GABRIELLE GIFFFORDS
8TH DISTRICT, ARIZONA

WASHINGTON OFFICE:
502 CANNON HOUSE OFFICE BUILDING
WASHINGTON, DC 20515
(202) 225-2542

DISTRICT OFFICES:
TUCSON OFFICE
1661 NORTH SWAN, SUITE 112
TUCSON, AZ 85712
(520) 881-3588

COCHISE COUNTY OFFICE
77 CALLE PORTAL, SUITE B-160
SIERRA VISTA, AZ 85635
(520) 459-3115

Congress of the United States
House of Representatives
Washington, DC 20515

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Testimony of Barbara D. Lockwood, P.E.,
Manager, Renewable Energy, Arizona Public Service Company

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Committee on Science and Technology, Subcommittee on Energy and Environment
"Utility Scale Solar Power: Opportunities and Obstacles"

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Mr. Chairman and Members of the Subcommittee, thank you for the opportunity to provide Arizona Public Service Company's (APS') perspective on utility-scale solar power. My comments will focus on the opportunity solar provides for clean, reliable electricity, and the challenges associated with realizing that potential.

APS is the largest and longest serving electric power utility in Arizona. Arizona is the second fastest growing state in the country, and APS has more than a million customers who, at their peak energy consumption, use more than 7,000 megawatts of electricity. By 2025, APS will have nearly two million customers demanding over 13,000 megawatts of electricity. To meet this rapid growth in electricity demand, APS is investing $1 billion a year in infrastructure. That number does not include additional generation sources. For APS alone, our peak demand is growing at hundreds of megawatts per year, or the equivalent of one medium-sized natural gas plant each and every year. Meeting the growing needs of our customers is both a challenge and an opportunity.

In Arizona, our most abundant renewable resource is sunshine. The solar resource in Arizona is virtually unlimited, with more than 300 days of sunshine each year. In addition, Arizona has sizeable quantities of wide-open, flat landscape that is ideal for the installation of large-scale solar equipment. Among the most important factors in considering a resource for electricity production is the reliability of the fuel. Arizona's solar climate provides a resource that is both dependable and predictable.

APS is committed to making Arizona the solar capital of the world and bringing affordable renewable energy to all its customers. A balanced renewable energy portfolio including solar, wind, geothermal and biomass/biogas resources is fundamental to our operating strategy. For the past two decades, APS has worked with the solar industry and researchers around the U.S. and the world to bring lower cost and reliable solar electricity to our customers. In 1988, the APS Solar Technology And Research (STAR) center was developed to support the advancement of solar resources, including field operation of both photovoltaic and concentrating solar technologies. In addition to STAR, APS currently has over five megawatts of photovoltaic power plants in operation providing reliable solar energy to our customers.

APS has also supported the advancement of concentrating solar power (CSP). These technologies are "thermal electric systems" that use solar heat to drive generators and engines. 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.

In fact, APS constructed the first commercial CSP plant in the United States in almost 20years. The Saguaro Solar Power Plant, which came on-line in 2006, is a one megawatt parabolic trough facility located just north of Tucson at Red Rock, Arizona. This plant has provided critical learning for APS, the CSP industry, and researchers. While small in size, it has facilitated new interest in CSP around the country and the world.

But that was just the beginning of our entrance into commercial CSP. Also in 2006, APS stepped forward to lead a coalition of southwestern utilities interested in CSP. The Joint Development Group is a consortium of seven entities exploring the possibility of a 250 megawatt CSP project to be located in Arizona or Nevada. Acting as project coordinator, APS issued a request for proposals in December of 2007. If all goes well, the consortium project could be selected this summer.

But our most significant step to date is the announcement on February 21, 2008, of the Solana Generating Station. Solana is a 280 megawatt solar power plant to be located 70 miles southwest of Phoenix near Gila Bend, Arizona. APS has signed a long-term contract with Abengoa Solar, project developer and owner, for 100% of the electricity generated by Solana. Solana is the Spanish word for "sunny place."

If operating today, Solana would be the largest solar power plant in the world. The plant will use nearly three square miles of parabolic trough mirrors and receiver pipes, coupled with two 140-megawatt steam generators. Operating at full capacity, the plant will produce enough electricity to power 70,000 Arizona homes.

Solana also provides significant economic benefits to the state of Arizona. The Solana Generating Station will provide 1,500 construction jobs between 2008 and 2011 and 85 permanent operations jobs. Solana will also generate between $300 million and $400 million in tax revenue over the 30 year life of the plant. All total, Solana will result in over $1 billion in economic development for the Arizona economy.

Finally, Solana is an emission-free source of electricity, avoiding nearly 500,000 tons of carbon dioxide, 1,065 tons of nitrogen oxides, and 520 tons of sulfur dioxide each year. It is the equivalent of removing 80,000 cars from the road each year. Solana will also use 75% less water than the current agricultural usage of the land.

APS selected Abengoa Solar as its partner for Solana because of its track record as a solar developer, its critical operational experience and a reputation for meeting contractual obligations.

One of the most important aspects of Solana is its ability to capture and store solar energy for later use. By incorporating large insulated tanks filled with molten salt, heat captured during the day can be stored and used to produce electricity when the sun is no longer shining. The molten salt and heavily insulated tanks are able to retain heat with very high efficiency, and the stored heat can then be extracted in the evening or even the following day to create electricity.

The stored heat not only increases the total amount of electricity generated, it also adds specific operating benefits for APS. The ability to use stored heat on demand, also referred to as "dispatching," allows APS to respond to customer usage patterns and emergency energy needs more effectively. Most southwest utilities experience their highest customer demand during the summer months. While the power need is substantial in the middle of the day, peak energy demand occurs in the late afternoon and into the early evening hours. Because it can provide energy even after the sun has set, the solar trough with thermal energy storage provides the maximum value for APS and its customers.

Diversification of generation resources is critical to maintaining a reliable electric system and concentrating solar power provides a significant opportunity to diversify energy resources. In addition, the costs to construct and maintain concentrating solar power plants have declined while at the same time equipment and labor costs, rising fuel prices and emissions concerns are increasing the risks of conventional resources.

APS also recognizes that renewable energy strategies will become even more important under the prospects of carbon legislation. With zero carbon emissions, energy from solar power provides one method of addressing concerns around global warming while continuing to provide reliable electricity to our customers.

And Solana is not the end of our interest in CSP. APS is currently engaged in a formal dialogue with our regulators, stakeholders and customers about our future energy sources. We are exploring the availability, cost, regulatory and policy implications associated with many different types of resources including nuclear, natural gas, coal, energy efficiency and renewable energy. One of several scenarios under discussion is one where CSP plays a central role, adding 1,350 megawatts by 2020. Each of these efforts will help us to meet, and possibly exceed, the progressive Renewable Energy Standard established by the Arizona Corporation Commission.

CSP, in particular the solar trough, is proven, reliable technology. There are no technical barriers to deployment of this technology today, and APS is aggressively exploring the near-term potential.

In considering the long-term potential for utility scale solar, one topic of consideration is how to integrate large solar plants into the regional and national electric grid. This topic raises numerous issues including availability of land for large scale installation and the availability of transmission facilities and transmission capacity to deliver the energy to load centers. The lack of transmission capacity and how that is managed will be a significant factor in the long term success of utility-scale solar. 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, New Mexico, Nevada, 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 burgeoning population. The studies include the ability to reach those areas of the west with abundant cost-effective renewable resources.

Also, the possibility of locating large scale solar 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. As I previously stated, the Solana Generating Station requires three square miles of contiguous land. 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.

However, the biggest obstacle to the success of utility-scale solar, including Solana, is the potential expiration of the federal Investment Tax Credit (ITC). Solana, and projects like Solana, became possible when the federal ITC for solar systems was increased from 10% to 30% in 2006. While large-scale solar is still more expensive than conventional resources, the 30% investment tax credit decreased the cost sufficient to make these projects a reasonable option. Without these tax credits, large scale solar projects, including Solana, are simply not affordable today. As you know, the 30% ITC is scheduled to expire at the end of 2008. The approval, permitting and construction of the Solana Generating Station will take three to four years to complete. The Solana project also requires well over a billion in capital investment. APS, Abengoa Solar, and the financial institutions providing funding for Solana require certainty that Solana will be eligible for the ITC once operational. *If a long-term extension of the ITC is not granted, Solana will not be completed.*

A different federal tax credit, the production tax credit (PTC), has spurred significant development for other renewable energy resources, most notably wind energy. The PTC has been extended five times since its introduction in 1992 and each extension was for one to two years. Although the wind industry has worked toward longer term extensions, wind energy projects, and smaller scale solar projects, have much shorter time frames for construction, which makes short term extensions of the PTC acceptable, if not preferable. Although the solar ITC is typically packaged with the PTC in discussions of extensions, large-scale solar has very different needs related to tax credits. *A one or two year extension of the solar ITC is simply not sufficient to make large scale solar projects like Solana a reality.* In fact, a one or two year extension of the Solar ITC may effectively cancel the project. Large scale solar has little hope of realizing its

potential without a long-term extension of the ITC. APS believes an eight year extension is optimal. Eight years should be sufficient to get a number of large scale solar facilities completed. It is also long enough to establish the supporting industries like mirror and receiver manufacturing in the United States. Once the industry gains a foothold, prices will decline and incentives will no longer be necessary.

Another 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. This current policy forces a third-party owner to take advantage of the ITC and it creates unnecessary uncertainty and costs to the system. It requires the utility and regional grid to consider the operational and financial risks inherent in any third party relationship thus potentially affecting the utility operating strategies. APS is managing these risks with Solana, but it creates a suboptimum situation when it is the only strategy available.

I was also requested to address a recently published article. "A Solar Grand Plan," published in the Scientific American Magazine in December 2007, describes a world where solar energy provides 69 percent of the US's electricity by 2050. It includes huge tracts of land covered in solar and a new direct-current transmission system across the US. It also includes 16-hour thermal storage for CSP and compressed-air energy storage for photovoltaics, which allow the production of energy from solar resources around the clock.

"A Solar Grand Plan" is certainly grand. It's a big, bold vision for a new energy era. Without analyzing the details of the plan, there appear to be no glaring technical issues with the proposed strategies. CSP and photovoltaics are proven technologies. As described, thermal storage and compressed-air energy storage are likely viable concepts. Finally, direct current transmission is already in operation today.

No, the challenges with this plan are not technical. But there are enormous planning, regulatory, and policy challenges with achieving this vision. Most importantly, energy policy decisions are made largely at the individual utility and state level. Each utility and state has different perspectives, and different regulatory authorities, that control the vast majority of decisions around generation sources and transmission. And although I haven't analyzed the cost presented

in the article, the execution of such a plan would clearly depend on gaining great cost efficiencies.

Clearly, the potential for utility scale solar electricity is enormous. If, and only if, the ITC is given a long term extension, I predict we will see several thousand megawatts of utility scale solar developed in the next 5 to 10 years. At least seven major projects have been announced since 2006. If the ITC is not extended for a sufficiently long period of time, the industry will lose its precious momentum and no large scale solar plants are likely to be constructed. The future of large scale solar depends heavily extending the ITC and getting those first few plants in operation.

These initial plants are planned to supplement existing fossil fuel resources and help to satisfy our growing energy needs. In the long term, utility scale solar could be a viable option in replacing base load fossil fuel facilities as those assets are retired. But costs need to decline significantly to make that a viable option. Only then will solar be a viable option for replacing base load assets that are being retired. Assuming success in the near term, the prospect for the next 20 to 50 years is virtually unlimited.

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