ORIGINAL OPEN MEETING AGENDA ITEM

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BEFORE THE ARIZONA CORPORATION COMMISSION

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IN THE MATTER OF THE RESOURCE PLANNING AND PROCUREMENT IN 2011 AND 2012

DOCKET NO. E-00000A-11-0113

COMMENTS OF INTERWEST ENERGY ALLIANCE

A. Introduction

Interwest Energy Alliance is a non-profit trade association that represents the nation's leading companies in the renewable energy industry, bringing them together with nongovernmental organizations in the West (Arizona, Colorado, Nevada, New Mexico, Utah, and Wyoming). Interwest appreciates the opportunity to provide comments on Arizona Public Service Company's (APS) Integrated Resource Plan (IRP). We believe APS filed a complete and comprehensive resource plan that provides the Commission and stakeholders with the information necessary to have a robust discussion on the strengths and weaknesses of scenarios for energy development. Specifically, we appreciate the extent of the information in the plan, the multiple scenarios studies, and the number of sensitivities run. **Interwest encourages the ACC to acknowledge the IRP and instruct APS to pursue the Enhanced Renewable Energy Scenario. The Enhanced Renewable Energy case will provide the best hedge against future price increases and provide the most cost certainty. It creates the most balanced energy portfolio by increasing supply diversity and reducing risks.**

By design, Arizona's IRP process provides information for a 15-year planning horizon. This allows parties to take a longer term view than may be considered in the planning and approval of individual generation sources. It provides valuable information where attributes of different generation sources can be compared side by side and holistically. It will allow participants to consider and discuss what APS's electricity system might look like to help ensure that the system built will provide the products and services customers will want in the coming decades.

As the *Western Grid 2050 – Contrasting Futures, Contrasting Fortunes* report states, the "Western electricity sector [will be] investing more than $200 billion by 2030 regardless of the development path taken, the choices made will significantly affect quality of life in the West out to 2050."[1] Given the

[1] *Western Grid 2050: Contrasting Futures, Contrasting Fortunes,* Western Grid Group, Aspen Environmental Group, Dr. Carl Linvill, John Candelaria, Ashley Spalding, page 1

magnitude of the APS investment expected to be made on behalf of customers (over eight billion dollars during the next 15 years), the length of the life of generation and transmission assets (upwards of 40 years), and the small difference in projected costs between scenarios (less than three percent), it is important for the Commission to evaluate the portfolios based on the risk to consumers, shareholders and Arizona.

B. Assessing Risk

Part of the impetus for resurrecting the IRP process in Arizona was the growing uncertainty and complexity of choosing future electric-generation resources. The IRP provides information from which regulators and the utility can choose a mix of resources that represents the best value and lowest risk to meet the electricity needs of APS's customers. Former Colorado PUC Chairman Ron Binz, in his paper titled *Practicing Risk-Aware Electricity Regulation: What Every State Regulator Needs to Know,* discusses the many different types of risks associated with resource selection[2]. They include fuel and operating cost risks, new regulation risks, construction cost risk, carbon price risk, water constraint risk, capital shock risk, and planning load forecast risk[3].

Analysis presented in Chart 1 from the Binz report plots the cost of different technologies and the risk, based on the factors mentioned above. In the chart, the costs for some renewable technologies are higher than fossil and nuclear technologies. However, the risks associated with renewable energy and energy efficiency are significantly lower than the risks of natural gas, coal, and nuclear options. Thus, there is a tradeoff. Interwest maintains that as renewable technologies provide stable-cost energy, and costs for renewable technologies are continuing to decline, these resources present lower risk and a better value to utility customers than fossil and nuclear options. Fossil-fueled generation has uncertain costs due to unpredictability of future fuel prices. For nuclear, the costs of construction and fuel make prices uncertain[4].

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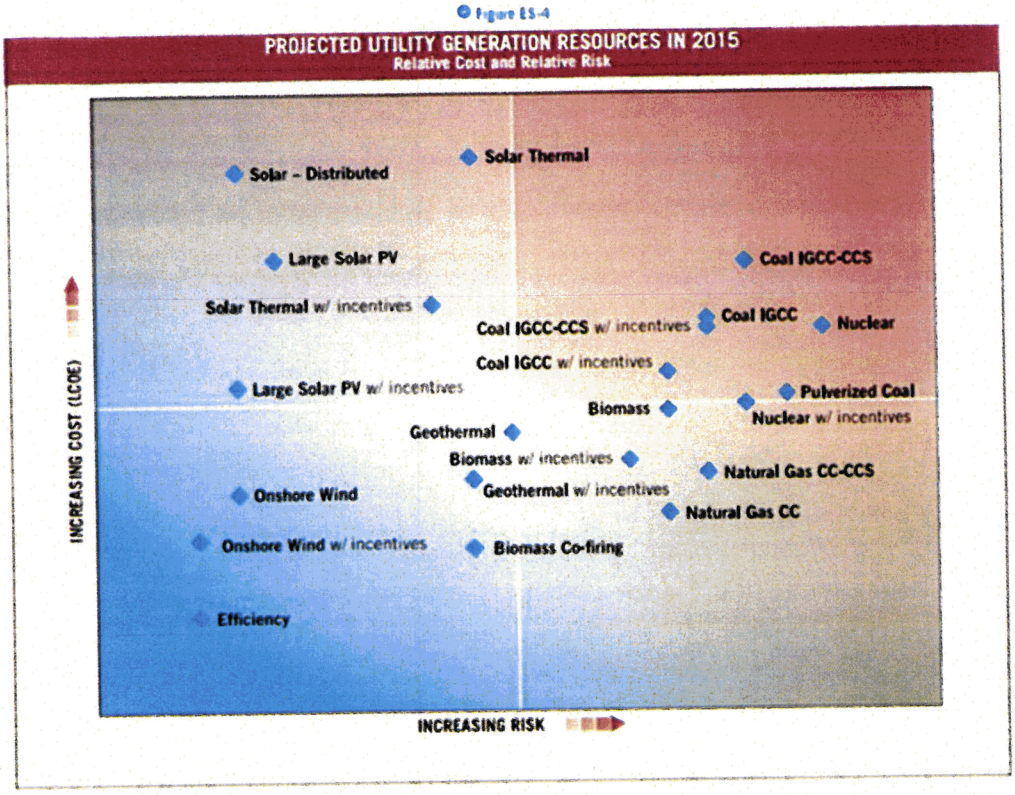
[2] http://www.rbinz.com/Binz%20Sedano%20Ceres%20Risk%20Aware%20Regulation.pdf

[3] Some risks, such as fuel costs increases were explicitly analyzed in sensitivity analysis. While others, such as the increased cost of capital, were not.

[4] Chart 1 shows the high risk of nuclear due in part to cost uncertainty.

CHART I.



Practicing Rick-Aware Electricity Regulation: What Every State Regulator Needs to Know[5]

C. Summary of Comments

Interwest recommends the ACC acknowledge the IRP and instruct APS to pursue the Enhanced Renewables case. The Enhanced Renewables case will provide a hedge against future fossil fuel price increases, and it creates the most balanced energy portfolio which increases supply diversity and reduces risks.

Interwest believes there are substantive and compelling reasons to support pursuit of the Enhanced Renewables procurement plan. Our comments are organized into the following sections that support development of the Enhanced Renewable Energy portfolio:

Section 1. The Enhanced Renewable Energy portfolio reduces exposure to fluctuating and rising fuel costs by reducing the consumption of natural gas.
Section 2. The Enhanced Renewable Energy portfolio is the most balanced portfolio.
Section 3. The Enhanced Renewable Energy portfolio increases energy security.

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[5] *Practicing Rick-Aware Electricity Regulation: What Every State Regulator Needs to Know*, Ceres, Ron Binz, April 2012 http://www.rbinz.com/Binz%20Sedano%20Ceres%20Risk%20Aware%20Regulation.pdf

Section 4. The Enhanced Renewable Energy portfolio increases economic development and jobs in Arizona.
Section 5. The Enhanced Renewable Energy portfolio helps to build a stably-priced electric system.
Section 6. The Enhanced Renewable Energy portfolio is the best economic deal for consumers.
Section 7. The Enhanced Renewable Energy portfolio relies on resources with declining costs.
Section 8. The Enhanced Renewable Energy portfolio will use less water and produce less pollution.
Section 9. Operational changes can greatly reduce cost of renewable energy integration.
Section 10. Arizona customers prefer increased amounts of renewable energy.

1. The Enhanced Renewable Energy scenario reduces exposure to fluctuating and rising fuel costs by reducing consumption of natural gas.

The APS-proposed Base Case portfolio increases reliance on natural gas from the current 23.7% of peak capacity in 2012 to 26.3% in 2027. This may not seem like a large increase. However, the amount of natural gas that is expected to be required (known as gas burn) almost doubles from 57.7 billion cubic feet (BCF) per year to 99.2 BCF. This is a sizeable increase in just 15 years, and it indicates the magnitude of the additional exposure to gas price volatility. For a historical perspective, as late as 1999, less than 5% of APS's generation came from natural gas. [6]

1.1. Customers Now Bear All Risks of Fuel Price Increases

For many years APS, and its shareholders, were required to share in the financial risk related to increases in fuel prices; known as the 90/10 sharing provision of the Power Supply Adjuster (PSA). As explained in the Commission Decision No. 73183, "When actual fuel costs exceed base fuel rates, APS can collect 90 percent of those costs, and when actual fuel costs are less than base fuel rates, APS can keep 10 percent of those savings. The PSA sharing mechanism is designed to give APS a financial incentive to prudently plan for and acquire its purchased power and fuel."[7] In practice, this meant that APS could collect only 90 percent of the cost of fuel that exceeded expected fuel costs from customers; ten percent of the costs had to be absorbed by the company. This had the effect of being a risk-sharing provision related to the cost of natural gas, coal, and nuclear fuels. In Decision No. 73183, this provision was replaced with a periodic review. The change to this important provision now allows the utility to pass all the cost of fuel increases on to customers and not have to absorb fuel price increases.[8] Thus, the risk to and impact on the company of cost increases for natural gas has decreased, while it has increased for consumer.

Chart 2 below shows the historic cost of natural gas from 2000 through 2012. It illustrates the volatility of the cost of natural gas, the impact of which directly affects the cost of electricity generated by natural gas and the price customers must pay for natural gas generation. While APS has factored in gradual natural gas price increases in sensitivity analyses, it did not, and cannot, accurately forecast price spikes which can have dramatic and immediate effects on customers.

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[6] Pinnacle West Capital Corporation, Statistical Report, 2000, page 90

[7] ACC decision #73183 page 25

[8] In place of the 90/10 sharing APS will be subject to periodic audits of fuel and power procurement. However, the first review is stipulated not to occur until 2014.

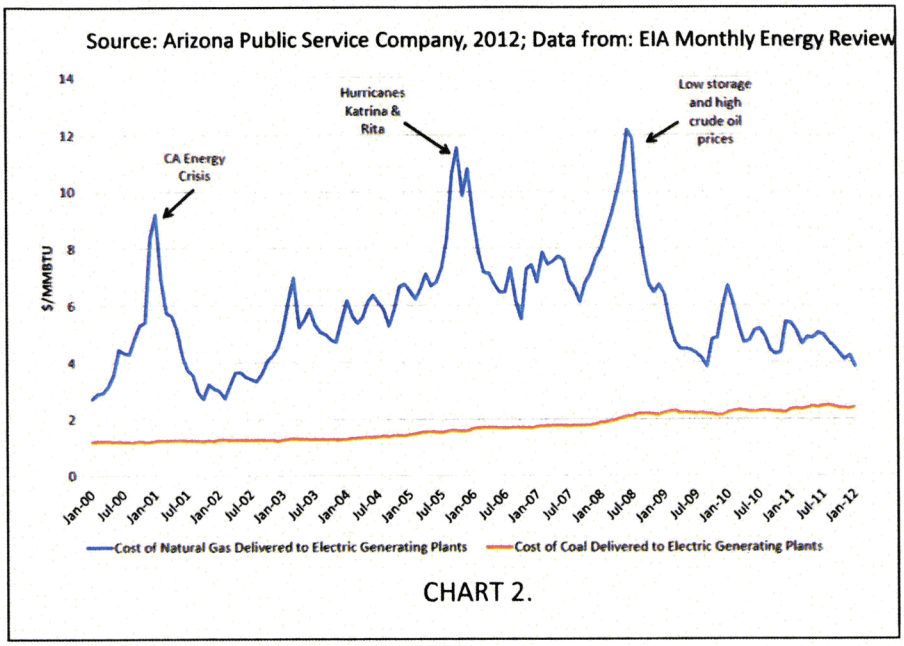

CHART 2.

1.2. APS Customers are concerned about natural gas volatility.

The Informed Perception process, conducted by Arizona State University for APS to discern customer priorities and preference of energy choices, found that customers were concerned about increases in the cost of natural gas. Quoting from the ASU report on small group discussion with APS customers, "To most participants, the major problem with relying on natural gas for electricity generation is its price instability. Many have seen their gas bills fluctuate widely with changes in natural gas rates over the years and are concerned that prices in natural gas are too unpredictable to plan major, large-scale energy projects around. Others expressed concerns about the high cost of developing natural gas plants and suggested that capital could be invested in more financially stable sources."[9]

As more fully discussed in Section 10, these customers were educated about energy choices before the statement was made. Thus, as the name of the project indicates, the statement is a summary of an informed group of APS customers.

Exposure to volatile natural gas has increased significantly as the percentage of gas in APS's portfolio has increased over the past decades. As reported above, natural gas was only 5 percent of APS's fleet in 1999. APS's proposed trajectory would increase reliance on natural gas to over one quarter of its resources. While APS can project the cost to build natural gas power plants, it is impossible to accurately project what the cost of operating that resource will be in the next decade, or especially within the forty-year life expectancy of a natural gas plant.

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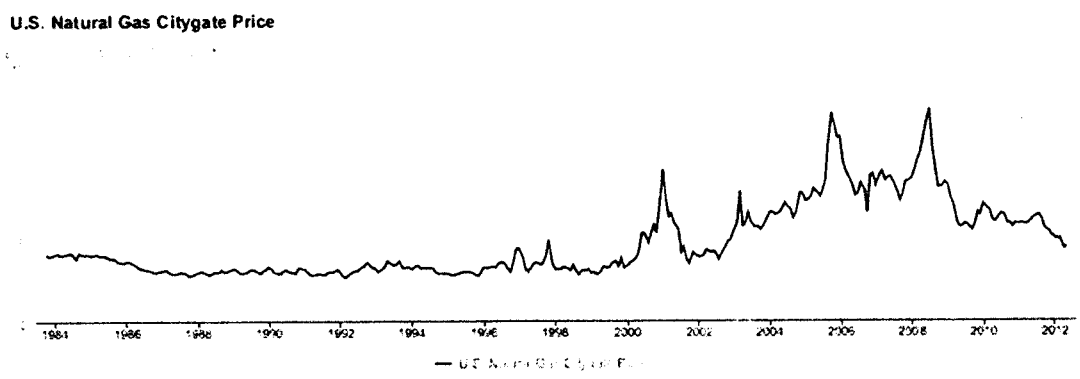
[9] *APS Informed Perception Project Report,* ASU Morrison Institute for Public Policy, 2011, page 33 https://morrisoninstitute.asu.edu/publications-reports/aps-informed-perception-project-report-final/view

CHART 3.



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Through the mid 1990's the U.S. enjoyed steady natural gas prices. However, as the electric Utlity industry has become more reliant on natural gas the price has been much more volatile. http://www.eia.gov/dnav/ng/hist/n3050us3m.htm

1.3. Uncertainty of Natural Gas from Hydraulic Fracturing (Fracking)

The U.S. is currently enjoying low natural gas prices largely due to new techniques that allow natural gas to be extracted from shale deposits. The process of hydraulic fracturing, commonly known as "fracking,"uses horizontal drilling to inject water and chemicals, at high pressure, into underground deposits. The pressure creates fractures in the rock that allow the gas to be unlocked and flow to the surface for collection. The California Energy Commission projects that by 2030, 50% of the nation's natural gas will be extracted using fracking techniques.

Currently there is a great deal of uncertainty around this process and how it is to be regulated to protect public health. This lack of policy certainty affects the cost of extraction – and ultimately the price – of natural gas.

To provide guidance to states, the Republican Governors' Association's Public Policy Committee recently released their energy report that supports "interstate efforts to establish best practices for regulation of hydraulic fracturing." These best practices may take the form or rules, regulations, policies, or laws. Most have not yet been developed.

At present fluids, injected underground in process of fracking, are exempt from the federal Safe Drinking Water Act by the Energy Policy Act of 2005.[10] However, concerns have been raised that chemicals in the fracking fluids can make their way into drinking water supplies, so this exemption may eventually be eliminated.

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[10] Energy Policy Act of 2005, page 102, section 322 Exemptions: "the underground injection of fluids or propping agents (other than diesel fuels) pursuant to hydraulic fracturing operations related to oil, gas, or geothermal production activities."

In Colorado, where local communities are seeing high levels of oil and gas development, state and local jurisdictions are struggling over which entity should regulate fracking and what regulations to impose. The town of Erie, Colorado, after having imposed a six-month moratorium on fracking to study the issue, established best management practices for the industry. Other towns in Colorado, such as Longmont and Colorado City, are still wrestling with drilling issues[11]. Over the long term, changing regulations could affect the supply, and ultimately the price, of natural gas.

1.4. International Price Pressures

Just a few years ago, the U.S. was expected to be an importer of natural gas as domestic supplies could not keep up with increasing demand. Several terminals to import liquid natural gas (LNG) were being considered and a few were being constructed on the East and West coasts. Today, LNG terminals are being considered to export LNG worldwide. The Federal Energy Regulatory Commission reports that there are 14 LNG export terminals proposed for the U.S. These facilities have a combined export capability of 19 BCF per day.

As world prices for natural gas are higher than current prices in the U.S., exporting may put upward pressure on the price of natural gas as suppliers can make more money selling product off shore. As an example, the import price for natural gas in Europe has hovered around $11 per MBtu since the spring of last year compared to three dollars for spot market gas in the U.S. at the Henry Hub.

Increased regulation to protect public health will result in increased cost of production and increased cost of natural gas.

1.5. Natural Gas and Electricity Industry Incompatibility

The natural gas and electricity industries operate and are regulated very differently. As the electricity industry uses more and more natural gas, incompatibilities between the industries are becoming apparent. As an example, electric utilities have to "nominate" or request the amount of natural gas they will need on a daily basis. For weekends, a utility has to determine the amount it will need for that two-day period. In 2010, in Colorado, utilities experienced unexpectedly cold weather over a weekend and did not have enough gas to operate their gas-fired generation at the output needed. Regulation and policy that impact the supply and delivery of natural gas may need to be overhauled as the electricity industry uses more natural gas. This incompatibility may create supply and cost issues for the electric power industry.

2. The High Renewables Portfolio is the most balanced portfolio.

Over the past few decades, APS has been diversifying its energy portfolio by adding nuclear, natural gas and, most recently, renewable energy and energy efficiency to its fleet of coal-fired power plants. As all sources of energy have positives and negatives, having a diverse portfolio

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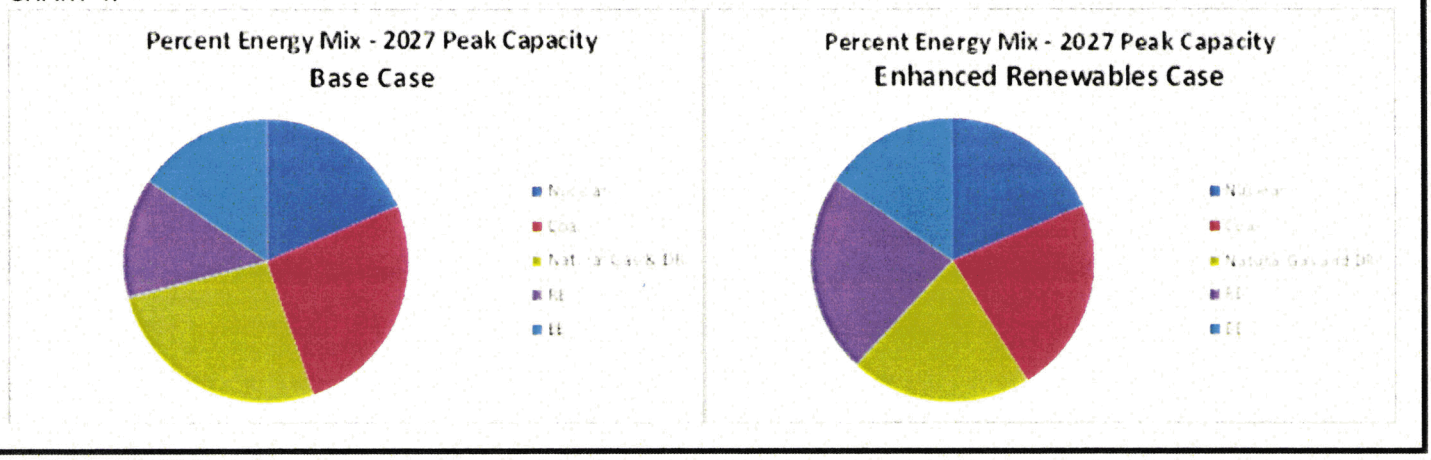
[11] *Colorado Towns Wrestle With Fracking Rules*, Energy Prospects, Penelope Kern, September 4, 2012

allows the utility to mitigate and mute risks associated with any single technology or fuel. As APS and other utilities begin to transition away from coal resources renewable energy can provide an important source of power to meet future needs.

As can be seen in the pie charts below, the Enhanced Renewables Portfolio would build the most balanced portfolio to meet peak energy needs. This evolution in electric generation sources has come about as new technologies have been developed, costs have changed, and health and environmental impacts of fossil fuels have become evident. Charting a course to have the most balanced portfolio will reduce risks and costs from any one energy resource.

CHART 4.



3. The Enhanced Renewables Portfolio increases energy security.

Arizona is endowed with world-class renewable energy resources. Development of these indigenous resources will provide energy security benefits for the state. First, by utilizing more solar energy, APS can continue to build resources close to loads. This can reduce the amount of transmission needed, which can reduce vulnerabilities to outages related to the transmission system. Second, renewables are typically built in a more modular fashion than fossil generation. Thus, if a generator trips off line, it is not such a large contingency. Third, renewables do not require purchase of fuel from outside the state or the nation. This eliminates vulnerability to supply disruptions.

4. The Enhanced Renewable Portfolio increases economic development and jobs in Arizona.

Arizona has been enjoying a surge in solar and wind development in the past few years. Projects installed in the state provide jobs and significant economic revenues. According to Governor Brewer in 2011, Arizona could count over 4,700 solar jobs. As of 2012, there are more than 265 solar companies operating in Arizona, including 26 solar manufacturing locations. Solar companies in Arizona offer services ranging from solar photovoltaic installation and maintenance to the

development and financing of large-scale solar projects.[12] The state has also enjoyed the investment of over $2.7 billion from three solar projects, including APS's Solana project. For wind development, county tax revenues have increased in the rural portions of the state. For example, for just phase one of the Dry Lake Wind Project, the Navajo County assessor's office reported $440,000 in new annual property tax revenues[13] from the project.

Arizona is working to build its standing as a development hub for solar as evidenced by the following:

- The Governor has been supportive of developing the state's solar resource and industry base, and is expected to develop a state energy policy that has a large focus on solar energy.
- The state legislature has adopted tax policy[14] to support and encourage locating solar and renewable energy manufacturing facilities in the state to enhance the local economy and create investment and jobs.
- The new Arizona Commerce Authority chose four primary focus areas for its work in state economic development. Solar is one of the four key areas.
- The Greater Phoenix Economic Council has focused on solar energy as a key economic development sector to help diversify and strengthen the region's economy. It regularly courts solar companies and conducts trade missions to encourage companies to locate or expand in the state.

However, any industry will grow only if there is demand for the product. The Enhanced Renewable Energy portfolio will increase demand for renewable energy over the base case and support solar-related economic development.

In addition to the increased jobs and economic development resulting from using Arizona's solar energy resource, increasing our use of this abundant local resource also limits the outflow of energy dollars out of state. The Arizona Department of Commerce, in its Energy Dollar Flow Analysis, calculated that 68% of the revenues spent on energy leave the state. [15] This includes spending on natural gas, gasoline, and other energy products. Paying for solar energy that is located in the state increases the retention of dollars in the state, which benefits the state's economy.

5. Building a stably-priced electric system.

Adding additional renewable energy resources, such as wind, solar and geothermal, will increase the amount of stably-priced resources in APS's resource mix. Renewable energy provides price

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[12] *Arizona Solar Policy Page*, Solar Energy Industries Association, Updated Q3 2012. http://www.seia.org/state-solar-policy/arizona

[13] Wind Energy and Arizona, Briefing to Arizona State Legislature, 2009, Dr. Tom Acker and Amanda Ormond

[14] The Renewable Energy Tax Incentive Program (RETIP) created in 2010 legislation– allows renewable energy companies expanding or locating in Arizona to receive up to a 10 percent refundable income tax credit on qualified capital investment and up to a 75 percent reduction on real and personal property taxes. Source: Arizona Commerce Authority

[15] *2006 Energy Dollar Flow Analysis for the State of Arizona,* Arizona Department of Commerce, Mark Hope, 2006

stability because there are no fuels to purchase. Once constructed, fuels costs are the major variable cost component of natural gas, nuclear, and coal-fired power plants. Renewable energy resources provide price certainty for the utility and customers for decades.

To see how renewable energy resources provide benefits to Arizona, we can look at the state's existing hydro resources. Arizonans enjoy moderate electric rates, in part, because of the renewable hydro-power resources developed decades ago. The state's hydro resources were expensive to build at the time but have provided decade after decade of stably-priced electricity. New renewable energy resources will provide the same price stability as our existing hydro resources.

As Arizona grows, it is going to need additional generation resources. APS forecasts spending over $8 billion in capital expenditures over the next 15 years. Investing in clean energy will be an investment in an electric system that will be stable in cost and provide benefits to current and future generations and businesses.

6. The Enhanced Renewables Portfolio is the best economic deal for consumers.

To evaluate which scenario might be best for consumers over the 15-year planning period, the IRP is instructive. As APS points out on page 53, "The four portfolios analyzed have markedly similar 15-year Net Present Value (NPV) of revenue requirements for the 15-year Planning Period." This means that while the resource mix for the four scenarios differs widely, the expected cost for all the cases are only slightly different. In fact, the projected NPV revenue requirement for 2012-2027 for the Base Case is $26.9 billion; while the Enhanced Renewables Case is $27.6 billion. This is a difference of only 2.3 percentage points.

Over the 15-year planning period, any number of factors could change, making the Enhanced Renewables Portfolio the same or lower cost than the Base Case. The high NPV cost projection for revenue requirements for the Base Case is 12.5% above the low projected cost for the Base Case. Thus, the additional cost projected today for the Enhanced Renewables is much less than the possible cost swing in the Base Case.

APS conducted useful analyses on the potential cost of the four portfolios based on a number of sensitivities of variables that can impact the overall price of each plan. Page 60 of the IRP provides a chart summarizing the sensitivity analysis run and the variation from project cost of each of the scenarios. Sensitivities were run on the following: low and high natural gas prices, low and high energy efficiency prices, low and high carbon costs, extension of tax credits for clean energy and cost of externalities. As APS notes, "The Base Case and Enhanced Renewable portfolios show much less variation in Revenue Requirements [than the two other scenarios], with 7% and 6% difference over the Planning Period, respectively.[16]"

Part of the purpose for APS to run different economic scenarios is to see the spread in costs caused by different assumptions. Information on the potential difference in cost is a measure of risk. The greater the uncertainty about the future prices, the greater the risk for the utility and

[16] IRP page 61

customers. As the IRP makes clear, compared to the other cases run, the Enhanced Renewable case provides the greatest certainty in cost over the 15-year planning period and it has the least amount of variability between the highest projected cost and the lowest projected cost.

This is an expected outcome as renewable energy provides stably-priced resources, which can be calculated on a long-term basis compared with resources that have more financial variables **that cannot be controlled by the utility**. The IRP analysis shows that the Enhanced Renewable scenario has the least-cost risk and could be 9% less expensive than the Base Case[17].

7. Renewable energy has declining cost trends.

Many forms of renewable energy are exhibiting decreasing cost trends. If, as indicated from research outlined below, these trends continue, APS and its customers may pay less for renewable energy resources than is projected in the IRP.

7.1 Solar Energy

One only has to look at the incentives paid by APS to residential customers who install solar photovoltaic systems (solar PV) to see that costs for solar have decreased dramatically over the past few years.

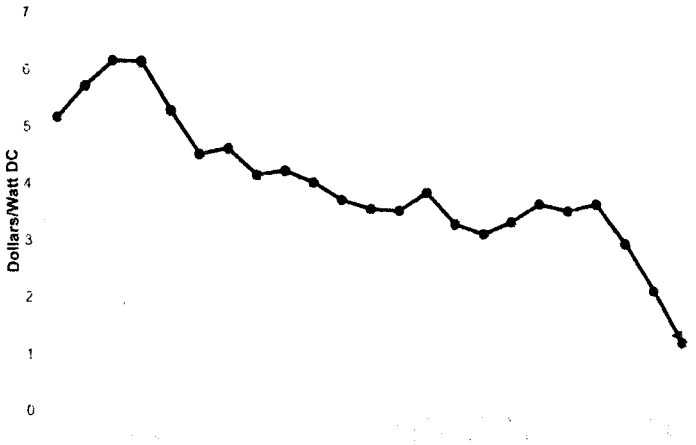
CHART 5.

APS Residential PV Incentives	
Year	**Per Watt**
2009	$3.00
2010	**$2.00-3.00**
2011	$2.00-0.70
2012	**$0.20**

Surging demand has dropped solar PV module prices approximately 75% in just the past three years, with another 50% expected over the next three. The average pre-incentive cost of going solar decreased 17% in 2010 alone, the most significant annual reductions since the data has been tracked. Costs declined another 11% in the first half of 2011. Midyear 2012 we are seeing solar panels prices averaging $0.79/Watt. Chart 6 below illustrates this impressive price curve.

[17] Comparing the high revenue requirements for the Base Case with the low revenue requirements of the Enhanced Renewable Case.

CHART 6. Solar Module Pricing Trends 1989-2011[18]



On a levelized cost of energy basis (full life-cycle cost of energy – known as LCOE), solar PV, on both utility scale and distributed generation scales is becoming competitive with average electricity prices in many wholesale, commercial and even residential electricity markets. According to a McKinsey & Company's Q2 2012 report, PV prices are expected to continue to fall as manufacturing capacity doubles over the next three to five years and underlying costs drop by as much as 10 percent annually until 2020. Their analysis suggests that by the end of the decade, costs could decline to $1 per watt peak for a fully installed residential system, which means prices for commercial and utility scale solar PV projects will be even lower than today.[19]

7.2 Wind Energy

Cost trends for wind are also declining. A May, 2012, National Renewable Energy Laboratory study reports:

> *Looking forward, the LCOE of wind energy is expected to continue to fall, at least on a long-term global basis and within fixed wind resource classes. Performance improvements associated with continued turbine up-scaling and design advancements are anticipated, and lower capital costs may also be achievable. ...[M]ost recent estimates project that the LCOE of onshore wind could fall by 20%–30% over the next two decades.*[20]

This costs trend has manifested in a great increase in the purchase of wind projects by utilities. According to the Lawrence Berkeley National Laboratory report:

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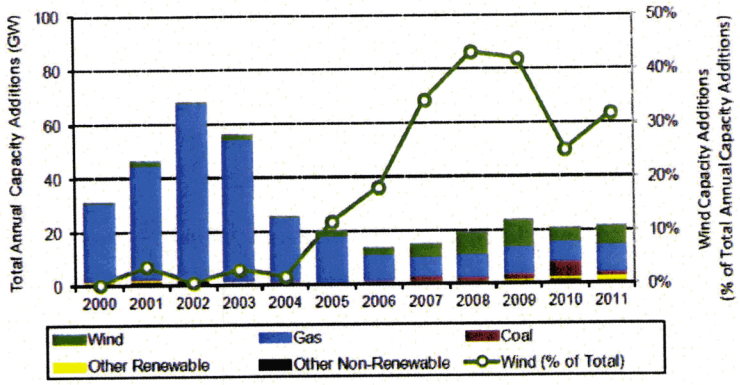
[18] Data from the Department of Energy, Energy Information Administration. EIA: October 19, 2011 http://www.eia.gov/totalenergy/data/annual/showtext.cfm?t=ptb1008

[19] *Solar power: Darkest Before Dawn*, McKinsey & Company, May 2012 http://www.mckinsey.com/client_service/sustainability/latest_thinking/solar_powers_next_shining.

[20] *The Past And Future Cost Of Wind Energy, Technical Report,* U.S. Department of Energy, National Renewable Energy Laboratory, NREL/TP-6A20-53510, May 2012, Eric Lantz, Ryan Wiser, Maureen Hand, page 28

"Wind power has represented one of the largest new sources of electric capacity additions in the United States in recent years. In 2011, wind power was again (for the sixth time in seven years) the second-largest new resource added to the U.S. electrical grid in terms of gross capacity additions, behind the 10,500 MW of new natural gas capacity."[21]

CHART 7. Relative Contribution of Generation Types in Annual Capacity Additions



Source: EIA, Ventyx, AWEA, IREC, SEIA/GTM, Berkeley Lab

Wind and solar costs are trending downward. This is to be expected; as solar and wind technologies mature, the manufacturing base increases, technology improves, and usage becomes more widespread, resulting in economies scale for manufacturing and installation. In contrast, natural gas and coal costs are expected to increase steadily above today's prices. Relying on technology with declining cost curves will prove more economic than relying on finite resources that have uncertain and increasing costs.

8. The Enhanced Renewable portfolio will use less water and produce less pollution.

8.1 Water

Water is the life blood of the state. As Arizona continues to grow increased demands are placed on our surface and groundwater supplies. Planning for and limiting the amount of water needed to support people, agriculture and power production can help ensure adequate supplies for the future. Consumption of water for power production can have an effect on statewide availability, but more importantly, on local availability. As illustrated in Chart 8,[22] the state's existing power plants already

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[21] *2011 Wind Technology Market Report,* U.S. Department of Energy, Lawrence Berkeley National Laboratory, August 2012, Ryan Wiser, Mark Bolinger, page 4
http://www1.eere.energy.gov/wind/pdfs/2011_wind_technologies_market_report.pdf

[22] *Freshwater Use by U.S. Power Plants -Electricity's Thirst for a Precious Resource,* Union of Concerned Scientists, November 2011, page 5
http://www.ucsusa.org/assets/documents/clean_energy/ew3/ew3-freshwater-use-by-us-power-plants.pdf

stress the state's water supplies. Development of renewable energy systems, with the exception of solar thermal plants, will not place additional stress on our water systems as these technologies are not thermal, and do not require any water for power production. Thus, the Enhanced Renewable Energy Portfolio is a more conservative use of the state's water resources than the Base Case.

CHART 8 Water-Supply Stress from Power Plants

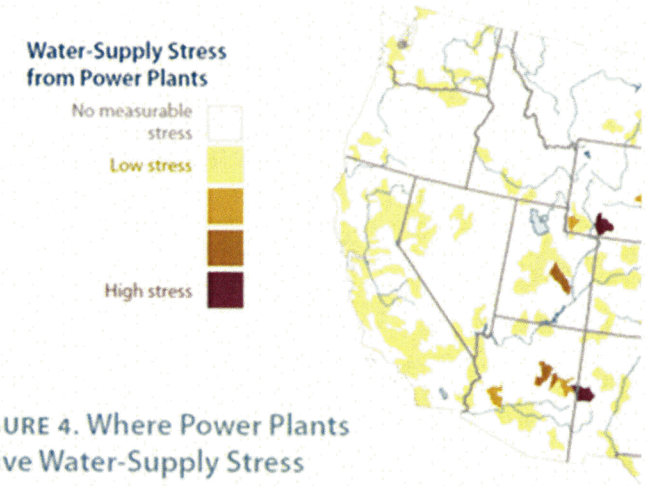

FIGURE 4. Where Power Plants Drive Water-Supply Stress

Calculating the Water Supply Stress Index both with and without power plant water use shows the contributions of plants in each basin, including where power plants were the primary driver of water-supply stress.

In its analysis, APS assumed that new combined cycle natural gas power plants would be dry cooled, which significantly decreases water use. However, water savings on the power plant production side may be dwarfed by water consumption for extraction of natural gas.

Water used for natural gas extraction through fracking uses large amount of water: several times the amount of water used in conventional well drilling. The American Petroleum Institute, in a guidance document to the industry, reports that shale wells use two to four million gallons of water each. Other estimates are upwards of 5 million gallons per well. In the arid west, water used for the development of shale deposits will compete with existing uses of agriculture and people.

8.2 Pollution

While Interwest believes that the Enhanced Renewable Portfolio should be pursued based on its economic merits, one cannot ignore the health benefits of developing a cleaner energy portfolio. Regulations on the amount and types of pollution that can be emitted from power plants has increased significantly over the past few decades as the study and knowledge of the health impacts of pollution on human health has become better understood.

One of the biggest unknowns and potential future costs in the electric power industry is the regulation of carbon dioxide and other greenhouse gases. While APS has made estimates of the potential costs of regulating carbon dioxide it is impossible to accurately calculate costs over the next 30 to 40 years.

As outlined in the IRP, APS is already required or will be required in the future to control emissions of the following pollutants that emanate from its power plants: Oxides of Nitrogen, Sulfur

Dioxide, particulate matter, Mercury, Coal Ash, Hazardous Air Pollutants, Carbon Monoxide and Lead[23]. APS spends millions of dollars to reduce the amount of these emissions. Chart 9 shows the amount of some pollutants that will be avoided by pursuing the Enhanced Renewable Energy Portfolio.

CHART 9[24]

Emissions Avoided from Enhanced Renewable Portfolio			
CO2	28,840,409 Metric Tons	S02	161 Metric Tons
CO	3,648 Tons	NOx	3,277 Tons
PM10	891 Tons	Mercury	134 Pounds

The simple fact is that wind and solar resources, which would be a larger portion of the company's energy mix under the Enhanced Renewables Portfolio, will not burden the company and customers with compliance costs for existing or future air emissions, waste disposal, and water treatment and disposal costs. It will also reduce exposure to future regulatory costs. Additionally and more importantly, the public will not be subject to additional pollution from power plants which effect human health.

9. Operational changes can greatly reduce cost of renewable energy integration.

As APS states in its plan, a "pressing need" is to integrate higher levels of renewables into the grid.[25] APS, along with utilities around the west, are working to understand impacts of greater variable resources on the grid and working to reduce costs of integration. Fortunately, recent studies have evaluated and identified methods to reduce future costs of integration.

9.1. APS-assigned "Firm-Up" costs

In the APS resource plan, on page 31, the utility offers a chart called *Future Technology Cost Comparison.* The chart is used to illustrate the levelized cost of different energy sources, to be able to compare the life-cycle cost of one resource to another. Categories of costs include generation, emissions, transmission and losses, and integration and "firm-up" costs. To calculate the cost of wind, APS added an appropriate integration cost, which had been calculated in a previous study performed by Northern Arizona University. On top of the integration cost, APS added an inaccurate "firm-up" cost. The firm up cost was derived by taking an APS-assigned capacity credit[26] of wind (20%) and adding the cost of natural gas generation (80%) to make the resource 100% firm. This assumes that the utility would need to have a one-for-one back-up for every MW of wind energy and that natural gas is the only way to provide that energy backup.

This approach is erroneous. First, if APS believes that all resources need to be 100% firm, then "firm-up" costs should be added to all resources, as no power source is 100% available. It would also follow that APS should have to build the back-up power for every generation source. We know this

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[23] Congress has identified over 188 Hazardous Air Pollutants which include substances that cause cancer, neurological, respiratory, and reproductive effects.

[24] APS 2012 Integrated Resource Plan, data from Table 18, page 90

[25] APS 2012 Integrated Resource Plan, page 27

[26] A capacity credit is how much of the time you can count on a resource, such as wind, to be available at peak.

is not the case. The electric system operates as a coordinated system – a balance of loads and resources. APS needs to have a sufficient amount of energy at its peak to meet demand. If wind is not available when it was planned, utilities have a variety of options (such as demand response) to meet a deficiency and don't require one-for-one megawatt of backup energy.

When utilities first purchased wind energy resources, they commonly believed that one-for-one back up was needed. However, this myth has been dispelled as utilities increase the amount of wind on their systems and learn how to operate the systems effectively with wind. Interwest acknowledges that adding variable-capacity resources to the system will require the utility to plan and operate its electric system somewhat differently than in the past. But, APS and other utilities have experienced similar shifts in the past when large nuclear facilities were added or natural gas became part of the fleet. Systems such as the Energy Imbalance Market, described below, can make available additional resources when needed and to ensure utilities can continue to reliably serve peak loads.

9.2. Reducing the cost of integration and "firm- up"

To more fully understand the challenges and opportunities of greater renewable penetration in the West, the Western Governors' Association commissioned a study by the Regulatory Assistance Project. The resulting report, *Meeting Renewable Energy Targets in the West at Least Cost: The Integration Challenge,* published on June 10, 2012, identified nine ways Western states could reduce integration costs. The recommendations include operational reforms, market tools, and use of flexible resources.

The report provides a summary of the nine identified methods and ranks them on costs, benefits, and amount of time needed to implement. Among the recommendations are: improved solar and wind forecasting to increase certainty of the availability of the resource; increasing the capability to dynamically transfer energy, thus reducing the cost of integrating a renewable resource to the utility where the resource is located; and developing a regional or west-wide Energy Imbalance Market. (see Appendix A for the matrix of recommendations from the report)

As APS increases its penetration of renewable resources, the work of the WGA and utilities across the region will help the utility better manage and maximize the use of variable energy resources. Greater use of renewables on the system can translate to reduced reliance on natural gas and reduced costs.

9.3. Energy Imbalance Market

The Energy Imbalance Market (EIM), if created, would be a voluntary market where utilities could purchase, or offer for sale, resources on a short-term basis (e.g., 5-minute basis). The system would use available, existing transmission capacity to deliver the resource to the purchasing utility. As the system is currently structured, utilities, like APS, can only elect to buy energy resources to meet imbalances in their system once per hour, at the top of the hour. An EIM would provide benefits to the utility in the form of increased reliability (as resources are available to purchase on a short-term basis), increased system flexibility which supports variable resources, greater opportunity for sharing of energy reserves, access to energy sources from around the entire western

interconnect, and more complete and efficient use of the transmission system. For consumers, it can mean significant cost savings.

To illustrate the point of how sharing of generation resources can be beneficial, one can look to seasonal exchanges. APS has had long-standing agreements with utilities in the Pacific Northwest to do seasonal exchanges. Energy needs peak in the Pacific Northwest in the winter and in summer in Arizona. Utilities have contracts to "exchange" power and thus are not required to build as much generation. These exchanges are mutually and financially beneficial. Unfortunately, these exchanges are ending. The EIM is similar in that it would allow utilities that need energy to purchase energy from utilities with excess generation. While the EIM is not a firm contract arrangement, it shows how sharing resources can lower costs for participating utilities by reducing the need to build generation that may only be needed a few hours of the year, during peak loads.

9.4. Western Public Utility Commission EIM Group

As the potential benefits of lower costs for consumers from a West-wide EIM have become more clearly understood, public utility commissioners from around the West have formed a group to further evaluate the effort. The Public Utility Commission EIM group has been evaluating the concept since April of 2011. They have conducted monthly webinars, commissioned analyses by national laboratories, requested proposals from entities that currently operate similar trading systems in other parts of the county, and studied how our neighbor to the east, the Southwestern Power Pool, operates its market. Based on the work done to date, the PUC EIM group decided in September 2012 in a meeting in Tempe that it would continue its efforts as an EIM has the potential to save each utility's customers millions of dollars per year while improving reliability and reducing the cost of integrating variable generation. Reports, webinars and information on the commissioner efforts can be found at http://www.westgov.org/wieb/

10. Arizona customers prefer increased amounts of renewables.

At the Commission and in a utility, there is often discussion about what energy sources or mix of sources customers would want and be willing to pay for, but little quantitative information exists beyond simple polls.

In 2010, the Commission directed APS to conduct a process to educate their customers about energy issues and then survey them to determine their preferences and priorities. The idea was to go beyond simple surveys and provide an educational component, so that customers understood the tradeoffs of different energy sources to inform their opinions. The output of the effort was to be used by the APS and the Commission to inform decision making.

The Morrison Institute for Public Policy at Arizona State University was chosen to conduct the research project called "Informed Perception".[27] The Morrison Institute focused on answering four questions:

"1.What are the energy preferences and priorities of residential utility customers among

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[27] https://morrisoninstitute.asu.edu/publications-reports/aps-informed-perception-project-report-final/view, page 2.

the resource choices?

2. What factors influence these preferences and priorities?

3. How does energy education affect attitudes and opinions about energy and energy planning?
4. Do changes in opinions and attitudes persist over time, or do they revert to their previous position?"

The Informed Perception involved surveying over 1,000 APS residential customers by phone, providing an educational briefing book to customers, hosting 184 customers for an entire day of in-person education on energy issues, and surveying the 184 customers four times to determine opinions before and after education. The findings are dramatic and unequivocal.

> "In the first survey (T1), administered before participants had been given any energy education in the form of the Energy Briefing Book or at the Energy Forum, 94% wanted an increase in the use of solar as a part of the energy portfolio and 82% wanted an increase in the use of wind power. By the end of the study (T4), the percent that advocated for increased use of solar and wind power were 94% and 78%, respectively.[28]"

Even with a slight decrease in the support for wind energy more than three in four people support increasing the amount of wind and over nine in ten support increasing the use of solar

The fourth survey of customers was conducted after a day of education that informed customers about the naturally variable nature of wind and solar and the potential additional cost. As the statement indicates, these educated customers see the value of renewable energy development and want APS to increase its development and reliance on renewable energy.

So, what do APS customers care about? The Morrison Institute asked customers to rank the importance of 10 energy issues. Chart 10 shows 10 issues and the response from each of the four surveys. The issue that customers rank as extremely important most often (across all four surveys) was "Getting electricity from sources that will never be used up." The second top issue was "minimizing air pollution."

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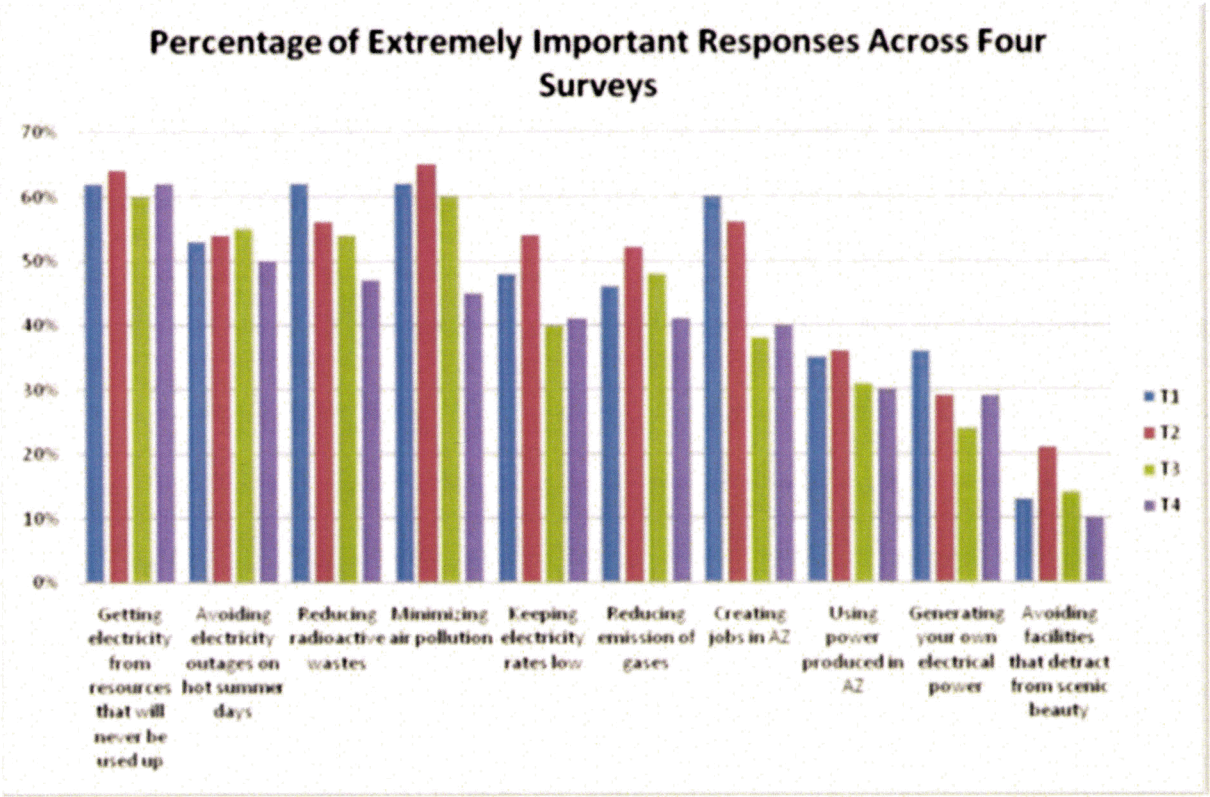
[28] https://morrisoninstitute.asu.edu/publications-reports/aps-informed-perception-project-report-final/view page 2.

CHART 10



The Informed Perception project is the most extensive evaluation of customer preferences ever conducted by a utility in Arizona. As the commission directed that APS conduct this process, and customers paid (at least indirectly) for this process, it is important that the Commission and APS use this information in decision making. Based on the overwhelmingly strong preference of customers for APS to increase the use of renewable energy it is safe to say that customers would support the Enhanced Renewable Energy portfolio over the Base Case.

Conclusion

The IRP process provides Commissioners, utilities, and stakeholders a unique opportunity to focus on the long-term energy future and balance of resources APS will use to serve customers in the future. APS has submitted a data-rich and comprehensive resource plan which the Commission should acknowledge. Interwest thanks APS for its extensive efforts.

Several facts are clear from a comparison of the Enhance Renewable Energy Portfolio to APS-preferred Base Case:

I. The Enhanced Renewables Porfolio has greater cost certainly and less risk than the Base Case. Based on APS's own analysis, the cost for the Base Case could be 9% higher than for the Enhanced Renewables Case.

II. In the last decade, the price of natural gas has been highly volatile. Price volatility and cost increases will be passed directly on to consumers. Depending more heavily on a volatile commodity creates economic risks for the state and APS customers.

III. Customers have indicated their strong preference for the development of renewable energy. They have felt the impacts of volatile natural gas prices and have indicated a willingness to pay an additional cost for renewable energy, if any.

IV. Development of the Enhanced Renewable Energy Portfolio will pay economic dividends to the state in the form of jobs and economic development.

V. The Enhanced Renewables Portfolio relies on technologies with declining costs and long-term price stability while the Base Case relies more on fossil fuel with uncertain fuel prices that, based on long term trends, are likely to increase over time.

Interwest believes it is in the best interest of customers for the Commission to direct APS to pursue development of resources as outlined in the Enhanced Renewable Energy Portfolio.

APPENDIX A

Excerpt from Western Governors' Association report *Meeting Renewable Energy Targets in the West at Least Cost: The Integration Challenge,* July 20, 2012, Lisa Schwartz, Regulatory Assistance Project

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Assessment of Integration Actions

The following table takes a West-wide view of costs and integration benefits of actions described in this report and estimates implementation timeframe. Appendix A describes underlying assumptions. The extent to which any of these actions is undertaken, and therefore its costs and benefits, depend in part on the level of adoption of other actions. However, each action is treated independently here; we are not ranking options against each other. Colors indicate confidence in our assessment of costs and integration benefits: blue – high confidence, yellow – medium confidence, orange – low confidence.

Option	Expected Cost of Implementation[29] (west-wide except where noted)	Expected Benefit for Integrating Variable Generation	Projected Timeframe in Implementing Option
Subhourly Dispatch and Intra-Hour Scheduling (non-standard, voluntary – not West-wide, 30-minute interval)	Low	Low	Short
Subhourly Dispatch and Intra-Hour Scheduling (standard, voluntary – not West-wide)[30]	Low to Medium	Low to Medium	Short
Subhourly Dispatch and Intra-Hour Scheduling (standard, required, West-wide)[31]	Low to High	Medium to High	Medium
Dynamic Transfers (improved tools and operating procedures)	Low	Low to Medium	Short to Medium
Dynamic Transfers (equipment upgrades, including new transmission lines)	Medium to High	Medium to High	Medium to Long
Energy Imbalance Market (subregion-only)	Medium to High	Medium[32]	Medium
Energy Imbalance Market (West-wide)	Medium to High	High[33]	Medium to Long
Improve Weather, Wind & Solar Forecasting	Medium	Medium to High	Short to Medium
Geographic Diversity (if using existing transmission)	Low to Medium	Low to Medium	Medium
Geographic Diversity (if new transmission needed)	High	Medium	Long
Reserves Management: Reserves Sharing	Low	Low to Medium	Short
Reserves Management: Dynamic Calculation	Low	Low to Medium	Short
Reserves Management: Using Contingency Reserves for Wind Events	Low to Medium	Low to Medium	Short to Medium
Reserves Management: Controlling Variable Generation (assuming requirements are prospective)	Low to Medium	Low to Medium	Medium to Long
Demand Response: Discretionary Demand	Low to Medium	Low to Medium	Short to Medium
Demand Response: Interruptible Demand	Low to Medium	Low to Medium	Short to Medium
Demand Response: Distributed Energy Storage Appliances	Low to Medium	Low to Medium	Short to Medium
Flexibility of Existing Plants—Minor Retrofits	Low to Medium	Low to Medium	Short to Medium
Flexibility of Existing Plants—Major Retrofits	Medium to High	Medium to High	Medium to Long
Flexibility for New Generating Plants	Low to High	Medium to High	Medium to Long

[29] Low - less than $10 million region-wide; medium - between $10 million and $100 million; high – more than $100 million.
[30] Ranges in costs and integration benefits reflect differences in scheduling intervals – 5 to 15 minutes vs. 30 minutes.
[31] *Id.*
[32] A forthcoming National Renewable Energy Laboratory report will provide more information on integration benefits of an EIM.
[33] *Id.*

Respectfully Submitted, this 22 day of October, 2012.

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