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BEFORE THE US HOUSE OF REPRESENTATIVES
SUBCOMMITTEE ON ENERGY AND ENVIRONMENT,
HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY, HEARING ON
"RESEARCH, EDUCATION AND TRAINING PROGRAMS TO FACILITATE
ADOPTION OF SOLAR ENERGY TECHNOLOGIES"
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Mr. Chairman, Members of the Committee, it is a pleasure to provide testimony to you regarding 1) the importance of thermal energy storage technology to the viability of concentrating solar power, and 2) how a study to integrate concentrating solar power plants with the electric grid can facilitate the commercialization and implementation of large-scale CSP.

Arizona Public Service Company (APS) is the largest and longest serving electric power utility in Arizona. Arizona is also the fastest growing state in the United States. APS is adding customers at three times the national average and our customers' electricity demand is growing at four times the national average. To meet this rapid growth in electricity demand Arizona's electric utilities are investing over $2 billion a year in infrastructure. Plans for the future include conventional generation, new transmission and distribution and an increased focus on conservation and cost effective renewable energy resources.

In Arizona our most abundant renewable resource is sunshine. And, for the past 15 years, my responsibility has been to work with the solar industry and researchers around the U.S. and the world to bring lower cost and reliable solar electricity to our customers.

APS' first work in the solar technology area was .in 1954 when APS helped organize the first International Solar Energy Exposition in Phoenix AZ that lead to the formation of the International Solar Energy Society. In the 1970's, APS applied early solar PV technology in remote off-grid telecommunications applications, and since the

early 1980's APS has been an active participant in the study and development of solar energy for large scale utility use.

In 1988, the APS Solar Technology Applied Research (STAR) center was developed to support the advancement of solar resources, including field operation of both photovoltaic (PV) and concentrating solar technologies. Our early work at STAR gave APS the expertise and experience to undertake several noteworthy projects including Arizona's first customer-sited PV systems tied to the grid, and Arizona's first utility scale grid-tied solar PV system. APS is proud to provide solar services to the National Park Service and several military bases in Arizona to assist with the use of PV in support of remote off-grid operations. And, we currently have over 5 MW of PV tracker power plants in operation providing reliable solar energy to our customers.

From a technology development perspective our primary focus has been on large scale solar technologies. As early as 1995, APS STAR center was a test site for the dish Stirling systems, and the advancement of Concentrating PV (CPV) systems. We have more then 10 years experience operating silicon CPV, and three years ago installed the nation's first grid-tied triple-junction high concentration PV system. Based upon inquiries from companies around the world it seems clear that our CPV work has helped stimulate new interest in CPV technology. And while there is significant CPV work now being undertaken in other countries, it is my belief that the United States remains in the technological lead of this very promising solar technology.

In another very promising technology area, APS has supported the advancement of concentrating solar power (CSP). These technologies are "thermal electric systems" that use solar heat to drive engines and generators. CSP thermal systems include solar trough concentrator systems and central receiver (power tower) systems that use many mirrors to focus light on a central solar collector . CSP also include solar dish Stirling systems and other advanced solar concepts.

The solar trough systems are worth particular note. For more then a decade solar trough systems in California have been the largest collection of solar power in the world, and they have operated well. CSP is also currently the most cost effective solar technology and has the greatest potential to compete economically with conventional generation in the near to mid-term.

Because of this potential, just last year, APS constructed the first solar trough plant in the US in over 14 years. Our intent was to help to re-establish and again advance the US solar trough technology. The plant is the 1 MW APS Saguaro Solar Trough plant, near Tucson Arizona.

While not part of the Saguaro design, an important attribute of the solar thermal CSP systems is the ability to incorporate thermal storage techniques into the design to improve the reliability of power output. This is an extremely important feature that many intermittent renewable resources such as PV and wind do not have. While all renewables have value for their ability to help reduce the use of fossil fuels, the ability to store the thermal energy for times when its needed provides a level of reliability that does not exist with intermittent resources. This is especially critical to utilities that have an obligation to provide reliable power at all times.

Common wisdom is that solar technologies produce power when it is needed the most, during the daytime. While this is largely true, there are exceptions that are not obvious such as fluctuations due to clouds and a mismatch to late-day power consumption. This latter exception is the norm for Arizona and most of the desert southwest. In the southwest, power consumption reaches its peak in the months of July, August and September, when the summer heat result in heavy air conditioning loads. The correlation between power consumption and high summer temperatures are a good match for CSP however the correlation is not as perfect as one might expect. In a 24 hour period, Arizonan's use the most energy in the early evening, between 5 and 7 pm, when they return home from work, turn down the air conditioning, cook dinner, do laundry and generally go about their lives. Unfortunately, solar electricity production, even from CSP, does not match this hourly demand profile very well. Solar electricity production reaches its peak levels sometime in the mid-afternoon and tails off significantly in the early evening as the sun lowers on the horizon. Thermal storage has the potential to bridge the gap between maximum generation and peak demand.

Without the availability of solar energy during the peak, utilities must look to other reliable resources like natural gas to meet customer demand. But, thermal storage has the real potential to change utility resource decisions because with storage CSP systems will be able to reliably serve customers when electricity costs are the highest.

There currently exists some support in the national labs for the development of the thermal storage concept, which we recognize and appreciate. However the resources are apparently limited in comparison to the substantial expense of a meaningful development and test plant. Certainly a dedicated research and development program on thermal storage could significantly accelerate the use of this promising technology.

The second topic of discussion relating to CSP is the integration of large CSP plants into the regional and national electric grid. This topic raises numerous issues including availability of land for large scale installation, land-use issues such as water use and permitting and the availability of transmission facilities and transmission capacity to deliver the energy to load centers. The cost, timing and risks associated with each of these factors must also be considered..

One additional aspect of large scale CSP that must be considered is the status of financial incentives. Currently, the 30% Investment Tax Credit (ITC) for solar has resulted in projected project costs that are significantly more competitive than any time in the past. But without a long term extension of the ITC, many large scale CSP projects will never be launch due to the time it takes to address the issues noted in the preceding paragraph. Large scale CSP plants require three to five years from commitment to start up Today, the ITC is set to expire at the end of 2008. The one to two year ITC extensions that have been typical in previous years, will not provide sufficient certainty to enable major CSP development. Long term extension of the ITC is critical to CSP development. .

One critical aspect of the ITC is the fact that it is not available to public utilities. The restriction needlessly narrows application of the credit and is unfair to U.S. citizens because the vast majority purchase power from a public utility, as it is defined by the tax code. Therefore, a utility wishing to plan a large CSP resource would need to assume no ITC, or secure a third-party owner of the plant. This current policy forcing a third-party relationship to take advantage of the ITC creates unnecessary uncertainty and costs to the system. It forces the utility and regional grid to consider the operational and financial risks inherent in any third party relationship thus affecting the utility operating strategies. These risks can certainly be analyzed and managed but create a potential suboptimum situation when they are the only strategy available.

While there are numerous issues to be addressed, APS is bullish about CSP and is leading a group of southwestern utilities exploring a 250 MW CSP plant in the desert southwest. We have found several constraints to a successful project including the financial factors associated with the end of the ITC in 2008, and the lack of transmission capacity. In fact, transmission is generally constrained in much of the west and significant new transmission investment is needed in the coming years for all types of generation be they renewable or conventional generation. New transmission is being planned throughout the west and in California and Texas specifically to access renewable resources including wind and geothermal. Others states and utilities, including APS, are studying their needs for both intra and interstate transmission to ensure a robust grid to meet the needs of the West's burdgeoning population. The studies include the ability to reach those areas of the west with abundant low cost renewable resources.

Answers to the questions about CSP, and indeed renewables in general, are not simple. Intermittent renewable resources such as wind and solar present special economic challenges for transmission investment because they do not efficiently utilize the transmission investment at all times. Wind integration studies have and are being performed. We believe CSP has a significant potential to provide large amounts of renewable energy to the U.S. and that a federal study on transmission for large scale CSP would be beneficial and appropriate.

Finally the issue of locating large scale CSP on federal land should be investigated and analyzed. By its nature, solar technologies require significant geographic footprints. A general rule of thumb for a solar installation is 5 to 10 acres per megawatt. That means for a single 250 megawatt facility, 1,250 to 2,500 contiguous acres of land would be required. Considering that the federal government is the largest land owner in the US, a study of federal land in high solar resource areas that may be made available for CSP development would also be beneficial and appropriate.

In summary, APS is proud of its contributions to the advancement of solar technologies including CSP, but more needs to be done. APS believes that large scale CSP has the best potential to provide cost effective solar energy to the U.S. and this potential improves dramatically with the addition of thermal storage. Understanding how these large CSP installations will impact the regional and national grid must be

understood. We support federal funding for a CSP integration study. We encourage additional federal attention and support for CSP and welcome the opportunity to continue to work with the US national labs and the solar industry on the further advancement of solar resources into our national energy portfolio.

Thank you Mr. Chairman and the Members of the Committee for the opportunity to share these observations and opinions with you.