

2020 IRP Stakeholder Update

September 15, 2020

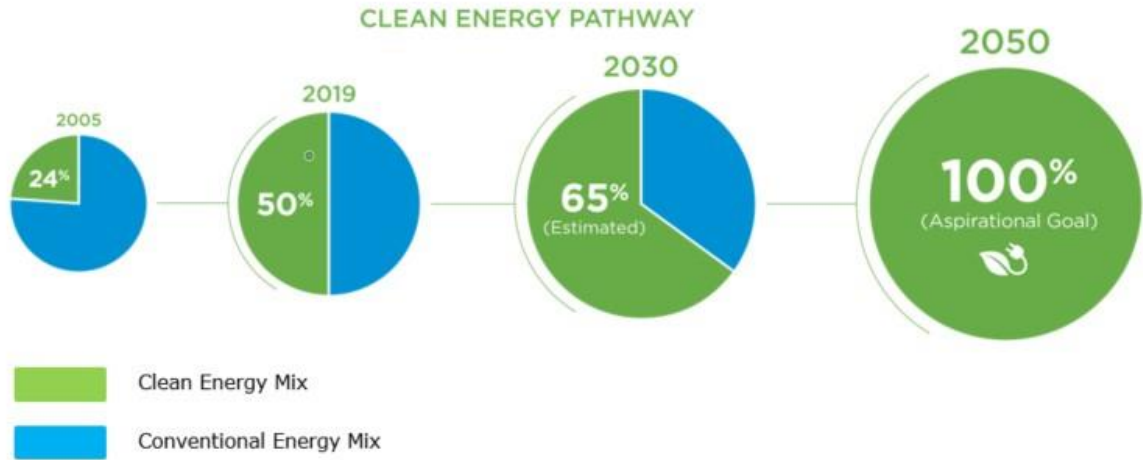


Welcome

Jeff Burke - APS



APS Clean Energy Pathway



Clean Energy Commitments

A 2050 goal to provide 100% clean, carbon-free electricity

A 2030 interim target of achieving a resource mix that is 65% clean energy, with 45% of our customers' electricity needs served by renewable energy

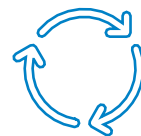
A commitment to end our use of coal-fired generation by 2031

Agenda



Welcome

Jeff Burke - APS



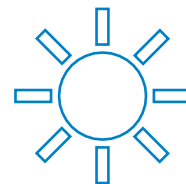
DSM Model Development

David Alspecter – Guidehouse



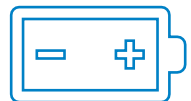
Review of IRP

Derek Seaman - APS



2020 Summer Peak Review

Kent Walter – APS



Energy Storage Update

Scott Bordenkircher- APS



Updates & Looking Ahead

Jeff Burke - APS

Review of IRP

Derek Seaman - APS

Planning for Future Needs

- We will **adapt** to new and future technology
 - Energy storage, hydrogen, carbon capture...
 - Long duration storage solutions will become essential to reliability with high renewable additions
- Technology will be needed to achieve 100% **clean** while maintaining **affordability**
- Many **future technologies** emerging are not yet commercial
- We see our path forward only made possible by working with our **stakeholders** in the best interest of our **customers**



Portfolio Perspectives*

APS will offer multiple portfolios and sensitivities but will not selected a preferred portfolio

Core Portfolios

(Meets CEC goals)

	Bridge	Shift	Accelerate ¹
<u>Renewable Focused</u>	✓	✓	✓
<u>Energy Storage Reliance</u>	✓	✓	✓
<u>Natural Gas Development</u>	✓	x	x

*Technology agnostic plan was created for reference only

¹The ACC requires at least one plan include 25 MW of biomass

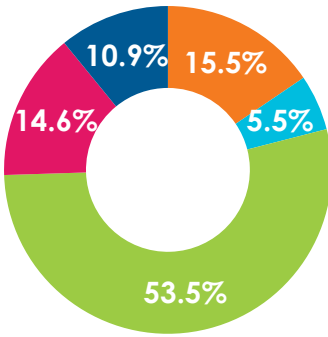
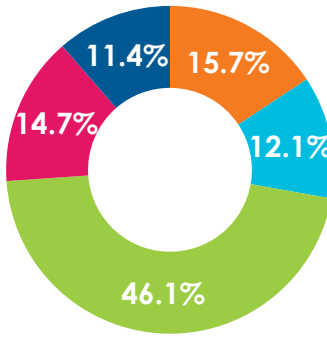
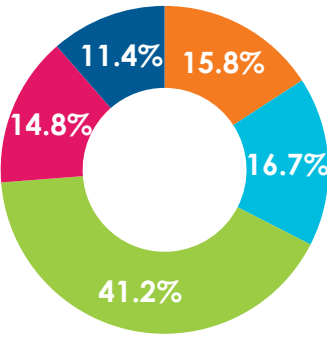
Action Plan Resource Additions (2020-2024)

2020-2024 ADDITIONS	ALL PATHS (MW)
Demand Side Management	575
Demand Response	193
Distributed Energy	408
Renewable Energy	962
Energy Storage	750
Merchant PPA / Hydrogen-ready CTs	0
Microgrid	6
Total	2,894

- Action Plan is the same over all portfolios
- Focus near-term is on clean and reliable resources
- All-source RFP to determine actual resource additions

2035 Metrics and Energy Mix by Portfolio

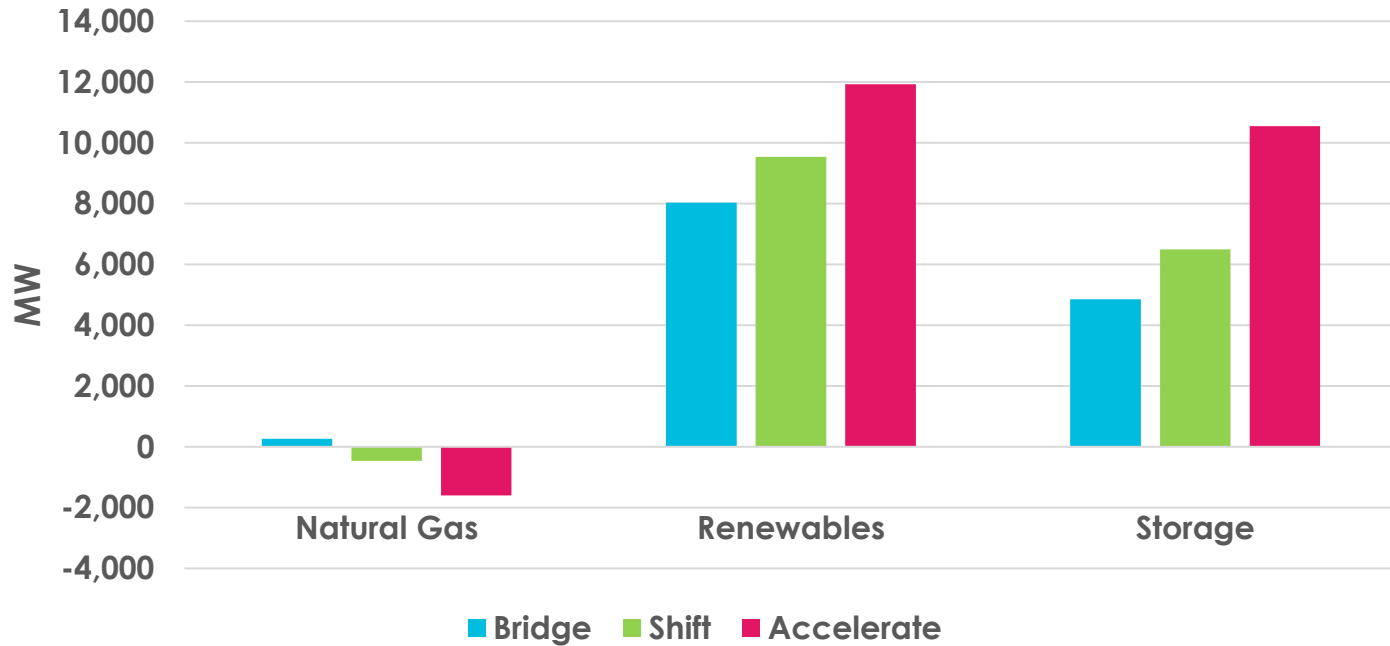
	PATH 1. BRIDGE PORTFOLIO	PATH 2. SHIFT PORTFOLIO	PATH 3. ACCELERATE PORTFOLIO
Clean Energy	79%	84%	91%
RES Achieved	58%	66%	77%
Total Resource Additions (MW)	17,170	19,646	24,911



■ Nuclear
 ■ Coal
 ■ Natural Gas
 ■ Renewable Energy
 ■ DSM
 ■ Purchase

Net Portfolio Resource Additions by 2035

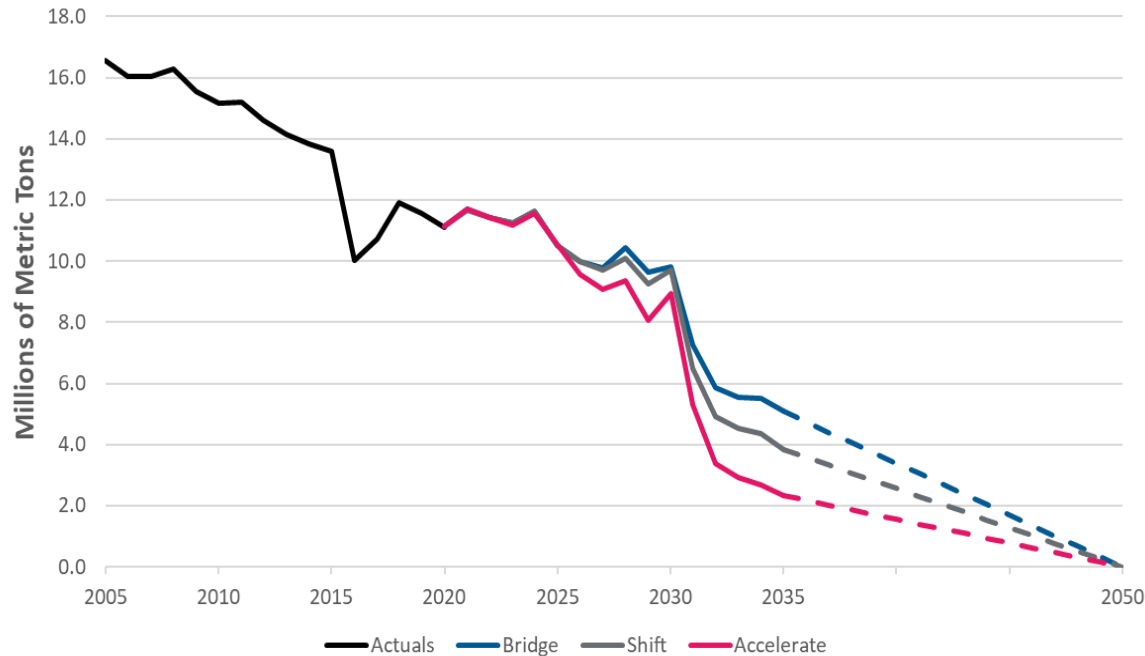
Compared to our current resources today



Large renewable and storage resources needed in every portfolio

Moving Forward Together

Carbon Reduction Trajectory



- Energy storage and DSM compliment renewable energy on our path forward
- All paths lead to 100% clean, carbon-free electricity by 2050
- We remain committed to our regulators, stakeholders, communities and customers

Questions?



DSM Flexibility

APS IRP Stakeholder Update

September 15, 2020

Background

APS faces a unique set of challenges and opportunities



System peak times shifting later and later in the day



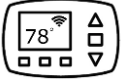
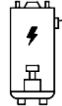

Abundance of clean energy generated during the middle of the day

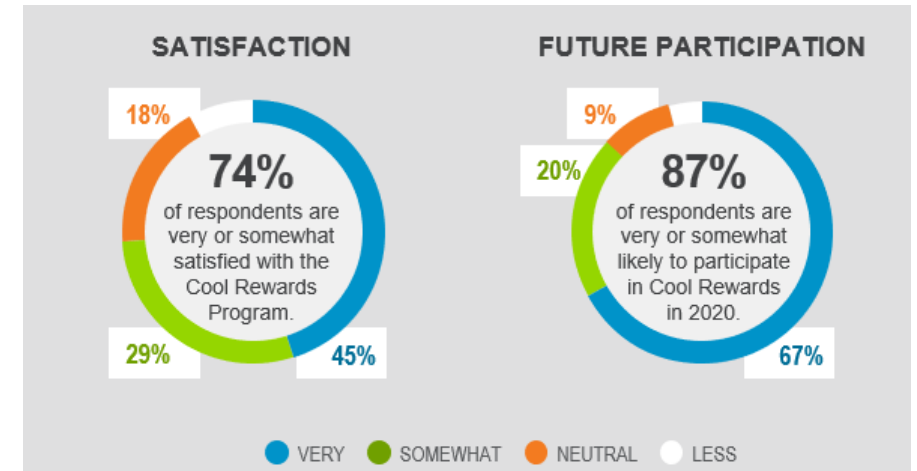


Increased ramp rates from EV charging that occurs at the end of the “on-peak” period

Background

DSM programs provide the flexibility to address these challenges while providing a positive customer experience.

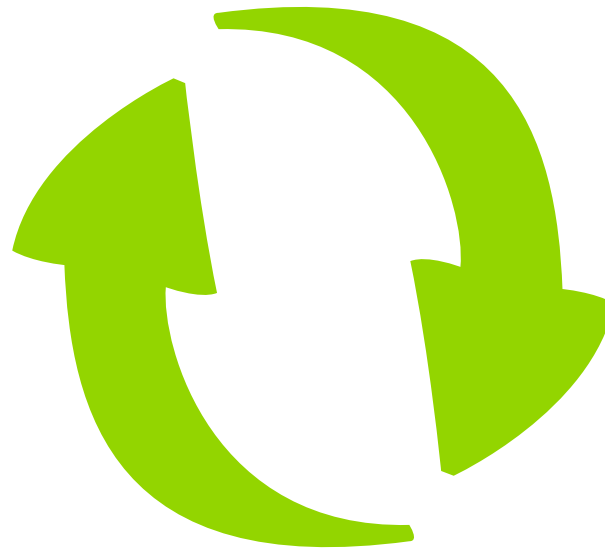
Use Cases	 Cool Rewards	 Reserve Rewards	 Storage Rewards
Reduce system peak via demand response events	✓		
Solar sponging / duck curve management		✓	✓
Customer peak demand charge management	✓		✓
Reduce system peak via daily scheduled load shift / Provide feeder congestion relief	✓	✓	✓



The Challenge (and Opportunity)

APS's planning processes are more effectively modeling DSM's flexibility to support its clean energy commitments.

DSM
PLANNING



RESOURCE
PLANNING

Datasets, Tools, and Metrics

APS has several resources to model DSM programs to optimize future design and provide customers value through rate design

- Hourly Load Impacts for DSM Technologies
- Hourly APS plant dispatch and load forecast
- Emission Factors
- Hourly avoided energy and capacity costs
- Customer Retail Rates
- Technology and Program Costs

Datasets



- Loadshape Viewer
- Program Planning and Potential model
- Emissions Calculator
- Customer Surveys and Interviews

Tools



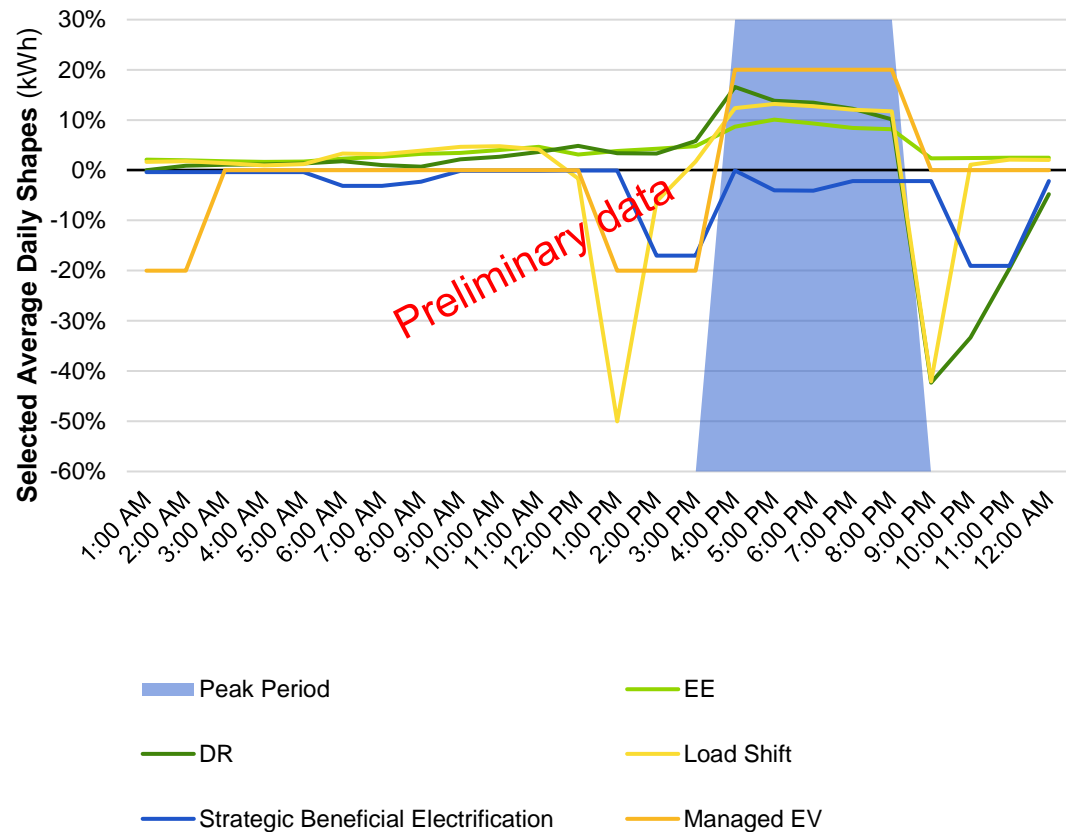
- Hourly energy impacts and peak reductions
- Program Cost Effectiveness
- Emissions Reductions
- Customer Satisfaction

Metrics



8760 Hourly Loadshapes

Impacts for each DSM technology in APS's portfolio are based on extensive data collection, research and analysis activities



- Decades-worth of end-use metering for EE measures
 - Residential Hot Water, HVAC, Appliances, Pool pumps
 - Commercial Lighting and VFDs
- AMI and Telemetry Data Analytics
 - Smart Thermostats
 - Thermostat Demand Response
 - Grid-interactive Water Heating
- Modelling of Load-shifting Technologies
 - Residential Batteries
 - C&I Thermal Energy Storage

Leveraging Data for Company and Customer Value

The loadshapes inform metrics to measure company and customer value

Clean



Emissions
Impacts

Affordable



Customer bill
savings &
cost
effectiveness

Reliable



Measurable
and
dependable
impacts

Customer Focused

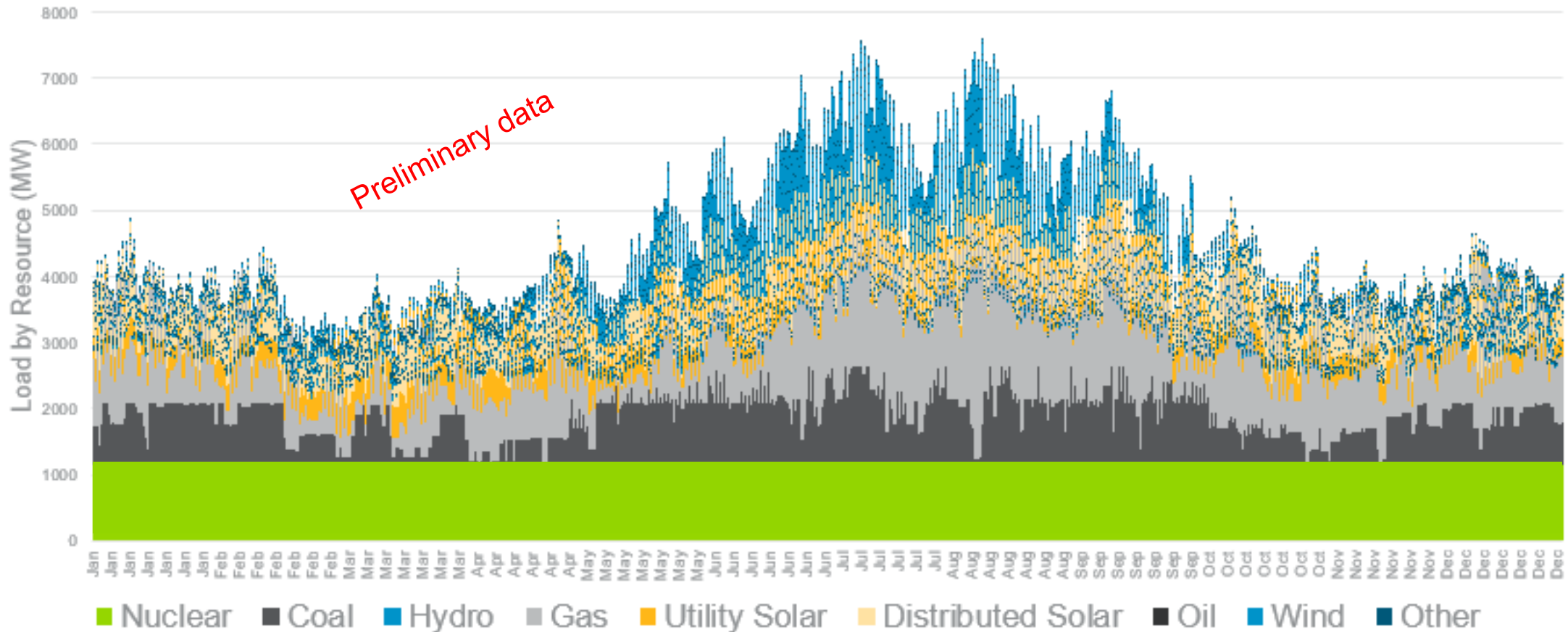


Customer
satisfaction

Clean - Translating impacts into emissions reductions

Use APS System dispatch and plant emission factors to ...

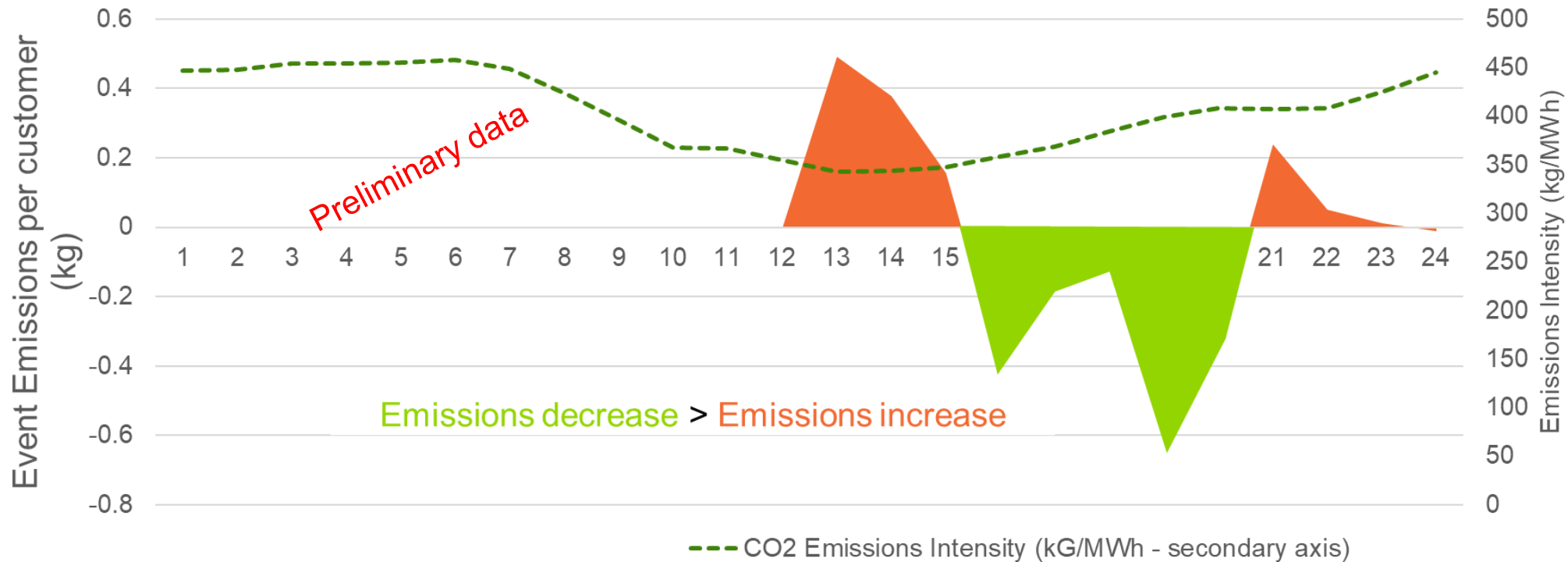
2019 Hourly Dispatch by Resource Type



Preliminary data

Clean - Translating impacts into emissions reductions

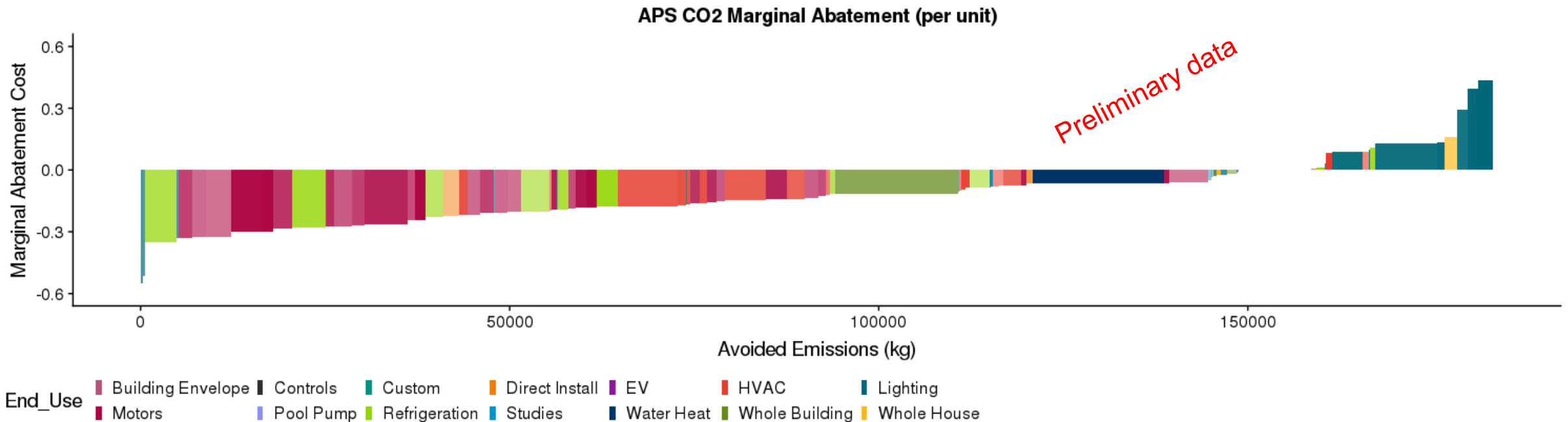
...calculate and forecast emissions reductions for all measures in APS portfolio.



**Example of emissions reductions for a 2019 Cool Rewards Event.*

Clean - Translating impacts into emissions reductions

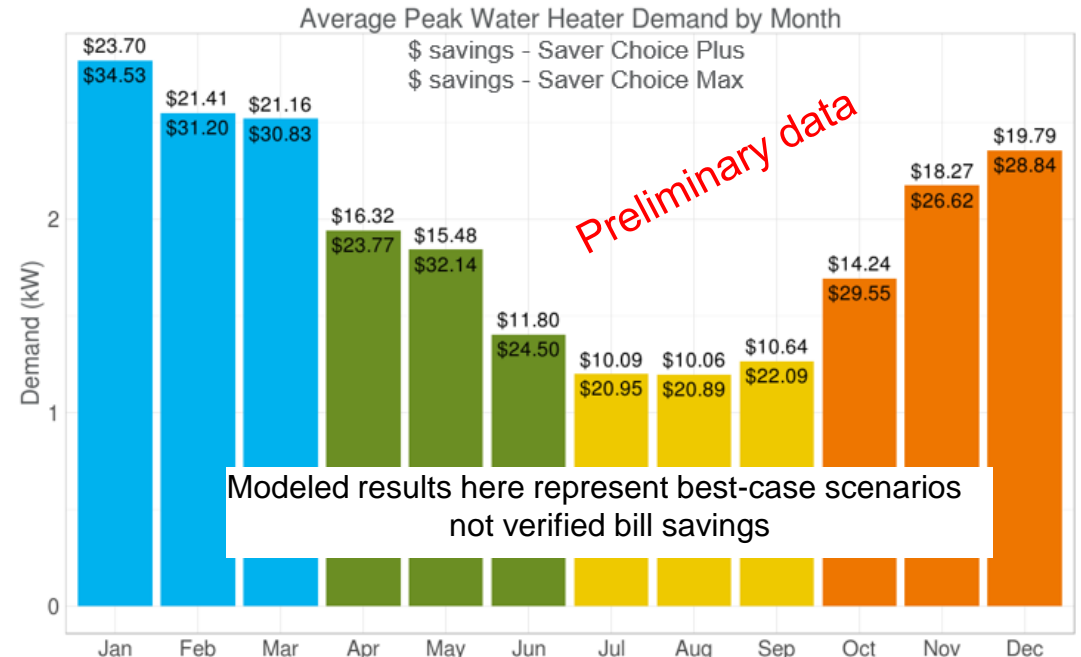
Align GHG emission reductions for each technology/program with associated cost



Affordable - Optimizing DSM for customer value

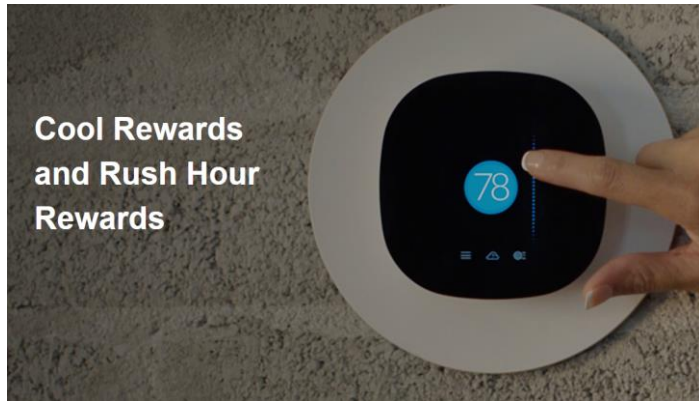
The APS planning model (*left*) considers all loadshapes, technology and program costs, avoided costs, and customer rates to calculate:

- Program Cost-effectiveness using multiple tests
- Customer Bill Impacts (*below*)
- Optimization of DSM portfolio

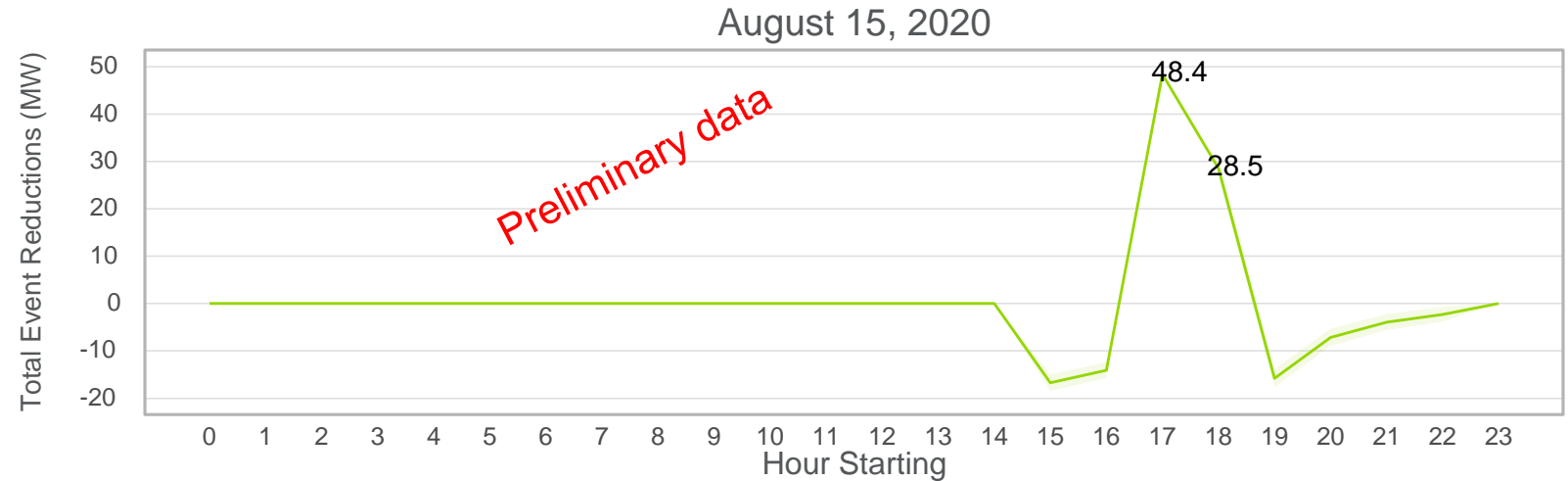


Reliable – Measurable and reliable load reductions

Providing reliable service to APS customers while addressing critical system needs



- The reductions presented here reflect actual, preliminary impacts observed at the generator from four events held over five days in August with 17,000-18,000 participating customers.
- Positive numbers reflect load reductions observed during the event; negative numbers reflect load increases from pre-cooling and snap back.



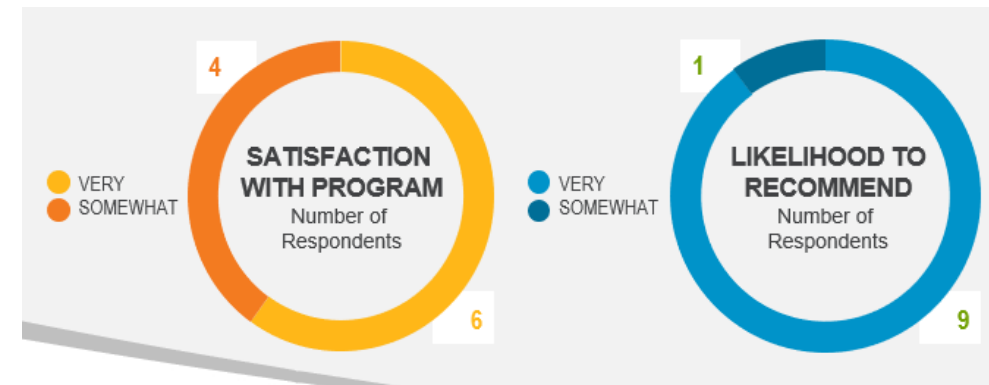
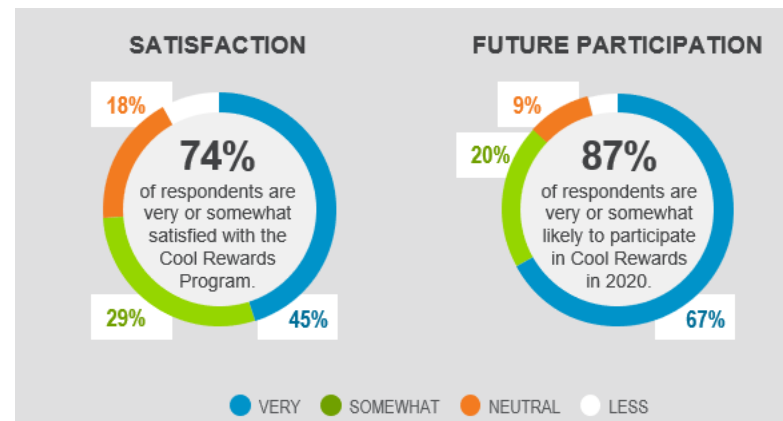
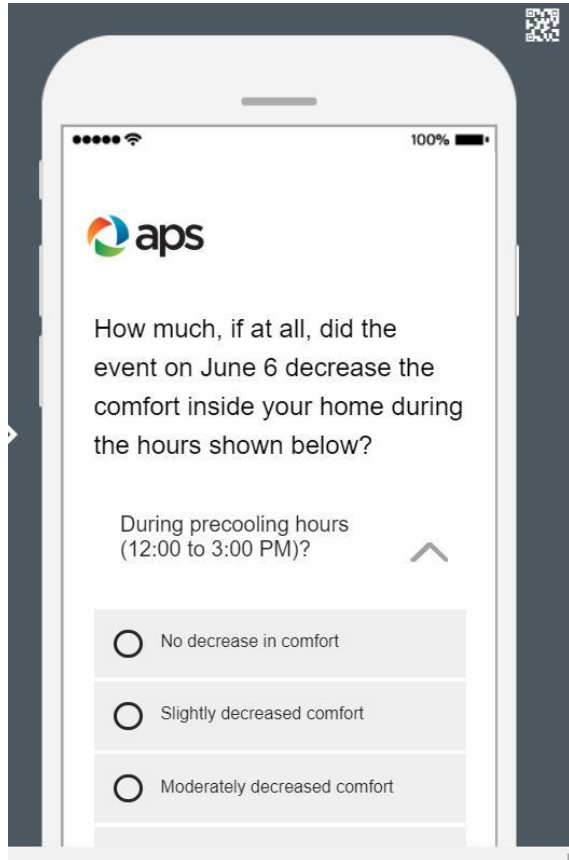
Event Date	Average per Device Reductions Over the Event Period	Total Average Event Period Reductions	Total Peak Hour Reductions
14-Aug-20	1.25 kW	29.8 MW	37.8 MW
15-Aug-20	1.61 kW	38.4 MW	48.4 MW
17-Aug-20	1.18 kW	28.3 MW	35.3 MW
18-Aug-20	1.17 kW	28.1 MW	34.8 MW

Customer-Focused – Customer Surveys

Comfort, customer satisfaction, and a focus on “easy”

Participant surveys for all programs help deliver positive customer outcomes and ensure satisfaction. Priorities include:

- Minimizing comfort impacts of DR events
- Ensuring customers understand the program objectives and benefits to them
- Reducing barriers to participation with easy and intuitive customer interfaces



Emerging Opportunities

Providing APS customers with additional DSM flexibility opportunities

Demand Response

Behavior Based Demand Response

Small-Medium Business Direct Install

Advanced Lighting Controls

Hotel Automated Load Management

Irrigation Pumping Opportunities

Data Center Opportunities

Reverse Demand Response

Load Shifting

Commercial Scale Batteries

Commercial Refrigeration Controls

Thermal Storage for Refrigeration Applications

Commercial HVAC Thermal Storage

Electric Thermal Heat Storage

Smart Appliances

Strategic Beneficial Electrification

Induction Cooktops

All-Electric Retrofits

Indoor Agriculture Opportunities

Electric Standby Truck Refrigeration

Ultraviolet Germicidal Irradiation

Managed Charging for Electric Vehicles

Forklifts

Airport Ground Support Equipment (GSE)

Medium Heavy Duty Vehicle Fleet Electrification: Municipal Buses

Medium Heavy Duty Vehicle Fleet Electrification: Sanitation

Contact

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APS McMicken Battery Energy Storage System Incident

Scott Bordenkircher

McMicken Battery Energy Storage System

- APS owned - 2 MW capacity, 2 MWh energy
- Commissioned on March 14, 2017
- Renewables research and development
- Incident occurred April 19, 2019
- Investigation conducted April 2019 – June 2020

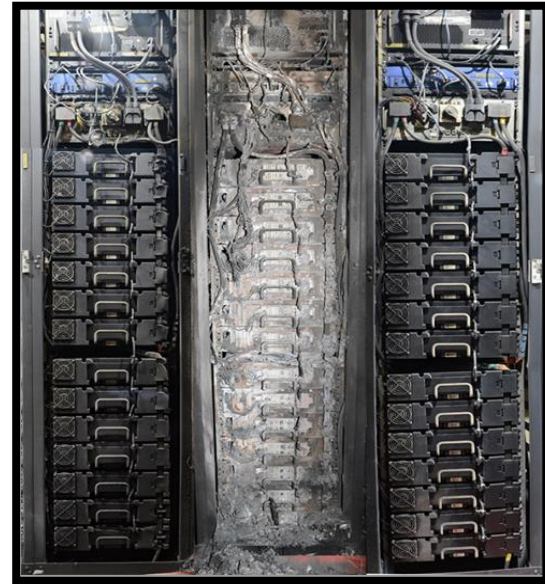


Main Contributing Factors

1. Internal failure in a battery cell initiated thermal runaway
2. The fire suppression system was incapable of stopping thermal runaway
3. Lack of thermal barriers between cells led to cascading thermal runaway
4. Flammable off-gases concentrated without a means to ventilate
5. Emergency response plan did not have an extinguishing, ventilation, and entry procedure

Mitigation Recommendations

1. Cell-to-cell and module-to-module cascading
2. Ventilation and monitoring
3. Cooling and extinguishing
4. Response plans and entry
5. Industry standards



Key Takeaways

- APS has worked extensively with outside experts to determine new specifications and requirements for energy storage systems that recognize the learnings from the McMicken incident and ultimately provide for safer batteries
- APS is sharing the information in the McMicken report to improve battery safety, limit potential safety hazards to utility and non-utility personnel, and to better inform owners, operators and first responders
- The McMicken lessons should serve to challenge manufacturers and system integrators to improve battery system design, engineering and safety standards and principles, for the benefit of all

Questions?



Southwestern Heat Storm

August 2020

APS WAS PREPARED AND RESPONDED EFFECTIVELY

- As a result, **Arizona customers** were **resilient** to record heat
- Resource Adequacy **impacts the region**
- **Customer engagement** continues to be a **resource**
- Asset backing was critical to position for success
- **Cooperation** among utilities is essential

AUGUST 2020

SOUTHWESTERN HEAT STORM

- A **major heat wave** descended upon the Western United States in mid-August 2020
- Arizona has experienced the **hottest summer on record**, with over 50 days above 110 degrees
- Widespread **excessive heat warnings** and heat advisories were issued in 12 states, including most of California, with 50+ million people experiencing highs over 100 degrees



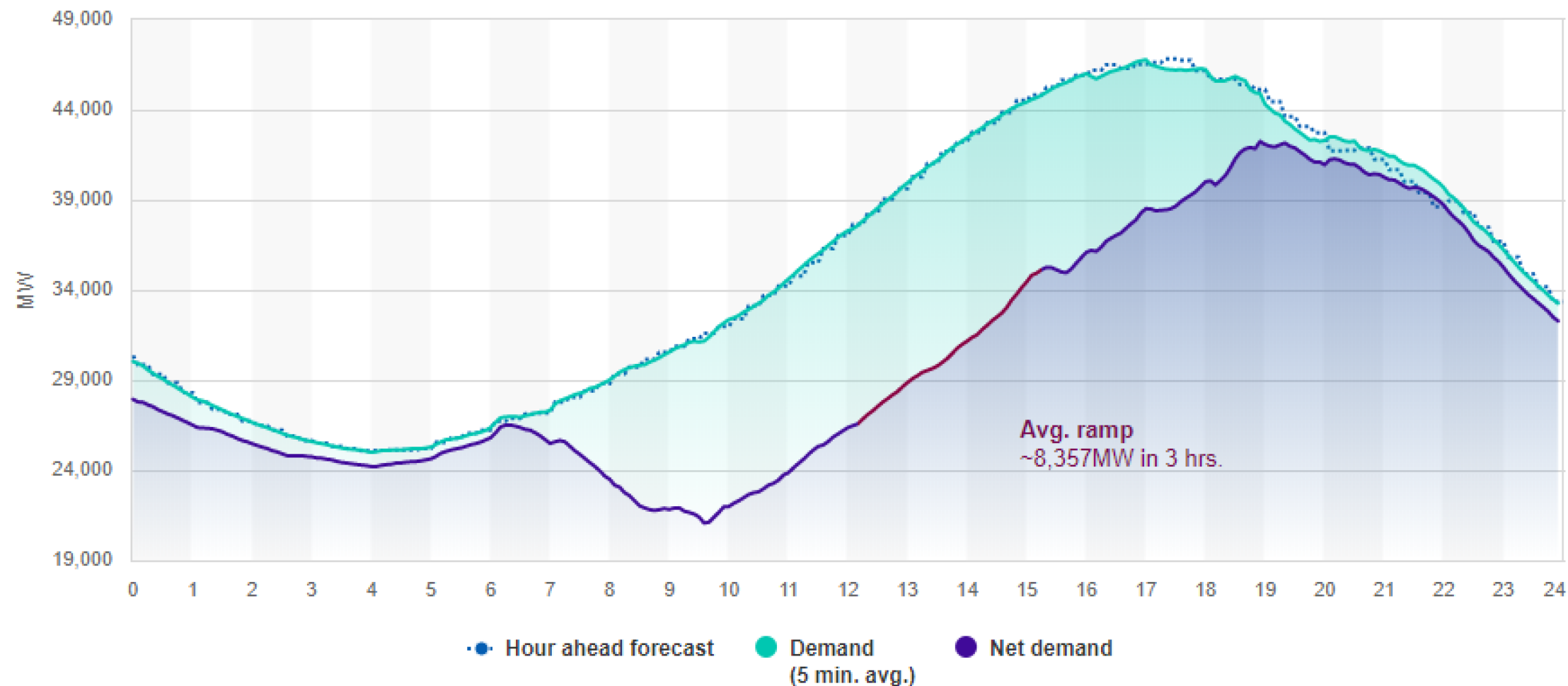
REGIONAL OUTLOOK

- California **relies on excess generation to import** for their needs
- This **heatwave across the west** produced a backdrop of rolling blackouts across California
- Firm transactions that were sourced through California **were cut** or at risk of being cut up until 15 minutes before the hour which led to multiple organizations in the West declared energy emergencies bordering APS's territory. These included:
 - The **California Independent System Operator (CAISO)**
 - **Nevada Energy (NVE)**
 - **Imperial Irrigation District (IID)**
 - **Public Service Company of New Mexico (PNM)**
 - **Western Area Power Administration, Lower Colorado Region (WALC)**
 - **SRP** (after the loss of a major transmission line on Aug 18)

MOST CHALLENGING PERIOD AFTER SUN GOES DOWN WHILE LOADS REMAIN HIGH

08/14/2020

Net demand trend



APS CALLED ON ITS DIVERSE FLEET OF RESOURCES TO MEET CUSTOMER NEEDS



NATURAL GAS



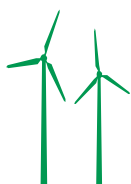
COAL



NUCLEAR



SOLAR PV



WIND



CSP w/ STORAGE



BIOGAS



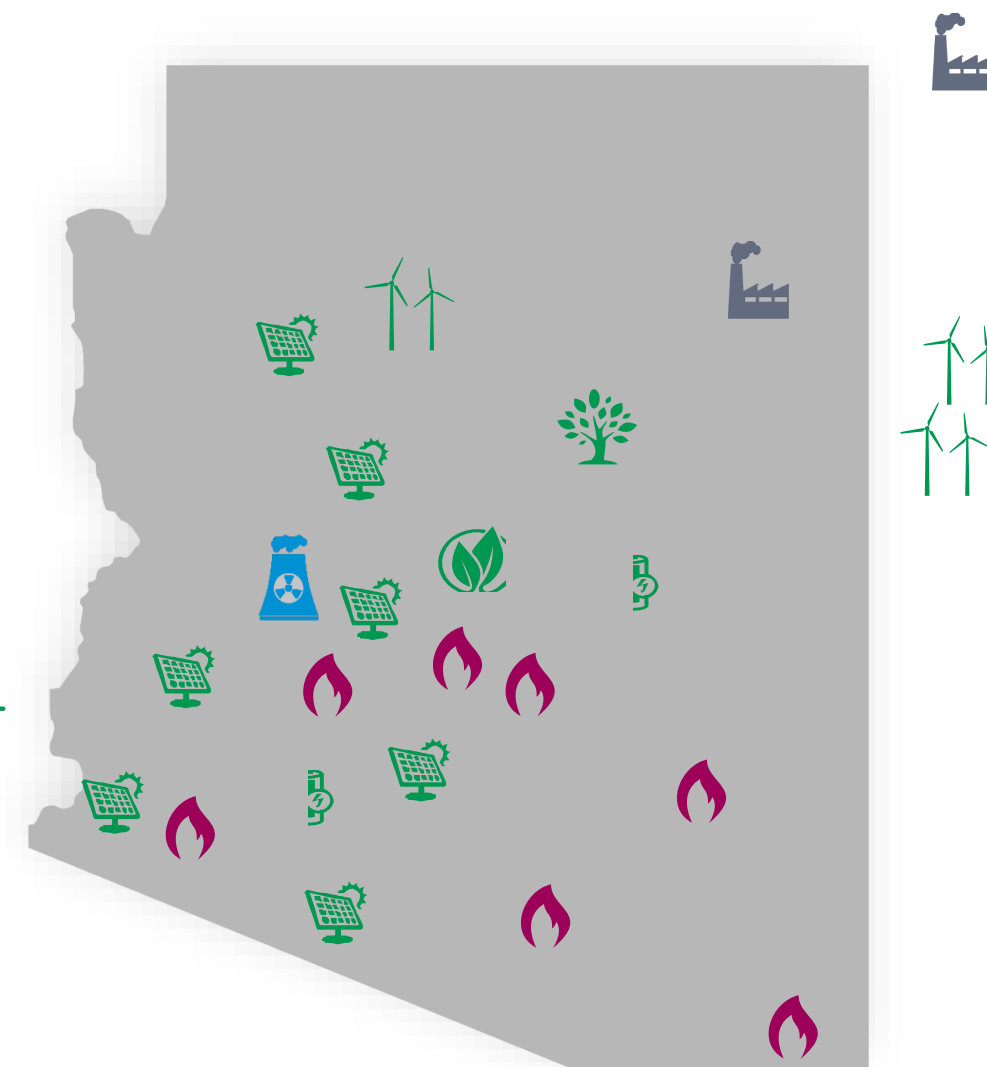
BIOMASS



GEO THERMAL



CUSTOMER ENGAGEMENT

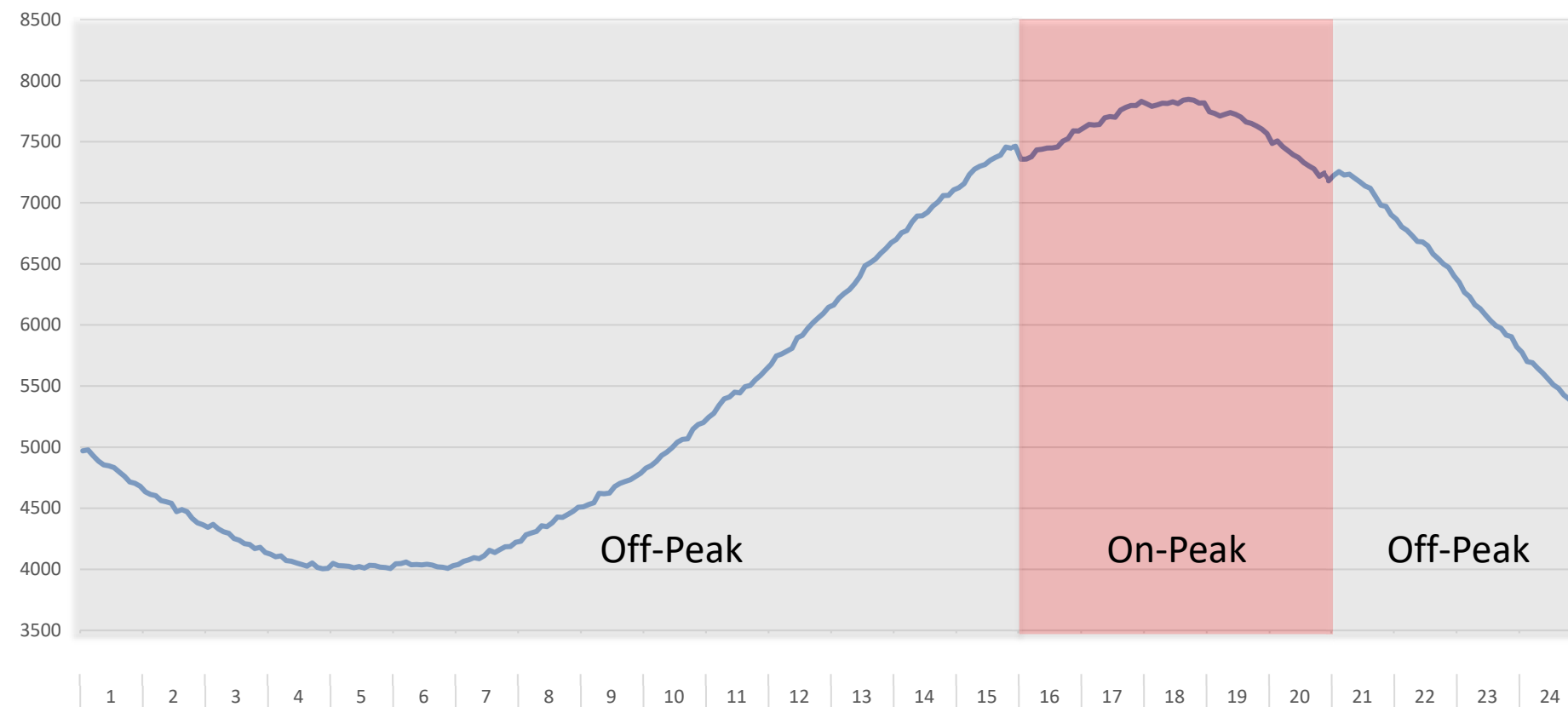


CUSTOMERS ARE ENGAGED THROUGH SAVINGS WITH TIME OF USE PLANS

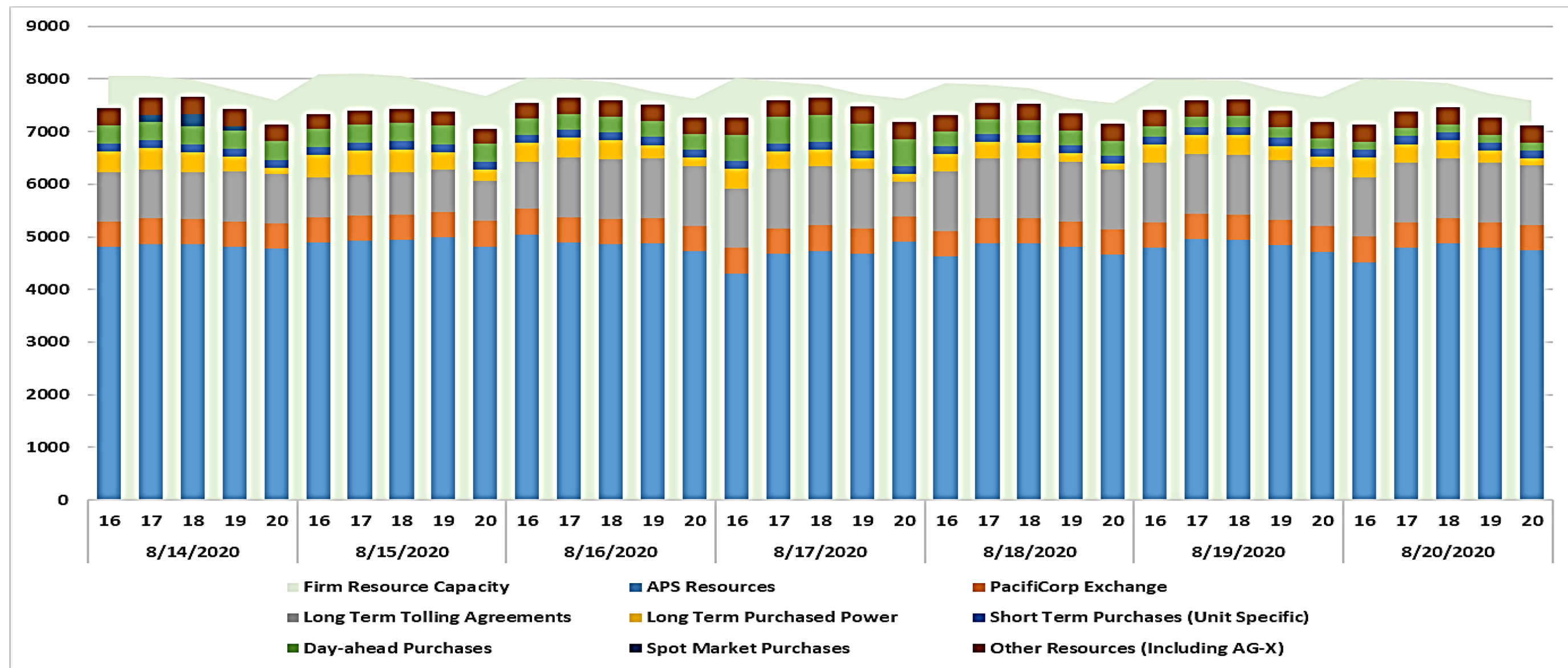
**Control Area Peak
(Instantaneous):
7,875 MW**

**Control Area Peak
(Hourly):
7,812 MW**

APS Control Area Customer Demand – July 30, 2020 (APS All-time Peak)



RELIABLE APS OPERATIONS ACROSS THE HEAT WAVE



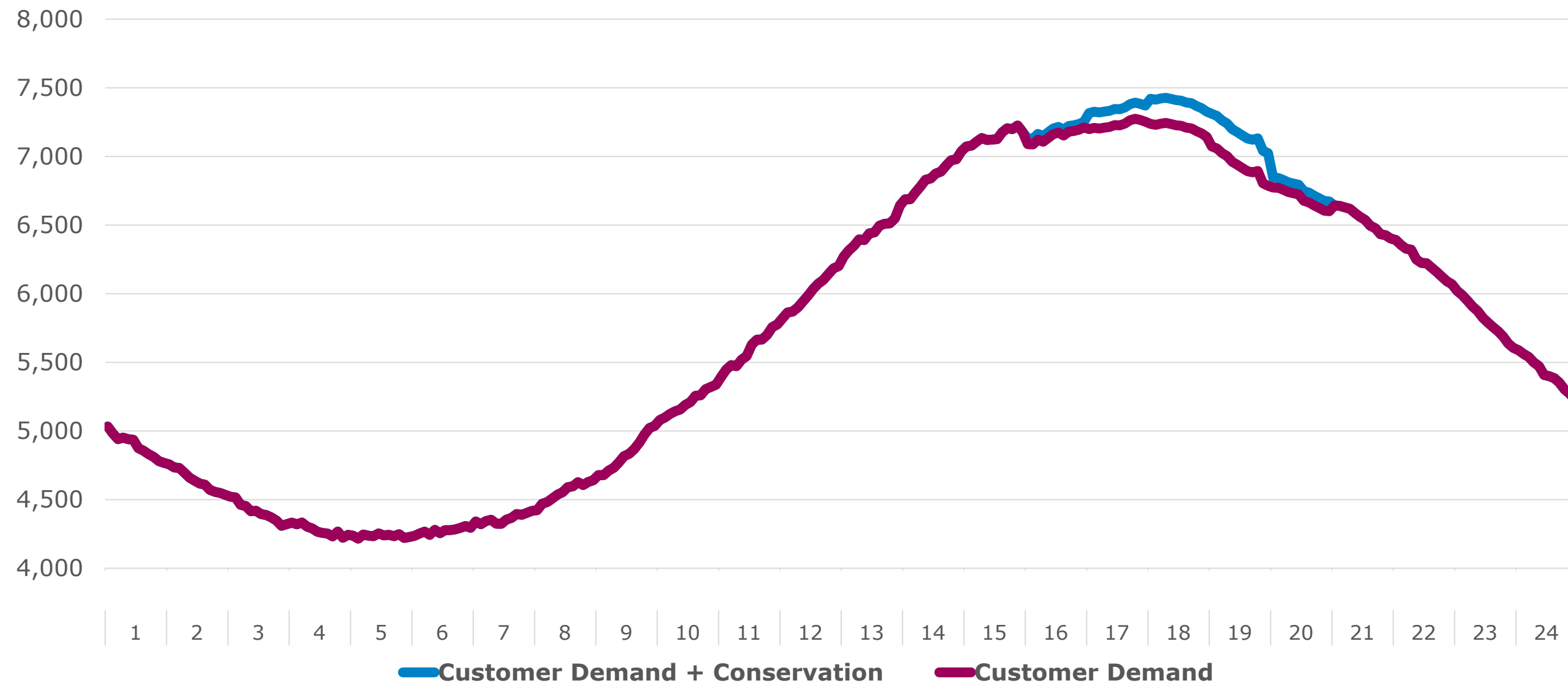
RELIABLE PLANNING IS ITERATIVE

		8/18/2020		
		Day-Ahead	Morning	Afternoon
Summary	Temperature Forecast	113	115	115
	Forecasted Peak Load	7245	7483	7434
	Forecasted Reserves ¹	1129	625	633
	Reserve Percentage at Peak	15%	8%	8%
Reserve Breakdown	Gross reserves	1129	815	823
	Curtailement Risk	0	190	190
	NERC Requirement	376	376	376
	Minimum Reserves ²	376	566	566
	Above Minimum Reserve (MW)	753	249	257

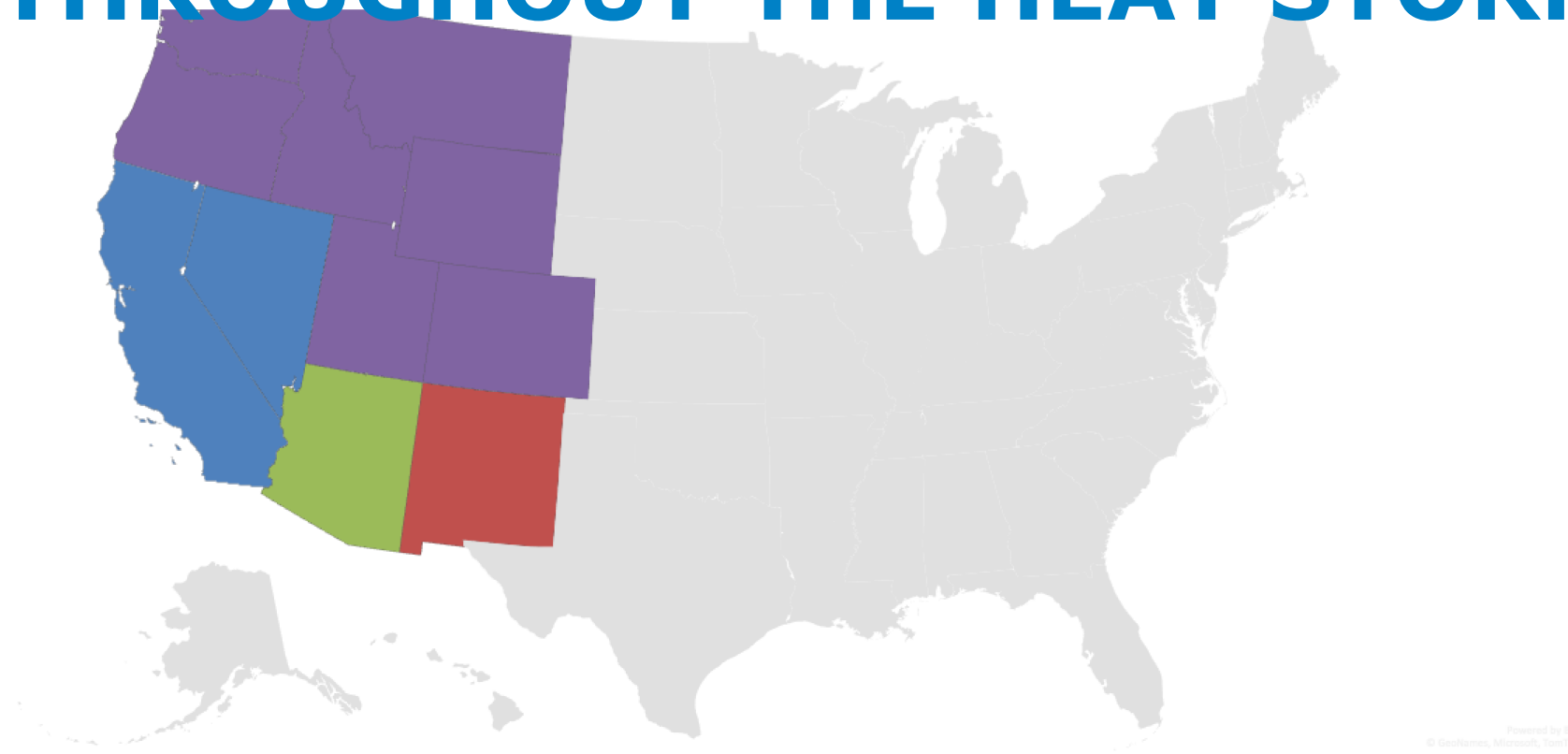
1. Gross Reserves less Curtailement Risk

2. Gross Reserves less Curtailement Risk and NERC Requirement

IMPACT OF CUSTOMER CONSERVATION OVER PEAK



APS PROVIDED MEASURED EMERGENCY ASSISTANCE THROUGHOUT THE HEAT STORM



	<i>Friday</i>	<i>Saturday</i>	<i>Sunday</i>	<i>Monday</i>	<i>Tuesday</i>	<i>Wednesday</i>
August	14	15	16	17	18	19
CAISO	EEA-3	EEA-3	EEA-2	EEA-3	EEA-3	
IID					EEA-3	
NVE (Nevada)		EEA-1			EEA-3	EEA-1
PNM					EEA-2	
PSEI (Puget Sound)						
SRP						EEA-1
WALC (WAPA)					EEA-1	
Avangrid				EEA-1		
GCPD (Washington)				EEA-1		

- Assistance provided in measured approaches to ensure APS customer reliability needs were met first

KEY TAKEAWAYS

- Regional power resource **constraints are real**
- There is a significant difference between asset-backed resources and market purchases.
- The **system is dynamic** and planning adjusts based on changes
- **Customers** continue to be outstanding **partners** to operations
- APS was well positioned to manage customer reliability throughout the events



Looking Forward

Jeff Burke - APS



Updates & Looking Ahead

- RFP update
- Green bond issuance
- DSM tool to support 2021 plan
- COVID load impacts
- All-source RFP Q4 2020
 - Clean energy
 - Renewable energy
 - Capacity



We are committed to the achieving our clean energy future with YOU

Thank You

