

ARIZONA ENERGY LANDSCAPE

Jeff Burke

Director, Resource Planning

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ARIZONA OVERVIEW

ARIZONA – ECONOMIC OVERVIEW

Population

- 7.0 million
- Population migration robust
- Growth: 1.6% in 2016
- More than double the national average

Economy

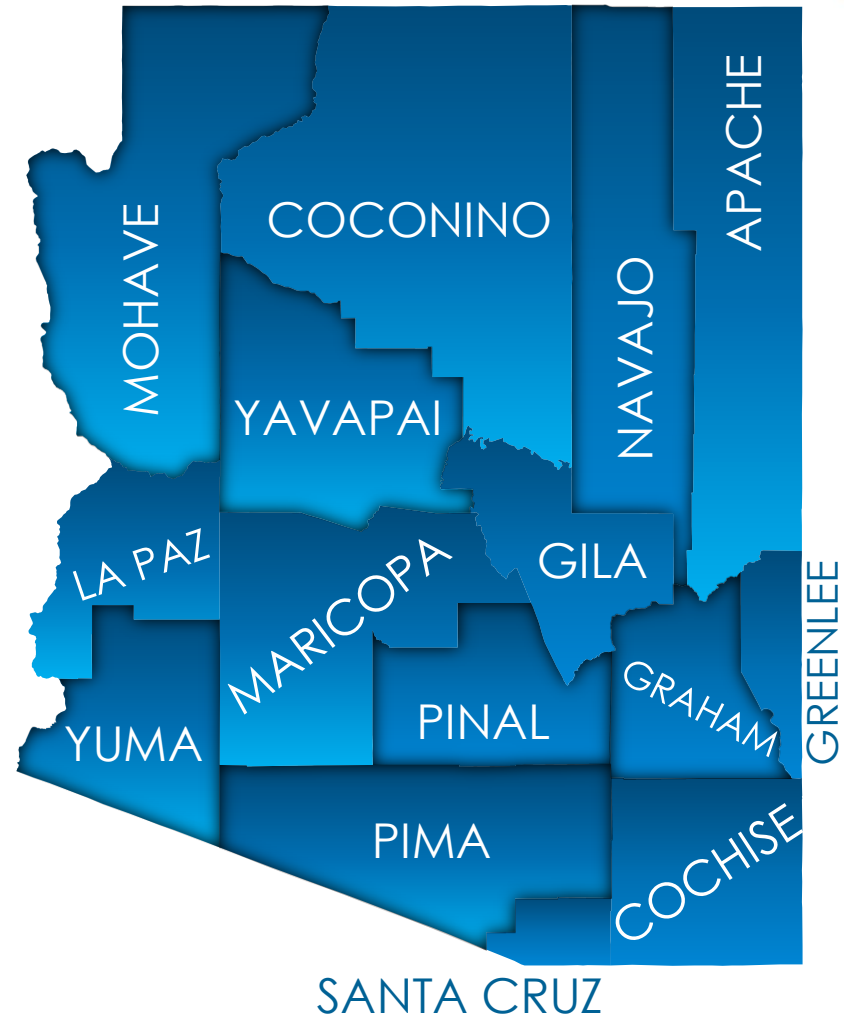
- Gross State Product: \$320 billion
- Arizona, with its highest GSP growth rate since 2007, is projected to beat the national average of 3.0% in upcoming years

Employment

- Employment growth continues to outpace national average
 - Job growth is 2x the national average
- Since 2015, over 140,000 private sector jobs have been added

Advantages to Doing Business in Phoenix

- Deep talent pool from tech companies, universities and tech resources
- High quality life
- Low cost-to-do business



DATA CENTER GROWTH CONTINUES

Phoenix Ranks #5

Low-cost, reliable electricity

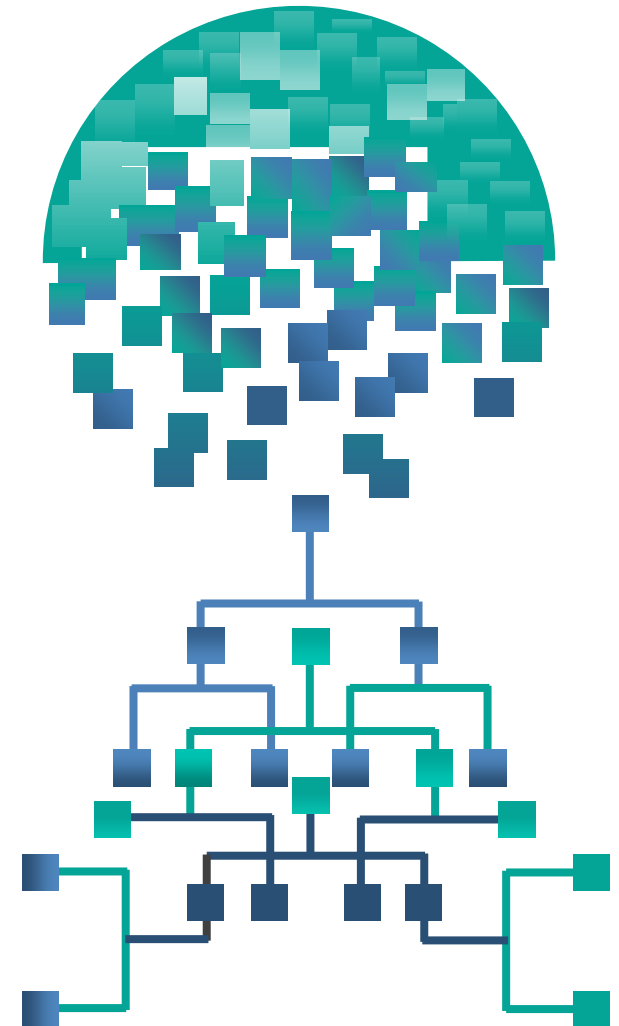
- Compared to other southwest markets
- APS energy mix is 50% clean energy

Long-term commitment

- Phoenix continues to add and expand data centers to meet the growing data needs
- Existing and planned data center capacity requirements approaching 400 MW

Safe location

- Phoenix has an extremely low incidence of natural disasters



APS OVERVIEW

APS - OVERVIEW

Company

- Serving AZ since 1886
- AZ largest tax payer
 - \$3.4B annual economic impact

Customers

- 1.2 million

2017 Peak Demand

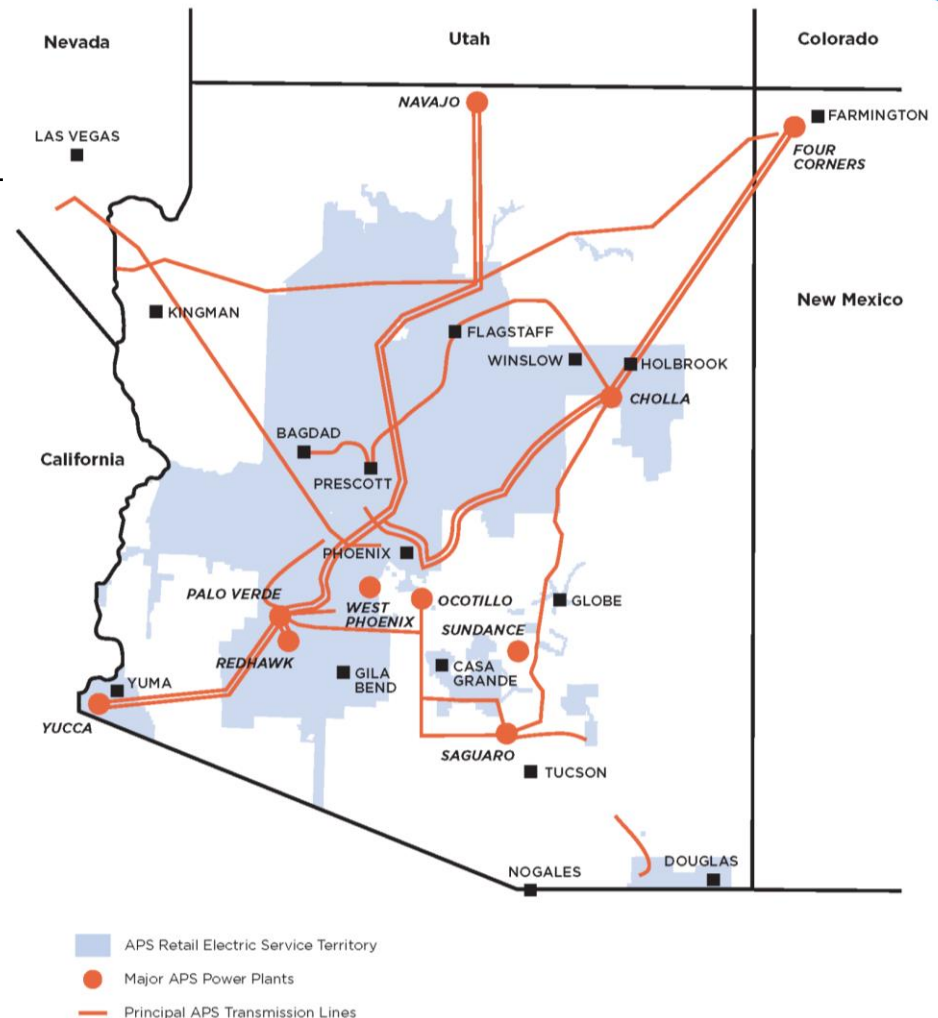
- 7,367 MW

Generation Capacity

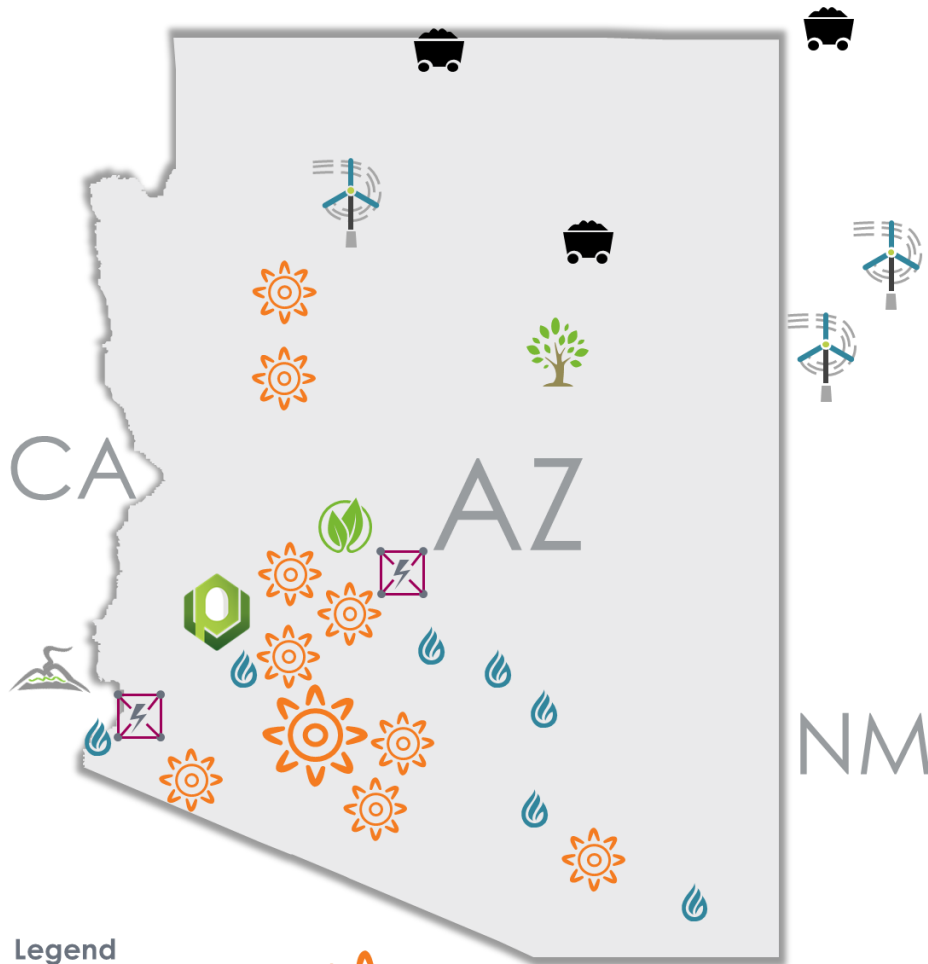
- About 6,300 MW of owned capacity

Transmission & Distribution

- Approximately 430 substations, 300,000 transformers and more than 550,000 poles and structures



APS RESOURCE DIVERSITY

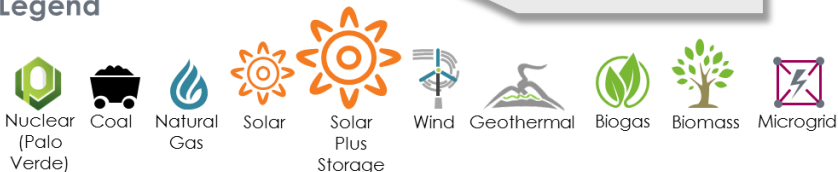


- Renewable energy resources are the second largest piece of the APS system

2018 Resources (MWs)

	NAMEPLATE CAPACITY
Nuclear	1,146
Coal	1,672
Natural Gas	4,959
Microgrid/ESS (Quick Start)	34
Renewables	1,784
Customer-Based DSM	854
TOTAL	10,448

Legend

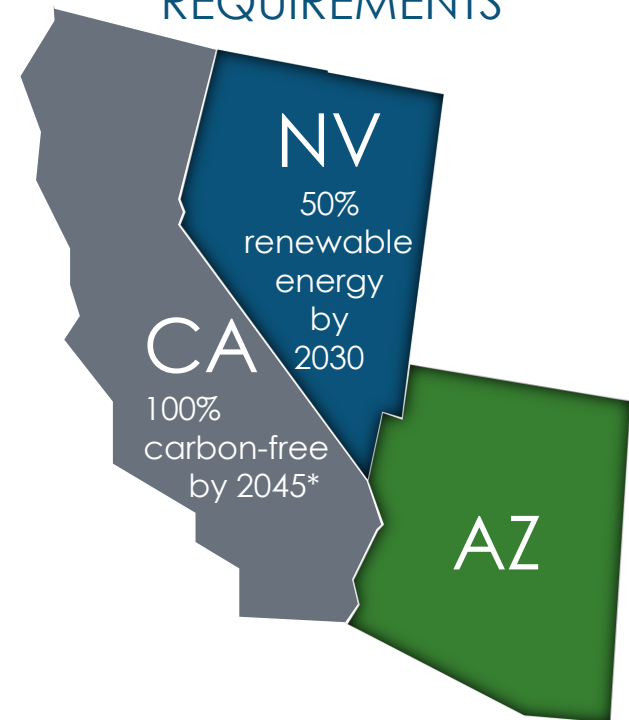


THE TRANSFORMATION OF WESTERN ENERGY MARKETS

MEGATRENDS AFFECTING ENERGY SUPPLY

- Increasing levels of regional renewable energy resources due to:
 - Regulatory / legislative mandates
 - Continued growth in rooftop solar resources
- Baseload resources challenged
 - Designed to operate at high capacity factors
- Low natural gas prices

RECENTLY PROPOSED AND ENACTED RENEWABLE ENERGY REQUIREMENTS

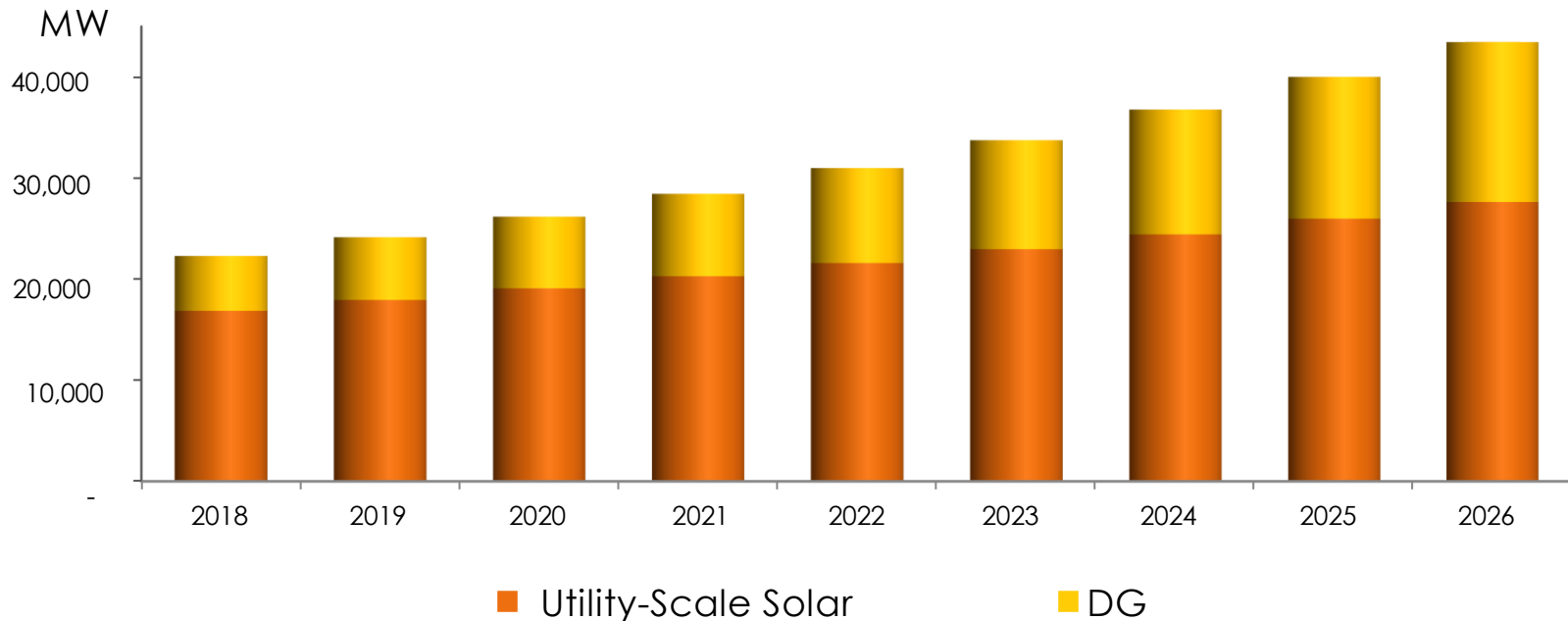


*Enacted September 10, 2018 9

REGIONAL FORECASTS

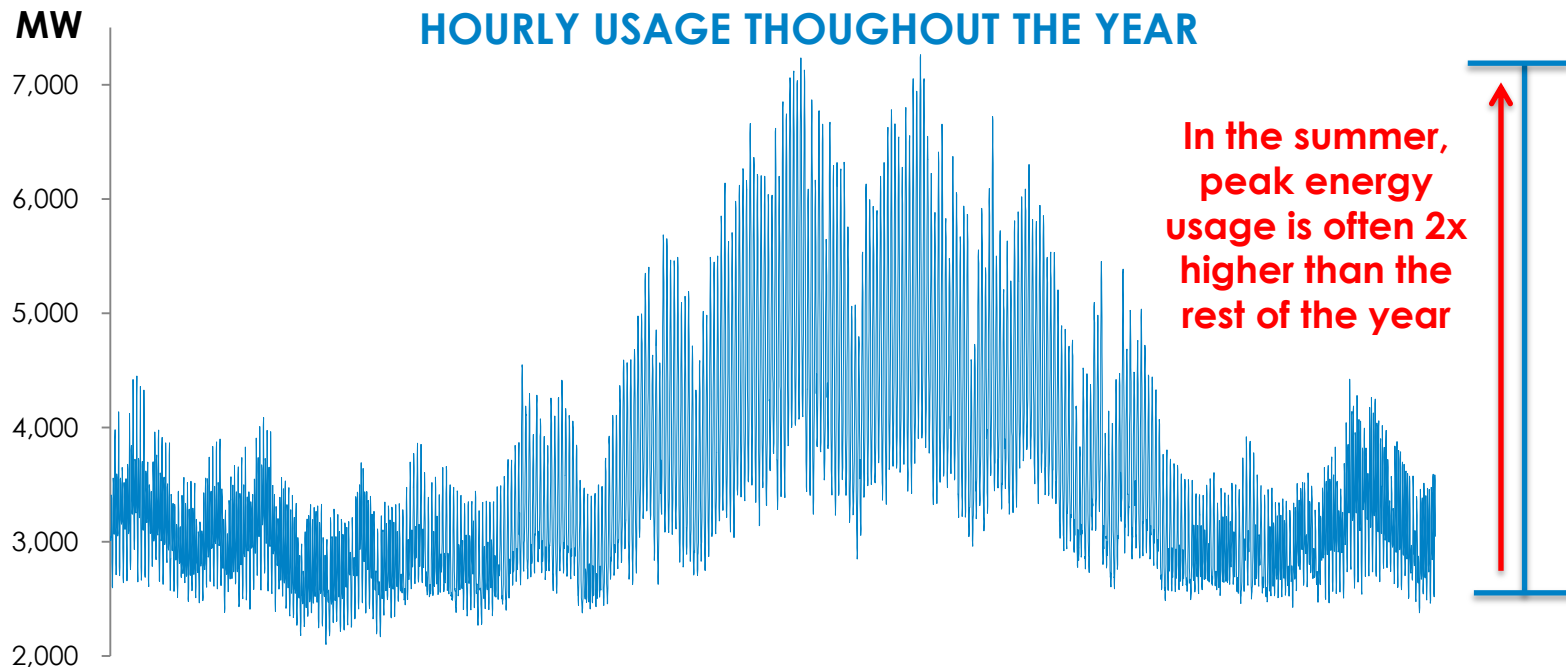
- Continued growth in western solar market
- California is expected to exceed 40,000 MW of installed solar by the middle of the next decade
- Solar penetrations are four years ahead of schedule

CAISO SOLAR FORECAST



TYPICAL ANNUAL ENERGY USAGE

- APS's customer base is ~90% residential
- Weather conditions drive load and resource needs
- Customer demand for power peaks in the summer months due to air conditioner load in Arizona's 100^o+ temperatures

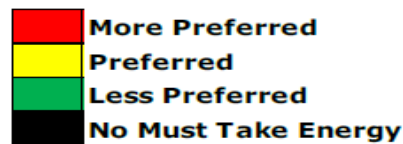
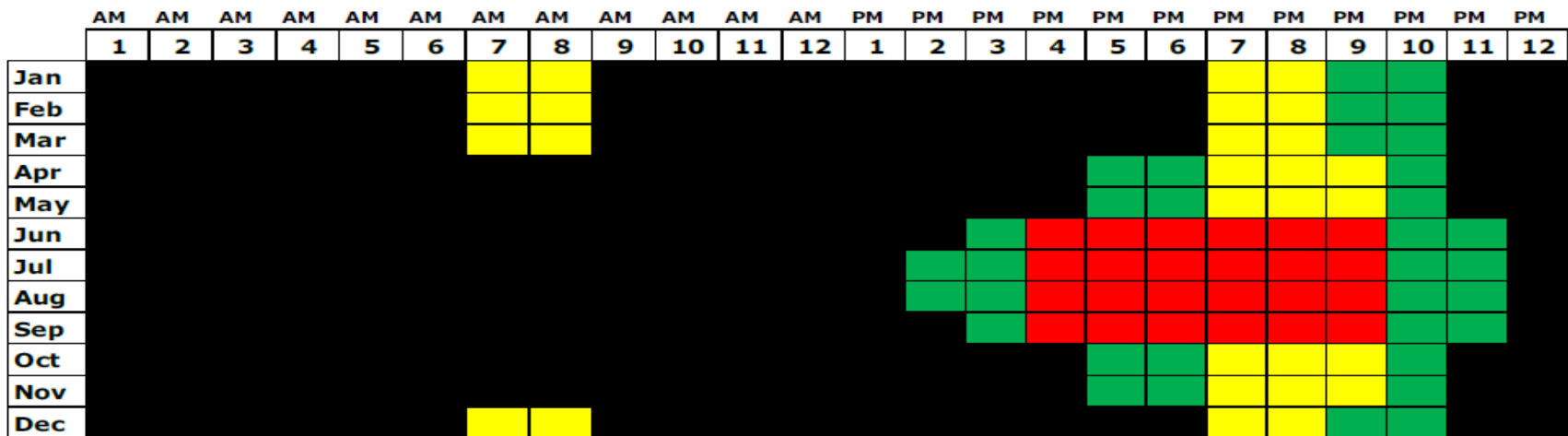


PEAKING RESOURCE NEEDS

Primary need June to September 3-9pm

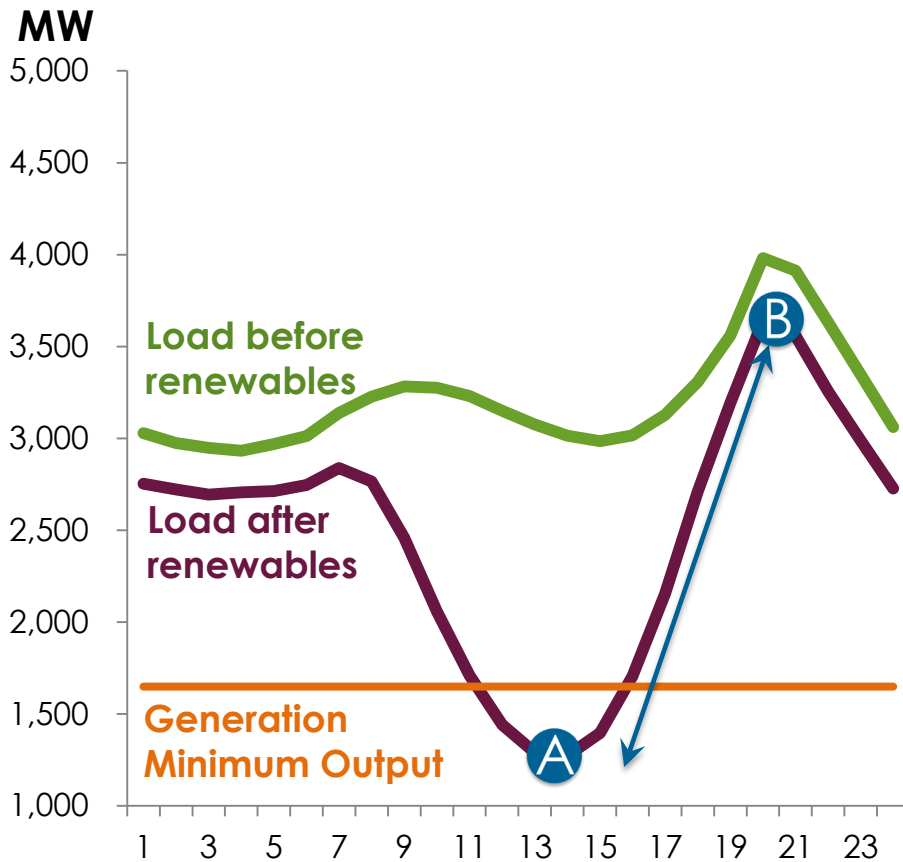
Appendix A

Time of Day Relative Net Load Heat Map



THE “DUCK CURVE”

Non-Curtailable Rooftop Solar is Changing the Load Shape of the Grid



A Meeting Evening Peak → B

- The mid-day dip in load disappears once the sun sets
- This causes a steep ramp in demand heading into the evening peak
 - Requires fast-starting, flexible resources to respond

A The mid-day dip in load due to growth of non-curtailable rooftop solar resources on the system

B Evening peak

POLICY and LEGISLATIVE DEVELOPMENTS

CLEAN ENERGY FOR A HEALTHY ARIZONA AMENDMENT (CEHA)

- **What It Is**

- Proposed Constitutional Amendment requiring 50% renewable energy (in retail sales) by 2030. Proposed effective date: January 01, 2019

- **What It Is Not**

- Despite its name, CEHA is not about clean energy. Only renewable energy resources are counted towards the 50% goal

- **Impacts**

- Early closure of all baseload resources
- Nearly 8,000 MW of renewables on the system by 2030
- Operating challenges will intensify

- **How Much Will It Cost?**

- \$15 billion in increased costs for APS customers
- Customer bills are projected to double by 2030

- **Not inclusive**

- Only renewable energy resources are eligible
- Other clean resources, like nuclear and energy efficiency , are not eligible

50%
RENEWABLES



CEHA'S OVERHAUL OF THE PORTFOLIO

High Cost, Low Reward



IN

Nearly 8,000 MW of renewable energy will be on the APS system by 2030 – a level that does not align with customer needs

- **Solar – 2,400 MW**
- **Wind – 800 MW**
- **Storage – 1,500 MW**
- **Rooftop Solar – Over 3,000 MW**
- **Natural Gas - Over 1,000 MW of additional natural gas resources will be needed**



OUT

The premature closure of power plants totaling 2,500 MW in capacity will come at a cost to Arizona jobs and APS customers

- **Cholla – 12/31/2022**
- **Four Corners – 12/31/2023**
- **Palo Verde – 12/31/2024**



COST

- **\$15 Billion**
- **Customer bills double**

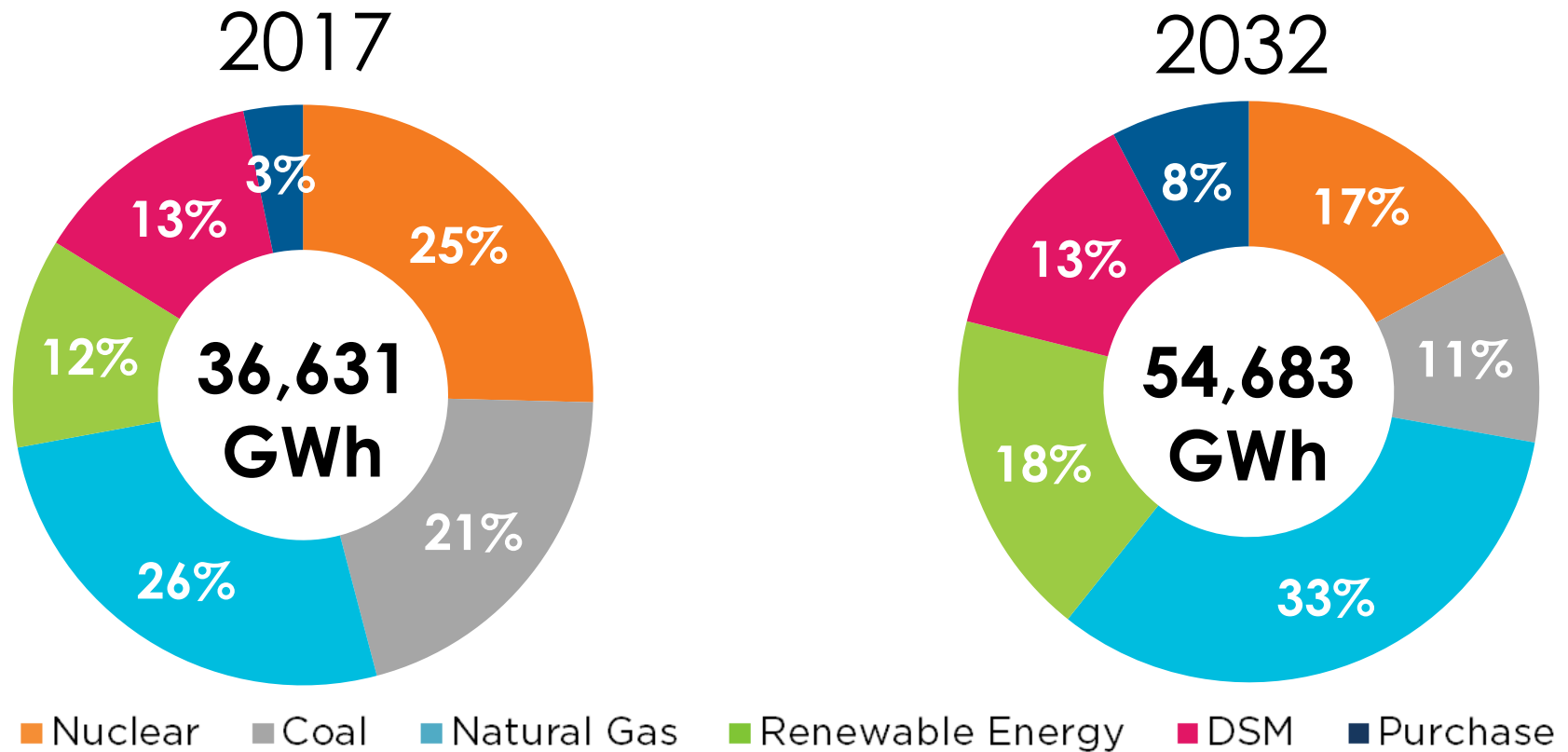
ARIZONA ENERGY MODERNIZATION PLAN ("AEMP")

- Introduced by ACC Commissioner Andy Tobin on January 30, 2018
- Goals
 - Establish a forward-looking, comprehensive energy plan for the state of Arizona
 - Power Arizona's economy on 80% clean energy by 2050
 - Expand energy storage in Arizona to 3,000 MW by 2030
 - Establish a forest biomass energy requirement
 - Promote electric vehicle infrastructure

80%
Clean
Energy
by 2050

IMPACT ON ENERGY MIX

Reliability, Affordability & Diversity Are Key



PLANNING REQUIRES FLEXIBILITY

The Future Must Have an All-The-Above Approach

