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March 3, 2015

MEMORANDUM

TO: Power Committee

FROM: Charlie Grist, Tina Jayaweera, Kevin Smit

SUBJECT: Guidance on Conservation Supply Curves

BACKGROUND:

Presenter: Charlie Grist, Tina Jayaweera, Kevin Smit

Summary: Staff will provide results of the conservation potential assessment for the Seventh Power Plan. The assessment describes the energy, capacity, and cost characteristics of achievable conservation along with seasonal shape and annual availability characteristics. Staff seeks Council guidance on the suitability of the conservation potential assessment as draft plan inputs.

Initial results show the total 20-year achievable conservation potential is around 5,100 aMW (11,000 MW). Approximately 1,400 aMW (2,900 MW) is available in the first five-years, of which about 870 aMW (1550 MW) costs less than \$40/MWh. The cost and availability of conservation resources are inputs to the Regional Portfolio Model (RPM) along with characteristics data for generation and demand response resources. Later in plan development, the Council will consider RPM results and other factors to identify how much of the achievable potential is cost-effective and to inform Seventh Plan conservation targets.

The conservation potential assessment is composed of many measures that were also included in the Sixth Plan. Some Sixth Plan measures have been culled because they have been achieved or adopted into federal standards or state codes. Others have been dropped because of reduced

estimates of savings from updated stock assessments or technical analysis. On the other hand, many additional measures have been added to the Seventh Plan assessment due to developments in technology. Some notable new measures include: solid-state lighting, devices to control plug loads, variable refrigerant flow HVAC systems and efficient data center equipment. Finally, savings estimates used in the Sixth Plan have been revised based on the most recent updates from the Regional Technical Forum.

Two other factors influence the size of the remaining conservation potential. Regional conservation programs are forecast to achieve over 1600 aMW of savings between the adoption of the Sixth Plan in 2010 and the start of the Seventh Plan in 2016. In addition, recently adopted federal standards and state buildings codes are forecast to capture about 1400 aMW of savings from 2016 through 2035. Both of these factors contribute to lower load forecasts in the Seventh Plan.

The net result of the new assessment is that the total maximum achievable technical potential is about 1,500 aMW less than the Sixth Plan. However, as a percent of forecast loads, the potential is about the same as in the Sixth Plan. The distribution of savings by cost also is very similar to the Sixth Plan.

The development of the conservation potential assessment has benefitted from outside review. The Conservation Resources Advisory Committee has met nine times advising staff on key aspects of the assessment and approach. The Regional Technical Forum has reviewed many of the technical inputs. The analysis done by the staff is in a suite of about 80 measure workbooks. The measure workbooks are continuing to receive external review, primarily by Bonneville Power Administration and its contractors. Staff will continue to incorporate reviewer feedback and develop a few additional measure workbooks through the end of March. At that time, inputs will be available to the RPM. Staff does not anticipate significant changes from the results presented herein.

Relevance: This presentation provides the Council a preview of the results that will be inputs to the Regional Portfolio Model for the draft plan.

Workplan: 1D. Prepare for Seventh Power Plan and maintain analytical capability; update conservation supply curves.

Background: Early draft results for the conservation supply curves were discussed with the Power Committee of the Council for the Seventh Plan in the February 2015 meeting.

Conservation Resources

Council Meeting
March 10, 2015

Agenda

- **Definitions**
- **What the Data Represent**
- **Quick Methodology Overview**
- **Amount, Cost and Pace Findings**
- **Take-Aways**

Definitions

- **Achievable potential**
 - Maximum annual pace
 - Program year
- **Levelized cost**
- **Resource type**
 - Retrofit
 - Lost opportunity
- **Energy & capacity**

What the Data Represent

- **Inputs to RPM**
 - Achievable potential, cost & pace
 - These are not conservation targets
 - Cost-effectiveness & targets determined later
- **Numbers are not final!**
 - Ready for RPM at the end of March
 - Few additional measures to be added
 - Workbooks currently undergoing external review
 - We do not expect major shifts from today's data

The Basic Formula for Savings

Achievable Savings Potential =

Number Units * kWh savings per Unit * Achievable Penetration

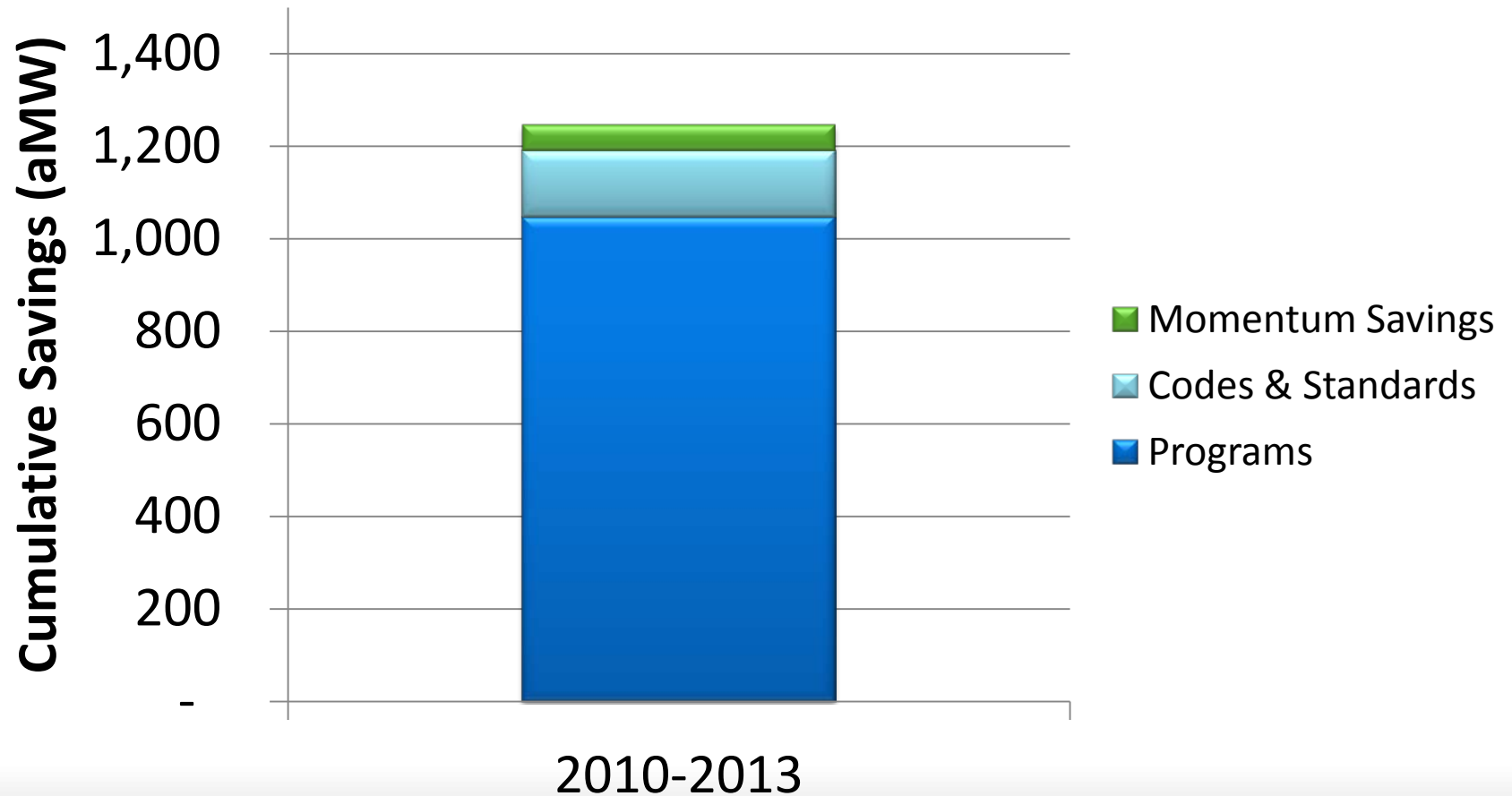
Examples:

- Number Homes
- Floor Area of Retail
- Number of Refrigerators
- Acres Irrigated
- Number transformers

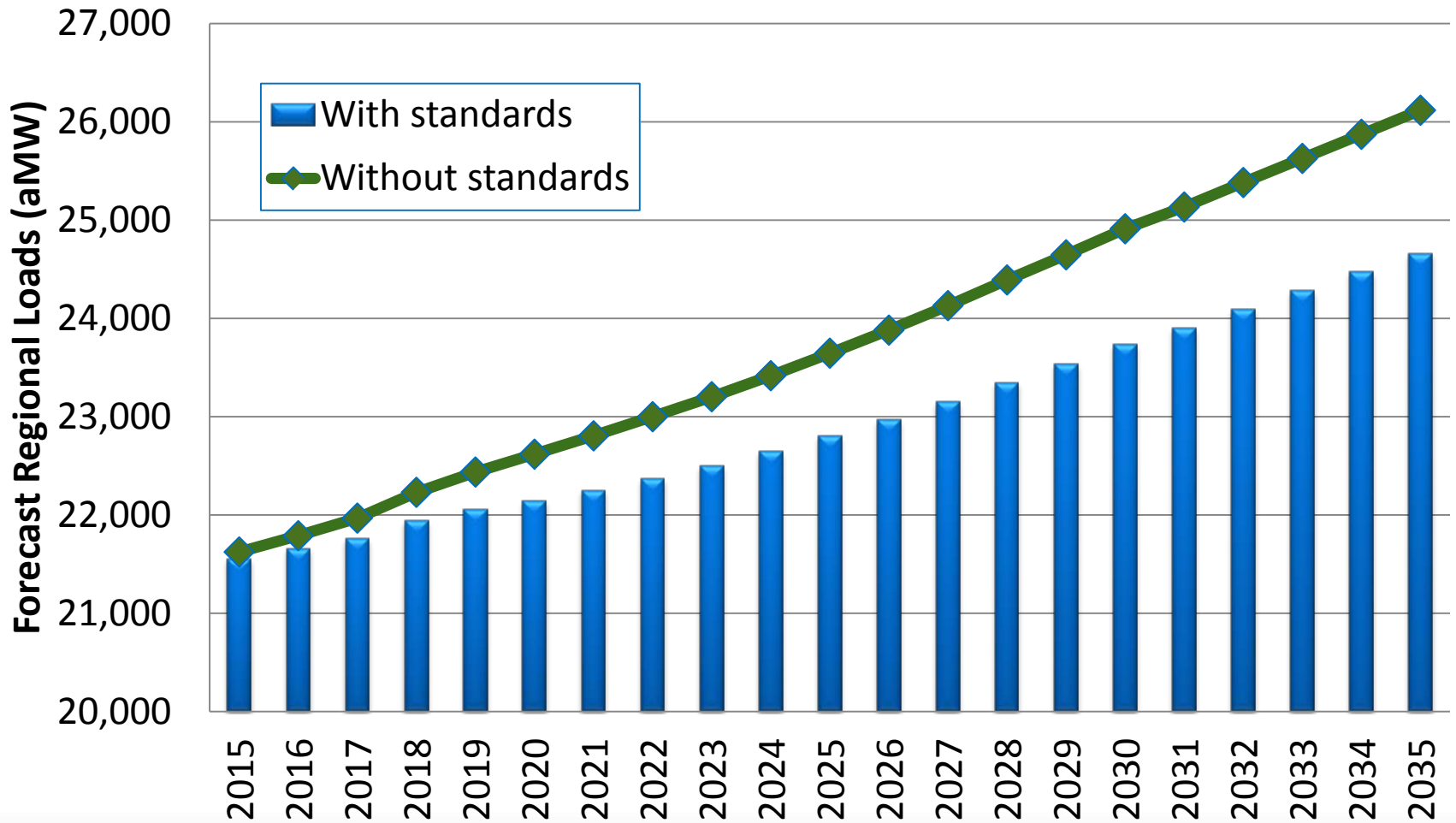
Fraction of available or remaining stock that is realistically achievable over time

(kWh/Unit at Baseline Efficiency – kWh/Unit at Improved Efficiency)

Sixth Plan Accomplishments Thru 2013

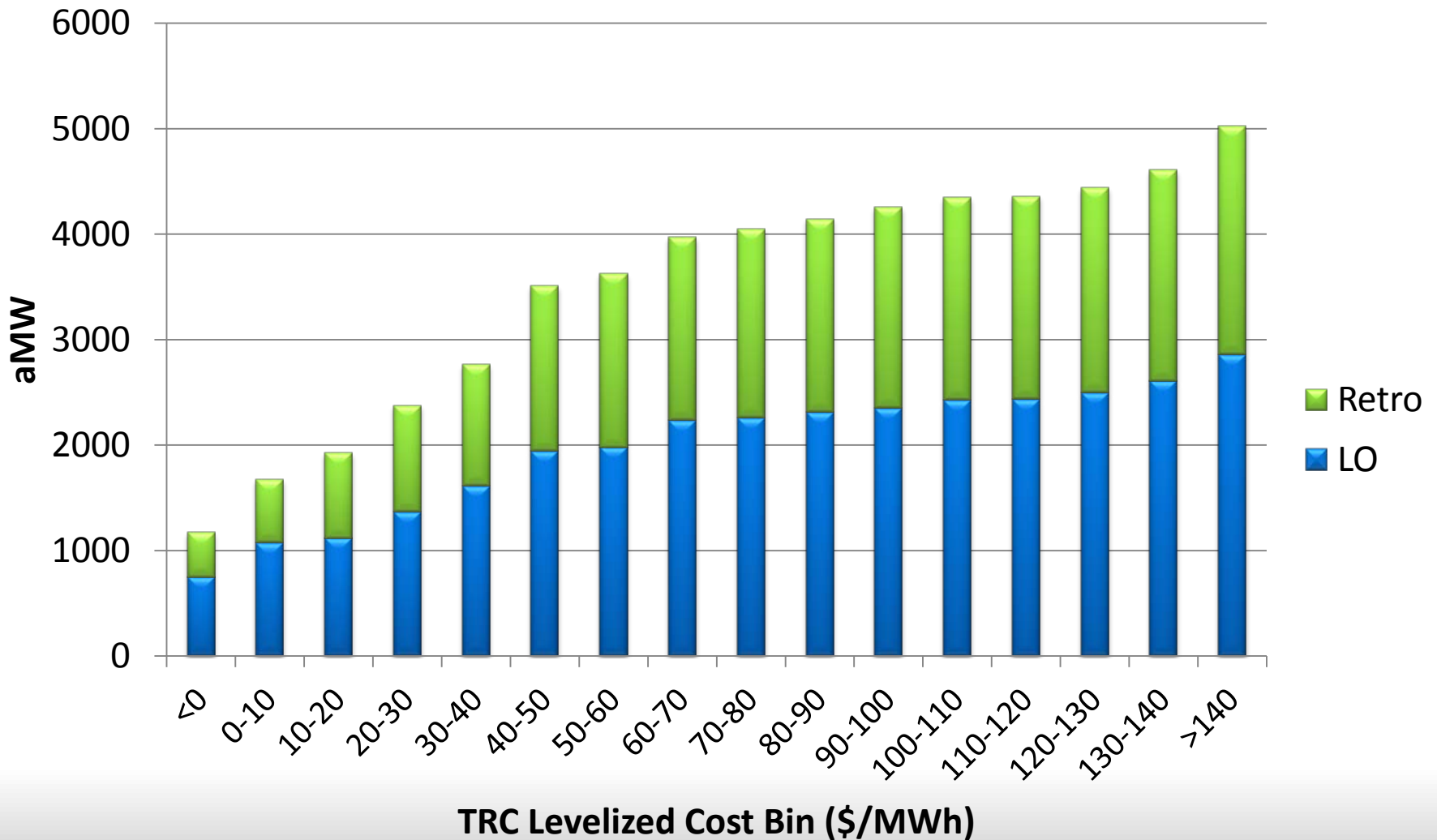


Impact of Federal Standards on Loads*

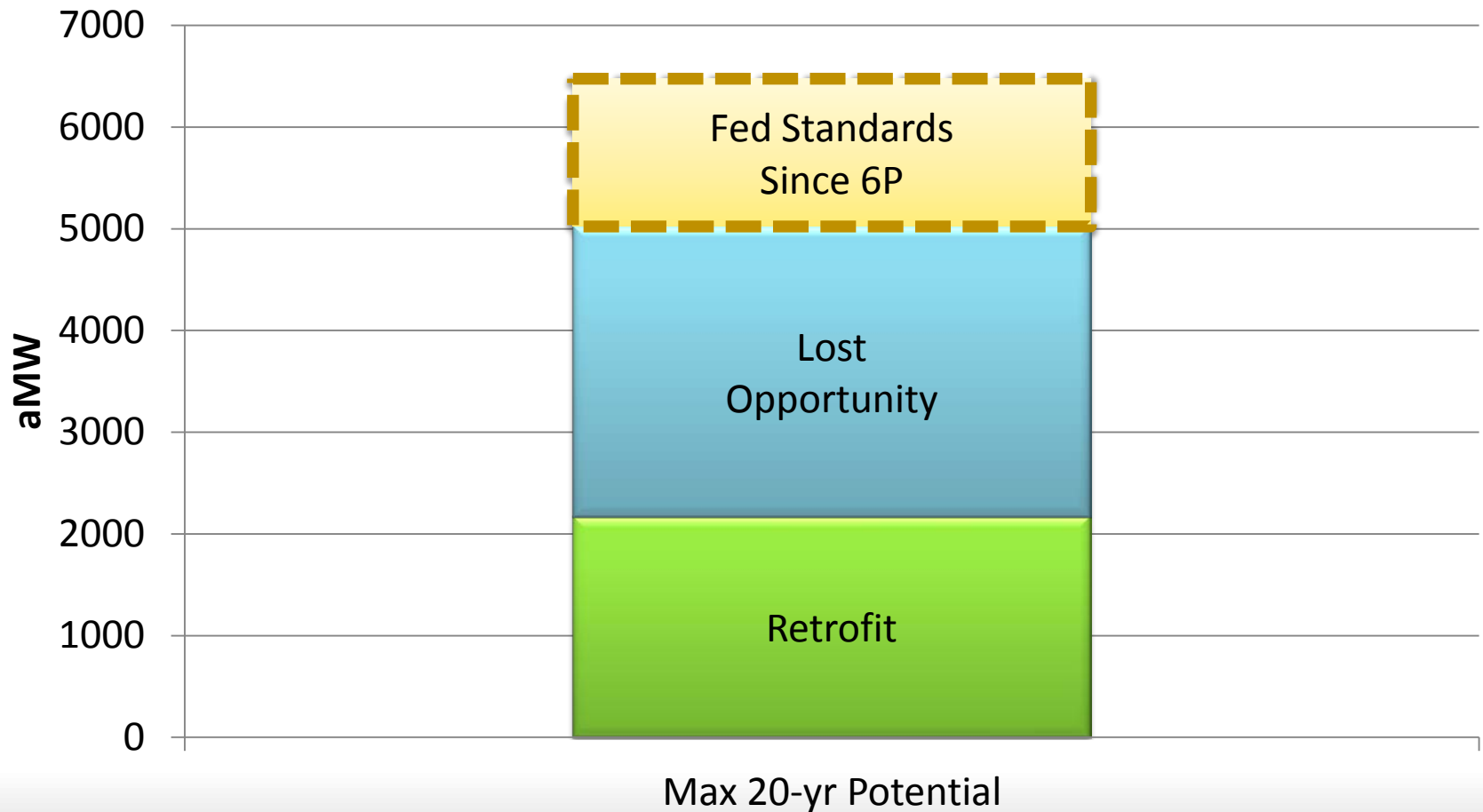




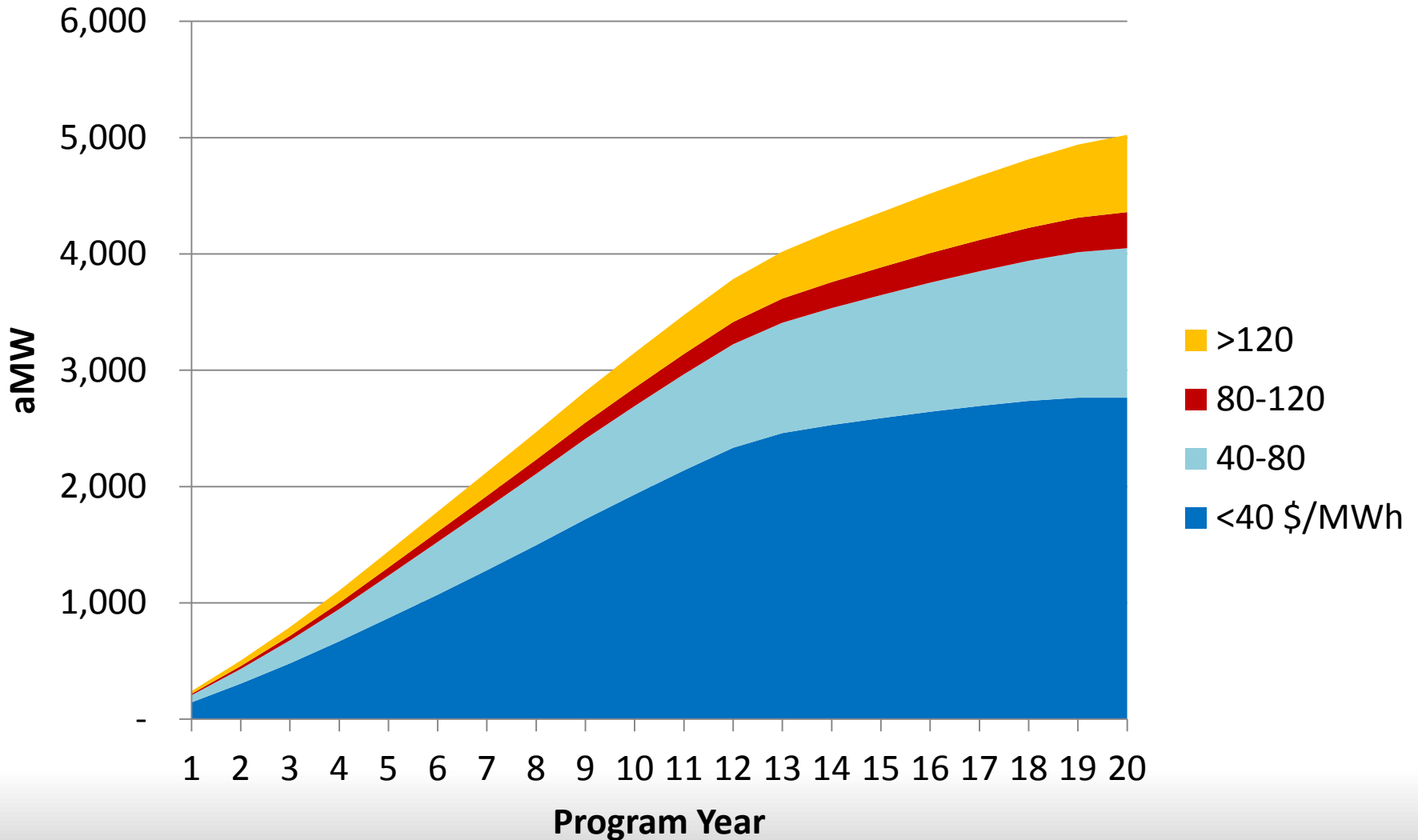
Preliminary 7P Supply Curve



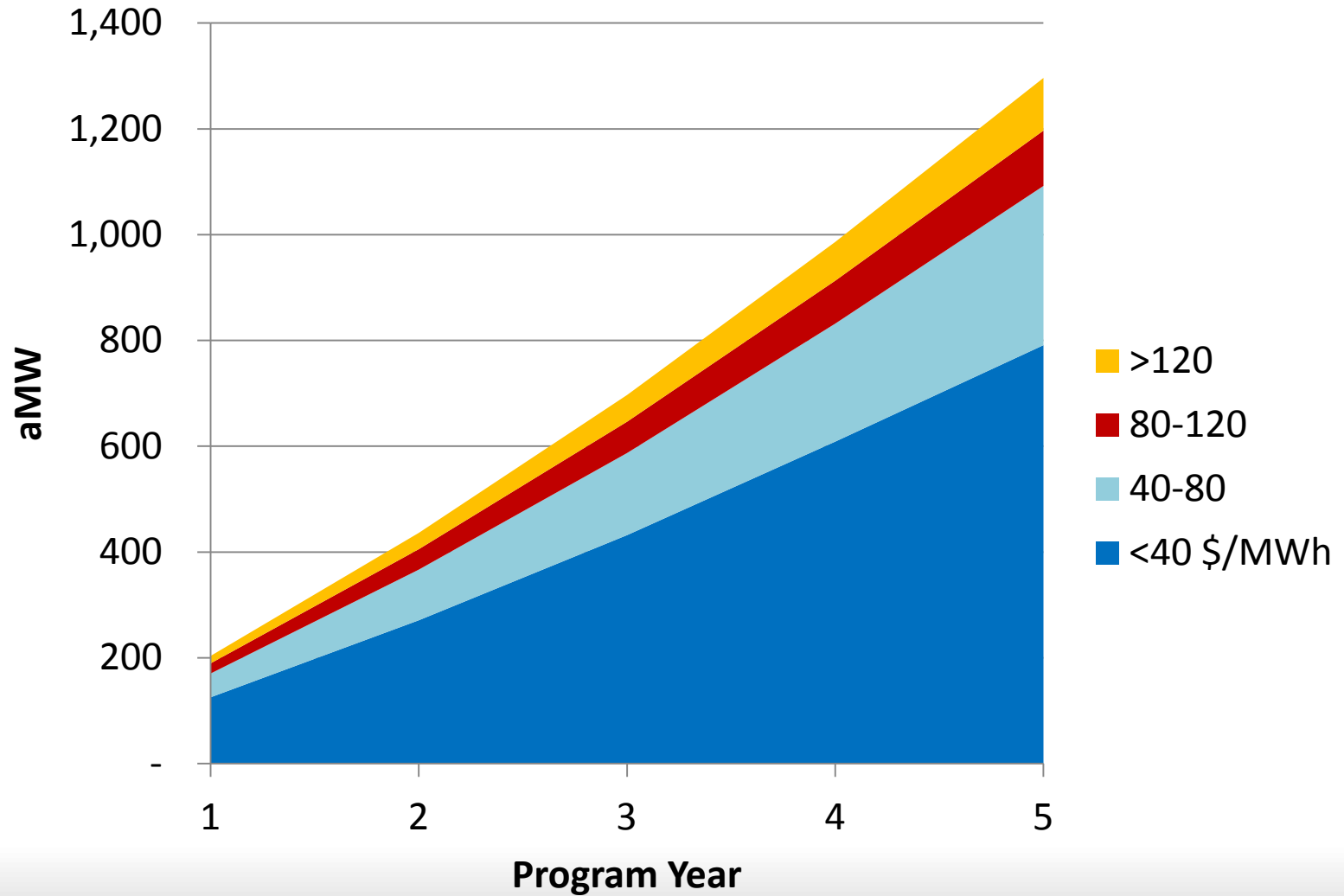
Total Possible Load Reduction



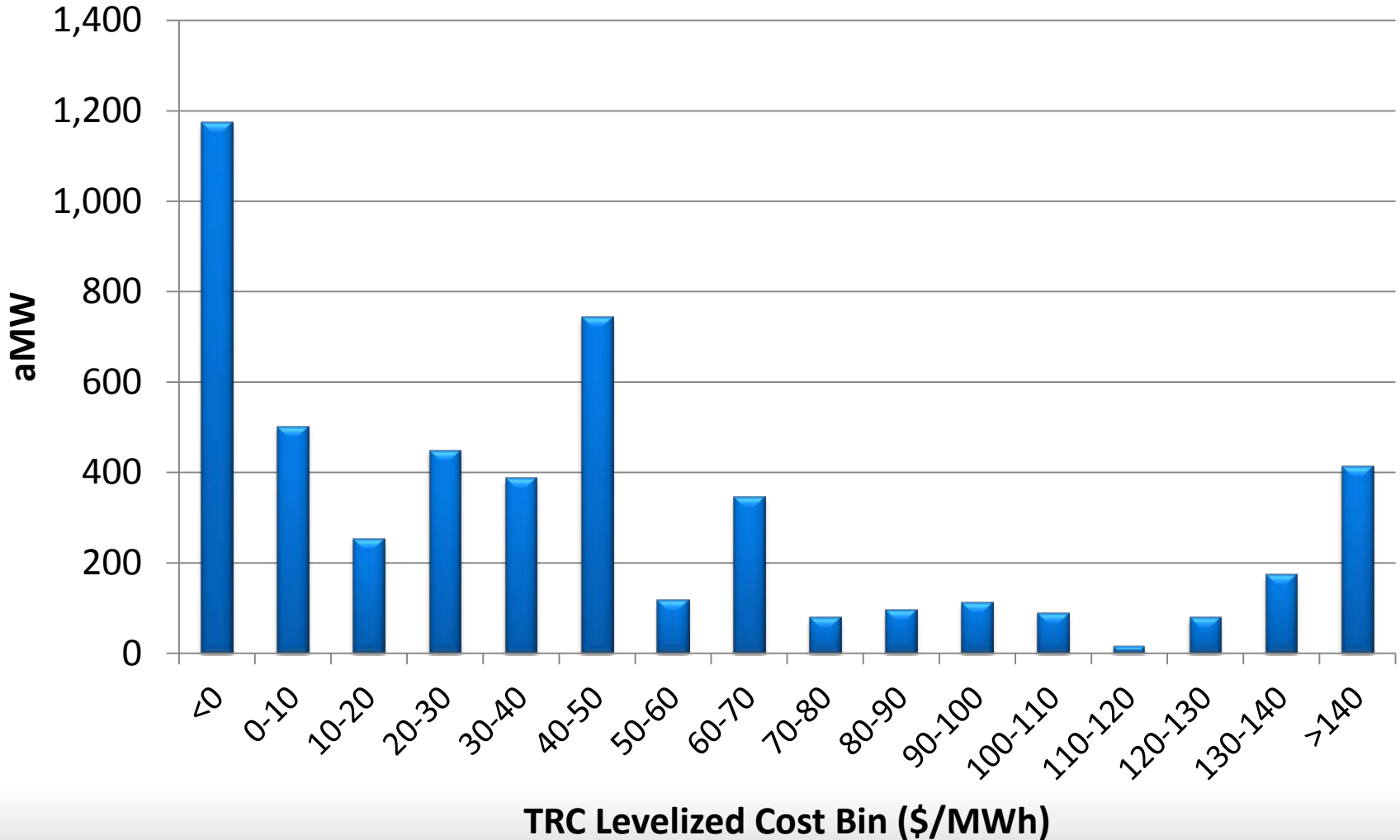
Cumulative Max Conservation by Cost Bin (20 years)



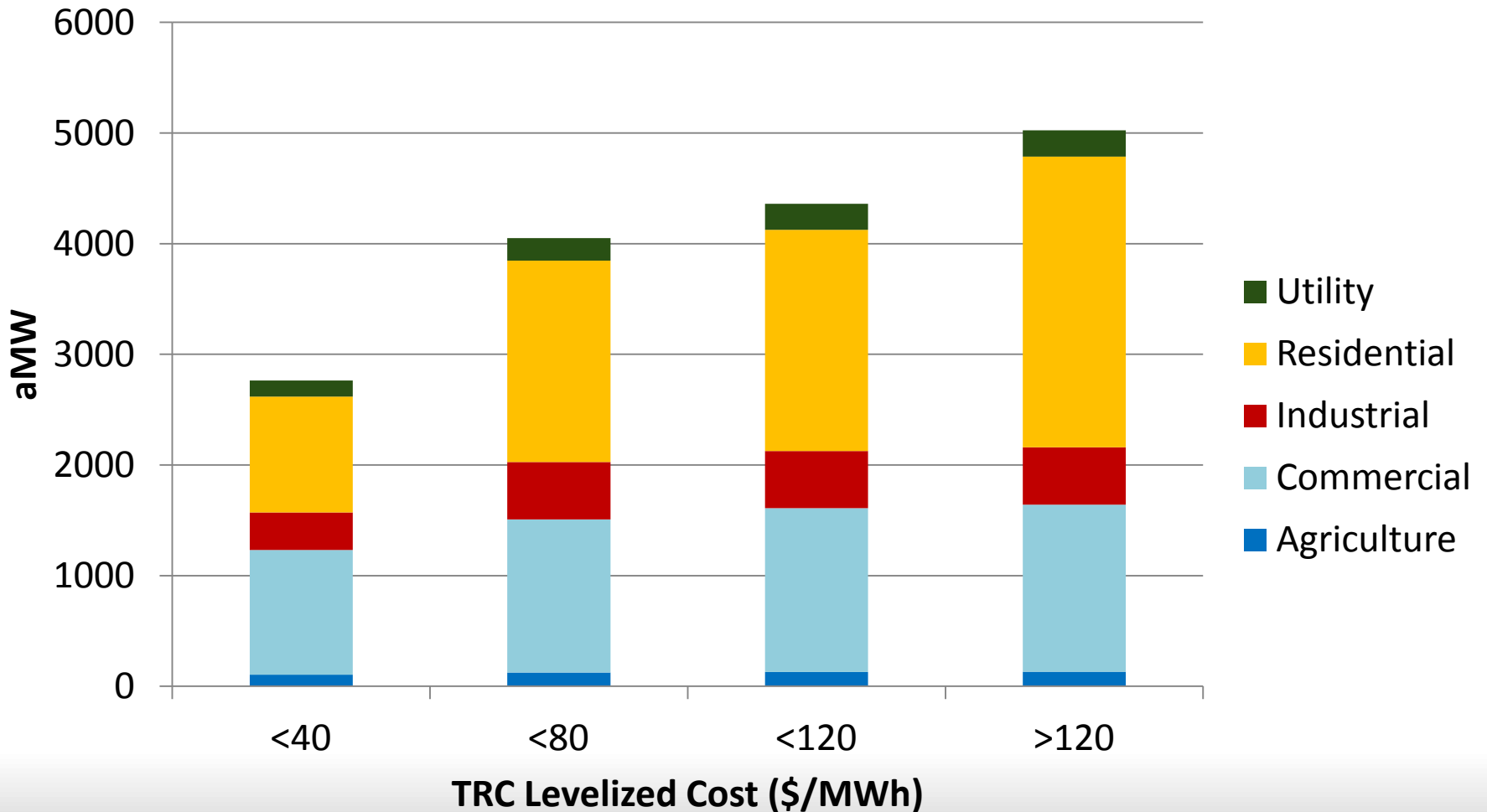
Cumulative Max Conservation by Cost Bin (5 years)



Seventh Power Plan Conservation Price Bin

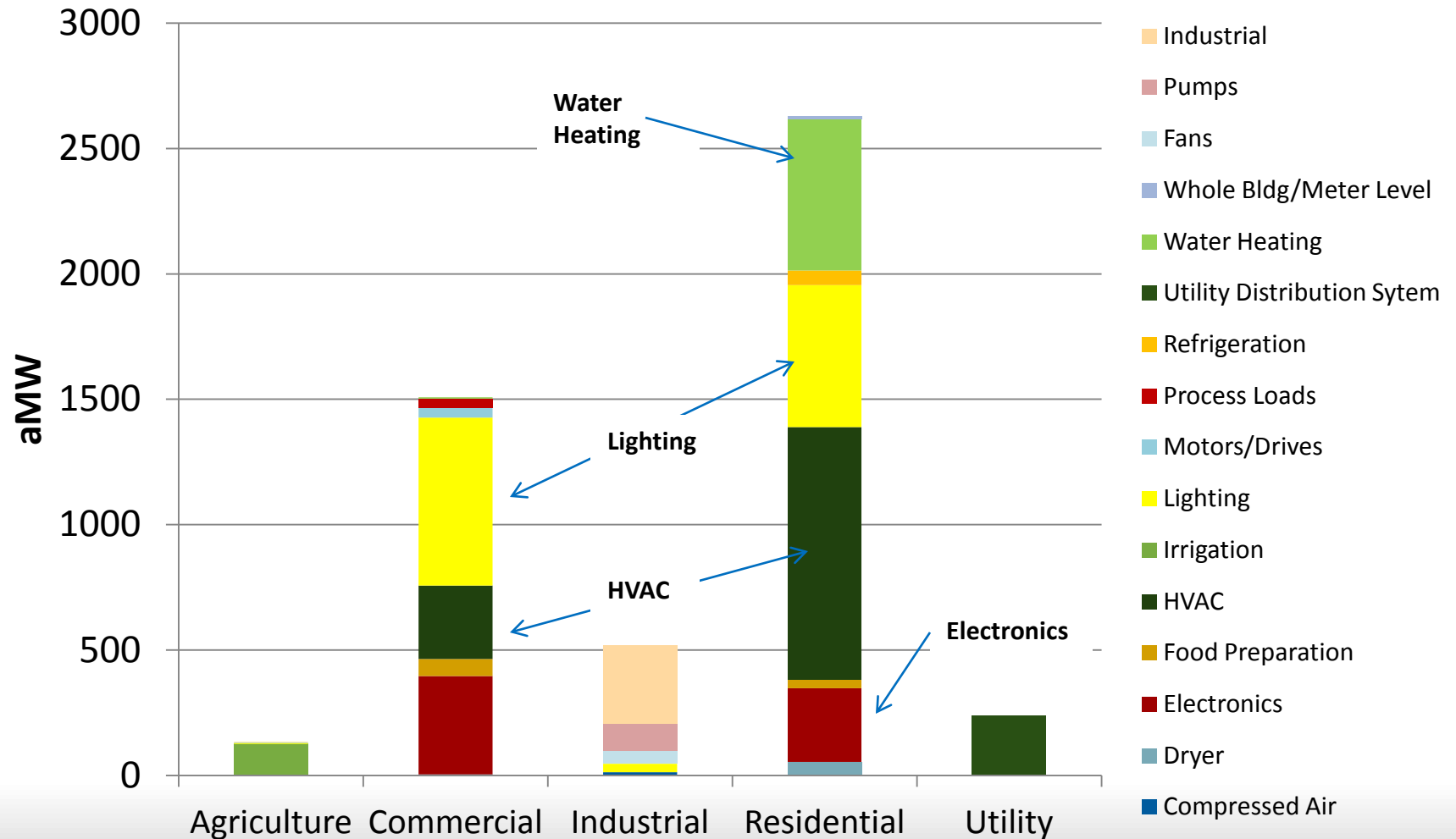


Max Achievable Conservation by Sector at Various Price Bins (Cumulative)



Max Achievable Potential by Sector and End Use

(All Cost Bins)

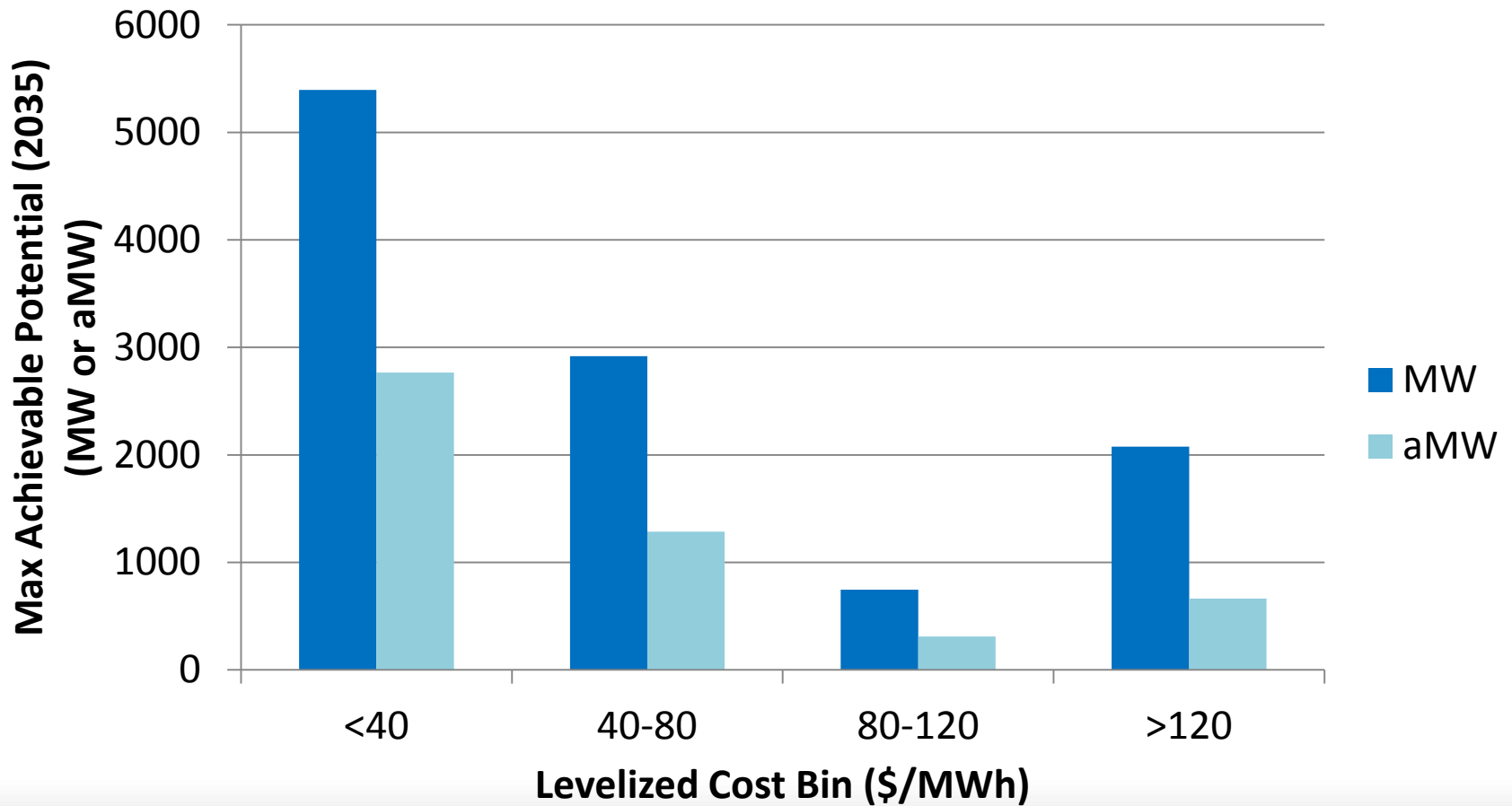


Measure List

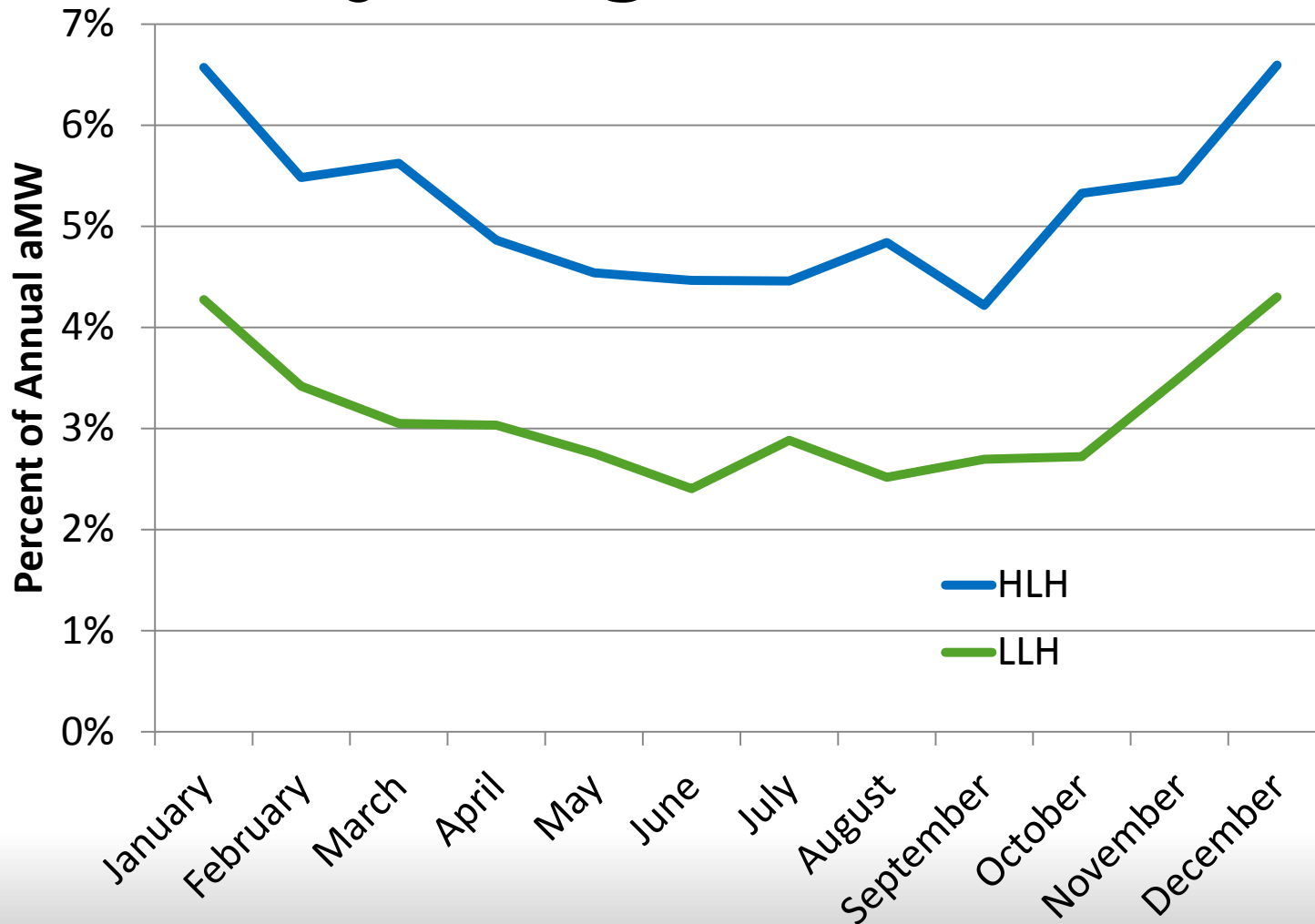
- Over 100 measures and around 1400 measure permutations analyzed across five sectors
- Significant new measures
 - Solid state lighting
 - Variable refrigerant flow HVAC systems
 - HP clothes dryer
 - Advanced power strips
- 6P measures removed or modified
 - TVs
 - Distribution system
 - Packaged refrigeration systems
 - New residential construction shell



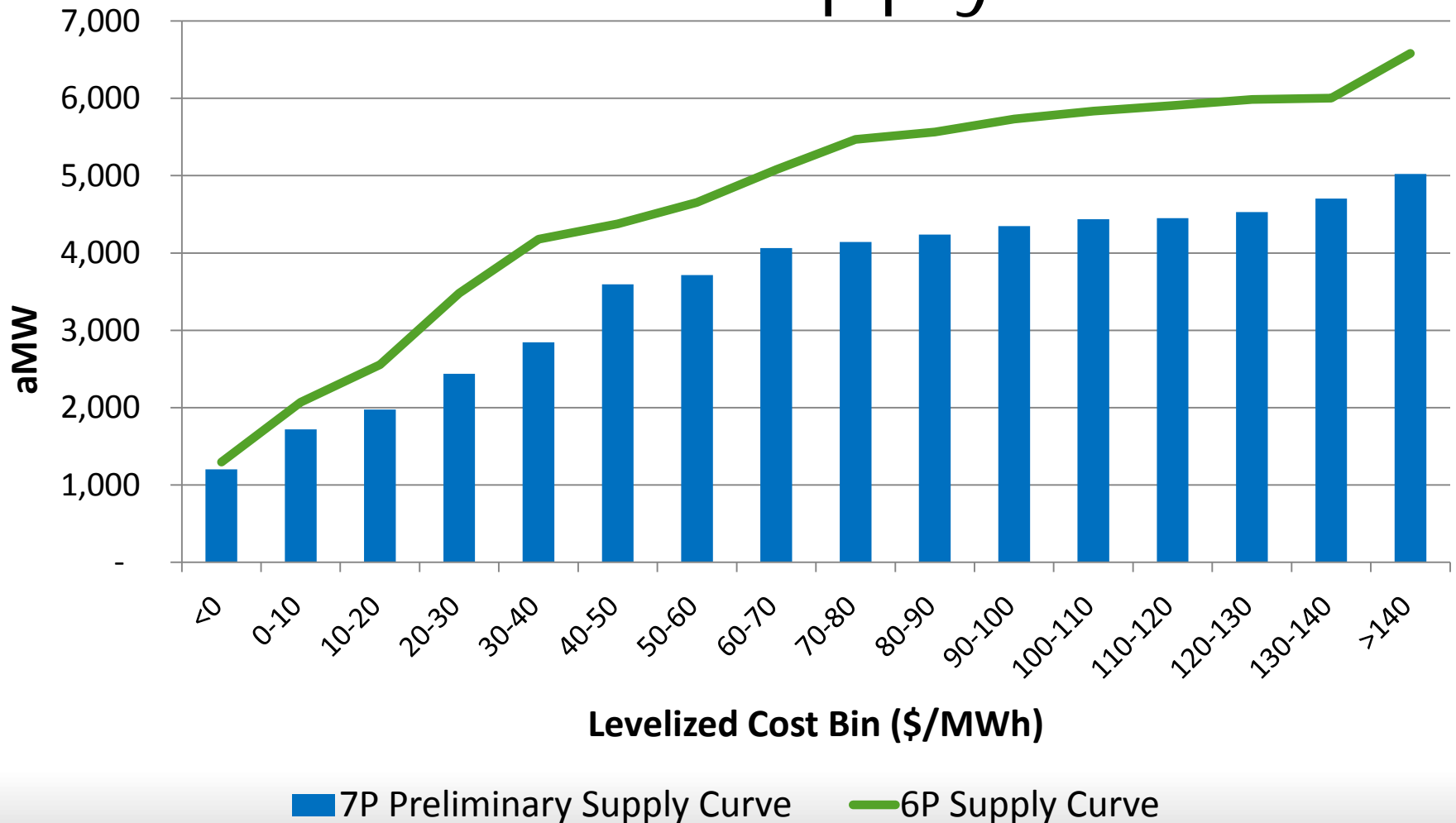
Winter Peak vs. Annual Energy



Savings Shape by Heavy & Light Load Hours



Sixth and Seventh Plan Conservation Supply Curves



Some Observations



- Over 5000 aMW identified – 20-year
- Similar cost profile to 6P
- Similar Retrofit potential to 6P
 - Although there have been lots of accomplishments, there are also new substantive measures
- Less Lost Opportunity potential – due to new codes & standards in place
- Similar measure set – a few new notables
- Significant impact on January single hour peak

Supplemental Slides

MEASURES IN THE SEVENTH PLAN CONSERVATION ASSESSMENT

Residential Measures

Total Achievable Potential Available by Year (aMW)



Residential	2025	2035
HVAC	439	820
ResWx	242	266
ASHP	34	122
Controls Commissioning & Sizing	14	50
DHP	40	143
DHP Ducted	66	158
Duct Sealing	30	34
GSHP	2	19
HRV	2	16
WIFI enabled tstats	9	12
Lighting	413	565
Lighting	351	503
Lighting PPA	62	62
Electronics	229	302
Advanced Power Strips	191	260
Computer	31	34
Monitor	7	8

Residential	2025	2035
Water Heating	255	613
Showerheads	96	121
HPWH	51	289
Behavior	34	45
Solar Water Heater	32	56
Clothes Washer	23	60
Aerator	17	33
Dishwasher	0	1
WasteWater Heat Recovery	1	8
Refrigeration	7	58
Refrigerator	6	55
Freezer	0	3
Food Preparation	15	34
Electric Oven	11	28
Microwave	4	6
Dryer	13	53
Clothes Dryer	13	53
Whole Bldg/Meter Level	1	7
EV Supply Equip	1	7
Grand Total	1,371	2,453

Commercial Measures

Total Achievable Potential Available by Year (aMW)

Commercial	2025	2035	Commercial	2025	2035
Lighting	429	682	Refrigeration	65	77
LPD Package	200	382	Grocery Refrigeration Bundle	56	63
Low Power LF Lamps	38	39	Water Cooler Controls	9	13
Lighting Controls Interior	14	38	Food Preparation	19	67
Exterior Building Lighting	116	143	Cooking Equipment	18	66
Street and Roadway Lighting	47	60	Pre-Rinse Spray Valve	1	1
Parking Lighting	9	9	Process Loads	41	49
Bi-Level Stairwell Lighting	4	11	Municipal Sewage Treatment	29	35
Electronics	263	392	Municipal Water Supply	12	14
Data Centers	185	261	Motors/Drives	16	39
Smart Plug Power Strips	41	47	ECM-VAV	12	34
Desktop	25	56	MotorsRewind	4	5
Monitor	11	24	Compressed Air	2	4
Laptop	1	4	Compressed Air	2	4
HVAC	166	371	Water Heating	4	5
Advanced Rooftop Controller	72	119	Showerheads	4	4
Commercial EM	37	77	WHTanks	1	2
DCV Parking Garage	11	13	Grand Total	1,004	1,687
Demand Control Ventilation	15	29			
Secondary Glazing Systems	14	40			
VRF	15	88			
Premium Fume Hood	1	4			

Agriculture Measures

Total Achievable Potential Available by Year (aMW)

Agriculture	2025	2035
Irrigation	87	125
Irrigation Hardware	47	54
Irrigation Pressure	9	26
Irrigation Water Mgmt	23	23
Irrigation Efficiency	7	22
Lighting	3	4
Dairy	0	0
Lighting	3	3
Motors/Drives	3	3
Dairy	0	0
Irrigation Motor	3	3
Refrigeration	1	1
Dairy	1	1
Grand Total	93	133



Industrial Measures

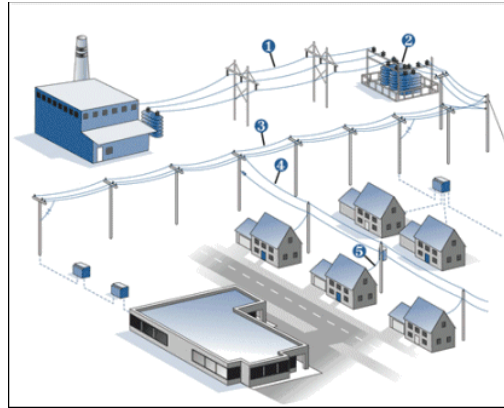
Total Achievable Potential Available by Year (aMW)



Industrial	2025	2035
Pumps	92	108
Fans	45	54
Energy Project Management	80	95
Integrated Plant Energy Management	43	86
Lighting	30	34
Plant Energy Management	40	45
Food Processing	15	17
Food Storage	13	14
Compressed Air	11	12
Material Handling	16	19
Hi-Tech	8	10
Pulp	6	13
Paper	3	6
Wood	6	7
Metals	0	1
Grand Total	407	519

Utility System Measures

Total Achievable Potential Available by Year (aMW)



Utility	2025	2035
Utility Distribution System	155	236
LDC voltage control method	60	92
Light system improvements	35	53
Major system improvements	38	58
EOL voltage control method	20	30
SCL implement EOL w/ major system improvements	1	2
Grand Total	155	236