Renewable and Technology Integration at APS

Presentation to the XM Forum
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Outline

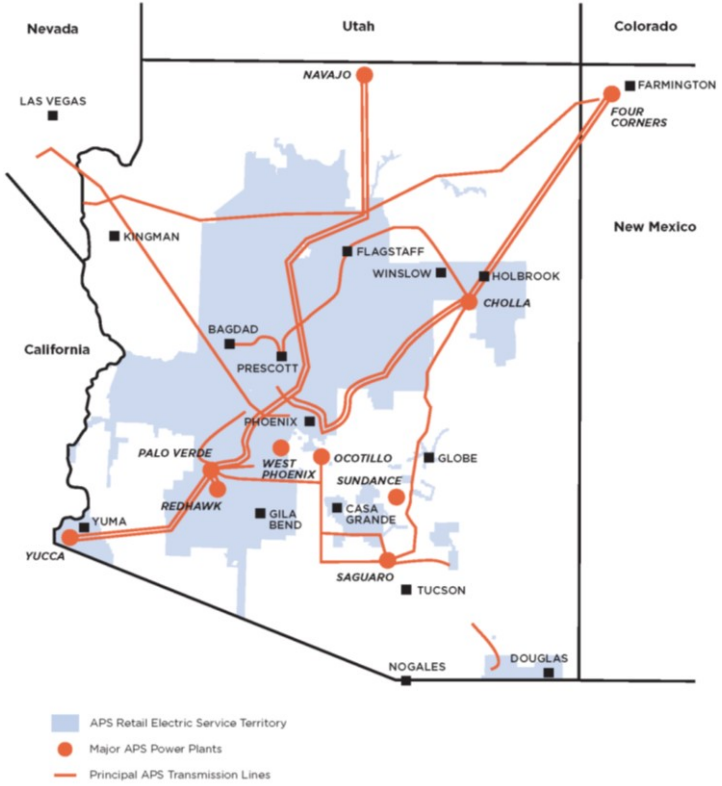
- Introduction to APS
- APS Clean Energy Commitment
- Generation and renewables
- Near-term future projections
- Technology integration

Introduction to APS

Clean Energy Commitment

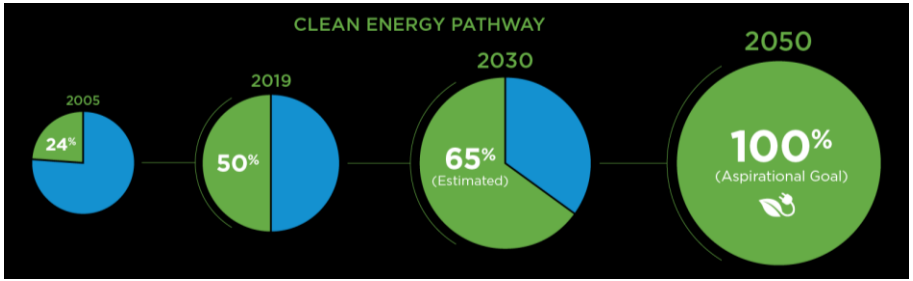
APS Service Territory

- 11 of Arizona's 15 counties
- 34,646 square mile service area
- 1.2 M meters, 2.7 M people
- Over 35,000 transmission and distribution line miles
- 430 substations; 300,000 transformers; over 550,000 poles and structures
- Operating voltages 500, 345, 230, 115, 69, 21, 12.47 kV
- System Peak Load 7,660 MW (2020)



APS Clean Energy Commitment

Click link above to read about CEC and access the report



Clean energy commitments

- 100% clean, carbon-free electricity by 2050
- 65% clean energy by 2030 with 45% renewable energy
- Eliminate coal by the end of 2031

A clean economic future

- Meet our responsibility to power a low-carbon economy in AZ
- Guided by sound science to advance a healthy environment
- Market-driven energy innovation and a strong Arizona economy are critical
- Starting from an energy mix that is 50% clean, including energy efficiency and carbon-free and clean energy from Palo Verde Generating Station

Pathways to 100% Clean

Policy decisions	Support policy decisions that leverage market-based technology and innovation to attract investment in Arizona
Existing power sources	Near-term use of natural gas until technological advances are available to maintain reliable service at reasonable prices
Evolving market-based solutions	Participation in the Energy Imbalance Market provides access to clean energy resources while saving customers money
Electrification	Electrification will drive a cleaner environment and more energy-efficient operations throughout the economy
Modernization of the electric grid	Continue to advance infrastructure that is responsive and resilient while providing customers more choice and control
Energy storage solutions	Storage creates opportunity to take advantage of midday solar generation and better respond to peak demand

Next Steps: Collaboration, alignment and innovation

- Reliability and affordability are foundational
- Collaborate with customers, stakeholders and regulators
- Promote economy-wide electrification of industry, transportation and buildings
- Support innovation, research and development of new technology

aps.com/cleanenergy

APS existing generation, renewables and technology

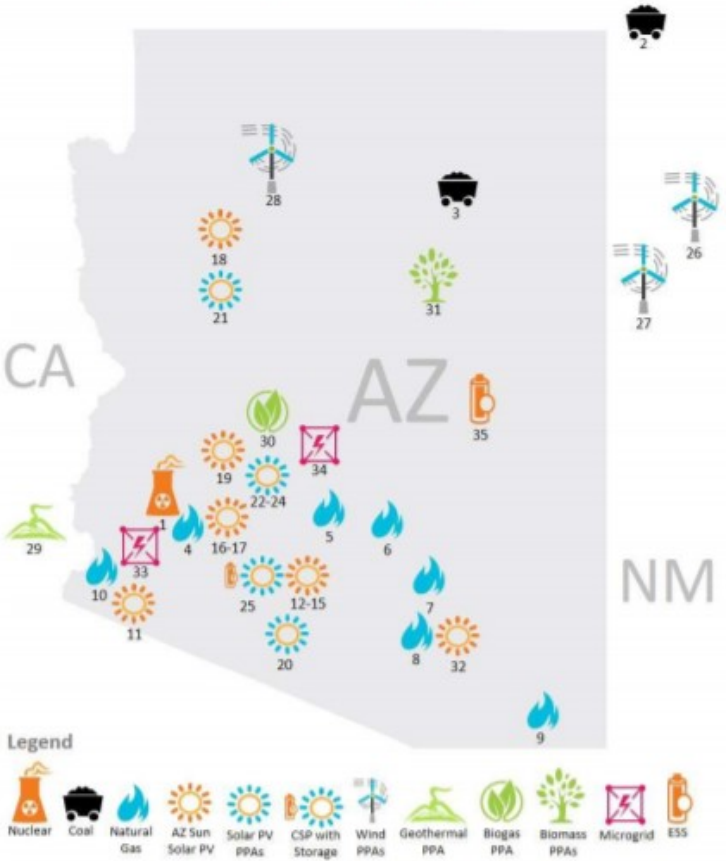
APS Existing Resources

The map in FIGURE 2-3. **APS RESOURCE MAP**-3 details the location of APS's existing resource mix, with the exception of small-scale solar projects, customer-side resources such as EE, rooftop solar and demand response and conventional purchased power contracts. These resources are existing as of 2020.

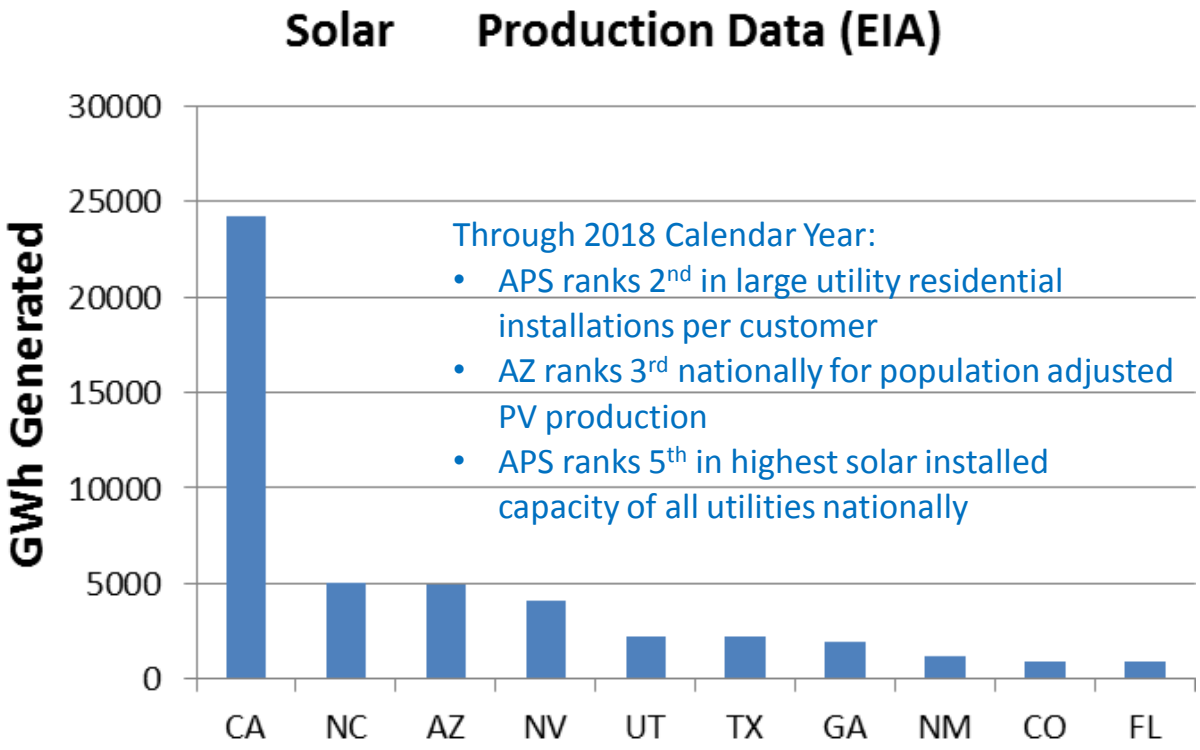
TABLE 2-2. APS EXISTING RESOURCES

By Resource	
Total Resources	**10,773 MW**
Nuclear	1,146 MW
Coal	1,357 MW
Natural Gas	5,233 MW
Owned Resources	3,573 MW
PPAs	1,660 MW
Microgrid	32 MW
ESS	2 MW
Renewables	883 MW
Solar	567 MW
Owned Resources	242 MW
PPAs	325 MW
Wind (PPAs)	289 MW
Other (PPAs)	27 MW
Customer-Based	2,120 MW
Energy Efficiency	1,038 MW
Distributed Energy	1,044 MW
Demand Response	38 MW

FIGURE 2-3. APS RESOURCE MAP



U.S. Energy Information Administration

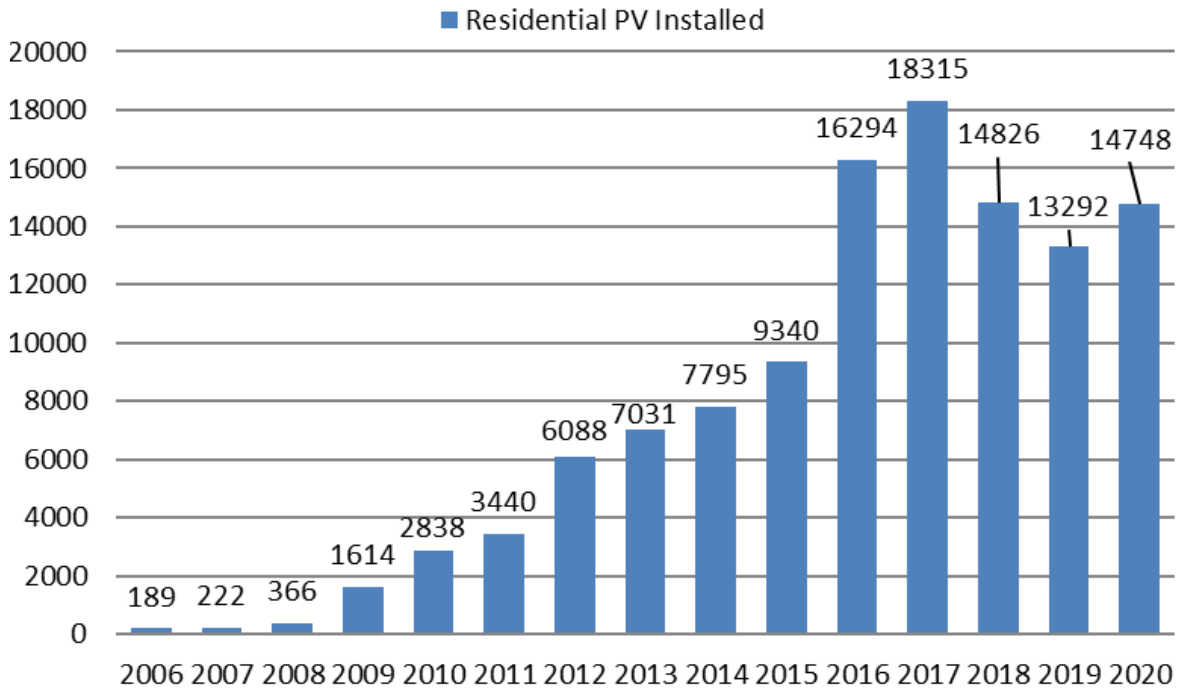


Through 2018 Calendar Year:

- APS ranks 2nd in large utility residential installations per customer
- AZ ranks 3rd nationally for population adjusted PV production
- APS ranks 5th in highest solar installed capacity of all utilities nationally

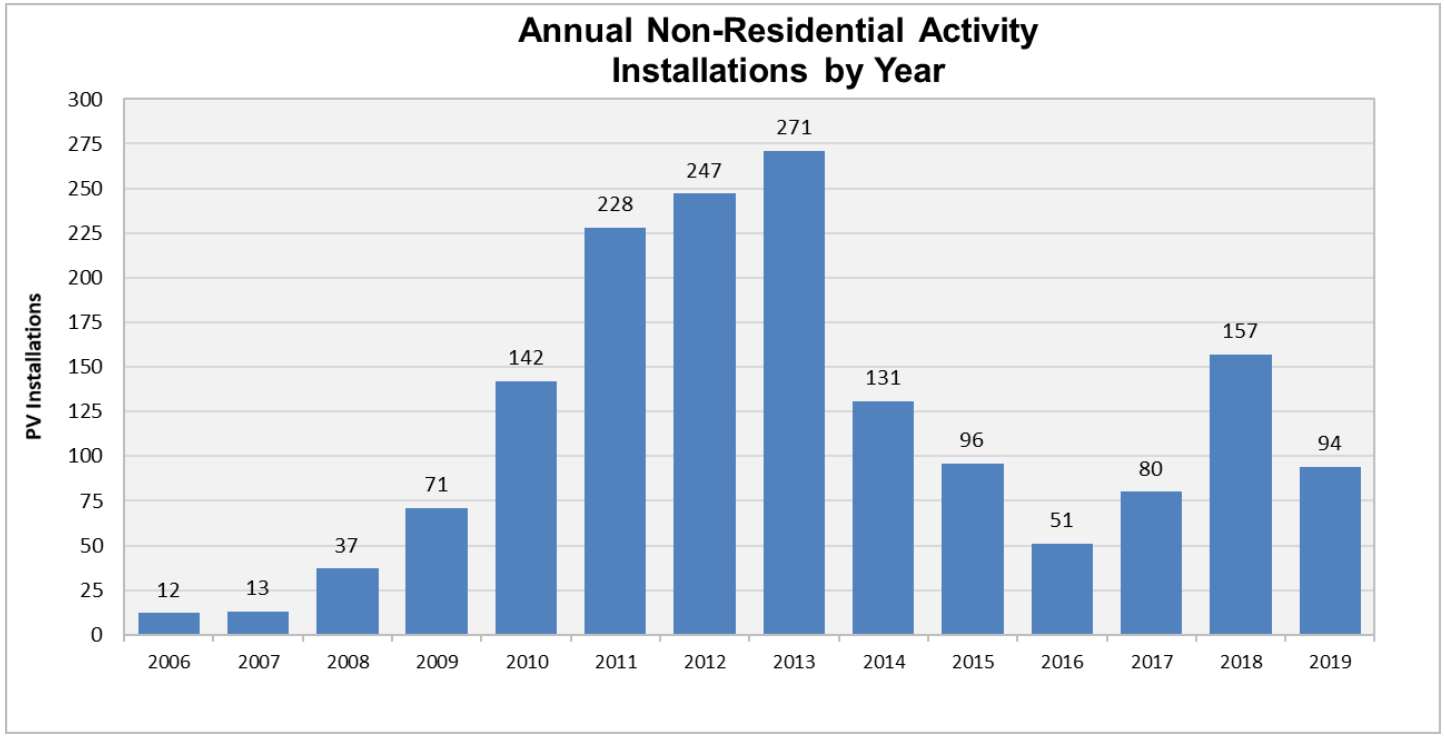
https://www.eia.gov/electricity/data/state/

APS Annual Residential Installations



- Over 125,547 (1039 MW-DC residential rooftop PV systems (05/30/2021)
- Average over 1500 applications/month
- Growing volumes of ES (1056: 8.6 MW/20.2 MWh) and PV+ES
- Customer solar is a major part of clean energy future

APS Annual Non-Residential Activity



Technologies: DSM and DR

Instant Information

SOLAR

Grid-Interactive Water-Heaters

Pool Pump

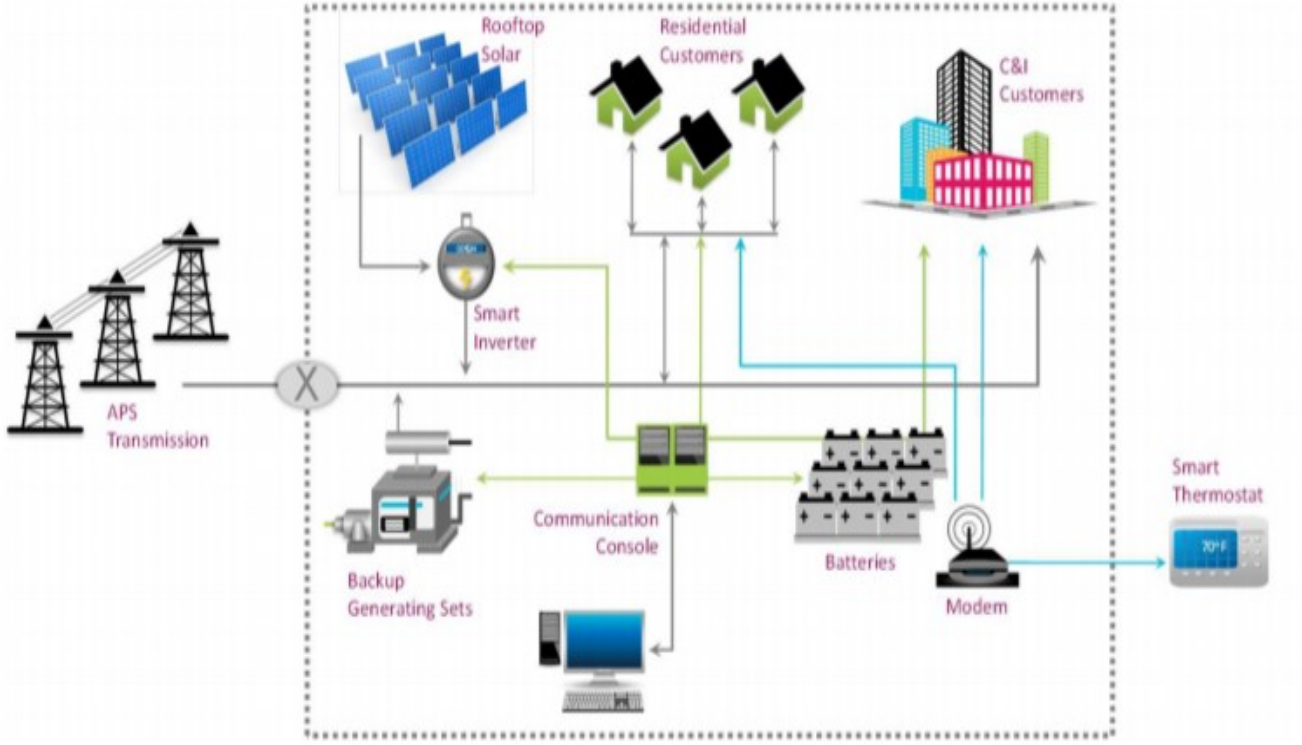
Home Energy Management

Electric Vehicles

Battery Energy Storage

Smart Thermostats

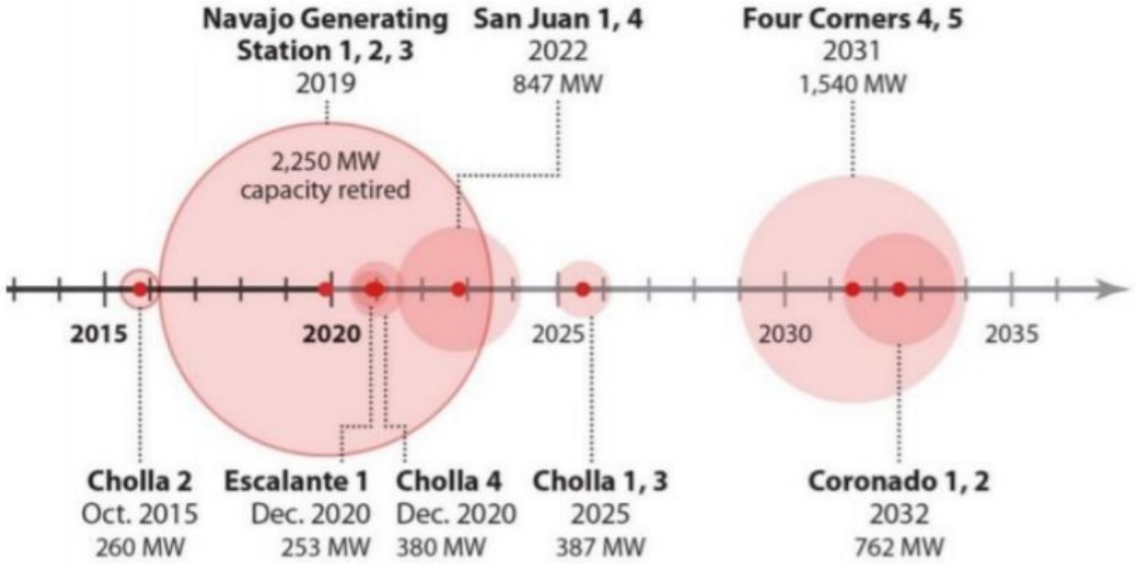
Technologies: Microgrids



Near-term future projections

Phasing Out Coal

Regional Trends in Coal-Fired Power



Source: Institute for Energy Economics and Analysis

Near-Term Planned Future Resource Additions

- Resource additions must support APS Clean Energy Commitment, prepare for coal retirements, and integrate customer technologies and solutions (DSM, DR, DE)

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

DSM Programs and Initiatives

CURRENT DSM PROGRAMS

DSM programs that are currently being implemented

1. Existing Homes Program (includes HVAC, Home Performance and Consumer Products)
2. Residential New Construction
3. Multi-Family EE
4. Limited Income Weatherization
5. Home Energy Reports
6. Non-Residential Existing Facilities (includes Small Business)
7. Non-Residential New Construction
8. Schools
9. Energy Information Service
10. Codes and Standards
11. APS System Savings
12. Demand Response
13. Energy and Demand Education

NEW DSM PROGRAMS

Recently proposed DSM programs and pilots

1. Beneficial Electrification Pilot
2. Electric Vehicle Load Management Pilot
3. New Home Connected Community Research Project
4. Demand Response, Energy Storage and Load Management Initiative (currently being implemented)

DSM PROGRAMS IN DEVELOPMENT

DSM technologies and trends currently being assessed

1. Connected Devices
2. Load Monitoring and Management
3. Load Shifting
4. Energy Storage
5. Automated Demand Response
6. Reverse Demand Response

Grid Scale Energy Storage

BATTERY STORAGE PROJECTS UNDER CONTRACT

100MW/400MWh

- 20-year PPA
- adjacent to West Wing (Peoria)
- in service by end of 2022
- ACC approved January 2021

50MW/200MWh

- 20-year PPA
- adjacent to El Sol (Youngtown)
- in service for summer 2022
- ACC approved January 2021

141MW/423MWh

- APS owned
- retrofits to AZ Sun facilities; optimization of existing facilities
- in service for summer 2022

All resources will incorporate APS safety requirements

Other thoughts

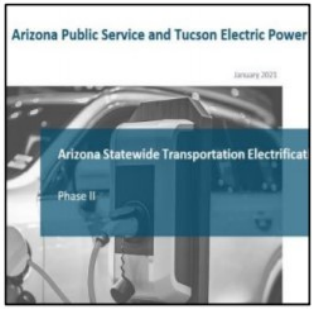
https://www.aps.com/en/About/Our-Company/Doing-Business-with-Us/Resource-Planning

Transportation Electrification – long term goals

The APS fleet from Bolts to Bucket trucks – **enhancing fleet stewardship**

EVs and the customer experience – **deeper connections and economic**

Transportation electrification for emissions reductions – support **ozone attainment**

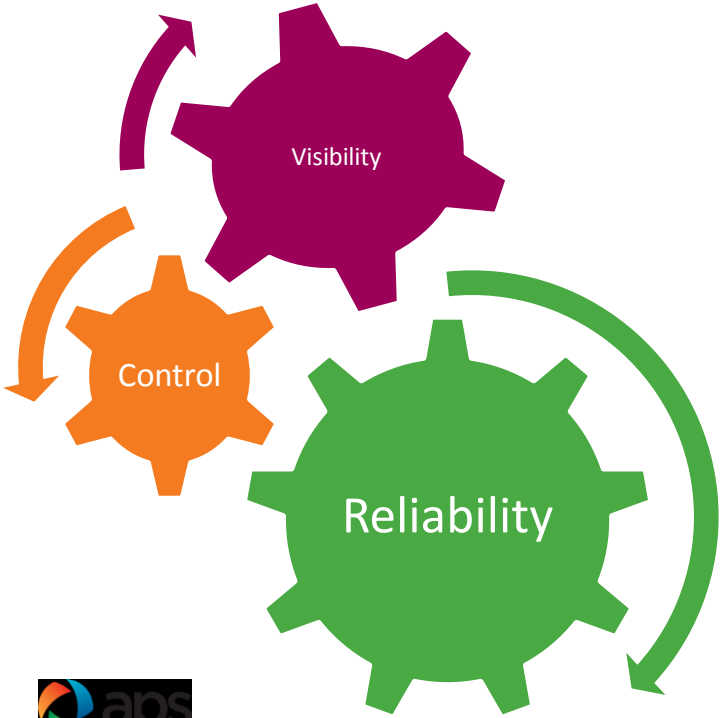


Strengthening our relationships with vendors, stakeholders, utility partners

Manage EV growth increased load at the right time can lead to downward pressure on rates – **accelerate EV**

Enabling Technologies and Projects

- Future focus
  - Build a flexible, DER centric, future grid
  - Leverage DER technologies for improved operations
  - See the problem → effective controls → reliable ops
- Making it all fit together
  - Advanced Distribution Management System (ADMS)
  - Transmission Energy Management System (EMS)
  - Data Management and Tools
- Additional technologies
  - Battery Energy Storage Systems (BESS)
  - Advanced Inverters
  - Other DER and BTM technologies



How Distributed Solar PV Impacts Visibility

… and results in seasonal variability