A photograph of a rooftop solar panel array in a desert landscape with mountains in the background. The solar panels are dark blue and arranged in rows on a flat roof. The background shows a clear blue sky with some light clouds and a range of brown mountains.

Arizona's Energy Future

American Society of Farm Managers and
Rural Appraisers - ASFMRRA

2010 AG Forum

Kris Mayes, Chairman

Arizona Corporation Commission

February 26, 2010



Energy Challenges Facing Arizona

- **Growth**
 - In 2007, Domestic Net Migration totaled 90,402 or 7,500 monthly.
 - 2009 projects from ASU reflect flat growth.
 - Between 2000 and 2039, Arizona's population will more than double. By 2030 Arizona's population will exceed 10.7 million people – becoming the 10th largest in the country.
 - Between 2000 and 2007, Arizona's consumption of electrical power grew at about three times the rate of the United States as a whole.
- **Arizona's current peak energy needs are approximately 16,000 MW**
 - By 2025 peak energy needs will be approximately 32,000 MW.
- **Without aggressive energy efficiency and smart growth, Arizona customers will face the prospect of adding the equivalent of:**
 - **4** Palo Verde Nuclear Generation Stations (4000 MW each) OR
 - **8** Hoover Dams (2080 MW each) OR
 - **28** 2x1 Combined Cycle Natural Gas Plants (570 MW each).
- **Rising Energy Costs**
 - Rate filings premised on volatile natural gas prices and growth.
 - Nationally, energy expenditures account for \$1 Trillion, or 8.4% of GDP.



Meeting Arizona's Energy Challenges

- As Arizona's population grows each year, so does peak electrical usage.
- This peak can be met by building new transmission lines and power plants as well as by the use of renewable energy, energy efficiency and demand response.
 - Renewable Energy Standard (“RES”) has created \$145M / year market in Arizona.
 - APS alone has over 250 MW in utility scale contract commitments.
 - Commission has adopted an Energy Efficiency requirement for Arizona's regulated utilities of 22% by 2020.
 - One Study estimated 440 MW of developable Demand Response existing in APS' territory.



Emissions Growth in Arizona

- **A recent report by Environment America found that Arizona added fossil-fuel pollutants at a faster rate, 61% growth, than any other state between 1990 to 2007.**
 - National rate was 19%.
- **Coal was the largest source of power-plant pollution and accounted for 40% of the emissions measured.**
 - Arizona has six major coal-fired power plants.

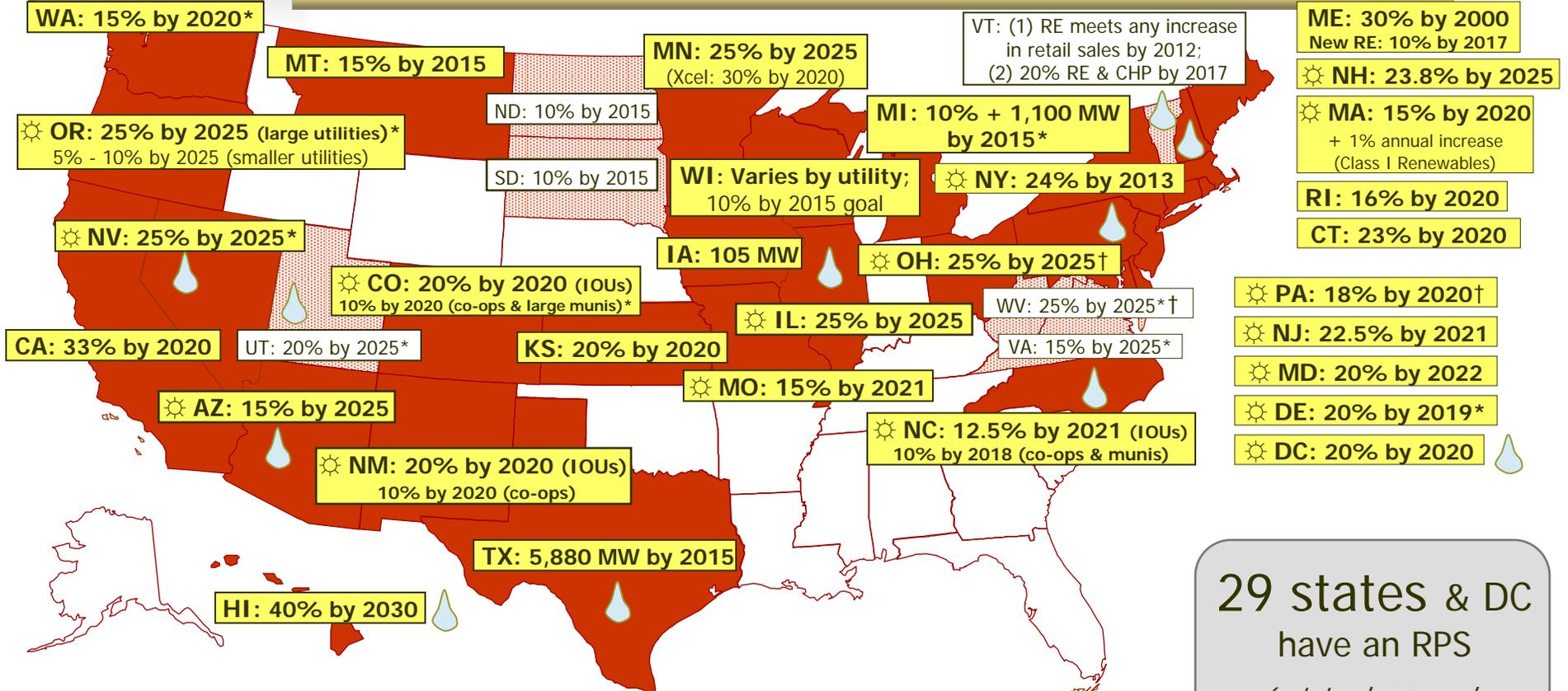


Energy Diversification

- **Facing the future in a carbon-constrained world, what will Arizona's electric generating portfolio look like?**
 - Since 1998, majority of power plants sited in AZ have been natural gas.
 - In 2009 the Commission sited two solar plants (Agua Caliente and Starwood) and transmission infrastructure for a third (Mesquite). A fourth is currently under review.
 - Coal represents approximately 28% of APS' generating resources.
 - Coal represents approximately 69% of TEP's generating resources.
- **Options for Arizona?**
 - New natural gas
 - Subject to large fuel price volatility and uncertain carbon legislation.
 - “Clean” Coal
 - Significant impacts from likely carbon legislation.
 - Nuclear
 - Waste disposal, heavy water usage and Significant upfront costs.
 - Renewables
 - Upfront costs, intermittancy issues and transmission requirements.
 - Given growth, Arizona, and other Western States are going to need to take long looks at all resource options.



Renewable Portfolio Standards



29 states & DC
have an RPS
6 states have goals

- State renewable portfolio standard
- State renewable portfolio goal
- Solar water heating eligible
- Minimum solar or customer-sited requirement
- Extra credit for solar or customer-sited renewables
- Includes non-renewable alternative resources



Renewable Energy in Arizona

- **One Certainty in the West: Renewables will play a far more important role than in the past.**
- **Arizona was one of the first states in the nation to implement a renewable requirement for its electric utilities.**
- **Arizona's Environmental Portfolio Standard was initiated in 2001 to promote the use and development of renewable energy.**
- **In October, 2006, the Commission approved the Renewable Energy Standard, which builds upon the EPS and will once again make Arizona a leader in renewable energy, particularly solar.**
- **The Commission established a mechanism in the rules that requires each utility to file a tariff to recover the costs of implementing the RES program.**
- **RES alone has created a \$145 Million/year renewable energy market in Arizona.**



The RES: The Power of Distributed Generation

- The RES rules require regulated utilities to generate 15% of their energy from renewable resources by 2025.
- The RES allows utilities to use solar, wind, biomass, biogas, geothermal and other similar technologies to generate “clean” energy to power Arizona’s future. The rules package outlines what technologies qualify and allow for new and emerging technologies to be added as they become feasible.
- In addition to utility-owned projects such as Tucson Electric Power’s large solar installation in Springerville, Arizona, the Commission also required a growing percentage of the total resource portfolio to come from distributed generation – residential or non-utility owned installations.
- The distributed energy requirement starts at 5 percent of the total portfolio in 2007 and grows to 30 percent of the total renewable mix after 2011.



Net Metering

- **Net metering provides customers an opportunity to benefit from excess energy they contribute to the electric grid.**
 - Under the program, regulated utilities provide rolling credit month-to-month and customers are paid annually for any excess energy remaining.
- **Key Features**
 - System must be sized to meet customer's electric load and not exceed 125% of total connected load.
 - No Statewide capacity limit



Environmental Benefits

- **By 2025, the RES rules could prevent emissions of:**
 - 93 billion pounds of carbon dioxide
 - 186 million pounds of nitrogen oxide
 - 129 million pounds of sulfur dioxide
 - 1,277 pounds of mercury
- **RES**
 - Will power 500,000 homes in Arizona by 2025
 - 2,500 MW of renewable energy will be generated pursuant to the RES



Distributed Generation: Third Party Providers

- Arizona's Renewable Energy Standard calls for 4.5% distributed generation (2.25 residential; 2.25 commercial) by 2025.
- High DG carve-out has spurred a robust solar rooftop industry and new companies wishing to own & operate solar systems on behalf of schools, businesses, even homeowners.
- A currently pending matter before the ACC limits the level of detail that can be discussed but we will look at how other states have addressed third party provider issues
 - Look at: Oregon, Nevada, Texas
 - Every state is unique so one state decision does not necessarily inform other outcomes



Case Study: Oregon

- Were third-party providers of solar systems qualified as either electricity service suppliers (ESS) or Public Utilities?
 - Oregon statute defines an Electricity Service Provider as a person or entity that offers to sell electricity services available pursuant to direct access to more than one retail electricity customer. Direct Access allows retail consumers to buy electricity and certain ancillary services from entities other than distribution utilities.
- Utility question was straightforward as Oregon law exempts wind and solar providers from regulation by the PUC.
- The Oregon PUC determined that third-party owners were not ESS' subject to regulation because they made no use of the utility's distribution system and the installed distributed generation was not intended to result in net generation (sales to the grid).



Case Study: Nevada

- Nevada statute defines a utility as “any plant or equipment, or any part of a plant or equipment, within this State for the production, delivery or furnishing for or to other persons...light, power in any form...”
- The Nevada PUC found that third-party providers were not PUCs relying on an Attorney General opinion which excluded companies that serve only one customer on private property under private contract from being defined as public utilities.



Case Study: Nevada

- Key Concerns
 - If third-party providers were held to be public utilities they would be subject to net metering. The PUC found this construction strained as it would place the net metering system provider on both sides of the transaction by offsetting the use of power from the public utility and being itself the public utility.
- Nevada Commission Staff raised the issue of consumer protection related to third-party financing. The Order concluded that in finding these contracts beyond regulation by the Commission it would be inappropriate to subject third-party owners to oversight but protections were offered under Nevada contract law and through civil remedies.



Other States

- **Florida: Third-Party Ownership is unavailable; Third-Party leasing can be used (lease of equipment rather than buying electricity).**
- **Colorado: Has allowed third-party ownership; Utilities have waived monopoly rights.**
- **Texas: Third-Party ownership is used but not available within jurisdiction of municipal utilities.**



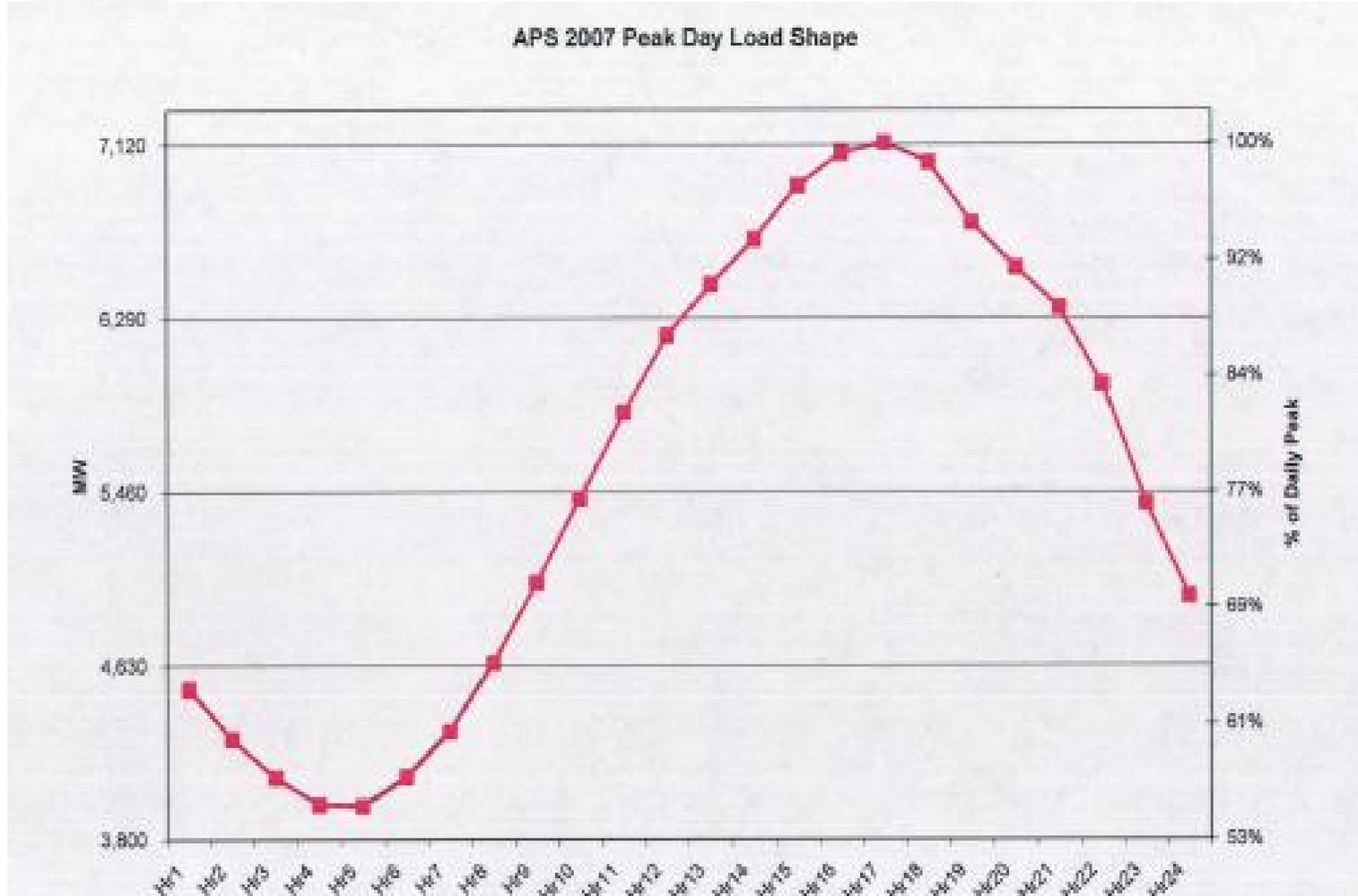
American Clean Energy and Security Act of 2009 (Waxman-Markey)

● Key Features:

- Renewable Energy Standard: 20% by 2020
 - At least 15% from Renewables
 - But, Governor can petition for up to 8% to be met from documented electricity savings
 - 3x credit multiplier for distributed renewable generation
- Safe Climate Act
 - 42% below 2005 levels in 2030
 - Electric bill impacts of 5% to 11.5% by 2025
- Transmission Planning
 - Grants FERC enhanced oversight over transmission decisions of Western states
- Energy Efficiency
 - National energy productivity goals of 2.5%/year by 2012
 - Adopts national energy efficiency building codes

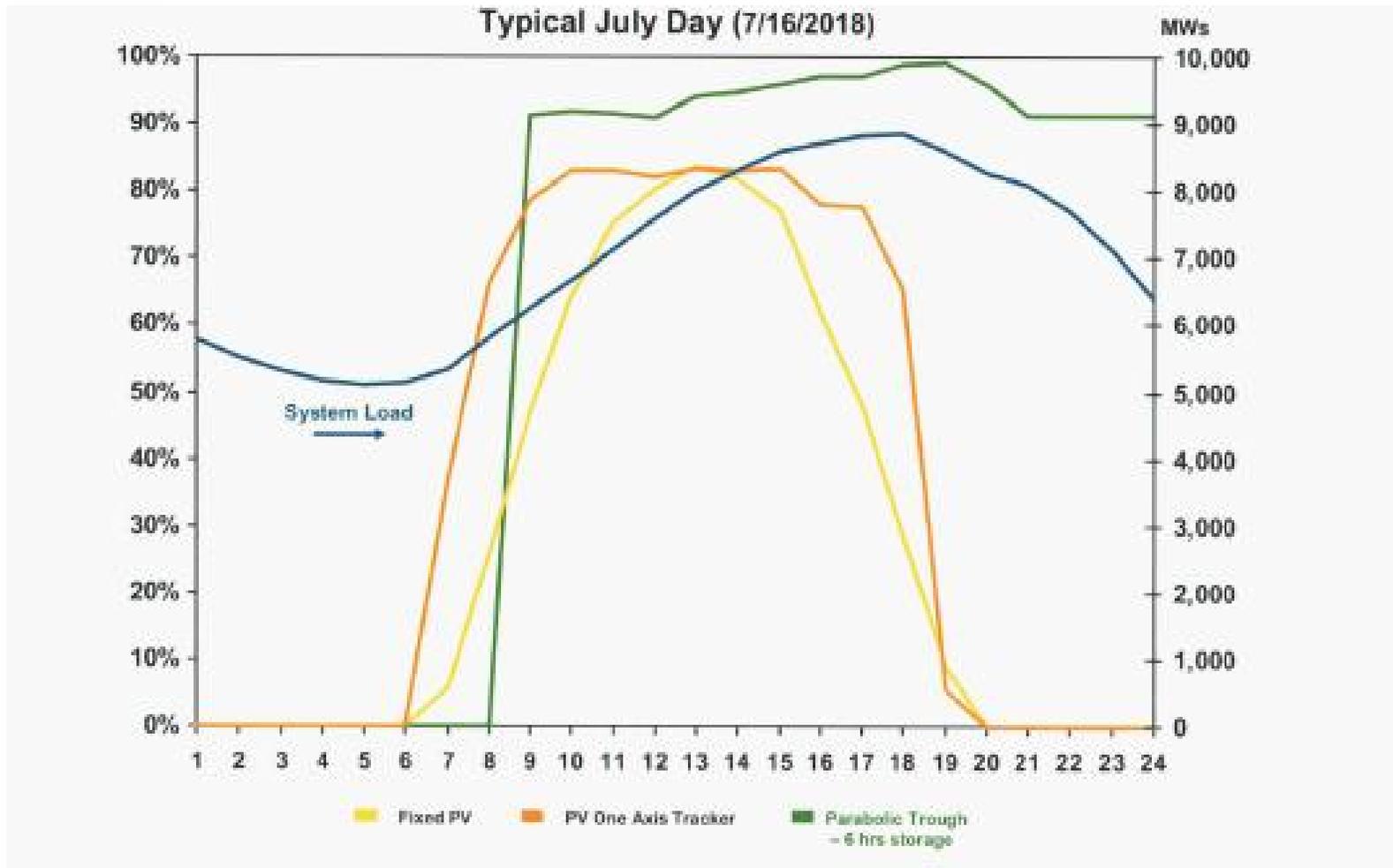


APS 2007 Load Profile





Solar Profile vs System Profile





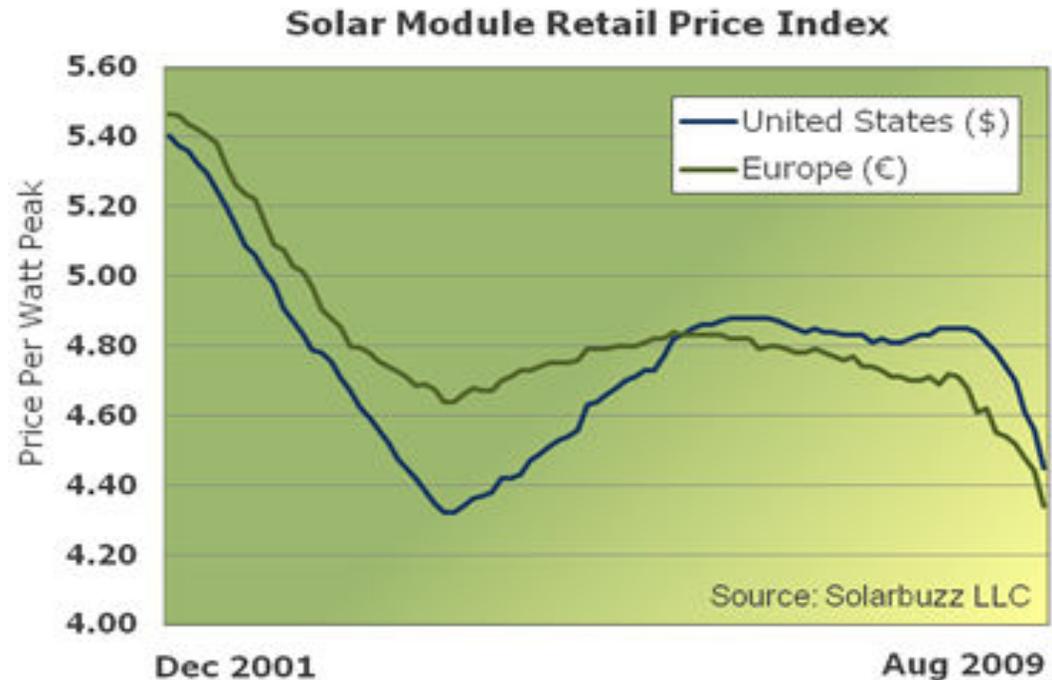
Cost of Fossil-fuel Electricity is Rising

- **Fossil fuel prices have been historically volatile and their costs have trended up over the long term.**
 - Renewable generation costs are primarily in plant and not in fuel.
 - Renewables provide a hedge against fossil fuel volatility and their long term costs have trended down.
- **Carbon Legislation (Waxman-Markey)**
 - APS has estimated that current proposals could raise rates between 11% - 41%.
- **Minimizing reliance on fossil fuels reduces our dependence on foreign sources and enhances energy security.**



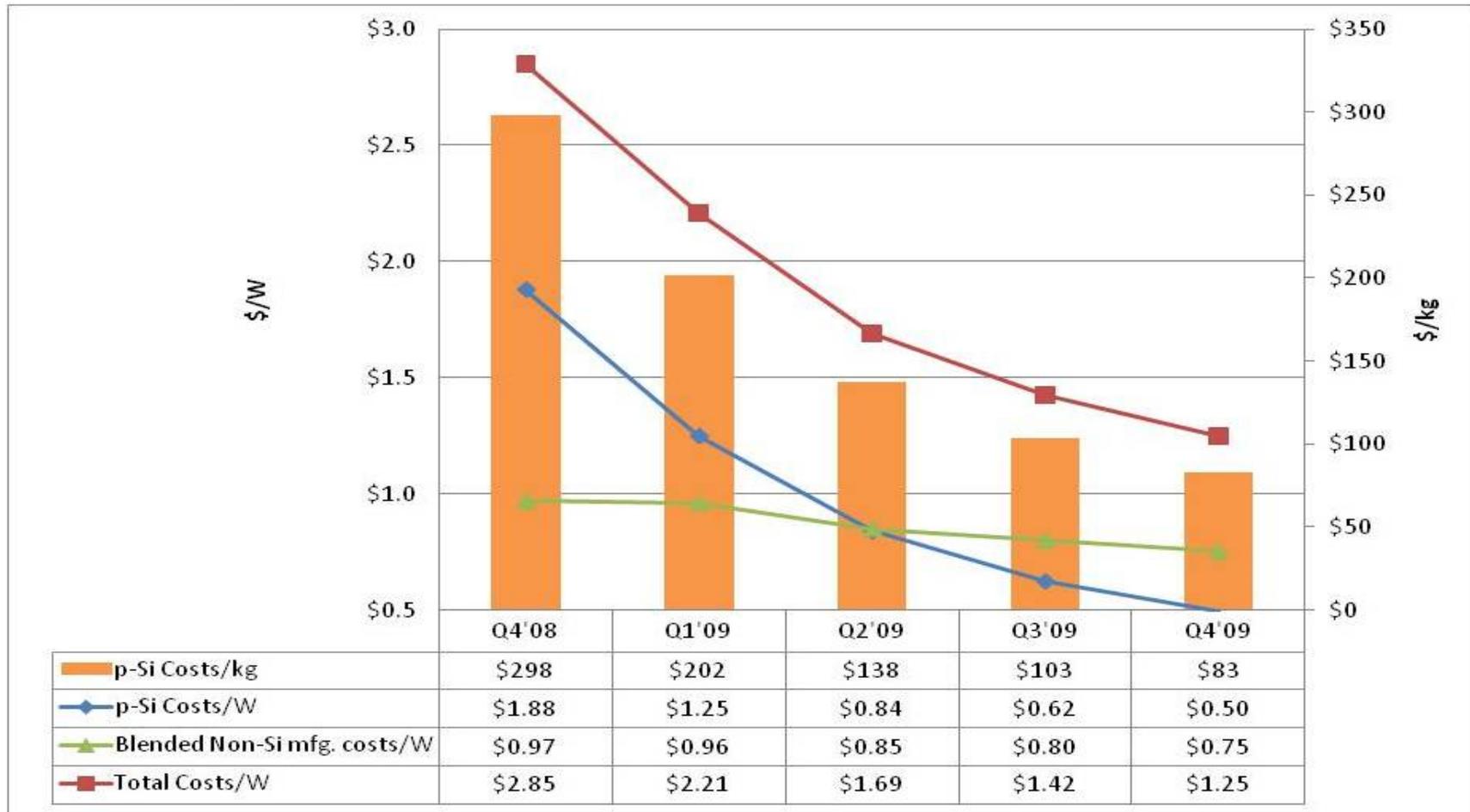
Solar Trend: Costs are Falling

- **Module Prices are down 20 percent since 2001**
- **Accelerated Decline in 2009**



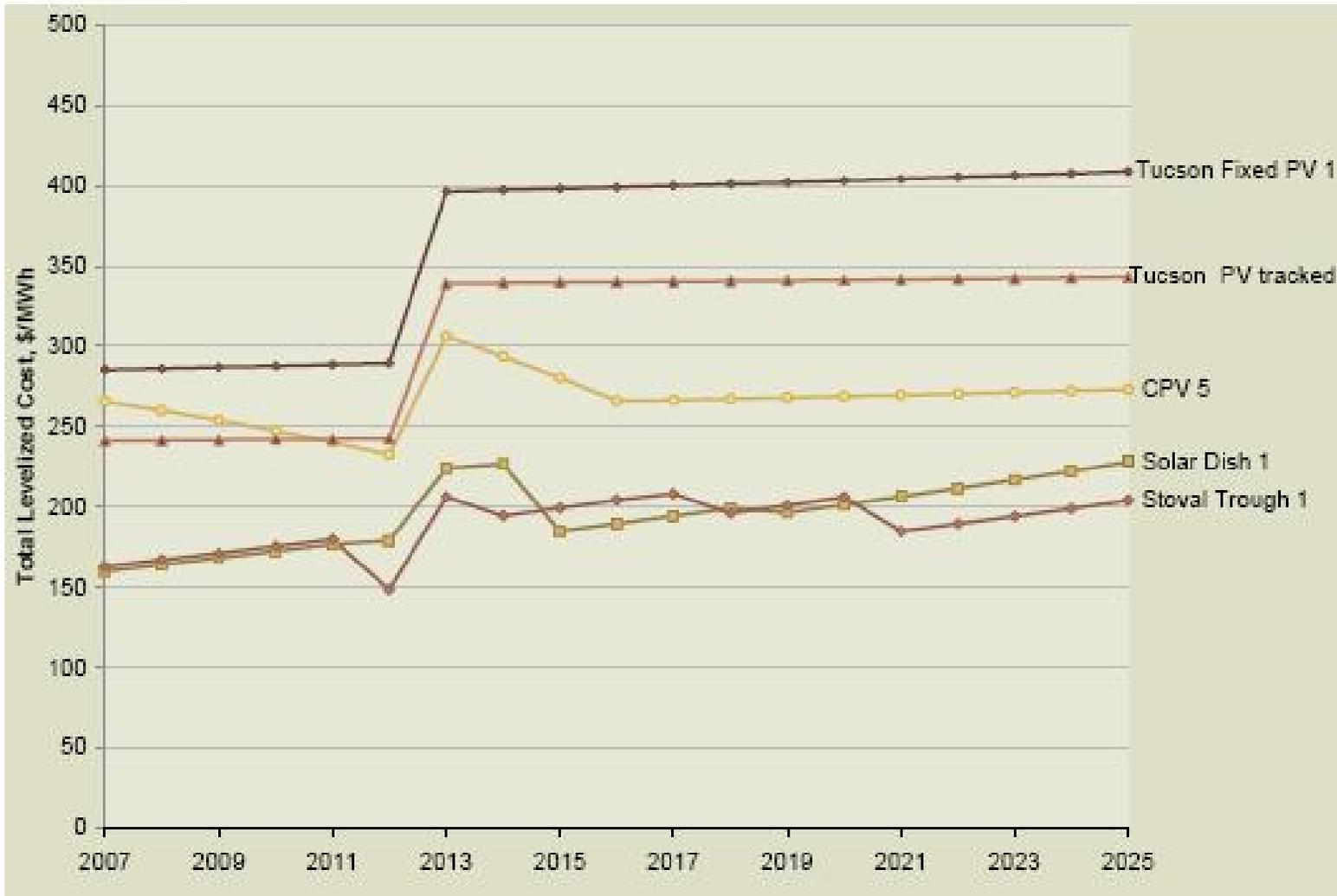


Solar Trend: Costs are Falling



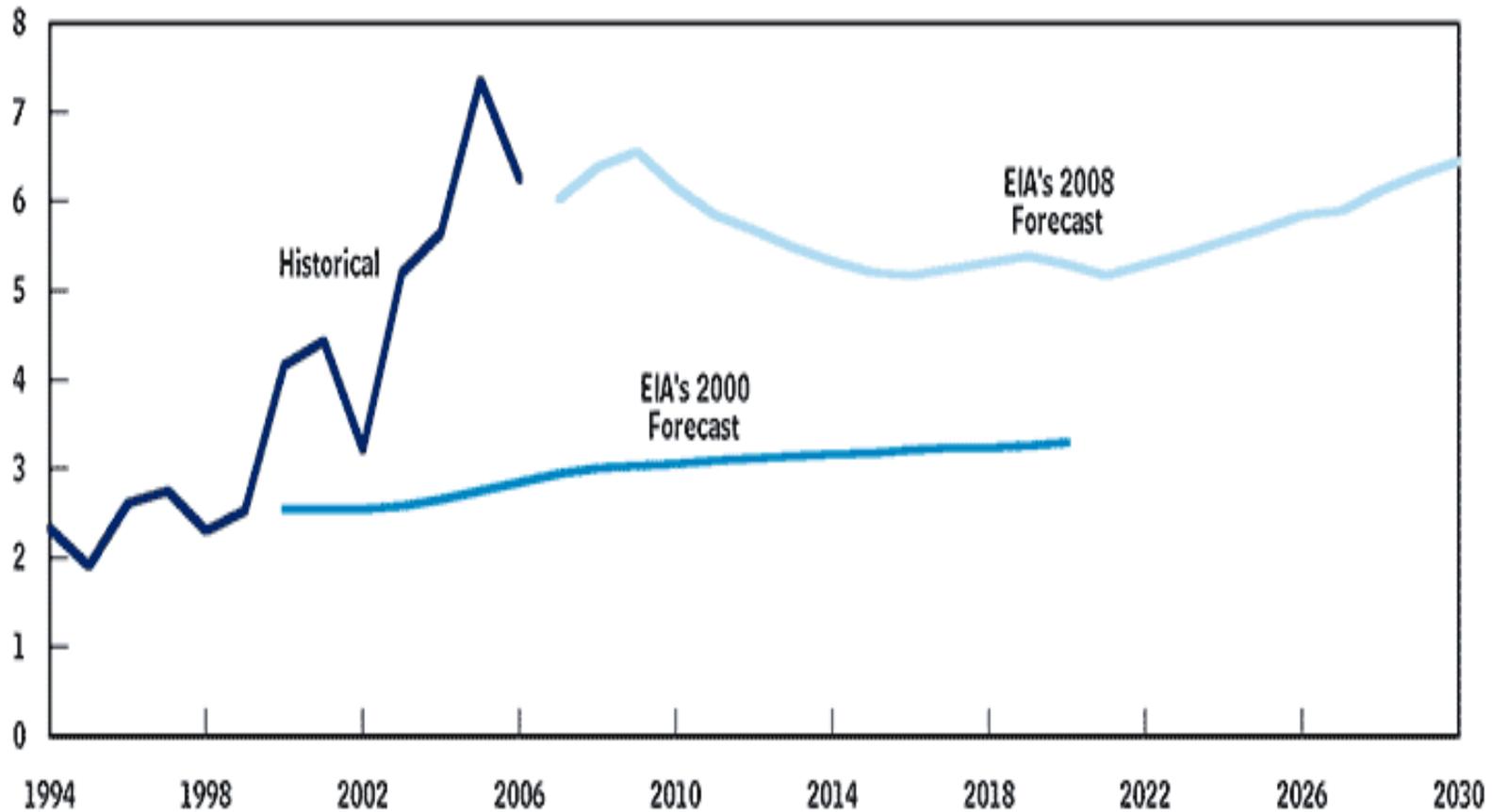


Representative Solar Costs



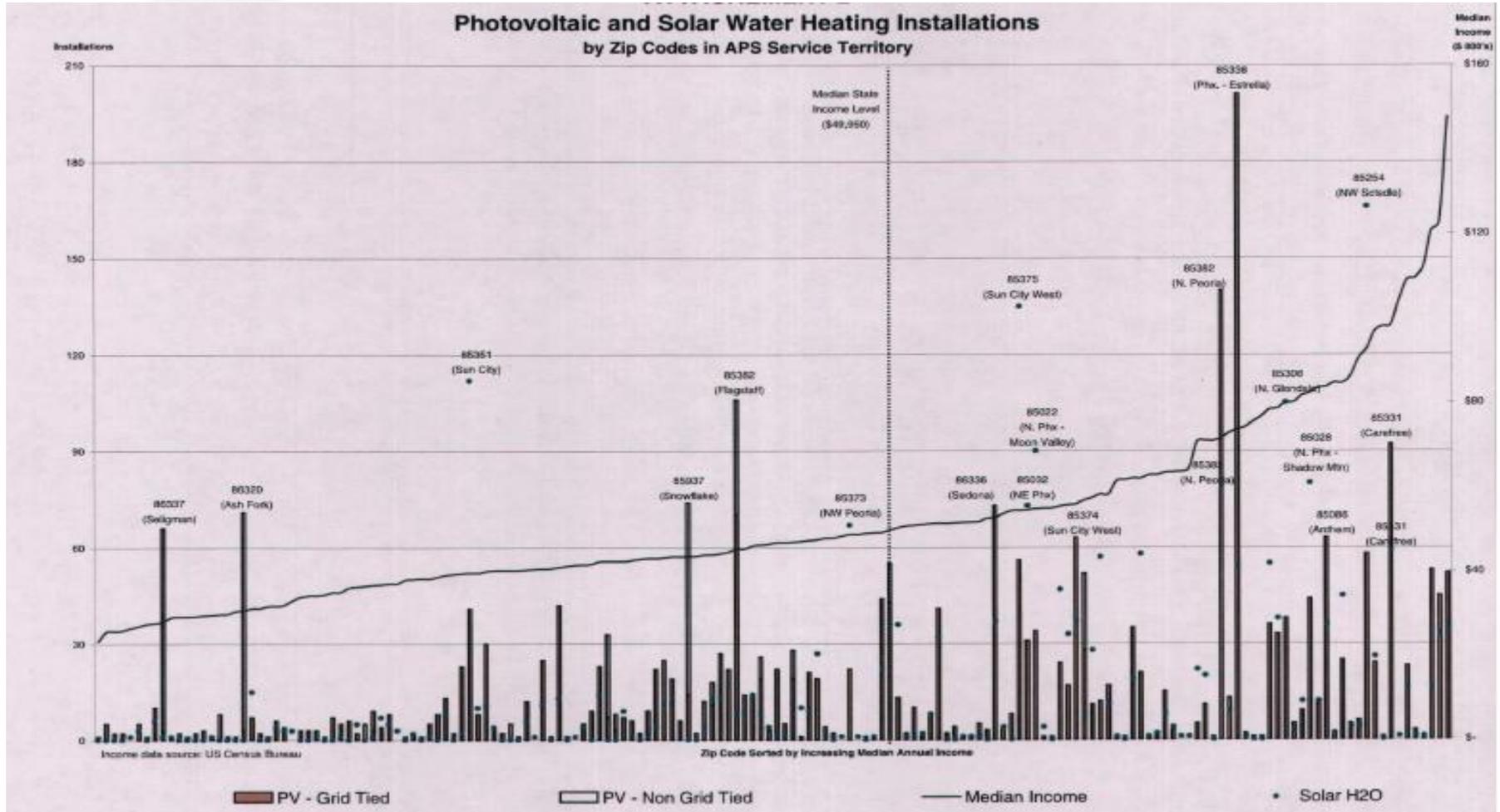


Projected Natural Gas Prices





Distribution of Solar Systems in Arizona



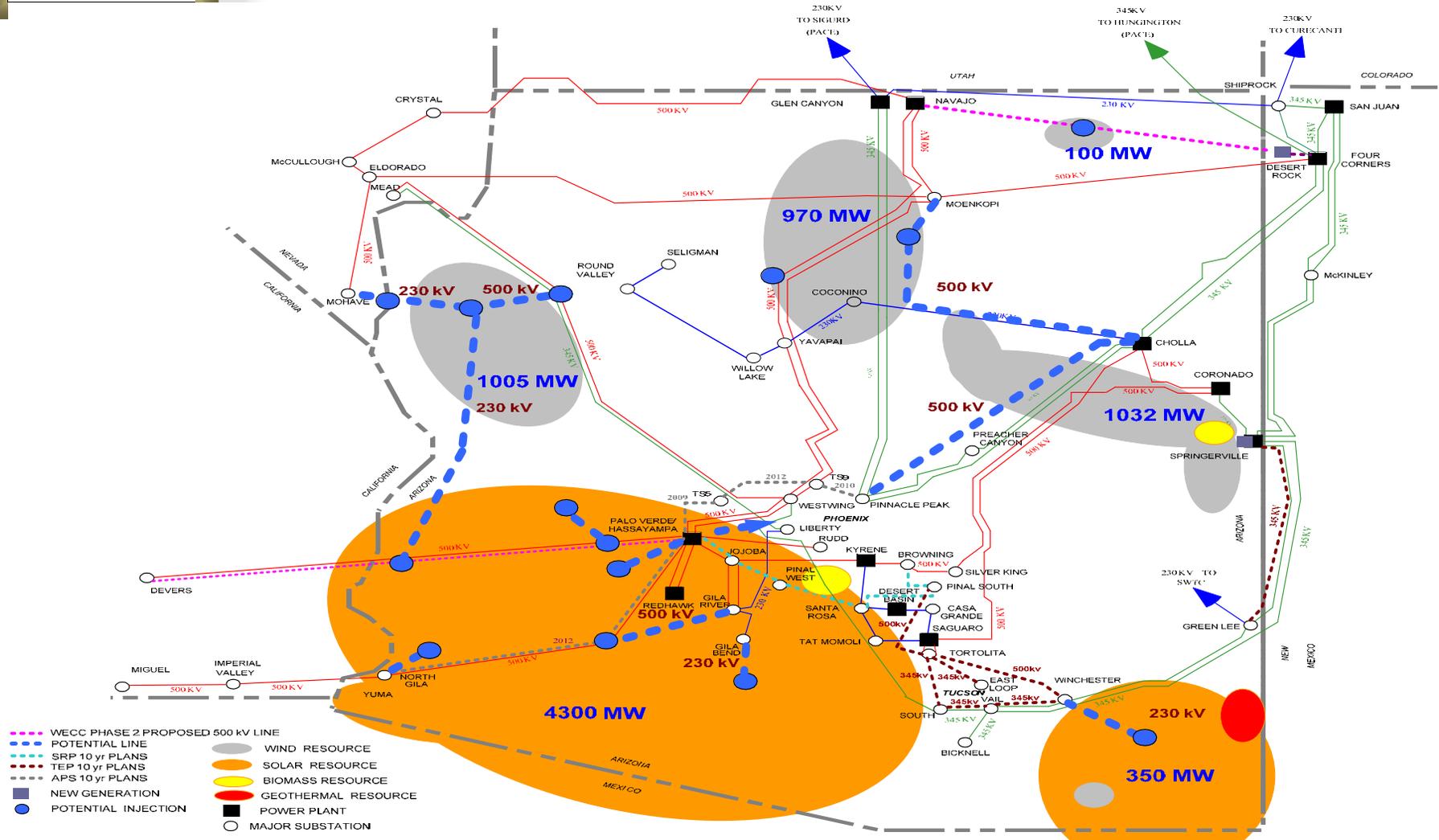


Resource Planning Rules

- **Commission has had Integrated Resource Planning Rules in place but during period of deregulation they were put aside in late 1990's.**
- **In December 2009, the Commission approved revised Resource Planning Rules which will require affected utilities to prepare a forward looking energy plan.**
 - Rules will require a 10-year plan to be filed every two years identifying the sources of the energy generated.
 - Affected utilities will also need to identify how they will comply with demand response, energy efficiency and the state's RES.
 - Greater consideration will be given to water use in electricity generation and emissions.
- **Rule changes should clarify data requirements and transition the Commission from strict least-cost planning to best resource planning.**
 - Colorado has moved away from strict least-cost planning.
 - Renewables may not meet a strict least-cost test however when considering carbon legislation, fixed costs, environmental benefits among the data provides a fuller picture of utility.



Potential Configuration for Transmission to Serve All Available Renewable Resources





Siting Transmission Lines

- **Interest in developing Western renewable energy is driving transmission planning efforts throughout the Western Interconnection.**
- **In Arizona, a central limitation results from the issue of “need”: Law requires the balancing of the need for the line against its environmental impacts.**
 - Utilities build to meet the “need” of state ratepayers.
 - Today “need” should include promotion of interstate transport of renewable energy.



Interconnection Requests

Arizona Renewable Generation Interconnection Requests

APS

Solar 7102MW
 Wind 3348MW
 Biomass 22MW

SRP

Solar 2762MW
 Wind 1350MW

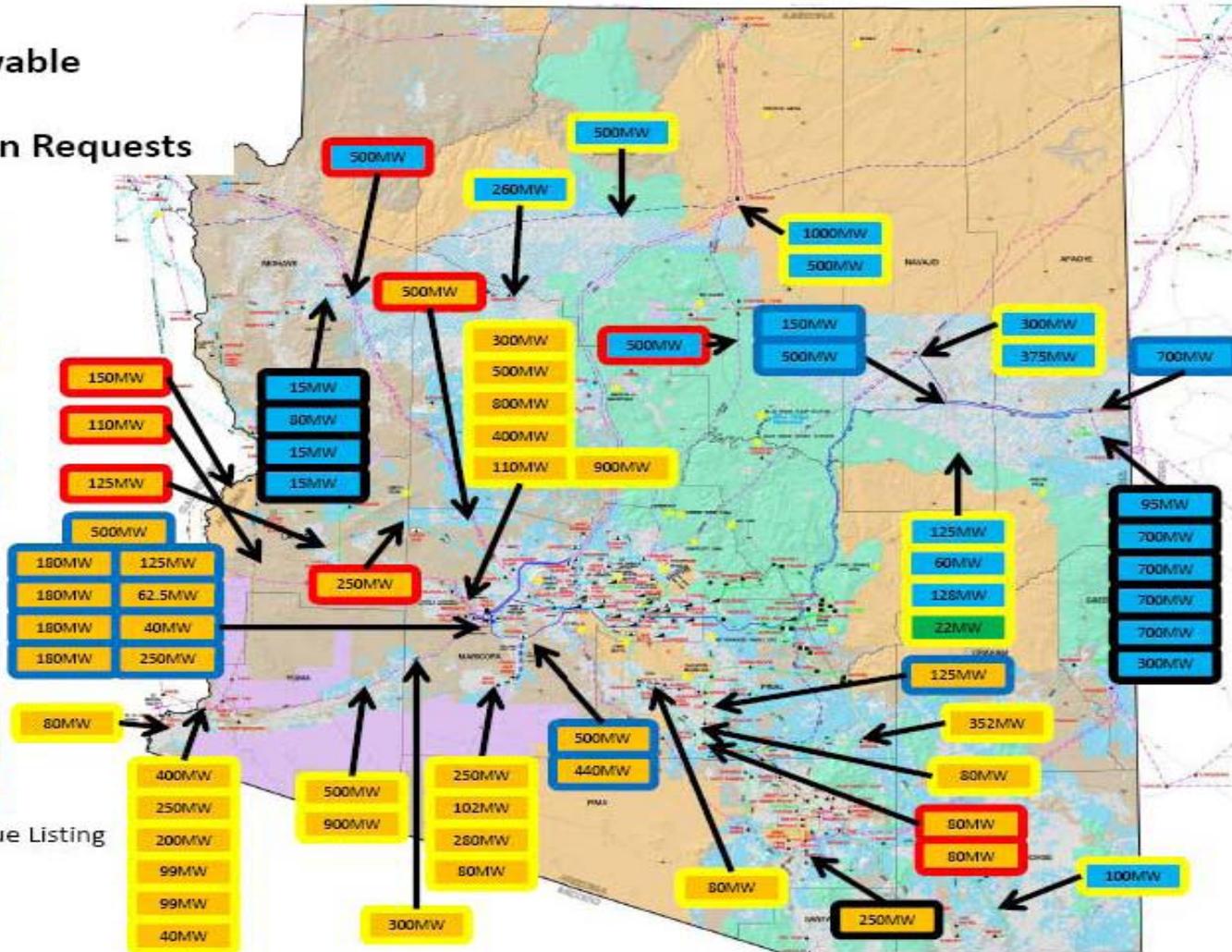
TEP

Solar 250MW
 Wind 3320MW

WAPA

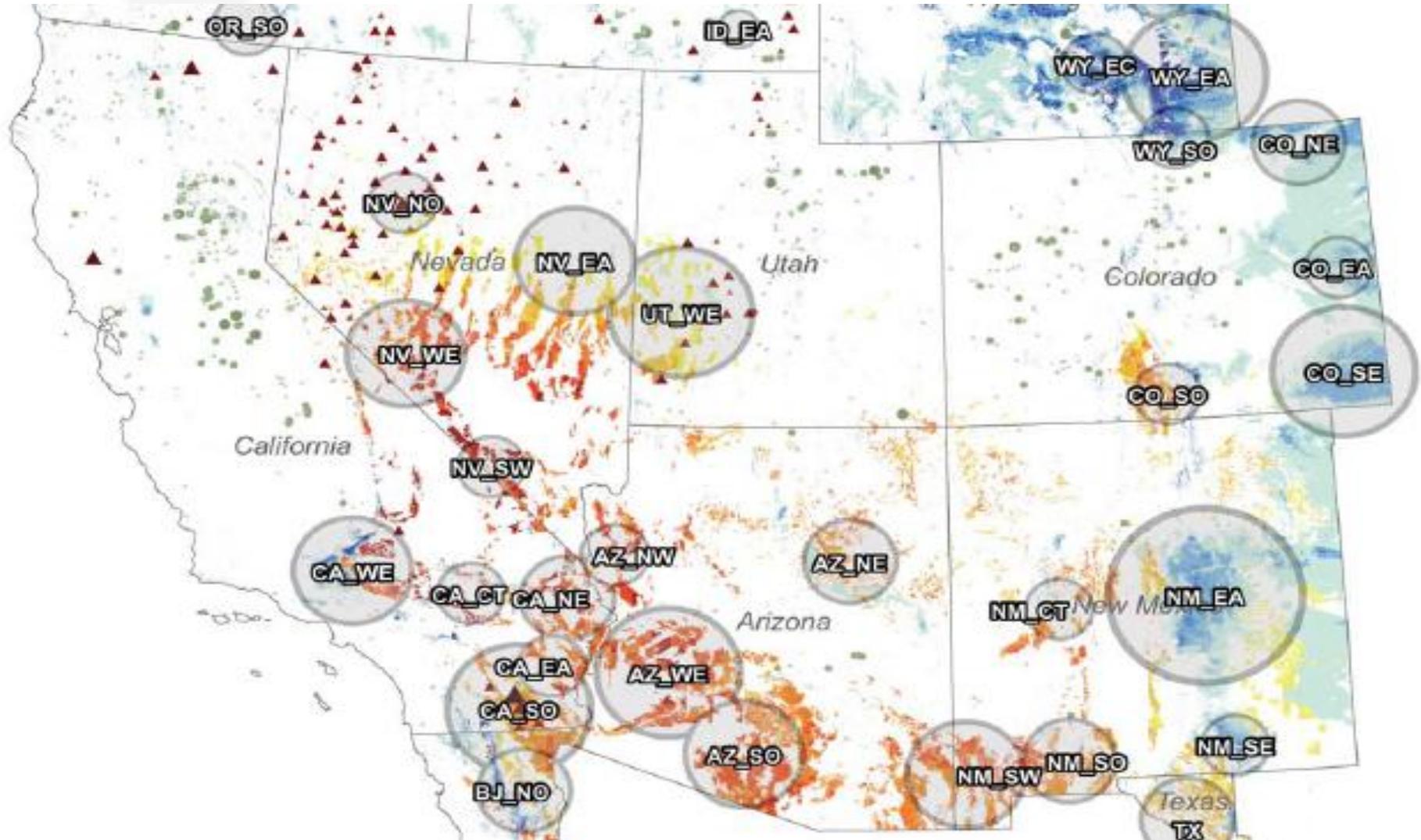
Solar 1295MW
 Wind 1000MW

Interconnection Queue Listing
 As of 3/2/09





Western Renewable Resources





Land Planning and Renewables

- **For utility scale projects we need to consider the land area use efficiency or acres per megawatt**
 - Estimates range from 5-11 acres per megawatt for solar projects.
 - Recent solar projects like Mesquite have estimated 6 acres per megawatt.
 - Mesquite will be developed on 4000 acres of land.
 - Dateland will be developed on 2300 acres of land.
- **Arizona totals 72,645,120 acres**
 - BLM administers 12,200,000 acres.
 - State lands administers 9,200,000 acres.
- **These agencies will play an important role going forward**



Externalities

- **Externalities are the hidden costs involved in the production and use of energy that are not directly priced in the cost of energy.**
 - Examples include: Water use, pollution impacts, health effects.
- **A recent report by the National Research Council of the National Academies found that the aggregate damage associated with emissions of SO₂, NO_x, and PM from coal-fired facilities in 2005 averaged \$156M/plant.**
 - Arizona's six plants contributed nearly \$1B in annual damage.



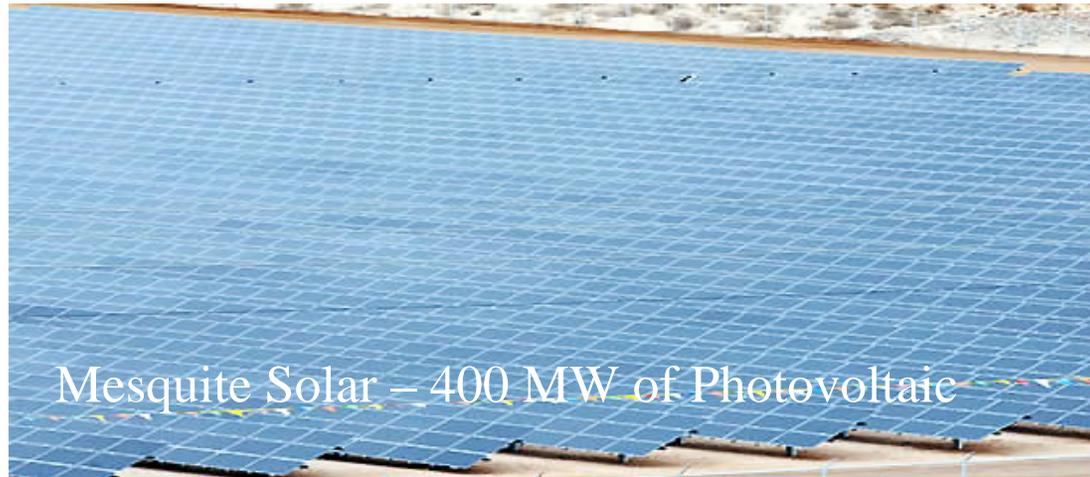
Externalities

- **For Coal: On a per kWh basis, damage is 3.2 cents per kWh.**
- **For Natural Gas: On a per kWh basis, damage is .16 cents per kWh.**
 - Arizona average cost of electricity is 8.34 cents per kWh.
- **In comparison, some renewable technologies like wind and certain solar technologies resulted in minimal external costs.**
- **Commission is launching workshops to study/price externalities.**
 - ACC and utilities will be able to use those values to make proper resource planning decisions/properly value & encourage renewables & energy efficiency.



Water-Energy Nexus

- Recent projects proposed for Arizona will deploy photovoltaic or Solar Thermal technologies
- Water usage by solar facilities is closely scrutinized by the Commission and state agencies





Solar Water Use

- **Important to focus on technology and underlying land usage; water usage depends on technology chosen.**
- **According to a Department of Energy Report, a wet-cooled Solar Thermal plant can require up to 800 gal/MWh; with dry-cooling this can be reduced to 80 gal/MWh.**
 - Coal plant uses 500 gal/MWh
 - Nuclear plant uses 620 gal/MWh
- **Photovoltaic and wind plants use 1 gallon/MWh.**



Energy Efficiency: The “Negawatt”

- **The cheapest form of “energy” that exists**
 - Recent APS case found cost to be 1.02 cents per kWh.
 - The Energy Information Administration calculated Arizona’s average retail price of electricity across all sectors to be 8.34 cents per kWh.
- **Increasing incentives for Energy-Efficiency creates substantial new construction investment and employment retrofitting buildings.**
 - One study estimated that energy efficiency created twice as many jobs as natural gas generation, creating 21.5 jobs for every \$1 million invested vs. 11.5 jobs. (New Energy for America, Apollo Jobs Report 2004).
 - According to the Center for Energy, Resources and Economic Sustainability at the University of California, Berkeley, California’s energy-efficiency policies created nearly 1.5 million jobs from 1977 to 2007, while eliminating fewer than 25,000.



Energy Efficiency

- **ACC has currently approved annual budgets for APS, TEP and Southwest Gas of approximately \$37M.**
- **There are currently 40 approved energy efficiency programs at Arizona's gas and electric utilities**
 - APS (10 Programs) TEP (9 Programs)
 - UNSE (6 Programs) UNSG (4 Programs)
 - SWG (7 Programs) SSVEC (4 Programs)
- **The Commission has recently asked APS to look at and propose on-the-bill financing for their residential customers.**



Energy Efficiency

- **Some Existing Programs include:**

- Low-Income Weatherization (All)
- HVAC (APS, TEP, UNSE)
- New Construction (APS, TEP)
- Compact Fluorescent Lamps (APS, TEP)
- Building Operator Training (APS)
- Pool pump rebate (APS)
- Refrigerator replacement program (APS)



Energy Efficiency Docket

- **The Commission recently approved a 22% by 2020 energy efficiency standard for Arizona's regulated utilities.**
 - Compare to 2.5% national Energy Efficiency goal in Waxman-Markey.
- **This rulemaking is currently in the comment stages with hope of being finalized by late summer.**
- **The 22% Energy Efficiency standard will lead to additional rebate programs / construction opportunities for homeowners and businesses – i.e. pool pump rebate approved for APS customers.**



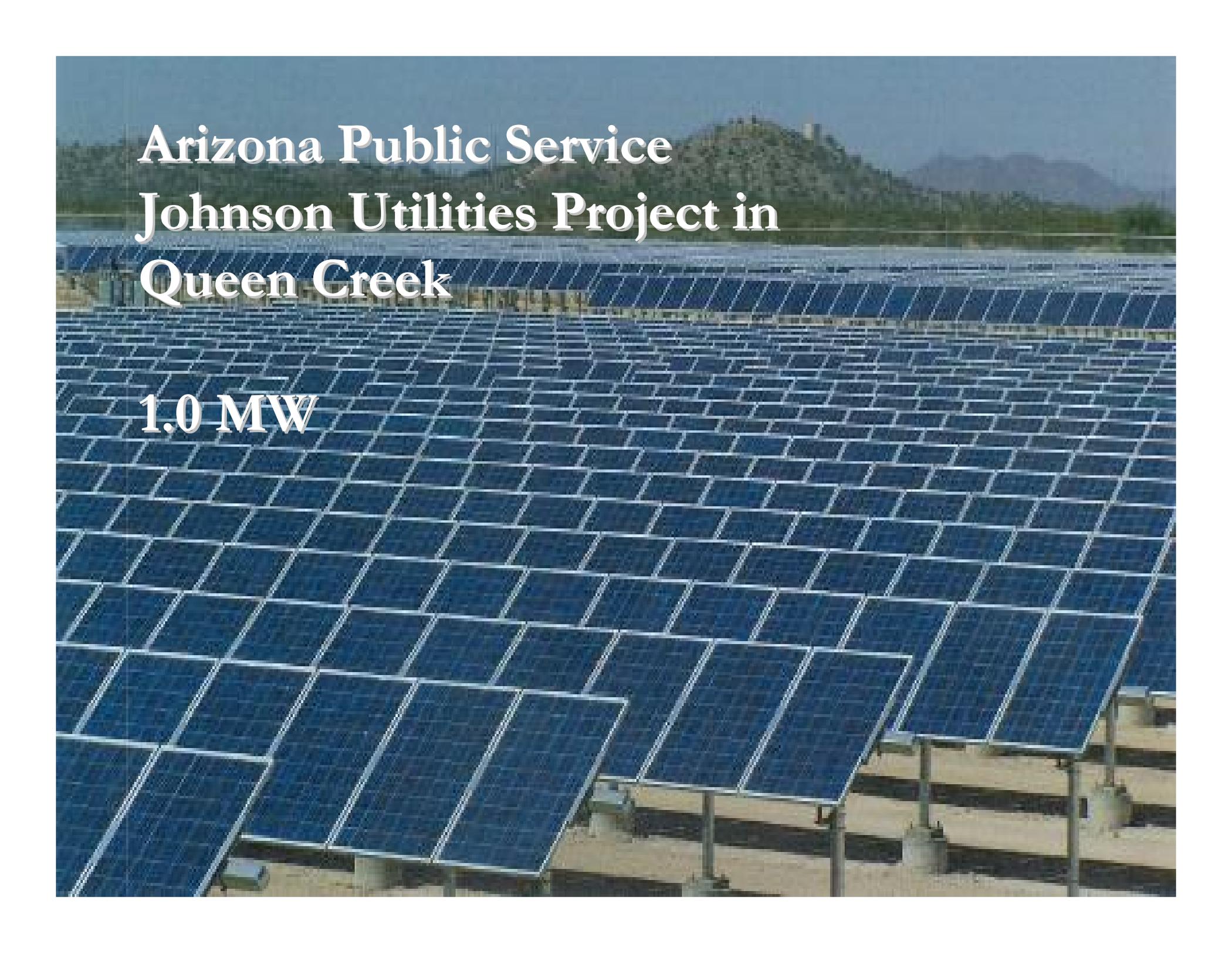
Energy Efficiency: Decoupling

- **Utility rates are currently tied to sales.**
- **Decoupling breaks the link between utility revenues and sales by tying revenues to other attributes.**
 - Ex) $\text{Total revenue} / \text{Number of customers} = \text{Revenue per Customer} \rightarrow \text{base rates on revenue/customer.}$
- **Several states have moved forward on decoupling, particularly for gas utilities.**



Washington Case: Avista

- **Recent rate case in Washington state included lengthy discussion of decoupling.**
- **In reviewing the utility application, the Commission took notice of specific issues.**
 - Recovery of revenue from weather effects.
 - Phantom losses from customers changing tariffs.
 - Disproportionate impacts on low-income customers.
- **Some concerns that decoupling rates from usage would actually create a disincentive to Consumers to conserve.**
 - Decoupling would affect the price signal to consumers.
- **Ultimately the Commission accepted decoupling, albeit with changes.**
 - Not all lost revenues were passed on to ratepayers; Commission didn't approve a lower ROE to recognize the lower risk faced by the Company.



**Arizona Public Service
Johnson Utilities Project in
Queen Creek**

1.0 MW

Arizona State University

PHASE 1:

- Combined 1.8 MW installation on the Tempe Campus
- 1.6 MW installed under a "Solar Services Agreement"
- Two elevated parking garage roof installations on single axis trackers

PHASE 2:

- Another 8 MW installed on three campuses



The image shows three large, blue, parabolic solar dish collectors mounted on metal structures. Each dish is supported by a complex metal frame and has a receiver at its focal point. The dishes are set against a clear blue sky with some light clouds. In the background, a flat landscape with some distant hills and a few small structures is visible. The overall scene is a clear, sunny day at a solar power plant.

1.5 MW SRP Plant in Peoria

60 SunCatchers

Each dish can generate up to 25,000 watts of power



SRP Dry Lake Wind Project, 63 MW

Navajo County, AZ

Skystream Wind Turbine, Flagstaff, AZ

1.8 kW

Slide Courtesy of Southwest Wind Power



An aerial photograph of Deer Valley High School, showing a large, multi-story building with a flat roof covered in solar panels. The surrounding area includes parking lots, other buildings, and some trees. The text is overlaid on the top portion of the image.

Arizona Public Service

Deer Valley High School

1.004 MW



Conclusion

Arizona Corporation Commission documents and orders can be found by visiting www.azcc.gov

Information on Arizona's Renewable Energy Standard can be found by visiting

www.azcc.gov/divisions/util/electric/environmental.htm

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