv.html

Western Greenhouse Gas Emissions



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
WY	40	39	43	41	43	40	41	41	44	42	44	44	42	43	44	43	43	43	44	41	42	41	43
WA	8	8	10	10	12	8	11	9	12	11	14	14	11	14	14	14	9	12	13	13	13	7	6
UT	29	28	30	30	31	29	30	31	31	32	33	32	33	34	34	35	35	37	38	35	34	33	31
OR	2	4	5	4	5	3	3	3	6	6	7	9	6	8	8	8	6	10	10	9	10	6	7
NV	17	18	19	18	20	18	20	19	21	21	25	24	21	23	25	26	17	17	18	18	17	14	15
NM	27	23	26	27	28	27	28	29	29	30	31	30	28	30	30	32	32	31	30	32	29	31	29
MT	16	17	18	15	18	17	14	16	18	18	17	18	16	18	19	19	19	20	20	17	20	16	15
ID	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	0	1
CO	31	31	32	32	33	33	34	34	35	35	39	41	40	40	40	40	41	42	41	38	39	38	39
CA	40	38	46	42	49	37	33	36	39	43	53	58	44	43	46	42	46	50	51	48	43	36	48
AZ	33	33	35	37	38	32	32	35	37	39	44	45	45	46	51	50	52	55	57	52	54	52	51
TOTAL	242	238	263	256	278	245	245	253	273	278	306	315	286	299	312	310	302	316	321	303	301	275	284

Source: http://epa.gov/statelocalclimate/resources/state_energyco2inv.html

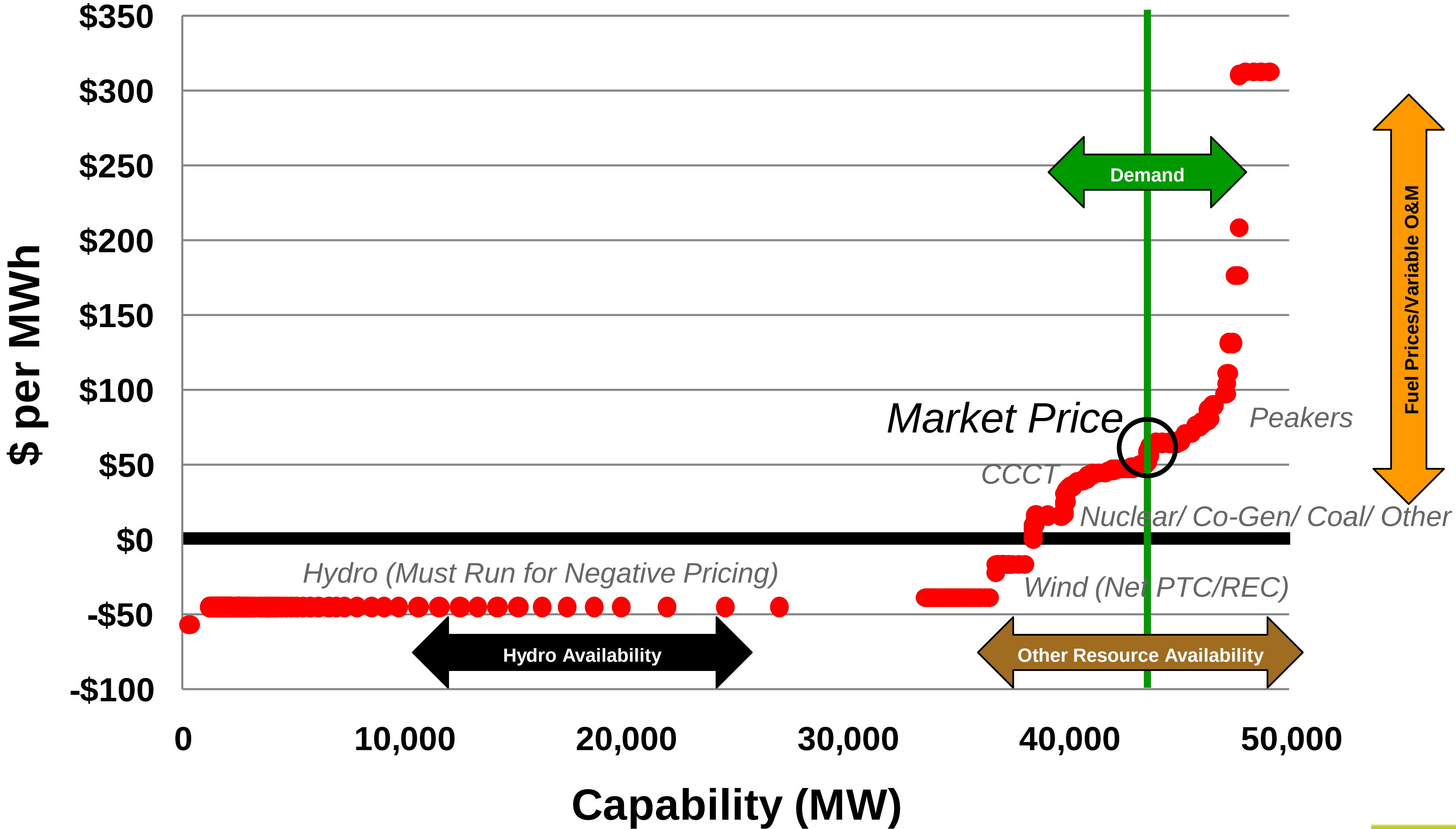
Electric Market Modeling

- 3rd party software- EPIS, Inc.
- Electric market fundamentals- production cost model
- Simulates generation dispatch to meet load
- Outputs:
  - Market prices
  - Regional energy mix
  - Transmission usage
  - Greenhouse gas emissions
  - Power plant margins, generation levels, fuel costs
  - Avista's variable power supply costs

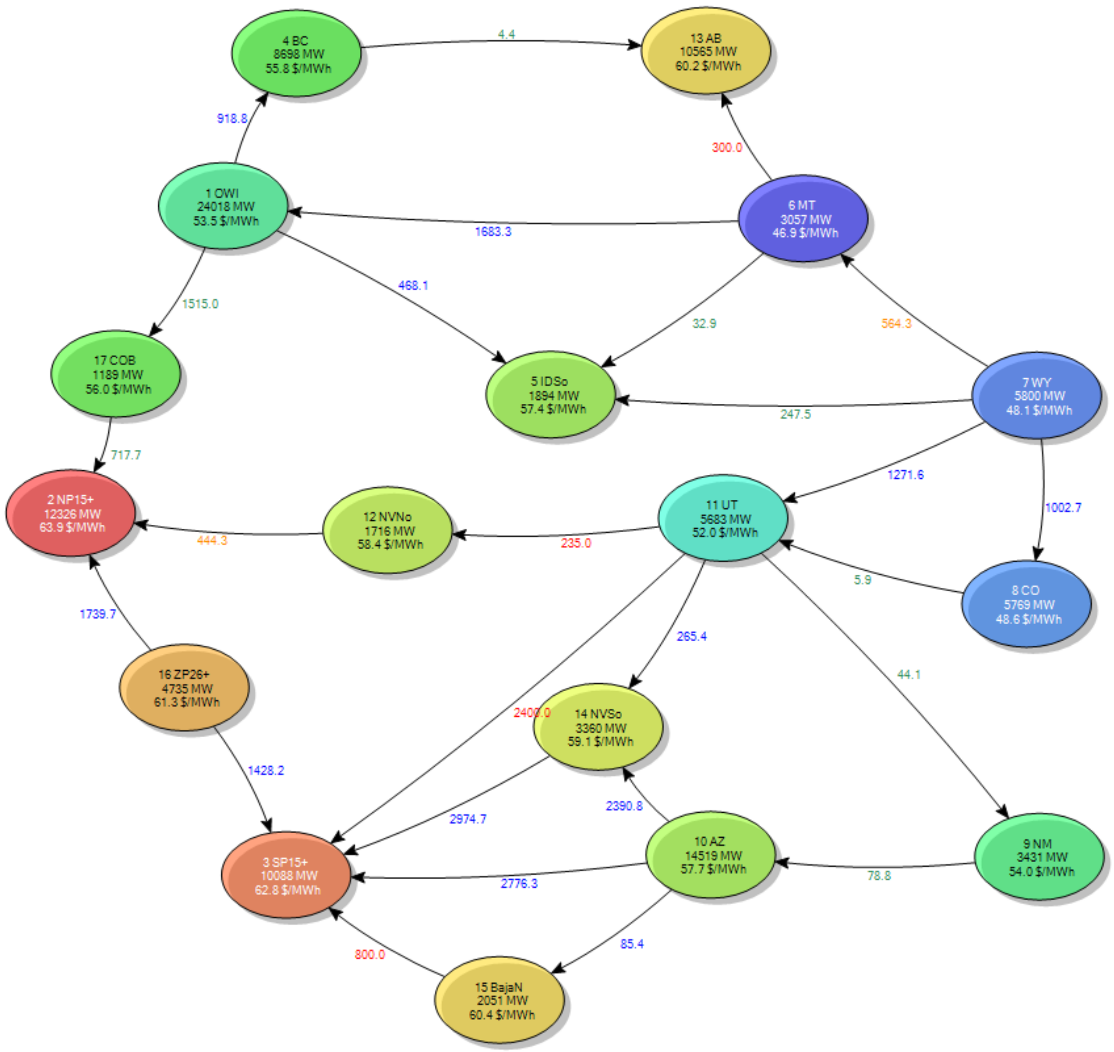
Stochastic Approach

- Simulate Western Electric market hourly for next 20 years (2016-35)
  - That is 175,248 hours for each study
- Model 500 potential outcomes
  - Variables include fuel prices, loads, wind, hydro, outages, inflation
  - Simulating 87.6 million hours
- Run time is about 5 days on 30 processors
- Why do we do this?
  - Allows for complete financial evaluation of resource alternatives
  - Without stochastic prices we cannot account for tail risk

Aurora Pricing Example- Supply/Demand Curve



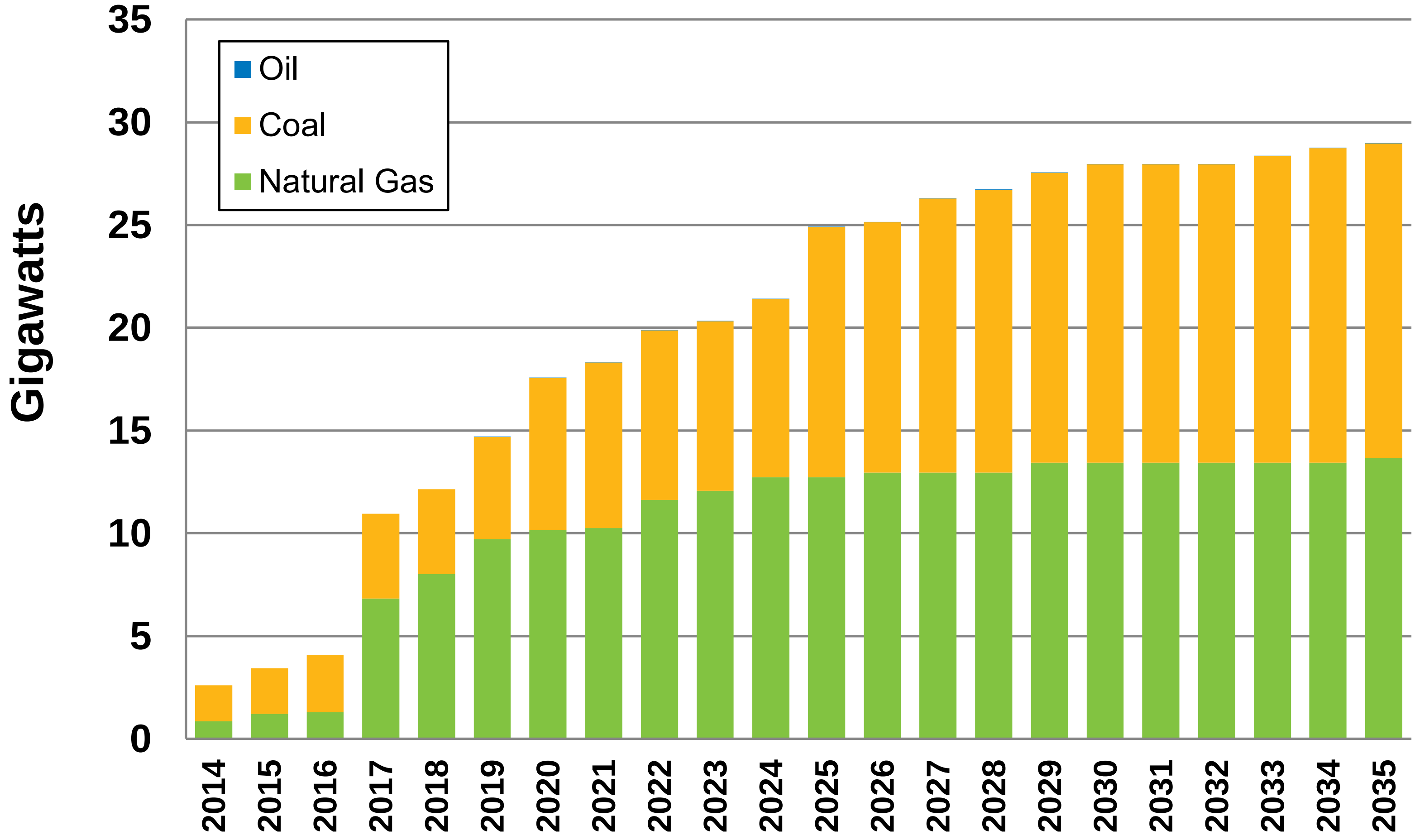
Modeled Western Interconnect Topology



Greenhouse Gas Reduction Modeling

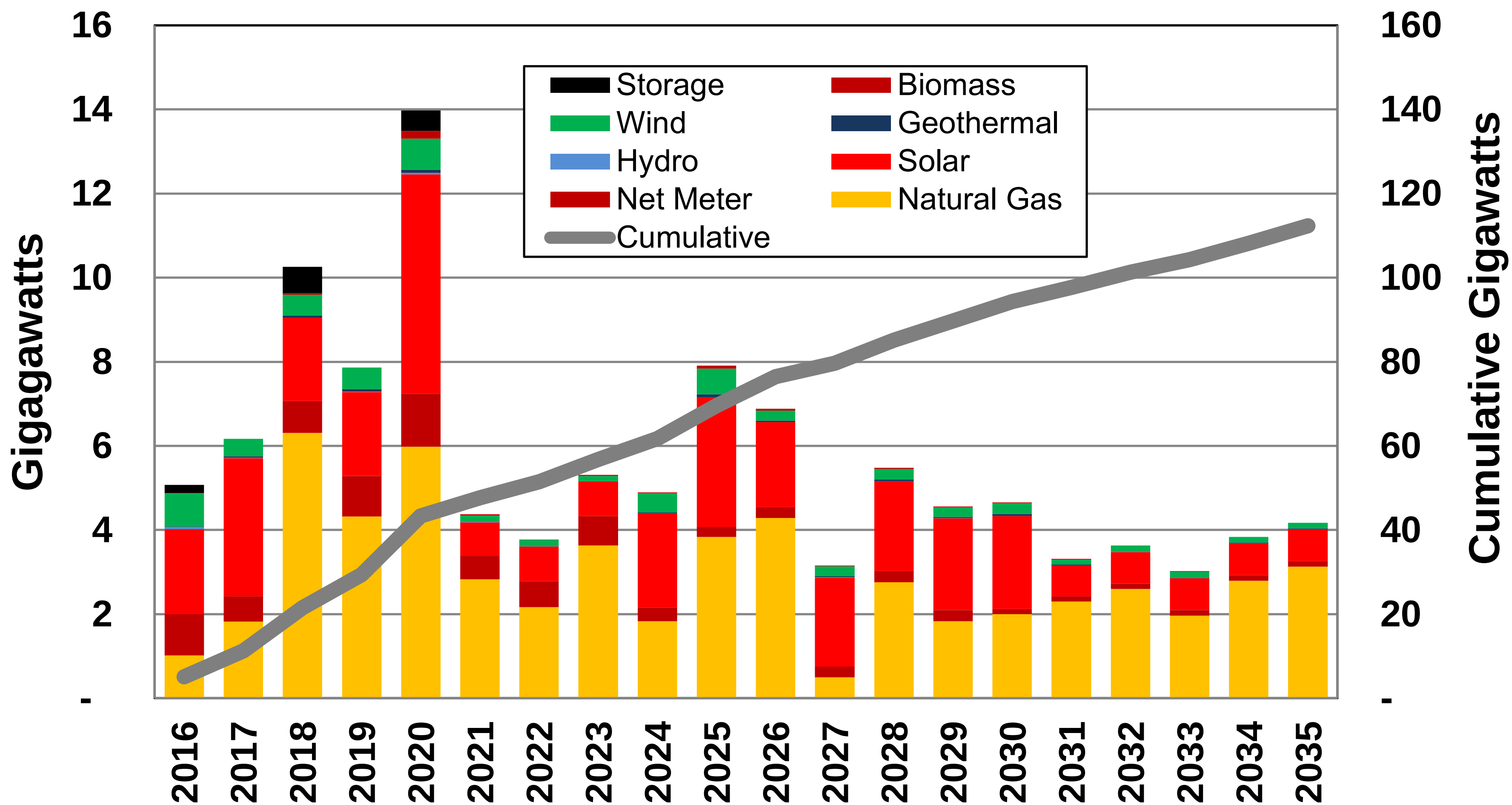
- California, BC, and Alberta include CO_2 price adder
- 10% probability for other states to have future carbon price adder ("Tax")
  - Price is $12 per metric ton beginning in 2020, with a 5% escalator
- Meets EPA 111(d) glide path reduction for total region by 2030
- Load growth is lowered to less than 1% across the Western Interconnect to account for increased conservation
- No new coal-fired generation
- Uses existing state Renewable Portfolio Standards

Western Resource Planned Retirements



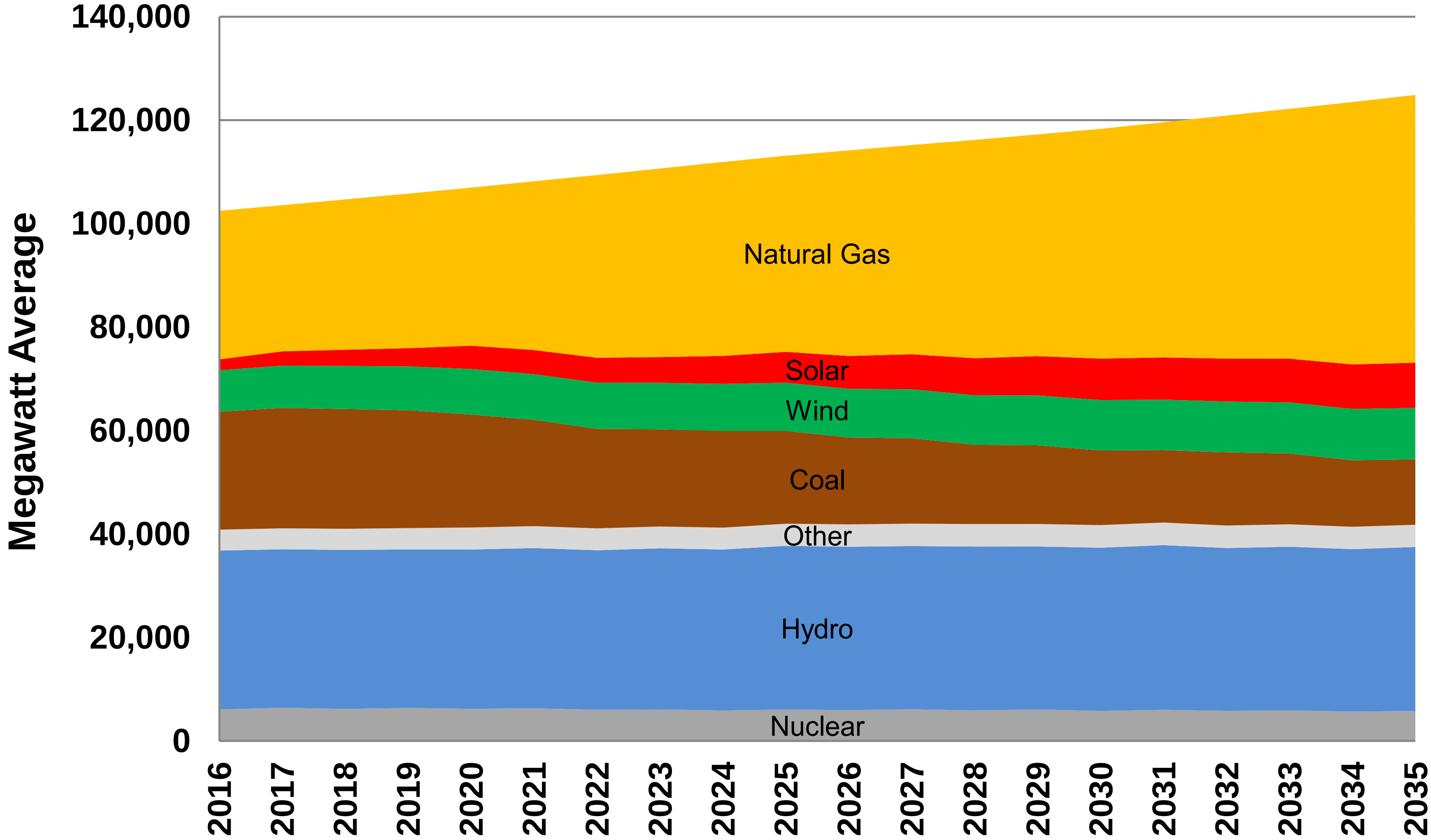
Note: Includes only announced plants, and small coal plants in carbon constrained states
Majority of natural gas retirements are once through cooling

New Resources to Western Interconnect

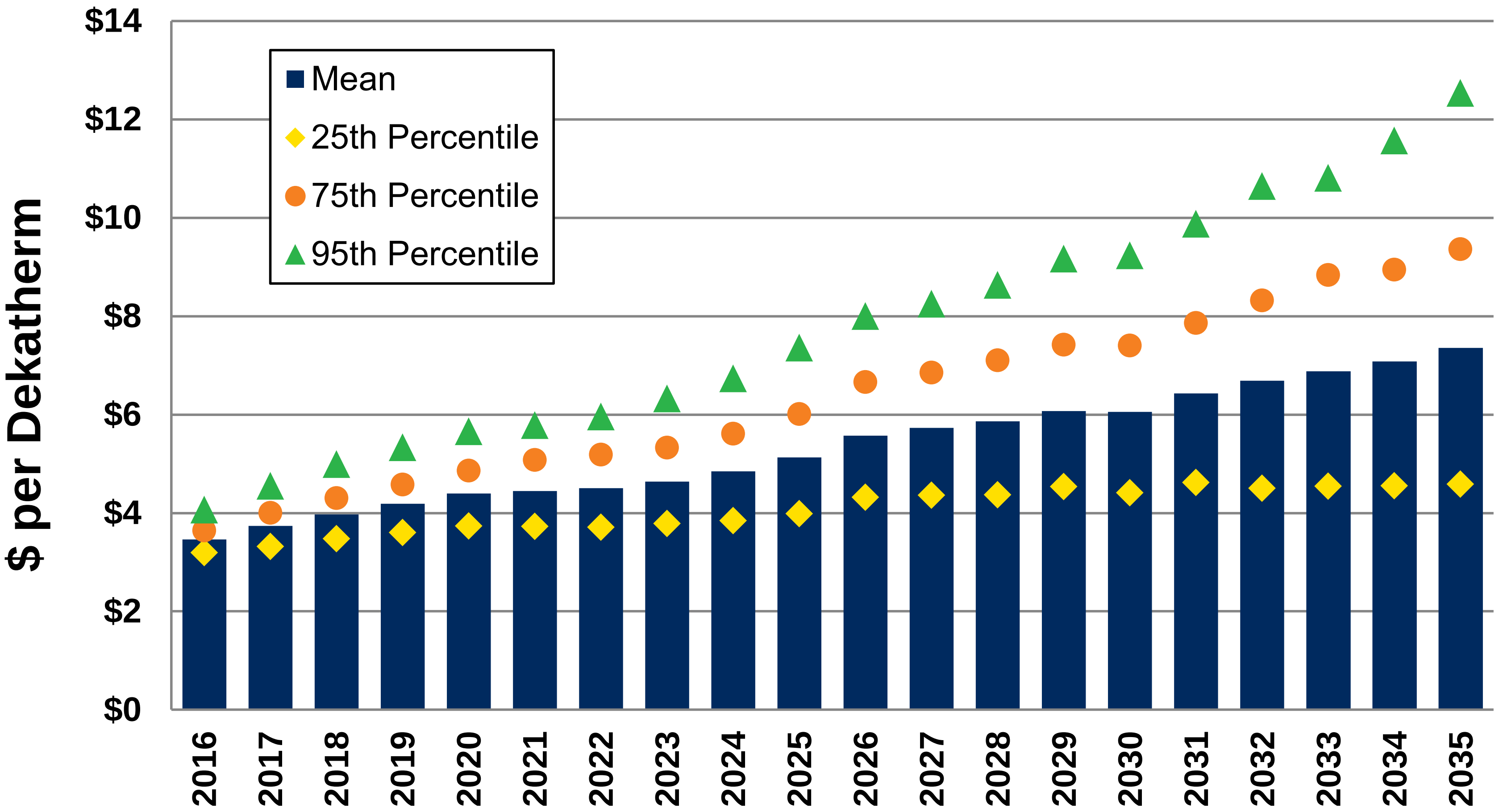


Resource Type Mix Forecast

(Western Interconnect)



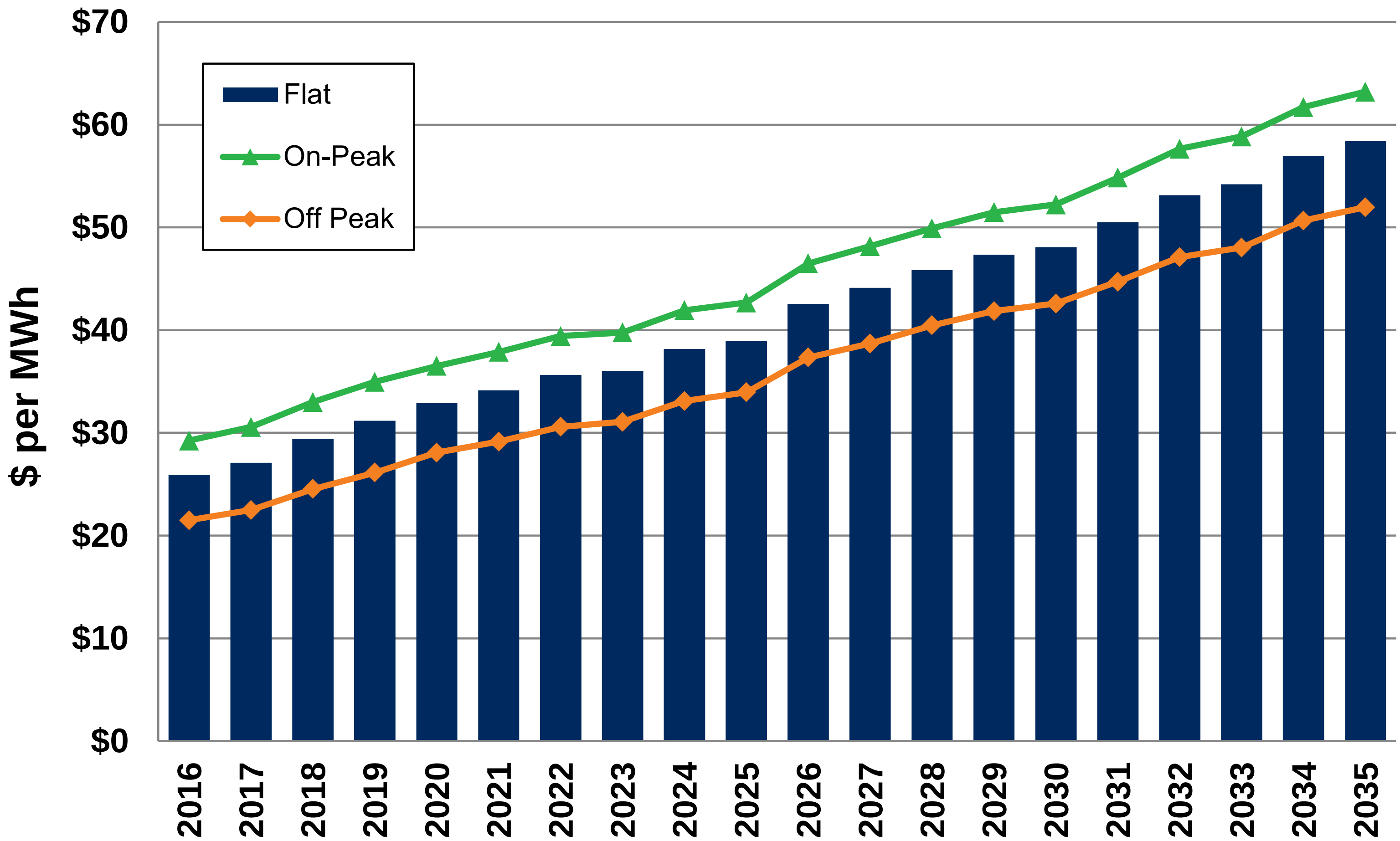
Stanfield Natural Gas Price Forecast



Levelized mean price $4.85/dth

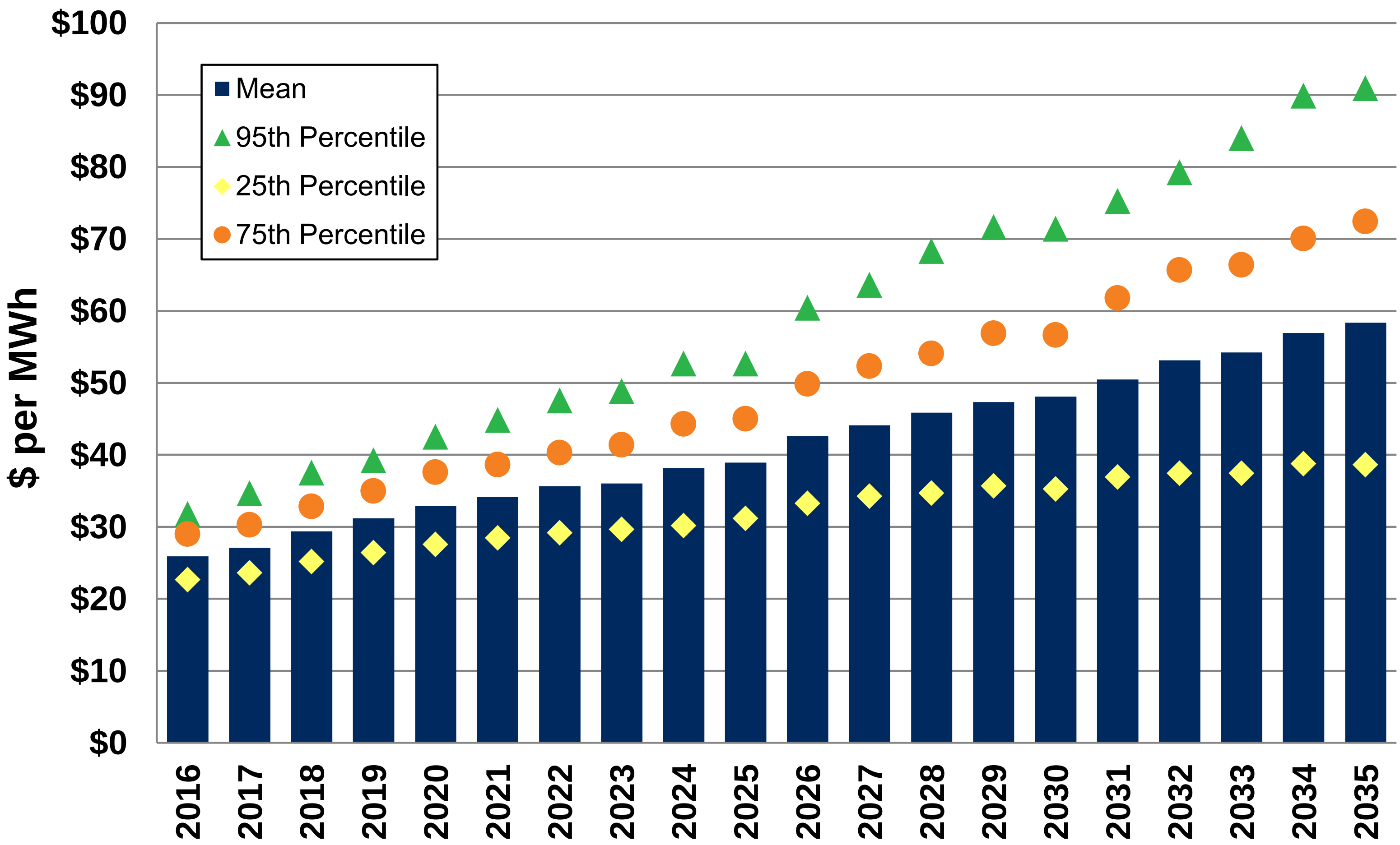
Note: Coefficient of variation (stdev/mean) in 2016 is 15%, in 2035, the volatility increases to 56%

Mid-Columbia Electric Price Forecast
(Mean of 500 iterations)



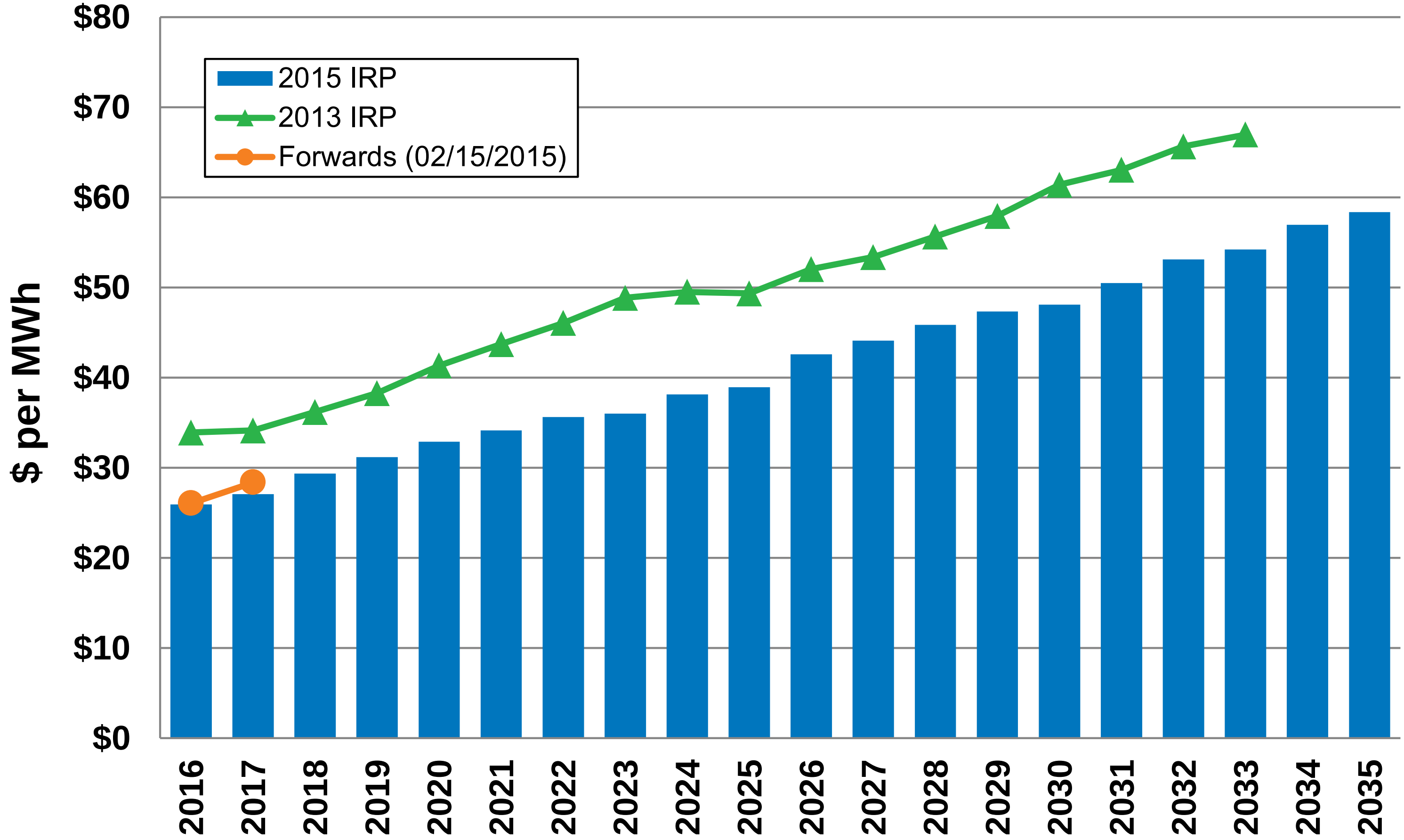
<u>Levelized Prices</u>
Flat: $37.29/MWh
On Peak: $41.08/MWh
Off Peak: $32.24/MWh

Mid-Columbia Electric Price Forecast
(Flat Price Statistics)

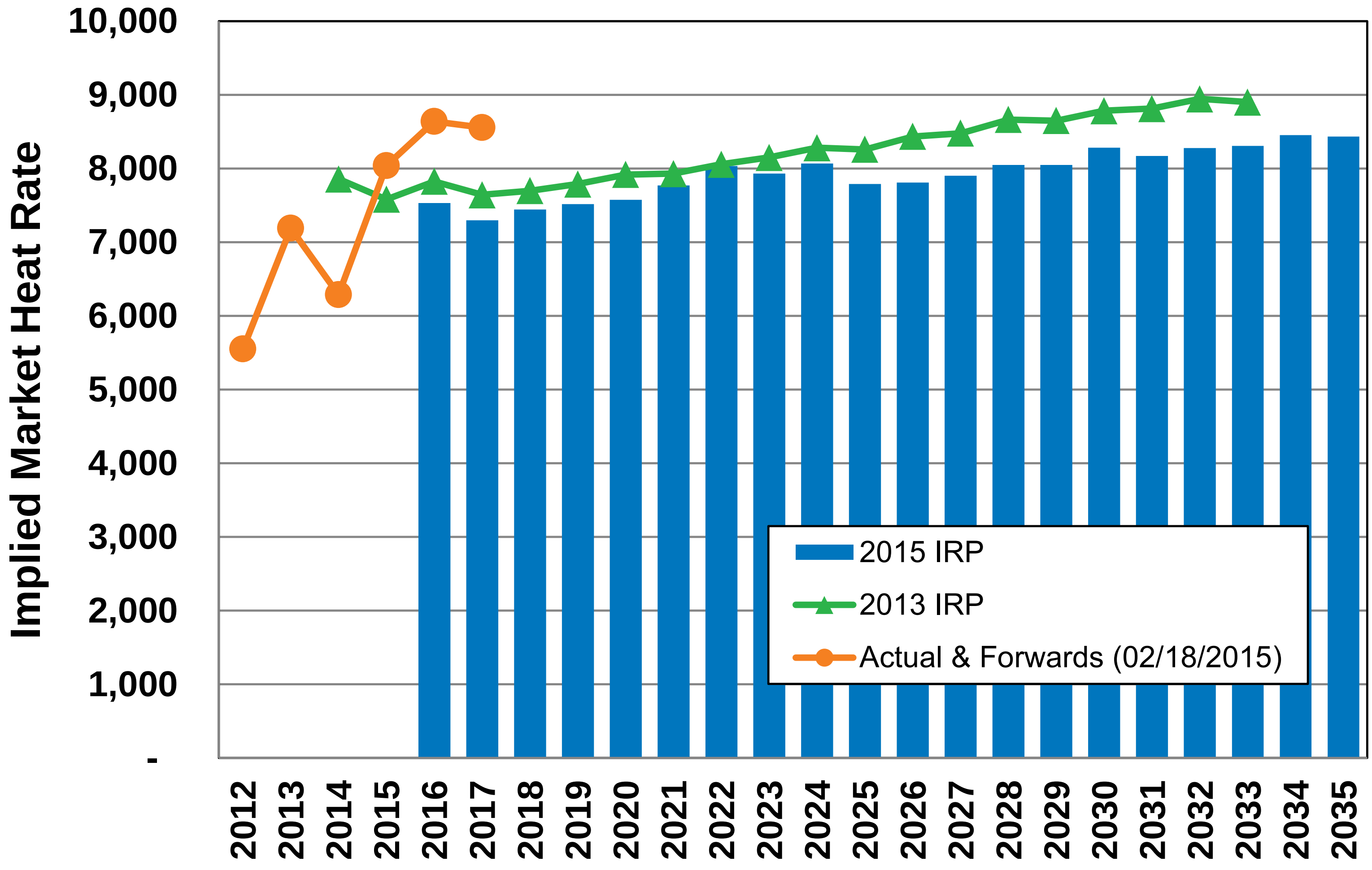


Note: Coefficient of variation (stdev/mean) in 2016 is 22%, in 2035, the volatility increases to 52%

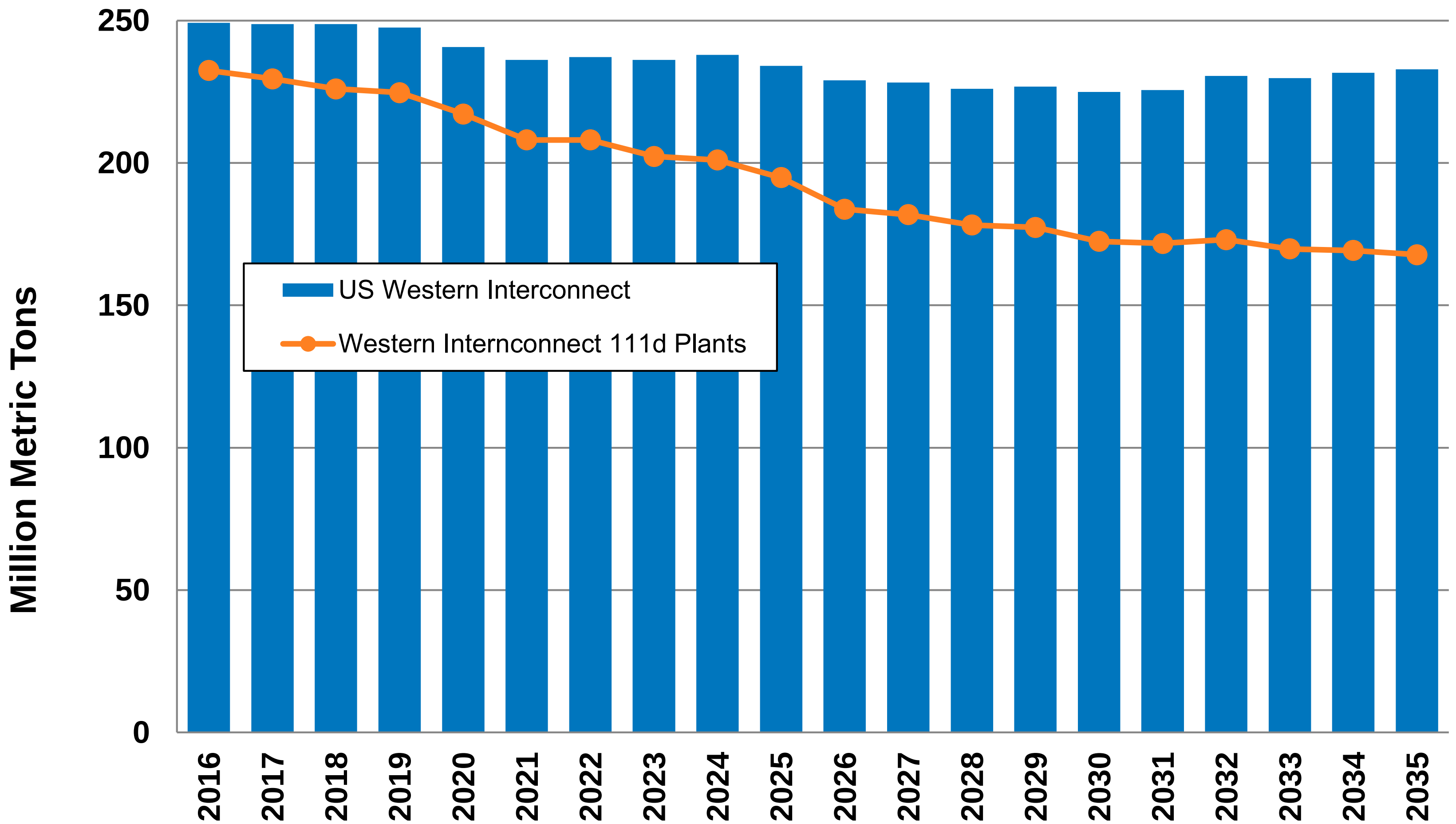
IRP Price Forecast Comparison (Flat Prices)



Implied Market Heat Rate

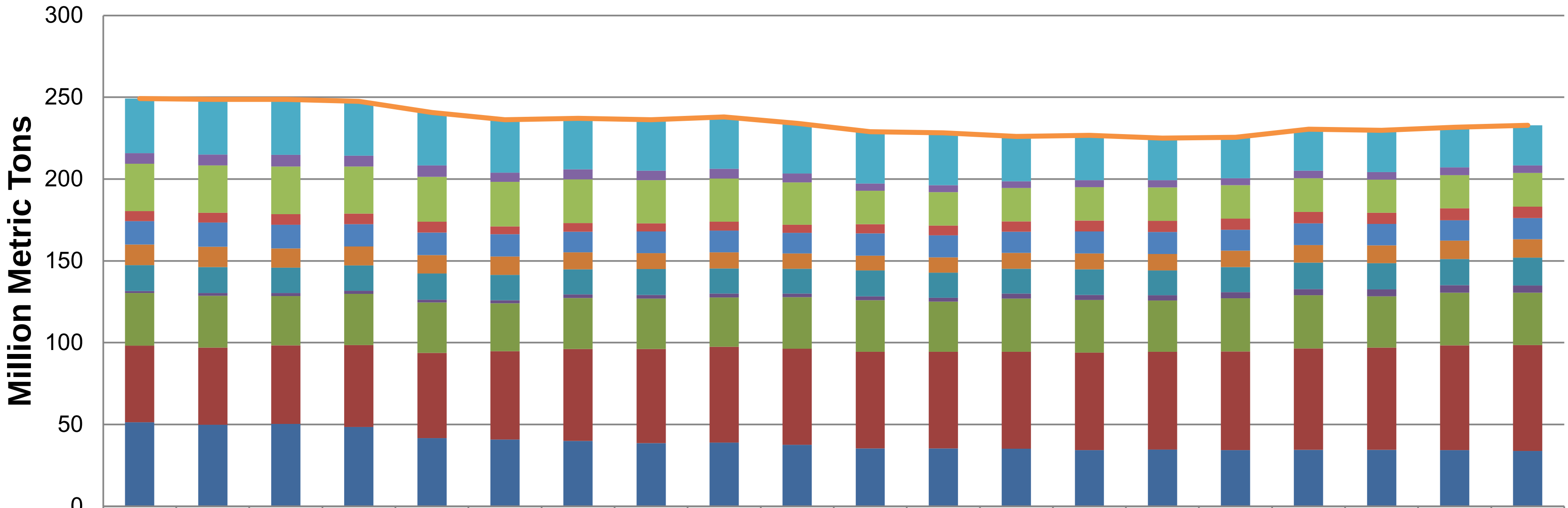


Greenhouse Gas Emissions Forecast
(US Western Interconnect Total)



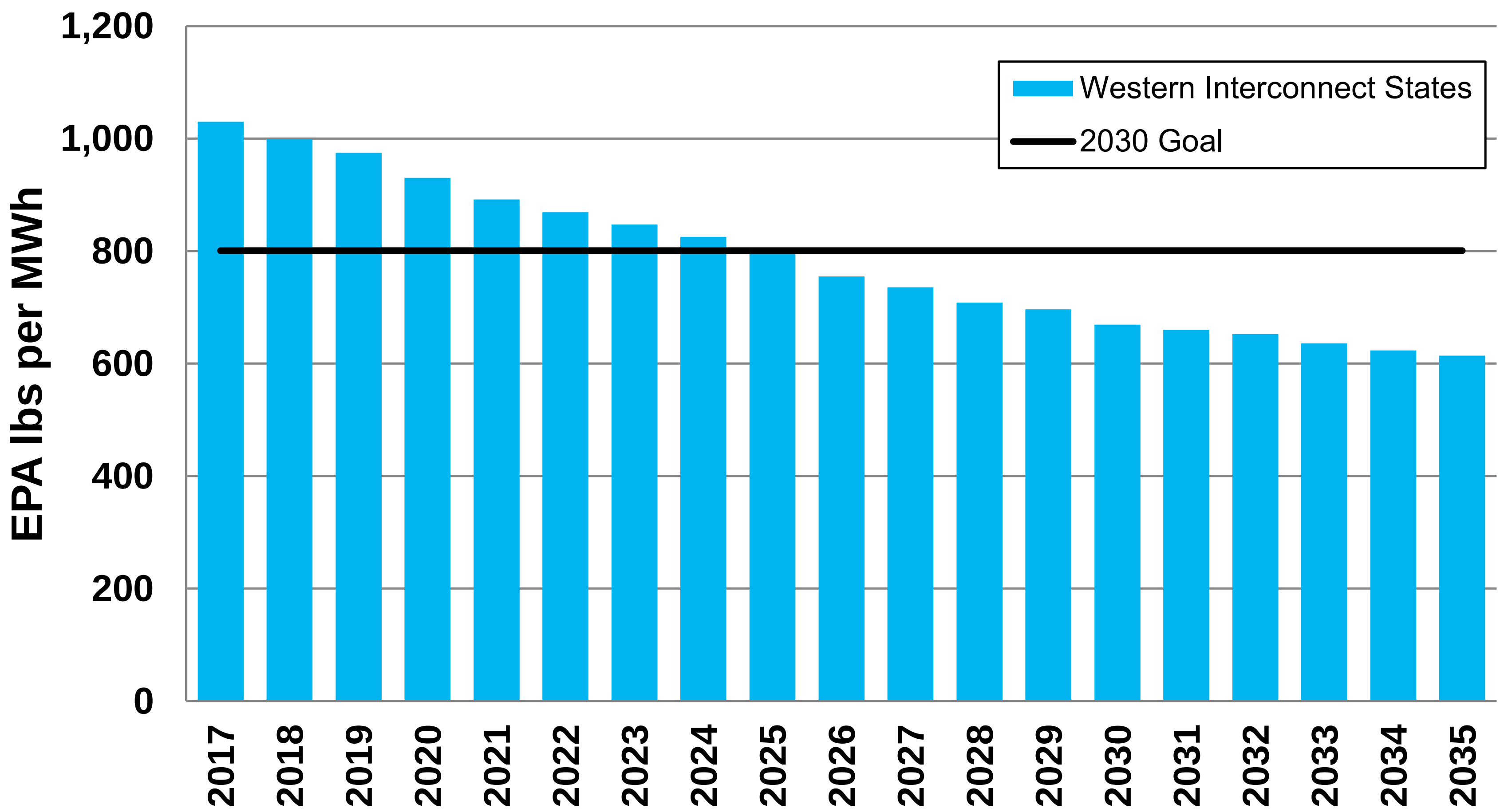
Greenhouse Gas Emission Forecast

(State Level)



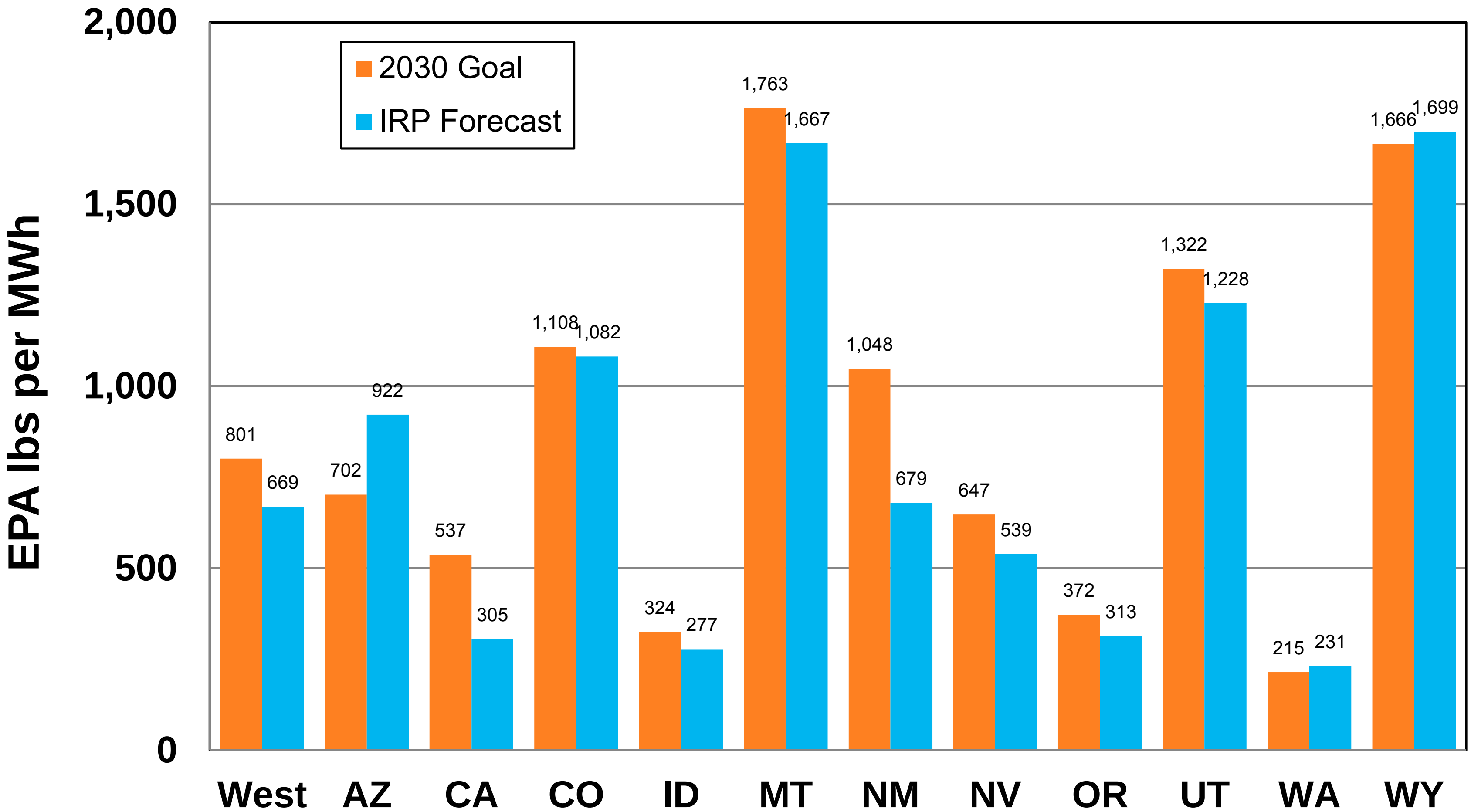
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Wyoming	33.3	33.7	34.0	33.2	32.4	32.2	31.2	31.0	31.6	30.7	31.7	31.9	27.3	27.5	25.6	25.0	25.4	25.5	24.4	24.5
Washington	6.5	6.7	7.1	6.7	6.9	5.7	6.0	5.8	6.0	5.4	4.3	4.3	4.2	4.2	4.4	4.3	4.6	4.5	4.8	4.6
Utah	28.9	28.8	29.0	28.7	27.5	27.2	26.8	26.3	26.4	25.8	20.5	20.3	20.4	20.5	20.5	20.4	20.5	20.3	20.2	20.5
Oregon	6.2	6.0	6.6	6.5	6.6	4.8	5.2	5.1	5.4	5.0	5.6	5.9	6.3	6.6	6.8	6.7	7.0	6.9	7.3	7.0
New Mexico	14.3	14.9	14.5	13.6	13.8	13.5	12.7	13.1	13.2	12.5	13.6	13.5	12.9	13.4	13.3	12.7	13.3	13.1	12.5	13.0
Nevada	12.7	12.5	11.7	11.7	11.2	11.4	10.2	9.7	9.9	9.5	9.2	9.4	9.7	9.8	10.1	10.1	10.8	10.9	11.2	11.3
Montana	15.8	15.8	15.5	15.4	16.0	15.4	15.4	15.9	15.4	15.0	15.8	15.2	15.2	15.7	15.3	15.3	16.3	15.9	16.1	16.9
Idaho	1.1	1.7	1.8	1.9	1.7	1.9	2.2	2.2	2.3	2.3	2.2	2.4	3.0	3.1	3.2	3.7	3.7	4.3	4.5	4.4
Colorado	32.2	31.7	30.1	31.4	30.9	29.4	31.1	30.9	30.1	31.5	31.6	30.6	32.6	32.2	31.3	32.6	32.4	31.3	32.3	32.0
California	46.9	47.1	48.0	49.9	52.1	53.9	56.2	57.5	58.6	58.8	59.1	59.2	59.3	59.4	59.7	60.2	62.0	62.6	63.9	64.7
Arizona	51.3	49.9	50.4	48.5	41.6	40.8	40.1	38.6	39.0	37.6	35.3	35.3	35.1	34.4	34.7	34.4	34.5	34.5	34.3	33.8
USA	249.	248.	248.	247.	240.	236.	237.	236.	238.	234.	229.	228.	226.	226.	225.	225.	230.	229.	231.	232.

EPA 111d Goal Comparison

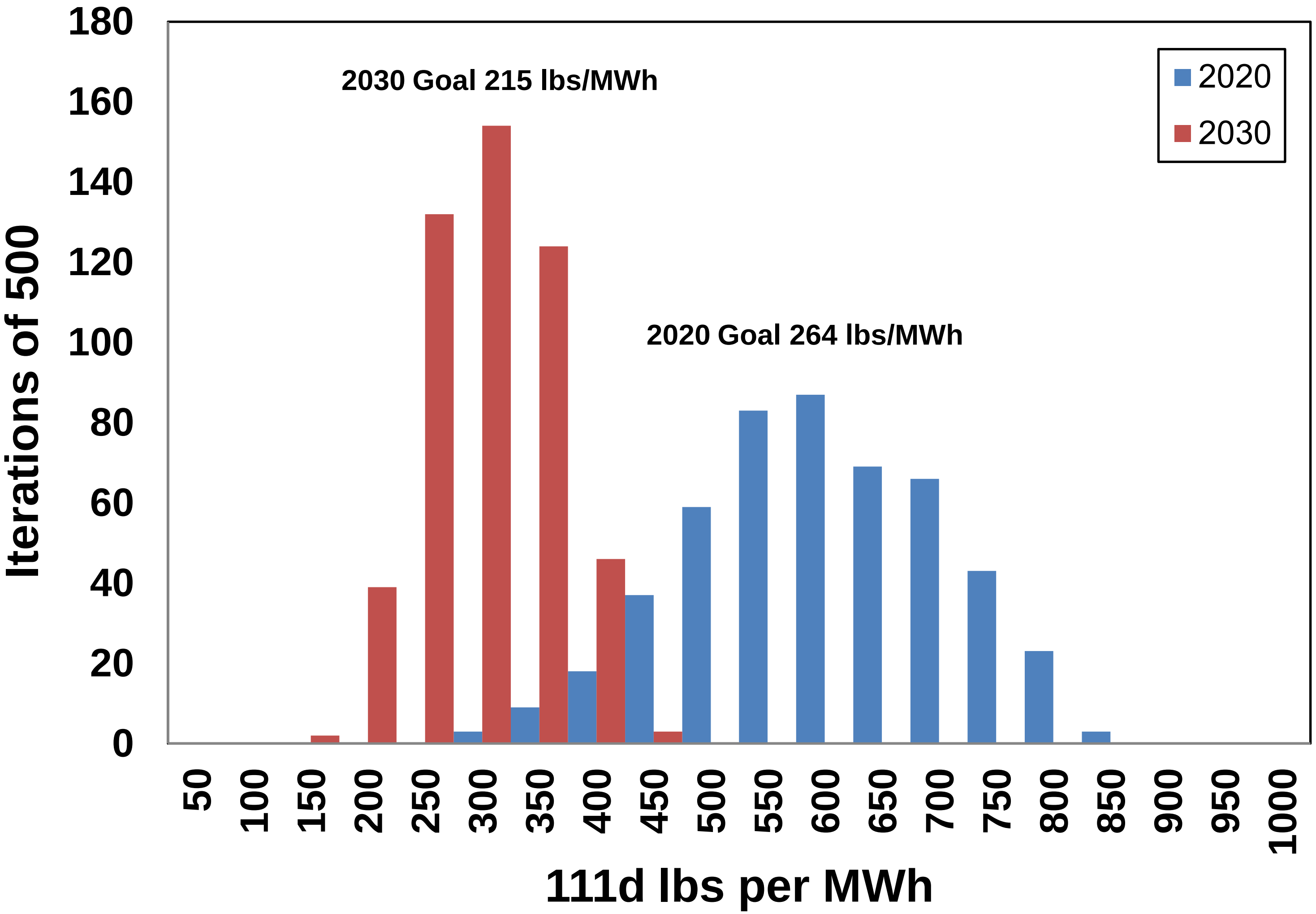


Note: EPA 2030 goal is adjusted for Langley Gulch and plants residing outside of the Western Interconnect

111(d) EPA State Goal Comparison



Washington Emission Volatility



2015 Electric IRP
Resource Requirements

Clint Kalich, Manager of Resource Planning and Analysis
Fourth Technical Advisory Committee Meeting
February 24, 2015

L&R Methodology Review

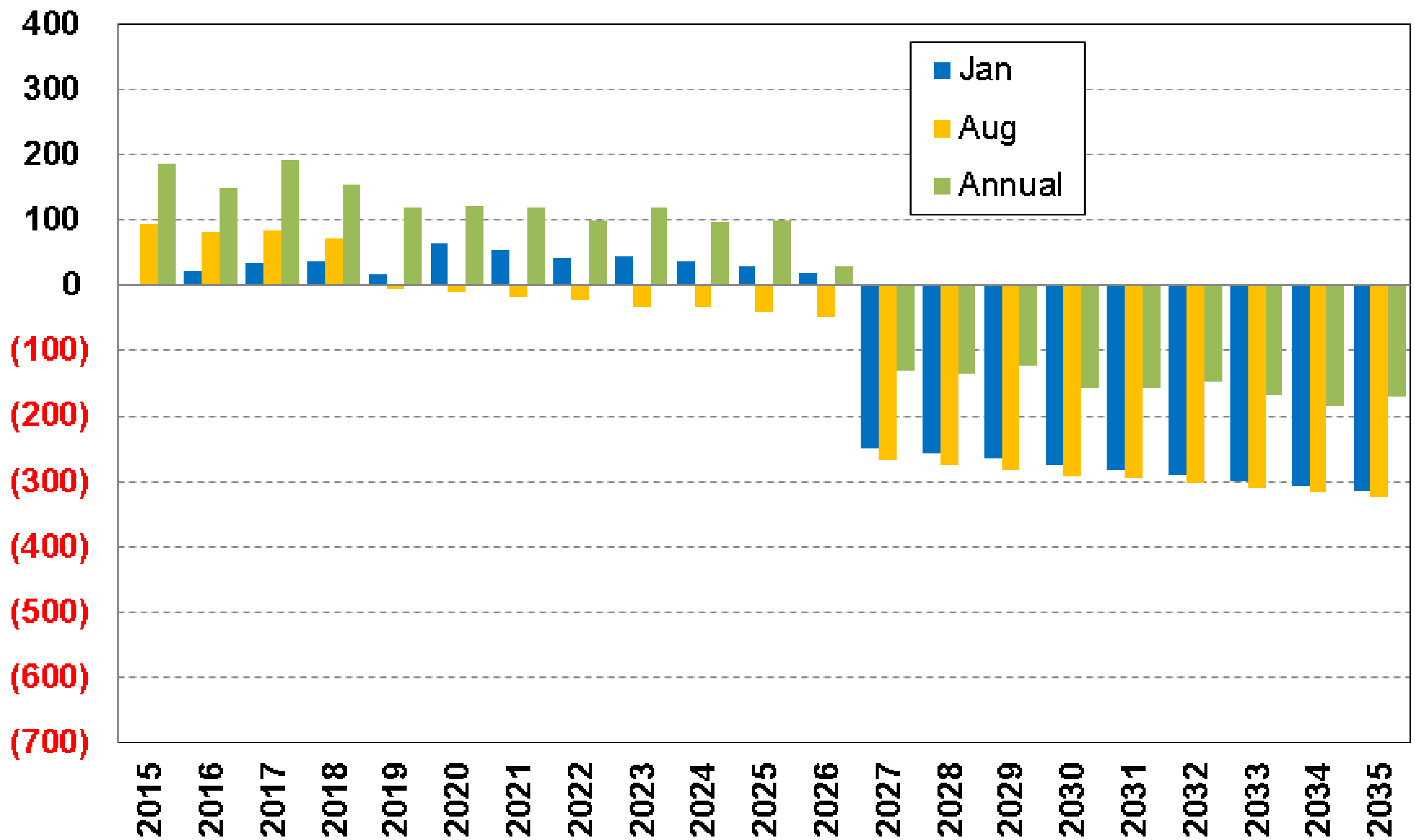
- Sum up resource capabilities against loads
  - Reduced by planned outages
- Capacity
  - Planning Margin
  - Operating Reserves and Regulation (~8%)
  - Largest deficit months between 1- and 18-hour analyses

L&R Methodology Review

- Energy
  - Reduced by planned and forced (5-year average)
  - Maximum *potential* thermal generation over the year
  - 80-year hydro average, adjusted down to 10^{th} percentile
- Renewable Portfolio Standards
  - 3% / 9% / 15% requirement of Washington retail load in 2012 / 2016 / 2020
  - Qualifying resources less any forward sales obligations
  - Banking provisions help smooth out year-to-year variation
- Final resource need determined by shortest position each year

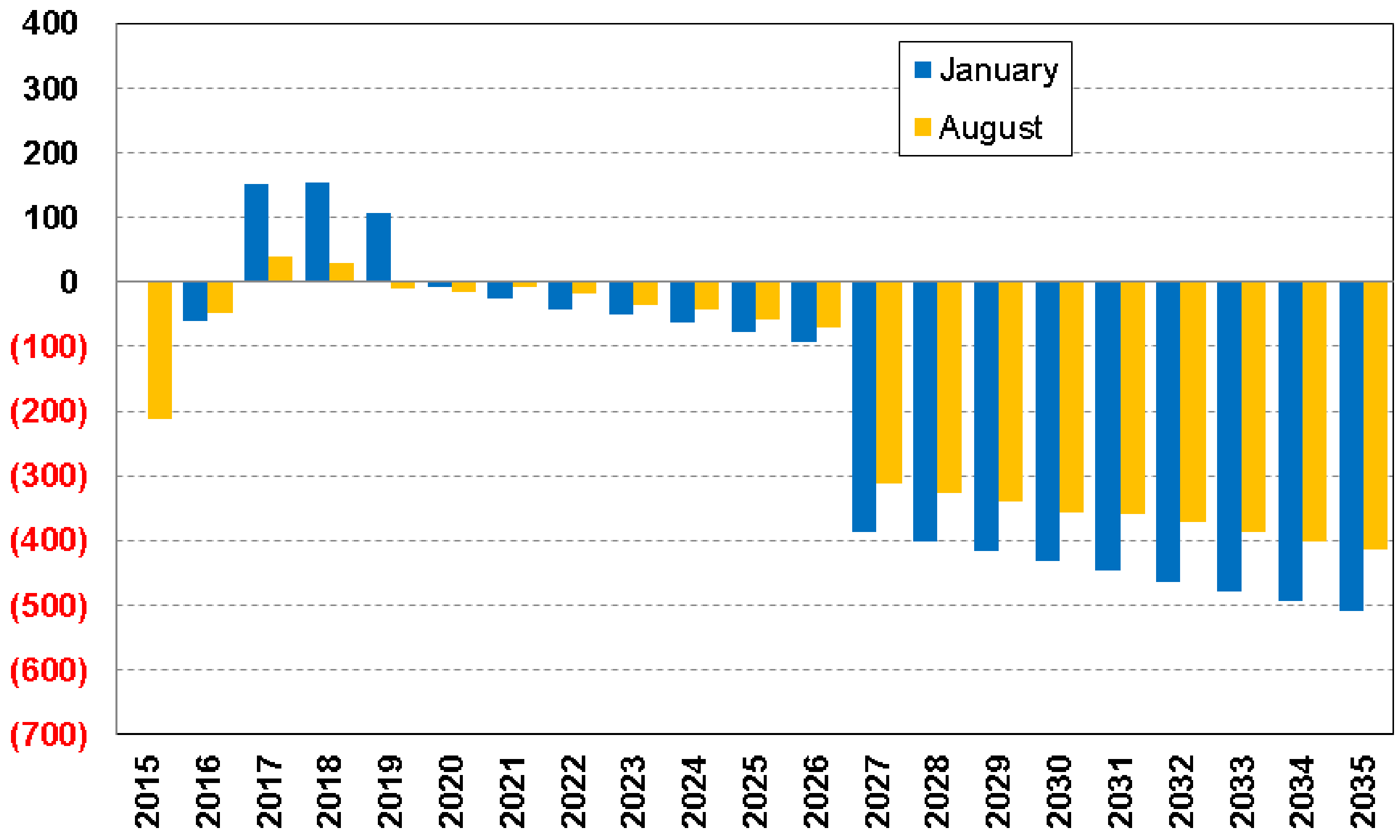
Energy Position (aMW)

Year	Jan	Aug
2014	0	0
2015	0	94
2016	23	81
2017	34	84
2018	36	73
2019	17	(4)
2020	64	(11)
2021	53	(18)
2022	42	(22)
2023	43	(32)
2024	36	(34)
2025	29	(40)
2026	21	(47)
2027	(249)	(268)
2028	(257)	(274)
2029	(265)	(281)
2030	(274)	(292)
2031	(282)	(295)
2032	(290)	(302)
2033	(298)	(309)
2034	(307)	(316)
2035	(315)	(323)



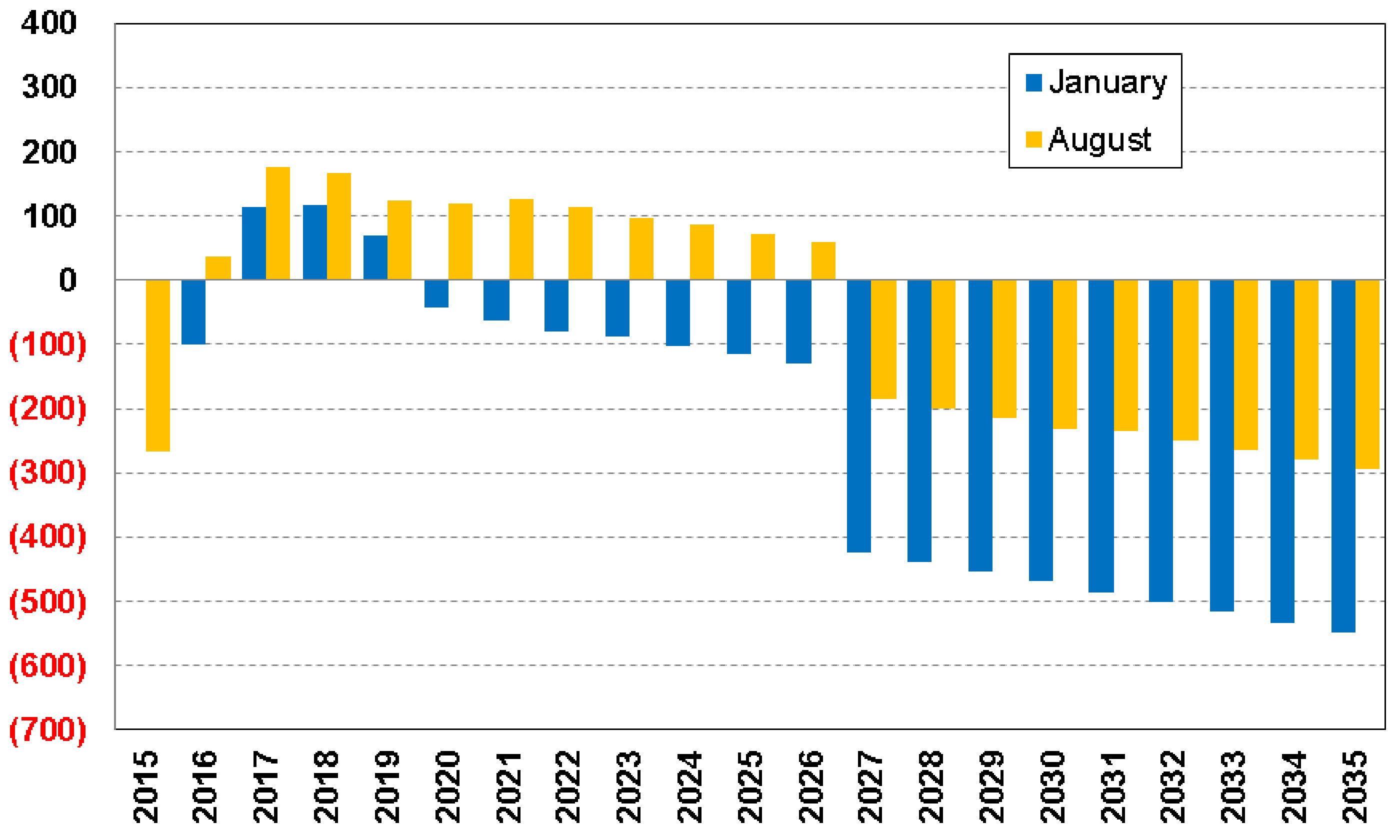
18-Hour Capacity Position (MW)

Year	Jan	Aug
2014	0	0
2015	0	(212)
2016	(60)	(48)
2017	151	38
2018	155	30
2019	106	(10)
2020	(7)	(14)
2021	(25)	(8)
2022	(43)	(18)
2023	(49)	(35)
2024	(64)	(44)
2025	(78)	(57)
2026	(93)	(70)
2027	(387)	(313)
2028	(401)	(326)
2029	(416)	(339)
2030	(432)	(357)
2031	(447)	(359)
2032	(463)	(373)
2033	(478)	(387)
2034	(494)	(400)
2035	(509)	(414)

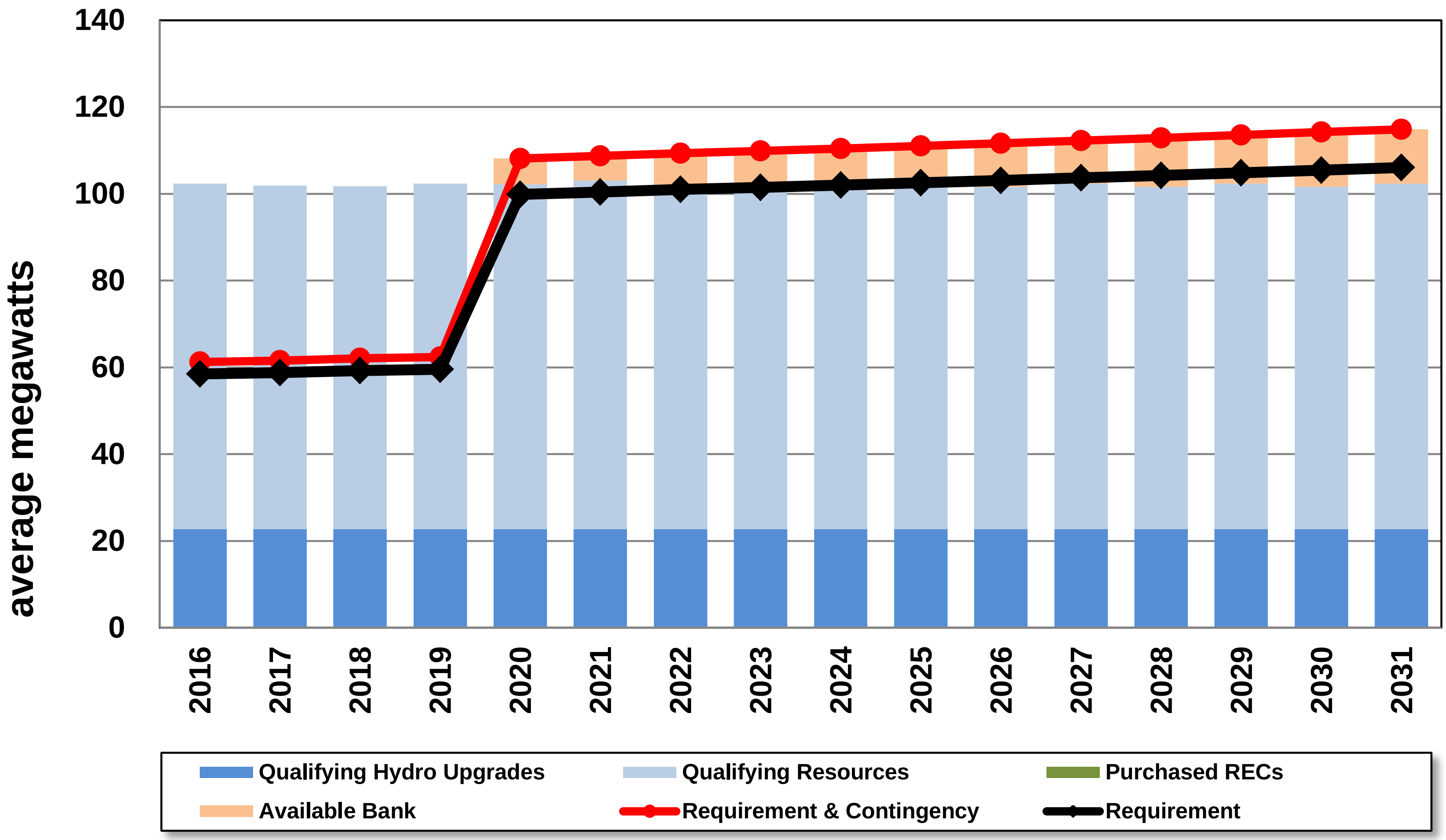


1-Hour Capacity Position (MW)

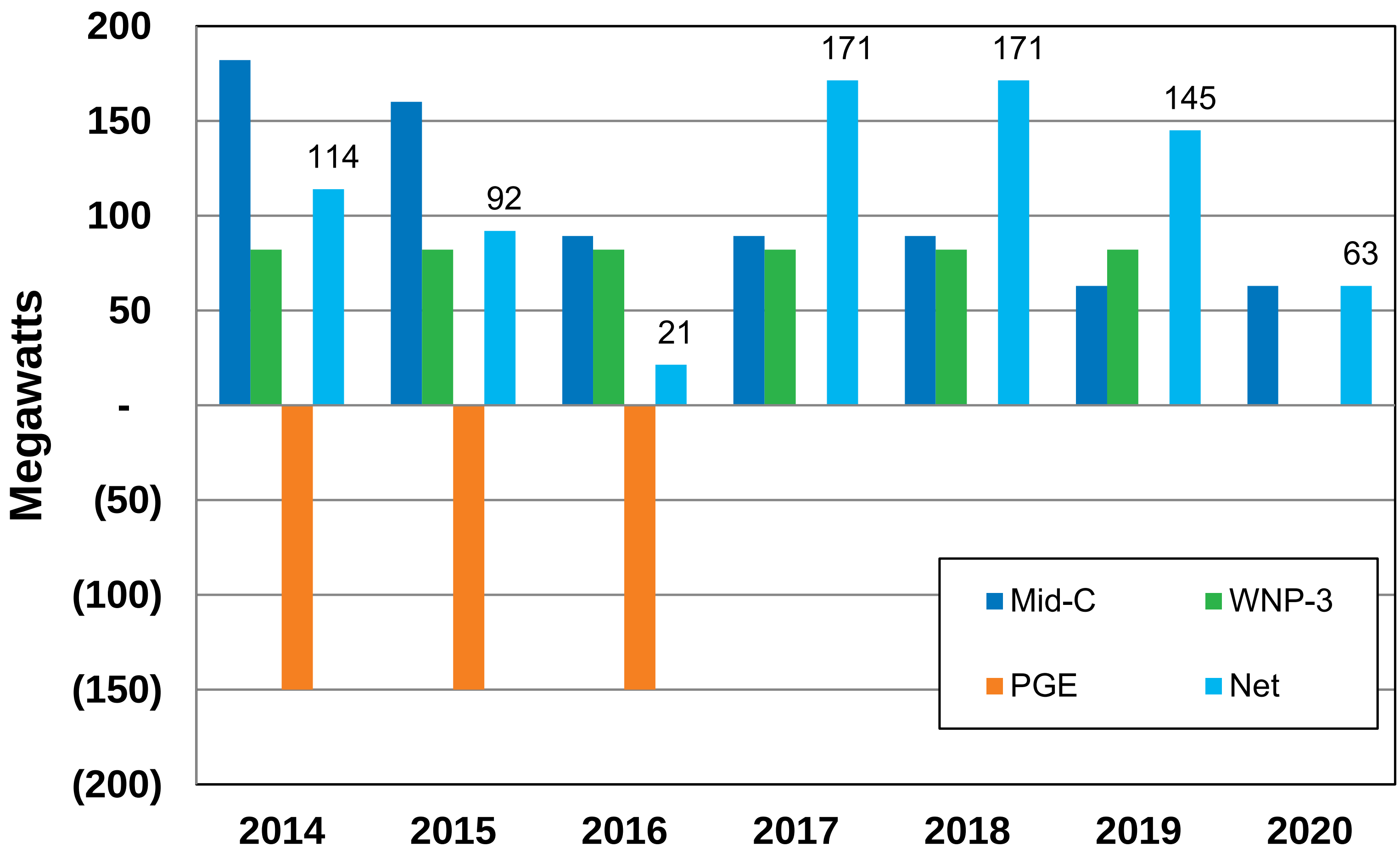
Year	Jan	Aug
2014	0	0
2015	0	(266)
2016	(99)	36
2017	115	177
2018	118	167
2019	69	124
2020	(44)	120
2021	(62)	126
2022	(80)	114
2023	(87)	96
2024	(101)	87
2025	(116)	73
2026	(131)	59
2027	(425)	(185)
2028	(440)	(199)
2029	(455)	(214)
2030	(470)	(232)
2031	(486)	(235)
2032	(501)	(250)
2033	(517)	(265)
2034	(532)	(280)
2035	(548)	(295)



Washington RPS Position (aMW RECs)



Impact of Major Contracts (Winter Capacity)



Position Summaries

Energy

Year	Jan	Aug
2014	0	0
2015	0	94
2016	23	81
2017	34	84
2018	36	73
2019	17	(4)
2020	64	(11)
2021	53	(18)
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18-Hr Cap

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1-Hr Cap

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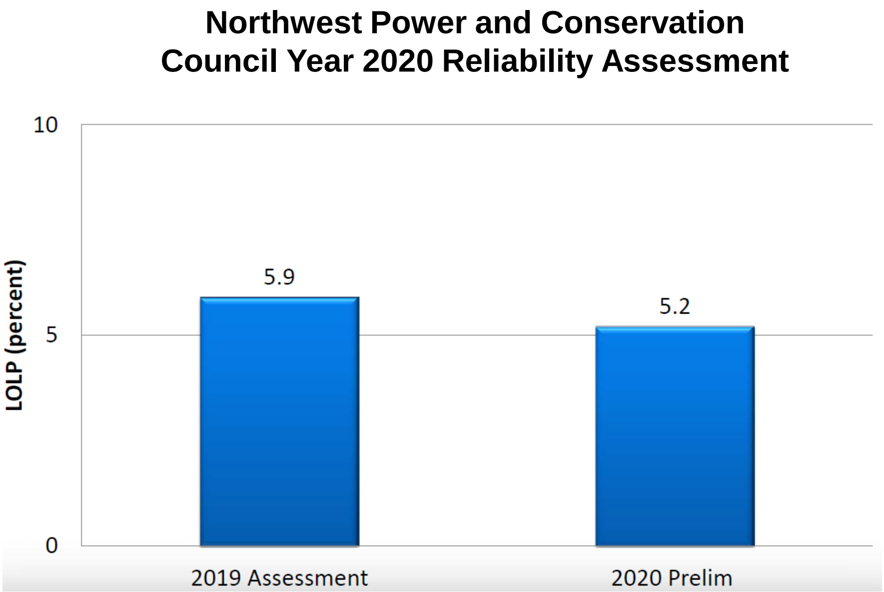
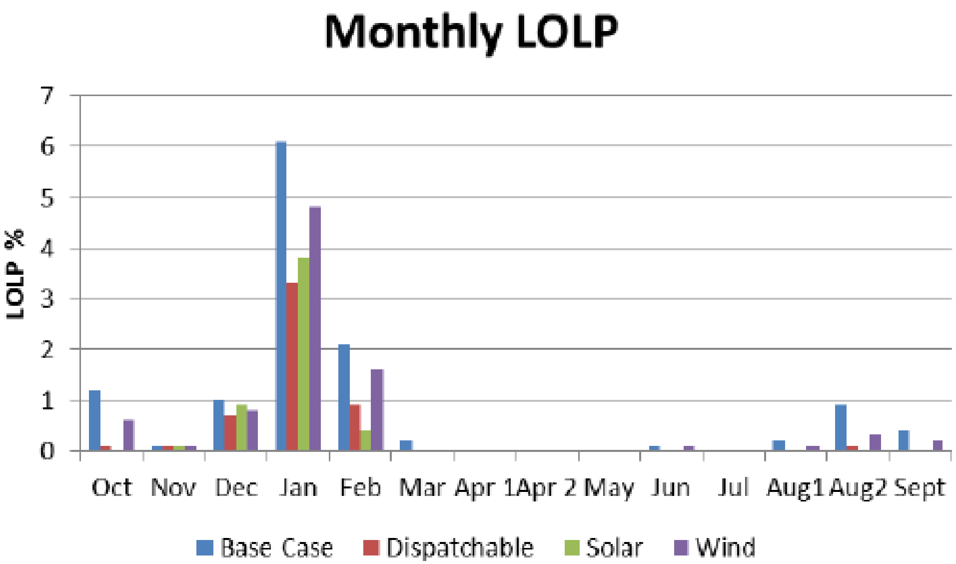
2034	(532)	(280)
2035	(548)	(295)

Rely on the Wholesale Market?

- Market is made up of real generating assets
- Largest market reliance questions for Avista
  - Is there enough surplus in region to meet our and other utilities' future needs?
  - Are we willing to expose ourselves to market volatility?

Rely on the Wholesale Market?





- 5% is considered by industry to be a minimum level for reliability
- 2021 likely will be worse given closure of Boardman and Centralia Unit 1 in 2020 (over 1,200 MW)
- 2026 loss of Centralia Unit 2 (670 MW)

Resource Option Capacity Contributions

Technology	Type	Name-plate (MW)	Winter Capacity	Summer Capacity
GE - 7F.05	Gas Peaker	203.0	109%	97%
GE - 7F.04	Gas Peaker	170.5	109%	96%
GE - 7F.04- Add HRSG	Gas CCCT	115.3	107%	96%
GE - 7EA	Gas Peaker	96.1	106%	96%
GE - LMS100PA	Gas Hybrid	101.2	105%	94%
Jenbacher 920 flex	Gas Recip	9.3	100%	100%
Siemens- SGT-800-50	Gas Peaker	45.1	110%	96%
GE - LM6000- PF Sprint	Gas Peaker	42.5	107%	95%
GE - 7F.05 1x1	Gas CCCT	341.3	106%	97%
GE - 7F.04 1x1	Gas CCCT	285.8	107%	96%
Wind On System	Wind	33.0	0%	0%
Solar Photovoltaic Fixed	Solar	10.0	0%	62%
Solar Photovoltaic 1 Axis	Solar	10.0	0%	70%
Battery Storage	Battery	25.0	100%	100%
Northeast CT Water Injection	Upgrade	7.5	100%	100%

Technology	Type	Name-plate (MW)	Winter Capacity	Summer Capacity
Rathdrum Supplemental Compression	Upgrade	24.0	100%	100%
Rathdrum CT 2055 Uprates	Upgrade	5.0	100%	100%
Kettle Falls Upgrade	Upgrade	12.0	100%	100%
Rathdrum CT: Inlet Evaporation	Upgrade	4.3	0%	403%
Kettle Falls Fuel Stabilization	Upgrade	3.0	100%	100%
Long Lake 2nd Powerhouse	Upgrade	68.0	100%	100%
Post Falls Upgrade	Upgrade	22.0	24%	0%
Monroe St 2nd Powerhouse	Upgrade	80.0	31%	0%
Cabinet Gorge 2nd Powerhouse	Upgrade	110.0	0%	0%
Direct Load Control	Customer	7.2+	100%	100%
Firm Curtailment	Customer	7.5+	100%	100%
Time-Of-Use	Customer	1+	100%	100%
Critical Peak Pricing	Customer	4+	100%	100%
StandbyGeneration	Customer	20+	100%	100%

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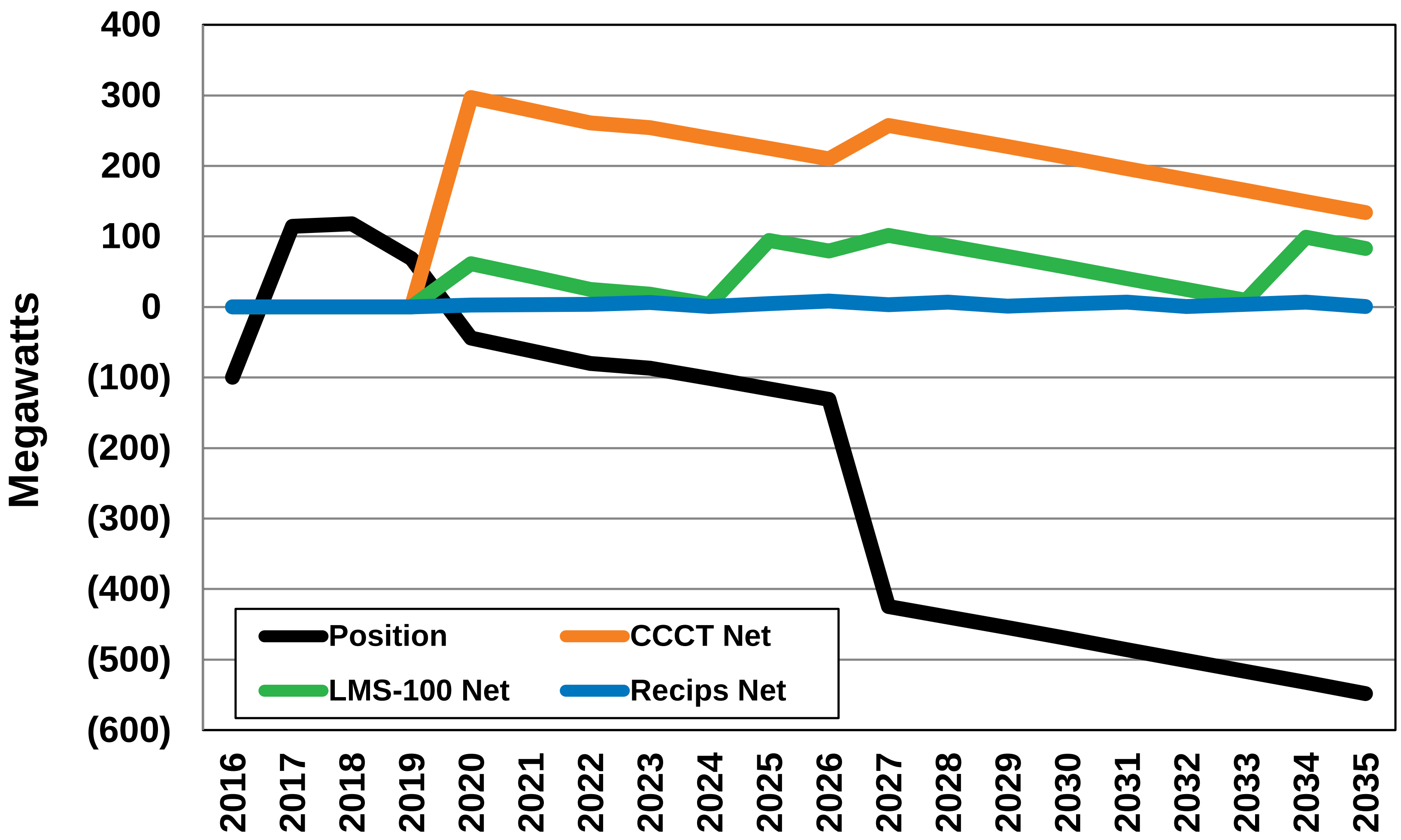
Resources Acquisitions Are Lumpy



Options to Address Lumpiness

- Wait until size of need is larger
  - Pro: no surplus, Con: exposed to market
- Build smaller-sized units
  - Pro: closely meets need, Con: higher cost machines
- Partner with other utilities
  - Pro: better match of need, Con: not much interest

2015 Electric IRP Interconnection Studies

Richard Maguire, System Planning Engineer
Fourth Technical Advisory Committee Meeting
February 24, 2015

Federal Standards of Conduct

1. No non-public transmission information can be shared with Avista Merchant Function employees
2. There are Avista Merchant Function employees attending today
3. We will not be sharing any non-public transmission information

Agenda

- Introduction to Avista System Planning
- Two Big Changes This Year
- Recent Avista Projects
- Generation Interconnection Study Process
- Large Generation Interconnection Queue
- Integrated Resource Plan (IRP) Requests
- Future Transmission Planning Initiatives

Introduction to Avista System Planning

- Transmission system planning
- Distribution system planning
- Asset Management
- We all care about:
  - Federal, regional, and state compliance
  - Regional system coordination
  - Internal standards and processes

Big Change #1 – Regional Coordination

$$\frac{WECC}{SanDiegoOutage} = \frac{WECC}{2} + Peak$$

- WECC

  "has been approved by the Federal Energy Regulatory Commission (FERC) as the Regional Entity for the Western Interconnection"

- Peak Reliability

  "is listed on the NERC Compliance Registry to perform the Reliability Coordinator (RC) and Interchange Authority (IA) functions as statutory activities"

PEAKRELIABILITY
assuring the wide area view

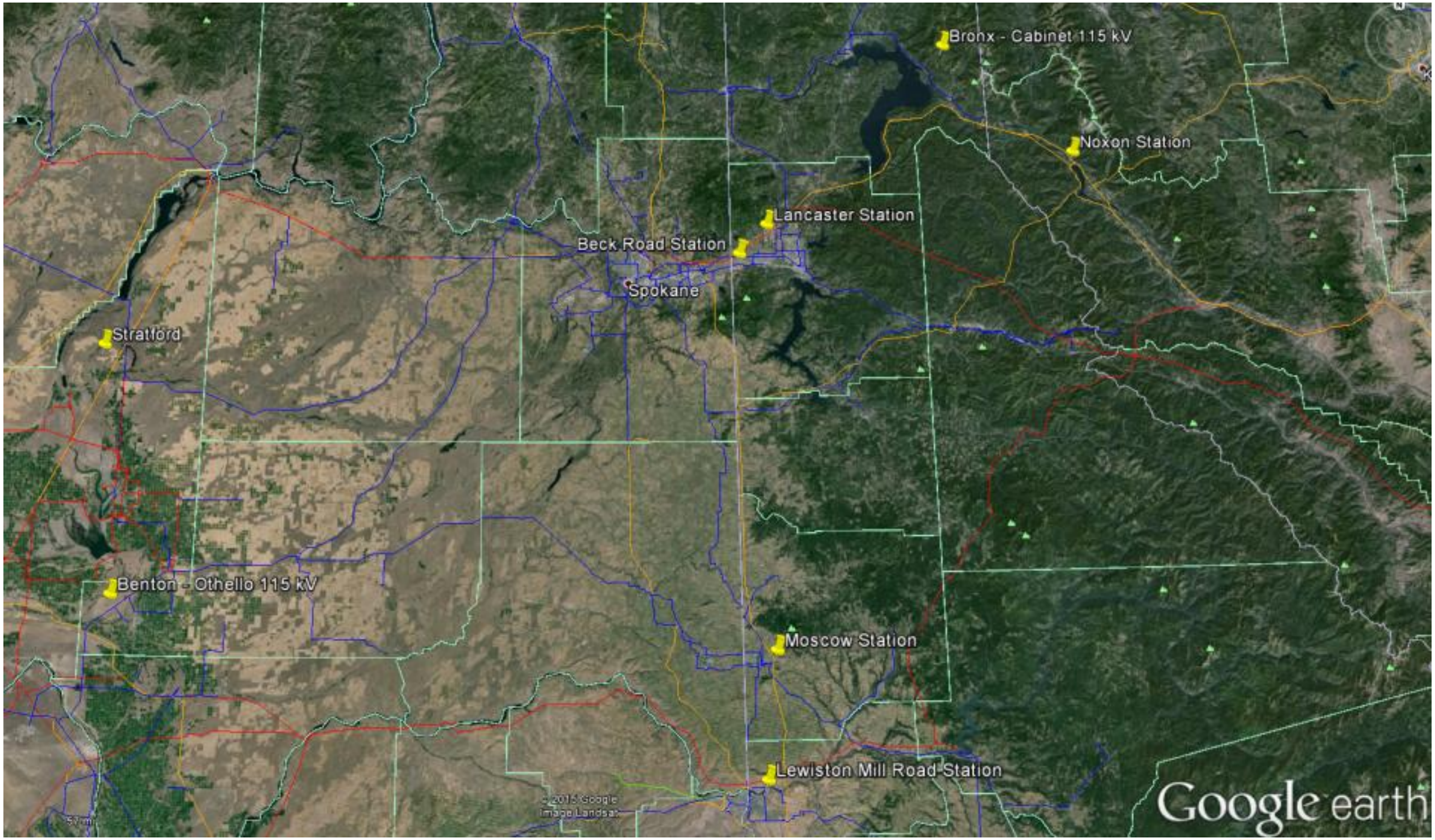
Big Change #2 – NREC TPL Standards

- Background
  - Loss of two or more elements (N-1-1)
    - If you have 300 elements (line, xfmr, bus, etc)
      - 300 X 299 = 89,700 outage events
      - If order does not matter (AB = BA)
        - » COMBIN(300,2) = 44,850 outage events
  - 44,850 analysis takes about **12 hours** on my laptop
- "Out with the old": TPL-xxx-3
  - N-1-1 termed, 'Category C'
  - Engineering judgment allowed pairing down the list
- "In with the new": TPL-xxx-4
  - N-1-1 termed, 'P6'
  - More 'teeth' in standard means more testing necessary
    - We need to look at all P6 events
  - Takes about a month on a study machine for all cases

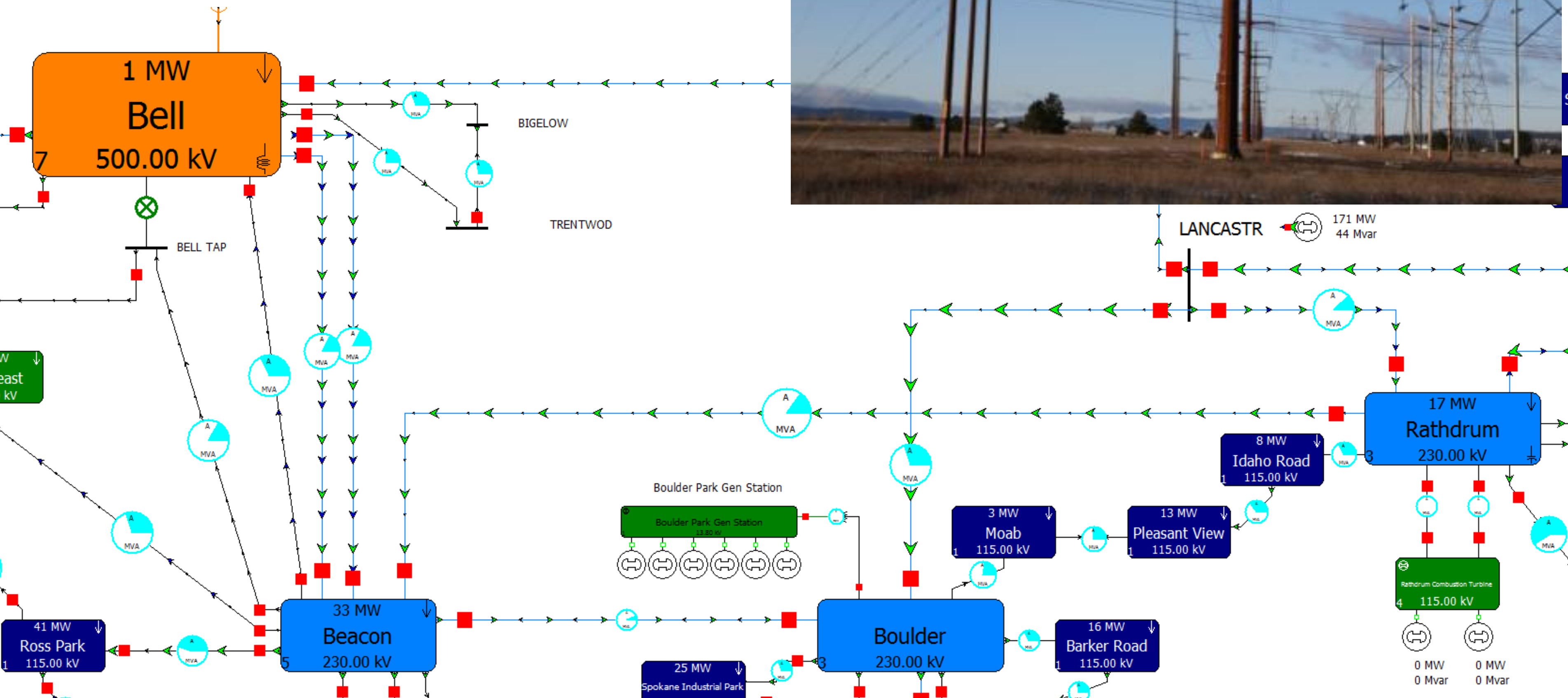
Big Change #2 – What are we doing?

- People possibilities
  - We could work longer, or we could take work home
  - We could take on risk and use engineering judgment
  - We could hire another engineer
- Process possibilities
  - We are working with PowerWorld Corporation to enhance their 'Distributed Computing' environment
  - We are investigating new study machine purchases
  - A collection of machines working concurrently REALLY reduces analysis times

Recent Transmission Projects



Lancaster 'Loop-in'



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Moscow Station

Noxon Station

Generation Interconnection Study Process

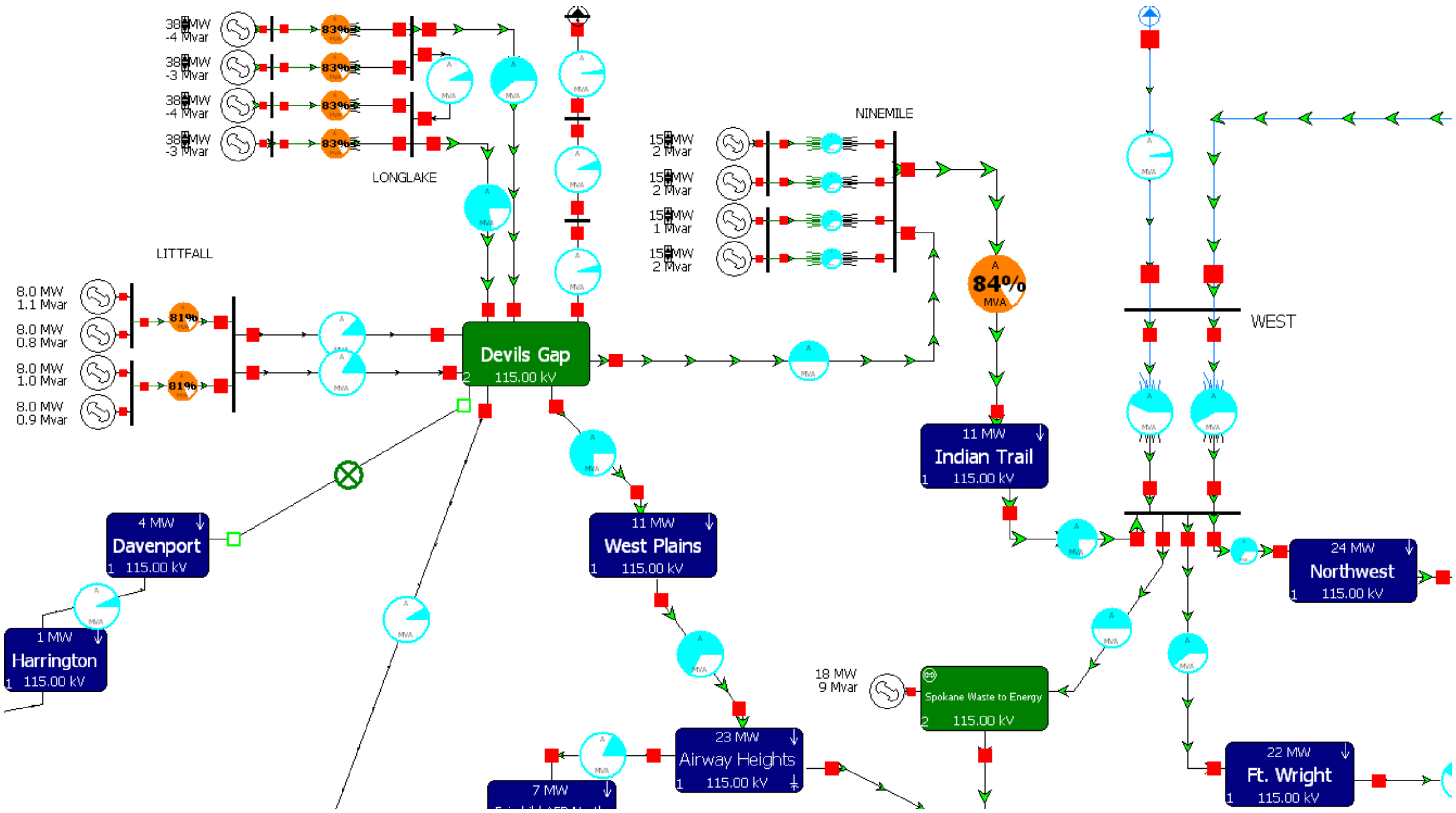
- Typical Process for Generation Requests
  - We generally get requests via two sources:
    - External developers
    - Internal IRP requests
  - Typical process:
    - We hold a scoping meeting to discuss particulars
    - We outline a study plan
    - We augment WECC approved cases for our studies
    - We analyze the system against the standards
    - We publish our findings and recommendations

Generate Study Cases

	From Number	From Name	To Nur	To Name	Circu	Status	Xfrmr	R	X	B	Lim A MVA
1	40017	ADDY	48007	ADDY AVA	1	Closed	YES	0.03883	0.70558	0.00000	20.0
2	40017	ADDY	48071	CHEWELAH	1	Closed	NO	0.01395	0.05425	0.00778	111.0
3	40017	ADDY	48135	GIFFORD	1	Closed	NO	0.14267	0.13096	0.01488	29.5
4	40017	ADDY	48223	METCHIP	1	Closed	NO	0.00606	0.02316	0.00345	111.0
5	40023	AHSAHKA	48303	OROFINO	1	Closed	NO	0.00500	0.02072	0.00268	111.0
6	40087	BELL BPA	48033	BELL TAP	1	Open	NO	0.00118	0.00369	0.00043	85.9
7	40087	BELL BPA	48449	WAIKIKIT	1	Closed	NO	0.00093	0.00373	0.00051	111.0
8	40149	BR									
9	40149	BR									

Western Montana Hydro	625.6 MW	West of Hatwai (Path 6)	117.4 MW
Noxon Rapids (562MW)	137.9 MW	Lolo-Oxbow 230kV	276.8 MW
Cabinet Gorge (265MW)	81.7 MW	Dry Creek-Walla Walla 230kV	159.6 MW
Libby (605MW)	216.0 MW		
Hungry Horse (430MW)	190.0 MW	West of Cabinet	1109.1 MW
		Montana-Northwest (Path 8)	970.0 MW
Colstrip Total			
Colstrip 1 (330MW)	330.0 MW	Idaho-Northwest (Path 14)	-584.6 MW
Colstrip 2 (330MW)	330.0 MW	Midpoint-Summer Lake (Path 75)	-75.2 MW
Colstrip 3 (823MW)	763.8 MW	Idaho-Montana (Path 18)	-274.5 MW
Colstrip 4 (823MW)	775.5 MW		

Analyze Study Cases



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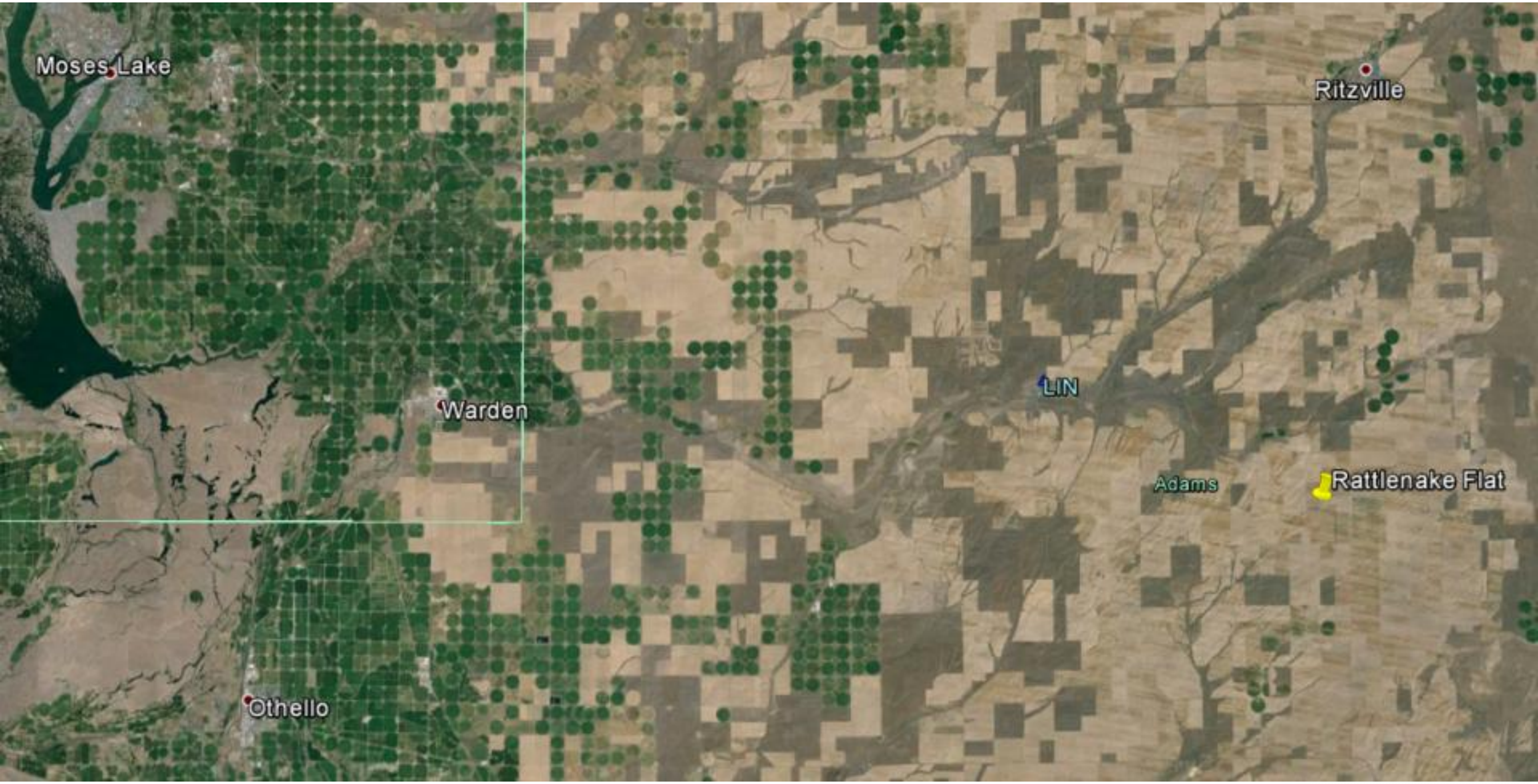
Publish Results

- Customer News
- FERC Filings
- FERC Order 890
- Integrated Resource Plan
  - 2007 Native Load IRP Table
  - 2007 Native Load IRP Table w/Rev
  - 2009 IRP Meeting - March 25, 2009
  - 2009 IRP Meeting Announcement
  - 2009 IRP Posting Notice
  - 2009 IRP Transmission Request
  - 2009 Native Load IRP Table
  - 2010 IRP TAC Meeting Notice
  - 2010 IRP TAC Meeting Presentation
  - 2011 IRP Follow Up Meeting
  - 2011 IRP Posting Notice
  - 2011 Native Load IRP Table
  - 2013 IRP Generation Study (Cabinet Gorge)
  - 2013 IRP Generation Study (Nine Mile HED)
- Interconnection Requirements

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

LGIA #43 – 150 MW Wind Project



2015 IRP Request Snapshot

Station	Request (MW)	POI Voltage	Cost Estimate ($ million)
Kootenai County	100	230 kV	12 - 16.1
Kootenai County	350	230 kV	47.2
Rathdrum	26	115 kV	2.84 - 10.9
Rathdrum	50	115 kV	10.7 – 18.7
Rathdrum	200	115 kV	10.3 - 48.5
Rathdrum	50	230 kV	7 – 16.8
Rathdrum	200	230 kV	15.5 – 21.5
Thornton	30	230 kV	.4
Thornton	100	230 kV	.4
Othello	25	115 kV	2
Northeast	10	115 kV	0
Kettle Falls	10	115 kV	0
Long Lake	68	115 kV	19.7
Monroe Street	80	115 kV	7
Post Falls	10	115 kV	2.1
Post Falls	20	115 kV	5.2

[1] Preliminary estimates are given as -25% to +75%

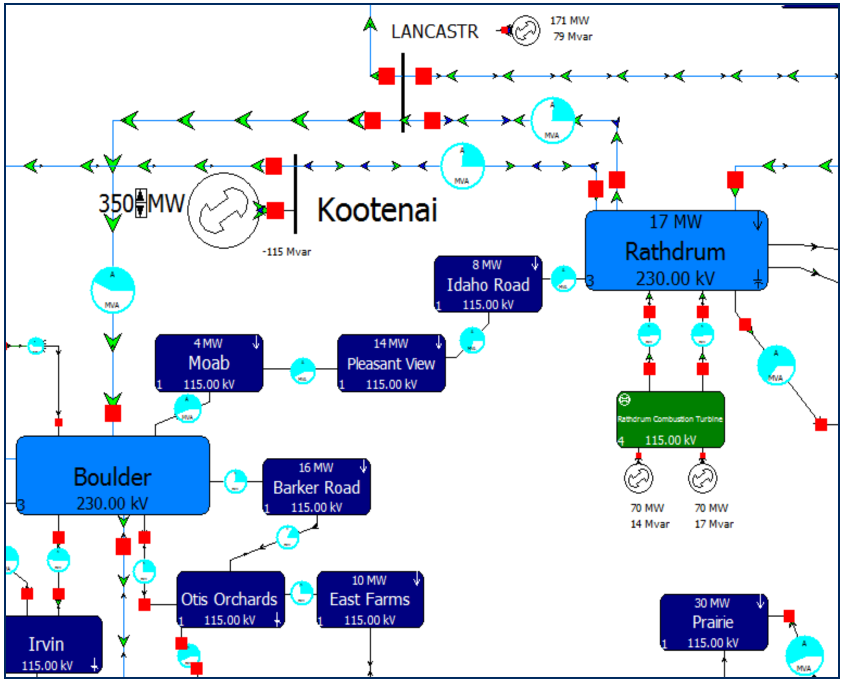
Cost Assignment for Generation Integration

- Simulate Generation Integration
  - Develop new list of “gen” violated elements
  - Compare new list to previous violated elements (without gen)
    - New violated elements are assigned to gen project
  - If previous violated elements need a corrective action advanced in time
    - Consider assignment of advancement cost to gen project
  - Any projects that improve transmission service to existing AVA customers need consideration as a network upgrade

2015 IRP Study Notes

- These are pre-feasibility studies
  - Limited cases and scenarios
  - No stability studies
- All generation fully on
- Results include incremental issues, not base case issues
- $$ estimates for planned projects are flexible

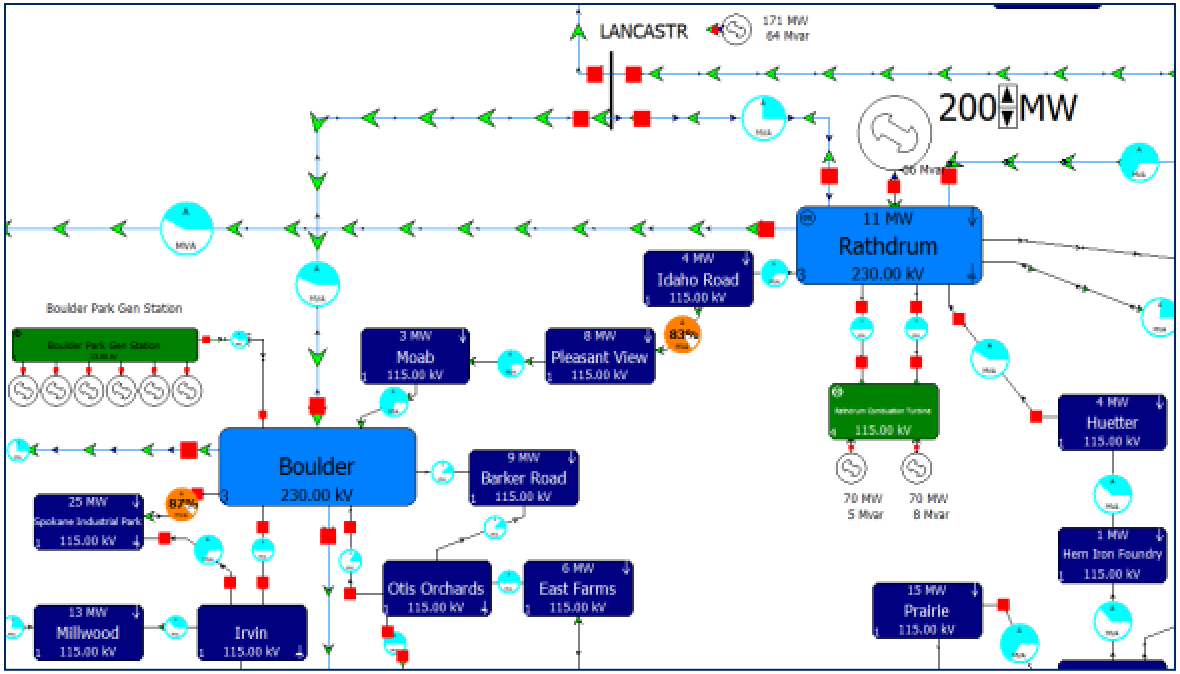
Kootenai: 100 MW to 350 MW



- $16 to $48 Million
- Overlaps existing projects
- 426 MW existing already

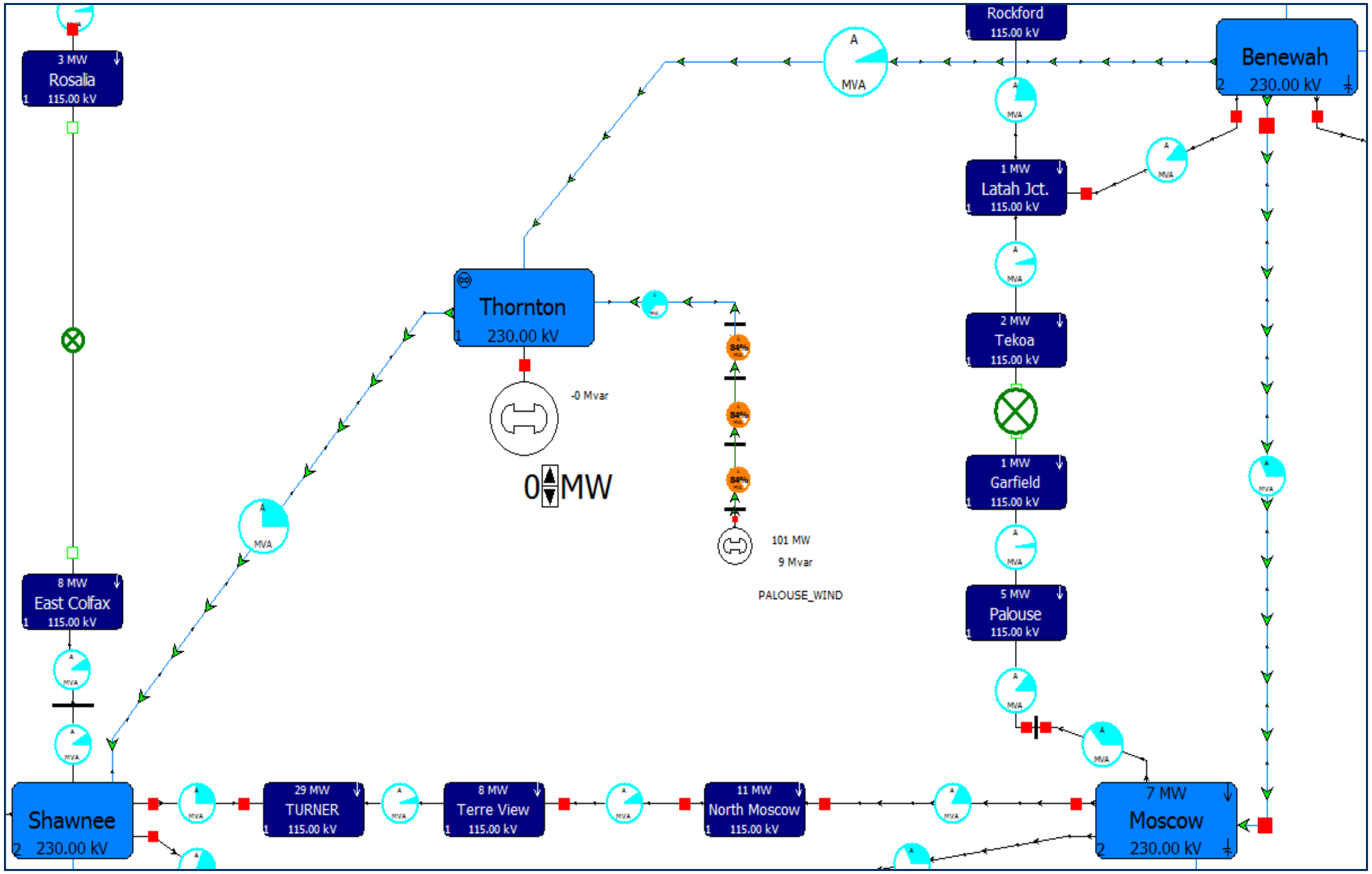
Rathdrum: 26 MW to 200 MW

- $2.84 to $48.5 Million
- Overlaps existing projects
- 426 MW existing already



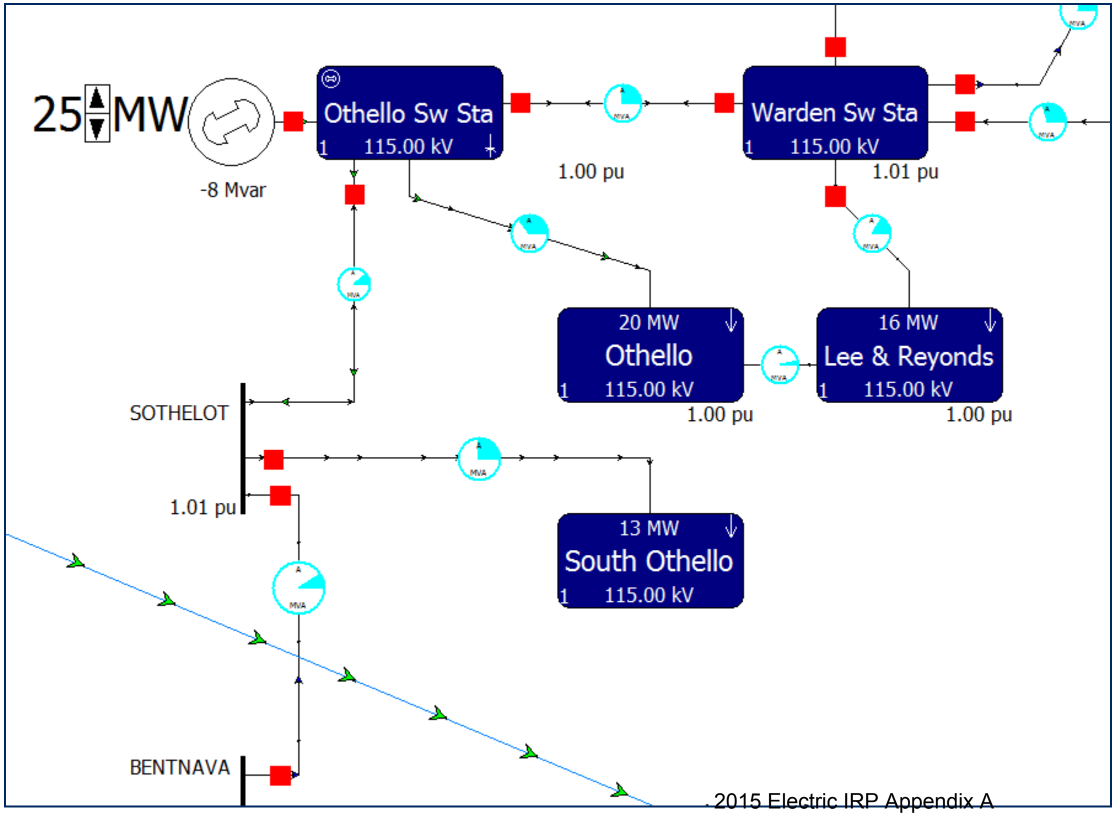
Thornton: 30 MW to 100 MW

- $400 K for new breaker



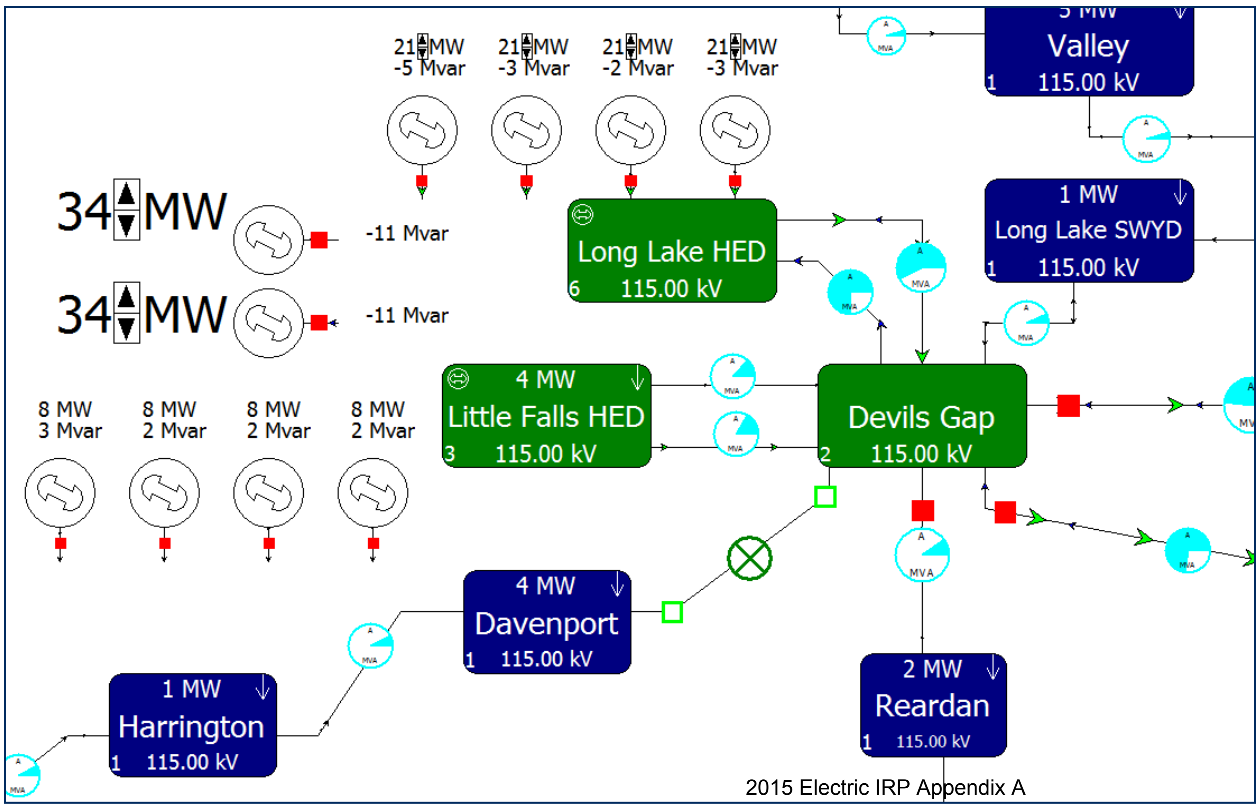
Othello: 25 MW

- $2 Million
- Station work only



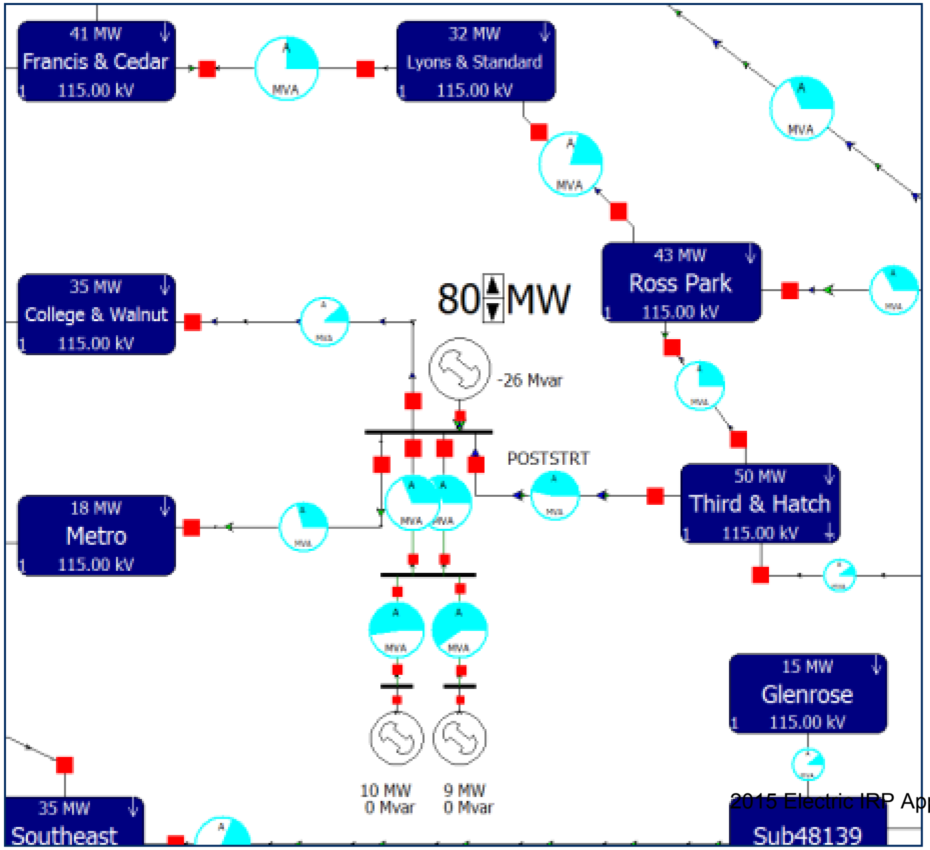
Long Lake: 68 MW

- $19.7 Million
- 108 MW existing + 9 mile



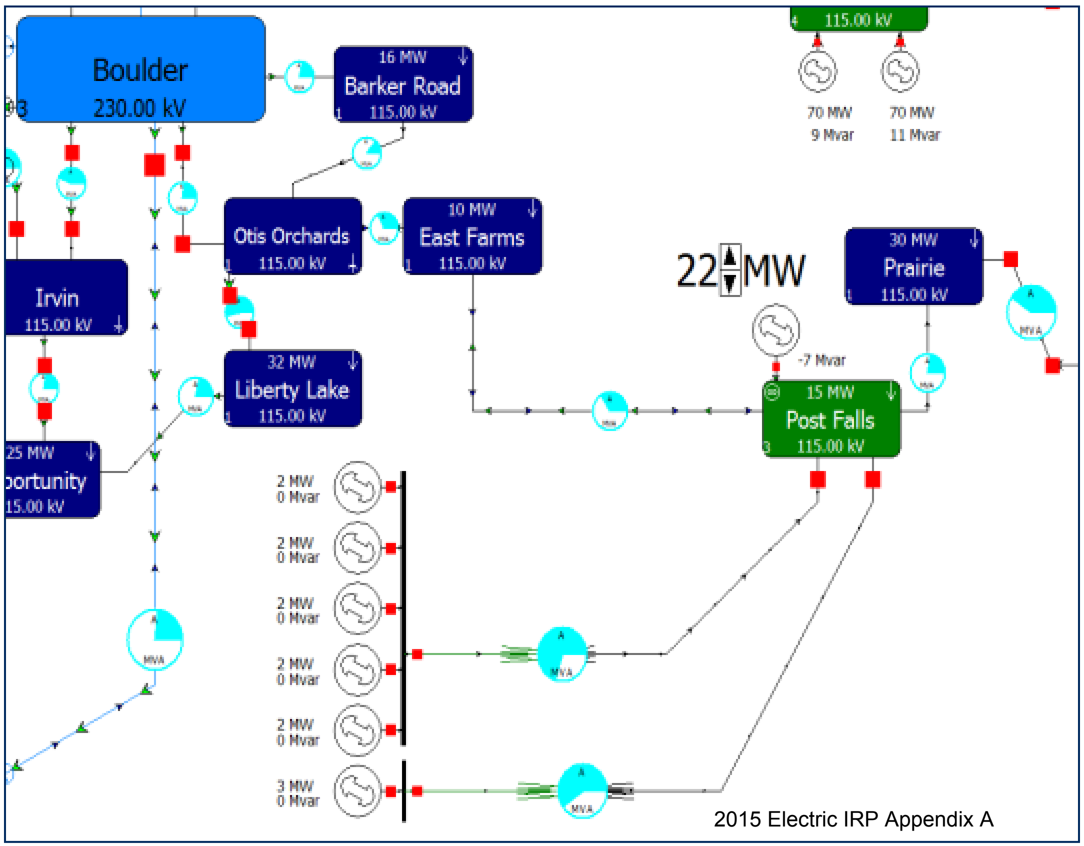
Monroe Street: 80 MW

- $7 Million
- College & Walnut Station



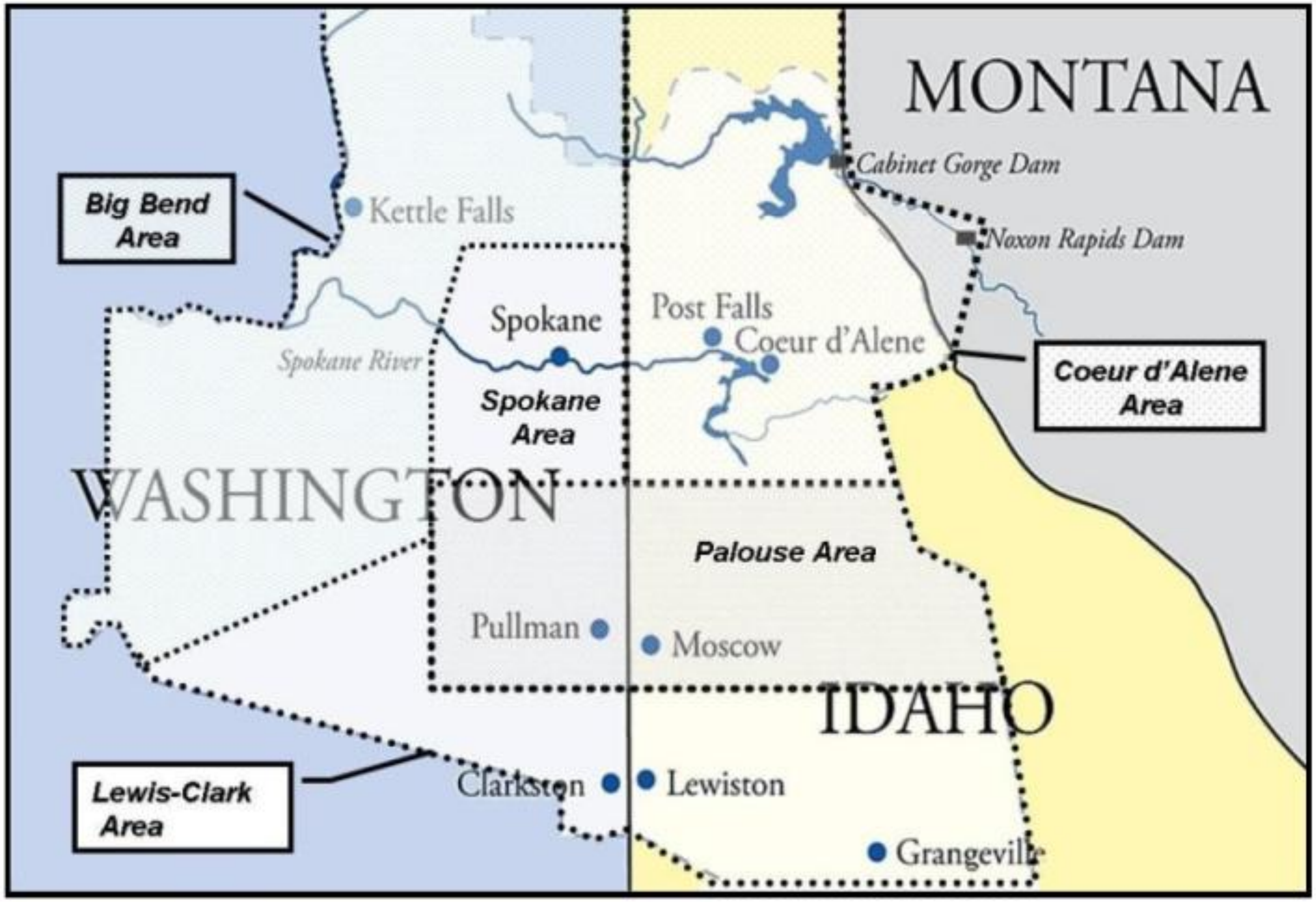
Post Falls: 10 MW to 20 MW

- $2.1 to $5.2 Million
- Congested area already



2015 Electric IRP Appendix A

Future Planning Initiatives



Future Initiatives

- Big Bend
  - New 230 kV transformation needed
- Coeur d’ Alene
  - Noxon Station work
  - 115 kV rebuilds
- Lewiston / Clarkston
  - Voltage issues
- Palouse
  - Two transformer outage scenario
- Spokane
  - Long-term 230 kV transformation additions

2015 Electric IRP
Market Scenarios and Portfolio Analysis

John Lyons, Ph.D. – Senior Resource Policy Analyst
Fourth Technical Advisory Committee Meeting
February 24, 2015

Scenarios in the 2015 IRP

- Scenarios are modeled to provide details about the impacts of different critical planning assumptions that could impact future resource choices, such as:
  - Technological innovations
  - Regulatory changes
  - Environmental regulations or legislation
  - Load and resource changes

2015 IRP Scenario Types

1. Deterministic Market Scenarios: use expected input levels (natural gas prices, hydro, loads, wind, and thermal outages)

2. Stochastic Market Scenarios: use Monte Carlo analysis

3. Portfolio Scenarios: show alternative portfolios to highlight the cost differences from the PRS

Market Scenarios

Stochastic scenarios test the preferred resource strategy (PRS) across several fundamentally different futures:

- Expected Case
- Expected Case without Colstrip (2027-2035)
- Benchmarking Case
- 111(d) draft rule by state meets 2020 goals
- Social Cost of Carbon

Portfolio Scenarios

- Shut down Colstrip in 2026
- 2013 PRS
- High and low load forecasts
- All load growth with renewables and peakers for capacity:
    - All hydro, wind, solar
- All deficits met by market purchases
- Efficient frontier
- Efficient frontier with tail risk
- TAC requested high cost Colstrip case
- Retire CCCT/coal and replace with renewables
- Increased distributed solar penetration

2015 Electric Integrated Resource Plan

Technical Advisory Committee Meeting No. 5 Agenda

Tuesday, May 19, 2015

Conference Room 130

Topic	**Time**	**Staff**
1. Introduction & TAC 4 Recap	8:30	Lyons
2. Review of Market Futures	8:40	Gall
3. Ancillary Services Valuation	9:30	Shane
4. Conservation Potential Assessment	10:00	Kester (AEG)
5. Lunch	11:30	
6. Draft 2015 PRS & Portfolio Analysis	12:30	Planning Group
7. Adjourn	3:00	

2015 Electric IRP
TAC Meeting Expectations and Schedule

John Lyons, Ph.D.
Fifth Technical Advisory Committee Meeting
May 19, 2015

Technical Advisory Committee

- The public process of the IRP – input on what to study, how to study, and review assumptions and results
- Technical forum with a range of participants with different areas of input and expertise
- Open forum, but we need to stay on topic to get through the agenda and allow all participants to ask questions and make comments
- Welcome requests for studies or different assumptions.
  - Time or resources may limit the amount of studies
  - The earlier study requests are made, the more accommodating we can be
  - January 15, 2015 was the final date to receive study requests
- Action Items – areas for more research in the next IRP

Technical Advisory Committee

- Technical forum on inputs and assumptions, not an advocacy forum
- Focus is on developing a resource strategy based on sound assumptions and inputs, instead of a forum on a particular resource or resource type
- We request that everyone maintain a high level of respect and professional demeanor to encourage an ongoing conversation about the IRP process
- Supports rate recovery, but not a preapproval process
- Planning team is available by email or phone for questions or comments between the TAC meetings
- **TAC 6 – June 24, 2015:** Review of final PRS, draft 2015 IRP document and Action Items.

TAC #4 Recap

- Introduction & TAC 3 Recap – Lyons
- Demand Response Study – Doege
- Natural Gas Price Forecast – Scott
- Electric Price Forecast – Gall
- Resource Requirements – Kalich
- Interconnection Studies – Maguire
- Market Scenarios and Portfolio Analysis – Lyons

Today's Agenda

- Introduction & TAC 4 Recap (8:30) – Lyons
- Review of Market Futures (8:40) – Gall
- Ancillary Services Valuation (9:30) – Shane
- Conservation Potential Assessment (10:00) – Kester (AEG)
- Lunch (11:30)
- Draft 2015 PRS and Portfolio Analysis (12:30) – Planning Group
- Adjourn 3:00

AVISTA

DRAFT

Market Futures

James Gall
Fifth Technical Advisory Committee Meeting
May 19, 2015

DRAFT

Introduction

- Follow up presentation to the "Expected Case" market price forecast from the previous TAC meeting- this presentation shows alternatives prices given each future scenario
- Used to value the cost of energy and resource options for potential resource strategies
- Illustrate macro level impacts of environmental policies

DRAFT

Market Futures Overview

- Expected Case
  - Stochastic, meets regional 111(d) goals, 10% probability of \$13.23 CO_2 “tax” (1^{st} yr), Stanfield \$4.65/dth levelized, 80 year hydro
- Benchmark Case
  - Similar to expected case, stochastic, no CO_2 “tax”, no 111d goal
- Social Cost of Carbon
  - Stochastic case, similar to expected case, except includes ~\$21/short ton CO_2 “tax” levelized
- Colstrip Retires
  - Stochastic case, similar to expected case, except Colstrip 1-4 retires by the end of 2026 and replaced with natural gas combined cycle plants
- State-by-State 111(d)
  - Deterministic case, each state meets 111(d) goals
  - MWh credit remains in state generated in
  - Includes a low water year scenario

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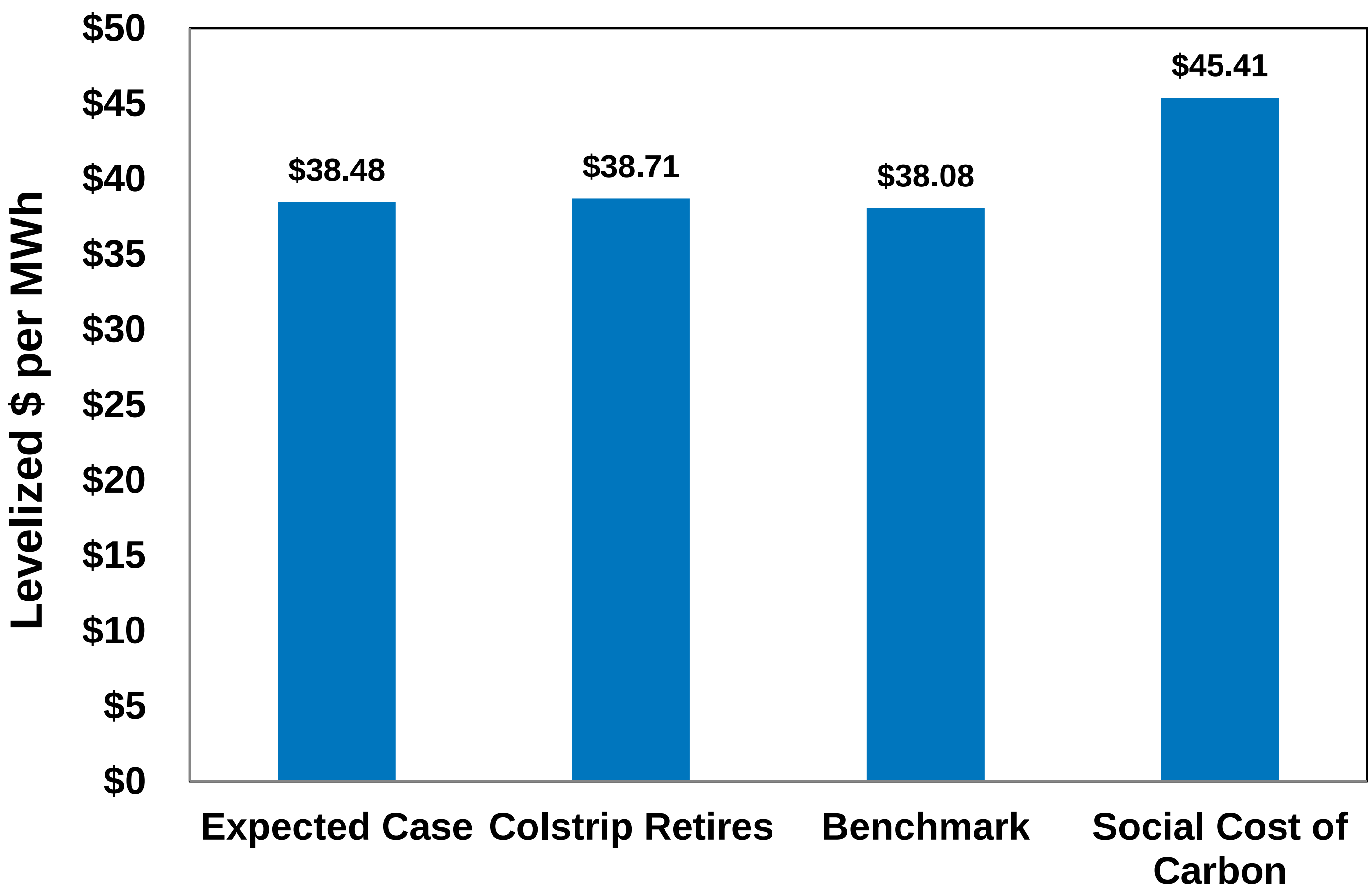
20-year Levelized Flat Mid-C Electric Price Comparison (Stochastic)



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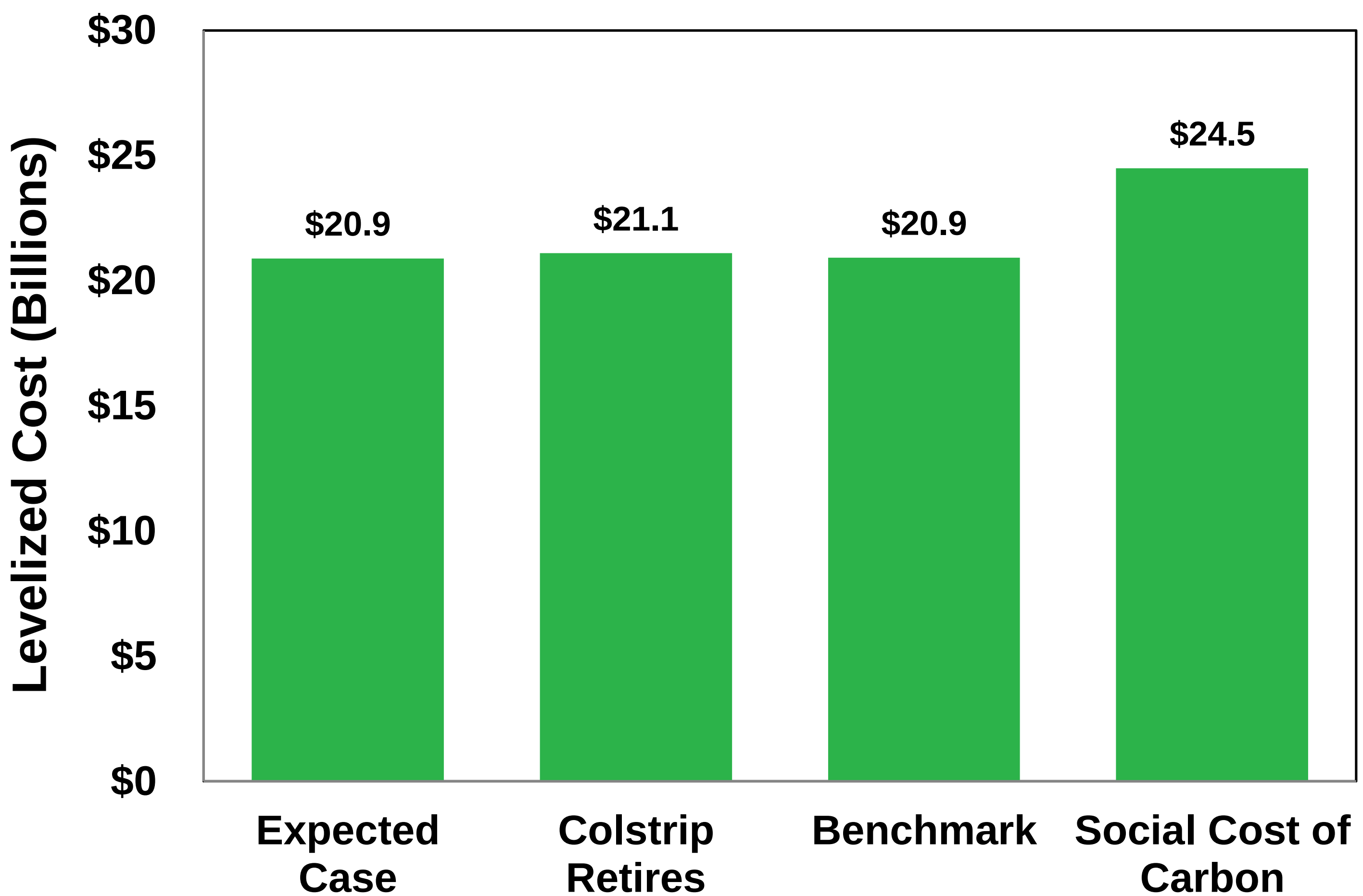
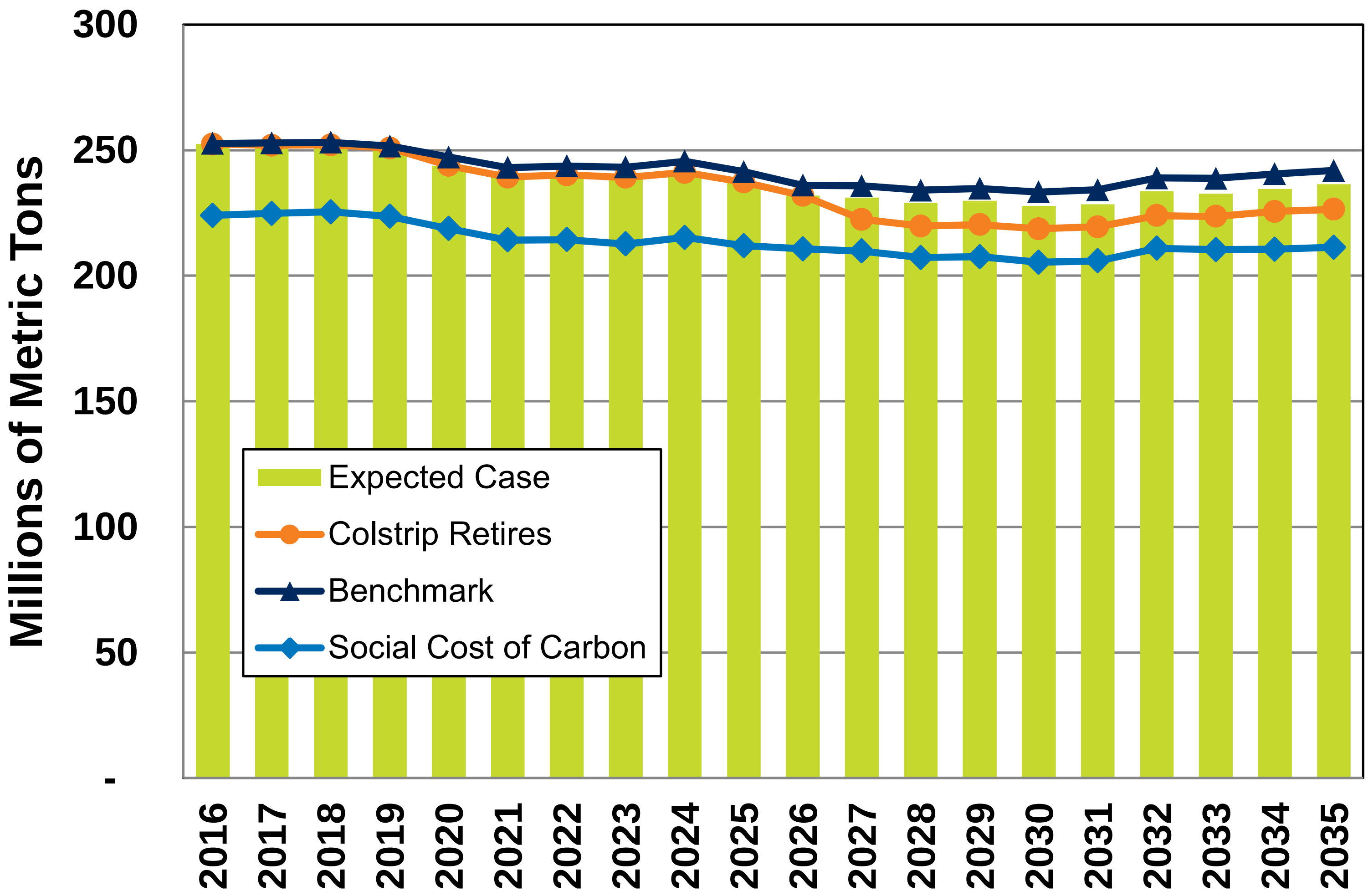
Cost to Serve
US West: Production + Fixed Costs



US West: Greenhouse Gas Emissions Comparison



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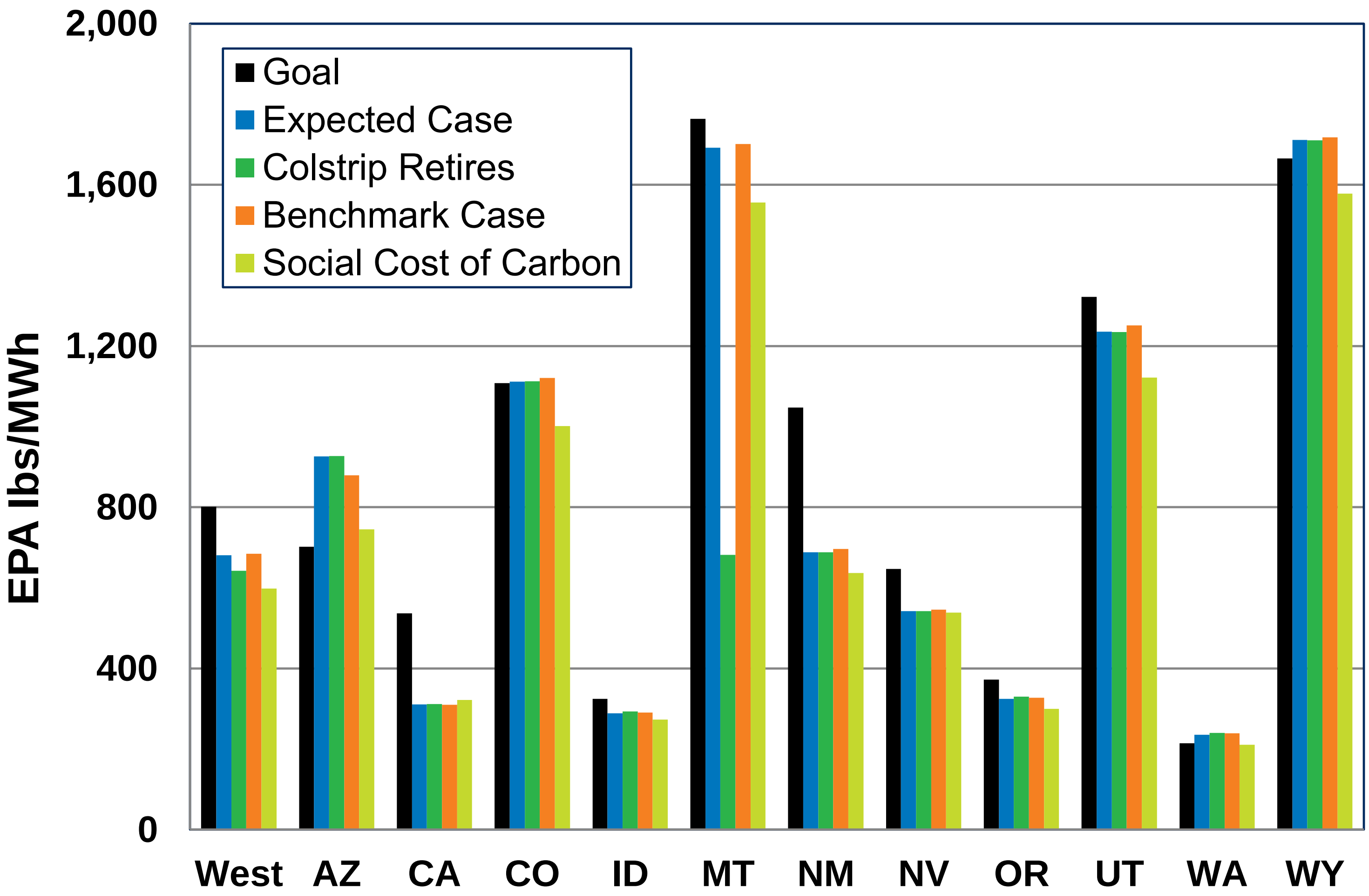
Meeting 111(d) Targets in 2030



AVISTA

How to Meet the Proposed 111(d) in 2020 & 2030 State by State

- Resource Retirements:
  - Northwest: Centralia and Boardman must close by end of 2019
  - Other States: Most of SW coal must retire earlier
- Conservation:
  - Continue acquisition levels from Expected Case
- Renewables:
  - Arizona & Utah must increase penetration
  - Other states stay on current steady track
- NW Carbon Pricing
  - WA & OR required $1.25/ton charge nominal 2020-2035
  - ID required $3.00/ton 2020-2029 and $1.50/ton 2030-2035

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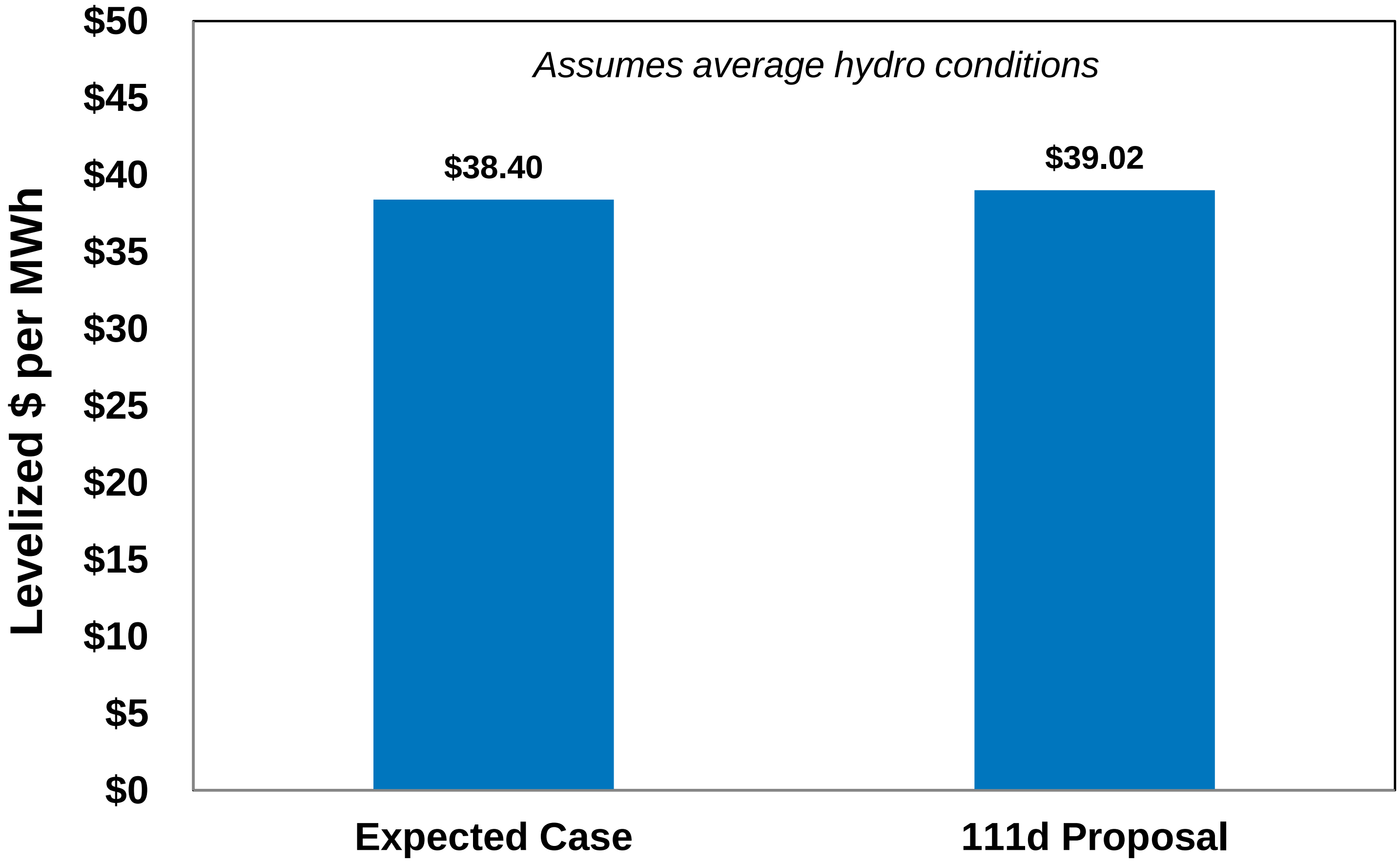
Mid-C Market Price Impact of the 111(d) Proposal Scenario (Deterministic)



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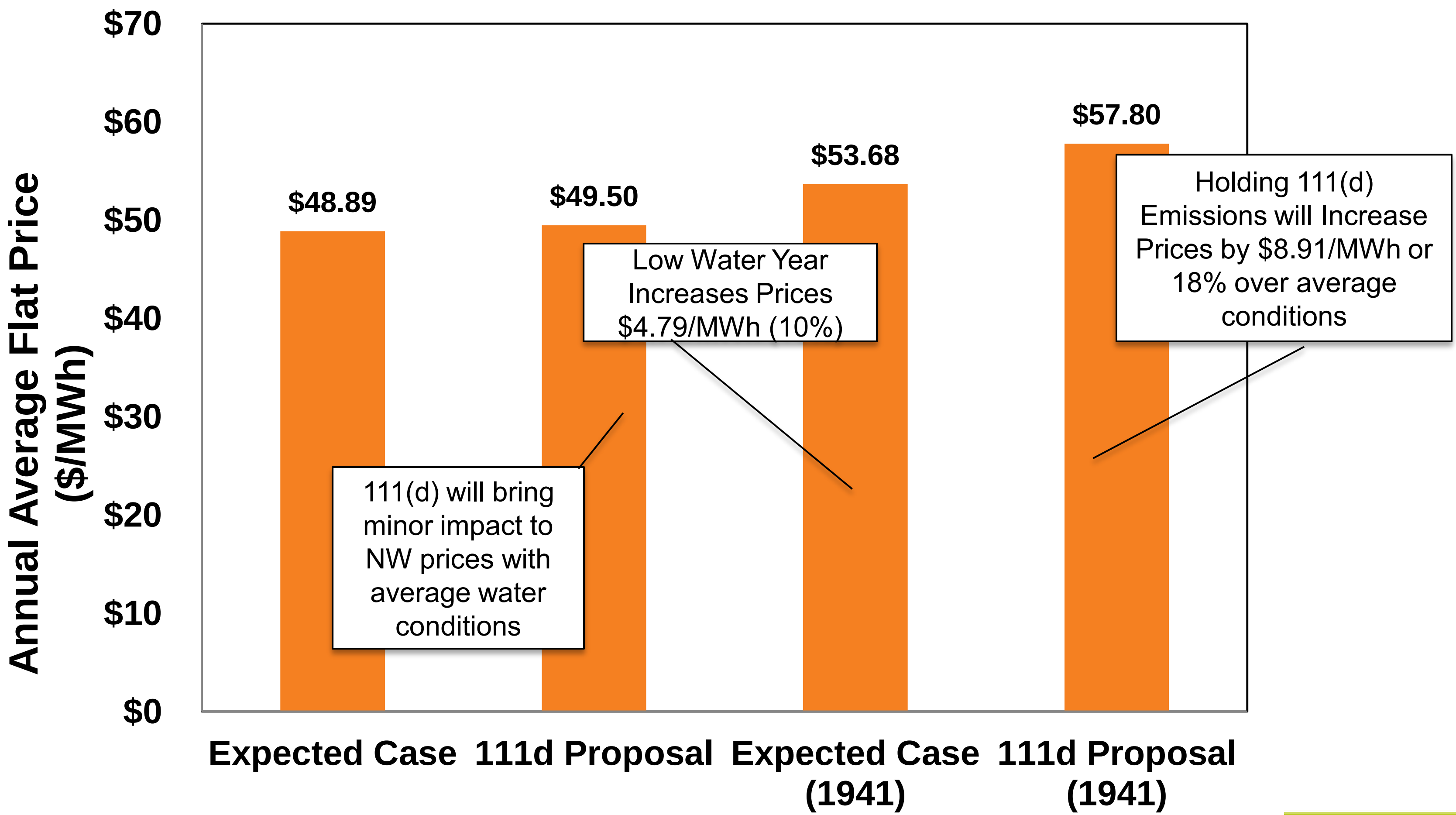
111(d) Impact in a Low Water Year

- Can the Northwest meet 111(d) goals in a low water year?
- Modeled 1941 water year (10th percentile year)
- Solve for Carbon Price to meet goal in each year
  - WA: $18/ton (2020), $18/ton (2030)
  - OR: $19/ton (2020), $15/ton (2030)
  - ID: $23/ton (2020), $14/ton (2030)
  - Neighboring states have small price increases

Mid-C Market Prices: 111(d) Low Water Year 2030 With Water Year = 1941



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Financial Impact to Western States

- Proposed 111(d) goal's annual levelized cost to the US West is **$340 million** over the Expected Case in an Average Water Year.
- In Low Water Year the US West will pay up to **$1.6 billion (2020)** beyond the Expected Case's Low Water Year cost, declining to **$175 million** in 2030. *(levelized $755 million)*

Ancillary Services Valuation

Xin Shane
Fifth Technical Advisory Committee Meeting
May 19, 2015

Ancillary Services Valuation Basics

What?

- The U.S. Federal Energy Regulatory Commission (FERC) defines ancillary services as: "those services necessary to support the transmission of electric power from seller to purchaser given the obligations of control areas and transmitting utilities within those control areas to maintain reliable operations of the interconnected transmission system."
- FERC identifies six different ancillary services:
  - scheduling and dispatch
  - reactive power and voltage control
  - loss compensation
  - load following
  - system protection
  - energy imbalance

Why?

- Ancillary services are a significant value component of a generating unit
- The Washington UTC asked Avista to "use the Company's new modeling capabilities to evaluate the benefits of storage resources to Avista's generation portfolio."

Avista Decision Support System

Overview of ADSS Model

Mixed-Integer Linear Programming Definition

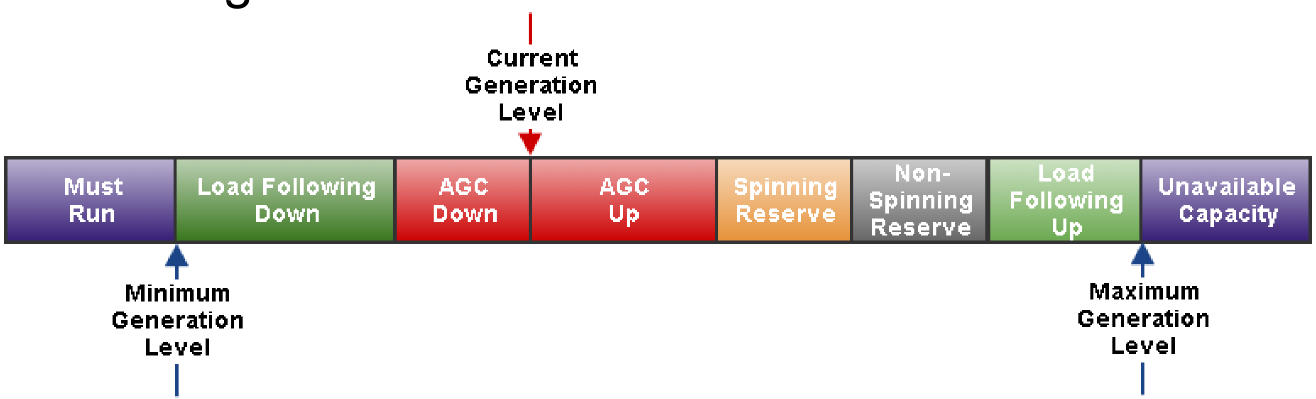
A mixed-integer linear program is a problem with

- Linear objective function, $f^T x$, where f is a column vector of constants, and x is the column vector of unknowns
- Bounds and linear constraints, but no nonlinear constraints (for definitions, see Writing Constraints)
- Restrictions on some components of x to have integer values

In mathematical terms, given vectors f, lb, and ub, matrices A and Aeq, corresponding vectors b and beq, and a set of indices intcon, find a vector x to solve

$$\min_x f^T x \text{ subject to } \begin{cases} x(\text{intcon}) \text{ are integers} \\ A \cdot x \le b \\ Aeq \cdot x = beq \\ lb \le x \le ub. \end{cases}$$

- Mixed-Integer linear program
- Full emulation of utility power supply problem
  - hourly analysis out to 20+ years
  - trading floor behavior
  - energy and ancillary services
  - unit- and engineering-level system definitions
  - modeling of transmission and market hubs



Hydro Modeling in ADSS

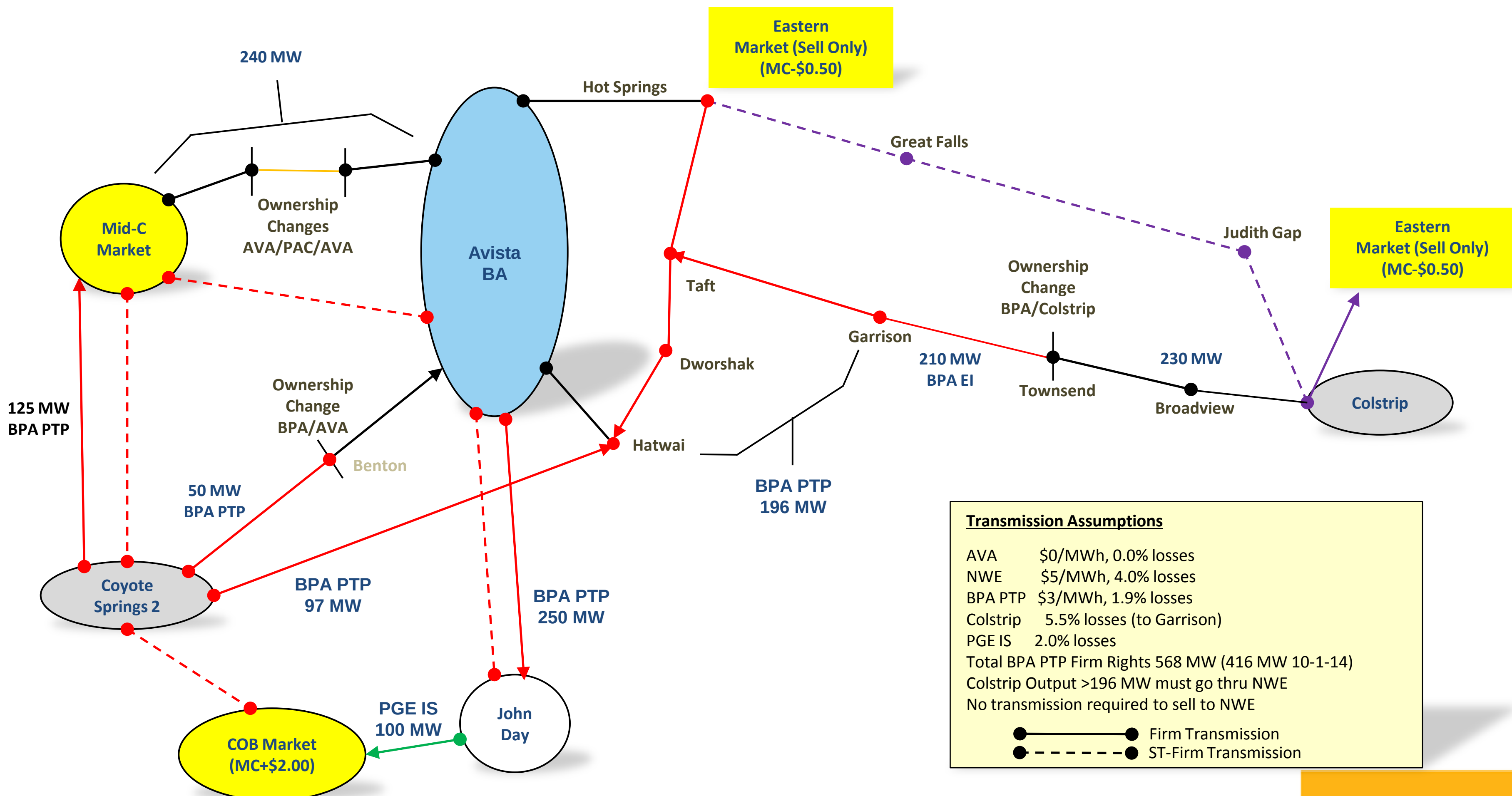
- Cascading hydro
- "Engineering level" representation
- Full power curve modeling
- Flow limitations
  - ramping rates
  - minimums/maximums
  - in-stream flow limits
  - dissolved gas
- Plant head
  - impacts of flow on head ("live" tailrace)
  - in-plant head losses
  - impacts of head on efficiency curves

- Operating considerations
  - min/max up/down times
  - must run
  - dispatch and merit order
  - motoring/condensing
  - AGC control
  - start-up/shut-down costs
  - min/max turbine/generator limits
  - rough zones, thermal limits
  - flash boards, Obermeyer gates
  - unit steady states
  - elevation targets
  - water right limits

Thermal Modeling in ADSS

- "Engineering level" representation
- Weather impacts
  - barometric pressures
  - dew point
  - temperature
  - humidity
- Detailed heat rate curves
- Start-up & shut down costs
  - fuel, O&M, ramp rates
- Multiple fuels
- Detailed emissions modeling
  - NO_X, SO_X, VO_X, Hg, CO_2
  - generation-level production
  - permit limit optimization (allocation)
- Multiple operating stages
  - duct firing
- Operating considerations
  - ramp rates
  - min/max up/down times
  - must run
  - dispatch and merit order (on and off)
  - AGC control
  - min/max turbine/generator limits
  - thermal limits
  - equal wear cycling
  - unit steady-states
  - water right limits

Transmission/Market Modeling in ADSS

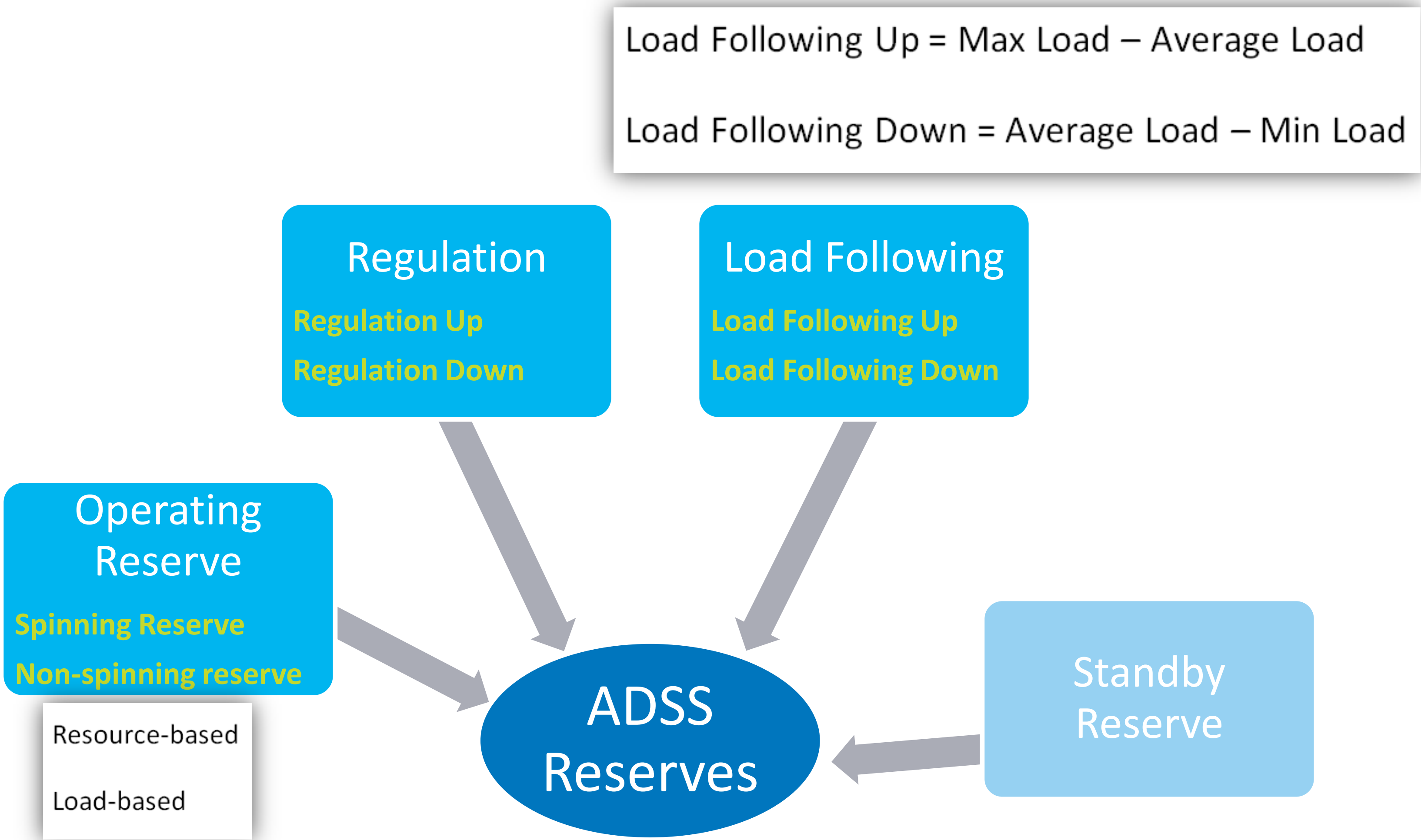


Transmission Assumptions

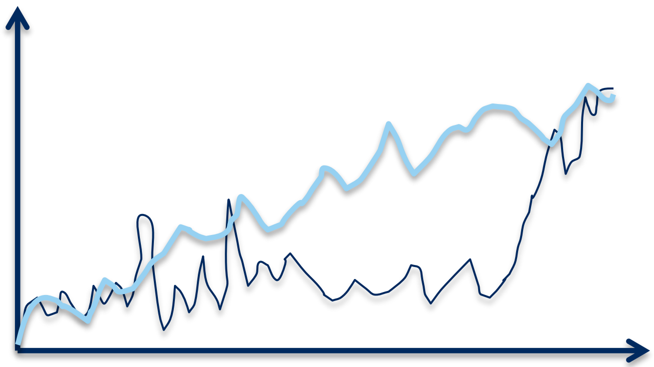
AVA $0/MWh, 0.0% losses
NWE $5/MWh, 4.0% losses
BPA PTP $3/MWh, 1.9% losses
Colstrip 5.5% losses (to Garrison)
PGE IS 2.0% losses
Total BPA PTP Firm Rights 568 MW (416 MW 10-1-14)
Colstrip Output >196 MW must go thru NWE
No transmission required to sell to NWE

Firm Transmission
ST-Firm Transmission

Reserve Modeling in ADSS



Storage Valuation



Key Input Assumptions

- Storage Specification
  - Max Storage = 3 × Capacity
    - e.g., 1 MW = 3 MWh
  - 85% Efficiency
  - Hourly Charge/Discharge Rate = 100% of Capacity
  - Capable of All Ancillary Services
    - Regulation +/- 100%
    - Load following +/- 100%
    - Spin/non-spin +/- 100%
- Model Input
  - Year 2012 Historical Data
  - Year 2015 Gas and Power Prices
  - Average Hydro

Study Scenario

- By Size
  - 35 MW, 30 MW, 25 MW, 10 MW, 5 MW and 1 MW
- By Ancillary Service Product Type
  - Charge/Discharge only
  - With Load Following/Contingency Reserve/Regulation
- By Energy Consumption Rate
  - 10%, 25% and 50% of Load Following and Regulation

Storage Valuation Results

Battery Value Summary by Size

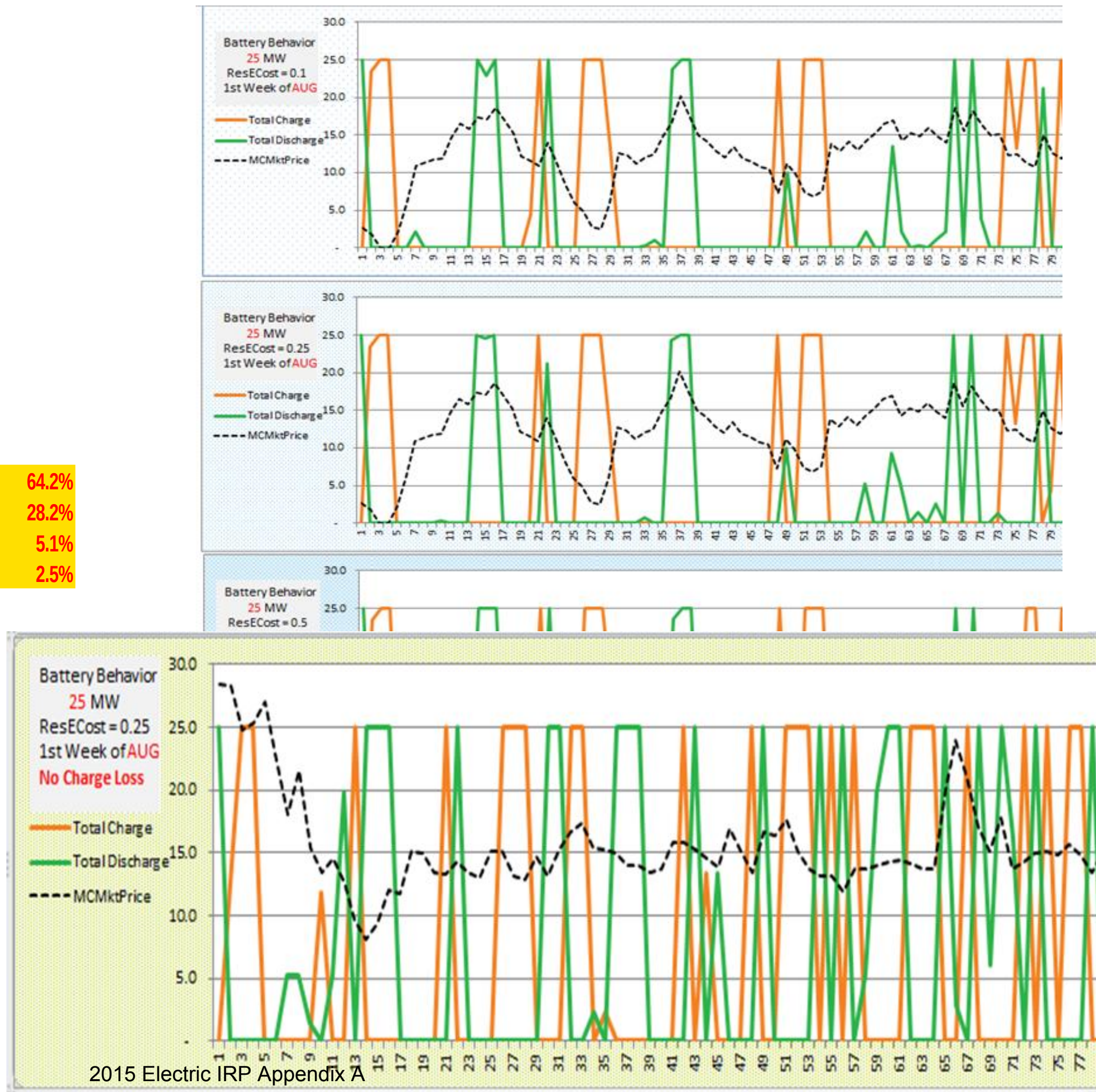
Battery Cap (MW)	Annual Value	Annual Value/KW
35	$ 1,201,590	$ 34.33
30	$ 1,024,569	$ 34.15
25	$ 923,291	$ 36.93
10	$ 381,407	$ 38.14
5	$ 189,000	$ 37.80
1	$ 36,862	$ 36.86

Battery Value Summary by Capability for 25MW

Capability	Annual Value - 25 MW	Incremental	
Charge/Discharge Only	$ 629,082		64.2%
Load Following	$ 905,114	$ 276,032	28.2%
SpinR/NSpinR	$ 678,906	$ 49,824	5.1%
Regulation(AGC)	$ 653,402	$ 24,320	2.5%

Battery Value Summary by Energy Cost Ratio of AS for 25MW

Energy Cost Ratio	Annual Value
0.10	$ 884,093
0.25	$ 923,291
0.50	$ 876,962



New Generating Resource Ancillary Services Valuation

- New Resources Included in Study
  - 100 MW CCCT
  - 100 MW LMS
  - 100 MW Recip
  - 25 MW Diesel Back-up Generator

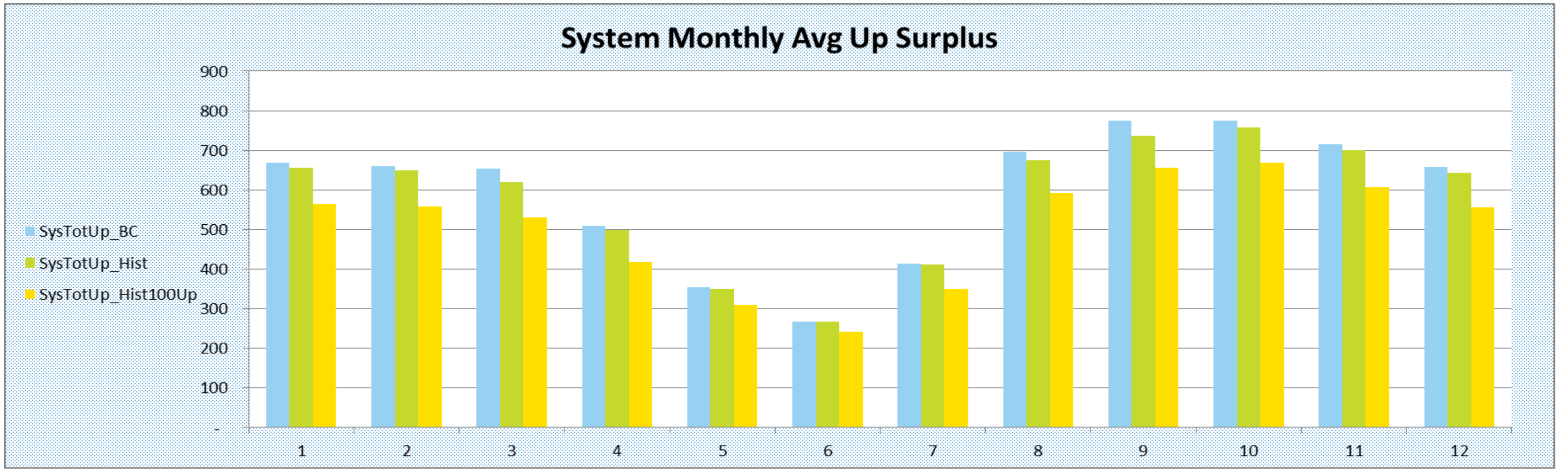
New Generating Resources	Ancillary Services Capability	Ancillary Service Value ($/kw year)
100 MW CCCT	Load Following/SpinR/Reg	$ 0.00
100 MW LMS	Load Following/SpinR/NSpinR/Reg	$ 1.12
100 MW Recip	Load Following/SpinR	$ 0.61
25 MW Diesel Back-up Generator	NSpinR	$ -

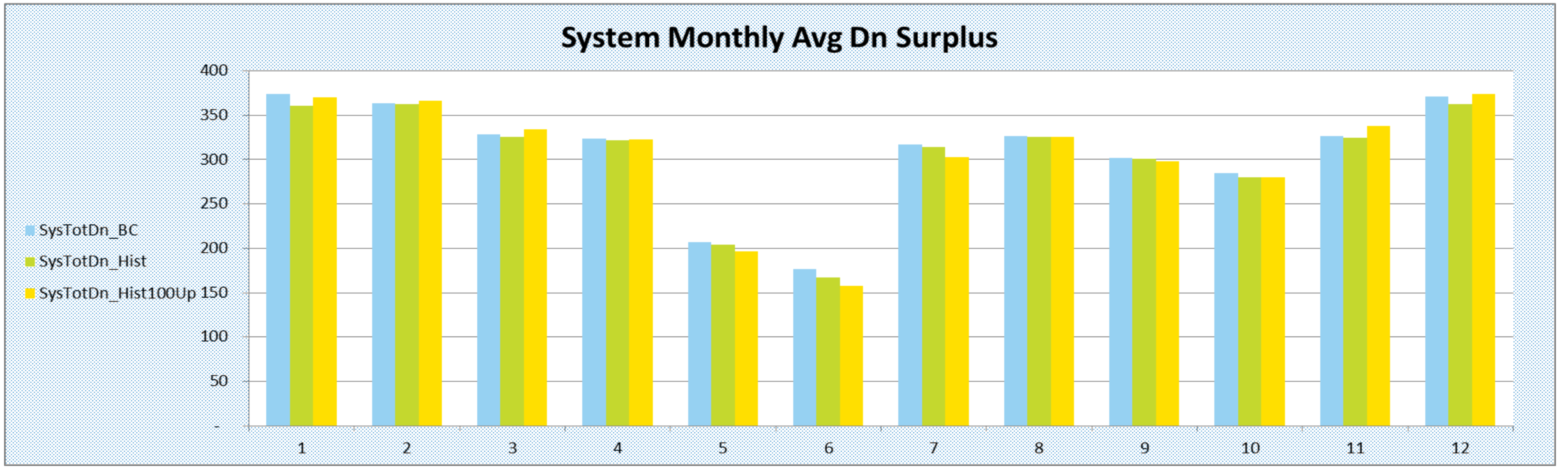
- Model Input
  - Based on Historical Data of Years 2010-14
  - Portfolio Contracts adjusted to Year 2020 Conditions
  - Load adjusted to Year 2020 Conditions

- Run Scenario: for each new resource
  - Base Case Run with Existing Portfolio of Year 2020 Conditions
  - Energy-Only Run (i.e., no ability to generate ancillary services)
  - Energy/Capacity Run (i.e., ability to generate energy *and* ancillary services)

Ancillary service value will be unique to each system

Why Are Ancillary Service Values Low





Avista Conservation Potential Assessment

Presentation to the Technical Advisory Committee

May 19, 2015

Outline

- Study Approach
  - Market Characterization
  - Baseline Projection
  - Measure Development
  - Economic Screening
  - Ramp Rate Development
- Potential Results
  - Overall – Washington and Idaho
  - Washington by sector
  - Idaho by sector
- Consistency with Council Methodology
- Supplemental slides
  - Market characterization for all three sectors for WA and ID

AEG Uses a Bottom-up Analysis Approach

Achievable potential

Establish Customer Acceptance

Program results
Council ramp rates
Other studies

Technical and economic potential

Screen EE Measures

Measure descriptions
Emerging technologies
RTF data
Avoided costs
AEG's DEEM

End-use projection by segment

LoadMAP™

Project the Baseline

Prototypes and energy analysis (***AEG's BEST***)
Avista Forecast data
Customer surveys
Secondary data

Base-year energy use by segment

Characterize the Market

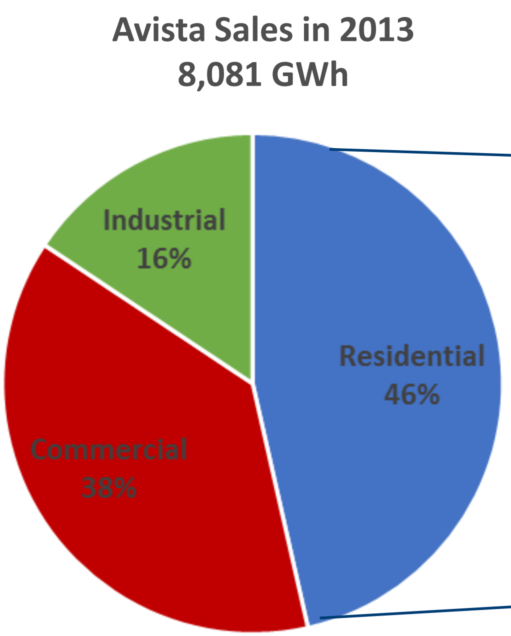
Avista data
Customer surveys
Secondary data
AEG's Energy Market Profiles

Establish objectives

Overview of Analysis Approach Using the Residential Sector

Step 1a: Characterize the Market

High-level characterization by sector – Washington and Idaho combined



Segment	Number of Customers	Annual Sales (GWh)	% of Sales	Intensity (kWh/HH)
Single Family	195,222	2,626	70%	13,450
Multi Family	17,229	139	4%	8,082
Mobile Home	12,526	151	4%	12,063
Low Income	96,112	837	22%	8,711
Total	**321,089**	**3,753**	**100%**	**11,690**

Step 1a: Characterize the Market

Residential characterization by state

- Full market characterization for Washington and Idaho is provided in the supplemental slides
- The following slides focus on Washington

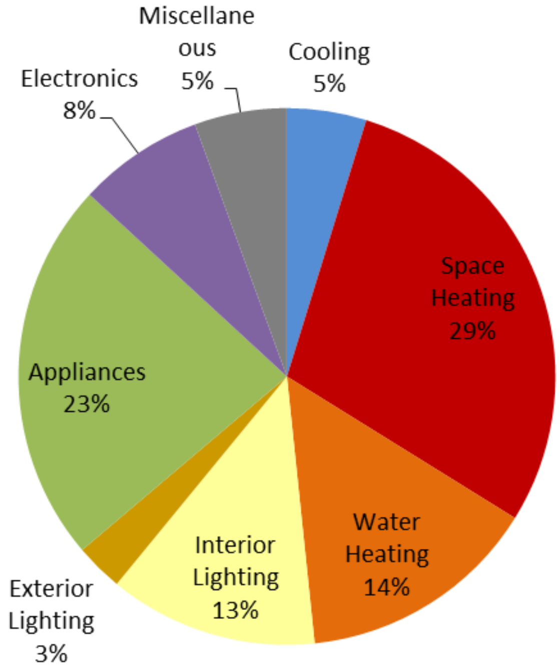
Washington				
Segment	Number of Customers	Annual Sales (GWh)	% of Sales	Intensity (kWh/HH)
Single Family	129,893	1,783	70%	13,726
Multi Family	11,964	99	4%	8,236
Mobile Home	7,691	95	4%	12,354
Low Income	64,092	570	22%	8,892
Total	**213,640**	**2,546**	**100%**	**11,919**

Idaho				
Segment	Number of Customers	Annual Sales (GWh)	% of Sales	Intensity (kWh/HH)
Single Family	65,329	843	70%	12,902
Multi Family	5,265	41	3%	7,733
Mobile Home	4,835	56	5%	11,599
Low Income	32,020	267	22%	8,349
Total	**107,449**	**1,207**	**100%**	**11,233**

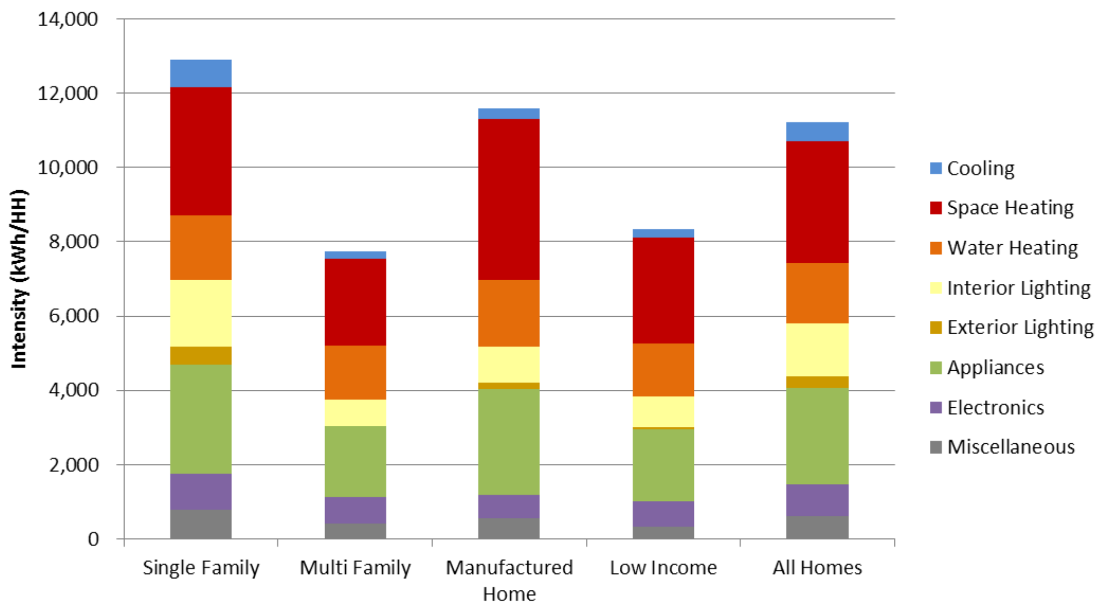
Step 1b: Develop Market Profiles by Sector and Segment

Base-year annual energy use by segment and end use

Total 2013 Residential Sales by End Use - Washington



Annual Intensity for Average Household - Washington

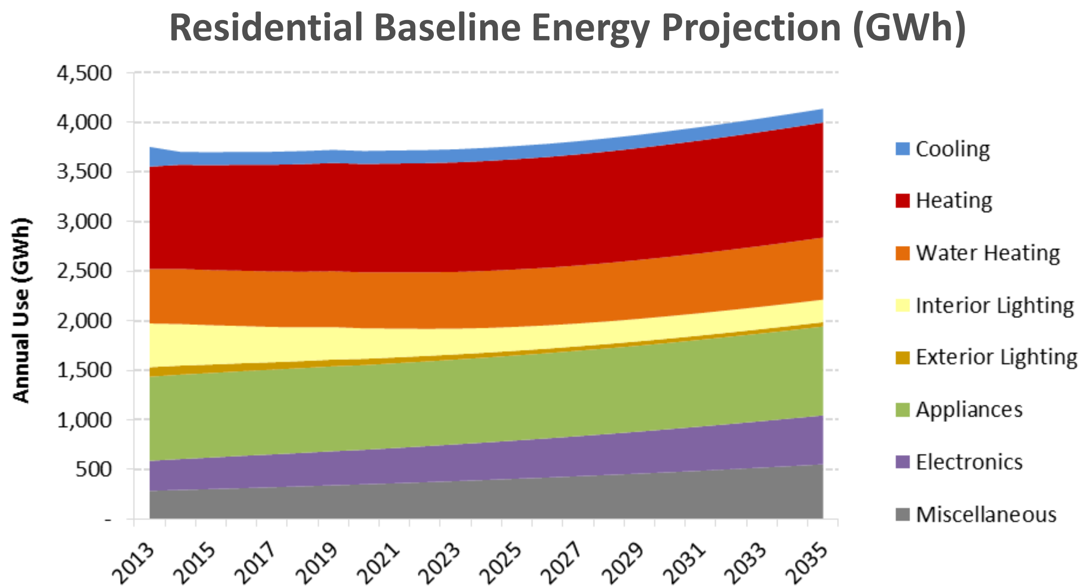


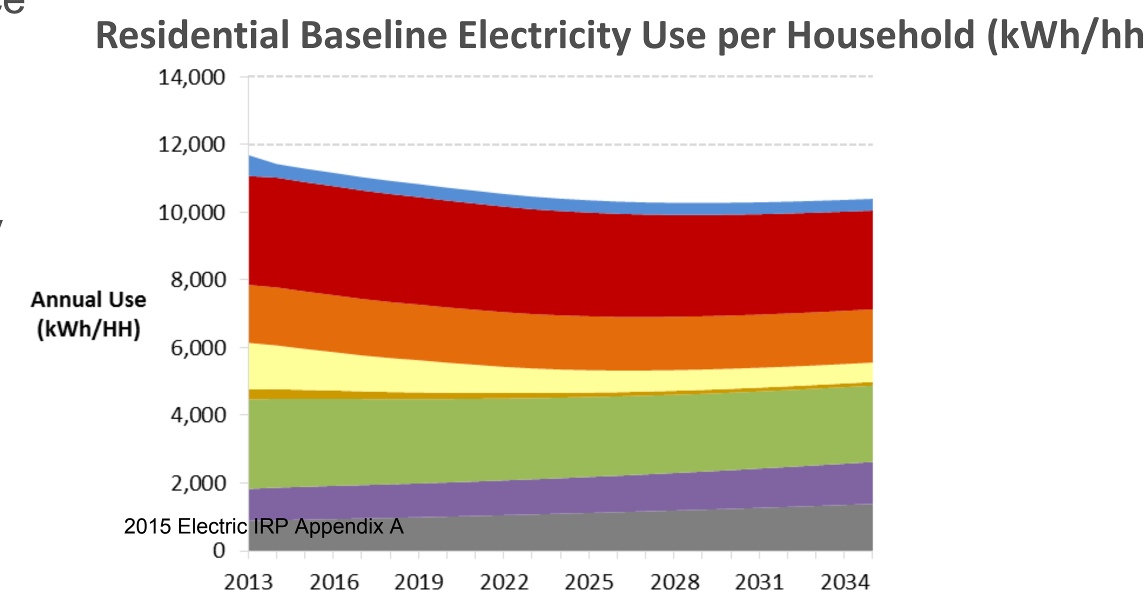
Data Sources:

- Avista billing data and residential GenPOP appliance saturation survey
- Residential Building Stock Assessment (NEEA)
- Commercial Building Stock Assessment (NEEA)
- Secondary data as needed to fill gaps

Step 2: Project the Baseline

- Baseline projection provides foundation for estimating potential future savings from conservation initiatives and reflects
  - Household growth and electricity price forecasts (from Avista)
  - Appliance standards in place at end of 2014 (AEG database)
  - No naturally occurring conservation or future utility programs
  - Alignment with Avista load forecast





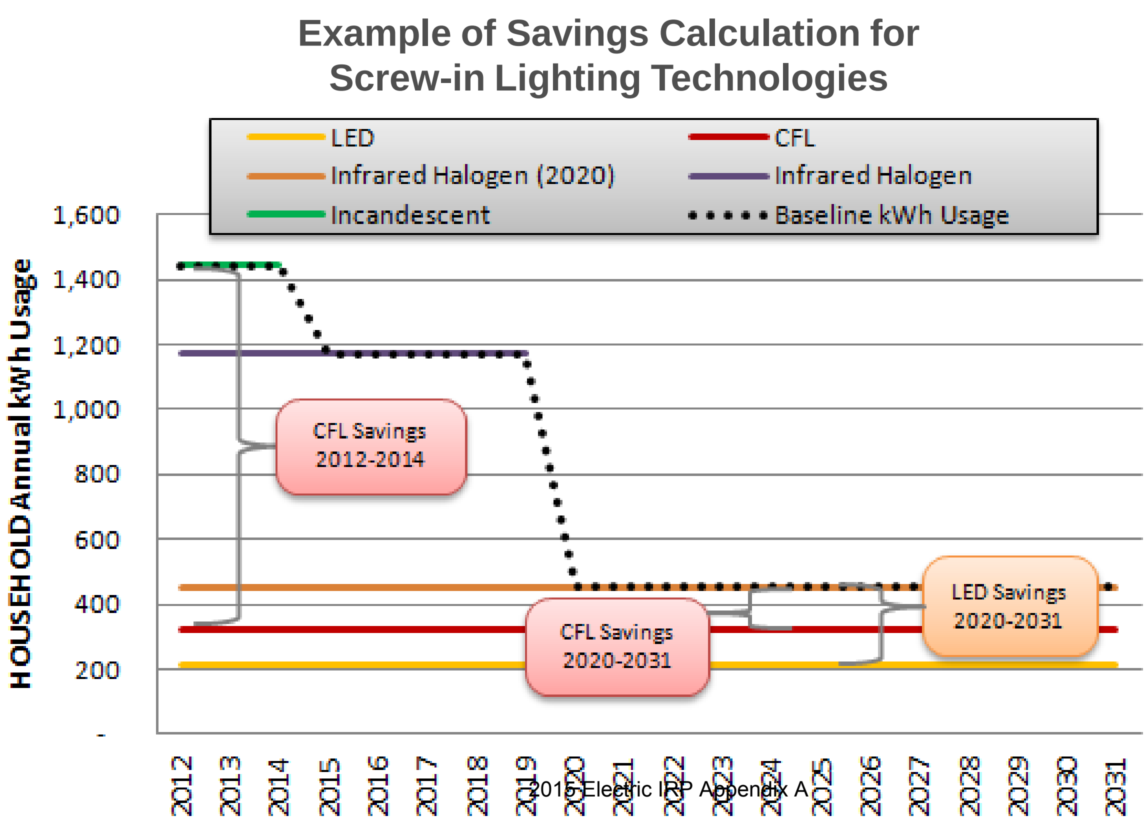
Step 3: Screen EE Measures

- Develop measure list using
  - Council workbooks
  - Existing programs
  - AEG databases
- Characterization
  - Description
  - Costs
  - Savings
  - Applicability
  - Lifetime
- Data sources
  - RTF
  - Avista data
  - AEG's database
  - BEST simulations
- Measure Crosswalk

Example: Water heating measures
Conventional (EF 0.95)
Heat pump water heater (EF 2.3)
Solar water heater
Low-flow showerheads
Timer / Thermostat setback
Tank blanket

Step 3: Screen EE Measures

- Measure savings change relative to baseline throughout study (as shown)
- We use a market baseline, consistent with RTF/Council
- Measure costs change with market projections and expectations



Step 4: Estimate Potential Future Savings

Use LoadMAP model to estimate potential

Technical Potential

Theoretical upper limit of EE, where all efficiency measures are phased in regardless of cost

Economic Potential

Also a theoretical upper limit of EE, but includes only cost-effective measures

Achievable Potential

EE potential that can be realistically achieved by utilities, accounting for customer adoption rates and how quickly programs can be implemented

Estimating Potential and Developing Ramp Rates

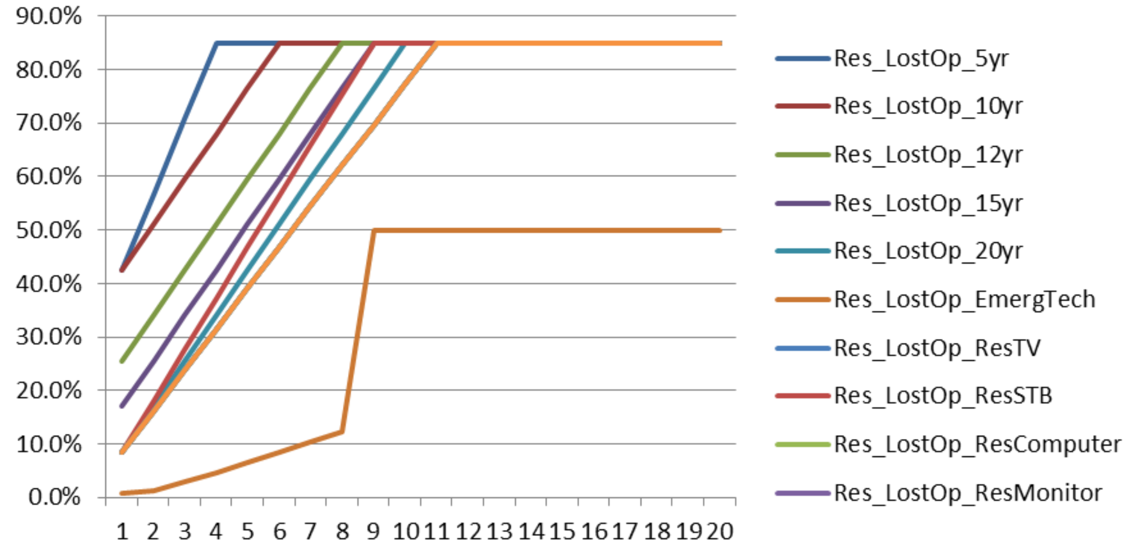
- **Technical potential** assumes most efficient option is chosen by all customers
- **Economic potential** assumes all customers choose the highest-efficiency option that passes economic screen
  - Use TRC and Avista’s avoided cost to perform economic screen
- **Achievable potential** is a subset of economic potential
  - Calculated by applying ramp rates to economic potential
  - Our approach for Avista:
    - Start with ramp rates from the 6th Power Plan
    - Map the Council ramp rates to ECMs in our analysis
    - Adjust the starting point for each measure’s ramp rate to align with Avista’s recent program accomplishments

Customer Adoption (Ramp) Rates

Residential ramp rates from NWPCC

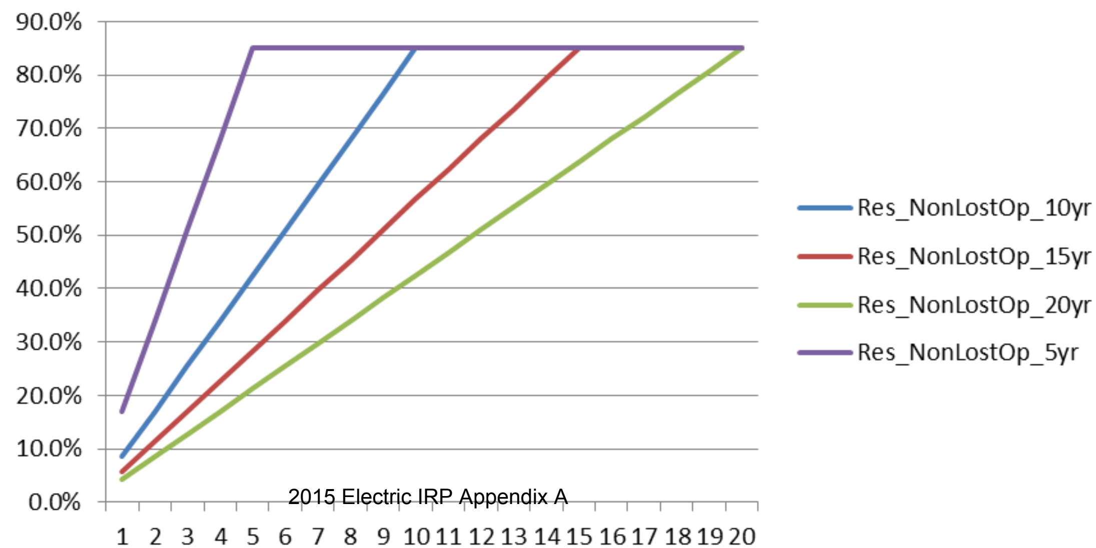
Lost Opportunity Ramp Rates:

Applied to equipment units each year that are turning over into a new purchase decision.



Non-Lost Opportunity Ramp Rates:

Applied cumulatively to all applicable opportunities in the market over time.



Summary of Changes since Previous study

- Updated base year from 2011 to 2013
- Refined the market segmentation
- Incorporated Avista's GenPOP residential saturation survey
- Supplemented with NEEA's Residential Building Stock Assessment (RBSA) and Commercial Building Stock Assessment (CBSA) data
- Characterized summer peak demand, in addition to annual energy use by segment and end use
  - Also estimated potential summer-peak savings
- Used updated forecasting assumptions for baseline projection
- Developed revised ramp rates using Council ramp rates as starting point and adjusting to reflect Avista program results in recent years
  - Developed estimates based solely on Council ramp rates for comparison purposes
- Incorporated new avoided costs
- And otherwise updated all measure, technology and modeling assumptions
  - There was substantial change in lighting: LED prices came down and lamps are readily available and acceptable to customers

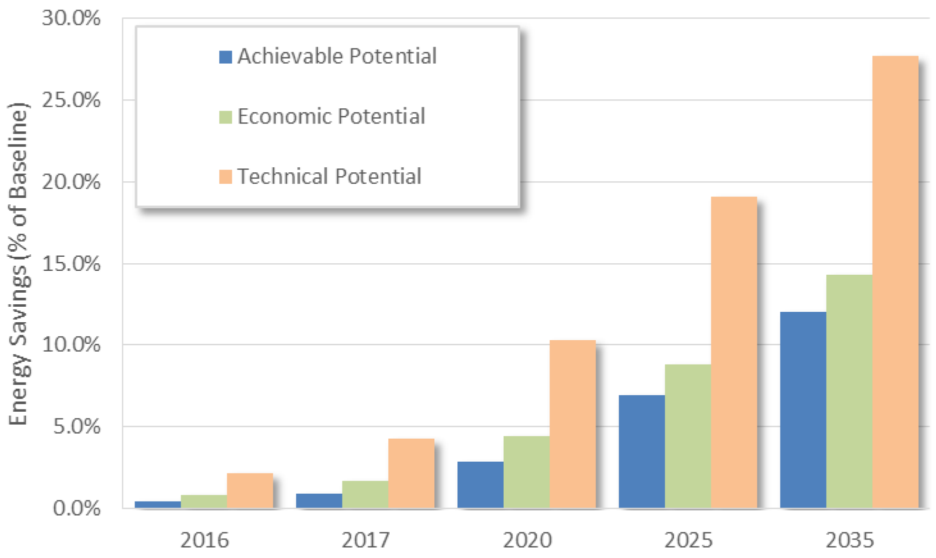
Summary of Conservation Potential Across All Sectors

Avista Conservation Potential – All Sectors

Washington and Idaho combined

From 2015 to 2025, cumulative achievable potential savings are 574 GWh, or 65.6 aMW.

Achievable potential in 2025 is about 78% of economic potential.



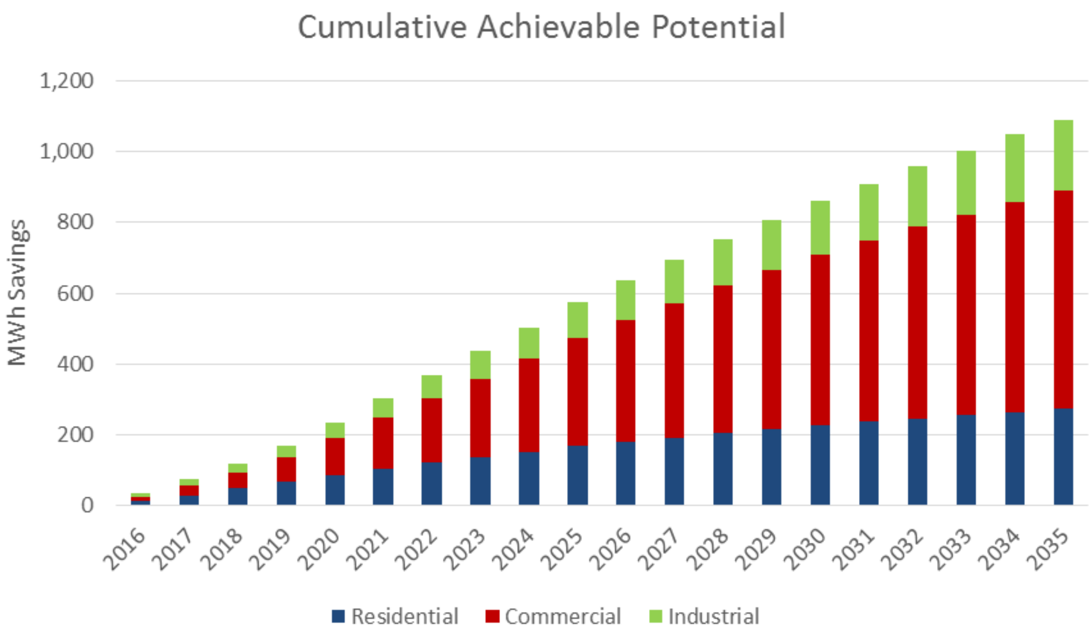
	2016	2017	2020	2025	2035
Cumulative WA and ID Savings (GWh)					
Achievable Potential	34	74	236	574	1,090
Economic Potential	68	139	360	733	1,292
Technical Potential	173	344	837	1,581	2,506
Cumulative Savings (aMW)					
Achievable Potential	3.9	8.5	27.0	65.6	124.5
Economic Potential	7.7	15.8	41.1	83.7	147.5
Technical Potential	19.7	39.3	95.5	180.5	286.1

2015 Electric IRP Appendix A

Avista Conservation Potential – All Sectors

Washington and Idaho combined

In the early years, savings from residential and commercial are about the same. Starting in 2020, savings are more likely to come from the commercial sector as a result of appliance standards. Industrial consistently contributes about 20% of the savings each year.



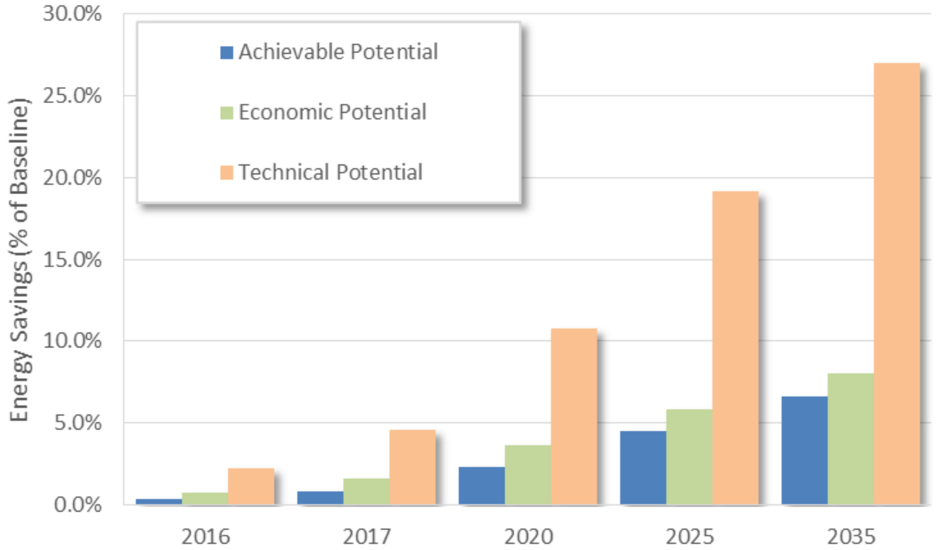
2015 Electric IRP Appendix A

Avista Conservation Potential – Residential

Washington and Idaho combined

From 2016 to 2025, cumulative achievable potential savings are 169 GWh, or 19.3 aMW.

Achievable potential in 2025 is about 77% of economic potential.



	2016	2017	2020	2025	2035
Cumulative WA and ID Savings (GWh)					
Achievable Potential	13.1	29.9	87.1	168.6	274.1
Economic Potential	29.3	60.1	136.7	219.4	333.8
Technical Potential	84.5	168.7	400.1	718.9	1,116.7
Cumulative Savings (aMW)					
Achievable Potential	1.5	3.4	9.9	19.3	31.3
Economic Potential	3.3	6.9	15.6	25.0	38.1
Technical Potential	9.6	19.3	45.7	82.1	127.5

2015 Electric IRP Appendix A

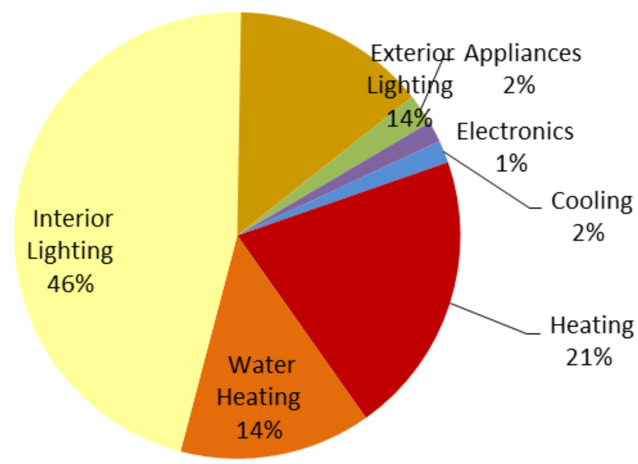
Avista Residential Savings Potential – WA & ID

Cumulative achievable potential in 2017

Top measures by energy savings

Measure / Technology	2017 Cumulative Energy Savings (MWh)	% of Total
Interior Lighting - Screw-in/Hard-wire (LED)	13,616	45.6%
Ducting - Repair and Sealing	5,057	16.9%
Exterior Lighting - Screw-in/Hard-wire (LED)	4,152	13.9%
Water Heater - Pipe Insulation	2,264	7.6%
Water Heater - Faucet Aerators	1,037	3.5%
Behavioral Programs	688	2.3%
Thermostat - Clock/Programmable	674	2.3%
Insulation - Ducting	621	2.1%
Water Heater - Low-Flow Showerheads	419	1.4%
Electronics - Personal Computers	285	1.0%
Total	**28,800**	**96.4%**

Energy savings by end use

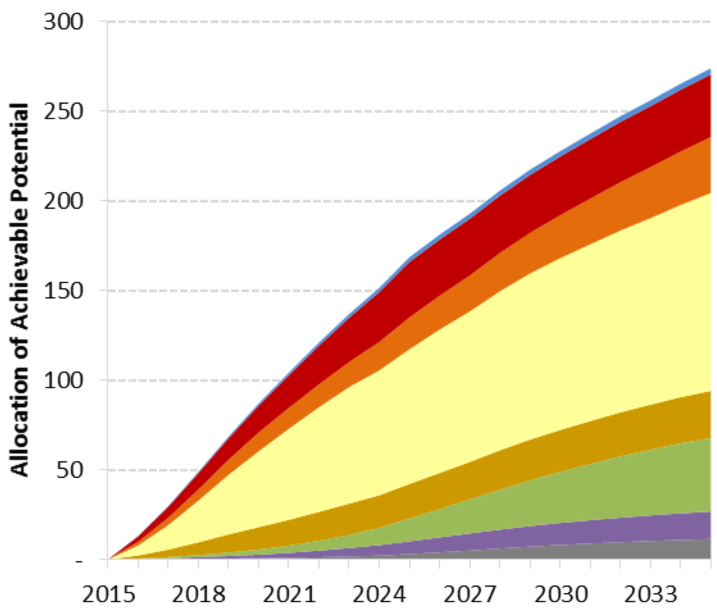


2015 Electric IRP Appendix A

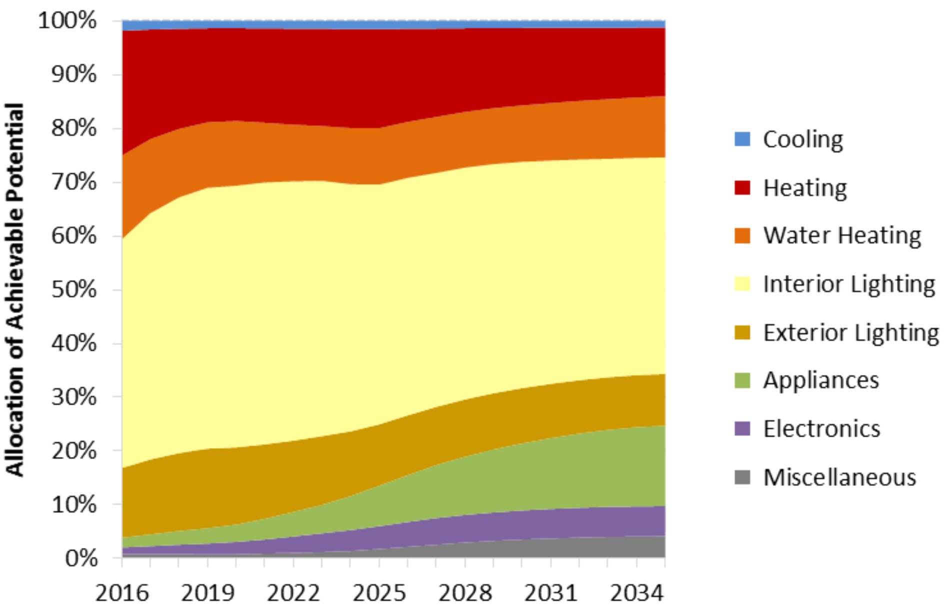
Avista Residential Savings Potential – WA & ID

Cumulative achievable energy savings potential over time

Cumulative Achievable Potential (GWh)



% of Cumulative Achievable Potential

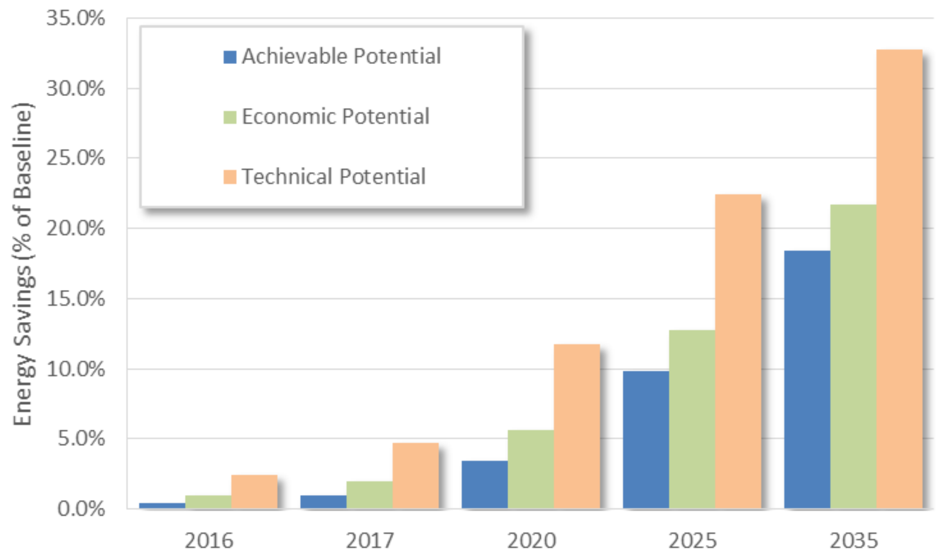


Avista Conservation Potential – Commercial

Washington and Idaho combined

From 2016 to 2025, cumulative achievable potential savings are 304 GWh, or 34.7 aMW.

Achievable potential in 2025 is about 77% of economic potential.



	2016	2017	2020	2025	2035
Cumulative WA and ID Savings (GWh)					
Achievable Potential	13.2	28.4	104.7	304.4	617.3
Economic Potential	29.2	59.7	171.1	395.3	727.7
Technical Potential	71.2	141.7	352.8	694.2	1,095.9
Cumulative Savings (aMW)					
Achievable Potential	1.5	3.2	12.0	34.7	70.5
Economic Potential	3.3	6.8	19.5	45.1	83.1
Technical Potential	8.1	16.2	40.3	79.2	125.1

2015 Electric IRP Appendix A

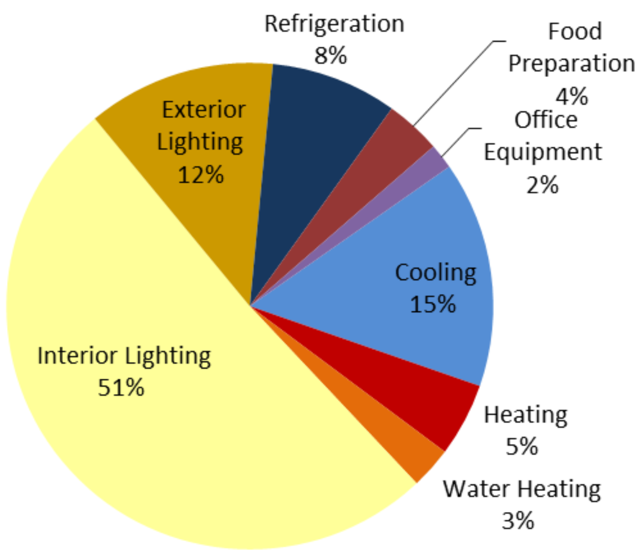
Avista Commercial Savings Potential – WA & ID

Cumulative achievable potential in 2017

Top measures by energy savings

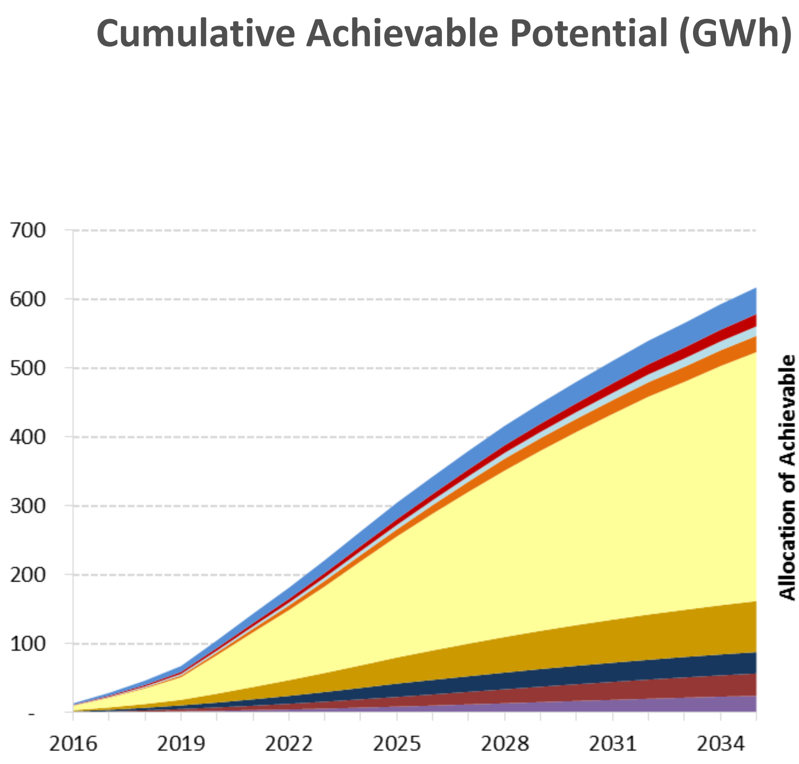
Measure / Technology	2017 Cumulative Energy Savings (MWh)	% of Total
Interior Lighting - Linear LED	6,604	23.3%
Interior Lighting - Screw-in/Hard-wire LED and CFL	3,889	13.7%
Chiller - Chilled Water Reset	1,362	4.8%
Exterior Lighting - Linear LED	1,135	4.0%
Interior Lighting - High-Bay Fixtures T5 and LED	1,130	4.0%
HVAC - Duct Repair and Sealing	1,068	3.8%
Interior Lighting - Occupancy Sensors	975	3.4%
Interior Lighting - Skylights	831	2.9%
Exterior Lighting - Screw-in/Hard-wire CFL and LED	702	2.5%
Exterior Lighting – HID T5 and LED	671	2.4%
Total Top 10 Measures	**18,367**	**64.7%**

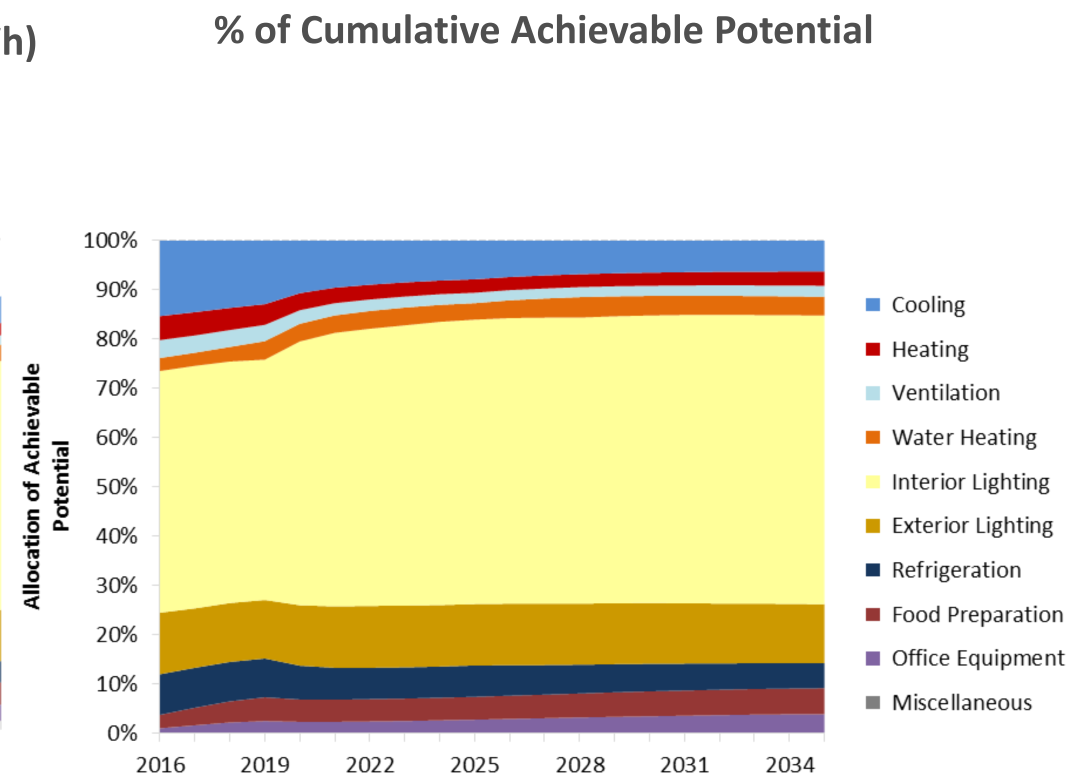
Energy savings by end use



Avista Commercial Savings Potential – WA & ID

Cumulative achievable energy savings potential over time



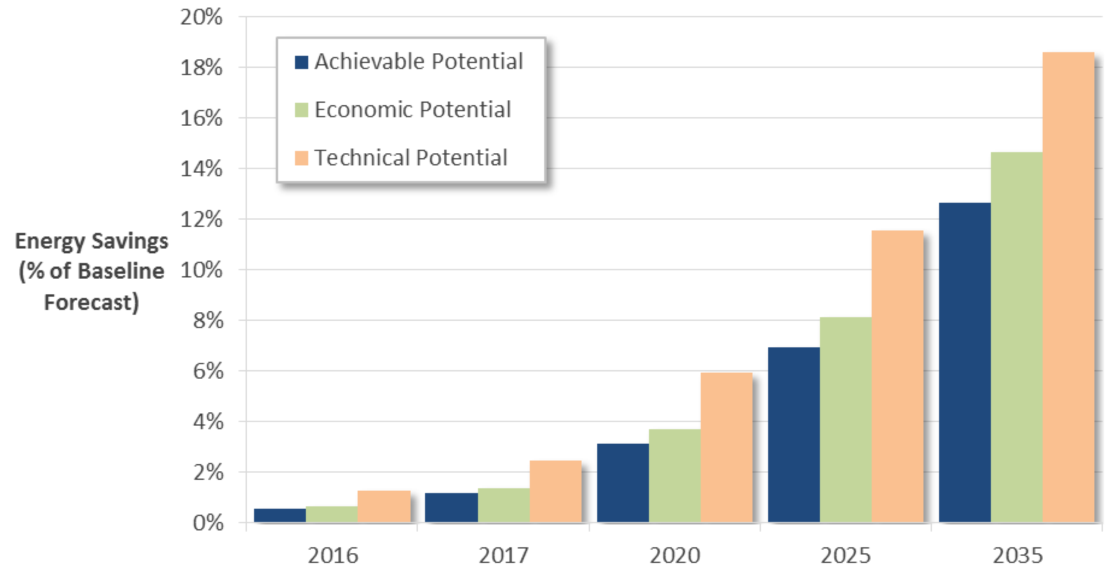


Avista Conservation Potential – Industrial

Washington and Idaho combined

From 2016 to 2025, cumulative achievable potential savings are 102 GWh, or 11.6 aMW.

Achievable potential in 2025 is about 86% of economic potential.



	2016	2017	2020	2025	2035
Cumulative WA and ID Savings (GWh)					
Achievable Potential	7.8	16.0	44.4	101.5	199.0
Economic Potential	9.1	18.8	52.1	118.4	230.8
Technical Potential	17.1	33.9	83.7	168.4	293.2
Cumulative Savings (aMW)					
Achievable Potential	0.9	1.8	5.1	11.6	22.7
Economic Potential	1.0	2.1	5.9	13.5	26.3
Technical Potential	1.9	3.9	9.6	19.2	33.5

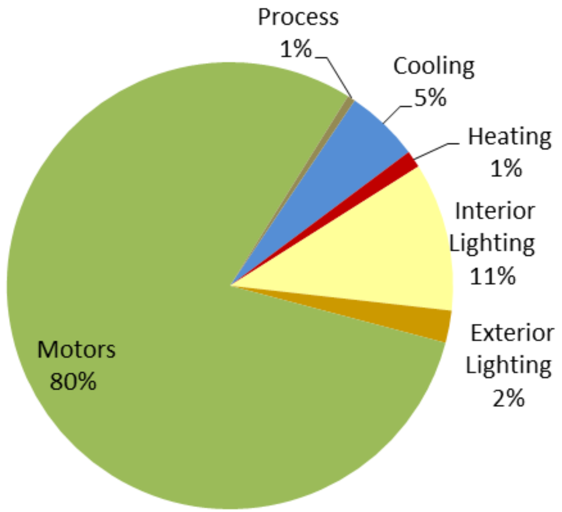
Avista Industrial Savings Potential – WA & ID

Cumulative achievable potential in 2017

Top measures by energy savings

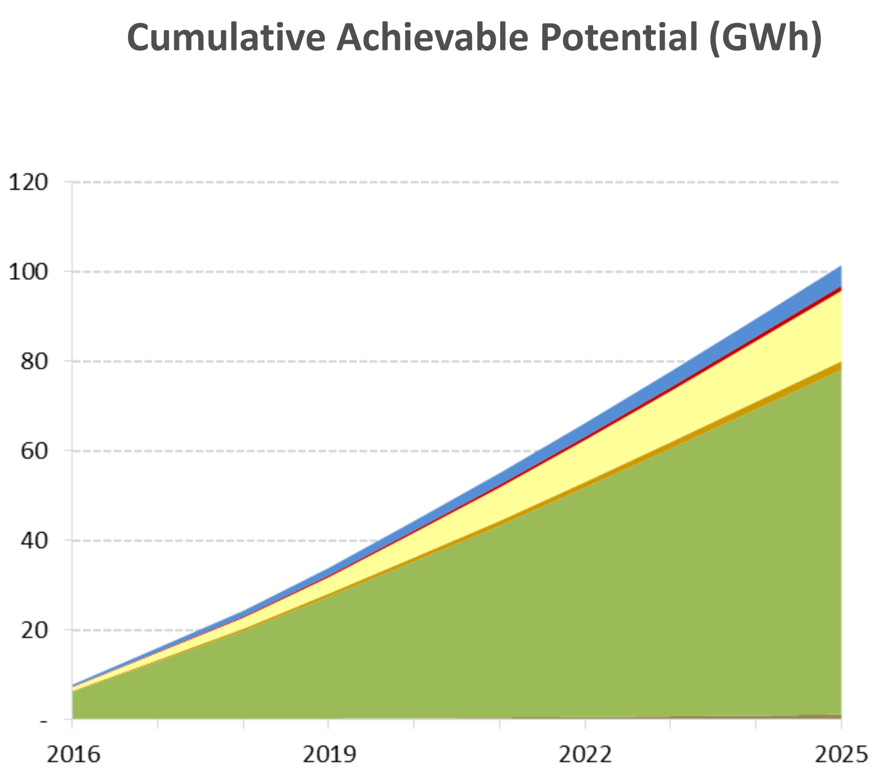
Measure / Technology	2017 Cumulative Energy Savings (MWh)	% of Total
Fan System - Optimization and Improvements	4,524	28.3%
Motors - Variable Frequency Drive (Pumps)	3,020	18.9%
Motors - Variable Frequency Drive (Fans & Blowers)	1,505	9.4%
Compressed Air - Air Usage Reduction	1,247	7.8%
Pumping System - Optimization and Improvements	893	5.6%
Interior Lighting - Occupancy Sensors	703	4.4%
Interior Lighting - High-Bay Fixtures	420	2.6%
Fan System - Maintenance	414	2.6%
Interior Lighting - Screw-in/Hard-wire LED	403	2.5%
Motors - Variable Frequency Drive (Compressed Air)	399	2.5%
Total Top 10 Measures	**13,528**	**84.5%**

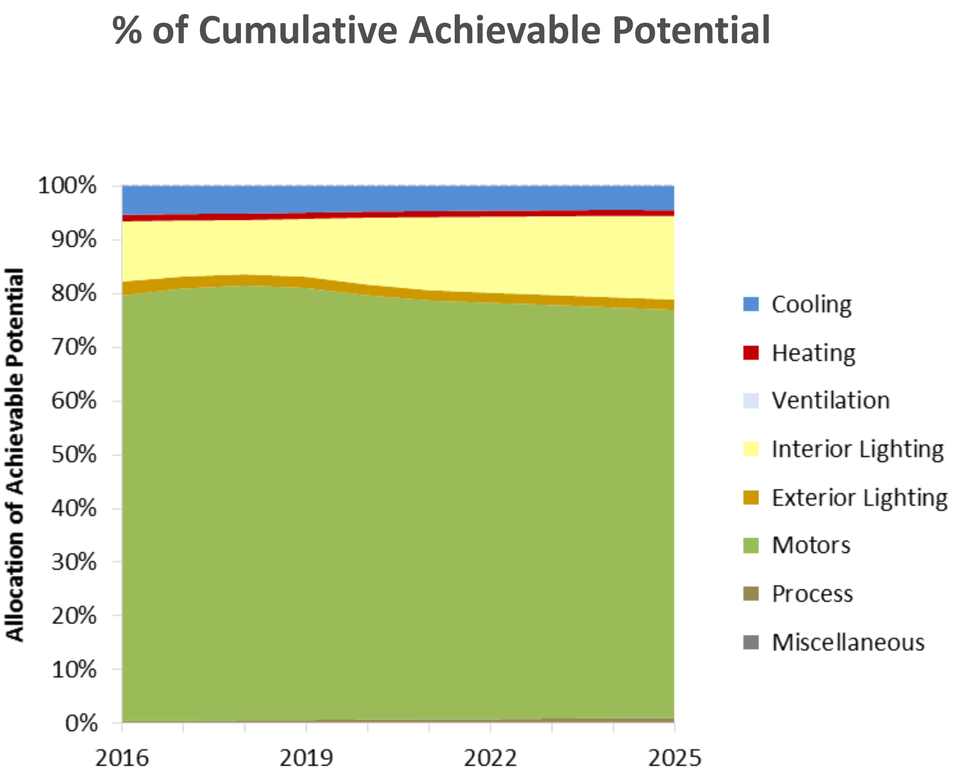
Energy savings by end use



Avista Industrial Savings Potential – WA & ID

Cumulative achievable energy savings potential over time





AEG Consistency with Council Methodology

- End-use model — bottom-up
  - Building characteristics, fuel and equipment saturations
  - Stock accounting based on measure life
  - Codes and standards that have been enacted are included in baseline
  - Lost- and non-lost opportunities treated differently
- Measures – comprehensive list
  - RTF measure workbooks
  - AEG databases, which draw upon same sources used by RTF
- Economic potential, total resource cost (TRC) test
  - Considers HVAC interactions, non-energy benefits
  - Avoided costs include 10% credit based on Conservation Act
- Achievable potential – ramp rates
  - Based on Sixth Plan ramps rates, but modified to reflect Avista's program history

Summary of Conservation Potential Across All Sectors – Sensitivity Case

Sensitivity Case

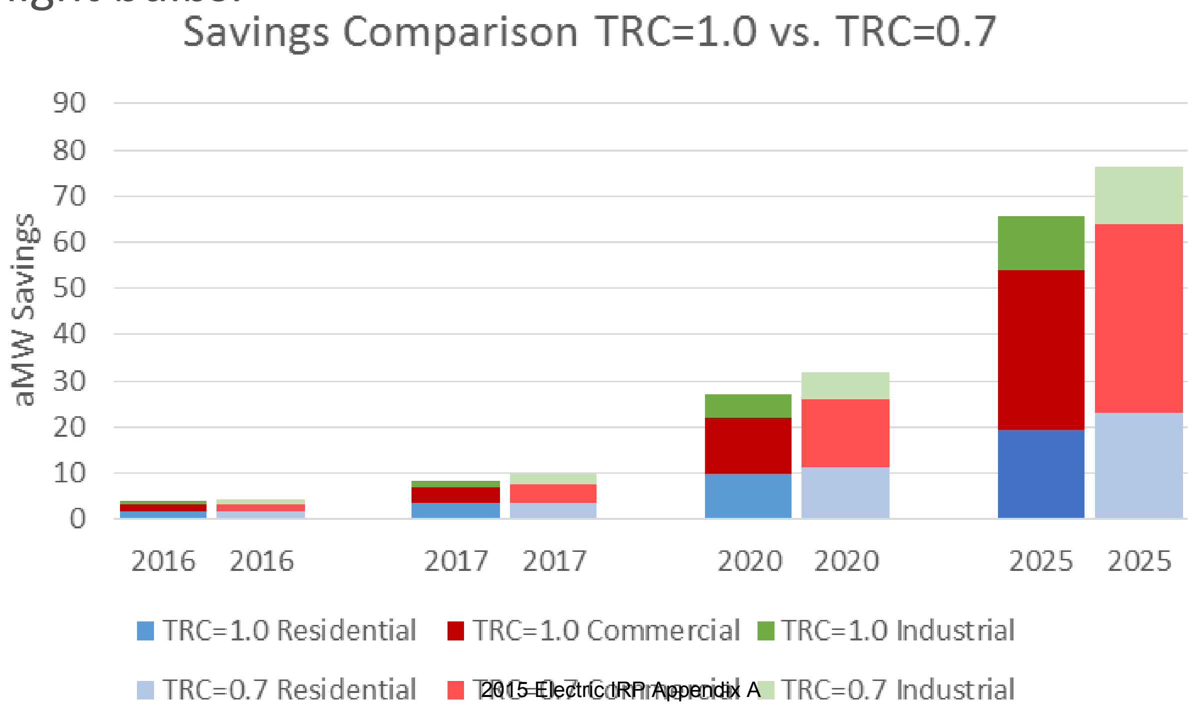
- Ran another version of the model to see which measures were on the edge of passing the TRC
  - Set the TRC threshold to 0.7
- The biggest impact was in the commercial sector
- The measures that pass at the 0.7 level, but not the 1.0 level include:
  - ENERGY STAR Homes
  - Weatherization in more segments
  - Commercial faucet aerators and low flow nozzles
  - LED light bulbs pass in more segments
  - Industrial compressed air replacements

Avista Conservation Potential – All Sectors

Washington and Idaho combined

The case with TRC=0.7 provides more savings since more measures pass the economic screen. With the lower TRC, there is an additional 0.5 aMW in 2016 and an additional 10.7 aMW in 2025.

- The biggest increase in savings is in the commercial sector with the addition of linear LED light bulbs, faucet aerators and additional screw-in LED light bulbs.



Thank You!

Bridget Kester

bkester@appliedenergygroup.com

Fuong Nguyen

fnguyen@appliedenergygroup.com

Sharon Yoshida

syoshida@appliedenergygroup.com

Ingrid Rohmund

irohmund@appliedenergygroup.com

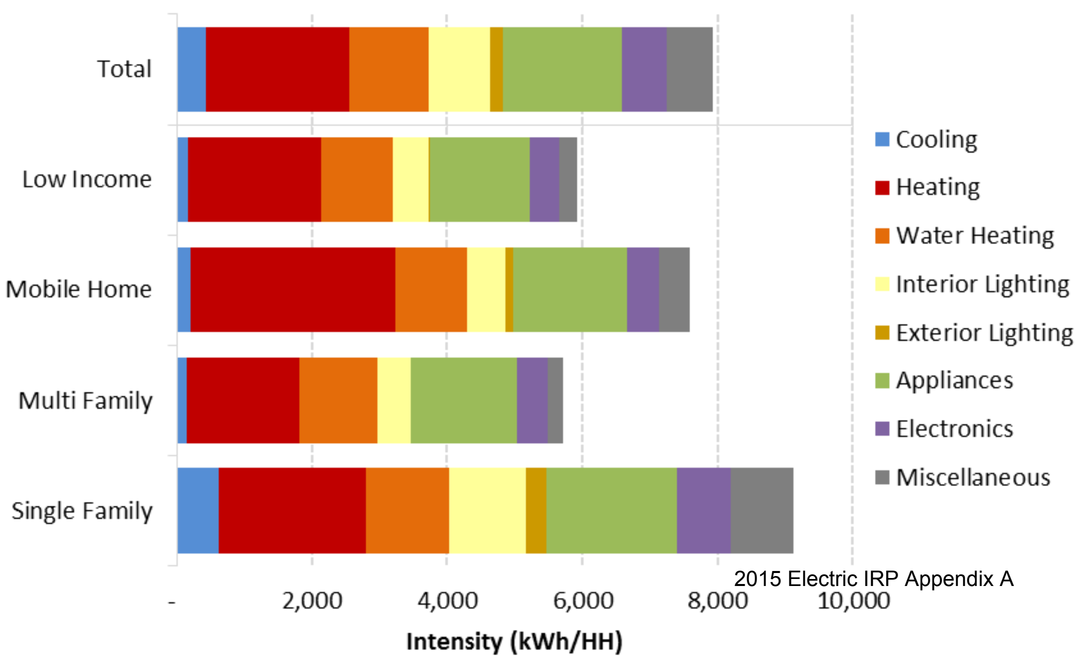
Supplemental Slides:

Base-year market profiles,
baseline projection and
sector-level peak-demand savings

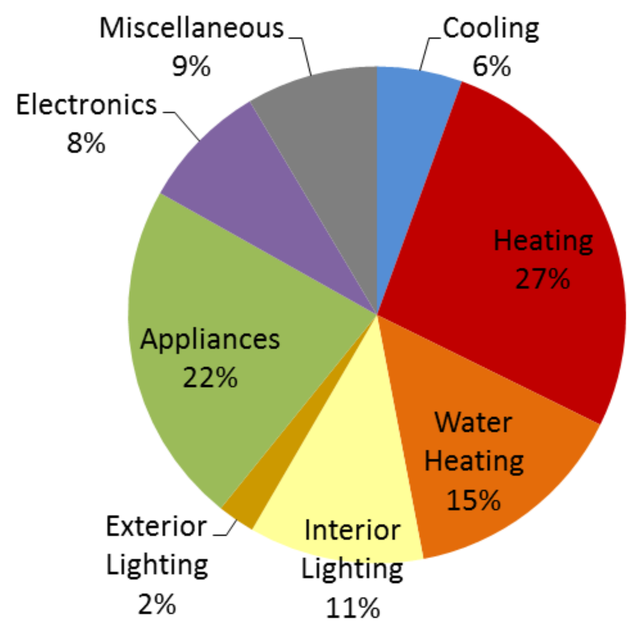
WA Residential Market Profile, 2013

Segment	Number of Customers	Annual Use (GWh)	% of Sales	Intensity (kWh/HH)
Single Family	129,893	1,783	70%	13,726
Multi Family	11,964	99	4%	8,236
Mobile Home	7,691	95	4%	12,354
Low Income	64,092	570	22%	8,892
Total	**213,640**	**2,546**	**100%**	**11,919**

Annual Intensity for Average Household

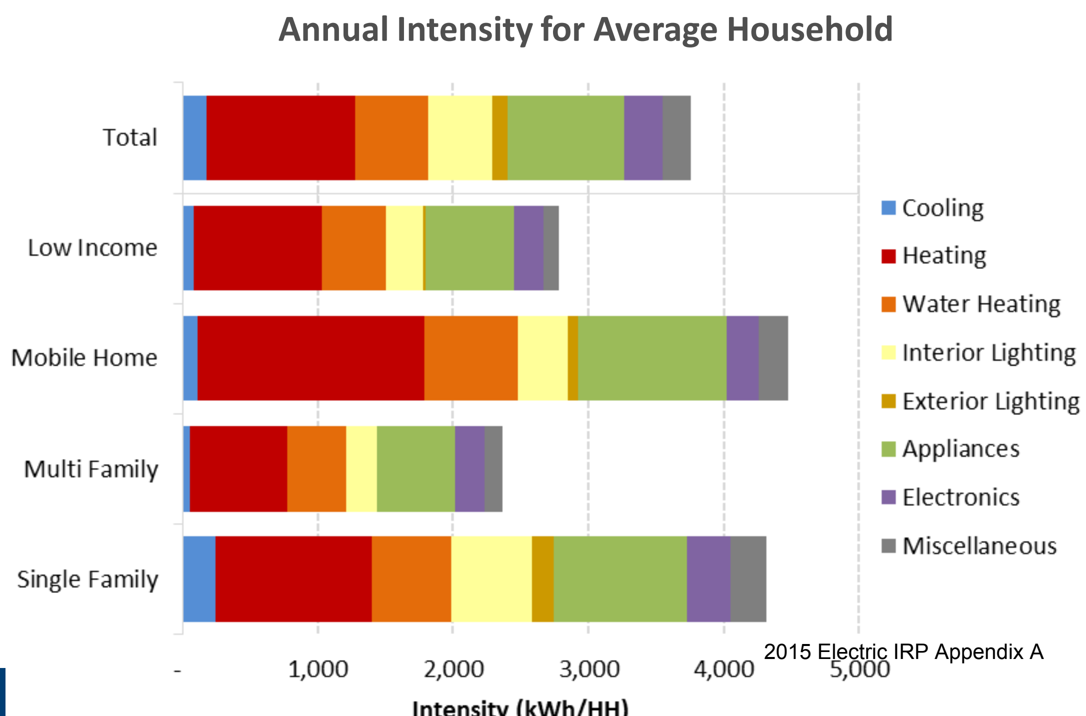


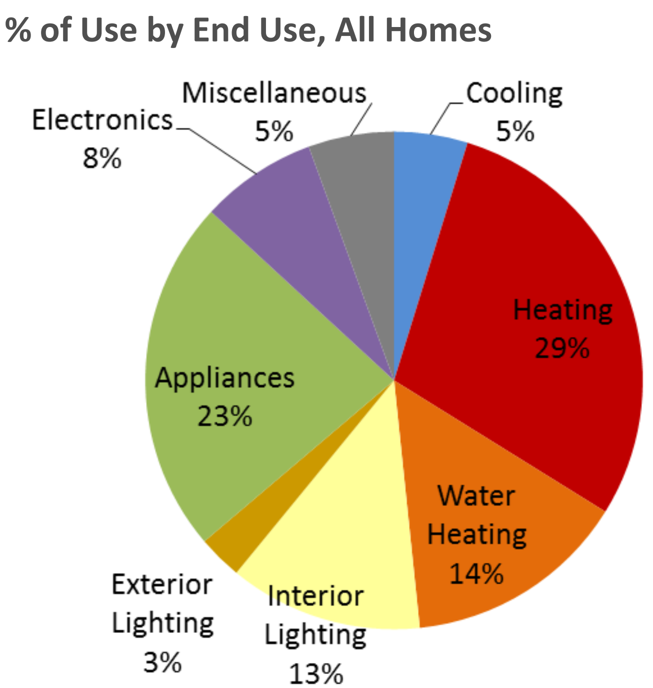
% of Use by End Use, All Homes



ID Residential Market Profile, 2013

Segment	Number of Customers	Annual Use (GWh)	% of Sales	Intensity (kWh/HH)
Single Family	65,329	843	70%	12,902
Multi Family	5,265	41	3%	7,733
Mobile Home	4,835	56	5%	11,599
Low Income	32,020	267	22%	8,349
Total	**107,449**	**1,207**	**100%**	**11,233**





WA Residential Market Profile, 2013

The technology detail behind the end-use profiles

Market profiles characterize how customers use electricity in the base year (2013)

Basic Equation:

$$Energy = \sum_{e} (N \times Sat_e \times UEC_e)$$

where

Energy	=	annual energy use
e	=	equipment technology
N	=	number of homes
Sat_e	=	saturation of homes with the equipment
UEC_e	=	unit energy consumption in homes with the equipment

Average Market Profiles - Electricity

End Use	Technology	Saturation	UEC (kWh)	Intensity (kWh/HH)	Usage (GWh)
Cooling	Central AC	36.9%	1,249	461	98
Cooling	Room AC	26.4%	402	106	23
Cooling	Air-Source Heat Pump	6.5%	1,268	82	17
Cooling	Geothermal Heat Pump	0.2%	1,326	2	0
Cooling	Evaporative AC	1.2%	809	10	2
Space Heating	Electric Room Heat	24.3%	5,302	1,288	275
Space Heating	Electric Furnace	13.4%	9,021	1,213	259
Space Heating	Air-Source Heat Pump	6.5%	10,487	677	145
Space Heating	Geothermal Heat Pump	0.2%	5,564	10	2
Water Heating	Water Heater (<= 55 Gal)	50.9%	3,025	1,539	329
Water Heating	Water Heater (55 to 75 Gal)	6.5%	3,145	203	43
Water Heating	Water Heater (> 75 Gal)	0.3%	4,209	12	3
Interior Lighting	Screw-in/Hard-wire	100.0%	955	955	204
Interior Lighting	Linear Fluorescent	100.0%	114	114	24
Interior Lighting	Specialty Lighting	100.0%	286	286	61
Exterior Lighting	Screw-in/Hard-wire	100.0%	289	289	62
Appliances	Clothes Washer	91.8%	104	95	20
Appliances	Clothes Dryer	49.9%	738	368	79
Appliances	Dishwasher	77.1%	447	345	74
Appliances	Refrigerator	100.0%	829	829	177
Appliances	Freezer	55.3%	669	370	79
Appliances	Second Refrigerator	20.7%	1,010	209	45
Appliances	Stove	70.3%	453	318	68
Appliances	Microwave	94.8%	139	132	28
Electronics	Personal Computers	64.3%	214	138	29
Electronics	Monitor	78.6%	91	71	15
Electronics	Laptops	76.3%	57	43	9
Electronics	TVs	177.4%	255	452	97
Electronics	Printer/Fax/Copier	72.6%	65	47	10
Electronics	Set top Boxes/DVRs	143.9%	128	184	39
Electronics	Devices and Gadgets	100.0%	54	54	11
Miscellaneous	Pool Pump	1.9%	2,514	49	10
Miscellaneous	Pool Heater	0.5%	4,025	19	4
Miscellaneous	Furnace Fan	58.7%	249	146	31
Miscellaneous	Well pump	9.3%	642	60	13
Miscellaneous	Miscellaneous	100.0%	744	744	159
	Total			**11,919**	**2,546**

ID Residential Market Profile, 2013

The technology detail behind the end-use profiles

Market profiles characterize how customers use electricity in the base year (2013)

Basic Equation:

$$Energy = \sum_{e} (N \times Sat_e \times UEC_e)$$

where

Energy	=	annual energy use
e	=	equipment technology
N	=	number of homes
Sat_e	=	saturation of homes with the equipment
UEC_e	=	unit energy consumption in homes with the equipment

Average Market Profiles - Electricity

End Use	Technology	Saturation	UEC (kWh)	Intensity (kWh/HH)	Usage (GWh)
Cooling	Central AC	33.4%	1,134	379	41
Cooling	Room AC	18.6%	416	77	8
Cooling	Air-Source Heat Pump	5.3%	1,282	68	7
Cooling	Geothermal Heat Pump	0.0%	0	0	0
Cooling	Evaporative AC	1.5%	777	12	1
Space Heating	Electric Room Heat	24.2%	6,354	1,540	165
Space Heating	Electric Furnace	13.1%	8,904	1,168	126
Space Heating	Air-Source Heat Pump	5.3%	10,465	557	60
Space Heating	Geothermal Heat Pump	0.0%	0	0	0
Water Heating	Water Heater (<= 55 Gal)	49.2%	2,904	1,429	154
Water Heating	Water Heater (55 to 75 Gal)	6.2%	3,025	189	20
Water Heating	Water Heater (> 75 Gal)	0.3%	3,847	11	1
Interior Lighting	Screw-in/Hard-wire	100.0%	1,041	1,041	112
Interior Lighting	Linear Fluorescent	100.0%	129	129	14
Interior Lighting	Specialty Lighting	100.0%	243	243	26
Exterior Lighting	Screw-in/Hard-wire	100.0%	323	323	35
Appliances	Clothes Washer	85.1%	99	84	9
Appliances	Clothes Dryer	60.3%	754	454	49
Appliances	Dishwasher	77.6%	424	329	35
Appliances	Refrigerator	100.0%	789	789	85
Appliances	Freezer	52.3%	643	337	36
Appliances	Second Refrigerator	21.1%	945	199	21
Appliances	Stove	63.6%	433	275	30
Appliances	Microwave	91.2%	132	120	13
Electronics	Personal Computers	56.9%	200	114	12
Electronics	Monitor	69.6%	85	59	6
Electronics	Laptops	79.3%	53	42	5
Electronics	TVs	174.6%	248	434	47
Electronics	Printer/Fax/Copier	66.7%	61	41	4
Electronics	Set top Boxes/DVRs	92.5%	120	111	12
Electronics	Devices and Gadgets	100.0%	51	51	5
Miscellaneous	Pool Pump	1.6%	2,342	38	4
Miscellaneous	Pool Heater	0.4%	3,750	15	2
Miscellaneous	Furnace Fan	59.7%	239	142	15
Miscellaneous	Well pump	12.5%	598	75	8
Miscellaneous	Miscellaneous	100.0%	356	356	38
	Total			11,233	1,207

WA Commercial Market Characterization, 2013

Segment	Electricity Sales (GWh)	% of Total Usage	Floor Space (Million Sq. Ft.)	Intensity (Annual kWh/SqFt)	Peak Demand (MW)
Small Office	280	13%	18.1	15.4	71
Large Office	106	5%	6.0	17.5	16
Restaurant	70	3%	1.7	42.4	11
Retail	285	14%	20.7	13.8	59
Grocery	209	10%	4.4	47.3	33
College	78	4%	5.6	13.9	13
School	117	6%	11.9	9.9	5
Hospital	271	13%	9.3	29.1	41
Lodging	112	5%	7.0	16.1	14
Warehouse	103	5%	13.7	7.5	12
Miscellaneous	455	22%	33.1	13.8	93
Total	**2,086**	**100%**	**132**	**15.9**	**368**

ID Commercial Market Characterization, 2013

Segment	Electricity Sales (GWh)	% of Total Usage	Floor Space (Million Sq. Ft.)	Intensity (Annual kWh/SqFt)	Peak Demand (MW)
Small Office	134	14%	8.7	15.4	35
Large Office	17	2%	1.0	17.5	3
Restaurant	12	1%	0.3	42.4	2
Retail	168	17%	12.1	13.8	35
Grocery	92	9%	1.9	47.3	14
College	73	7%	5.2	13.9	12
School	109	11%	11.1	9.9	4
Hospital	106	11%	3.6	29.1	16
Lodging	49	5%	3.0	16.1	6
Warehouse	47	5%	6.3	7.5	5
Miscellaneous	168	17%	12.2	13.8	34
Total	**976**	**100%**	**66**	**14.9**	**167**

WA Commercial Market Profile, 2013

The technology detail behind the end-use profiles

Market profiles characterize how customers use electricity in the base year (2013)

Basic Equation:

$$Energy = \sum_{e} (N \times Sat_e \times UEC_e)$$

where

Energy = annual energy use

e = equipment technology

N = total floor space in sq. ft.

Sat_e = saturation of sq. ft. with the equipment

UEC_e = unit energy consumption for square footage with the equipment

Electric Market Profiles

End Use	Technology	Saturation	EUI (kWh)	Intensity (kWh/Sqft)	Usage (GWh)
Cooling	Air-Cooled Chiller	10.3%	3.38	0.35	46.0
Cooling	Water-Cooled Chiller	12.3%	5.11	0.63	83.0
Cooling	RTU	37.5%	3.27	1.22	161.1
Cooling	Room AC	4.6%	2.93	0.13	17.5
Cooling	Air-Source Heat Pump	5.6%	3.01	0.17	22.1
Cooling	Geothermal Heat Pump	1.8%	1.85	0.03	4.4
Heating	Electric Furnace	12.7%	6.72	0.86	112.5
Heating	Electric Room Heat	7.6%	7.69	0.58	76.9
Heating	Air-Source Heat Pump	5.6%	5.87	0.33	43.1
Heating	Geothermal Heat Pump	1.8%	4.30	0.08	10.1
Ventilation	Ventilation	100.0%	1.59	1.59	209.2
Water Heating	Water Heater	53.1%	1.69	0.90	118.2
Interior Lighting	Screw-in/Hard-wire	100.0%	0.92	0.92	121.3
Interior Lighting	High-Bay Fixtures	100.0%	0.51	0.51	67.3
Interior Lighting	Linear Fluorescent	100.0%	2.17	2.17	285.8
Exterior Lighting	Screw-in/Hard-wire	100.0%	0.23	0.23	30.0
Exterior Lighting	HID	100.0%	0.64	0.64	83.8
Exterior Lighting	Linear Fluorescent	100.0%	0.35	0.35	46.4
Refrigeration	Walk-in Refrigerator/Freezer	8.8%	1.81	0.16	21.1
Refrigeration	Reach-in Refrigerator/Freezer	12.1%	0.29	0.04	4.6
Refrigeration	Glass Door Display	15.6%	0.98	0.15	20.1
Refrigeration	Open Display Case	7.7%	9.75	0.76	99.3
Refrigeration	Icemaker	29.6%	0.54	0.16	21.2
Refrigeration	Vending Machine	20.2%	0.33	0.07	8.9
Food Preparation	Oven	15.5%	0.92	0.14	18.8
Food Preparation	Fryer	3.3%	2.63	0.09	11.4
Food Preparation	Dishwasher	16.8%	1.68	0.28	37.2
Food Preparation	Steamer	3.3%	2.23	0.07	9.6
Food Preparation	Hot Food Container	6.4%	0.32	0.02	2.7
Office Equipment	Desktop Computer	100.0%	0.62	0.62	82.2
Office Equipment	Laptop	98.8%	0.08	0.08	10.9
Office Equipment	Server	86.8%	0.20	0.17	22.9
Office Equipment	Monitor	100.0%	0.11	0.11	14.5
Office Equipment	Printer/Copier/Fax	100.0%	0.08	0.08	9.9
Office Equipment	POS Terminal	57.7%	0.05	0.03	4.0
Miscellaneous	Non-HVAC Motors	53.0%	0.19	0.10	13.2
Miscellaneous	Pool Pump	5.8%	0.02	0.00	0.2
Miscellaneous	Pool Heater	1.8%	0.03	0.00	0.1
Miscellaneous	Other Miscellaneous	100.0%	1.03	1.03	135.1
Total				**15.86**	**2,086.3**

ID Commercial Market Profile, 2013

The technology detail behind the end-use profiles

Market profiles characterize how customers use electricity in the base year (2013)

Basic Equation:

$$Energy = \sum_{e} (N \times Sat_e \times UEC_e)$$

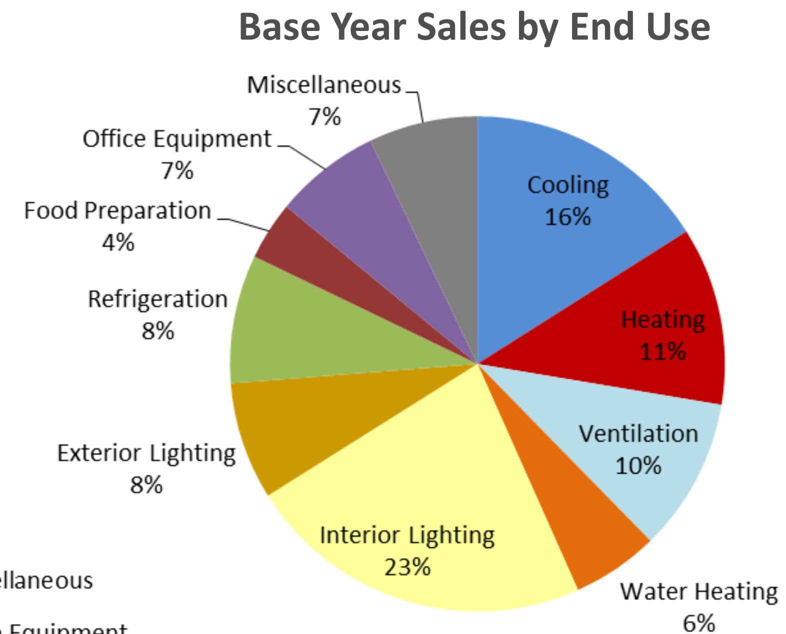
where

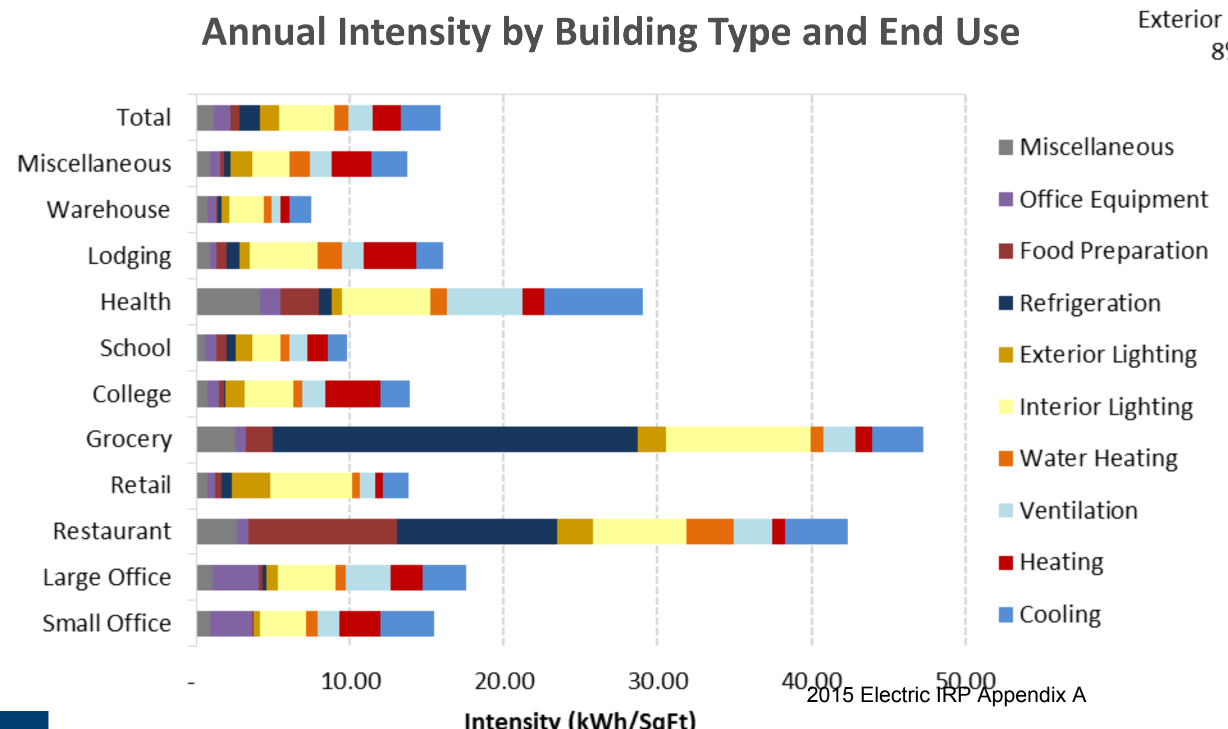
Energy	=	annual energy use
e	=	equipment technology
N	=	total floor space in sq. ft.
Sat_e	=	saturation of sq. ft. with the equipment
UEC_e	=	unit energy consumption for square footage with the equipment

Electric Market Profiles

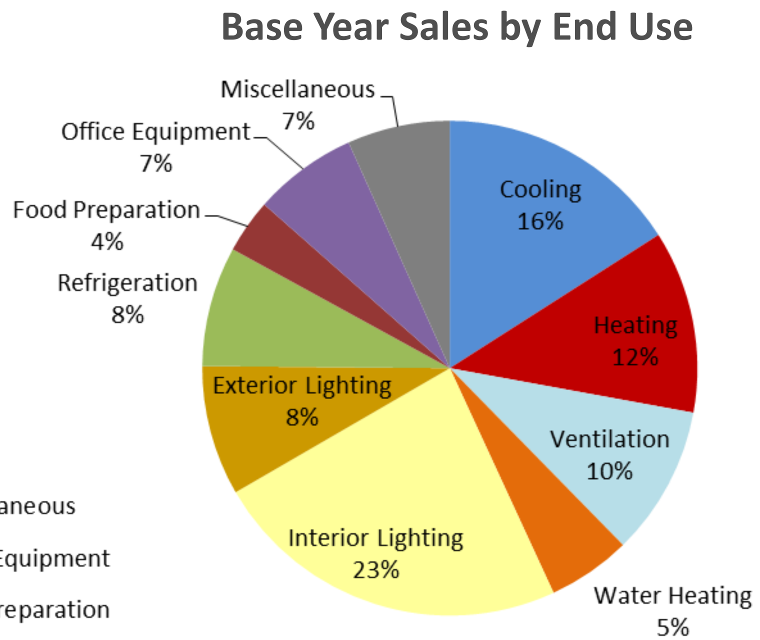
End Use	Technology	Saturation	EUI (kWh)	Intensity (kWh/Sqft)	Usage (GWh)
Cooling	Air-Cooled Chiller	12.4%	3.24	0.40	26.4
Cooling	Water-Cooled Chiller	10.2%	5.15	0.53	34.6
Cooling	RTU	35.6%	3.17	1.13	74.0
Cooling	Room AC	4.6%	2.77	0.13	8.4
Cooling	Air-Source Heat Pump	5.6%	2.81	0.16	10.2
Cooling	Geothermal Heat Pump	1.8%	1.68	0.03	2.0
Heating	Electric Furnace	11.5%	6.74	0.77	50.7
Heating	Electric Room Heat	7.6%	7.76	0.59	38.9
Heating	Air-Source Heat Pump	5.6%	5.91	0.33	21.5
Heating	Geothermal Heat Pump	1.8%	4.41	0.08	5.2
Ventilation	Ventilation	100.0%	1.46	1.46	95.5
Water Heating	Water Heater	51.4%	1.58	0.81	53.2
Interior Lighting	Screw-in/Hard-wire	100.0%	0.88	0.88	57.5
Interior Lighting	High-Bay Fixtures	100.0%	0.51	0.51	33.3
Interior Lighting	Linear Fluorescent	100.0%	2.11	2.11	138.8
Exterior Lighting	Screw-in/Hard-wire	100.0%	0.20	0.20	13.1
Exterior Lighting	HID	100.0%	0.60	0.60	39.1
Exterior Lighting	Linear Fluorescent	100.0%	0.47	0.47	30.7
Refrigeration	Walk-in Refrigerator/Freezer	8.8%	1.30	0.11	7.5
Refrigeration	Reach-in Refrigerator/Freezer	13.4%	0.26	0.04	2.3
Refrigeration	Glass Door Display	15.4%	0.85	0.13	8.6
Refrigeration	Open Display Case	8.4%	7.98	0.67	44.1
Refrigeration	Icemaker	31.6%	0.48	0.15	10.0
Refrigeration	Vending Machine	20.0%	0.32	0.06	4.1
Food Preparation	Oven	16.2%	0.86	0.14	9.1
Food Preparation	Fryer	3.1%	2.15	0.07	4.3
Food Preparation	Dishwasher	16.1%	1.49	0.24	15.7
Food Preparation	Steamer	3.1%	1.99	0.06	4.0
Food Preparation	Hot Food Container	7.4%	0.25	0.02	1.2
Office Equipment	Desktop Computer	100.0%	0.58	0.58	37.7
Office Equipment	Laptop	98.9%	0.07	0.07	4.7
Office Equipment	Server	89.1%	0.18	0.16	10.7
Office Equipment	Monitor	100.0%	0.10	0.10	6.7
Office Equipment	Printer/Copier/Fax	100.0%	0.07	0.07	4.7
Office Equipment	POS Terminal	57.6%	0.05	0.03	1.8
Miscellaneous	Non-HVAC Motors	51.6%	0.17	0.09	5.8
Miscellaneous	Pool Pump	5.7%	0.02	0.00	0.1
Miscellaneous	Pool Heater	1.7%	0.03	0.00	0.0
Miscellaneous	Other Miscellaneous	100.0%	0.91	0.91	59.5
Total				**14.87**	**975.5**

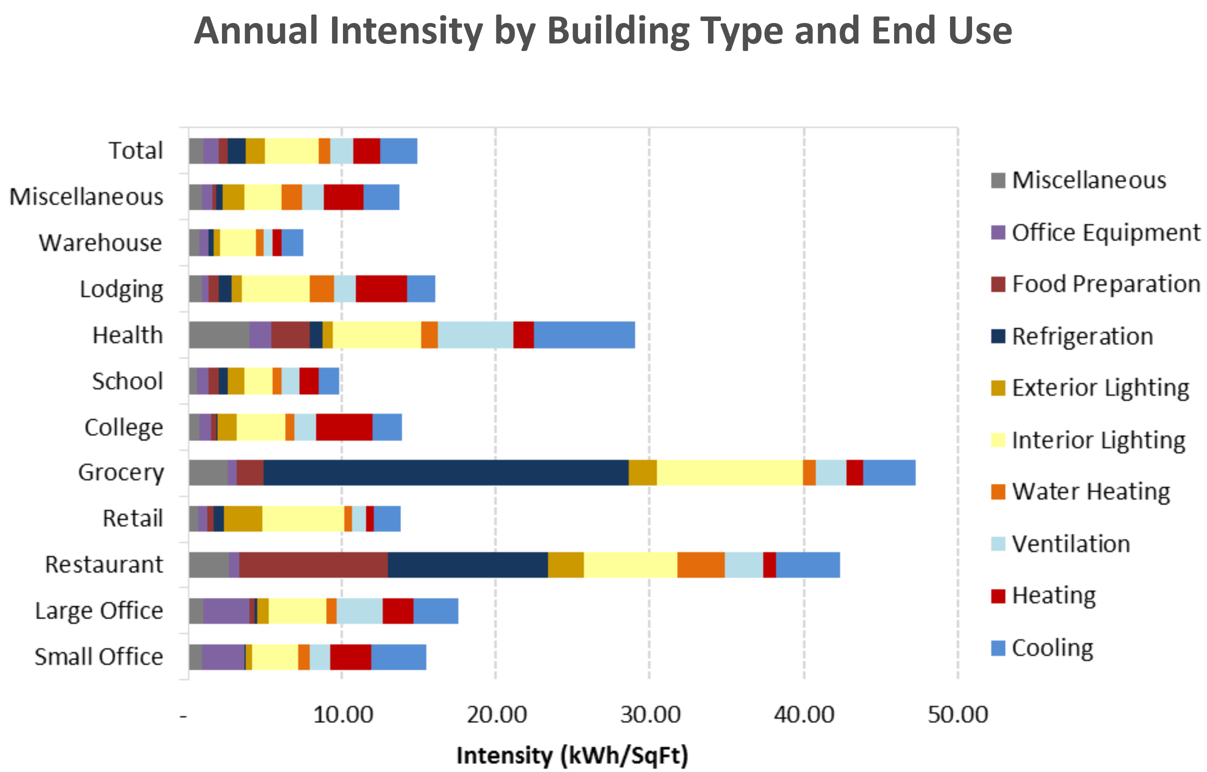
WA Commercial Market Profile, 2013





ID Commercial Market Profile, 2013

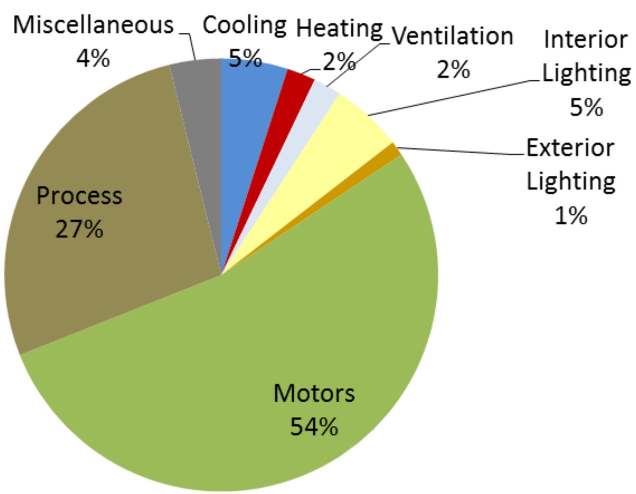




2015 Electric IRP Appendix A

WA Industrial Market Profile, 2013

The technology detail behind the end-use profiles

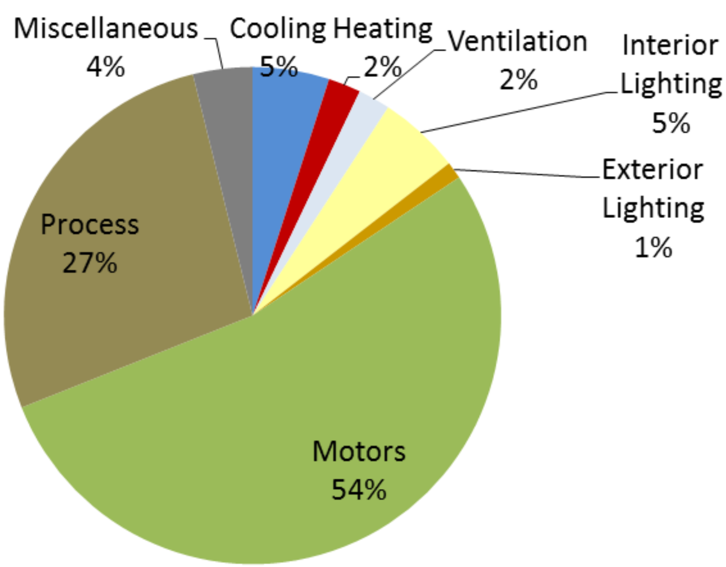


Average Market Profiles

End Use	Technology	Usage (GWh)	Intensity (kWh/Employee)
Cooling	Air-Cooled Chiller	17.4	1,072
Cooling	Water-Cooled Chiller	2.2	137
Cooling	RTU	22.4	1,383
Cooling	Room AC	1.5	94
Cooling	Air-Source Heat Pump	2.1	130
Cooling	Geothermal Heat Pump	0.0	0
Heating	Electric Furnace	12.5	769
Heating	Electric Room Heat	4.2	258
Heating	Air-Source Heat Pump	3.1	189
Heating	Geothermal Heat Pump	0.0	0
Ventilation	Ventilation	19.3	1,190
Interior Lighting	Screw-in/Hard-wire	4.9	302
Interior Lighting	High-Bay Fixtures	20.4	1,256
Interior Lighting	Linear Fluorescent	23.8	1,466
Exterior Lighting	Screw-in/Hard-wire	3.9	238
Exterior Lighting	HID	3.2	196
Exterior Lighting	Linear Fluorescent	3.2	198
Motors	Pumps	86.8	5,352
Motors	Fans & Blowers	68.0	4,189
Motors	Compressed Air	54.3	3,345
Motors	Conveyors	245.0	15,101
Motors	Other Motors	38.0	2,341
Process	Process Heating	99.2	6,115
Process	Process Cooling	32.5	2,005
Process	Process Refrigeration	32.5	2,005
Process	Process Electro-Chemical	64.5	3,972
Process	Process Other	21.8	1,345
Miscellaneous	Miscellaneous	35.6	2,197
	Total	**922.3**	**56,846**

ID Industrial Market Profile, 2013

The technology detail behind the end-use profiles



Average Market Profiles

End Use	Technology	Usage (GWh)	Intensity (kWh/Employee)
Cooling	Air-Cooled Chiller	6.5	734
Cooling	Water-Cooled Chiller	0.8	94
Cooling	RTU	8.4	947
Cooling	Room AC	0.6	64
Cooling	Air-Source Heat Pump	0.8	89
Cooling	Geothermal Heat Pump	0.0	0
Heating	Electric Furnace	4.6	516
Heating	Electric Room Heat	1.5	173
Heating	Air-Source Heat Pump	1.1	127
Heating	Geothermal Heat Pump	0.0	0
Ventilation	Ventilation	7.2	807
Interior Lighting	Screw-in/Hard-wire	1.8	205
Interior Lighting	High-Bay Fixtures	7.6	854
Interior Lighting	Linear Fluorescent	8.8	997
Exterior Lighting	Screw-in/Hard-wire	1.4	162
Exterior Lighting	HID	1.2	134
Exterior Lighting	Linear Fluorescent	1.2	134
Motors	Pumps	32.3	3,640
Motors	Fans & Blowers	25.3	2,850
Motors	Compressed Air	20.2	2,275
Motors	Conveyors	91.1	10,272
Motors	Other Motors	14.1	1,593
Process	Process Heating	36.9	4,159
Process	Process Cooling	12.1	1,364
Process	Process Refrigeration	12.1	1,364
Process	Process Electro-Chemical	24.0	2,702
Process	Process Other	8.1	915
Miscellaneous	Miscellaneous	13.3	1,494
	Total	**343.0**	**38,668**

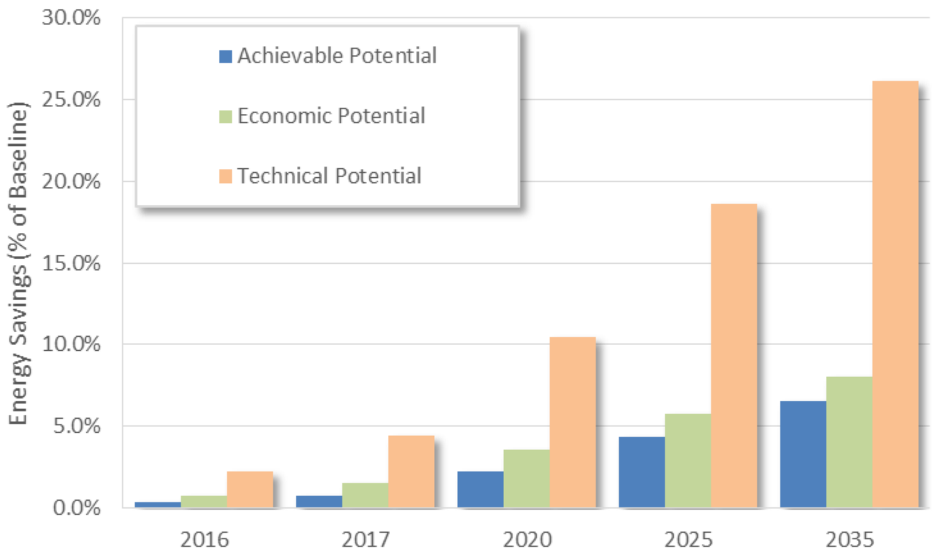
Sector-level Potential Savings - Washington

Avista Conservation Potential – Residential

Washington

From 2015 to 2025, cumulative achievable potential savings are 111 GWh, or 12.6 aMW.

Achievable potential in 2025 is about 76% of economic potential.



	2016	2017	2020	2025	2035
Cumulative WA Savings (GWh)					
Achievable Potential	8.5	19.3	56.2	110.7	181.1
Economic Potential	18.9	38.7	88.4	144.7	221.1
Technical Potential	55.2	110.0	261.0	469.4	721.3
Cumulative Savings (aMW)					
Achievable Potential	1.0	2.2	6.4	12.6	20.7
Economic Potential	2.2	4.4	10.1	16.5	25.2
Technical Potential	6.3	12.6	29.8	53.6	82.3

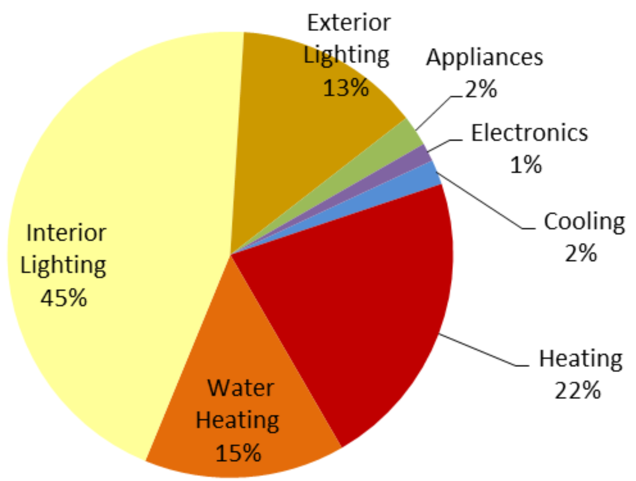
Avista Residential Savings Potential - Washington

Cumulative achievable potential in 2017

Top measures by energy savings

Measure / Technology	2017 Cumulative Energy Savings (MWh)	% of Total
Interior Lighting - Screw-in/Hard-wire LED and CFL	8,479	44.1%
Ducting - Repair and Sealing	3,483	18.1%
Exterior Lighting - Screw-in/Hard-wire CFL and LED	2,564	13.3%
Water Heater - Pipe Insulation	1,535	8.0%
Water Heater - Faucet Aerators	699	3.6%
Behavioral Programs	464	2.4%
Thermostat - Clock/Programmable	443	2.3%
Insulation - Ducting	429	2.2%
Water Heater - Low-Flow Showerheads	284	1.5%
Appliances – Freezer ENERGY STAR	177	0.9%
Total Top 10 Measures	**18,578**	**96.4%**

Energy savings by end use

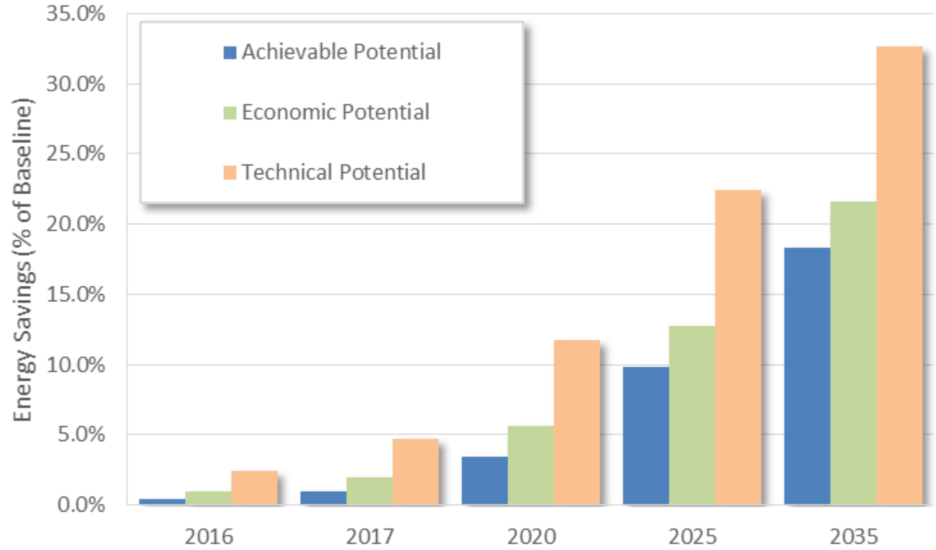


Avista Conservation Potential – Commercial

Washington

From 2015 to 2025, cumulative achievable potential savings are 207 GWh, or 23.6 aMW.

Achievable potential in 2025 is about 77% of economic potential.



	2016	2017	2020	2025	2035
Cumulative WA Savings (GWh)					
Achievable Potential	9.0	19.3	71.3	206.7	418.9
Economic Potential	19.9	40.6	116.4	268.4	493.8
Technical Potential	48.5	96.6	240.5	473.0	746.4
Cumulative Savings (aMW)					
Achievable Potential	1.0	2.2	8.1	23.6	47.8
Economic Potential	2.3	4.6	13.3	30.6	56.4
Technical Potential	5.5	11.0	27.5	54.0	85.2

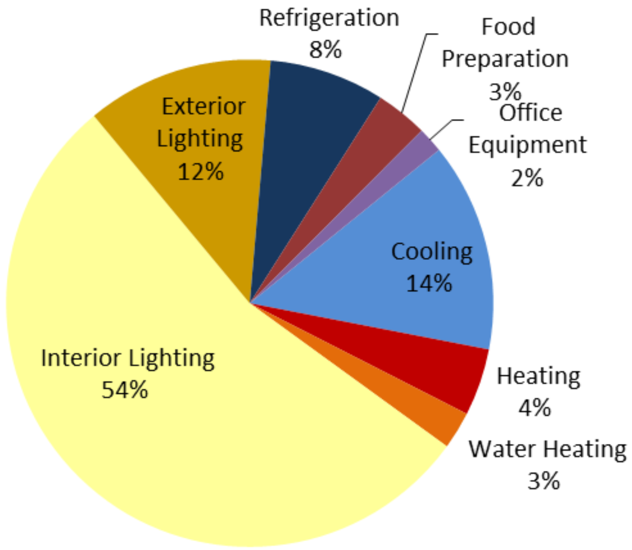
Avista Commercial Savings Potential - Washington

Cumulative achievable potential in 2017

Top measures by energy savings

Measure / Technology	2017 Cumulative Savings (MWh)	% of Total
Interior Lighting - Linear LED	4,470	23.1%
Interior Lighting - Screw-in/Hard-wire CFL and LED	2,652	13.7%
Chiller - Chilled Water Reset	924	4.8%
HVAC - Duct Repair and Sealing	793	4.1%
Interior Lighting - High-Bay Fixtures T5 and LED	764	4.0%
Exterior Lighting - Linear LED	688	3.6%
Interior Lighting - Occupancy Sensors	678	3.5%
Interior Lighting - Skylights	561	2.9%
Exterior Lighting - Screw-in/Hard-wire CFL and LED	478	2.5%
Grocery - Open Display Case - Night Covers	459	2.4%
Total Top 10 Measures	**12,467**	**64.5%**

Energy savings by end use

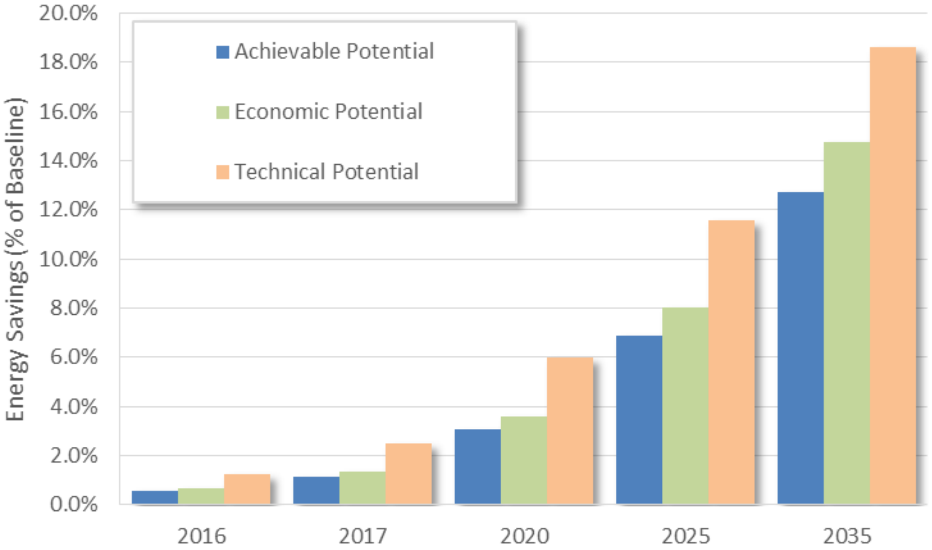


Avista Conservation Potential – Industrial

Washington

From 2016 to 2025, cumulative achievable potential savings are 73 GWh, or 8.4 aMW.

Achievable potential in 2025 is about 86% of economic potential.



	2016	2017	2020	2025	2035
Cumulative WA Savings (GWh)					
Achievable Potential	5.4	11.2	31.3	73.3	146.0
Economic Potential	6.3	13.1	36.8	85.5	169.3
Technical Potential	12.4	24.7	61.1	122.8	213.8
Cumulative Savings (aMW)					
Achievable Potential	0.6	1.3	3.6	8.4	16.7
Economic Potential	0.7	1.5	4.2	9.8	19.3
Technical Potential	1.4	2.8	7.0	14.0	24.4

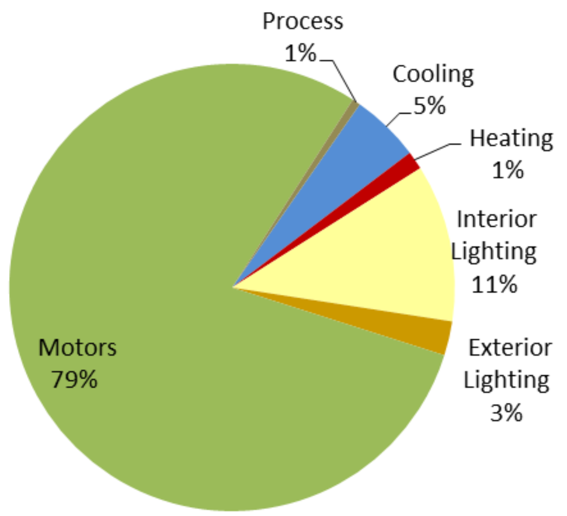
Avista Industrial Savings Potential - Washington

Cumulative achievable potential in 2017

Top measures by energy savings

Measure / Technology	2017 Cumulative Savings (MWh)	% of Total
Fan System - Optimization and Improvements	3,298	29.5%
Motors - Variable Frequency Drive (Pumps)	2,206	19.8%
Motors - Variable Frequency Drive (Fans & Blowers)	1,098	9.8%
Compressed Air - Air Usage Reduction	911	8.2%
Pumping System - Optimization and Improvements	663	5.9%
Interior Lighting - Occupancy Sensors	520	4.7%
Motors - Variable Frequency Drive (Compressed Air)	377	3.4%
Interior Lighting - High-Bay Fixtures LED	306	2.7%
Interior Lighting - Screw-in/Hard-wire CFL and LED	294	2.6%
HVAC - Duct Repair and Sealing	264	2.4%
Total Top 10 Measures	**9,938**	**89.0%**

Energy savings by end use



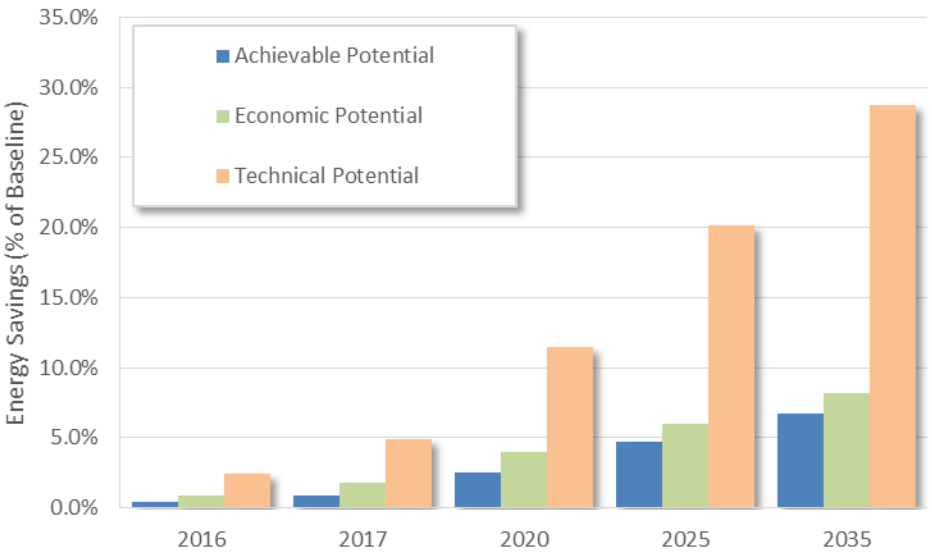
Sector-level Potential Savings - Idaho

Avista Conservation Potential – Residential

Idaho

From 2016 to 2025, cumulative achievable potential savings are 58 GWh, or 6.6 aMW.

Achievable potential in 2025 is about 76% of economic potential.



	2016	2017	2020	2025	2035
Cumulative ID Savings (GWh)					
Achievable Potential	4.6	10.6	30.9	58.0	93.0
Economic Potential	10.4	21.4	48.3	74.7	112.8
Technical Potential	29.2	58.7	139.0	249.5	395.3
Cumulative Savings (aMW)					
Achievable Potential	0.5	1.2	3.5	6.6	10.6
Economic Potential	1.2	2.4	5.5	8.5	12.9
Technical Potential	3.3	6.7	15.9	28.5	45.1

Avista Residential Savings Potential - Idaho

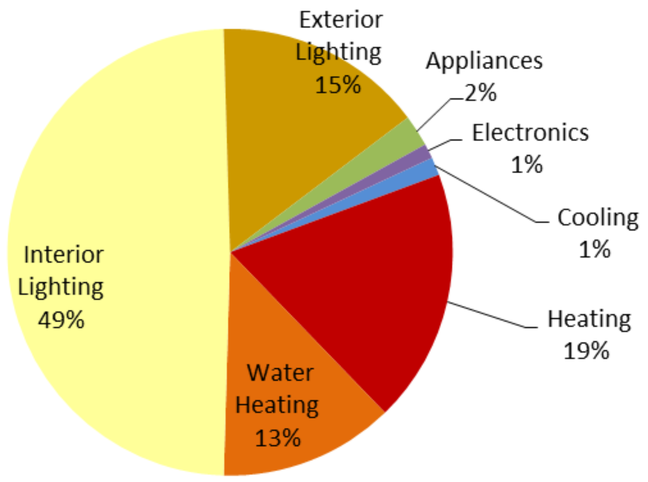
Cumulative achievable potential in 2017

Top measures by energy savings

Measure / Technology	2017 Cumulative Energy Savings (MWh)	% of Total
Interior Lighting - Screw-in/Hard-wire LED and CFL	5,137	48.5%
Exterior Lighting - Screw-in/Hard-wire LED and CFL	1,588	15.0%
Ducting - Repair and Sealing	1,574	14.9%
Water Heater - Pipe Insulation	729	6.9%
Water Heater - Faucet Aerators	337	3.2%
Thermostat - Clock/Programmable	231	2.2%
Behavioral Programs	225	2.1%
Insulation - Ducting	193	1.8%
Water Heater - Low-Flow Showerheads	135	1.3%
Appliances – Freezer ENERGY STAR	95	0.9%
Total Top 10 Measures	**10,243**	**96.8%**

2015 Electric IRP Appendix A

Energy savings by end use

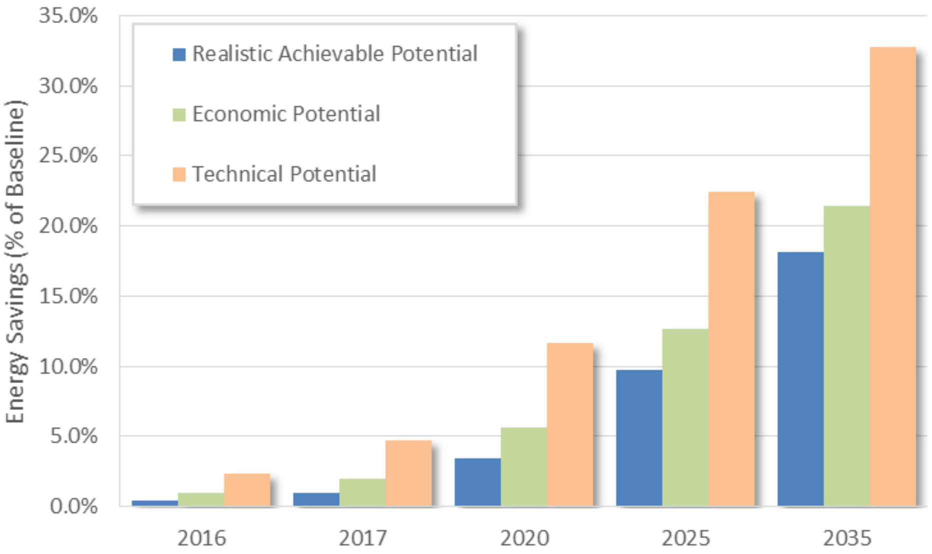


Avista Conservation Potential – Commercial

Idaho

From 2015 to 2025, cumulative achievable potential savings are 98 GWh, or 11.2 aMW.

Achievable potential in 2025 is about 77% of economic potential.



	2016	2017	2020	2025	2035
Cumulative ID Savings (GWh)					
Achievable Potential	4.2	9.0	33.4	97.7	198.4
Economic Potential	9.3	19.1	54.6	126.9	233.9
Technical Potential	22.7	45.1	112.3	221.2	349.5
Cumulative Savings (aMW)					
Achievable Potential	0.5	1.0	3.8	11.2	22.6
Economic Potential	1.1	2.2	6.2	14.5	26.7
Technical Potential	2.6	5.2	12.8	25.3	39.9

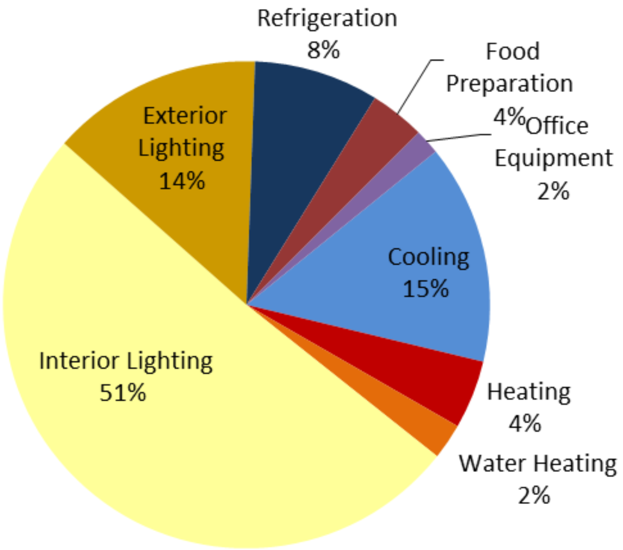
Avista Commercial Savings Potential - Idaho

Cumulative achievable potential in 2017

Top measures by energy savings

Measure / Technology	2017 Cumulative Savings (MWh)	% of Total
Interior Lighting - Linear LED	2,134	23.9%
Interior Lighting - Screw-in/Hard-wire LED and T5	1,237	13.8%
Exterior Lighting - Linear LED	448	5.0%
Chiller - Chilled Water Reset	437	4.9%
Interior Lighting - High-Bay Fixtures LED	366	4.1%
Interior Lighting - Occupancy Sensors	297	3.3%
HVAC - Duct Repair and Sealing	275	3.1%
Interior Lighting - Skylights	270	3.0%
Exterior Lighting - Screw-in/Hard-wire CFL and LED	224	2.5%
Exterior Lighting – HID T5 and LED	217	2.4%
Total Top 10 Measures	**5,905**	**65.4%**

Energy savings by end use

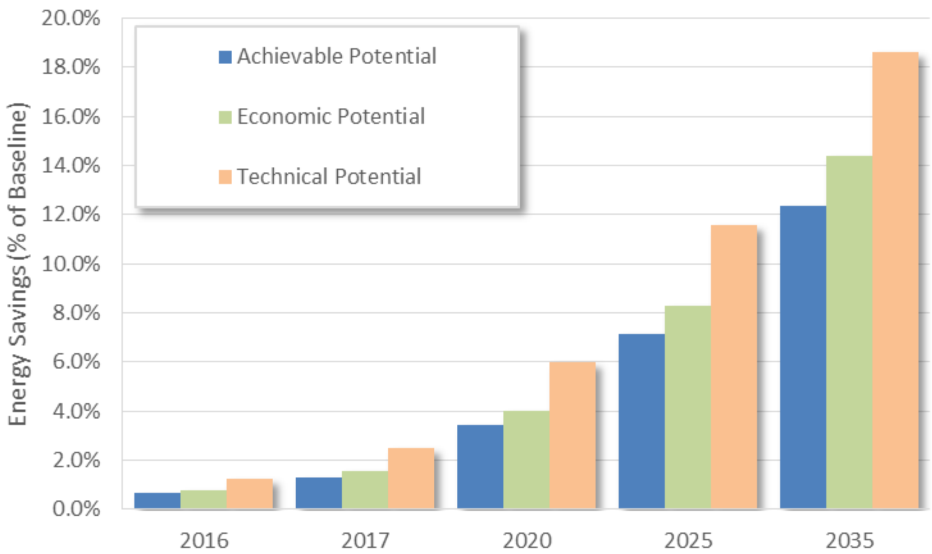


Avista Conservation Potential – Industrial

Idaho

From 2015 to 2025, cumulative achievable potential savings are 28 GWh, or 3.2 aMW.

Achievable potential in 2025 is about 85% of economic potential.



	2016	2017	2020	2025	2035
Cumulative ID Savings (GWh)					
Achievable Potential	2.4	4.8	13.0	28.2	53.0
Economic Potential	2.8	5.7	15.3	32.9	61.5
Technical Potential	4.6	9.2	22.7	45.6	79.4
Cumulative Savings (aMW)					
Achievable Potential	0.3	0.6	1.5	3.2	6.0
Economic Potential	0.3	0.6	1.7	3.8	7.0
Technical Potential	0.5	1.0	2.6	5.2	9.1

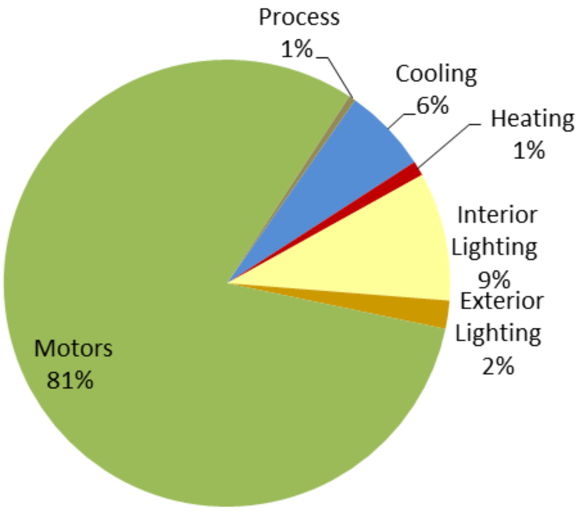
Avista Industrial Savings Potential - Idaho

Cumulative achievable potential in 2017

Top measures by energy savings

Measure / Technology	2017 Cumulative Savings (MWh)	% of Total
Fan System - Optimization and Improvements	1,226	25.4%
Motors - Variable Frequency Drive (Pumps)	814	16.8%
Fan System - Maintenance	414	8.6%
Motors - Variable Frequency Drive (Fans & Blowers)	407	8.4%
Compressed Air - Air Usage Reduction	336	7.0%
Compressed Air - System Optimization and Improvements	271	5.6%
Pumping System - Optimization and Improvements	230	4.8%
Interior Lighting - Occupancy Sensors	183	3.8%
Interior Lighting - High-Bay Fixtures LED	114	2.4%
Motors - Variable Frequency Drive (Other)	110	2.3%
Total Top 10 Measures	**4,104**	**84.9%**

Energy savings by end use



AEG
Applied Energy Group

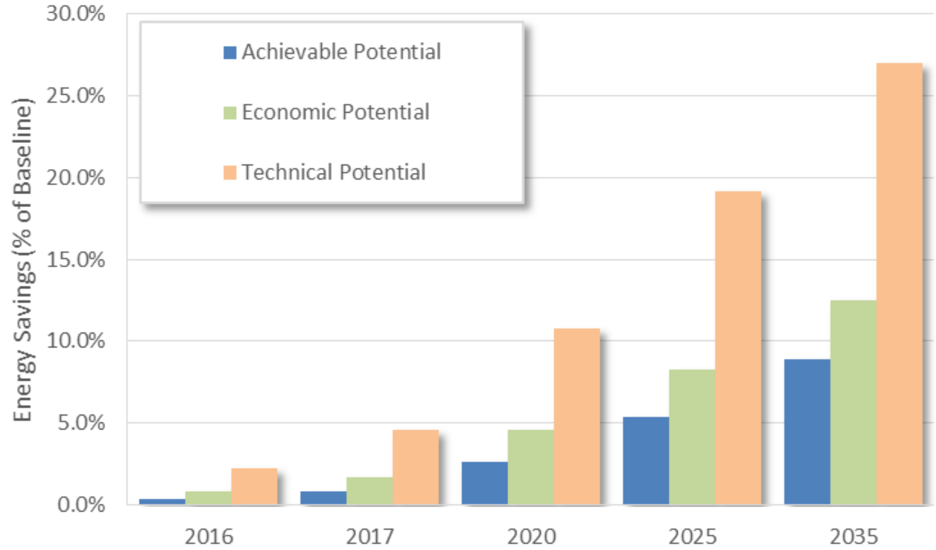
Summary of Conservation Potential – Sensitivity Case

Avista Conservation Potential – Residential

Washington and Idaho combined

From 2016 to 2025, cumulative achievable potential savings are 201 GWh, or 23.0 aMW.

An additional 3.7 aMW is possible by 2025, compared to the TRC=1.0 case.



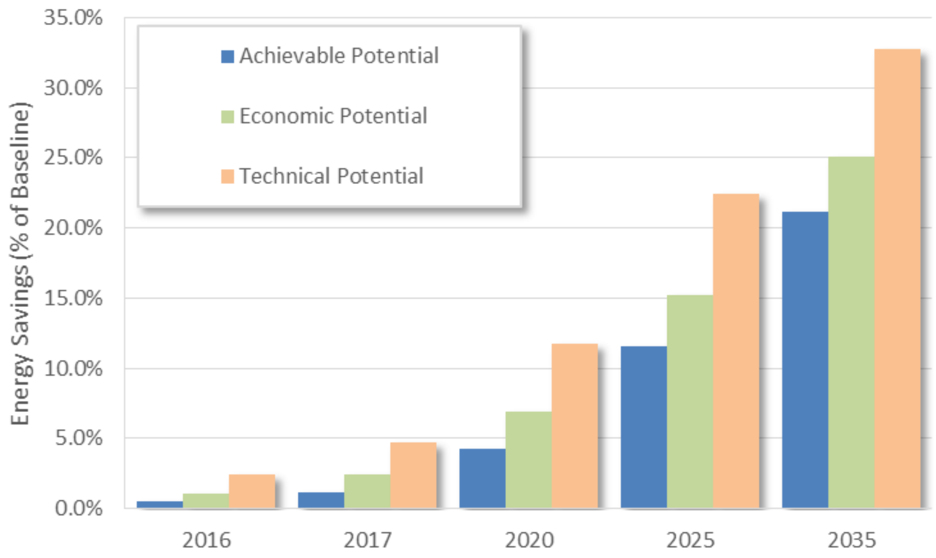
	2016	2017	2020	2025	2035
Cumulative WA and ID Savings (GWh)					
Achievable Potential	13.6	31.0	97.5	201.5	368.8
Economic Potential	30.7	63.5	171.4	311.2	517.2
Technical Potential	84.5	168.7	400.1	718.9	1,116.7
Cumulative Savings (aMW)					
Achievable Potential	1.5	3.5	11.1	23.0	42.1
Economic Potential	3.5	7.2	19.6	35.5	59.0
Technical Potential	9.6	19.3	45.7	82.1	127.5

Avista Conservation Potential – Commercial

Washington and Idaho combined

From 2016 to 2025, cumulative achievable potential savings are 356 GWh, or 40.7 aMW.

An additional 6.0 aMW is possible by 2025, compared to the TRC=1.0 case.



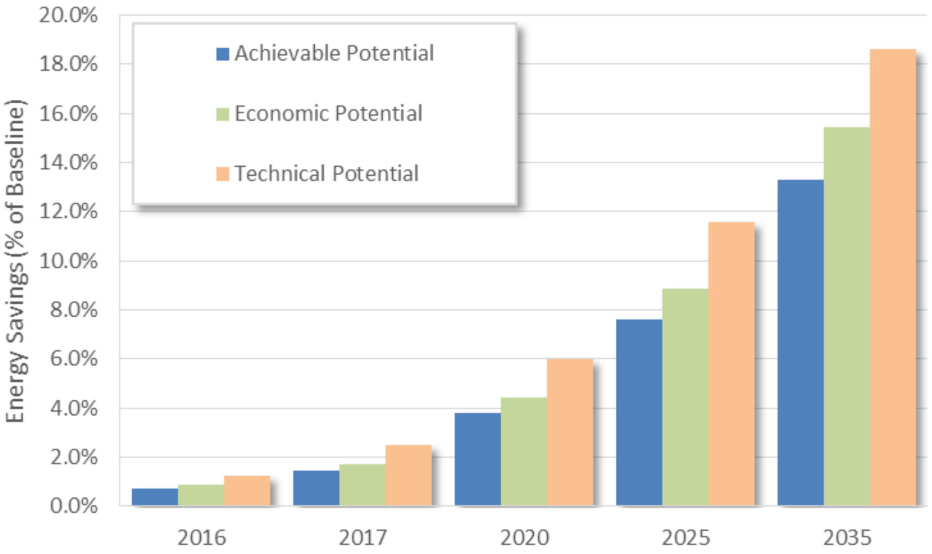
	2016	2017	2020	2025	2035
Cumulative WA and ID Savings (GWh)					
Achievable Potential	15.3	35.5	128.8	356.1	708.8
Economic Potential	32.7	72.0	208.5	470.5	839.8
Technical Potential	71.2	141.7	352.8	694.2	1,095.9
Cumulative Savings (aMW)					
Achievable Potential	1.7	4.1	14.7	40.7	80.9
Economic Potential	3.7	8.2	23.8	53.7	95.9
Technical Potential	8.1	16.2	40.3	79.2	125.1

Avista Conservation Potential – Industrial

Washington and Idaho combined

From 2016 to 2025, cumulative achievable potential savings are 111 GWh, or 12.7 aMW.

An additional 1.1 aMW is possible by 2025, compared to the TRC=1.0 case.



	2016	2017	2020	2025	2035
Cumulative WA and ID Savings (GWh)					
Achievable Potential	9.9	19.9	53.0	110.9	209.5
Economic Potential	11.6	23.4	62.3	129.4	242.9
Technical Potential	17.1	33.9	83.7	168.4	293.2
Cumulative Savings (aMW)					
Achievable Potential	1.1	2.3	6.0	12.7	23.9
Economic Potential	1.3	2.7	7.1	14.8	27.7
Technical Potential	1.9	3.9	9.6	19.2	33.5

Avista Residential Savings Potential – WA & ID

Cumulative achievable potential in 2017

Top measures by energy savings

Measure / Technology	2017 Cumulative Energy Savings (MWh)	% of Total
Interior Lighting - Screw-in/Hard-wire (LED)	13,616	43.9%
Ducting - Repair and Sealing	5,057	16.3%
Exterior Lighting - Screw-in/Hard-wire	4,152	13.4%
Water Heater - Pipe Insulation	2,264	7.3%
Water Heater - Faucet Aerators	1,037	3.3%
Thermostat - Clock/Programmable	726	2.3%
Behavioral Programs	689	2.2%
Insulation - Ducting	630	2.0%
ENERGY STAR Homes	606	2.0%
Total	**28,777**	**92.7%**

- Programmable thermostats passed in the multi-family segments, moving it up in the rankings
- Insulation – ducting passed in the multi-family segment, increasing the savings
- ENERGY STAR Homes did not pass the TRC at the 1.0 level in any segment

Avista Commercial Savings Potential – WA & ID

Cumulative achievable potential in 2017

Top measures by energy savings

Measure / Technology	2017 Cumulative Energy Savings (MWh)	% of Total
Interior Lighting - Linear LED	6,604	18.6%
Interior Lighting - Screw-in/Hard-wire LED and CFL	3,923	11.0%
Interior Lighting - Occupancy Sensors	3,211	9.0%
Chiller - Chilled Water Reset	1,360	3.8%
Interior Lighting - High-Bay Fixtures T5 and LED	1,205	3.4%
Exterior Lighting - Linear LED	1,135	3.2%
HVAC - Duct Repair and Sealing	1,068	3.0%
Water Heater - Faucet Aerators/Low Flow Nozzles	917	2.6%
Interior Lighting - Skylights	831	2.3%
Exterior Lighting – HID T5 and LED	820	2.3%
Total Top 10 Measures	**21,075**	**59.3%**

- Interior lighting – screw-in includes more LED in more segments
- Occupancy sensors pass in more segments
- High Bay fixtures pass in more segments
- Faucet aerators and Low flow nozzles did not pass when the TRC threshold was 1.0
- Exterior lighting includes more LED

Avista Industrial Savings Potential – WA & ID

Cumulative achievable potential in 2017

Top measures by energy savings

Measure / Technology	2017 Cumulative Energy Savings (MWh)	% of Total
Fan System - Optimization and Improvements	4,524	22.8%
Motors - Variable Frequency Drive (Pumps)	3,020	15.2%
Fan System - Maintenance	1,635	8.2%
Motors - Variable Frequency Drive (Fans & Blowers)	1,505	7.6%
Compressed Air - Air Usage Reduction	1,247	6.3%
Compressed Air - Air Compressor Replacement	1,217	6.1%
Motors - Variable Frequency Drive (Compressed Air)	936	4.7%
Pumping System - Optimization and Improvements	891	4.5%
Interior Lighting - Occupancy Sensors	713	3.6%
Interior Lighting - High-Bay Fixtures	420	2.1%
Total Top 10 Measures	16,108	81%

- Fan system maintenance savings increased
- Compressed air – compressor replacement did not pass when the TRC threshold was 1.0
- Motors – Variable Frequency Drives savings increased

Thank You!

Bridget Kester

bkester@appliedenergygroup.com

Fuong Nguyen

fnguyen@appliedenergygroup.com

Sharon Yoshida

syoshida@appliedenergygroup.com

Ingrid Rohmund

irohmund@appliedenergygroup.com

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2015 Preferred Resource Strategy & Portfolio Analysis

James Gall
Fifth Technical Advisory Committee Meeting
May 19, 2015

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Introduction

- Discuss how Avista plans to meet resource deficits (PRS)
- Review methodology and decision making logic
- Discuss alternative resource strategies
- Discuss the impact to resource strategies with a different future than the Expected Case's future

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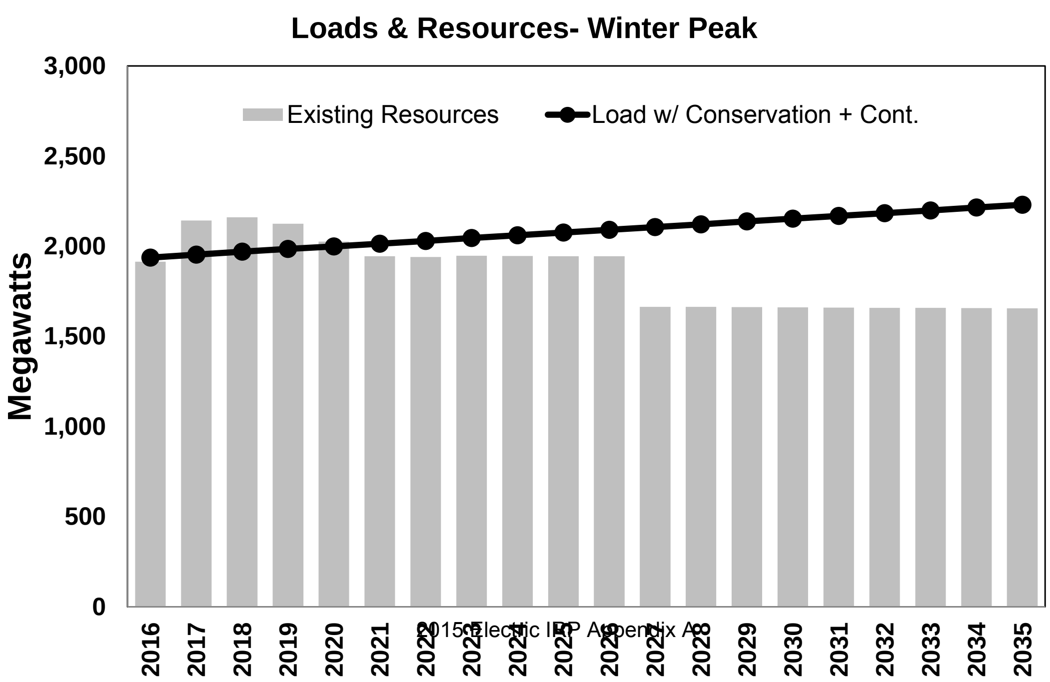
2013 IRP Preferred Resource Strategy

Resource	By the End of Year	Nameplate (MW)
Simple Cycle CT Wells/WNP-3	2019	83
Simple Cycle CT	2023	83
Combined Cycle CT Lancaster PPA	2026	270
Simple Cycle CT	2027	83
Rathdrum CT Upgrade	2028	6
Simple Cycle CT	2032	50
Total		**575**
Energy Efficiency	2014-2033	164 aMW
Demand Response	2022-2027	19 MW
Distribution Efficiencies	2014-2017	<1 MW

Resource Requirements

- Since the last TAC meeting, the peak capacity need has been pushed from 2020 to 2021.
- Avista signed a five year contract for five percent share of the Chelan County PUD's Rocky Reach and Rock Island projects



Developing Resource Portfolios

- "1990 Methodology" Least Cost
  - "Experts" package plausible resource portfolios
    - Mixes of resource start dates, resource types
  - Lowest cost is the goal
  - No quantitative risk measurement
  - Likely misses best portfolio and its timing

	Portfolio	Gas Peaking	Gas CCCT	Wind	Solar	Coal	Market
1	Market Reliance	0	0	0	0	0	100
2	All Gas Peaking	100	0	0	0	0	0
3	All Gas	50	50	0	0	0	0
4	Gas & Wind	50	0	50	0	0	0
5	Balanced	20	2	20	0	20	20
6	High Renewables	25	0	50	25	0	0
7	All Renewables	0	0	75	25	0	0

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Developing Resource Portfolios, Cont.

- Hybrid Approach
  - Continue arbitrary portfolio development
  - Add stochastic analysis to measure risk
- Benefits
  - Allows risk measurement
  - Disqualifies portfolio outliers
  - May show benefits of additional spending for risk reduction
- Costs
  - May not select lowest cost portfolio for the level of risk
  - Many best portfolios are missed

Avista's Portfolio Approach

- Best Practice- Efficient Frontier developed using a Mixed Integer Program (MIP)
- Each portfolio is the least cost "best" portfolio for each level of risk
- No need to build arbitrary portfolios
- Ensures the best portfolios are developed
- Allows for explicit and comprehensive measure of risk vs. cost
- Still does not pick the "ideal" portfolio

Efficient Frontier Video
http://www.investopedia.com/terms/e/efficientfrontier.asp

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Avista's Portfolio Approach, Cont.

- Mixed Integer Program (MIP)
  - Lindo System's What's Best software using Gurobi solver
    - *Superior speed improvement allowing more complex modeling*
  - Solves for least cost mix to meet Avista's resource shortfall
    - *NPV of power supply for next 25 years along with a small weighting of costs beyond 25 years*
  - New generating resources, resource upgrades, conservation, demand response all compete to meet the resource shortfall
    - *Options are treated as integers, therefore no partial units (including conservation)*
  - Model can solve to reduce power supply risk by selecting different resource strategies, while adhering to resource sizes
  - Can still test "arbitrary" portfolios to illustrate concepts

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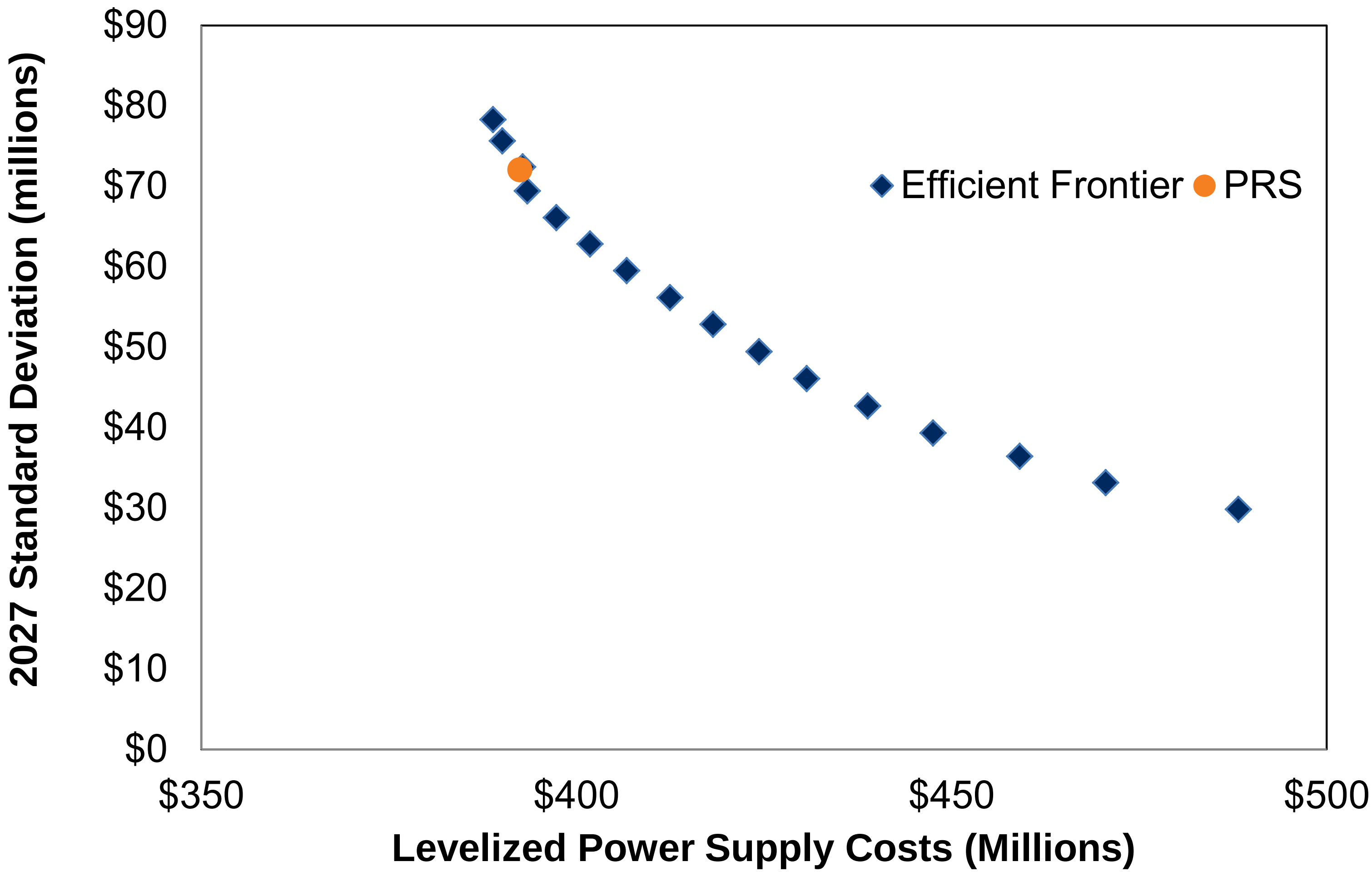
2015 IRP Efficient Frontier



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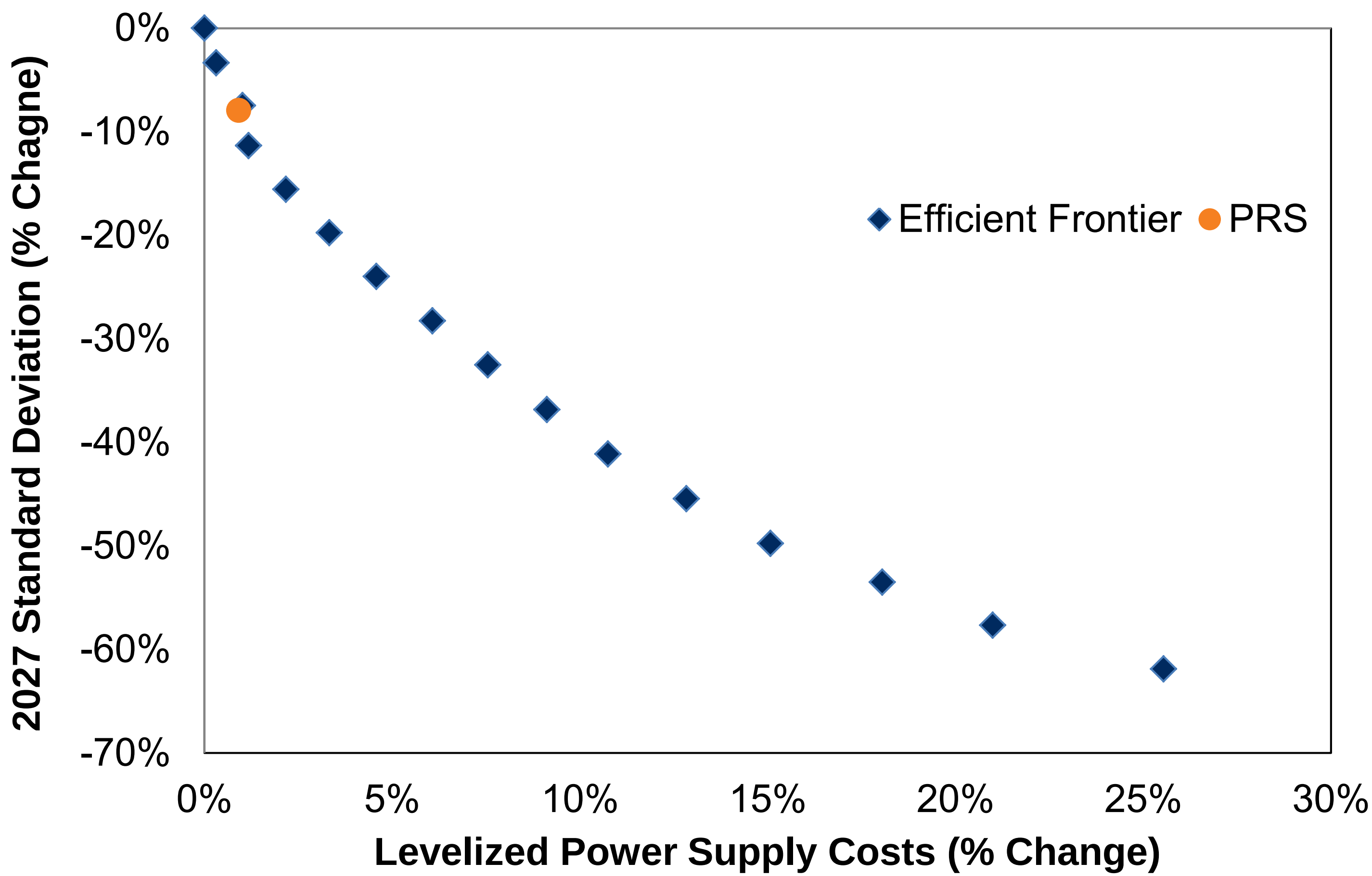
Efficient Frontier as Percent Change from Least Cost



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Selecting the "Best" Portfolio

- Using Avista's methodology, all portfolios are best for the assigned level of risk
- Academic research uses indifference curves "risk tolerance" to help select the "best" portfolio
- Other metrics to help select the portfolio
  - Risk adjusted PVRRs
  - Point to point derivatives

Risk Adjusted PVRR

- This metric adds to each year's revenue requirement, five percent of the added cost of the 95th percentile
  - If expected cost was $100, the 95th percentile is $200, the cost would be $105.
  - Method simulates the added cost of a 1 in 20 bad outcome
- Methodology is useful in "hybrid" portfolio development as it can distinguish between un-optimized portfolios
  - A less useful measure in MIP-derived portfolios as model minimizes this cost for each level of risk

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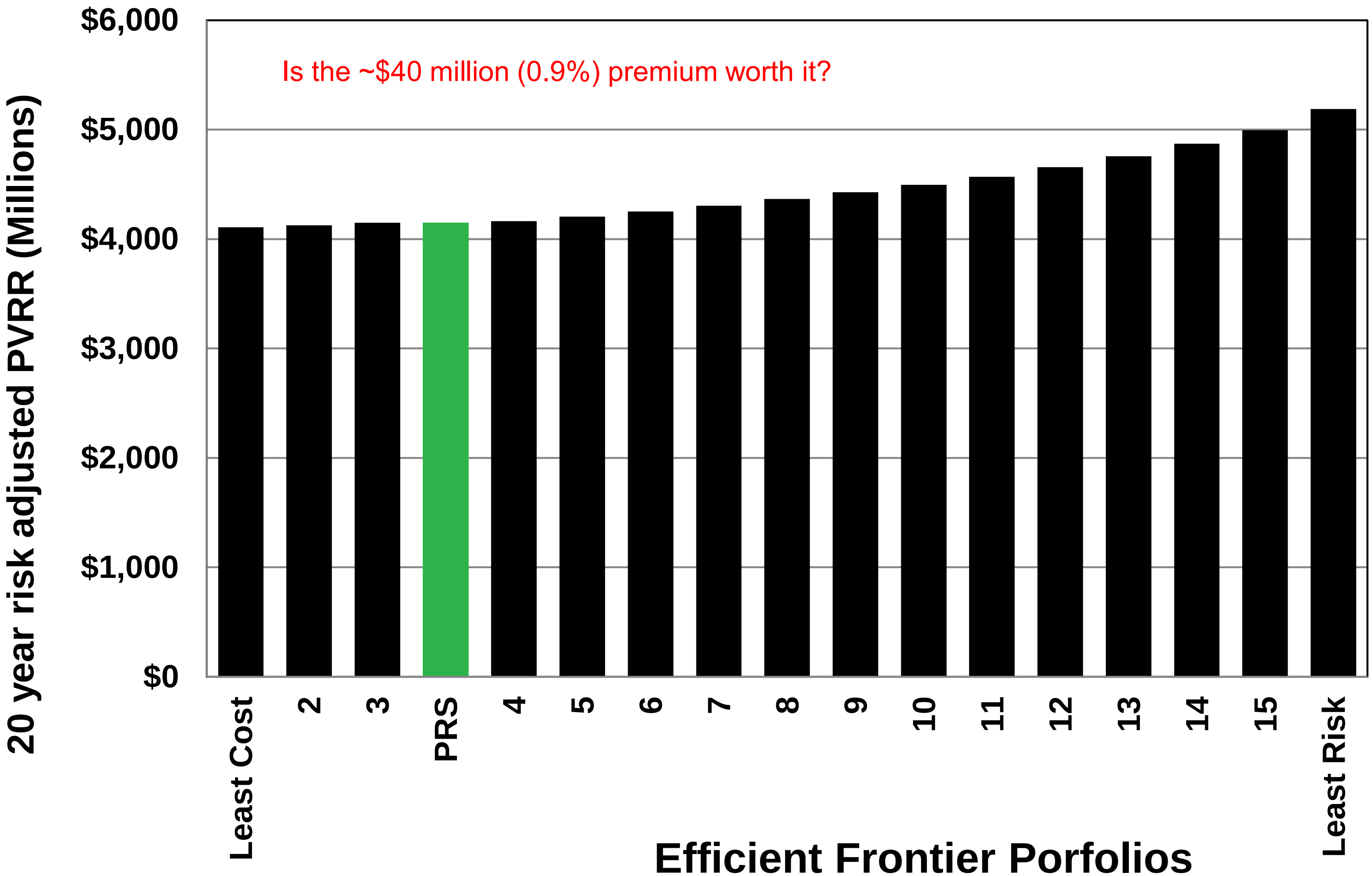
Risk Adjusted PVRR Results

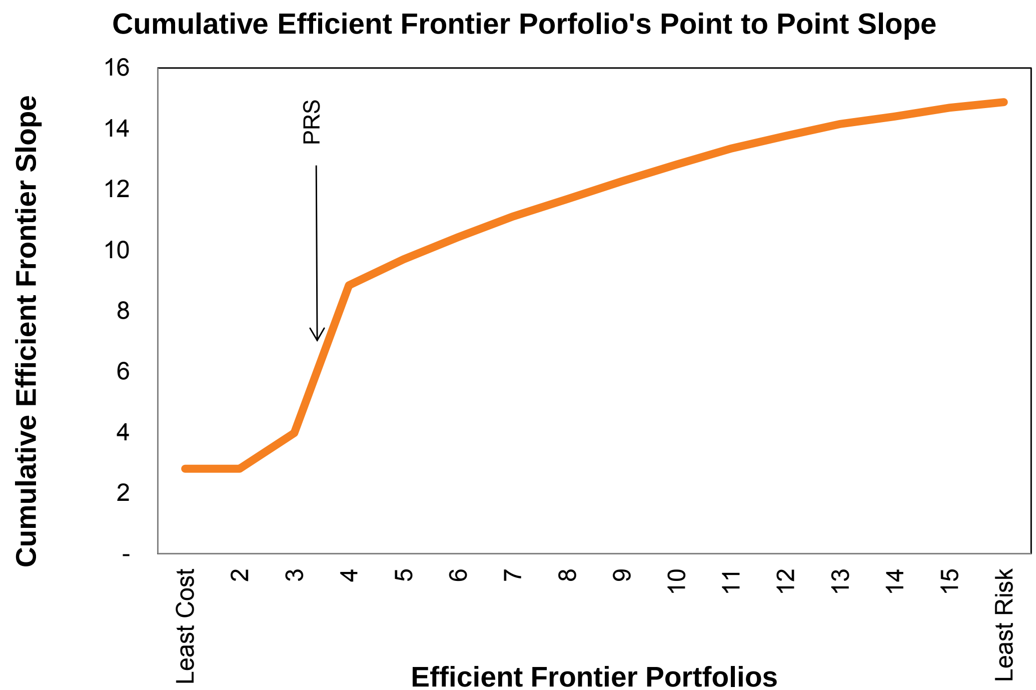


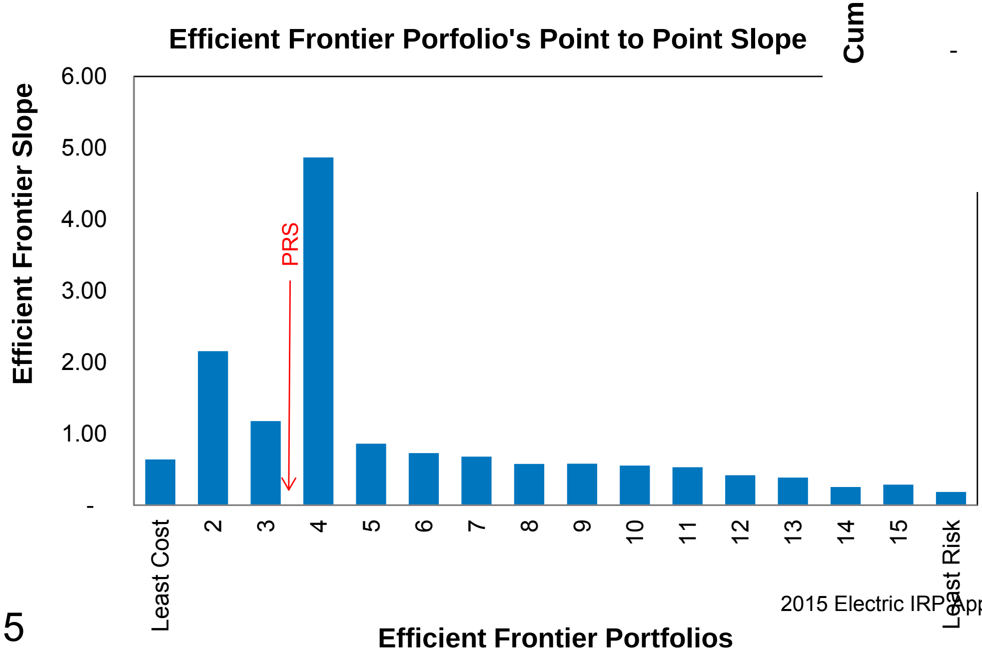
Point to Point Derivatives

- Distinguishes the relationship between added cost and risk reduction
- Typically want good trade off, but each portfolio manager's judgment of the trade off is different
- Avista selects a portfolio where there is a good trade off between cost and risk
- The measure used by Avista since 2005, when adopting present method, to select a preferred resource portfolio

Point to Point Derivatives

- Portfolio's between #3 and #4 vary the size of the 2027 CCCT





An inflection point does not necessarily mean it is the best place to land, as the benefit could be greatly outweighed by the cost—this could be the case in the 2015 IRP

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2015 IRP: Preferred Resource Strategy

Resource	By End of Year	ISO Conditions (MW)	Winter Capacity (MW)	Energy (aMW)
Natural Gas Peaker	2020	96	102	89
Thermal Upgrades	2021-2025	38	38	35
Combined Cycle CT	2026	286	306	265
Natural Gas Peaker	2027	96	102	89
Thermal Upgrades	2033	3	3	3
Natural Gas Peaker	2034	47	47	43
Total		**565**	**597**	**524**
Conservation (w/ T&D losses)	2016-2035		192	132

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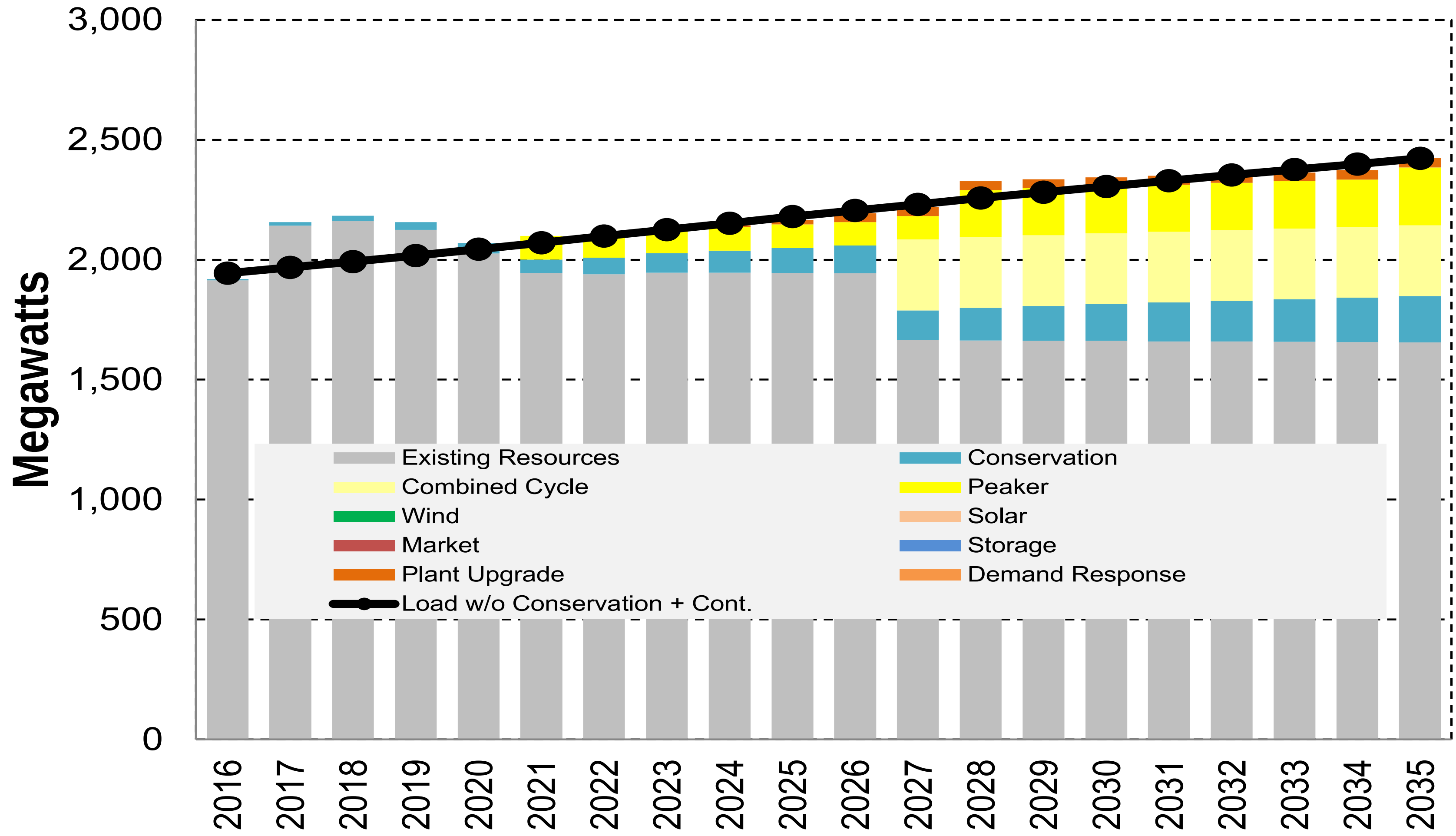
Loads & Resources- Winter Peak



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Conservation Modeling

- Load forecast adjusted higher to evaluate portfolio without conservation, grossed up using AEG's CPA conservation level
- Conservation measures are considered as resource options
  - ~2,500 programs below 130% of the avoided cost are included in PRiSM
  - Additional programs above 130% threshold are excluded
- PRiSM may chose conservation program or generation resource to fill resource deficits
  - PRiSM looks at the added energy, winter, and summer capacity for each program compared to its cost and energy savings
  - When valuing the energy savings, the Power Act 10% premium is included
- Programs are either on/off. A program cannot start and end unless its life cycle is complete

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Conservation Avoided Cost

- Energy: *$38.38/ MWh (flat delivery)* ***PLUS***
- Capacity & Risk: *$94.84/ kW-year (winter peak)* ***PLUS***
- T&D Capacity: *$12.30/ kW-year (winter peak)* ***PLUS***
- T&D Losses: *6.1%* ***PLUS***
- Power Act Adder: *10% added to energy & loss values*

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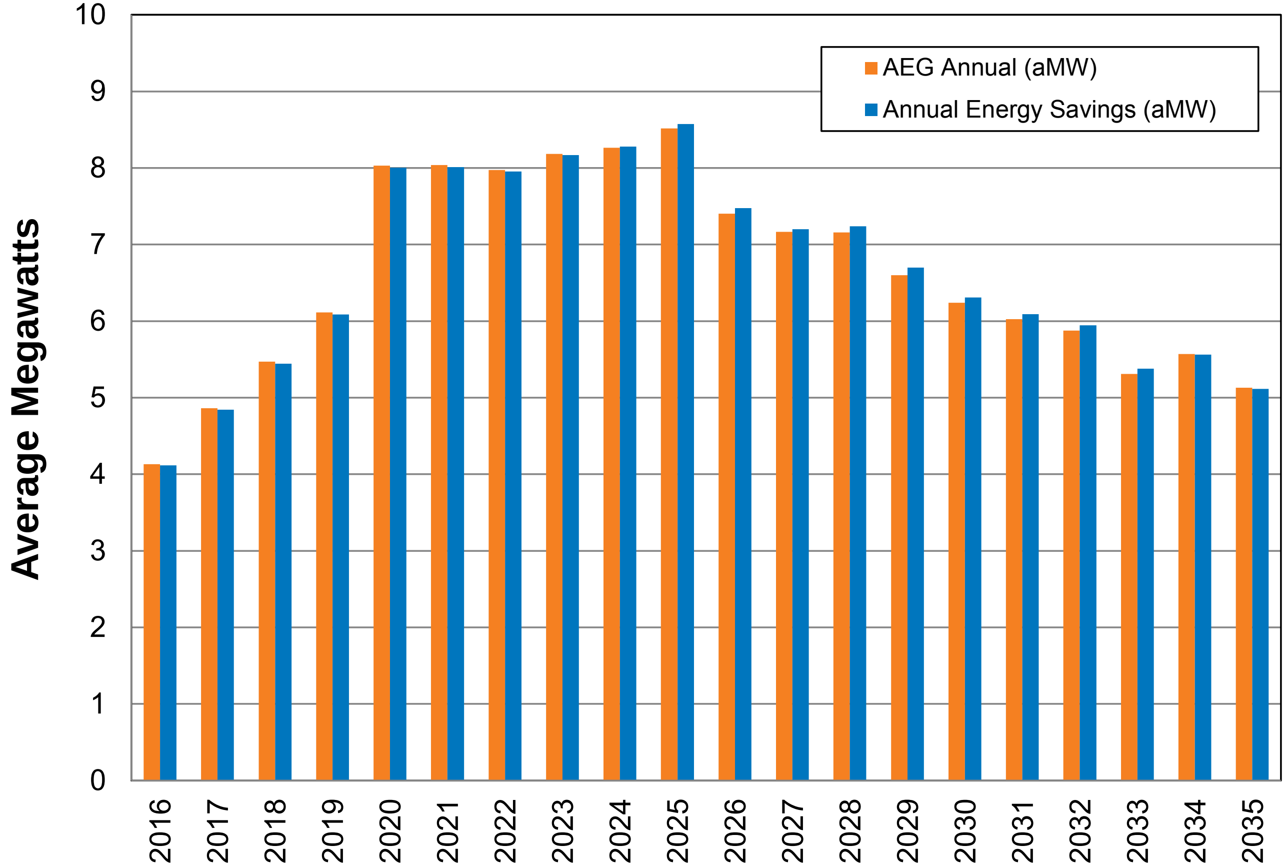
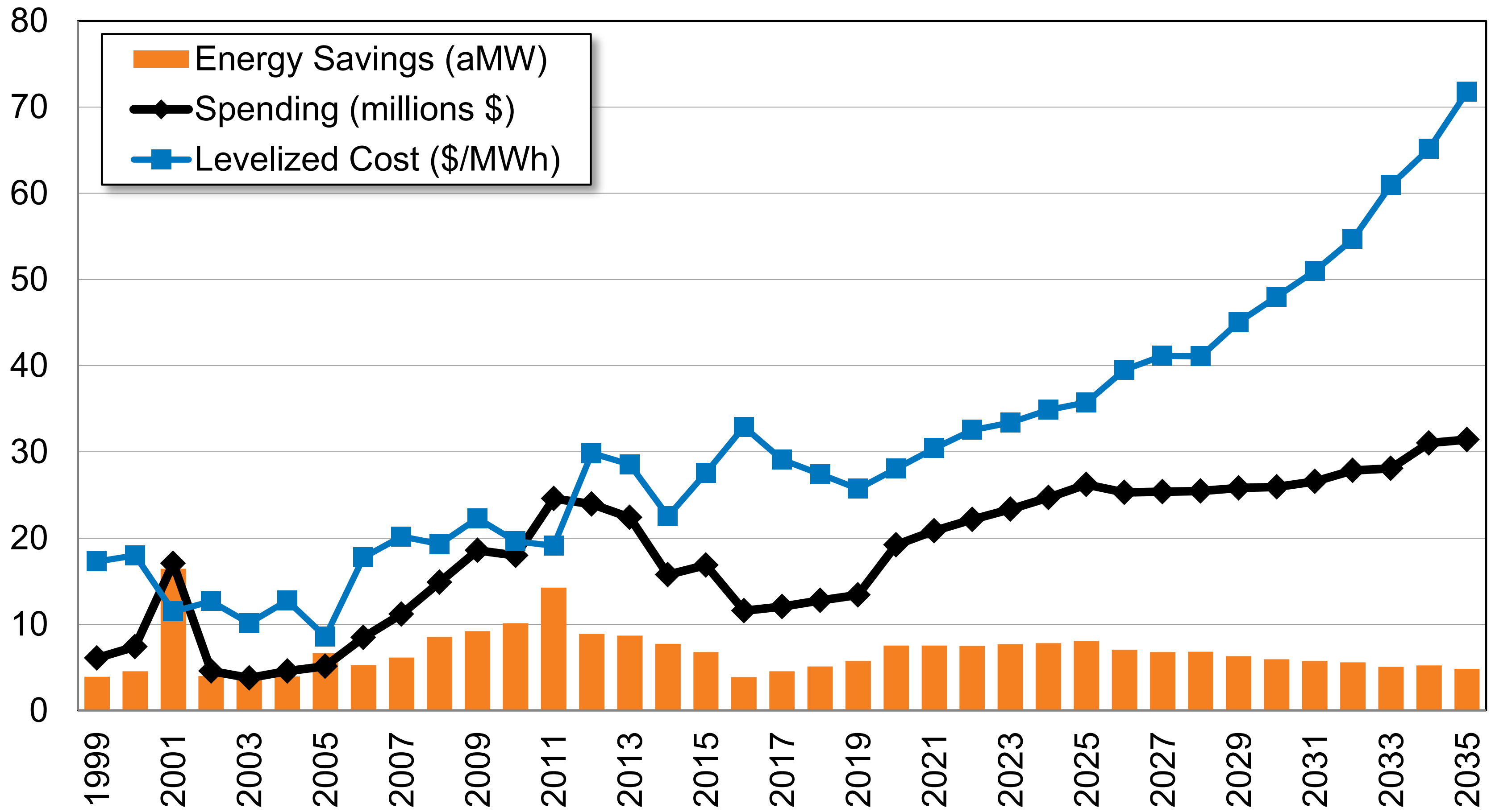
Conservation Selection vs. CPA with Losses



aMW	2016-2017	2016-2035
CPA	8.99	132.06
PRiSM	8.96	132.48

Utility Cost of Conservation



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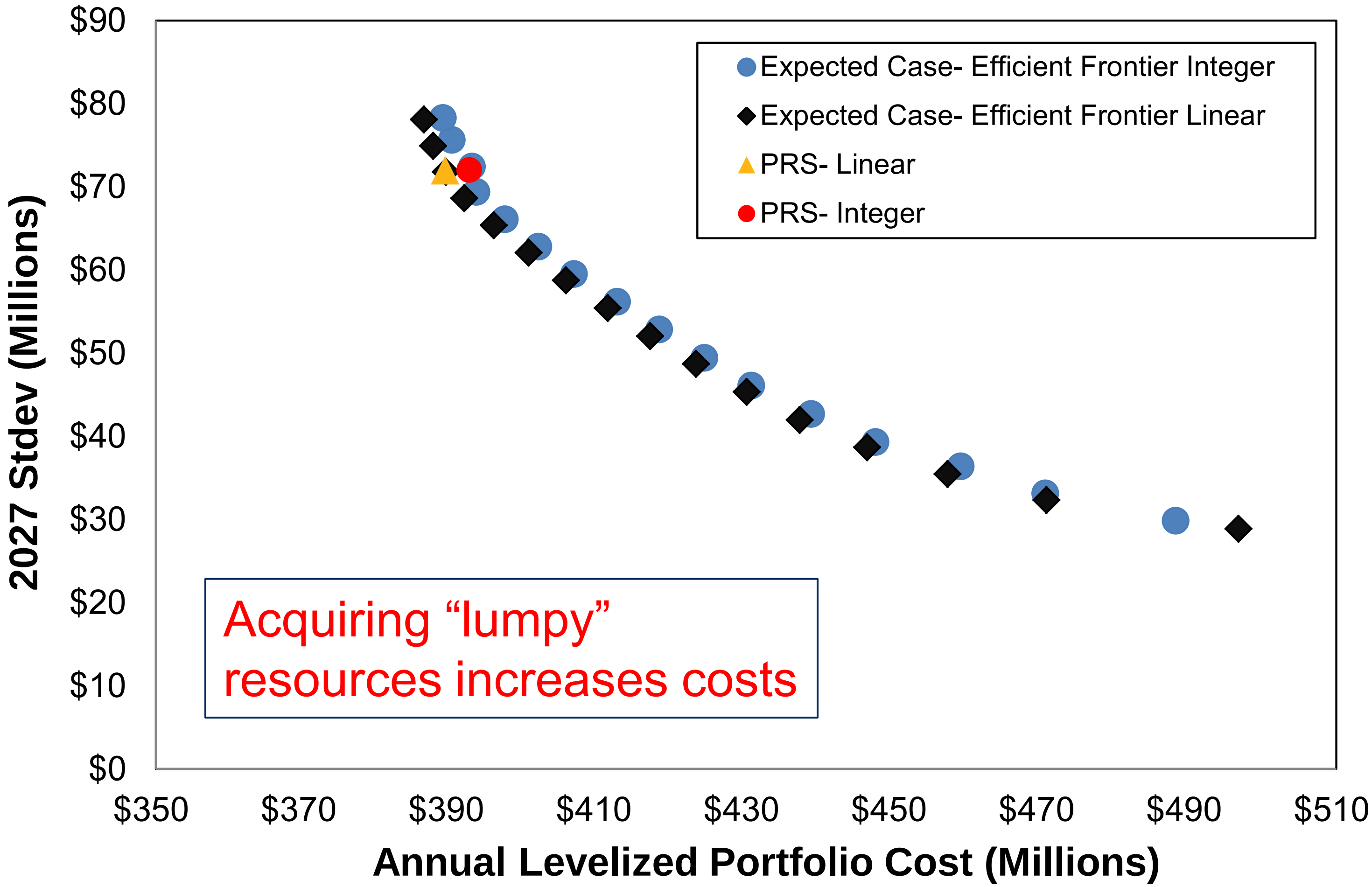
Integer vs. Linear Programing

- Linear programming allows all resource options to be chosen in any increment subject to min and max constraints
  - For example, a Combined Cycle CT can be selected with a capacity of 158.45 MW rather then the full 286 MW plant
- Integer programing holds resource options to specific sizes. Integer programming models resources lumpy rather then precise additions.
  - Lumpy resource additions adds costs compared to perfect resource acquisition

Mix Integer vs. Linear Programing



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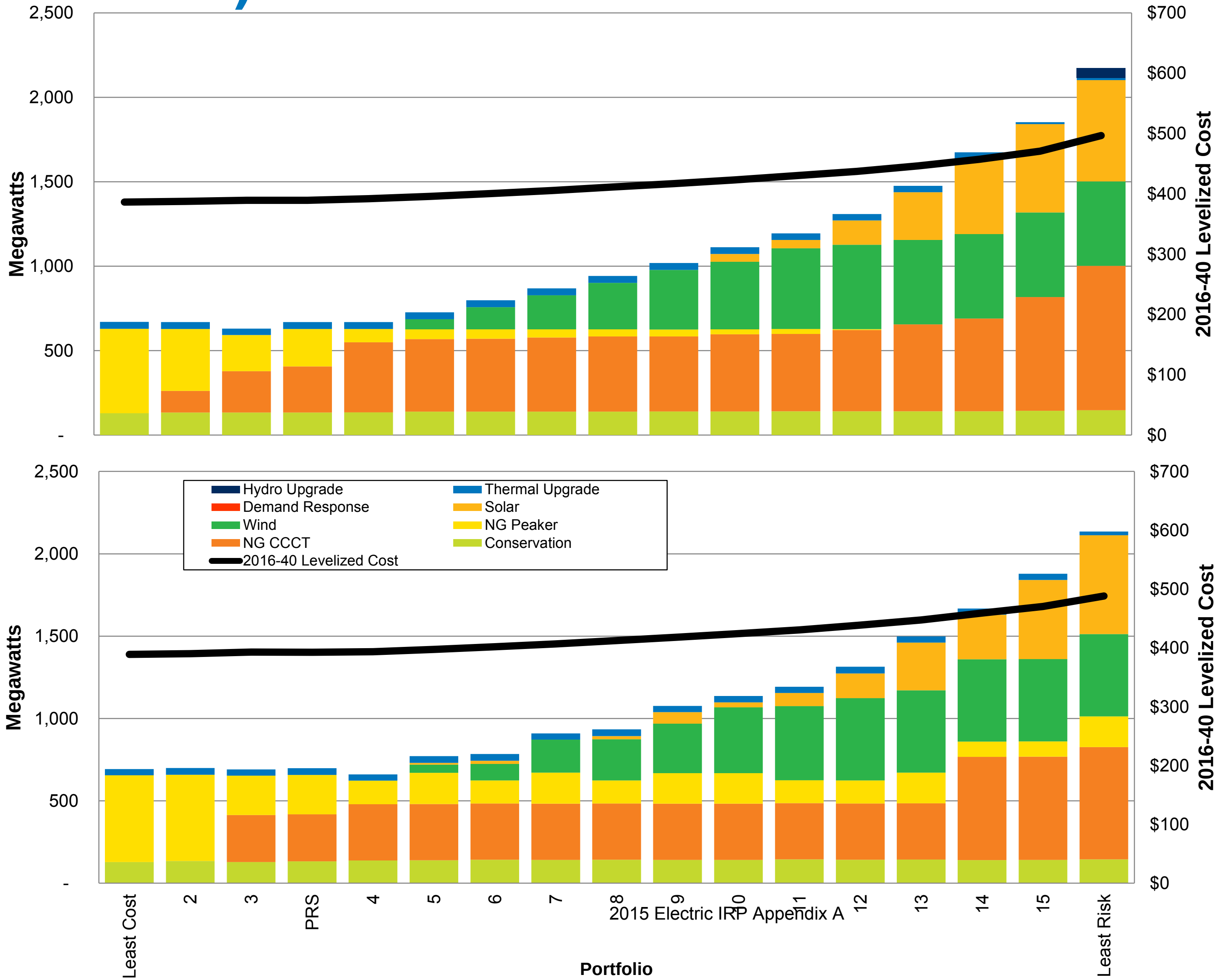
Other Resource Portfolios Along the Frontier (Nameplate MW)

Portfolio	NG Peaker	NG CCCT	Wind	Solar	Demand Response	Thermal Upgrade	Hydro Upgrade	Conservation
Least Cost	527	-	-	-	-	38	-	128
2	524	-	-	-	-	41	-	135
3	239	286	-	-	-	38	-	128
PRS	239	286	-	-	-	41	-	132
4	143	341	-	-	-	38	-	138
5	189	341	50	10	-	41	-	139
6	140	341	100	20	-	41	-	143
7	189	341	200	-	-	38	-	141
8	140	341	250	20	-	41	-	142
9	186	341	300	70	-	38	-	141
10	186	341	400	30	-	38	-	141
11	140	341	450	80	-	38	-	144
12	140	341	500	150	-	41	-	142
13	186	341	500	290	-	38	-	143
14	93	627	500	270	-	38	-	140
15	93	627	500	480	-	38	-	141
Least Risk	186	683	500	600	-	23	-	144

Efficient Frontier Portfolios (Integer vs. Linear)



Linear shows CCCT earlier and smoothed resource changes

Integer has delayed CCCT and lumpy resource changes

Portfolio Scenarios

- Load forecast
  - Low, high, increases DG solar penetration
- Colstrip retires end of 2026
- High cost Colstrip Retention
  - Colstrip retires end of 2022
- Market & Conservation
- 2013 PRS
- Renewables Meet All Load Growth
- Hydro Upgrades & Peakers
- Peakers & Hydro Total Portfolio

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Load Sensitivities

- *Purpose: Describe changes in PRS with alternative future load conditions*
- Low Load
  - Assumes lower GDP* growth (2.0%)
- High Load
  - Assumes higher GDP* growth (3.2%)
- DG Solar Penetration
  - Expected case forecast with DG solar penetration growing exponentially to 10% of residential customers with an 6 kW average system size by 2040

** Expected Case GDP forecast is ~2.6%*

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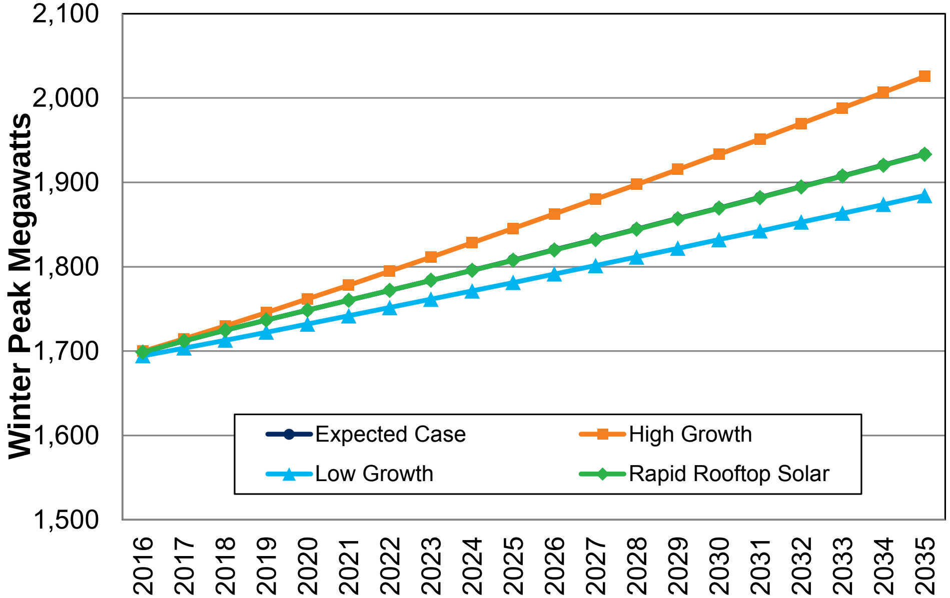
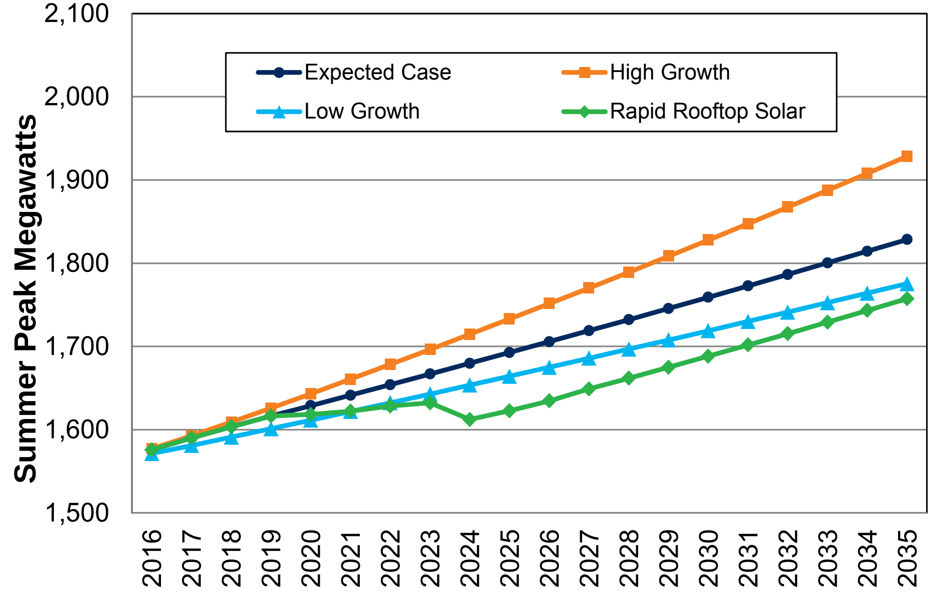
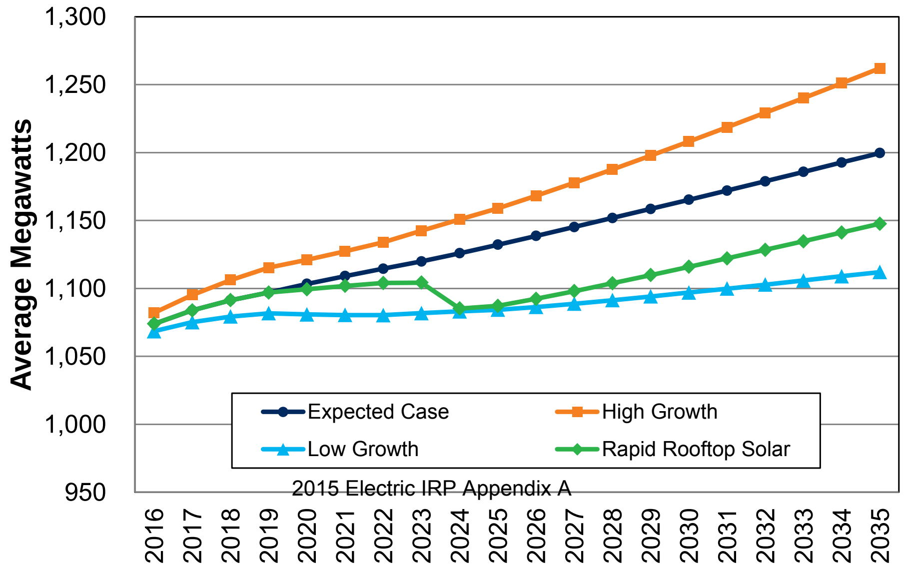
Load Sensitivities (continued)







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Load Sensitivity Resource Strategies

Resource	Expected Case PRS	Low Loads	High Loads	High DG Solar Penetration
NG Peaker	239	192	335	239
NG Combined Cycle CT	286	286	286	286
Wind	0	0	0	0
Solar	0	0	0	0
Demand Response	0	0	0	0
Thermal Upgrades	41	41	41	41
Hydro Upgrades	0	0	0	0
Total	**565**	**519**	**662**	**565**

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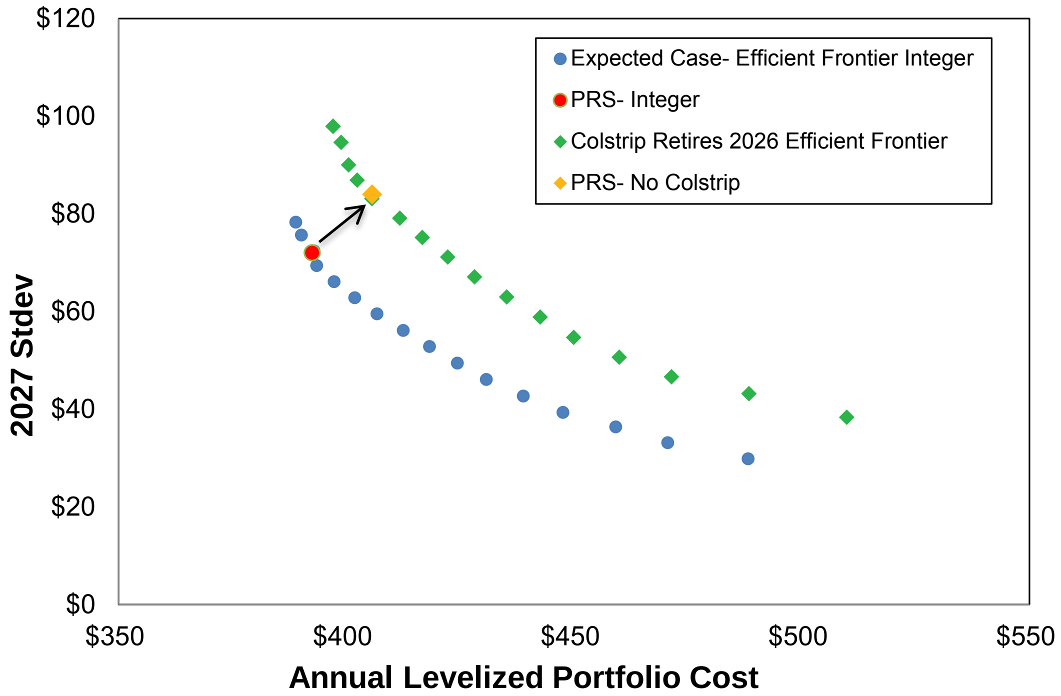
SCENARIO: Colstrip Analysis

- Assumes Colstrip retires at the end of 2026
- No Selective Catalytic Reduction (SCR) investment
- Plant is fully depreciated by end of 2031
- Pond closure costs begin in 2027
- Replacement resources similar to Expected Case PRS

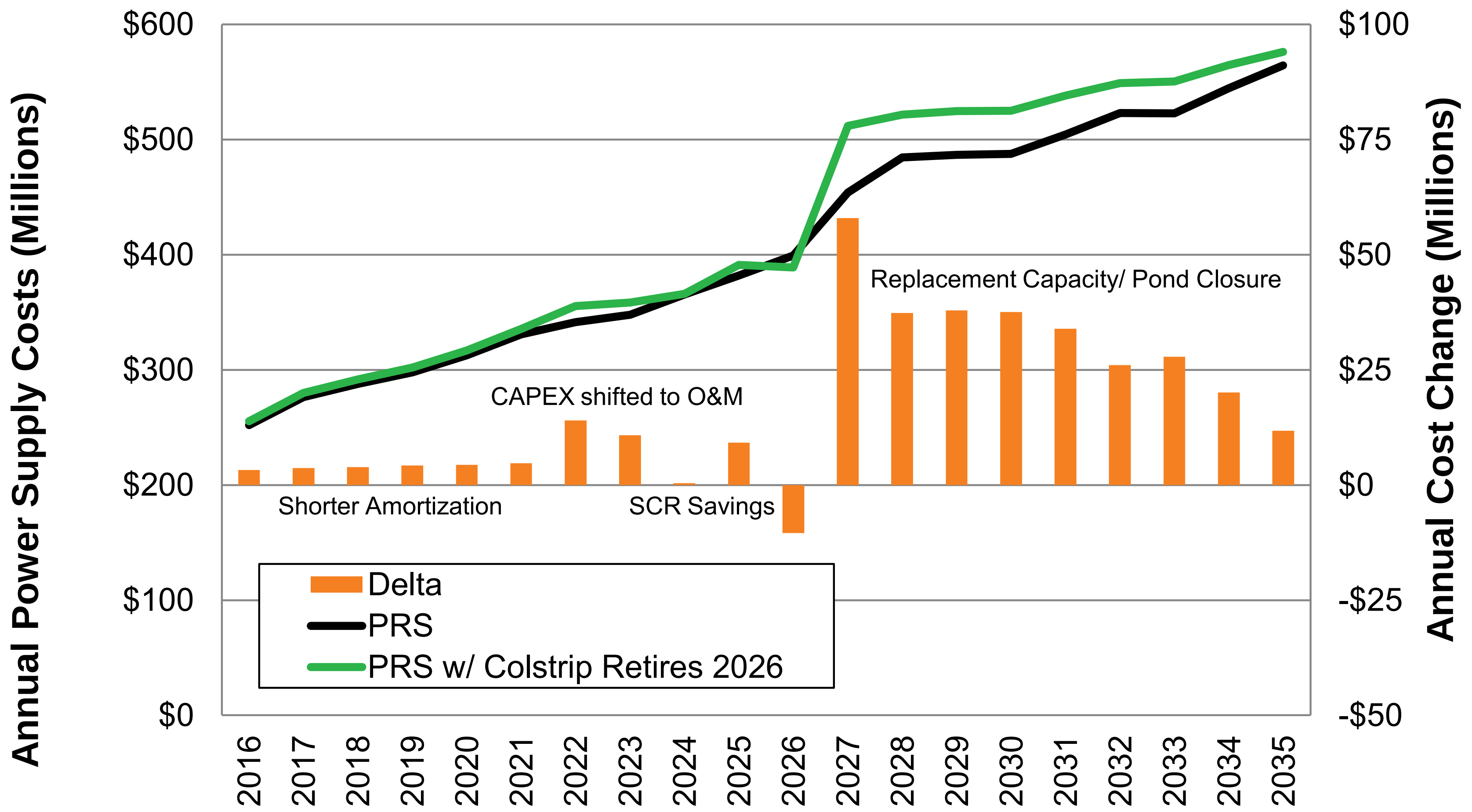
SCENARIO: Colstrip Retires in 2026



Resource	By End of Year	ISO Conditions (MW)
Natural Gas Peaker	2020	96
Thermal Upgrades	2021-2025	38
Combined Cycle CTs	2026	627
Total		**761**
Conservation (w/ T&D losses)	2016-2035	130.7

25-year levelized cost increase of $13.4 million (+ 4%) per year, risk increase $12 million (+ 17%), the 2027 increase is $58 million

Annual Power Supply Cost Impact After Colstrip Closure in 2026



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SCENARIO: High-Cost Colstrip Retention

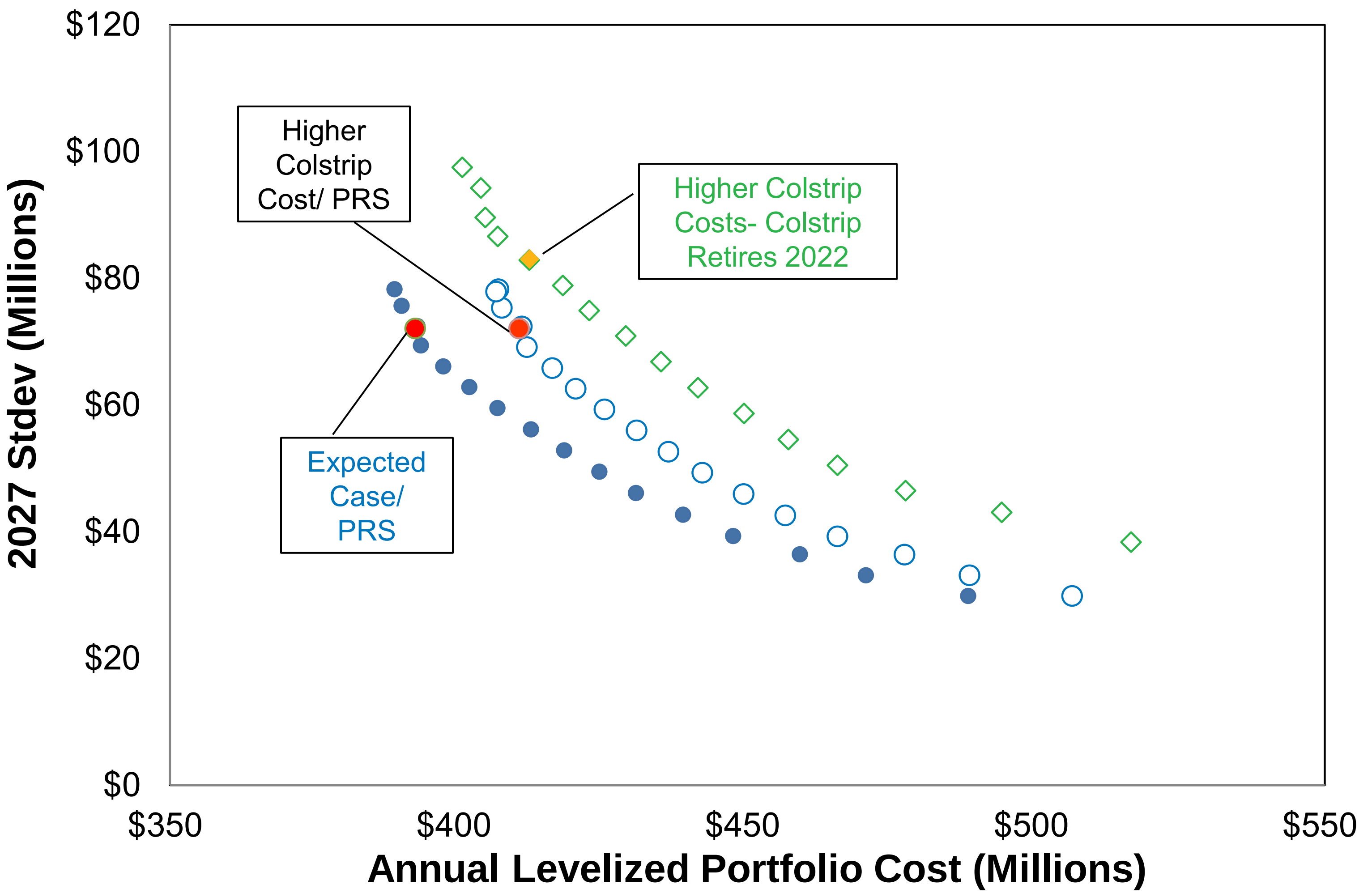
- Higher-cost Colstrip compliance assumptions provided by TAC members
  - Assumptions include:
    - SO_2 Scrubbers: $700 million (2022) w/ $45 million annual O&M
    - Dry Ash Handling Conversion: $60 million (2022) w/ $3 million annual O&M
    - Replacement Landfill: $9 million (2022) w/ $0.33 million annual O&M
    - New SCR: $268 million (2022) w/ $35 million annual O&M
    - Colstrip 1 & 2 retire in 2017, w/ common costs shifted to 3 & 4 owners
- Assumptions have not been vetted by Avista
- Two scenarios studied
  - PRS with higher compliance costs
  - Colstrip retirement at the end of 2022

SCENARIO: Colstrip Retires 2022

Resource	By End of Year	ISO Conditions (MW)
Natural Gas Peaker	2020	56
Thermal Upgrades	2021-2035	41
Combined Cycle CTs	2023-2026	627
Natural Gas Peaker	2035	47
Total		**770**
Conservation (w/ T&D losses)	2016-2035	131.0

- Early Colstrip retirement scenario adds CCCT earlier in the plan
- Peaker still required in 2020
  - More detailed economics could support bigger CCCT in 2020 rather than splitting between CCCT and a peaker

Colstrip Scenario Efficient Frontier Analysis



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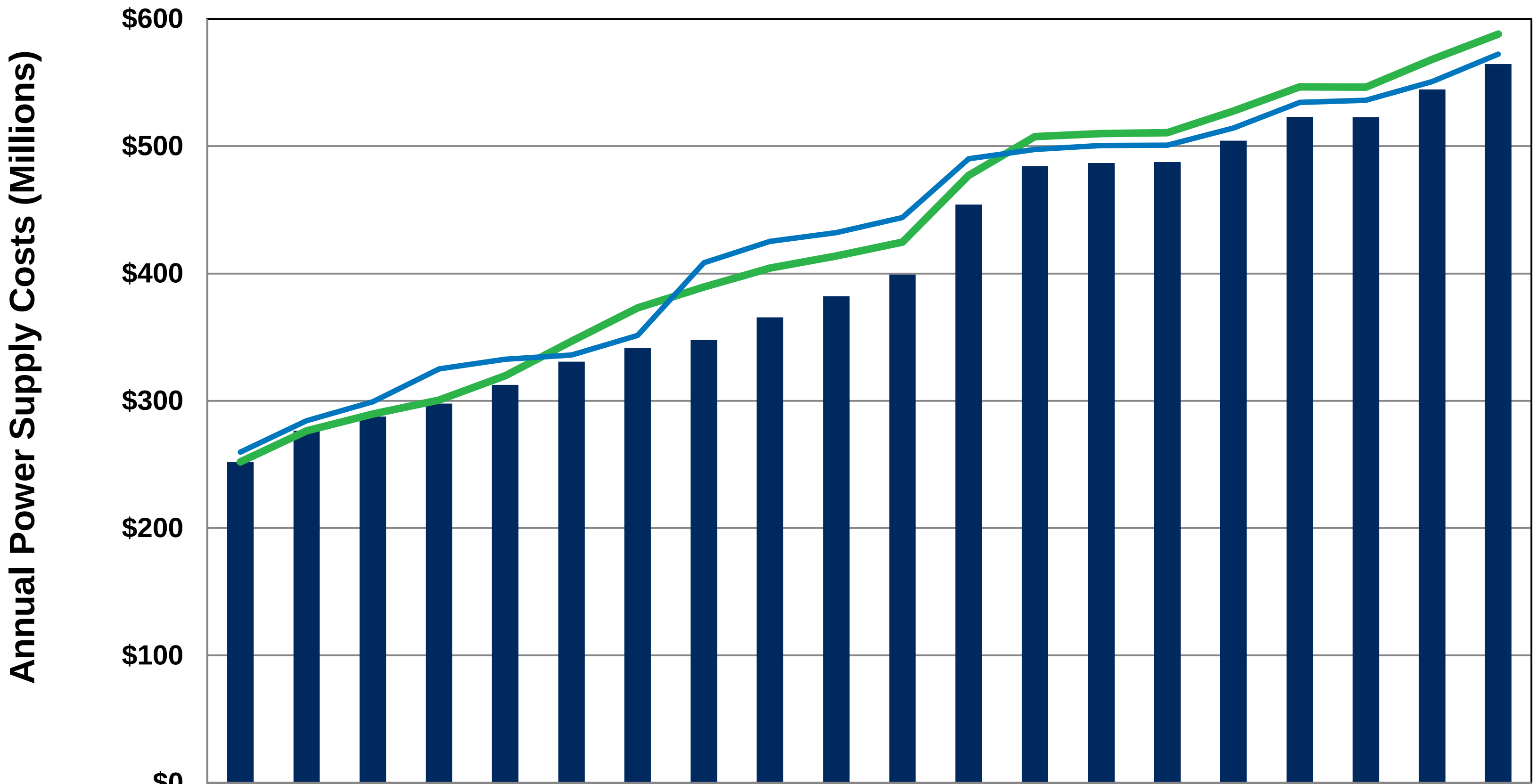
Colstrip Scenarios (Continued)



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	20-yr Levelize
PRS	252	276	288	298	313	331	341	348	366	382	399	454	484	487	488	504	523	523	545	564	$374
PRS High Colstrip Costs	252	276	290	301	320	347	373	389	404	414	425	477	507	510	511	528	547	546	568	588	$391
PRS Colstrip Retires 2022	260	284	299	325	333	336	351	408	425	432	444	490	498	500	501	514	534	536	551	572	$395

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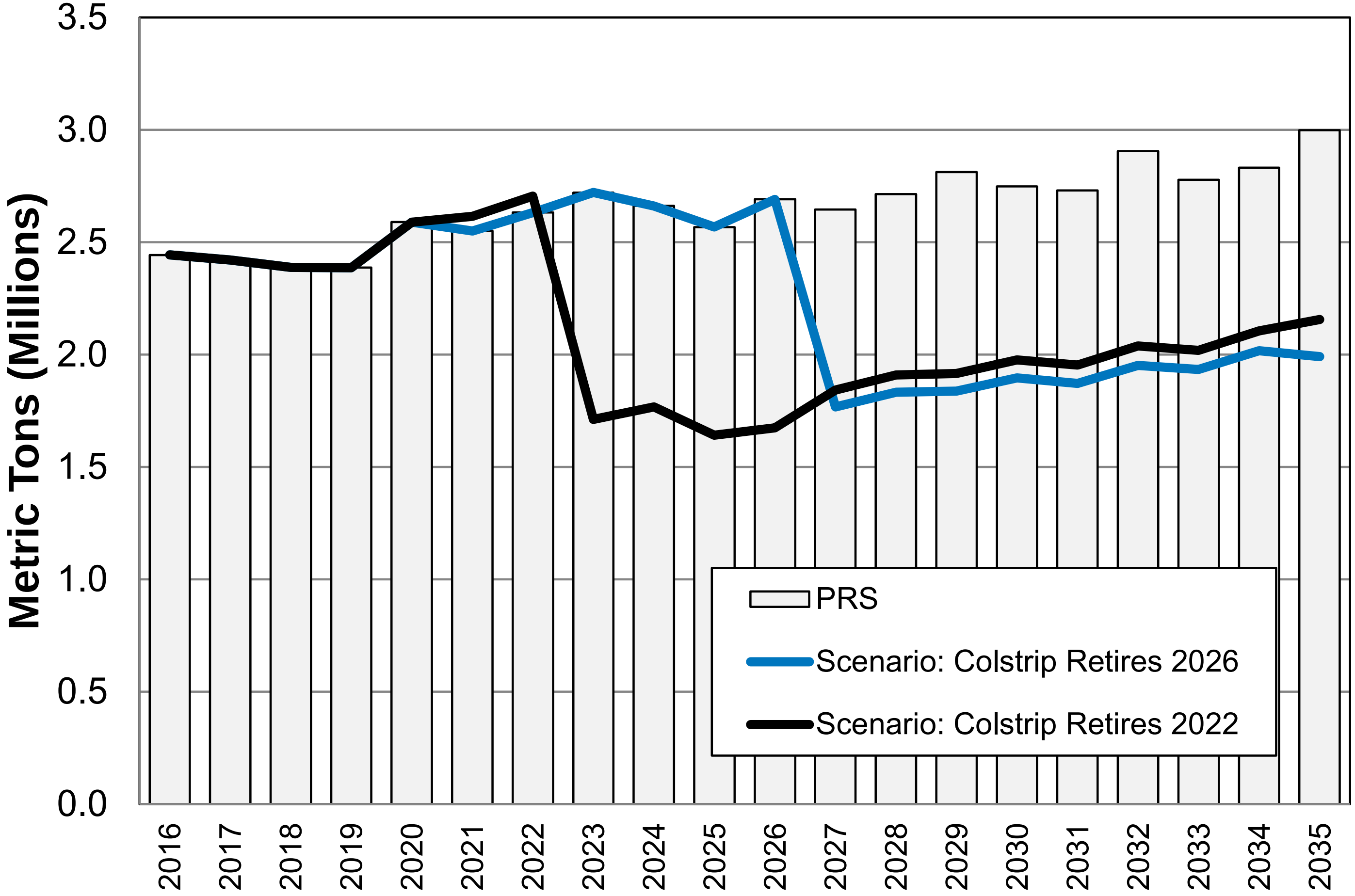
Colstrip Scenarios' Greenhouse Gas Emissions



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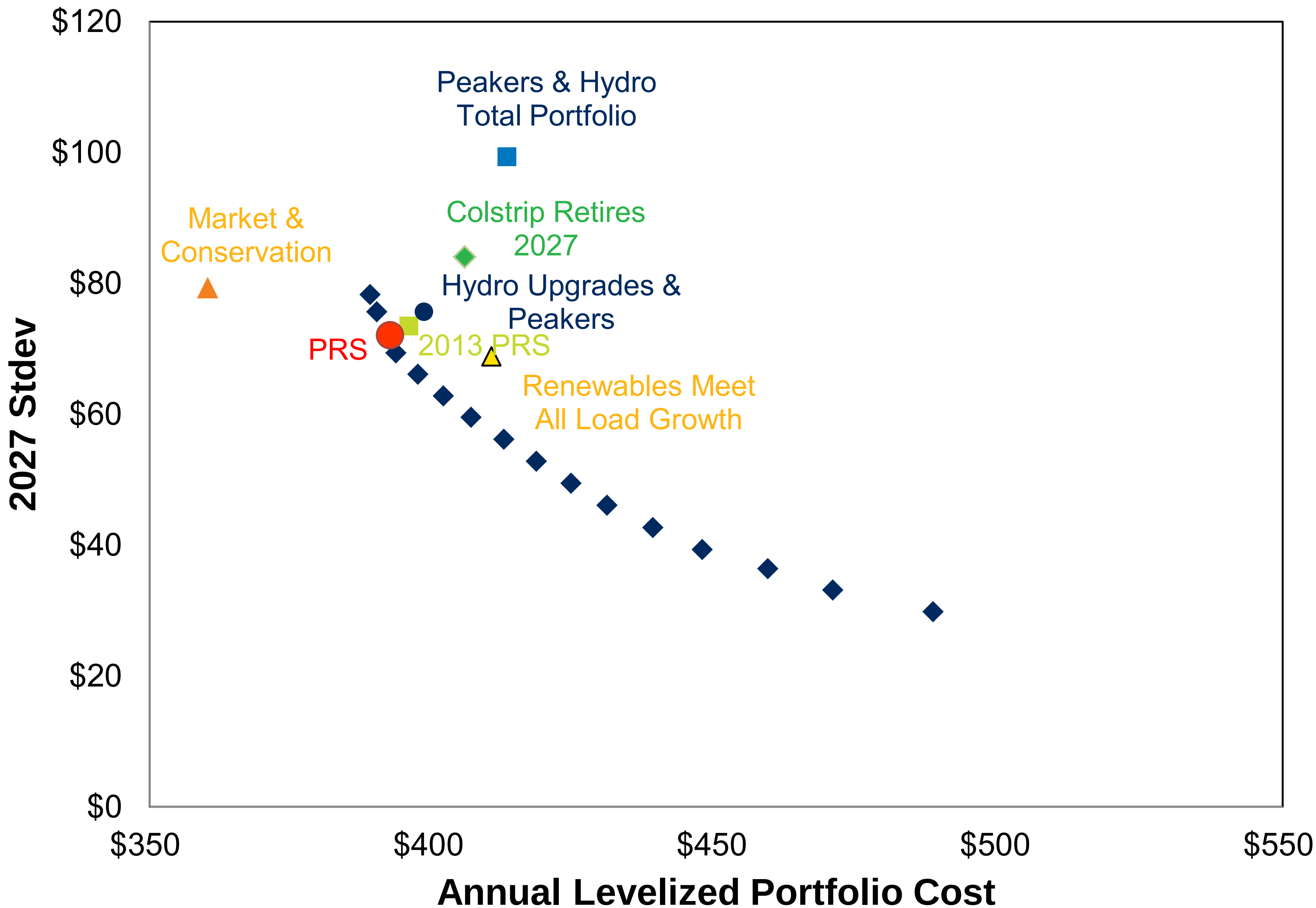
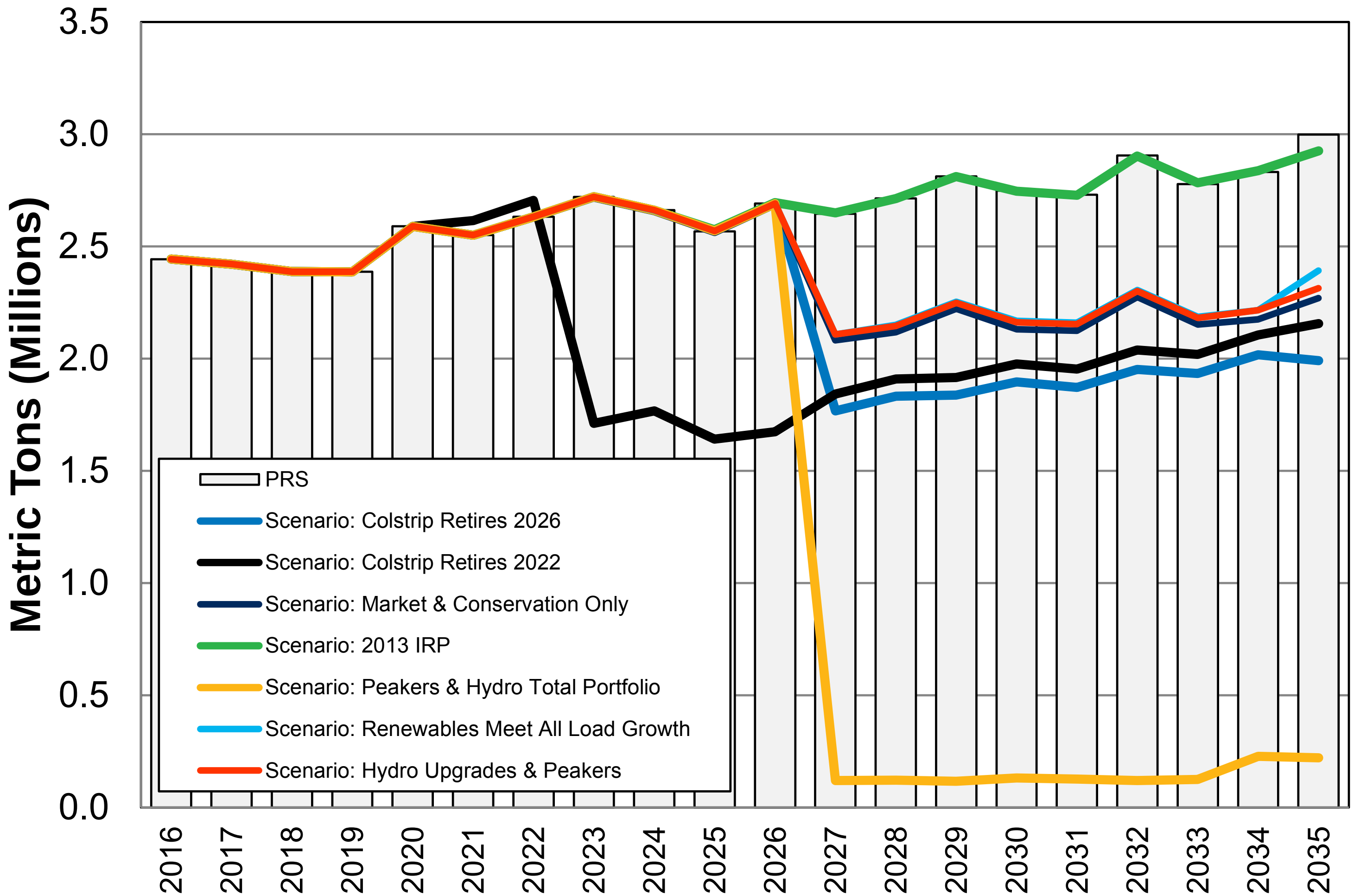
Other Resource Scenarios

- **Market & Conservation**
  - All future needs are met by conservation and market purchases
- **2013 PRS**
  - Build similar resources as the 2013 preferred resource strategy
- **Renewables Meet All Load Growth**
  - All load growth is met by renewable energy (wind)
- **Hydro Upgrades & Peakers**
  - Assumes Monroe Street & Long Lake upgrades in 2027
  - Peaking resources meet remaining capacity needs
- **Peakers & Hydro Total Portfolio**
  - By 2027 Avista retains only gas-fired peakers and hydro in its portfolio

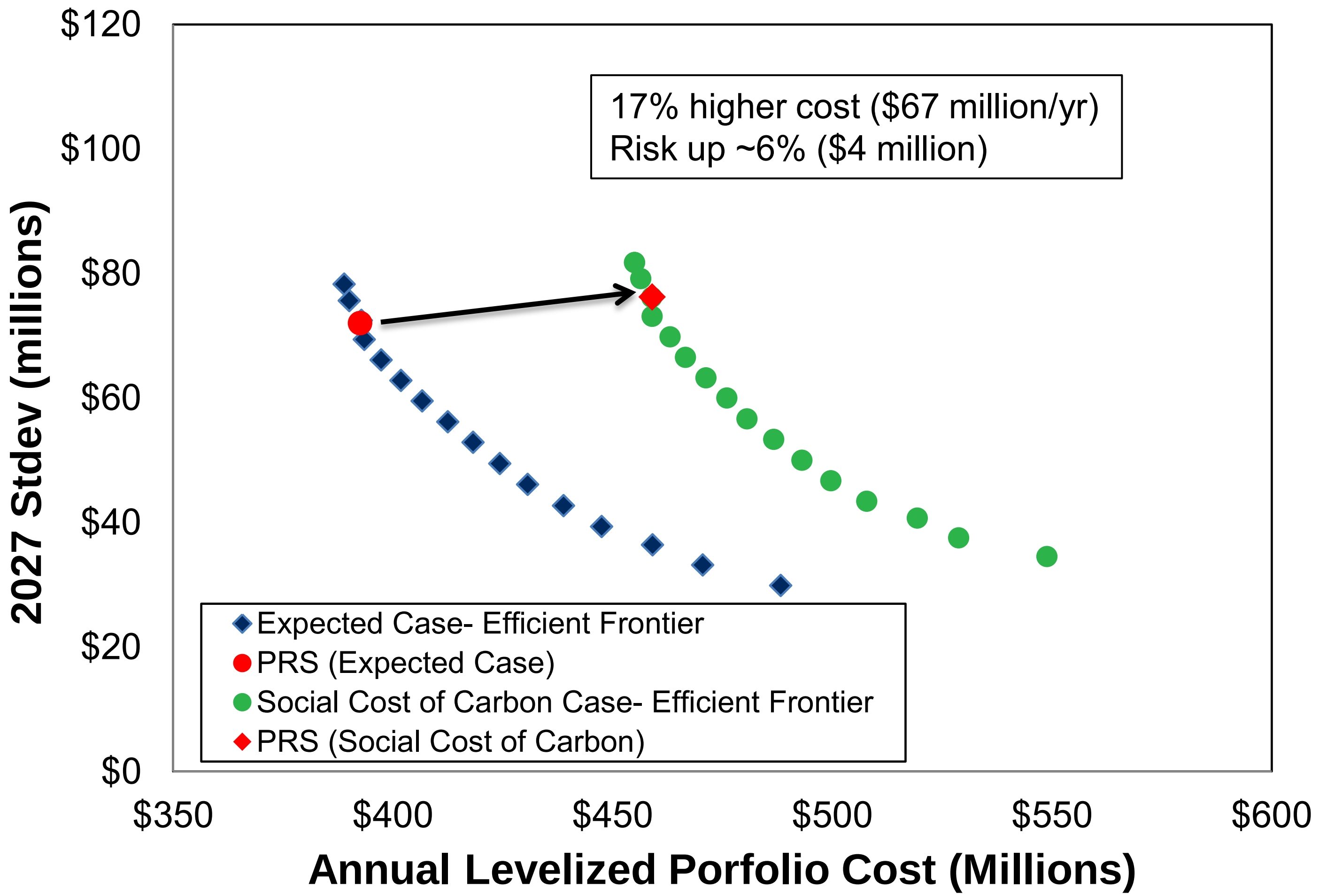
Other Portfolio Scenarios Efficient Frontier



Other Portfolio Scenario Greenhouse Emissions



Efficient Frontier w/ Social Carbon Cost



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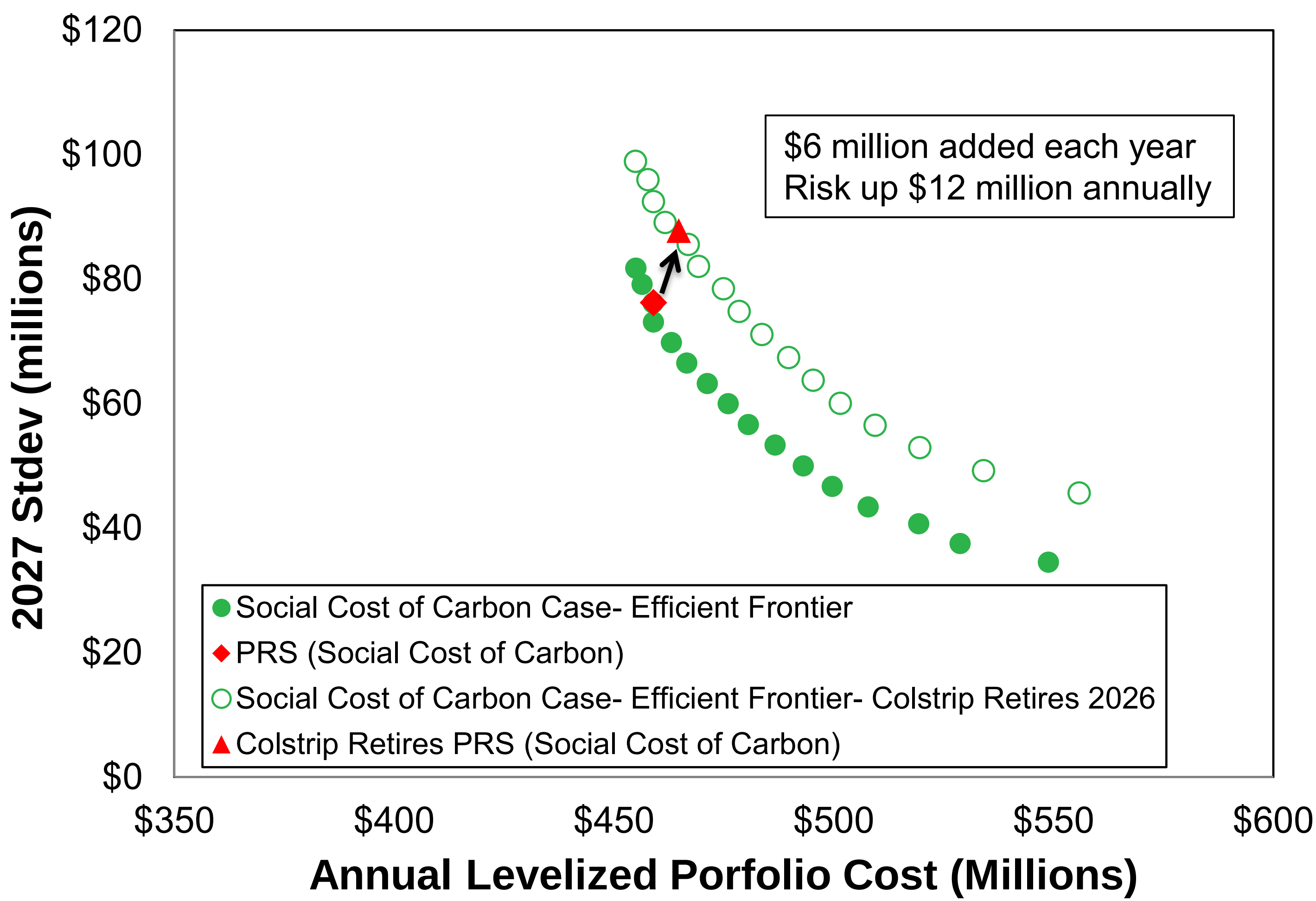
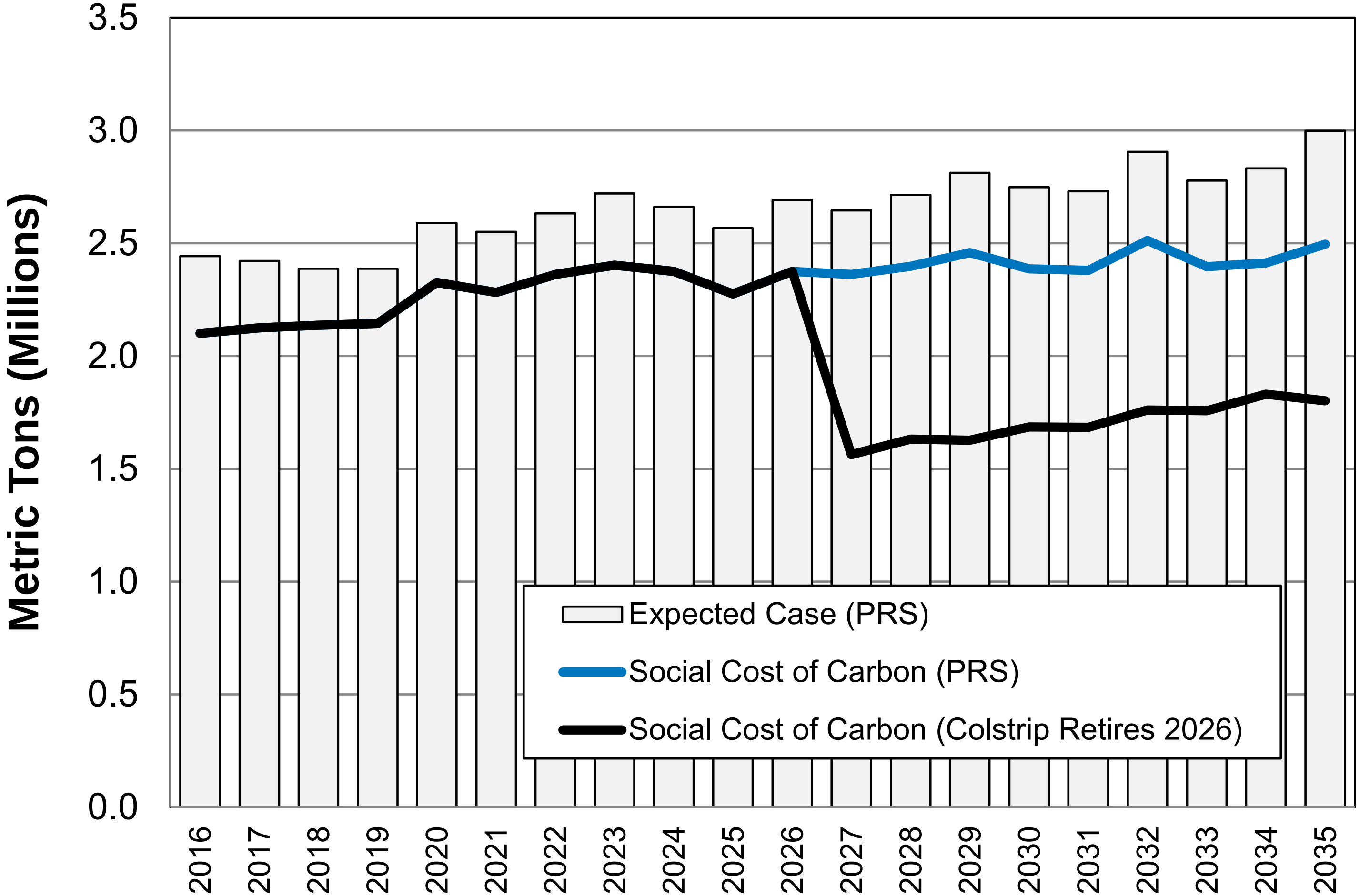
Efficient Frontier w/ Social Carbon Cost (Colstrip Retires 2026)



Avista Emissions with Social Cost of Carbon Market Future



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Social Cost of Carbon Summary

- Annual Power Supply Costs will increase approximately $67 million per year (17%)
- Avista’s greenhouse gas emissions fall 17%
- Colstrip still remains lower cost option
- Retiring Colstrip in 2026 increases levelized costs by $6 million compared to $13 million per year in the Expected Case
- Retiring Colstrip and a Social Cost of Carbon Market Future reduces Avista’s greenhouse gas emissions 48%

2015 Electric Integrated Resource Plan

Technical Advisory Committee Meeting No. 6 Agenda

Wednesday, June 24, 2015

Conference Room 130

Topic	Time	Staff
1. Introduction & TAC 5 Recap	8:30	Lyons
2. Avista Community Solar	8:35	Magalsky
3. 2015 Action Plan	9:15	Lyons
4. Final 2015 PRS	10:00	Gall
5. 2015 IRP Document Introduction	10:30	Staff
6. Lunch and Adjourn	11:30	

2015 Electric IRP
TAC Meeting Expectations and Schedule

John Lyons, Ph.D.
Sixth Technical Advisory Committee Meeting
June 24, 2015

Technical Advisory Committee

- The public process of the IRP – input on what to study, how to study, and review assumptions and results
- Technical forum with a range of participants with different areas of input and expertise
- Open forum, but we need to stay on topic to get through the agenda and allow all participants to ask questions and make comments
- Welcome requests for studies or different assumptions.
  - Time or resources may limit the amount of studies
  - The earlier study requests are made, the more accommodating we can be
  - January 15, 2015 was the final date to receive study requests
- Action Items – areas for more research in the next IRP

Technical Advisory Committee

- Technical forum on inputs and assumptions, not an advocacy forum
- Focus is on developing a resource strategy based on sound assumptions and inputs, instead of a forum on a particular resource or resource type
- We request that everyone maintain a high level of respect and professional demeanor to encourage an ongoing conversation about the IRP process
- Supports rate recovery, but not a preapproval process
- Planning team is available by email or phone for questions or comments between the TAC meetings
- Today is the final TAC meeting for the 2015 IRP.
- The TAC meetings for the 2017 IRP will start in the second quarter of 2016.

TAC #5 Recap

- Introduction & TAC 4 Recap – Lyons
- Review of Market Futures – Gall
- Ancillary Services Valuation – Shane
- Conservation Potential Assessment – Kester (AEG)
- Draft 2015 PRS & Portfolio Analysis – Planning Staff

Today's Agenda

- Introduction & TAC 5 Recap (8:30) – Lyons
- Avista Community Solar (8:35) – Magalsky
- 2015 Action Plan (9:15) – Lyons
- Final 2015 PRS (10:00) – Gall
- 2015 IRP Document Introduction – Planning Group
- Lunch and Adjourn (11:30)

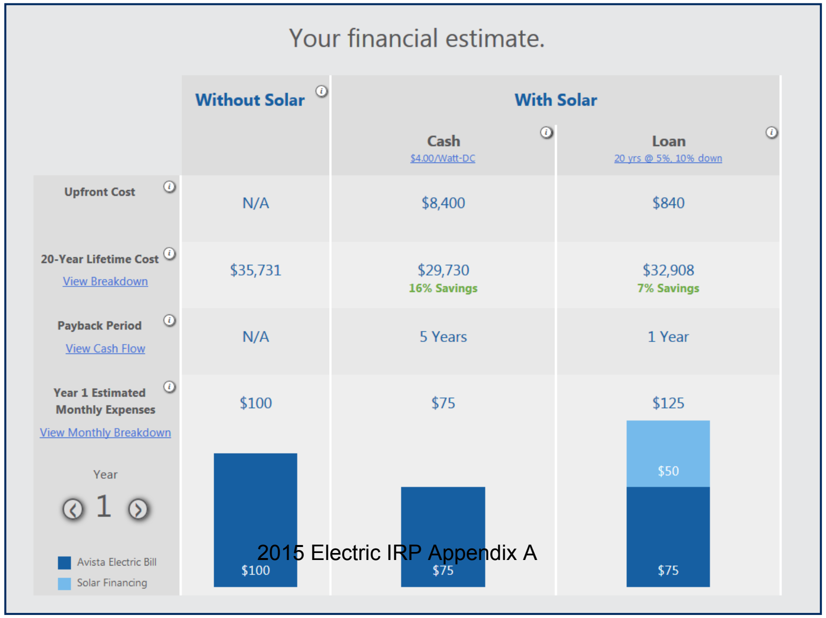
Solar Overview

Kelly Magalsky
Sixth Technical Advisory Committee Meeting
June 24, 2015

Concierge Model

www.avistautilities.com/solarestimator

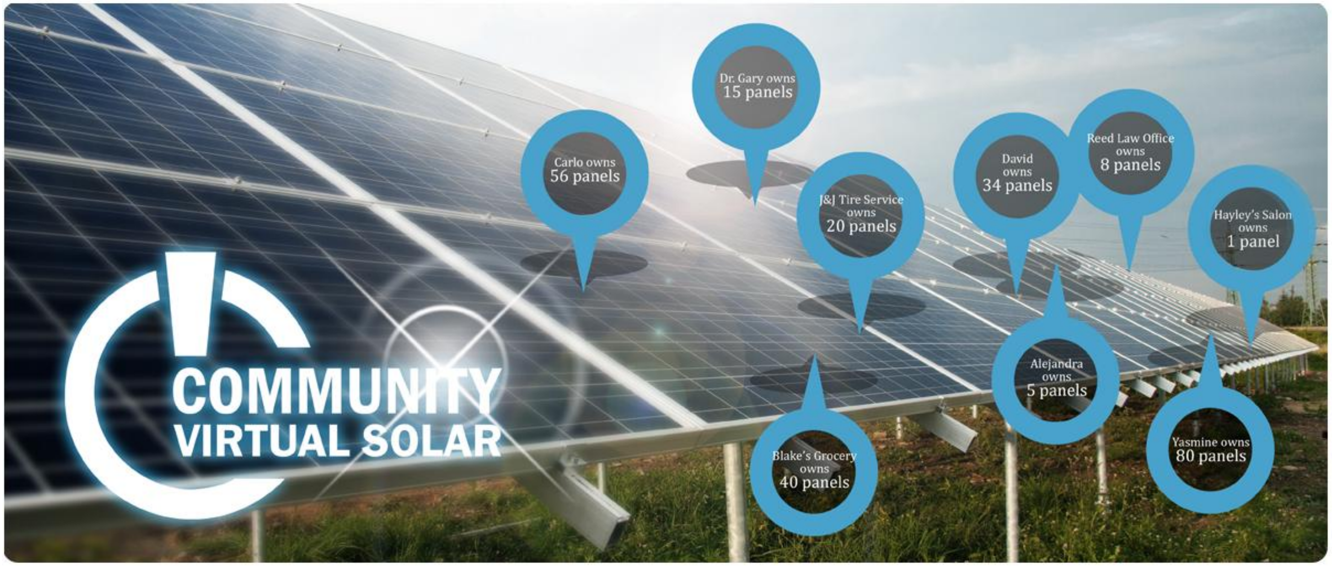
Solar Estimator



Avista Community Solar Project

Avista Community Solar Program

- Utility Owned 423 kW array (1,512 panels)
- Lottery to select customer/participants
- Expect 500 - 800 participants



- Site: Spokane Valley, WA
- Customer Enrollment: Now – July 17th

www.avistacommunitysolar.com or 1-800-923-9551

2015 Electric IRP Action Items

John Lyons, Ph.D.
Sixth Technical Advisory Committee Meeting
June 24, 2015

Generation Resource Related Analysis

- Analysis of the continued feasibility of the Northeast Combustion Turbine due to its age.
- Continue to review existing facilities for opportunities to upgrade capacity and efficiency.
- Increase the number of manufacturers and sizes of natural gas-fired turbines modeled for the PRS analysis.
- Evaluate the need for, and perform if needed, updated wind and solar integration studies.
- Participate and evaluate the potential to join a Northwest Energy Imbalance Market.
- Monitor regional winter and summer resource adequacy.
- Participate in state-level development of the Clean Power Plan.

Energy Efficiency

- Continue to study and quantify transmission and distribution efficiency projects as they apply to EIA goals.
- Complete the assessment of energy efficiency potential on Avista's generation facilities.

Transmission and Distribution Planning

- Work to maintain Avista's existing transmission rights, under applicable FERC policies.
- Continue to participate in BPA transmission processes and rate proceedings to minimize costs of integrating existing resources outside of Avista's service area.
- Continue to participate in regional and sub-regional efforts to facilitate long-term economic expansion of the regional transmission system.

Other 2015 Action Items

- Any areas of concern or suggestions?
- Please call or email the planning team with any suggestions or added Action Items.
- Can also make edits to the draft IRP when it is released.

2015 Electric IRP
Preferred Resource Strategy

James Gall
Sixth Technical Advisory Committee Meeting
June 24, 2015

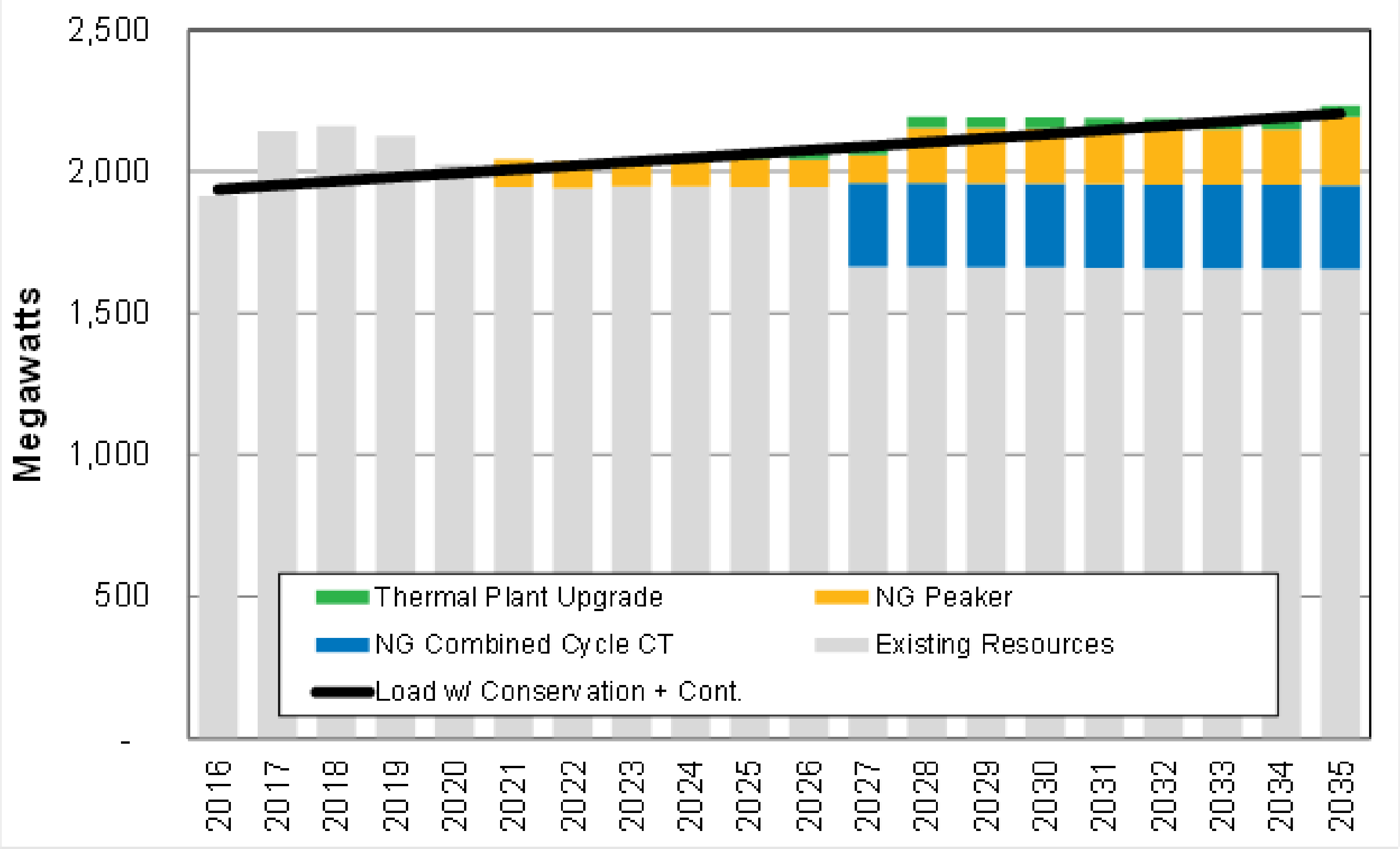
Introduction

- Discuss how Avista plans to meet resource deficits (PRS)
- No Changes to Preferred Resource Strategy since last TAC meeting
- Review tipping point analysis for resource options not selected in IRP

Tipping Point Analysis

- Lower resource costs to point PRiSM picks a different the resource in question, all capital costs are in 2014 dollars
- Utility Scale Solar:
  - *$1,300/kW would have to decline to $671/kW to be selected in 2022 (-48%)*
- Utility Scale Energy Storage:
  - *$2,736/kW, would have to decline to $770/kW in 2021 (-72%)*
- Demand Response:
  - *$217/kW-yr (levelized nominal) would have to decline to $117/kW-yr (-46%)*

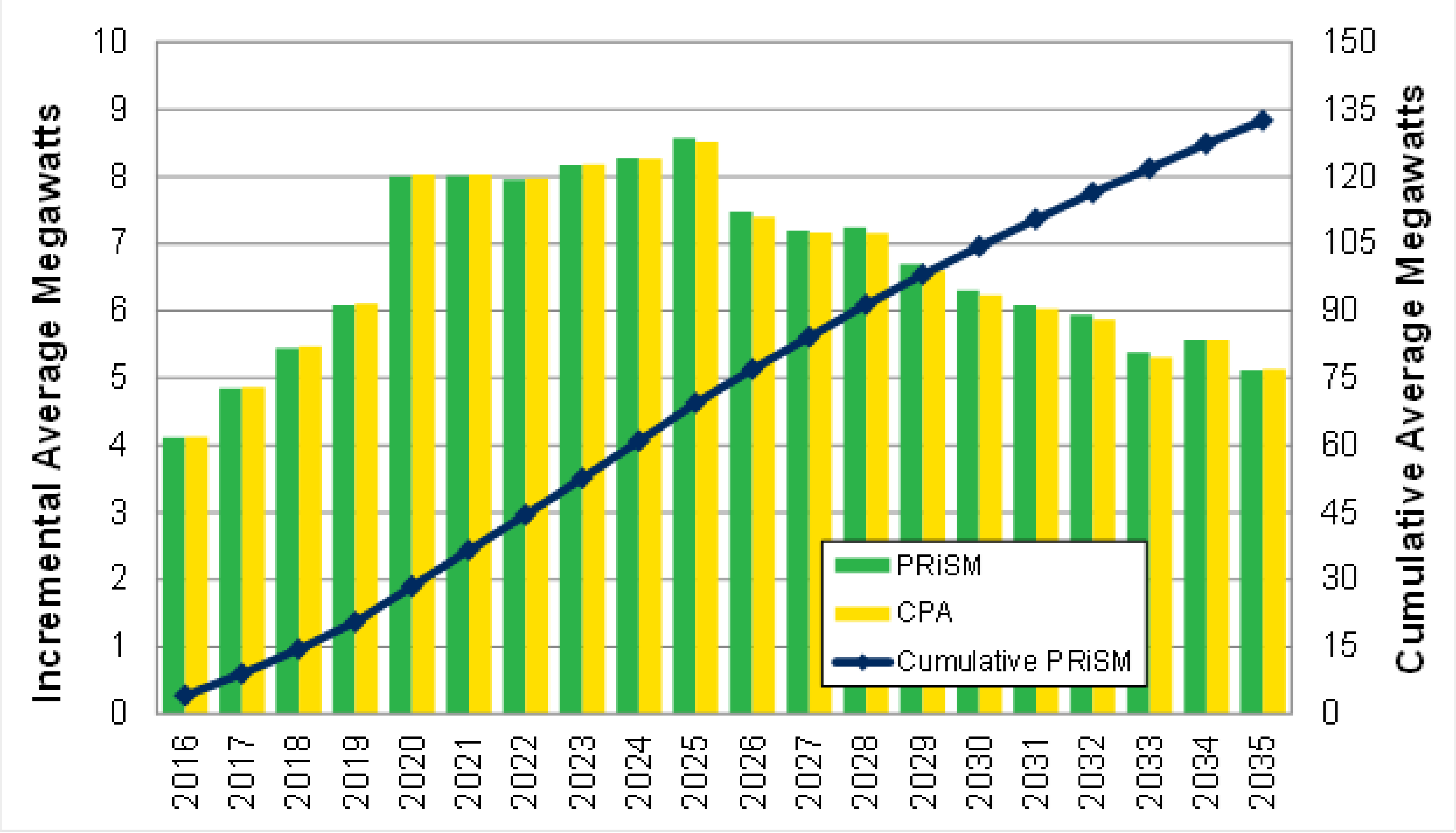
2015 IRP Load and Resource Additions



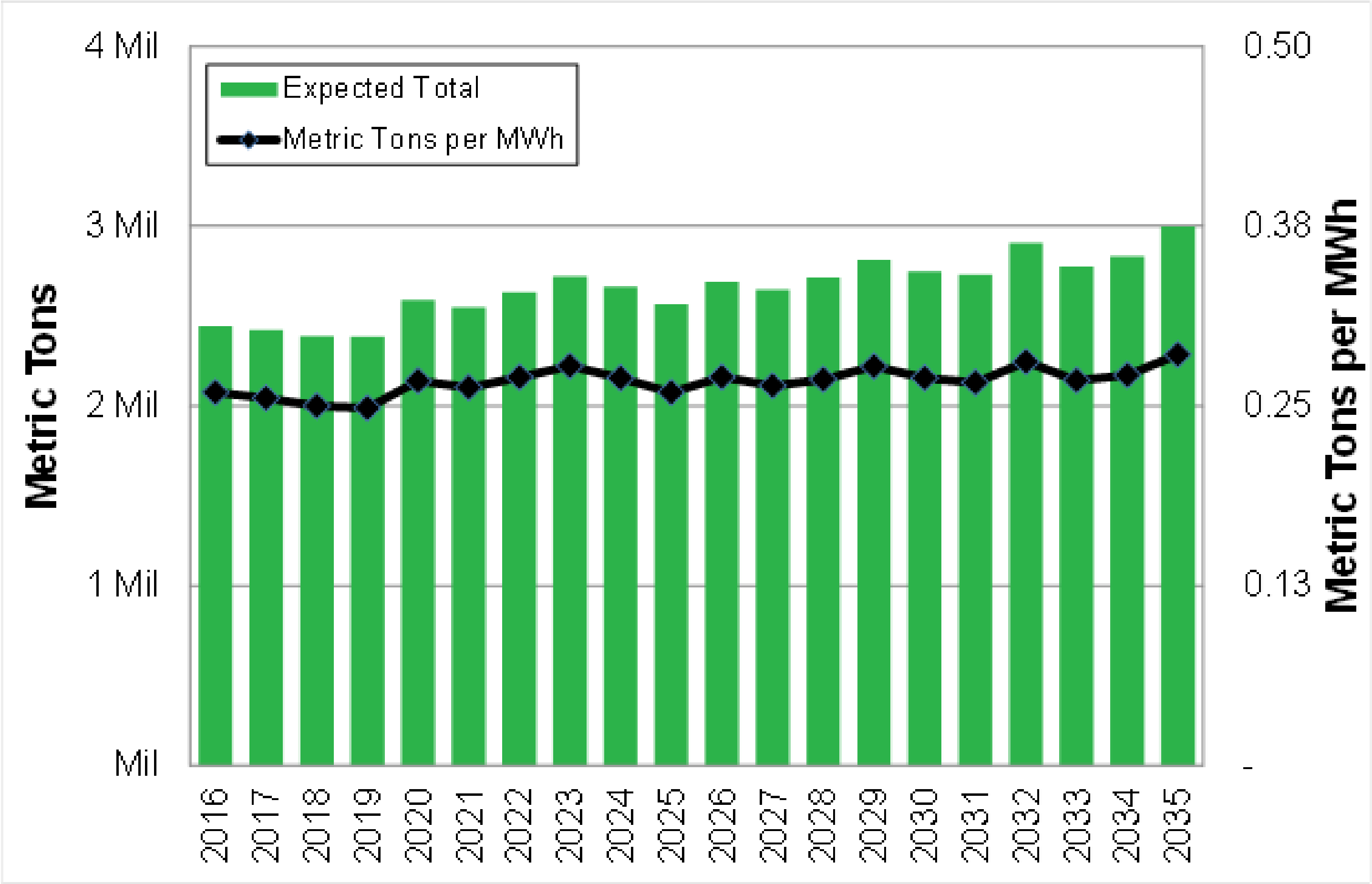
2015 IRP: Preferred Resource Strategy

Resource	By the End of Year	ISO Conditions (MW)	Winter Peak (MW)	Energy (aMW)
Natural Gas Peaker	2020	96	102	89
Thermal Upgrades	2021-2025	38	38	35
Combined Cycle CT	2026	286	306	265
Natural Gas Peaker	2027	96	102	89
Thermal Upgrades	2033	3	3	3
Natural Gas Peaker	2034	47	47	43
Total		**565**	**597**	**524**
Efficiency Improvements	**Acquisition Range**		**Winter Peak Reduction (MW)**	**Energy (aMW)**
Energy Efficiency	2016-2035		193	132
Distribution Efficiencies			<1	<1
Total			**193**	**132**

Conservation Forecast



Greenhouse Gas Emissions Forecast



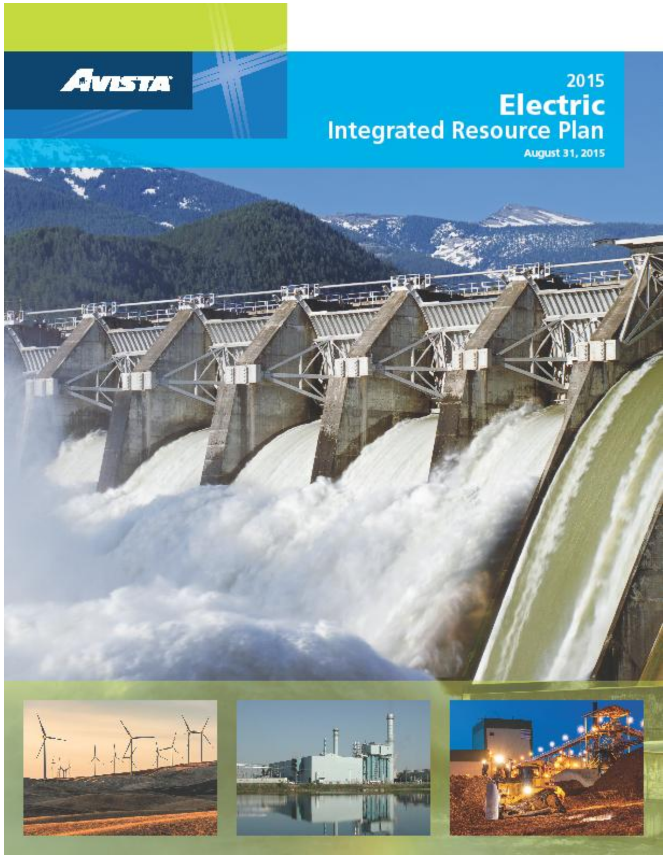
2015 Electric IRP Document Introduction

Planning Staff
Sixth Technical Advisory Committee Meeting
June 24, 2015

2015 Electric IRP Chapters

1. Executive Summary
2. Introduction and Stakeholder Involvement
3. Economic and Load Forecast
4. Existing Resources
5. Energy Efficiency and Demand Response
6. Long-Term Position
7. Policy Considerations
8. Transmission and Distribution Planning
9. Generation Resource Options
10. Market Analysis
11. Preferred Resource Strategy
12. Portfolio Scenarios
13. Action Plan

1. Executive Summary
2. Introduction and Stakeholder Involvement



3. Economic and Load Forecast

- Population and employment growth is starting to recover from the end of the Great Recession in 2009.
- The 2015 Expected Case's energy forecast grows 0.6 percent per year, replacing the 1.0 percent annual growth rate in the 2013 IRP.
- The retail sales forecast, residential use per customer continues to decline.
- Peak load growth is higher than energy growth, at 0.72 percent in the winter and 0.85 percent in the summer.
- Testing performed for this IRP shows that historical extreme weather events contain temperature extremes that are still valid for peak load modeling.

4. Existing Resources

- Hydroelectric represents about half of Avista’s winter generating capability.
- Natural gas-fired plants represent the largest portion of generation potential.
- Seven percent of Avista’s generating capability is biomass and wind.
- Nine Mile Falls rehabilitation and upgrade will be completed in 2016.
- 280 of Avista’s customers net meter 1.8 megawatts of their own generation.

5. Energy Efficiency and Demand Response

- Current Avista-sponsored conservation reduces retail loads by nearly 11 percent, or 127 aMW.
- 2015 IRP evaluates over 3,000 equipment options, and over 2,300 measure options covering all major end use equipment, as well as devices and actions to reduce energy consumption.
- This IRP co-optimizes conservation and demand response selection with generation resource options using our PRiSM model.

6. Long-Term Position

- Avista's first long-term capacity deficit net of energy efficiency is in 2021; the first energy deficit is in 2026.
- Avista uses a 14 percent winter planning margin in addition to meeting operating reserves for a 22.6 percent planning margin.
- The 2015 IRP meets all EIA mandates over the next 20 years with a combination of RECs, qualifying hydroelectric upgrades, Palouse Wind, and Kettle Falls.

7. Policy Considerations

- The 2015 IRP uses
  - existing carbon costs;
  - the goals of the Clean Power Plan proposal;
  - and a 10 percent probability of a carbon price to reduce greenhouse gas emissions.
- Scenario analyses address the impacts of the Clean Power Plan proposal by state and regionally, as well as various issues for Avista's Colstrip ownership interest.
- Avista's Climate Policy Council monitors greenhouse gas legislation and environmental regulation issues.

8. Transmission and Distribution Planning

- Avista actively participates in regional transmission planning forums.
- Avista System Planning transitioned from a biannual to an annual study process.
- Projects completed since the last IRP include new sections of transmission lines, and rebuilds and upgrades through the grid modernization project.
- Planned projects include reconductoring, and station rebuilds and reinforcements.
- Significant generation interconnection study work around Lind substation continues.

9. Generation Resource Options

- Only resources with well-defined costs and operating histories are options to meet future resource needs.
- Wind, solar and hydroelectric upgrades represent renewable options available to Avista.
- Upgrades to Avista’s Spokane and Clark Fork River facilities are included as resource options.
- Future requests for proposals might identify different technologies.
- Renewable resource costs assume no extensions of current state and federal incentives.

10. Market Analysis

- Natural gas, solar, and wind resources dominate new generation additions in the Western Interconnect.
- Clean Power Plan regulation could cause large price and costs swings, but without a final rule, the impacts are unknown.
- The Expected Case forecasts a continuing reduction of Western Interconnect greenhouse gas emissions due to coal plant shut downs brought on by federal and state regulations and low natural gas prices.

11. Preferred Resource Strategy

- Avista's first anticipated resource acquisition is a natural gas-fired peaker by the end of 2020 to replace expiring contracts and serve growing loads.
- A combined cycle combustion turbine replaces the Lancaster Facility when its contract ends in 2026.
- Upgrades to existing facilities help meet resource deficits.
- Energy efficiency offsets 52 percent of projected load growth through the 20-year IRP timeframe.

12. Portfolio Scenarios

- Lower or higher future loads do not materially change the resources strategy.
- Colstrip remains a cost-effective and reliable source of power to meet future customer loads.
- In the Without Colstrip in 2027 scenario, customer bills increase $68 million.
- A $19 per metric ton social cost of carbon market scenario increases customer's costs by $67 million per year levelized.
- Tipping point analysis suggests utility scale solar costs would need to decline another 48 percent to be in the Preferred Resource Strategy.

13. Action Plan

- Covered in earlier presentation

- Generation resource related analysis
- Energy efficiency
- Transmission and distribution planning

Remaining 2015 IRP Schedule

- July 10, 2015 – external draft released to TAC
- July 31, 2015 – external draft comments due
- August 28, 2015 – file final 2015 IRP with Commissions
- August 31, 2015 – 2015 IRP available to the public on Avista's web site
- Public comments period will be determined by the Commissions