APS RPAC Meeting

12/14/2021

MEETING AGENDA

- Welcome/Introduction
  - Justin Joiner
  - VP Resource Management
- Current Conditions/Summer Review/Market Dynamics
  - Justin Joiner
  - VP Resource Management
- Introductions
  - 1898 & Co.
  - E3
- Load Forecast Conclusion
  - Jeff Burke
  - Director Resource Planning
- RPAC Vision/Next Steps
  - Justin Joiner
  - VP Resource Management

Current Conditions/ Summer Review/Market Dynamics

Justin Joiner

Multiple factors are converging to create new dilemmas for resource adequacy in the West

Growing loads

Load growth – driven by net migration, new industry, and electrification – is increasing overall capacity needs

Planned firm resource retirements

Retiring coal plants across the West and aging facilities in California (including Diablo Canyon) require replacement

Renewables and storage additions

Transition to variable & energy limited resources is reshaping the nature of resource adequacy needs

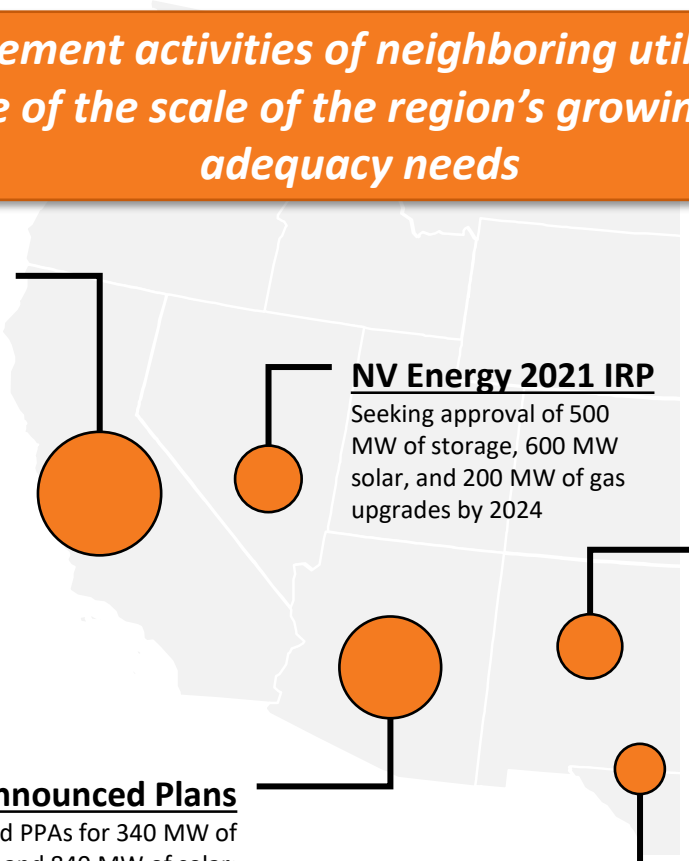
Increasing extreme weather

Regional climate conditions are resulting in increased frequency and intensity of extreme heat events, wildfire risks

Increasing risk of sustained drought

Hydroelectric generation facilities susceptible to significant impacts under drought, including risk of closure

Procurement activities of neighboring utilities are indicative of the scale of the region's growing resource adequacy needs



CPUC Mid-Term Reliability Decision

Authorizes 11.5 GW of effective capacity procurement by 2025 – most likely storage *(in the interim, the state has extended operating licenses for select once-through-cooling natural gas plants and eased restrictions on use of back-up generators)*

NV Energy 2021 IRP

Seeking approval of 500 MW of storage, 600 MW solar, and 200 MW of gas upgrades by 2024

PNM Replacement Resource Filings

Received approval for 650 MW of solar & 300 MW of storage; currently seeking approval of an additional 450 MW of solar & 290 MW of storage by 2023

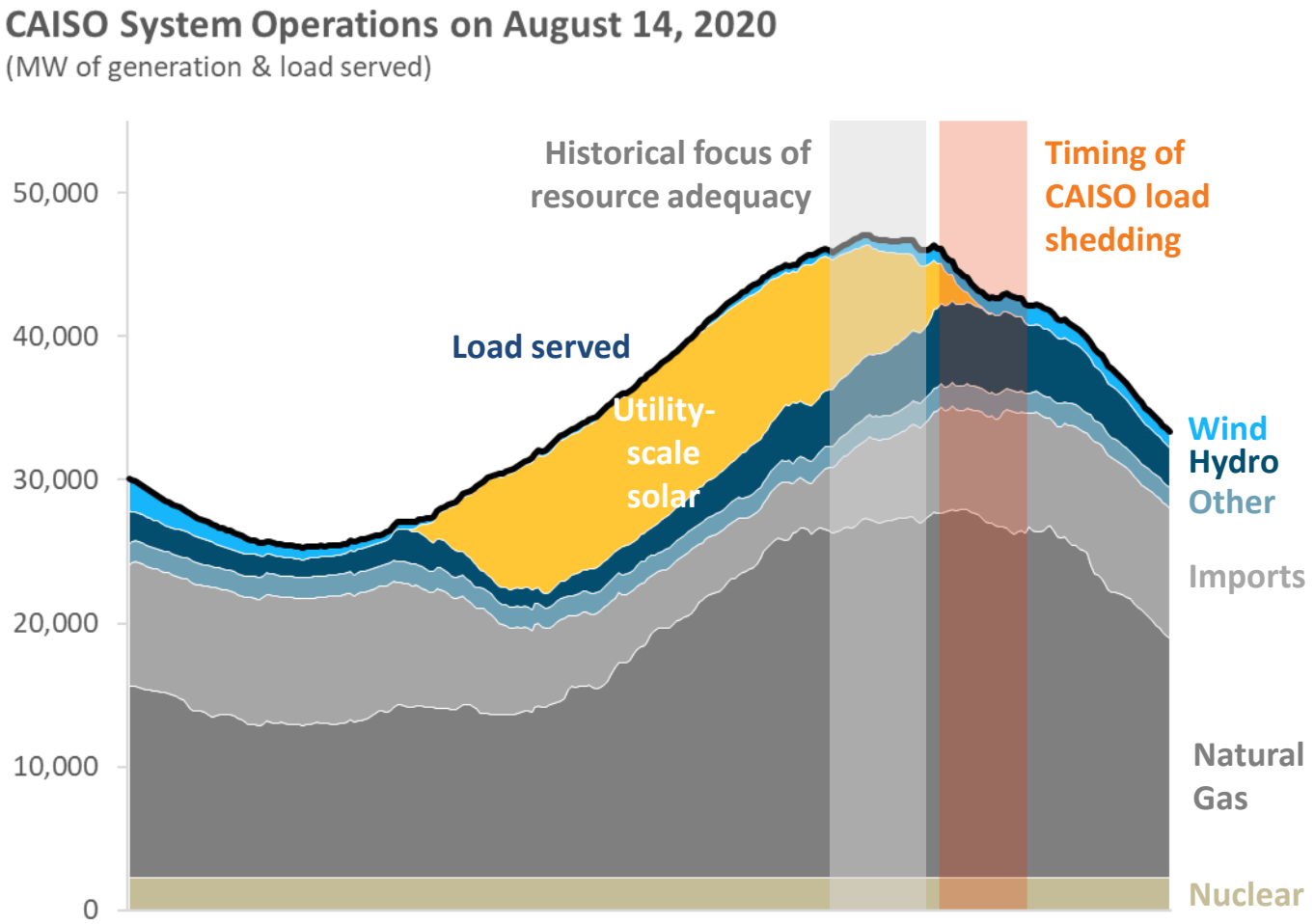
SRP Announced Plans

Signed PPAs for 340 MW of storage and 840 MW of solar; announced 800 MW expansion of Coolidge natural gas plant

EPE All-Source RFP

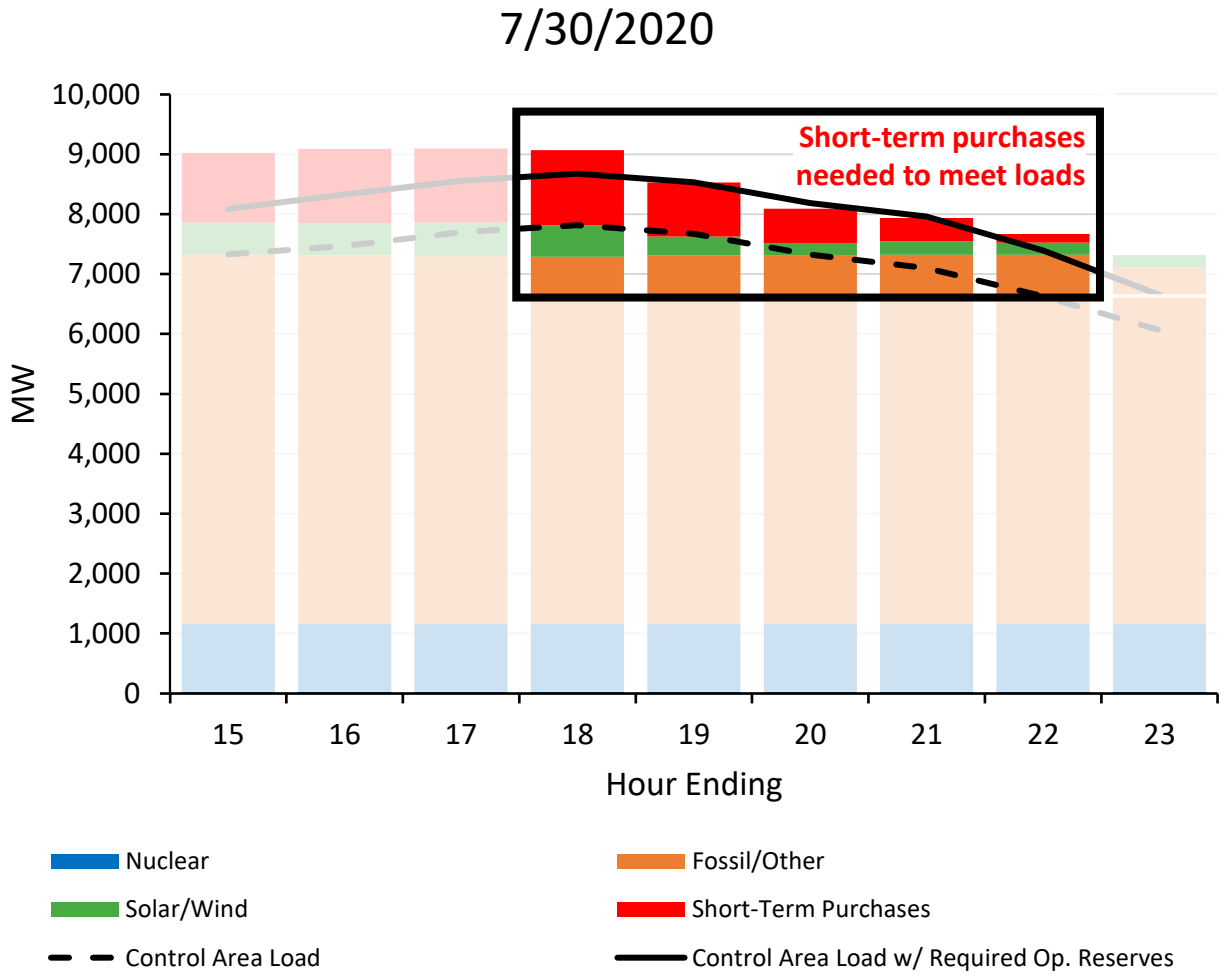
Issued in 2021 to fill 265 - 335 MW capacity need by 2025

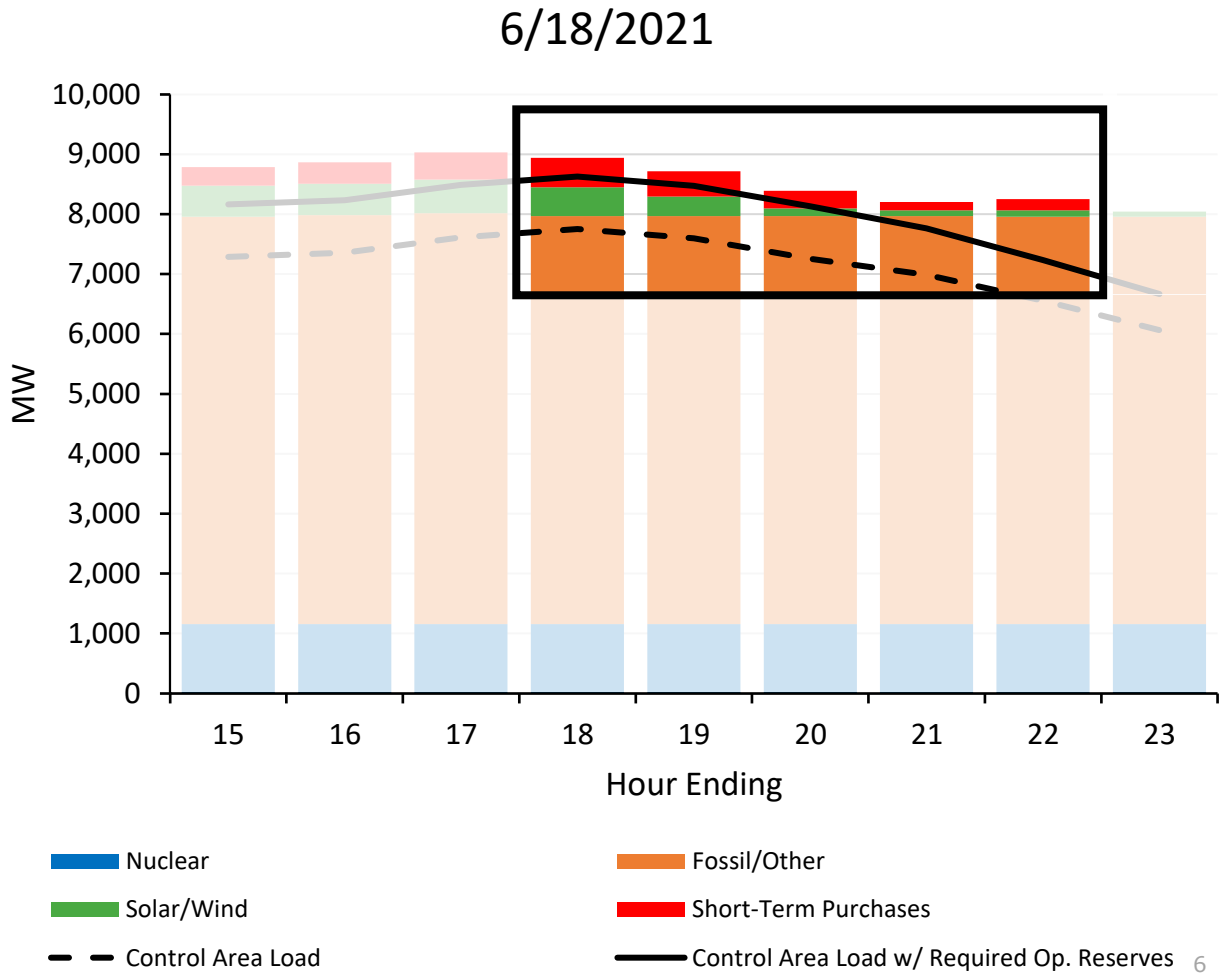
Increasing penetration of renewable generation is reshaping resource adequacy needs in the West



- Historically, resource adequacy has focused primarily on planning for peak demand
- Increasing penetrations of renewables and storage will cause risk to shift to other periods of the day, requiring innovation in planning approaches
- Many states in the West will transition to planning for evening net peak

On peak days this year and last year, APS depended on the short-term market to meet our obligations





A rapidly evolving landscape creates risk and opportunities

UTILITY DIVE

Arizona regulator warns that APS, Tucson Electric renewable overbuild could cost customers

Published Dec. 3, 2021

THE WALL STREET JOURNAL.

The Scramble for EV Battery Metals Is Just Beginning

Dec. 2, 2021

AZBIGMEDIA

Phoenix leads rapid growth in Arizona's tech sector through 2021

BUSINESS NEWS | 21 Jul | ERIC KELLY

Bloomberg

Blackouts Threaten Entire U.S. West This Summer as Heat Awaits

Outages are possible from Washington to New Mexico, with drought and searing temperatures forcing states to compete for electricity

S&P Global Platts

Mitsubishi Power to build hydrogen infrastructure across US West, other regions: CFO

Phoenix temperatures break another heat record, marking 4 consecutive days above 115

Michael Donohue Arizona Republic

Published 5:46 p.m. MT June 18, 2021

REUTERS®

Bill Gates' next generation nuclear reactor to be built in Wyoming

E&E NEWS

Major Calif. battery outage highlights energy storage risks

By Edward Klump | 09/13/2021 06:21 AM EST

THE VERGE

Renewables see record growth in 2021, but supply chain problems loom

AZ goes EV: Rate of electric car ownership relatively high in Arizona

By Brooke Newman/Cronkite News

July 4, 2021

Discussion & Questions

Introductions

1898 & Co.

E3

1898 & Co.

We are the business, technology and security solutions consultancy part of Burns & McDonnell.

We are a nationwide network of consulting professionals supporting:

- Business optimization
- Digital transformation
- Cyber security / risk management

Backed by the power of 8,000+ Burns & McDonnell employee-owners

1898 & CO SM
PART OF BURNS McDONNELL

Matthew Lind PE MBA

-Director and National practice lead for Resource Planning & Market Assessments business
-Worked in all North American markets
-Client profiles include electric utilities, independent developers, and RTO/ISO markets
-Expert witness testimony for G and T-related filings
-Support stakeholder processes related to IRP, RFP, etc.

About E3

- Founded in 1989, E3 is a leading energy consultancy with offices in San Francisco, Boston, New York, and Calgary
- E3 works extensively with utilities, developers, government agencies, and environmental groups to inform strategy and key decisions
- Our experts lead rigorous technical analyses, develop innovative methods to study new problems, and provide critical thought leadership to the industry
- E3's practice areas provide a comprehensive view of the industry including supply, delivery, demand, and investment

Climate Pathways

Work with public & private sector clients to evaluate economy-wide pathways for decarbonization

Includes comprehensive and long-term GHG analysis

Resource Planning

Provide integrated resource planning support for utilities, regulators, and stakeholders using in-house and commercial models

Conduct technical studies of resource adequacy and system operations

Asset Valuation and Markets

Conduct market analysis to support generation and transmission owners and developers

Inform strategy based on technical analysis and knowledge of markets, regulation & public policy

DERs and Rates

Analyze distributed energy resources, evaluating costs and benefits now and in the future

Support rate design and distribution system planning

E3 Team Members

Lakshmi Alagappan
Partner

Expert in integrated resource planning, transmission planning, and markets; consultant to utilities across the WECC and Northeast

Nick Schlag
Director

Expert in integrated resource planning and resource adequacy; consultant to utilities across Arizona, Nevada, and New Mexico

Adrian Au
Consultant

Analyst with experience studying renewable integration and resource adequacy in low-carbon electricity portfolios

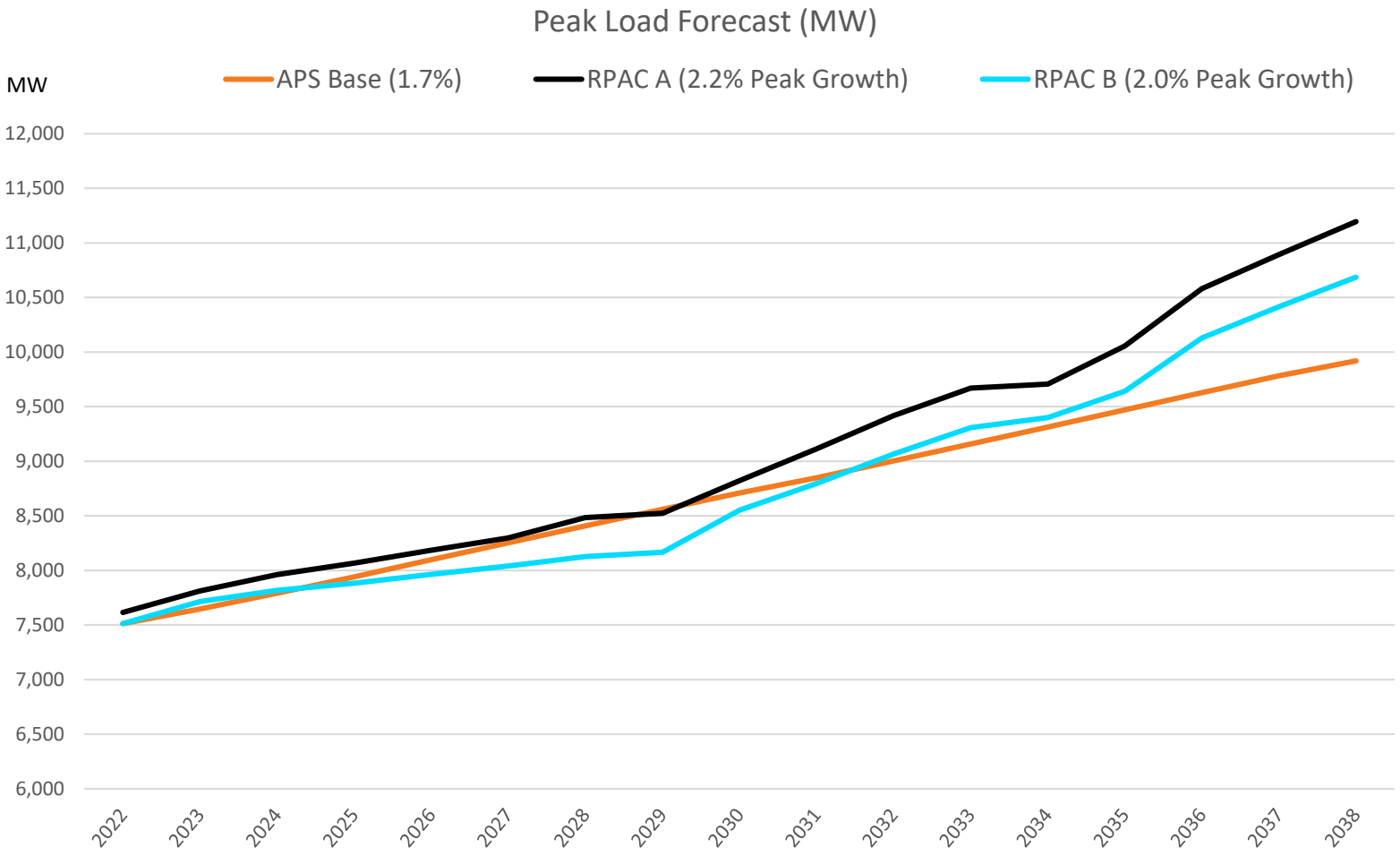
Load Forecast Conclusion

Jeff Burke

RPAC Load Forecast Selection Results

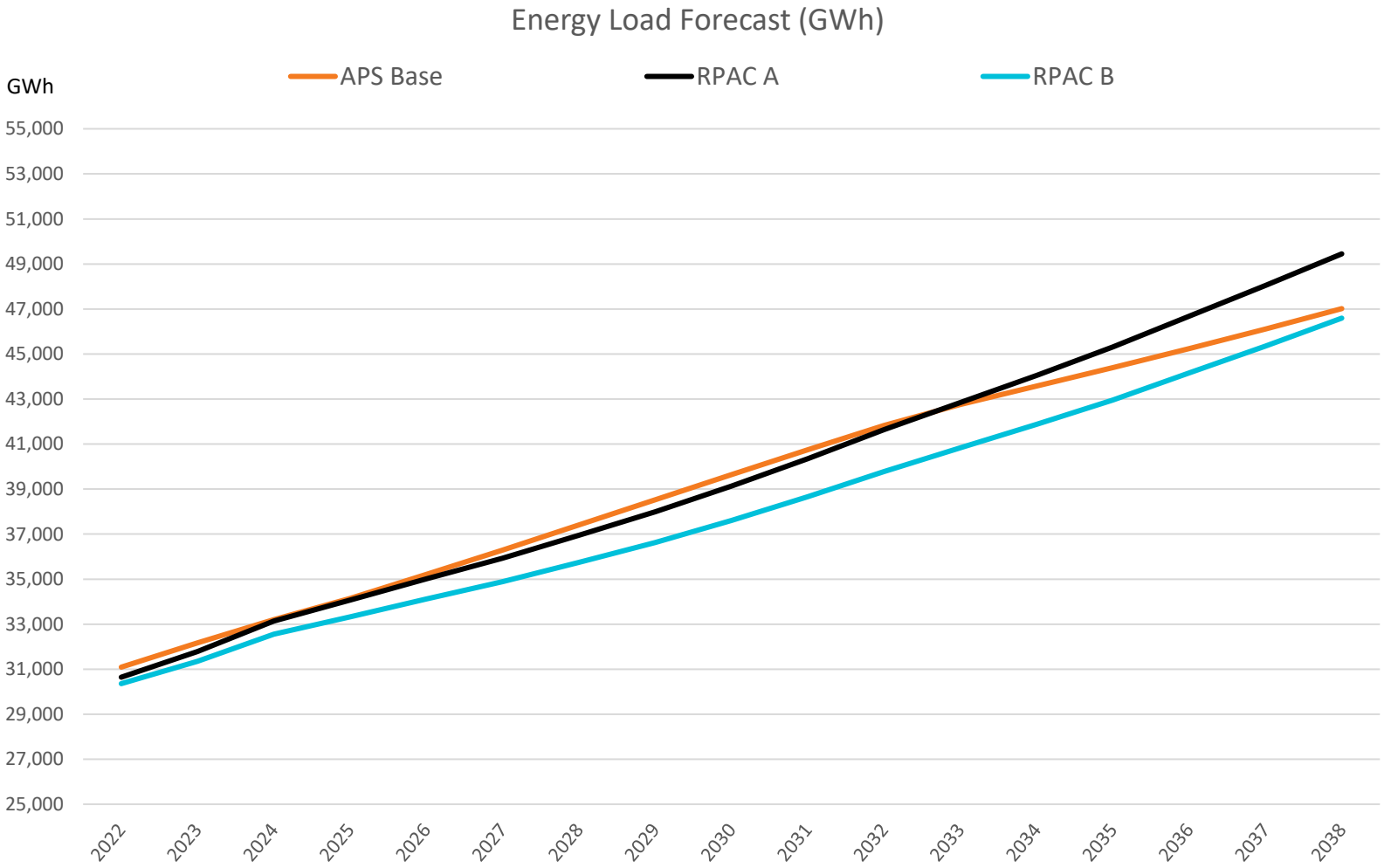
- APS developed multiple forecasts and prepared base, high and low estimates of significant drivers in the forecast for RPAC discussion:
  - Demand side management (DSM)
  - Distributed generation (DG)
  - Electric vehicles (EV)
  - Economic development
  - Extreme weather/Temperature
- The RPAC was asked for opinions and discussion based on forecast options provided by APS to formulate an alternative forecast:
  - DSM: Two options discussed equally: Base (1.3%) & High Scenarios (1.8%)
  - DG: High scenario (18,000-25,000 systems per year)
  - EVs: High scenario (~2.3M vehicles by 2038)
  - Economic development: Base scenario (Moderate economic development)
  - Extreme weather: (degrees above normal weather assumption): 2° Fahrenheit scenario

Peak Growth Comparison to APS Base Forecast



- RPAC peak forecasts reflect different levels of DSM
  - RPAC A shows 1.3% DSM
  - RPAC B shows 1.8% DSM
- High EV forecast reflects large peak growth in period 2030 and beyond
- Extreme weather variable reflects higher temperatures in the peak forecast only
  - Approximately 125 MW per degree

Energy Growth Comparison to APS Base Forecast



- RPAC Energy forecasts reflect different levels of DSM
  - RPAC A shows 1.3% DSM
  - RPAC B shows 1.8% DSM
- High DG forecast reduces energy growth over all years
- High EV forecast reflects increases in energy usage

RPAC Load Forecast – Next Steps

- Final forecasts will be provided to the ACC
- A letter will be attached discussing the following:
  - The RPAC members and associated representation
  - An overview of the process used to develop the forecasts noting that RPAC forecast was completed with available information provided by APS with feedback from the RPAC
  - The RPAC forecast was developed to discuss priorities and gain input from RPAC members, but should not be represented as a particular individual's perspective
  - Note that some RPAC forecast drivers were discussed as aspirational in nature

RPAC Focus and Next Steps

RPAC Focus and Commitments

- RPAC re-focus will begin now through May:
  - Monthly meetings, with an ad-hoc meeting as needed that accommodate RPAC members' schedules
  - 1898 and E3 will facilitate dialogue and provide supplemental analysis where beneficial to process
  - External speakers and industry experts will be engaged when possible to bring additional context to conversations

- RPAC focus premised on the APS Promise: As stewards of Arizona, our commitment is to do the right thing for the people and prosperity of our state. Our vision is to create a sustainable energy future for Arizona. Our mission is to serve our customers with clean, reliable and affordable energy
  - Clean: APS commitment of 65% clean, 45% renewable by 2035 and 100% clean, carbon-free by 2050
  - Reliable: the safe and dependable delivery of energy to our customers is at the core of APS
  - Affordable: costs, both immediate and long-term, must be considered in all options and plans

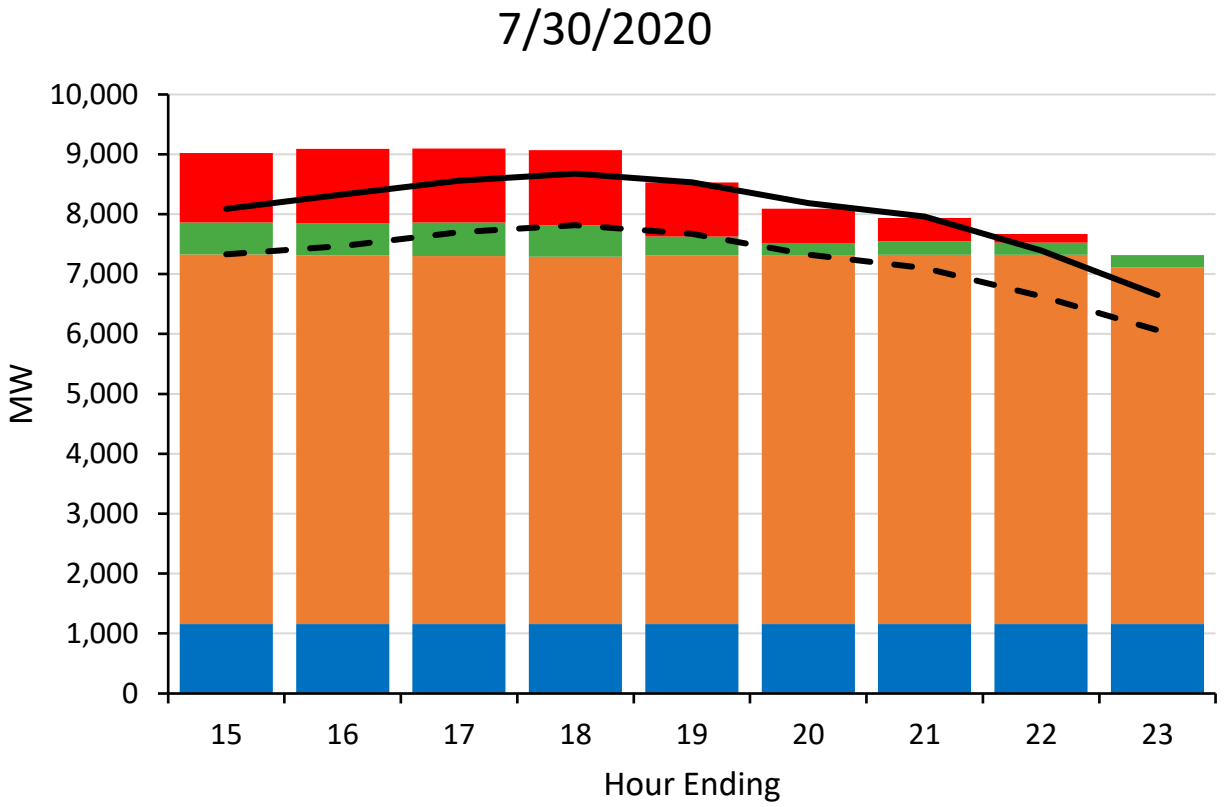
- RPAC focus will be principled around a process that is:
  - Transparent: materials going forward will be publicly posted well in advance
  - Collaborative: all views and goals to receive equal opportunity to participate and equal level of weight
  - Productive: an appropriate level of modeling and principled discussion will take place to ensure results

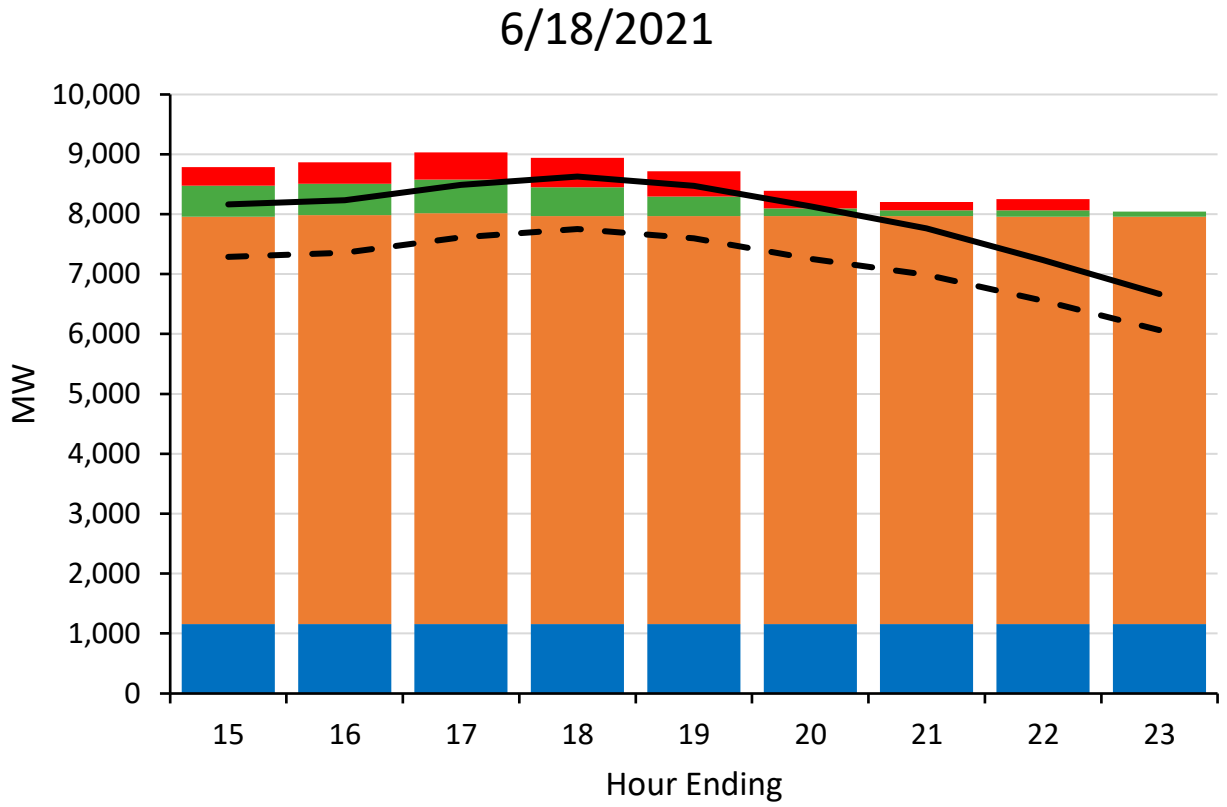
Discussion/Next Steps

- Upcoming RPAC Meetings:
  - January 20th
  - February 17th
  - March 23rd
- Open dialogue:
  - Questions/comments from RPAC
  - Suggestions on topics and focus and ways to be successful
- Get in touch:
  - Justin.Joiner@aps.com
  - (602) 250-2347

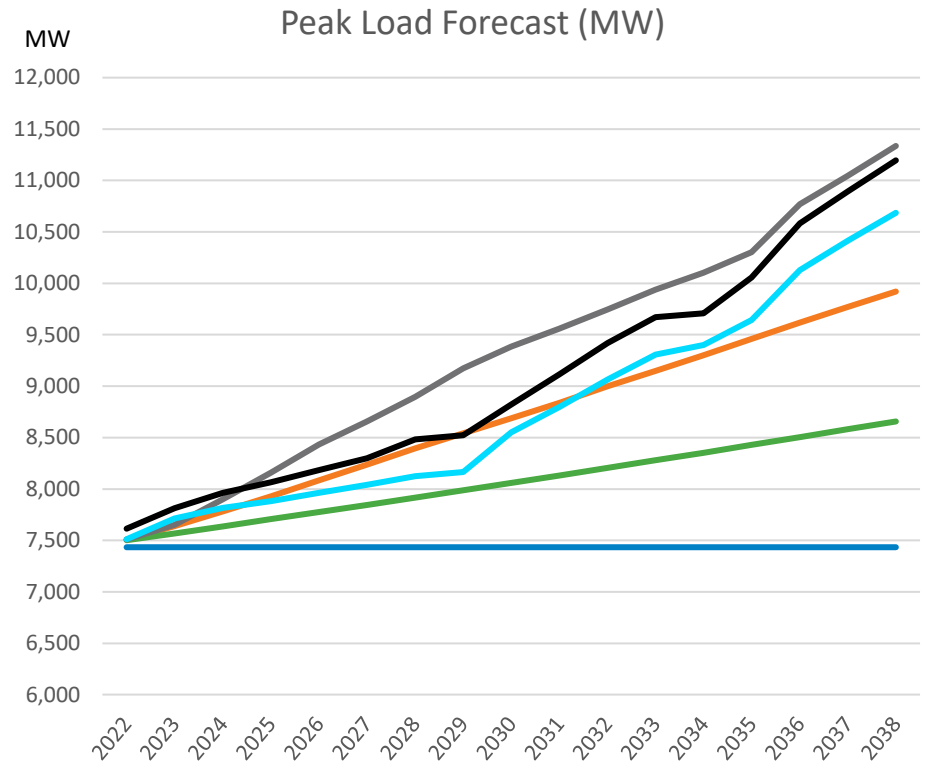
Appendix

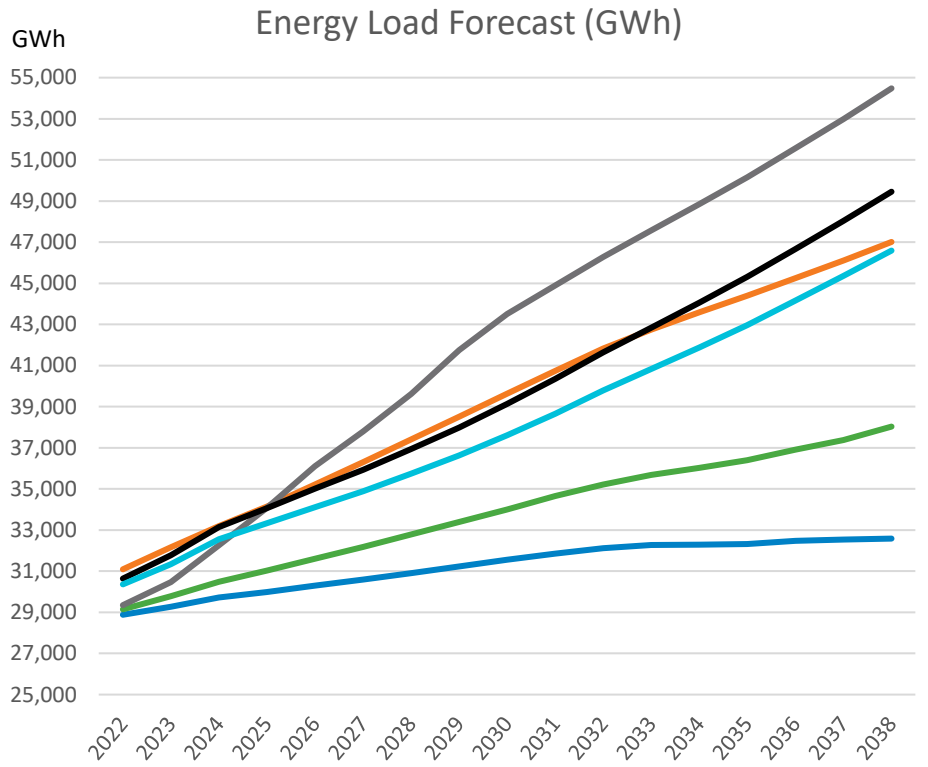
On peak days this year and last year, APS depended on the short-term market to meet our obligations





Load Forecast Comparisons

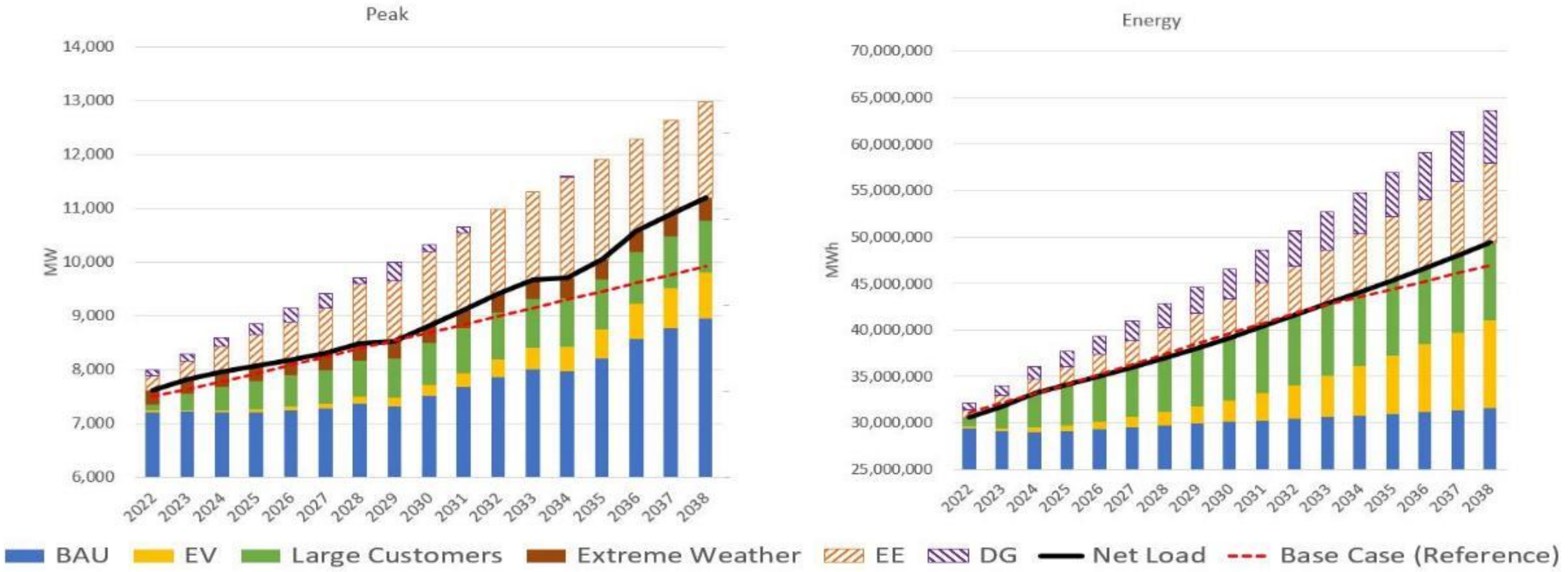




Base | Zero Peak Growth | Low Peak Growth | High Peak Growth | RPAC A | RPAC B

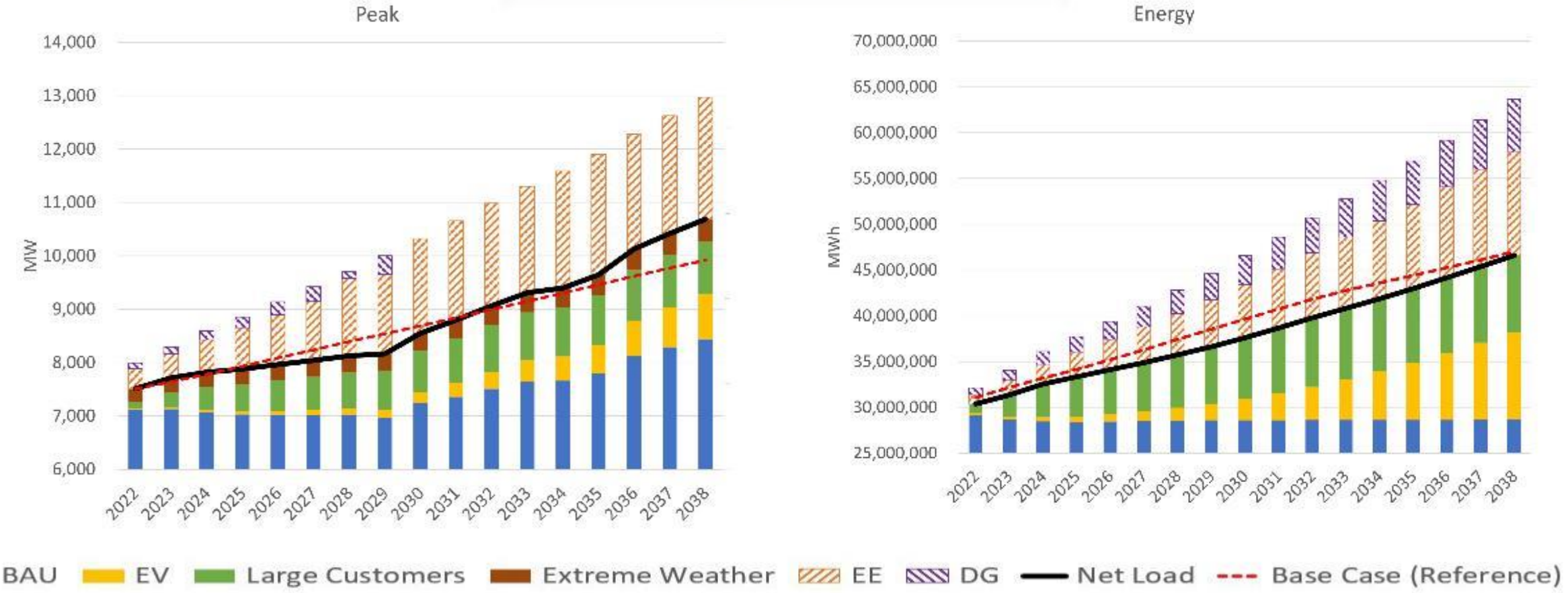
RPAC A - Model Results – (2.2% Peak Growth)

BAU	DSM	DG	EV	Large Customers	Extreme Weather
Base	Medium	High	High	Medium	2° F



RPAC B - Model Results – (2.0% Peak Growth)

BAU	DSM	DG	EV	Large Customers	Extreme Weather
Base	High	High	High	Medium	2° F



Peak Growth Annual Forecasts (MW)						
	Base	Zero Growth	Low Growth	High Growth	RPAC - A	RPAC - B
2022	7,508	7,435	7,502	7,509	7,613	7,254
2023	7,639	7,435	7,569	7,653	7,812	7,446
2024	7,782	7,435	7,637	7,900	7,962	7,541
2025	7,929	7,435	7,706	8,158	8,066	7,596
2026	8,084	7,435	7,776	8,433	8,184	7,669
2027	8,238	7,435	7,845	8,656	8,298	7,738
2028	8,394	7,435	7,916	8,895	8,484	7,813
2029	8,541	7,435	7,987	9,174	8,523	7,844
2030	8,688	7,435	8,059	9,385	8,821	8,219
2031	8,839	7,435	8,132	9,560	9,114	8,453
2032	8,998	7,435	8,205	9,747	9,418	8,712
2033	9,149	7,435	8,279	9,939	9,671	8,943
2034	9,302	7,435	8,353	10,104	9,707	9,027
2035	9,458	7,435	8,428	10,303	10,057	9,259
2036	9,619	7,435	8,504	10,770	10,581	9,733
2037	9,769	7,435	8,581	11,046	10,893	10,010
2038	9,919	7,435	8,658	11,336	11,195	10,268

Energy Growth Annual Forecasts (GWh)						
	Base	Zero Growth	Low Growth	High Growth	RPAC - A	RPAC - B
2022	31,091	28,889	29,146	29,352	30,647	30,356
2023	32,169	29,278	29,790	30,472	31,783	31,345
2024	33,197	29,718	30,492	32,252	33,140	32,553
2025	34,144	29,993	31,036	34,082	34,066	33,328
2026	35,212	30,290	31,607	36,098	35,009	34,117
2027	36,297	30,596	32,185	37,791	35,934	34,888
2028	37,413	30,907	32,787	39,618	36,946	35,743
2029	38,522	31,235	33,390	41,747	37,993	36,631
2030	39,640	31,560	34,004	43,504	39,132	37,610
2031	40,743	31,851	34,652	44,892	40,346	38,661
2032	41,823	32,112	35,214	46,278	41,636	39,786
2033	42,753	32,268	35,679	47,565	42,847	40,831
2034	43,581	32,292	36,024	48,840	44,055	41,871
2035	44,392	32,327	36,399	50,147	45,312	42,961
2036	45,246	32,472	36,909	51,573	46,675	44,157
2037	46,113	32,545	37,376	52,994	48,042	45,355
2038	47,018	32,583	38,036	54,478	49,449	46,593