



# 2021 IRP DSM Technical Workshop

April 16, 2020



# Agenda



- Schedule & Milestones
- Stakeholder Feedback
- Recap of Key Discussion Topics from February 18, 2020 CPA Workshop #2
- Drivers of Difference in Forecasted Potential by State
  - Baseline Load Considerations and Effects on Potential
  - Market Profiles: Sector Level Drivers
  - Other Drivers of Difference
- Next Steps



# Schedule and Milestones

Throughout the 2021 CPA development process, we will continue to request feedback from interested parties.

- As of **April 14, 2020**, we have received seven feedback forms.

Timeframe	Milestone	Public Input Request
December 20, 2019	Share Work Plan	Provide input on scope (2 forms)
January 21, 2020	Present on Scope of Work	Additional input on scope (0 forms)
January 31, 2020	Share Draft EE & DR Measure List	Provide feedback on included measures (5 forms)
February 18, 2020	Present on Measure List	Ask questions and provide feedback by end of month.
April 15, 2020	Finalize Measure List and Sent to Stakeholders	n/a – feedback incorporated
April 16, 2020	Share Key Drivers of Potential and Assumptions	Participate in meeting, provide input on key drivers
August 2020	Present Draft Results and Share Measure Data	Review materials and provide feedback
September 2020	Present feedback received and planned updates	Participate in meeting, provide input on planned updates
October 2020	Present final CPA Results	Participate in meeting
Early January 2021	Draft CPA Report for Review	Provide input on draft report
March 2021	Publish Final Report	n/a – feedback incorporated

We are here



# Stakeholder Feedback



# Measure List Feedback



Received three stakeholder feedback forms on the measure list

\* Feedback will be considered through April 30, 2020

Stakeholder	Comment	Response
UCE/SWEEP	Provide clarification on how emerging technologies are treated and whether cost reductions are considered.	AEG and PacifiCorp will explore the possibility of modeling cost declines for emerging technologies
UCE/SWEEP	Recommend excluding measures from the “emerging technologies” measure category that are commercially available, even if they have low market penetration.	AEG has removed this from the definition of emerging technologies for the 2021 CPA. This updated definition also resolved several other comments that certain measures should not be “emerging”
WA UTC Staff	Consolidate sector level measure lists and provide explanation of crosswalks	AEG consolidated the two measure tabs for each sector into one list and clarified the purpose of the crosswalks.
WA UTC Staff	Group measures by PacifiCorp Program Option to indicate which measures would be new to the program	This will be done as part of the measure characterization process and shared in the measure database when the analysis is complete
WA UTC Staff	Measure list does not contain quantitative savings by measure	The intent of the measure list review is to provide stakeholders with an opportunity early in the process to provide input on the list of DSM measures that will ultimately be considered in the CPA. Research on savings and costs are currently being conducted and will be made available to interested stakeholders
Utah Valley Earth Forum	Provided a list of measures to consider, including renewable and demand response measures	AEG provided responses to UVEF clarifying the intent of this measure list as an energy efficiency and demand-response measure list only. For the energy efficiency measures suggested, AEG clarified if the measure list already includes that or why it was not included.



# Recap of Key Discussion Topics from February 18, 2020 CPA Workshop #2





# Grid Services

## Demand response reclassification to Grid Services

- **Contingency Reserve**
  - Spin and Non-spin
  - In the 2019 IRP, an Operating Credit adjustment applied in System Optimizer (SO).
- **Regulation Reserve**
  - Regulating reserve – Operating Credit adjustment in SO (2019)
  - EIM Participation
    - The PaR model does not capture sub-hourly dispatch. In the 2019 IRP, PAC proposed an intra-hour flexible reserve credit; but was not used for portfolio selection.
- **Frequency Response**
  - In the 2019 IRP, the preferred portfolio has more than adequate frequency response capability without incenting adoption via credits, but credits may be appropriate if expected capability becomes insufficient.
- **Interruptible Load**
  - Assumed in the CPA as part of the measure development.
- **Load Shift**
  - Assumed in the CPA as part of the measure development.

Demand Response Program Options and Descriptions				PacifiCorp Grid Services Eligibility Mapping							
Program Option	Eligible Customer Segments	Mechanism / Description	Current Offering?	Capacity & Energy	Regulation	EIM Capacity & Energy	EIM Capacity & Energy FMM	EIM Capacity & Energy RTD	Non Spinning Reserves	Spinning Reserves	Frequency Response
Direct Load Control (DLC) of Central Air Conditioners	Residential, Small C&I, Medium C&I	DLC switch installed on customer's equipment.	Utah	X	X	X	X	X	X		

# Grid Services Performance Characteristics



All demand response programs and measures have been mapped to grid services based on their ability to meet the required performance characteristics of those services

## *Grid Services Performance Characteristics*

Grid Services	DR Products	Lower Limits			Upper Limits			For Eligibility		
		MIN Advance Notice (mins)	MIN Time to Full Deployment (mins)	MIN Duration (mins)	MAX Advance Notice (mins)	MAX Time to Full Deployment (mins)	MAX Duration (mins)	Advance Notice (seconds)	Full Deployment (seconds)	Duration (seconds)
Capacity & Energy	Capacity & Energy	55	55	60	1,440	1,440	60	86,400	86,400	3,600
Regulation	Regulation	1	29	1	29	30	60	1,740	1,740	3,600
Flexibility & Regulation	EIM Capacity & Energy	53	60	60	53	60	240	3,150	3,600	14,400
Flexibility & Regulation	EIM Capacity & Energy FMM	23	15	15	23	15	60	1,350	900	3,600
Flexibility & Regulation	EIM Capacity & Energy RTD	3	5	5	3	5	20	150	300	1,200
Non-Spinning Reserves	Non Spinning Reserves	10	10	60	10	10	60	600	600	3,600
Spinning Reserves	Spinning Reserves	0.07	10	60	0.983	10	60	4	600	3,600
Frequency Response	Frequency Response	0.07	0.017	1	0.983	0.983	1	4	59	60



# Finalization of Customer-Sited Energy Storage DR Measure

## Measure Description

- Incentive provided to customers to allow PacifiCorp to remotely discharge batteries during a peak DR event
  - For residential customers, the study will use lithium ion batteries similar to a Tesla Powerwall
  - For commercial and industrial, the study will use an array of lithium-ion batteries sized to meet a portion of customer load

## Program Characteristics

- Opt-in participation for customers who own qualifying battery storage
- Customers must use the battery for onsite energy management and back-up power only
- PacifiCorp will send a signal to customers, with notification time varying by the type of grid service needed
  - Eligible grid services are being evaluated with consideration to customer satisfaction
- PacifiCorp will control the discharge of the battery during the event

## Potential Event Characteristics

- Participating batteries will be controlled by event signal
- Batteries will be discharged only to the manufacturer's recommended minimum charge level or to a level that reflects a customer resiliency reserve depending on program characteristics.



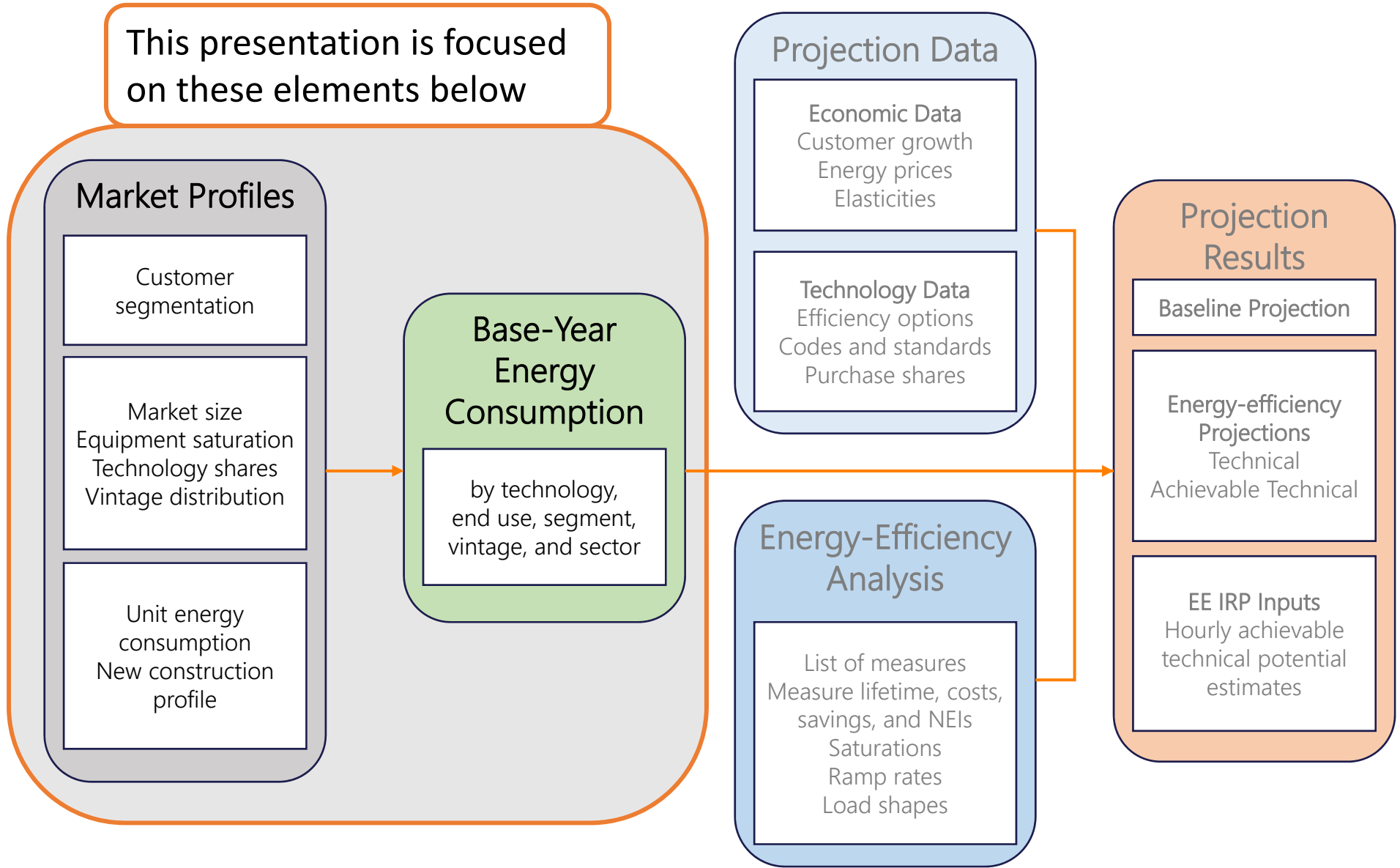
# Drivers of Difference in Forecasted Potential by State





# CPA Methodology (Except OR)

This presentation is focused on these elements below



# Overview of Key Drivers of Differences Between States



- Technical Drivers:

- Load Forecasts by Sector
- Sub-Sector Share of Load
- Sector Specific Measures
- Climate
- Equipment Saturations
- Measure Sources
- Ramp Rates

This CPA workshop is focused on these technical drivers

- Other Drivers:

- Cost-Effectiveness Requirements by State
- Measure Sourcing Requirements'
- Stringency of Local Building Codes and Standards

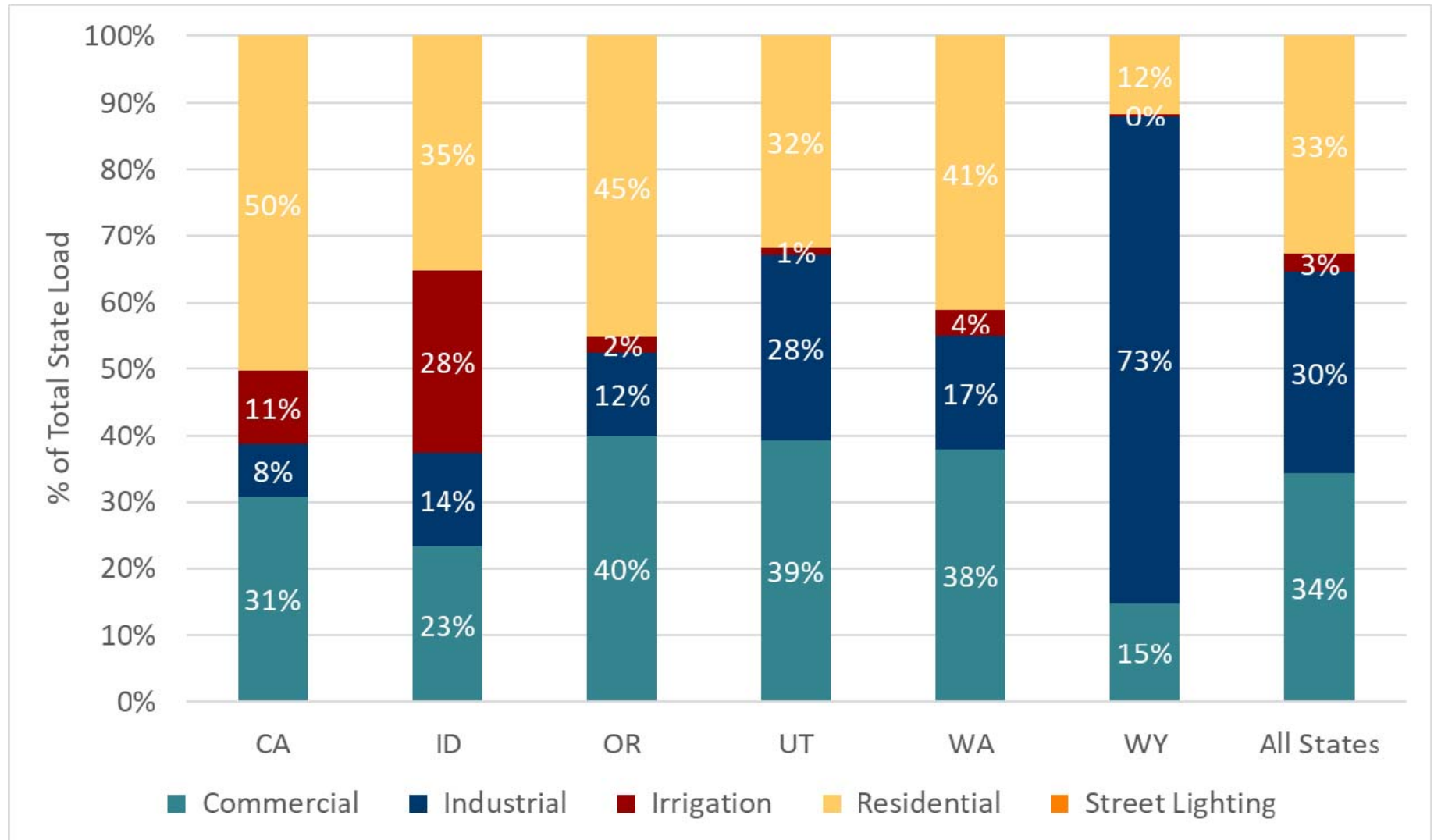


# Baseline Load Considerations and Effects on Potential



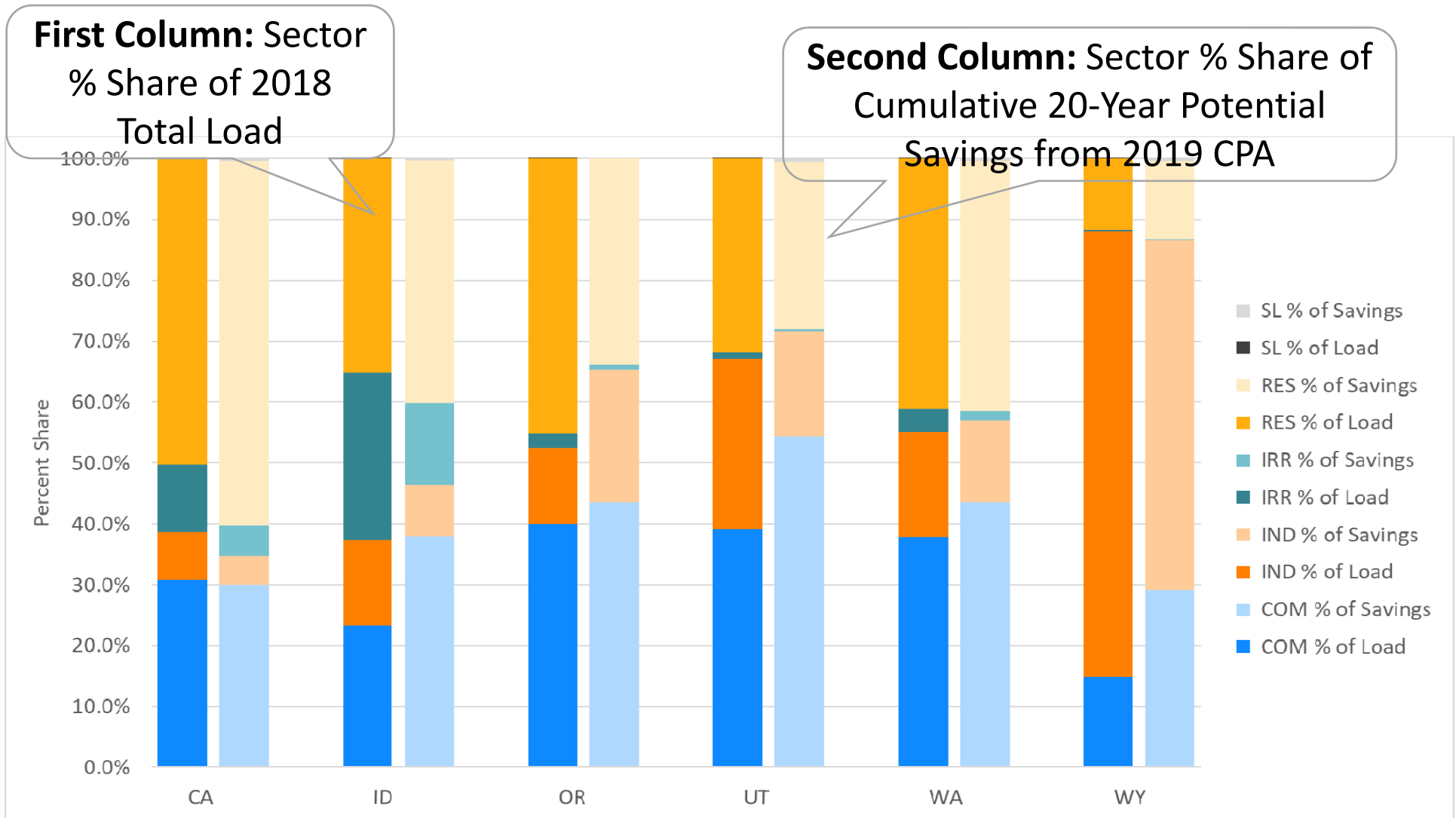


# Actual 2018 Load by State & Sector





# Share of Load vs. Share of Potential



*Savings potential is the Technical Achievable 20-year Cumulative Savings from the 2019 CPA, not IRP selections*

# Impact of Differences in Consumption by Sector



- State level consumption by sector drives overall savings opportunities
  - States with higher industrial and irrigation loads will tend to have lower savings potential compared to overall load due to fewer opportunities
  - Different measure level opportunities by sector and sub-sector
- Residential and commercial sectors have higher savings potential
  - More measure options
  - Often more mature programs have more potential in early years due to more advanced ramp rates





# Market Profiles: Sector Level Drivers



# Drivers of Residential Differences Between States



- Location and climate
  - Differences in climate and location drive the saturation of cooling equipment and the run time of heating equipment
  - More rural communities have higher saturations of electric heating equipment due to lack of access to natural gas
- Overall household energy use
  - Differences in household usage drives difference in certain end uses
  - Example: The types of existing heating equipment varies by home type which drives the amount of heating potential
- Saturation of equipment
  - Higher saturations of electric heating and water heating equipment increase overall household baseline energy use and present more savings opportunities

# Residential Market Profiles/Saturation



Segment: Single Family	
Households:	571,668
Total 2016 MWh:	5,655,105
Intensity (kWh/HH):	9,892

- Residential profile represents consumption for typical home in 2016
- Saturation - % of homes the electrically-powered technology is present
- UEC – annual energy consumed per unit when installed
- Intensity – Saturation\*UEC
  - Model is calibrated to total household intensity
- Usage – Intensity\*Households
  - Total MWh @generator

Single Family Market Profile - Utah					
End Use	Technology	Saturation	UEC (kWh)	Intensity (kWh/HH)	Usage (MWh)
Cooling	Central AC	76.2%	2,869.5	2,185.9	1,249,634
Cooling	Room AC	3.9%	1,284.9	50.1	28,665
Cooling	Air-Source Heat Pump	1.6%	3,018.0	47.3	27,048
Cooling	Geothermal Heat Pump	0.4%	2,656.5	11.2	6,375
Cooling	Evaporative AC	12.6%	647.0	81.4	46,555
Space Heating	Electric Room Heat	1.5%	13,422.0	200.6	114,685
Space Heating	Electric Furnace	6.2%	15,127.0	944.4	539,860
Space Heating	Air-Source Heat Pump	1.6%	8,329.0	130.6	74,646
Space Heating	Geothermal Heat Pump	0.4%	4,360.0	18.3	10,463
Space Heating	Secondary Heating	31.0%	392.0	121.5	69,461
Water Heating	Water Heater <= 55 Gal	8.8%	3,050.0	269.8	154,233
Water Heating	Water Heater > 55 Gal	0.7%	3,224.5	23.2	13,268
Interior Lighting	General Service Screw-in	100.0%	542.7	542.7	310,253
Interior Lighting	Linear Lighting	100.0%	78.6	78.6	44,931
Interior Lighting	Exempted Screw-In	100.0%	208.0	208.0	118,920
Exterior Lighting	Screw-in	100.0%	301.0	301.0	172,079
Appliances	Clothes Washer	98.3%	77.1	75.8	43,343
Appliances	Clothes Dryer	76.0%	741.2	563.5	322,131
Appliances	Dishwasher	91.7%	120.2	110.2	62,991
Appliances	Refrigerator	99.9%	601.6	601.0	343,570
Appliances	Freezer	61.2%	514.8	315.1	180,149
Appliances	Second Refrigerator	42.8%	829.0	354.5	202,684
Appliances	Stove/Oven	68.6%	442.8	303.6	173,550
Appliances	Microwave	98.5%	124.5	122.6	70,077
Electronics	Personal Computers	80.9%	161.0	130.3	74,477
Electronics	Monitor	97.3%	61.4	59.8	34,177
Electronics	Laptops	267.4%	42.1	112.7	64,421
Electronics	TVs	230.3%	113.6	261.5	149,467
Electronics	Printer/Fax/Copier	80.9%	42.1	34.0	19,462
Electronics	Set-top Boxes/DVRs	267.2%	98.6	263.5	150,657
Electronics	Devices and Gadgets	100.0%	84.2	84.2	48,107
Miscellaneous	Electric Vehicles	0.4%	4,324.0	18.1	10,343
Miscellaneous	Pool Pump	2.5%	3,500.0	88.8	50,778
Miscellaneous	Pool Heater	1.0%	3,517.0	34.7	19,845
Miscellaneous	Hot Tub / Spa	6.0%	2,032.0	121.4	69,400
Miscellaneous	Furnace Fan	89.7%	205.4	184.1	105,253
Miscellaneous	Well pump	4.8%	561.0	27.0	15,419
Miscellaneous	Miscellaneous	100.0%	811.2	811.2	463,728
<b>Total</b>				<b>9,892.3</b>	<b>5,655,105</b>

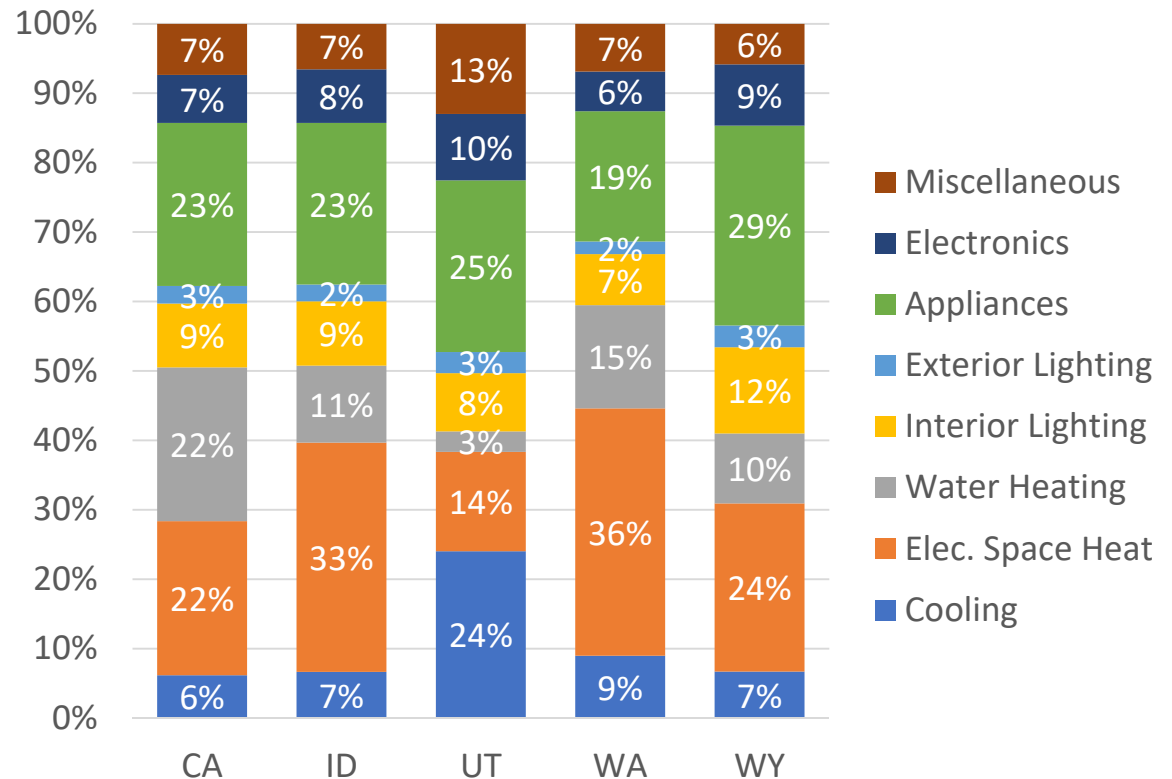


# Residential Market Comparison

## Key differences:

- Cooling Consumption
  - (24% in UT vs less than 10% all other states)
- Electric Space Heat Consumption
  - (36% in WA vs. 15% in UT)
- Electric Water Heat Consumption
  - (22% in CA vs. 3% in UT)
- Household Usage

Share of Single Family End-Use Consumption



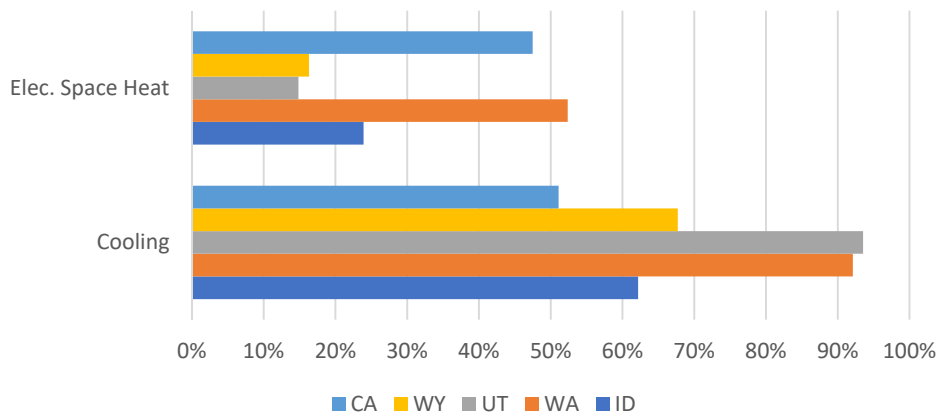
Average Annual Household Consumption by State (kWh)

	CA	ID	UT	WA	WY	Wt. Avg.
Single Family	10,753	11,747	9,892	15,981	9,487	10,858
% Variant from Avg.	-1%	8%	-9%	47%	-13%	0%

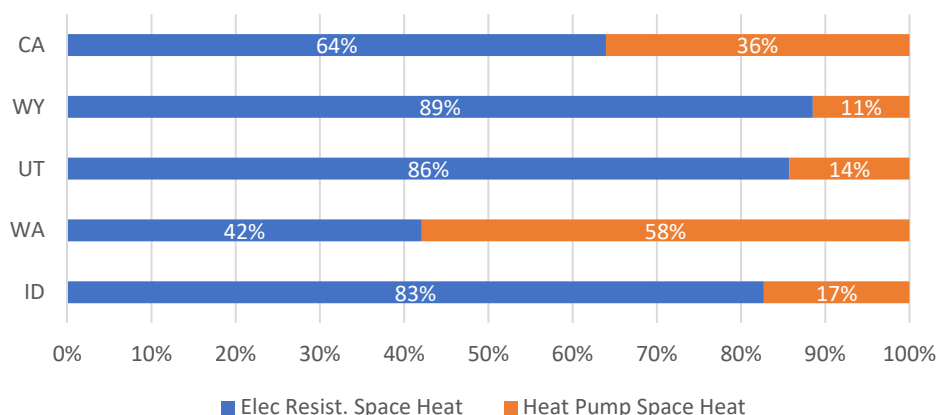
# Residential Cooling and Heating Saturation Comparison



Saturation of End-Use Equipment by State in Single Family Homes



Percent Share of Electric Heat Equipment Type by State in Single Family Homes



- Much higher saturation of cooling in WA and UT
- WA and CA have highest electric space heat saturations
  - However, that doesn't translate to same opportunities
  - 58% of all Electric Heated Homes in WA use heat pumps compared to 11% in WY
- More savings opportunities with electric resistance heat



# Drivers of Commercial Differences

- Building Type
  - Certain equipment is more applicable to certain building types
  - Example: Grocery has more refrigeration consumption and measures than other commercial buildings
- Climate and Location
  - Similar to Residential, climate can have a large impact due to varying runtimes
  - Access to natural gas service affects saturation of electric heating and water heating
- Data Sourcing
  - Data sourcing is more of a driver of difference than residential because third-party sources are required for commercial
  - Example: Different sources for RMP and Pacific Power states – CBECS and CBSA



# Commercial Market Profiles/Saturation

Segment	Large Office
Floor Space (Thousands SqFt)	6,869.03
Control Total (GWh)	105.0
Intensity (kWh/SqFt)	15.28

- Commercial profile represents consumption for typical building square foot in 2016
- EUI – energy utilization index
  - Different from UEC, kWh consumed per square foot when technology is present (not consumption per technology unit)
- Overall building intensities (kWh/SqFt) sourcing varies by state and adjusted due to weather and other characteristics. Typically Pacific Power states utilize CBSA 2014, RMP states utilize CBECs

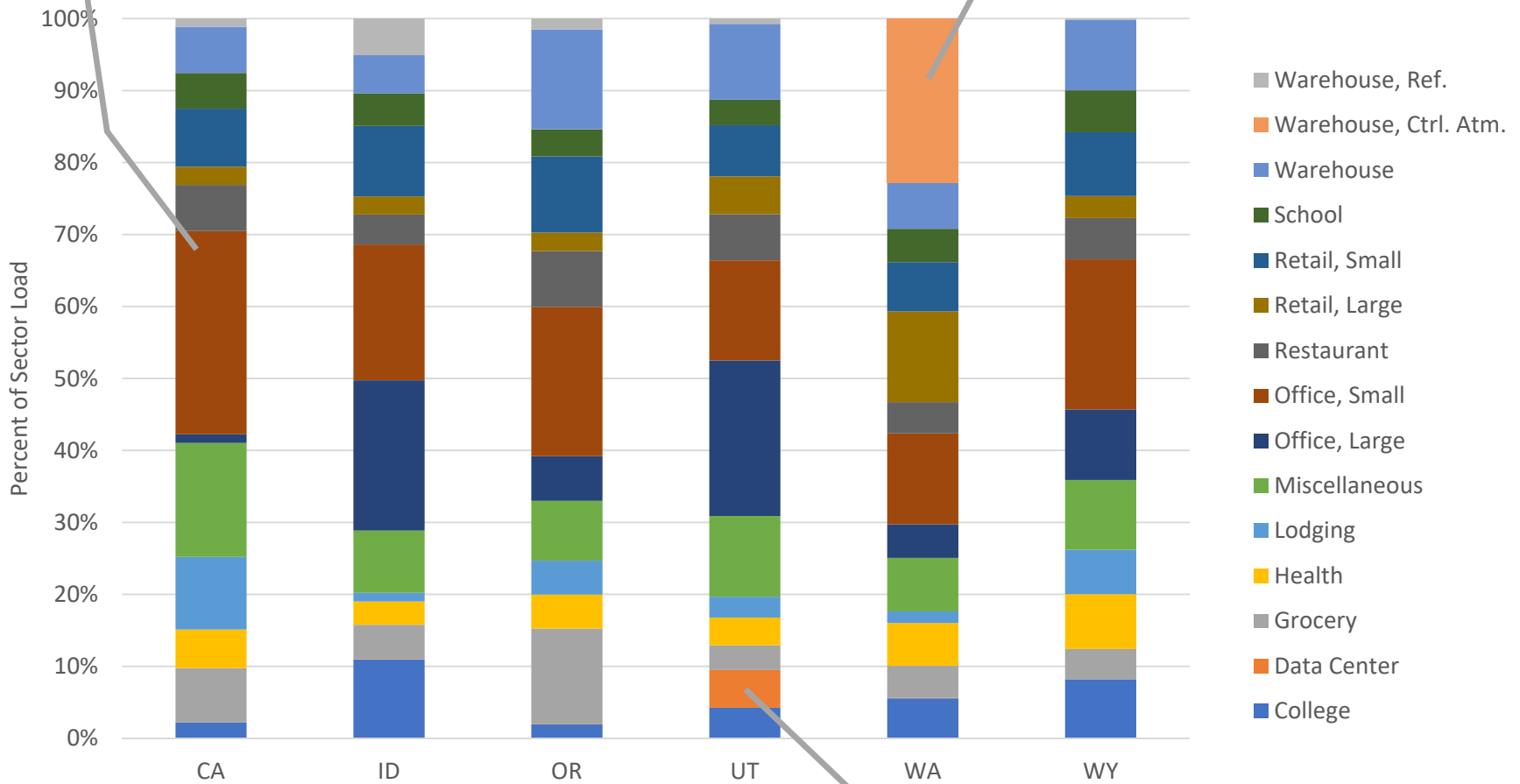
Large Office Market Profile - Idaho					
End Use	Technology	Saturation	EUI (kWh)	Intensity (kWh/Sqft)	Usage (GWh)
Cooling	Air-Cooled Chiller	9.3%	1.56	0.14	0.99
Cooling	Water-Cooled Chiller	60.4%	1.63	0.98	6.76
Cooling	RTU	8.1%	1.39	0.11	0.77
Cooling	PTAC	0.7%	1.14	0.01	0.05
Cooling	PTHP	26.2%	1.39	0.36	2.50
Cooling	Evaporative AC	3.7%	0.56	0.02	0.14
Cooling	Air-Source Heat Pump	0.9%	1.39	0.01	0.08
Cooling	Geothermal Heat Pump	0.0%	1.29	0.00	0.00
Heating	Electric Furnace	0.0%	2.58	0.00	0.00
Heating	Electric Room Heat	26.2%	2.46	0.64	4.42
Heating	PTHP	2.0%	2.07	0.04	0.29
Heating	Air-Source Heat Pump	0.9%	2.30	0.02	0.14
Heating	Geothermal Heat Pump	0.0%	2.19	0.00	0.00
Ventilation	Ventilation	100.0%	2.53	2.53	17.37
Water Heating	Water Heater	47.6%	0.98	0.47	3.22
Interior Lighting	General Service Lighting	100.0%	0.37	0.37	2.56
Interior Lighting	Exempted Lighting	100.0%	0.08	0.08	0.52
Interior Lighting	High-Bay Lighting	100.0%	0.54	0.54	3.72
Interior Lighting	Linear Lighting	100.0%	2.61	2.61	17.90
Exterior Lighting	General Service Lighting	100.0%	0.16	0.16	1.09
Exterior Lighting	Area Lighting	100.0%	0.50	0.50	3.46
Exterior Lighting	Linear Lighting	100.0%	0.30	0.30	2.08
Refrigeration	Walk-in Refrigerator/Freezer	2.0%	0.09	0.00	0.01
Refrigeration	Reach-in Refrigerator/Freezer	14.0%	1.57	0.22	1.51
Refrigeration	Glass Door Display	4.0%	0.54	0.02	0.15
Refrigeration	Open Display Case	1.3%	0.43	0.01	0.04
Refrigeration	Icemaker	44.9%	0.22	0.10	0.68
Refrigeration	Vending Machine	44.9%	0.06	0.03	0.17
Food Preparation	Oven	66.0%	0.04	0.03	0.19
Food Preparation	Fryer	76.4%	0.06	0.05	0.32
Food Preparation	Dishwasher	20.0%	0.04	0.01	0.05
Food Preparation	Hot Food Container	20.0%	0.01	0.00	0.02
Food Preparation	Steamer	20.0%	0.06	0.01	0.08
Office Equipment	Desktop Computer	100.0%	0.84	0.84	5.80
Office Equipment	Laptop	100.0%	0.26	0.26	1.79
Office Equipment	Server	100.0%	1.76	1.76	12.09
Office Equipment	Monitor	100.0%	0.15	0.15	1.02
Office Equipment	Printer/Copier/Fax	100.0%	0.04	0.04	0.30
Office Equipment	POS Terminal	40.0%	0.01	0.00	0.03
Miscellaneous	Non-HVAC Motors	89.6%	0.17	0.16	1.08
Miscellaneous	Pool Pump	0.0%	0.03	0.00	0.00
Miscellaneous	Pool Heater	0.0%	0.03	0.00	0.00
Miscellaneous	Clothes Washer	0.0%	0.01	0.00	0.00
Miscellaneous	Clothes Dryer	0.0%	0.03	0.00	0.00
Miscellaneous	Other Miscellaneous	100.0%	1.68	1.68	11.57
<b>Total</b>				<b>15.28</b>	<b>104.96</b>

# Commercial Market Comparison



CA: High Small Office Load

WA: Large Controlled Atmosphere Warehouse Load



Based on 2018 Actual Consumption

UT: Large Data Center Load



# Commercial Market Profile Comparison



Large Office Market Profile - Idaho						
End Use	Technology	Saturation	EUI (kWh)	Intensity (kWh/Sqft)	Usage (GWh)	
Cooling	Air-Cooled Chiller	9.3%	1.56	0.14	0.99	
Cooling	Water-Cooled Chiller	60.4%	1.63	0.98	6.76	
Cooling	RTU	8.1%	1.39	0.11	0.77	
Cooling	PTAC	0.7%	1.14	0.01	0.05	
Cooling	PTHP	26.2%	1.39	0.36	2.50	
Cooling	Evaporative AC	3.7%	0.56	0.02	0.14	
Cooling	Air-Source Heat Pump	0.9%	1.39	0.01	0.08	
Cooling	Geothermal Heat Pump	0.0%	1.29	0.00	0.00	
Heating	Electric Furnace	0.0%	2.58	0.00	0.00	
Heating	Electric Room Heat	26.2%	2.46	0.64	4.42	
Heating	PTHP	2.0%	2.07	0.04	0.29	
Heating	Air-Source Heat Pump	0.9%	2.30	0.02	0.14	
Heating	Geothermal Heat Pump	0.0%	2.19	0.00	0.00	
Ventilation	Ventilation	100.0%	2.53	2.53	17.37	
Water Heating	Water Heater	47.6%	0.98	0.47	3.22	
Interior Lighting	General Service Lighting	100.0%	0.37	0.37	2.56	
Interior Lighting	Exempted Lighting	100.0%	0.08	0.08	0.52	
Interior Lighting	High-Bay Lighting	100.0%	0.54	0.54	3.72	
Interior Lighting	Linear Lighting	100.0%	2.61	2.61	17.90	
Exterior Lighting	General Service Lighting	100.0%	0.16	0.16	1.09	
Exterior Lighting	Area Lighting	100.0%	0.50	0.50	3.46	
Exterior Lighting	Linear Lighting	100.0%	0.30	0.30	2.08	
Refrigeration	Walk-in Refrigerator/Freezer	2.0%	0.09	0.00	0.01	
Refrigeration	Reach-in Refrigerator/Freezer	14.0%	1.57	0.22	1.51	
Refrigeration	Glass Door Display	4.0%	0.54	0.02	0.15	
Refrigeration	Open Display Case	1.3%	0.43	0.01	0.04	
Refrigeration	Icemaker	44.9%	0.22	0.10	0.68	
Refrigeration	Vending Machine	44.9%	0.06	0.03	0.17	
Food Preparation	Oven	66.0%	0.04	0.03	0.19	
Food Preparation	Fryer	76.4%	0.06	0.05	0.32	
Food Preparation	Dishwasher	20.0%	0.04	0.01	0.05	
Food Preparation	Hot Food Container	20.0%	0.01	0.00	0.02	
Food Preparation	Steamer	20.0%	0.06	0.01	0.08	
Office Equipment	Desktop Computer	100.0%	0.84	0.84	5.80	
Office Equipment	Laptop	100.0%	0.26	0.26	1.79	
Office Equipment	Server	100.0%	1.76	1.76	12.09	
Office Equipment	Monitor	100.0%	0.15	0.15	1.02	
Office Equipment	Printer/Copier/Fax	100.0%	0.04	0.04	0.30	
Office Equipment	POS Terminal	40.0%	0.01	0.00	0.03	
Miscellaneous	Non-HVAC Motors	89.6%	0.17	0.16	1.08	
Miscellaneous	Pool Pump	0.0%	0.03	0.00	0.00	
Miscellaneous	Pool Heater	0.0%	0.03	0.00	0.00	
Miscellaneous	Clothes Washer	0.0%	0.01	0.00	0.00	
Miscellaneous	Clothes Dryer	0.0%	0.03	0.00	0.00	
Miscellaneous	Other Miscellaneous	100.0%	1.68	1.68	11.57	
<b>Total</b>				<b>15.28</b>	<b>104.96</b>	

Grocery Market Profile - California						
End Use	Technology	Saturation	EUI (kWh)	Intensity (kWh/Sqft)	Usage (GWh)	
Cooling	Air-Cooled Chiller	0.5%	0.29	0.00	0.00	
Cooling	Water-Cooled Chiller	0.3%	0.31	0.00	0.00	
Cooling	RTU	71.3%	0.30	0.21	0.09	
Cooling	PTAC	2.1%	0.29	0.01	0.00	
Cooling	PTHP	0.6%	0.27	0.00	0.00	
Cooling	Evaporative AC	1.2%	0.12	0.00	0.00	
Cooling	Air-Source Heat Pump	7.2%	0.27	0.02	0.01	
Cooling	Geothermal Heat Pump	0.0%	0.22	0.00	0.00	
Heating	Electric Furnace	6.4%	4.90	0.31	0.14	
Heating	Electric Room Heat	1.2%	4.67	0.05	0.02	
Heating	PTHP	0.6%	2.17	0.01	0.01	
Heating	Air-Source Heat Pump	7.2%	2.41	0.17	0.08	
Heating	Geothermal Heat Pump	0.0%	2.01	0.00	0.00	
Ventilation	Ventilation	100.0%	2.53	2.53	1.11	
Water Heating	Water Heater	21.5%	2.29	0.49	0.22	
Interior Lighting	General Service Lighting	100.0%	0.50	0.50	0.22	
Interior Lighting	Exempted Lighting	100.0%	0.13	0.13	0.06	
Interior Lighting	High-Bay Lighting	100.0%	1.56	1.56	0.68	
Interior Lighting	Linear Lighting	100.0%	6.27	6.27	2.75	
Exterior Lighting	General Service Lighting	100.0%	1.15	1.15	0.51	
Exterior Lighting	Area Lighting	100.0%	0.59	0.59	0.26	
Exterior Lighting	Linear Lighting	100.0%	0.56	0.56	0.25	
Refrigeration	Walk-in Refrigerator/Freezer	16.0%	1.15	0.18	0.08	
Refrigeration	Reach-in Refrigerator/Freezer	83.1%	1.38	1.15	0.50	
Refrigeration	Glass Door Display	94.9%	10.64	10.09	4.42	
Refrigeration	Open Display Case	94.9%	10.28	9.76	4.27	
Refrigeration	Icemaker	98.9%	1.16	1.15	0.50	
Refrigeration	Vending Machine	98.9%	0.37	0.36	0.16	
Food Preparation	Oven	11.0%	0.81	0.09	0.04	
Food Preparation	Fryer	87.0%	1.17	1.01	0.44	
Food Preparation	Dishwasher	54.9%	0.83	0.45	0.20	
Food Preparation	Hot Food Container	73.0%	0.22	0.16	0.07	
Food Preparation	Steamer	20.0%	1.18	0.24	0.10	
Office Equipment	Desktop Computer	100.0%	0.04	0.04	0.02	
Office Equipment	Laptop	64.0%	0.01	0.01	0.00	
Office Equipment	Server	100.0%	0.21	0.21	0.09	
Office Equipment	Monitor	100.0%	0.01	0.01	0.00	
Office Equipment	Printer/Copier/Fax	100.0%	0.01	0.01	0.01	
Office Equipment	POS Terminal	100.0%	0.10	0.10	0.04	
Miscellaneous	Non-HVAC Motors	34.6%	0.69	0.24	0.11	
Miscellaneous	Pool Pump	0.0%	0.35	0.00	0.00	
Miscellaneous	Pool Heater	0.0%	0.45	0.00	0.00	
Miscellaneous	Clothes Washer	0.0%	0.11	0.00	0.00	
Miscellaneous	Clothes Dryer	0.0%	0.36	0.00	0.00	
Miscellaneous	Other Miscellaneous	100.0%	0.95	0.95	0.42	
<b>Total</b>				<b>40.80</b>	<b>17.87</b>	



# Drivers of Industrial Differences

- **Industry Type**
  - The industry type drives the savings potential
  - Example: Some industrial facilities may look more like a warehouse while others are heavy processing, presenting different savings opportunities due to equipment types and operation schedules
- **Applicable Measures**
  - Savings opportunities differ by what type equipment is present in facility. Some industries have high compressed air loads whereas others may be driven more by motors or lighting loads.
  - Industrial projects tend to be highly customized, capital-intensive, and may require interruptions to operations, affecting their technical feasibility.
- **Data Sourcing**
  - Data sourcing is more of a driver of difference than residential because third party sources are required for industrial saturations.
  - Example: Different sources for RMP and PAC states – MECS for RMP and NWPC for Pacific Power
- **Climate is a much lower driver of difference in industrial than in the residential or commercial sectors**

# Industrial Market Profiles/Saturation



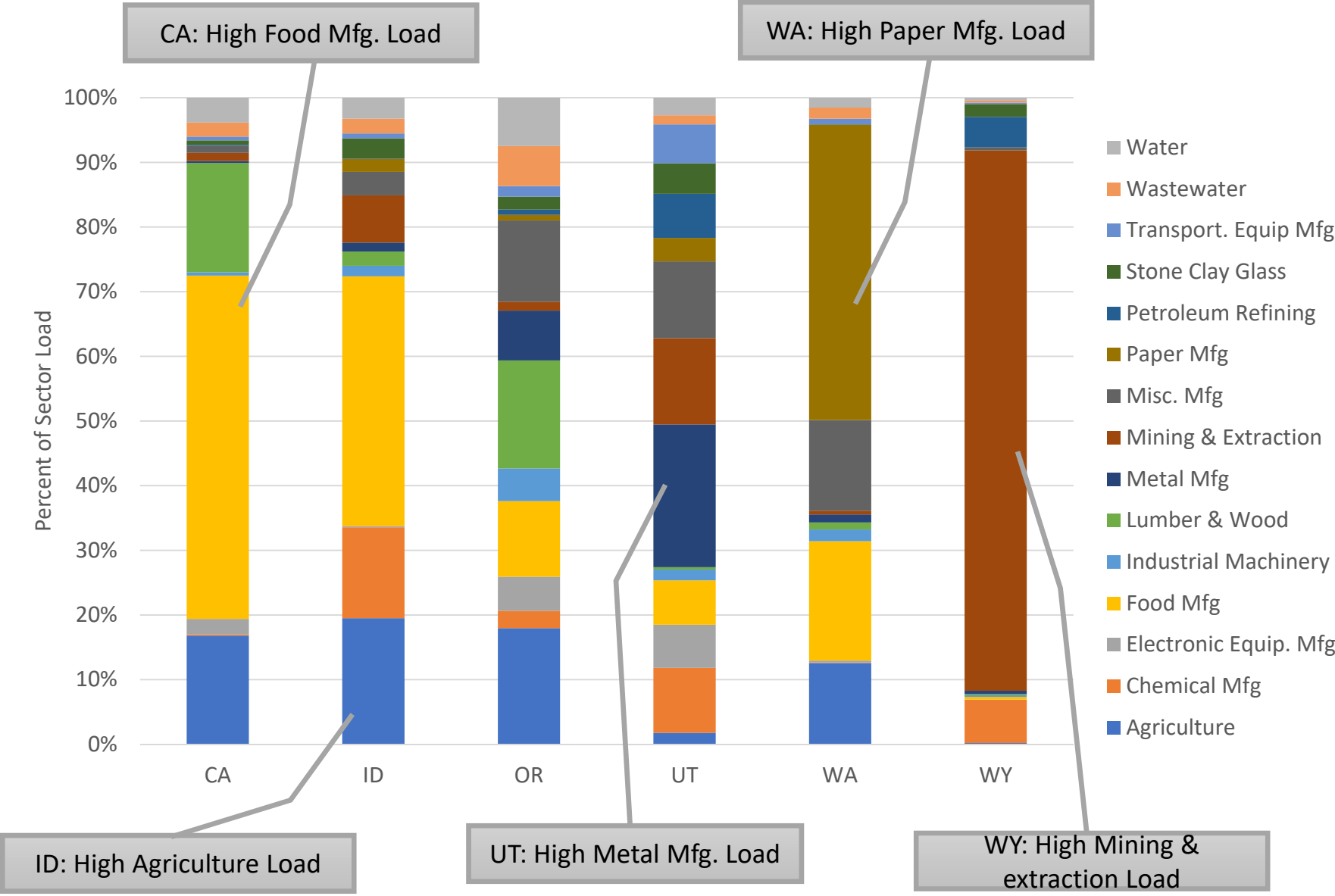
<b>Segment:</b>	<b>Mining</b>
Employees:	47,859
Control Total (GWh):	5,771.3
Intensity (MWh/employee):	120.6

- Industrial profile represents consumption for typical industry per employee in 2018
  - Employment is used as a proxy for energy consumption since floor area is less reliable
  - E.g. 10% of space may use 90% of energy, rest of space could be warehouse
- Began with commercial warehouse market profile by state, added industrial end uses
- Intensity from Bureau of Labor Statistics, cross-referenced with 2014 IFSA and MECs

Mining & Extraction Market Profile - Wyoming					
End Use	Technology	Saturation	EUI (kWh)	Intensity (kWh/Employee)	Usage (GWh)
Cooling	Air-Cooled Chiller	2.6%	75.5	1.9	0.1
Cooling	Water-Cooled Chiller	2.5%	-	-	-
Cooling	RTU	50.3%	3,557.5	1,790.3	85.7
Cooling	Air-Source Heat Pump	2.7%	3,218.0	87.6	4.2
Cooling	Geothermal Heat Pump	0.0%	1.0	-	-
Heating	Electric Furnace	0.0%	1.0	-	-
Heating	Electric Room Heat	9.1%	18,974.1	1,721.2	82.4
Heating	Air-Source Heat Pump	2.7%	18,102.0	492.7	23.6
Heating	Geothermal Heat Pump	0.0%	1.0	-	-
Ventilation	Ventilation	100.0%	3,309.0	3,309.0	158.4
Interior Lighting	General Service Lighting	100.0%	382.6	382.6	18.3
Interior Lighting	High-Bay Lighting	100.0%	950.5	950.5	45.5
Interior Lighting	Linear Lighting	100.0%	2,701.0	2,701.0	129.3
Exterior Lighting	General Service Lighting	100.0%	582.2	582.2	27.9
Exterior Lighting	Area Lighting	100.0%	314.3	314.3	15.0
Exterior Lighting	Linear Lighting	100.0%	725.8	725.8	34.7
Motors	Pumps	100.0%	32,276.4	32,276.4	1,544.7
Motors	Fans & Blowers	100.0%	6,004.9	6,004.9	287.4
Motors	Compressed Air	100.0%	9,758.0	9,758.0	467.0
Motors	Material Handling	100.0%	9,007.4	9,007.4	431.1
Motors	Other Motors	100.0%	3,753.1	3,753.1	179.6
Process	Process Heating	100.0%	28,887.8	28,887.8	1,382.5
Process	Process Cooling	100.0%	2,222.7	2,222.7	106.4
Process	Process Refrigeration	100.0%	2,222.7	2,222.7	106.4
Process	Process Electrochemical	100.0%	2,026.8	2,026.8	97.0
Process	Process Other	100.0%	2,466.5	2,466.5	118.0
Miscellaneous	Miscellaneous	100.0%	8,903.7	8,903.7	426.1
<b>Total</b>				<b>120,589.3</b>	<b>5,771.3</b>



# Industrial Market Comparison



# Industrial Market Profile Comparison



**Lumber & Wood Products Market Profile - Washington**

End Use	Technology	Saturation	EUI (kWh)	Intensity (kWh/Employee)	Usage (GWh)
Cooling	Air-Cooled Chiller	2.5%	-	-	-
Cooling	Water-Cooled Chiller	2.5%	-	-	-
Cooling	RTU	10.2%	-	-	-
Cooling	Air-Source Heat Pump	1.7%	-	-	-
Cooling	Geothermal Heat Pump	0.0%	-	-	-
Heating	Electric Furnace	0.5%	-	-	-
Heating	Electric Room Heat	2.6%	-	-	-
Heating	Air-Source Heat Pump	1.7%	-	-	-
Heating	Geothermal Heat Pump	0.0%	-	-	-
Ventilation	Ventilation	100.0%	-	-	-
Interior Lighting	General Service Lighting	100.0%	35.2	35.2	0.0
Interior Lighting	High-Bay Lighting	100.0%	87.5	87.5	0.1
Interior Lighting	Linear Lighting	100.0%	248.6	248.6	0.2
Exterior Lighting	General Service Lighting	100.0%	53.6	53.6	0.0
Exterior Lighting	Area Lighting	100.0%	28.9	28.9	0.0
Exterior Lighting	Linear Lighting	100.0%	66.8	66.8	0.1
Motors	Pumps	100.0%	759.4	759.4	0.7
Motors	Fans & Blowers	100.0%	739.6	739.6	0.7
Motors	Compressed Air	100.0%	494.5	494.5	0.5
Motors	Material Handling	100.0%	5,870.0	5,870.0	5.4
Motors	Other Motors	100.0%	33.6	33.6	0.0
Process	Process Heating	0.0%	-	-	-
Process	Process Cooling	0.0%	-	-	-
Process	Process Refrigeration	0.0%	-	-	-
Process	Process Electrochemical	0.0%	-	-	-
Process	Process Other	0.0%	-	-	-
Miscellaneous	Miscellaneous	0.0%	-	-	-
<b>Total</b>				<b>8,417.7</b>	<b>7.8</b>

**Mining & Extraction Market Profile - Wyoming**

End Use	Technology	Saturation	EUI (kWh)	Intensity (kWh/Employee)	Usage (GWh)
Cooling	Air-Cooled Chiller	2.6%	75.5	1.9	0.1
Cooling	Water-Cooled Chiller	2.5%	-	-	-
Cooling	RTU	50.3%	3,557.5	1,790.3	85.7
Cooling	Air-Source Heat Pump	2.7%	3,218.0	87.6	4.2
Cooling	Geothermal Heat Pump	0.0%	1.0	-	-
Heating	Electric Furnace	0.0%	1.0	-	-
Heating	Electric Room Heat	9.1%	18,974.1	1,721.2	82.4
Heating	Air-Source Heat Pump	2.7%	18,102.0	492.7	23.6
Heating	Geothermal Heat Pump	0.0%	1.0	-	-
Ventilation	Ventilation	100.0%	3,309.0	3,309.0	158.4
Interior Lighting	General Service Lighting	100.0%	382.6	382.6	18.3
Interior Lighting	High-Bay Lighting	100.0%	950.5	950.5	45.5
Interior Lighting	Linear Lighting	100.0%	2,701.0	2,701.0	129.3
Exterior Lighting	General Service Lighting	100.0%	582.2	582.2	27.9
Exterior Lighting	Area Lighting	100.0%	314.3	314.3	15.0
Exterior Lighting	Linear Lighting	100.0%	725.8	725.8	34.7
Motors	Pumps	100.0%	32,276.4	32,276.4	1,544.7
Motors	Fans & Blowers	100.0%	6,004.9	6,004.9	287.4
Motors	Compressed Air	100.0%	9,758.0	9,758.0	467.0
Motors	Material Handling	100.0%	9,007.4	9,007.4	431.1
Motors	Other Motors	100.0%	3,753.1	3,753.1	179.6
Process	Process Heating	100.0%	28,887.8	28,887.8	1,382.5
Process	Process Cooling	100.0%	2,222.7	2,222.7	106.4
Process	Process Refrigeration	100.0%	2,222.7	2,222.7	106.4
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Process	Process Other	100.0%	2,466.5	2,466.5	118.0
Miscellaneous	Miscellaneous	100.0%	8,903.7	8,903.7	426.1
<b>Total</b>				<b>120,589.3</b>	<b>5,771.3</b>

# 2019 CPA End Use Potential Comparison



Cumulative Technical Achievable Savings Potential Ranked by Measure Category and State from 2019 CPA

Measure Category	Rank in Savings Potential by State					
	UT	WA	CA	OR	ID	WY
Lighting	1	1	3	2	1	2
HVAC	2	2	1	1	2	4
Weatherization	3	4	4	4	5	7
Behavioral/EM	4	8	7	9	6	5
Ind (Motor/Pump/Other)	5	6	10	6	9	1
Water Heating	6	3	2	7	4	6
Appliance/Plug Load	7	7	6	8	7	8
Whole Building/Home	8	9	9	3	8	11
Compressed Air	9	11	13	5	12	3
Waste Heat to Power	10	13	12	-	13	10
Refrigeration	11	5	8	10	10	9
Cooking	12	12	11	12	11	12
Agriculture/Irrigation	13	10	5	11	3	13
Data Center	14	14	14	-	14	14



# Other Drivers of Difference





# Ramp Rates

- In previous CPAs, market ramp rates had been used to reflect differences in market maturity for certain states and sectors. All market ramp rates were removed for the 2019 CPA.
- New for the 2021 CPA, measure ramp rates will differ by state
  - NWPCC ramp rates had previously been applied to all states
  - Differences in historical and projected program participation by state will inform the starting point of measure ramp rates
  - Participation analysis is in progress



# Measure Sourcing



AEG will curate data from multiple sources, accounting for variations in baselines, weather conditions, etc.

Care must be taken to ensure source data is applied consistently and appropriately.

## *Example Measure: Air-Source Heat Pump*

Characterization	DEER (California)	Regional Technical Forum (Washington, Idaho)	New Mexico TRM (Utah)	Illinois TRM (Wyoming, Utah)
Baseline Definition	SEER 13 HSPF 8.1	SEER 14 HSPF 8.5	SEER 14 HSPF 8.0	SEER 14 HSPF 8.2
Efficient Definition	SEER 18 HSPF 9.2	SEER 18 HSPF 12	SEER 18 HSPF 9.6	SEER 18 HSPF 8.5 w/QI
Lifetime	15 years	15 years	18 years	18 years
Unit of Measure	per ton	per home	3 tons	per ton
Incremental Cost	\$685	\$5,378	--	\$724
Climate	California	CZ 1, HZ2	Santa Fe	Springfield, IL
Annual kWh Savings	n/a	604 kWh	999 kWh	1,640 kWh



# Measure Costs

Similar to how savings vary, costs are likely to change by jurisdiction as well.

The table below walks through the adjustments that AEG makes prior to leveling measure costs for supply curves, which are based on the state-specific cost-effectiveness test. The table is based on the 2019 CPA.

This is an illustrative example in the table below

Fieldz	Washington	California	Wyoming	Utah	Idaho
Primary cost-effectiveness test	TRC, plus 10% adder	TRC	TRC	UCT	UCT
Measure Cost	\$1,000	\$1,000	\$1,000	n/a	n/a
Incentive Paid	n/a	n/a	n/a	\$500 (50%)	\$700 (70%)
Utility Admin %	35%	44%	27%	18%	36%
Admin Spend	\$350	\$440	\$270	\$180	\$360
Cost for Bundling	\$1,350	\$1,440	\$1,270	\$680	\$1,060



# Additional Information and Next Steps



# Next Steps



## **Presentations**

- Draft CPA Technical Potential Results in August 2021 IRP Stakeholder Meeting
- Discuss feedback received and planned updates in September 2021 IRP Stakeholder Meeting
- Final CPA Technical Achievable Potential results in October 2021 IRP Stakeholder Meeting

## **CPA/IRP Analysis**

- Finalize Market Profiles and send out for Stakeholder review
- Conduct Jurisdictional Incentive and Administrative Cost analysis and share with stakeholders
  - This will inform ramp rates by state
- Finish Measure Characterization and Develop Supply Curves
- Determine modeling methodology for CPA (EE & DR) in IRP



# Additional Information

- Public Input Meeting and Workshop Presentation and Materials:
  - [pacificorp.com/energy/integrated-resource-plan/public-input-process](https://www.pacificorp.com/energy/integrated-resource-plan/public-input-process)
- 2021 IRP Stakeholder Feedback Forms:
  - [pacificorp.com/energy/integrated-resource-plan/comments](https://www.pacificorp.com/energy/integrated-resource-plan/comments)
- IRP Email / Distribution List Contact Information:
  - [IRP@PacifiCorp.com](mailto:IRP@PacifiCorp.com)
- IRP Support and Studies – CPA Draft Documents
  - [pacificorp.com/energy/integrated-resource-plan/support](https://www.pacificorp.com/energy/integrated-resource-plan/support)



# Upcoming Public Input Meeting/Workshop Dates

- June 18-19, 2020 – General Public Input Meeting
- ~~July 22-23, 2020 – Public Input Meeting~~
- July 30-31, 2020 – Public Input Meeting
- ~~August 20-21, 2020 – Public Input Meeting~~
- ~~September 10-11, 2020 – Public Input Meeting~~
- September 17-18, 2020 – Public Input Meeting
- ~~October 22, 2020 – Public Input Meeting (Conference Call Only)~~
- October 22-23, 2020 – Public Input Meeting
- ~~November 5-6, 2020 – Public Input Meeting~~
- December 3-4, 2020 – Public Input Meeting
- ~~December 10-11, 2020 – Public Input Meeting~~
- January 14-15, 2021 – Public Input Meeting
- ~~February 4-5, 2021 – Public Input Meeting~~
- February 25-26, 2021 – Public Input Meeting
- ~~March 4-5, 2021 – Public Input Meeting~~

*~~\*meeting dates are subject to change~~*



# Appendix



# Residential Market Profile Comparison



Single Family Market Profile - Utah					
End Use	Technology	Saturation	UEC (kWh)	Intensity (kWh/HH)	Usage (MWh)
Cooling	Central AC	76.2%	2,869.5	2,185.9	1,249,634
Cooling	Room AC	3.9%	1,284.9	50.1	28,665
Cooling	Air-Source Heat Pump	1.6%	3,018.0	47.3	27,048
Cooling	Geothermal Heat Pump	0.4%	2,656.5	11.2	6,375
Cooling	Evaporative AC	12.6%	647.0	81.4	46,555
Space Heating	Electric Room Heat	1.5%	13,422.0	200.6	114,685
Space Heating	Electric Furnace	6.2%	15,127.0	944.4	539,860
Space Heating	Air-Source Heat Pump	1.6%	8,329.0	130.6	74,646
Space Heating	Geothermal Heat Pump	0.4%	4,360.0	18.3	10,463
Space Heating	Secondary Heating	31.0%	392.0	121.5	69,461
Water Heating	Water Heater <= 55 Gal	8.8%	3,050.0	269.8	154,233
Water Heating	Water Heater > 55 Gal	0.7%	3,224.5	23.2	13,268
Interior Lighting	General Service Screw-in	100.0%	542.7	542.7	310,253
Interior Lighting	Linear Lighting	100.0%	78.6	78.6	44,931
Interior Lighting	Exempted Screw-In	100.0%	208.0	208.0	118,920
Exterior Lighting	Screw-in	100.0%	301.0	301.0	172,079
Appliances	Clothes Washer	98.3%	77.1	75.8	43,343
Appliances	Clothes Dryer	76.0%	741.2	563.5	322,131
Appliances	Dishwasher	91.7%	120.2	110.2	62,991
Appliances	Refrigerator	99.9%	601.6	601.0	343,570
Appliances	Freezer	61.2%	514.8	315.1	180,149
Appliances	Second Refrigerator	42.8%	829.0	354.5	202,684
Appliances	Stove/Oven	68.6%	442.8	303.6	173,550
Appliances	Microwave	98.5%	124.5	122.6	70,077
Electronics	Personal Computers	80.9%	161.0	130.3	74,477
Electronics	Monitor	97.3%	61.4	59.8	34,177
Electronics	Laptops	267.4%	42.1	112.7	64,421
Electronics	TVs	230.3%	113.6	261.5	149,467
Electronics	Printer/Fax/Copier	80.9%	42.1	34.0	19,462
Electronics	Set-top Boxes/DVRs	267.2%	98.6	263.5	150,657
Electronics	Devices and Gadgets	100.0%	84.2	84.2	48,107
Miscellaneous	Electric Vehicles	0.4%	4,324.0	18.1	10,343
Miscellaneous	Pool Pump	2.5%	3,500.0	88.8	50,778
Miscellaneous	Pool Heater	1.0%	3,517.0	34.7	19,845
Miscellaneous	Hot Tub / Spa	6.0%	2,032.0	121.4	69,400
Miscellaneous	Furnace Fan	89.7%	205.4	184.1	105,253
Miscellaneous	Well pump	4.8%	561.0	27.0	15,419
Miscellaneous	Miscellaneous	100.0%	811.2	811.2	463,728
<b>Total</b>				<b>9,892.3</b>	<b>5,655,105</b>

Single Family Market Profile - Washington					
End Use	Technology	Saturation	UEC (kWh)	Intensity (kWh/HH)	Usage (MWh)
Cooling	Central AC	38.7%	1,817.8	703.3	52,037
Cooling	Room AC	22.0%	671.9	148.0	10,950
Cooling	Air-Source Heat Pump	29.9%	1,900.0	568.4	42,051
Cooling	Geothermal Heat Pump	0.4%	1,672.5	7.0	519
Cooling	Evaporative AC	1.0%	709.6	7.4	551
Space Heating	Electric Room Heat	8.2%	11,861.9	974.6	72,109
Space Heating	Electric Furnace	13.8%	13,368.8	1,849.1	136,810
Space Heating	Air-Source Heat Pump	29.9%	9,089.4	2,719.0	201,165
Space Heating	Geothermal Heat Pump	0.4%	4,294.7	18.0	1,334
Space Heating	Secondary Heating	31.2%	429.9	133.9	9,910
Water Heating	Water Heater <= 55 Gal	62.4%	3,499.6	2,185.3	161,680
Water Heating	Water Heater > 55 Gal	5.1%	3,699.8	188.0	13,909
Interior Lighting	General Service Screw-in	100.0%	743.7	743.7	55,027
Interior Lighting	Linear Lighting	100.0%	146.5	146.5	10,839
Interior Lighting	Exempted Screw-In	100.0%	284.7	284.7	21,066
Exterior Lighting	Screw-in	100.0%	294.1	294.1	21,762
Appliances	Clothes Washer	96.5%	84.6	81.6	6,038
Appliances	Clothes Dryer	92.5%	812.9	751.9	55,629
Appliances	Dishwasher	91.7%	131.8	120.8	8,941
Appliances	Refrigerator	99.7%	656.9	655.2	48,475
Appliances	Freezer	71.7%	591.1	423.7	31,344
Appliances	Second Refrigerator	43.9%	909.2	398.7	29,497
Appliances	Stove/Oven	88.9%	485.7	431.9	31,955
Appliances	Microwave	98.1%	136.5	133.9	9,905
Electronics	Personal Computers	63.7%	176.5	112.4	8,319
Electronics	Monitor	76.6%	67.4	51.6	3,818
Electronics	Laptops	218.6%	46.2	101.0	7,472
Electronics	TVs	208.0%	124.5	259.0	19,166
Electronics	Printer/Fax/Copier	63.7%	46.1	29.4	2,174
Electronics	Set-top Boxes/DVRs	221.3%	108.2	239.4	17,715
Electronics	Devices and Gadgets	100.0%	118.1	118.1	8,740
Miscellaneous	Electric Vehicles	0.2%	4,742.1	11.2	832
Miscellaneous	Pool Pump	5.8%	3,838.5	224.1	16,580
Miscellaneous	Pool Heater	0.6%	3,857.1	24.9	1,845
Miscellaneous	Hot Tub / Spa	7.9%	2,228.4	175.0	12,945
Miscellaneous	Furnace Fan	54.0%	225.2	121.6	8,993
Miscellaneous	Well pump	28.6%	615.2	176.3	13,041
Miscellaneous	Miscellaneous	100.0%	367.7	367.7	27,205
<b>Total</b>				<b>15,980.7</b>	<b>1,182,345</b>



# Commercial Market Comparison



**Green** Highlights: State with highest share of 2018 in load each building type

**Yellow** Highlights: Building type with highest share of 2018 load in each state

	CA	ID	OR	UT	WA	WY
College	2%	11%	2%	4%	6%	8%
Data Center	0%	0%	0%	5%	0%	0%
Grocery	8%	5%	13%	3%	4%	4%
Health	5%	3%	5%	4%	6%	8%
Lodging	10%	1%	5%	3%	2%	6%
Miscellaneous	16%	9%	8%	11%	7%	10%
Office, Large	1%	21%	6%	22%	5%	10%
Office, Small	28%	19%	21%	14%	13%	21%
Restaurant	6%	4%	8%	6%	4%	6%
Retail, Large	3%	3%	3%	5%	13%	3%
Retail, Small	8%	10%	11%	7%	7%	9%
School	5%	5%	4%	4%	5%	6%
Warehouse	6%	5%	14%	11%	6%	10%
Warehouse, Ctrl. Atm.	0%	0%	0%	0%	23%	0%
Warehouse, Ref.	1%	5%	1%	1%	0%	0%

*Based on 2018 Actual Consumption*

# Industrial Market Comparison



**Green** Highlights: State with highest share of 2018 load each building type

**Yellow** Highlights: Building type with highest share of 2018 load in each state

	CA	ID	OR	UT	WA	WY
<b>Agriculture</b>	17%	20%	18%	2%	13%	0%
<b>Chemical Mfg.</b>	0%	14%	3%	10%	0%	7%
<b>Electronic Equip. Mfg.</b>	2%	0%	5%	7%	0%	0%
<b>Food Mfg</b>	53%	39%	12%	7%	18%	0%
<b>Industrial Machinery</b>	1%	2%	5%	2%	2%	0%
<b>Lumber &amp; Wood</b>	17%	2%	17%	0%	1%	0%
<b>Metal Mfg</b>	0%	1%	8%	22%	1%	1%
<b>Mining</b>	1%	7%	1%	13%	1%	84%
<b>Misc. Mfg</b>	1%	4%	13%	12%	14%	0%
<b>Paper Mfg</b>	0%	2%	1%	4%	46%	0%
<b>Petroleum Refining</b>	0%	0%	1%	7%	0%	5%
<b>Stone Clay Glass</b>	1%	3%	2%	5%	0%	2%
<b>Transport. Equip Mfg.</b>	1%	1%	2%	6%	1%	0%
<b>Wastewater</b>	2%	2%	6%	1%	2%	0%
<b>Water Treatment</b>	4%	3%	7%	3%	2%	0%