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July 20, 2016

Arizona Corporation Commission
DOCKETED

JUL 20 2016

DOCKETED BY

Docket Control
Arizona Corporation Commission
1200 W. Washington
Phoenix, Arizona 85007

RE: IN THE MATTER OF RESOURCE PLANNING and PROCUREMENT in 2015 and 2016. Docket No. E-00000V-15-0094

Attached is APS's Integrated Resource Planning Workshop Presentation used during the Special Open Meeting on July 18, 2016.

If you have any questions, please contact me at (602)250-3341.

Sincerely,

Kerri A. Carnes

KC/ks
Attachment

# *Flexibility for the Future*

## Integrated Resource Planning Workshop

**July 18, 2016**

**Jim Wilde**
**Director, Resource Planning**

**Jeff Burke**
**Manager, Resource Analysis**

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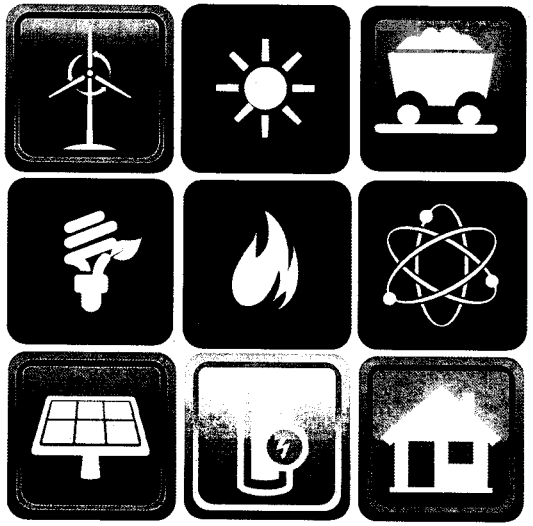
# Agenda

- Key Planning Drivers
- Evolving Load Patterns and Markets
- Forecasting
- Resource Needs
- Technologies Being Evaluated
- Customer Resources – Flexible Demand Management
- Action Plan Update
- Portfolios and Sensitivities
- IRP Process Considerations

# Key Planning Drivers

- Low natural gas prices
- Cost of environmental regulations
- Growth of renewable energy

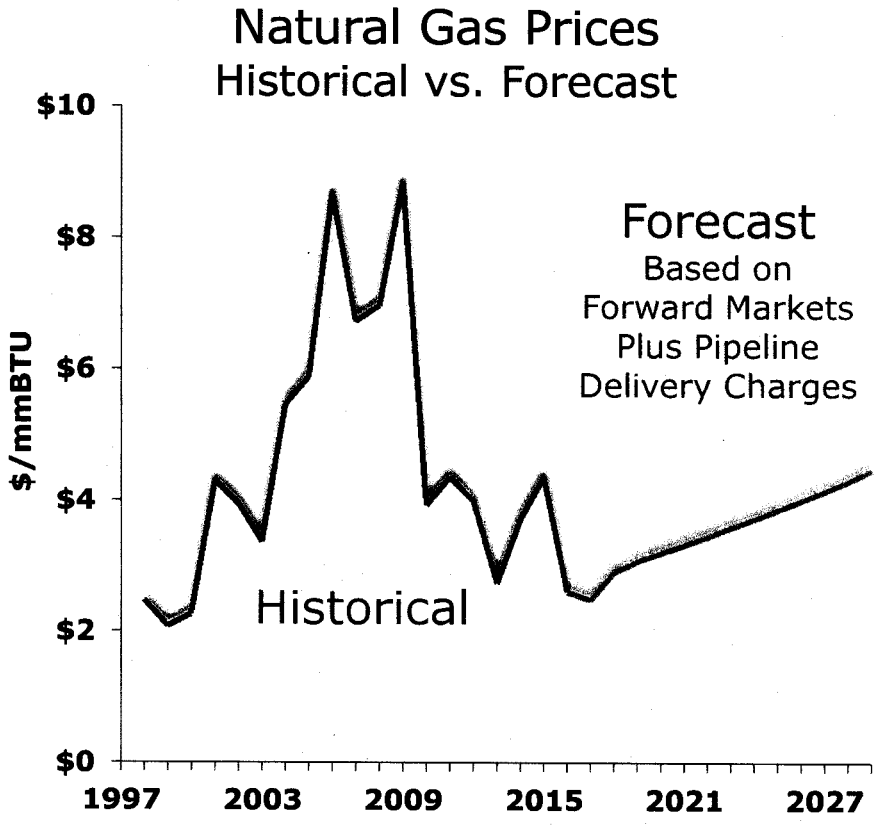
2017



2032

# Low Natural Gas Prices

- Favorable outlook
  - Stable long-term price forecast
  - Low emissions
- Flexible generation
  - Meets peak demand and integrates variable energy resources
- Greater Utilization
  - 2015 marked first year that the capacity factor for natural gas was greater than coal nationally

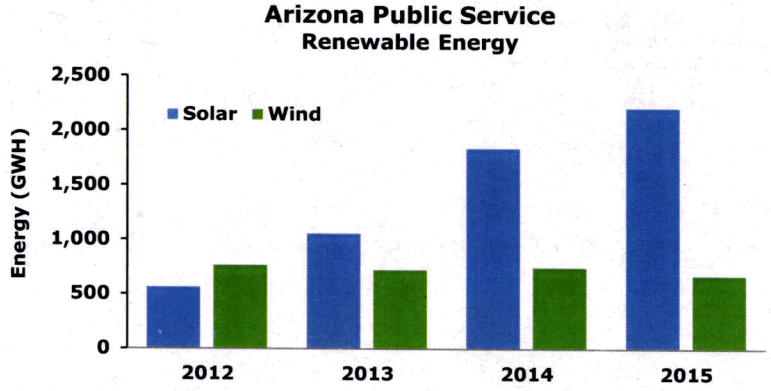


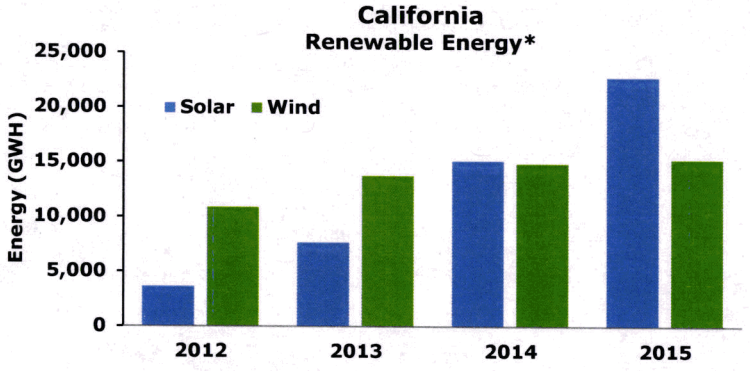
# Cost of Environmental Regulations

- Economies of scale favor larger units
- Emissions and water efficiency improvements
- Cholla
  - Retired Unit 2 (260 MW)
  - No longer burning coal Units 1,3 post 2025
  - Evaluating Units 1,3 on-going operations
- Navajo
  - Evaluating operations post 2019
- Four Corners
  - Retired Units 1-3 (560 MW)
  - Investing in SCR technology for Units 4-5

# Growth of Renewable Energy

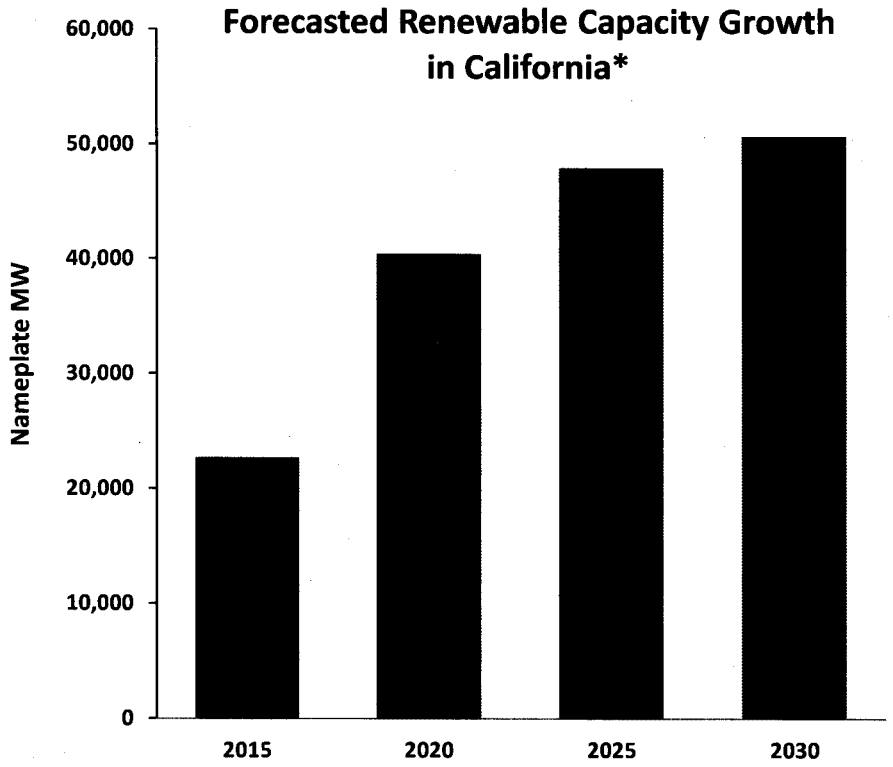
- Renewable production on the APS system has increased from 1,350 GWH's in 2012 to over 3,000 GWH's today
- Solar and wind production in CAISO has grown from 14,000 GWH's in 2012 to about 40,000 GWH's today




*Source: on IHS Report "North America Renewable Power Market Forecast, 2016–30"

# Growth in Installed Capacity Expected to Continue

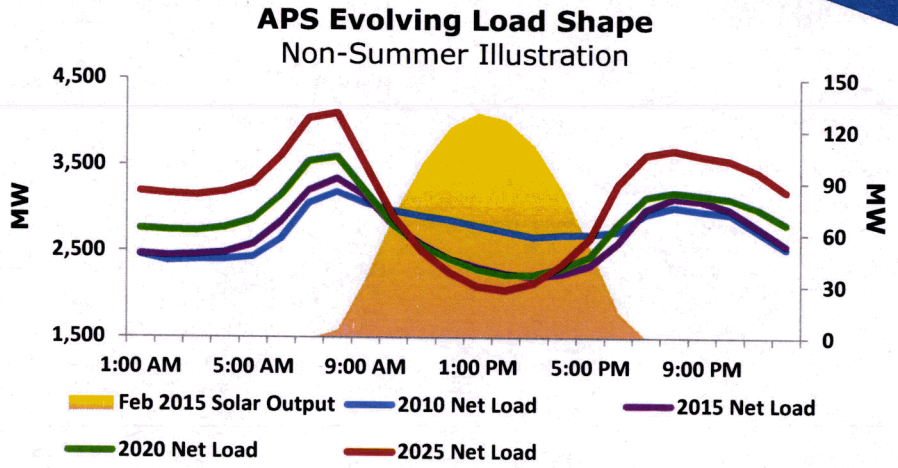


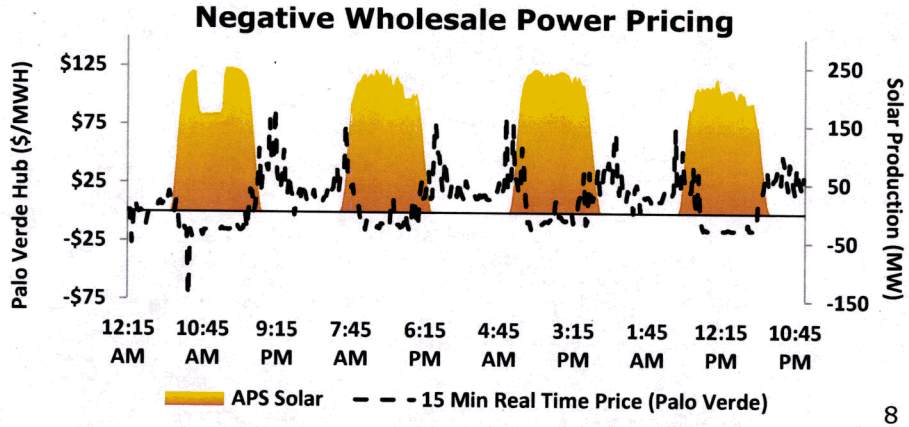

- California RPS increased to 50% by 2030
- Solar forecasted to be roughly 70% of installed renewable capacity

*Source: on IHS Report "North America Renewable Power Market Forecast, 2016–30"

# Evolving Load Patterns and Markets

- Net load shapes and wholesale market prices have changed due to increasing levels of renewable energy
- Economic purchase opportunities
- APS will need a more flexible resource portfolio to respond

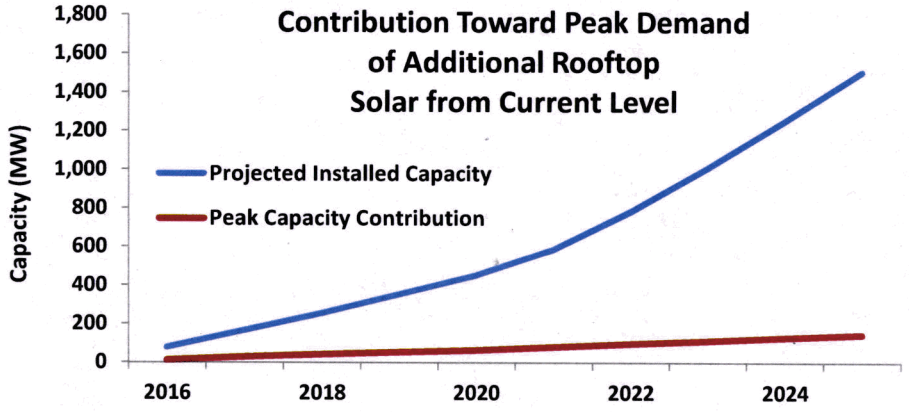


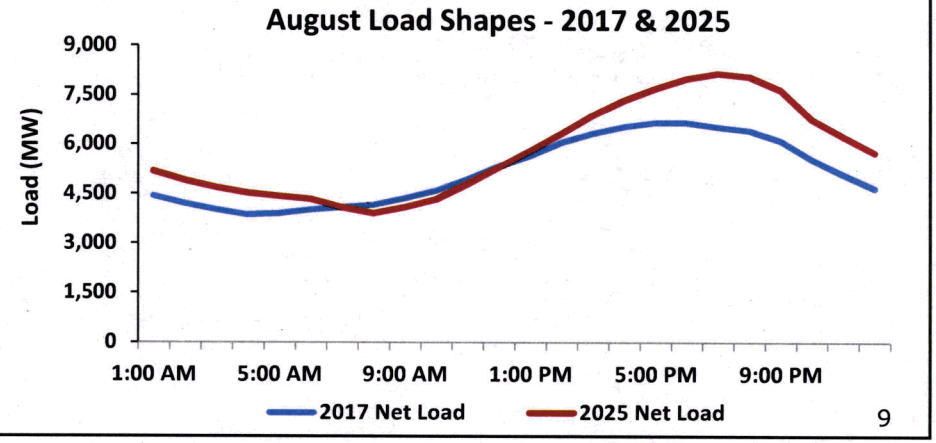




* Source: http://oasis.caiso.com/mrioasis/logon.do

# Distributed Generation Projections for Planning

- Roughly 500 MW of rooftop solar currently on APS's system
- APS customers installing roughly 100 MW of rooftop solar per year
- Very little rooftop solar production at time of peak customer demand

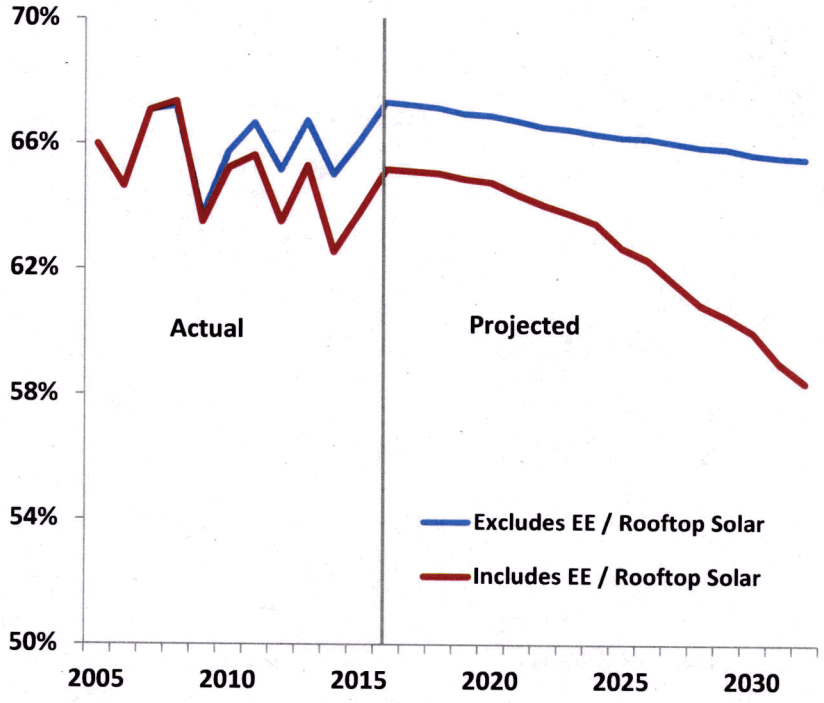


# Summer System Load Factor

## Effects of EE and Rooftop Solar (Jun-Aug)

- Energy efficiency and rooftop solar impact net energy consumption, but have limited impact on meeting peak demand
- Low load factor resources drive the need for a more flexible asset mix



# Load Forecasts

- Peak Demand and Sales Forecast (2017-2032)
  - Peak demand after EE and rooftop solar = 2.4% annual growth rate
  - Retail sales after EE and rooftop solar = 1.5% annual growth rate
- Historical Growth Rates
  - Peak Demand
    - Years 2000 to 2007 = 4.6%
    - Years 2008 to 2015 = 1.5%
  - Retail Sales
    - Years 2000 – 2007 = 3.7%
    - Years 2008 – 2015 = 1.1%
- Load Requirements by Class
  - Residential = 60%
  - All others = 40%

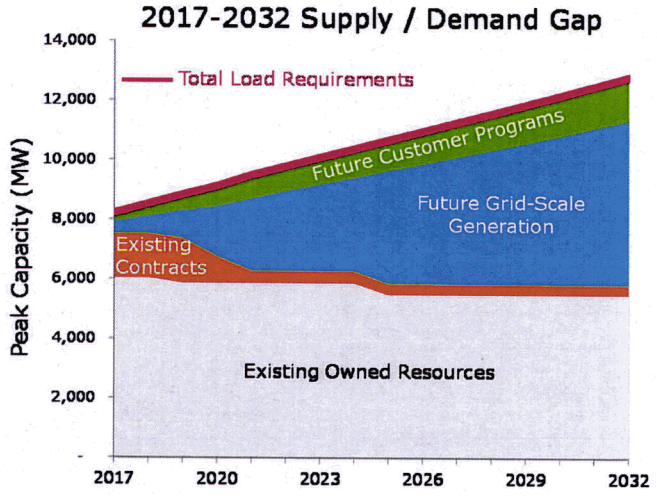
# Existing Resources

## Capacity By Type for Year 2016

| | Nameplate | On Peak | Peak Need |
|---|---|---|---|
| Nuclear | 1,146 | 1,146 | |
| Coal | 1,672 | 1,672 | |
| Gas/Oil Owned | 3,106 | 3,106 | |
| Solar Owned | 524 | 430 | |
| Wind | 283 | 55 | |
| Geo / Biomass / Landfill | 29 | 29 | |
| Purchases | 1,911 | 1,911 | |
| Rooftop Solar (additional) | 79 | 14 | |
| Energy Efficiency (additional) | 109 | 109 | |
| **Total** | **8,859** | **8,472** | **7,940** (After EE) |
| Existing Rooftop Solar | 490 | 161 | |

# Resource Changes Impacting Needs

- Coal fleet management
  - Retired FC 1-3 in 2013 (560 MW) in exchange for more efficient larger unit share
  - Cholla 2 retired October 1, 2015 (260 MW)
  - Plan to discontinue burning coal in Units 1&3 by 2025
  - Evaluation of on-going Cholla operations continues
- Ocotillo Modernization Project – 510 MW
  - Planned to be on-line by summer 2019
- Customer-sited micro-grid – 33 MW
  - Initial phase of flexible back-up generation
- Red Rock Solar – 40 MW
  - Solar project at Saguaro plant near Tucson
- All Source RFP for deliveries beginning 2020 – 400 to 600 MW
  - In process of evaluating proposals

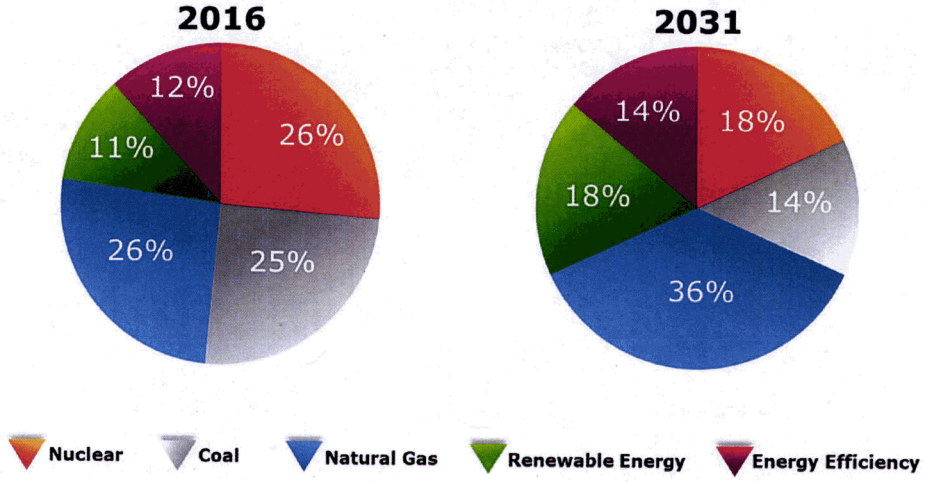


# Resource Needs

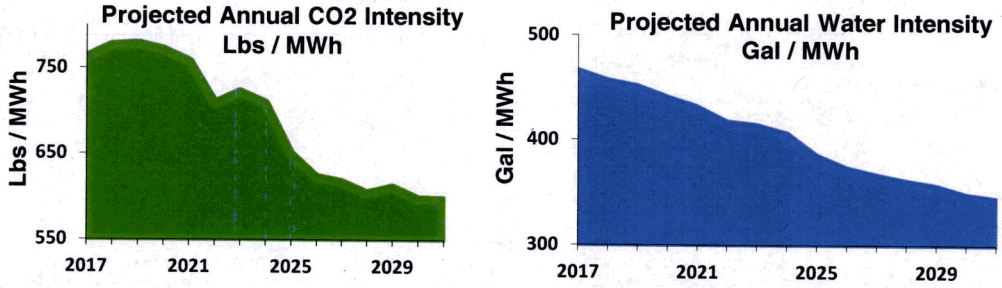
| PRELIMINARY 2017 IRP (Values in MW at Peak) | 2017 | 2022 | 2027 | 2032 |
|---|---|---|---|---|
| PROJECTED LOAD REQUIREMENTS (NEEDS) | 8,210 | 9,748 | 11,252 | 12,797 |
| Reserves (included in Load Requirements) | 974 | 1,194 | 1,370 | 1,557 |
| EXISTING RESOURCES AS OF JANUARY 2016 | | | | |
| APS-Owned Generation | 6,045 | 5,864 | 5,475 | 5,474 |
| Long-Term Contracts | 1,489 | 412 | 355 | 342 |
| Total Existing Resources as of January 2016 | 7,534 | 6,277 | 5,830 | 5,816 |
| RESOURCE GAP | (675) | (3,471) | (5,422) | (6,981) |
| FUTURE PROJECTED DISTRIBUTED RESOURCES | | | | |
| Energy Efficiency (1), (2) | 225 | 629 | 749 | 857 |
| Distributed Energy (1), (2) | 30 | 98 | 175 | 250 |
| Demand Response (3) & Microgrid (4) | 32 | 107 | 232 | 357 |
| Total Future Projected Distributed Resources | 287 | 835 | 1,156 | 1,464 |
| FUTURE PROJECTED UTILITY RESOURCES | | | | |
| Natural Gas | 363 | 2,611 | 4,084 | 5,229 |
| Renewable Energy & Energy Storage | 25 | 62 | 182 | 288 |
| Total Future Projected Utility Resources | 388 | 2,672 | 4,266 | 5,517 |
| TOTAL PROJECTED ADDITIONS | 675 | 3,507 | 5,422 | 6,981 |
| TOTAL RESOURCES | 8,210 | 9,784 | 11,252 | 12,797 |

# Sustainable Planning

## Diverse Energy Mix




## Improving Environmental Attributes




## Key Drivers to a Less Carbon-Intensive Portfolio

- Palo Verde Nuclear Generating Station
- Low natural gas prices
- Coal fleet management
- Renewable energy
- Energy efficiency

# Technologies Being Evaluated for IRP Portfolios

- Flexible demand management
  - Load shifting
  - Demand response / Load management
  - Peak demand reduction
- Energy storage
- Combustion turbines
- Reciprocating engines
- Solar
- Wind
- Coal
- Nuclear

# Action Plan Update

- Ocotillo Modernization Project
  - 510 MW project on track for 2019 in-service
  - Steam units planned to be retired at "first-fire"
- Coal Fleet Management
  - Cholla 2 retired October 1, 2015 – 260 MW
  - Evaluation regarding remaining Cholla Units 1&3
  - Upcoming decisions on Navajo Generation Station – 315 MW APS Share
  - Four Corners SCR installation begins Fall 2017
- Solar Partner Program
  - Installing West facing solar on customer homes
  - Better alignment with customer peak demand
  - Installation of 4 MWh of battery storage planned completion by end of 2016
- Solar Innovation Study
  - 75 home study, separated into three segments
  - Segments have differing combinations of: solar PV, smart inverter, HEM/load control, variable speed HVAC, energy storage

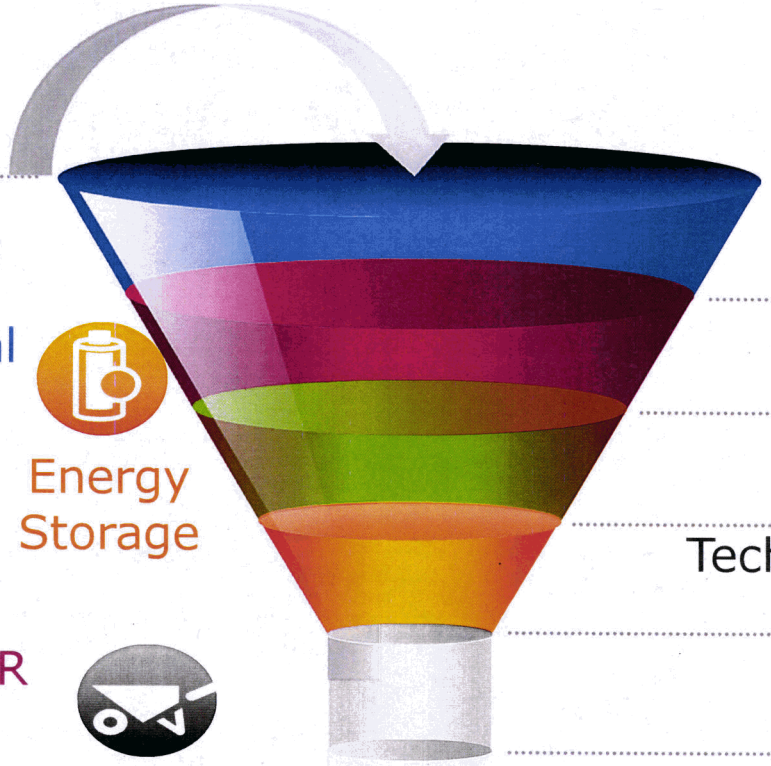
# Action Plan Update

- Microgrid
  - Installing customer sited back up generation for Marine Corp Air Station in Yuma and Aligned Energy in Phoenix
  - Approximately 33 MW combined of generation for initial phase by end of 2016
  - Benefits all customers by providing reserves and peak demand contribution
- Red Rock Solar
  - Large customers desiring "green" attributes
  - Constructing 40 MW SAT solar pv project at Saguaro Power Plant
- Energy Imbalance Market (EIM)
  - Integration of variable energy resources
  - Cost savings for customers through coordinated dispatch over large geographic area
  - On schedule for "go live" in October 2016
- Resource Procurement / Development
  - All-source RFP Issued in March of 2016 for 400 – 600 MW
    - Deliveries requested to begin 2020
  - Short term market purchases to meet near term needs
  - Beginning initial site planning for post 2020 resource needs

# Portfolio Variables and Sensitivities

PORTFOLIO VARIABLES

- Natural Gas
- Renewable Energy
- Energy Storage
- EE / DR
- Nuclear
- Coal



INPUT VARIABLES

- Natural Gas Prices
- CO2 Prices
- Load Forecast
- Technology Capital Costs
- Other?

Low ← Level of Penetration → High

# Portfolio Analysis

## Coal Strategy

Evaluates early retirement of Cholla Units 1 and 3 and NGS, executes Four Corners strategy

## Carbon Reduction

Evaluates carbon reduction beyond potential CPP requirements

## Energy Storage Systems

Incorporates greater penetration of ESS to further integrate renewables and help manage peak demand

## Small Modular Reactors

Incorporates new nuclear technology of small modular reactors to reduce carbon footprint and provide baseload power

## Expanded Renewables

Increases renewable energy portfolio contribution beyond requirements of the RES (to include both distributed and grid-scale renewable energy resources)

## Expanded Demand Side Management

Increases contribution of distributed energy resource solutions such as energy efficiency, demand response, battery storage, smart inverters and other technologies

# Scenario and Sensitivity Analysis Considerations

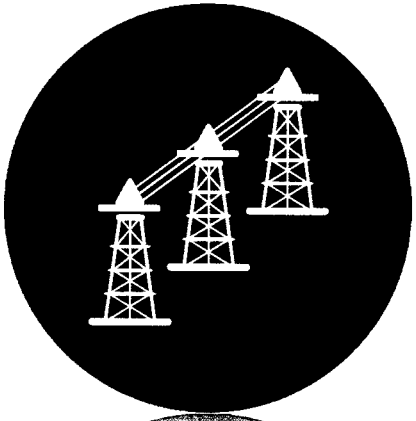
- Both scenario and sensitivity analyses were performed in APS's 2014 IRP
- In order to provide the highest value and avoid speculative assumptions regarding the correlation of variables within scenarios, APS recommends only performing sensitivity analysis in the 2017 IRP
- Sensitivities should include
  - Natural gas pricing, CO2 pricing, load forecast, resource costs

# IRP Filing Process Considerations

- APS is supportive of 3-year IRP cycle
  - Provides ample opportunities for dialogue on important issues
    - Preliminary IRP's provide high-level discussion on key items
    - Action Plan updates as items change
    - Workshops facilitate dialogue

# Flexibility

## Key to Providing Reliable, Affordable Electricity for Our Customers



### OPERATIONAL AGILITY

Add fast-starting, fast-ramping resources to meet peak demand and integrate renewables

### RATE DESIGN

Align price signals with resource needs and costs

### CUSTOMER RESOURCES

Provide additional tools for customers to better manage peak demand

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