Solar Integration Plan

March 2009

TUCSON SOLAR AMERICA CITY

U.S. DEPARTMENT OF ENERGY

COMMITTED TO A SUSTAINABLE SOLAR FUTURE

Solar Integration Plan

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Thornydale Phase III solar dedication September 12, 2007.

Speakers pictured left to right included: **Mark Schwirtz** (Trico Electric CEO), **Thomas P. Kimbus** (USDOE Solar America Cities Director), **Robert Walkup** (Tucson Mayor) and **Gabrielle Giffords** (U. S. Representative).

EXECUTIVE SUMMARY

Tucson is sunshine. What has primarily been a draw for health seekers and tourists is now also being recognized as a national asset in providing electricity. This clean renewable resource is useful to the City of Tucson and the entire country as a way to meet our electricity demands while reducing greenhouse gases and dependency on foreign oil.

The City of Tucson's **Solar Integration Plan**, March 2009, and its companion, the **Greater Tucson Solar Development Plan:** *Strategies for Sustainable Solar Power Development in the Tucson Region,* January 2009*,* were developed through the Tucson Solar Initiative, a Solar America Cities Program sponsored by the U. S. Department of Energy (USDOE). Both plans lay the groundwork for accelerated development of solar energy facilities in and around Tucson. The Greater Tucson Solar Development Plan calls for 16 megawatts (MW) solar electric generation capacity to be installed in the region by 2015. This Solar Integration Plan calls for 8 MW solar electric generation capacity to be installed in the City of Tucson by 2015. Copies of both plans are available online at http://www.tucsonaz.gov/energy/links.html **.**

The Introduction of this Solar Integration Plan briefly summarizes the City of Tucson's history of solar policy initiatives. Although much solar-related work is already underway, the City still needs to reduce the barriers and increase the amount of power generated by solar installations on city facilities. The remaining work must integrate with our City's **Framework for Advancing Sustainability** to reduce greenhouse gases and slow global warming.

The bulk of this Solar Integration Plan is organized into the following Guidelines for Action to make Tucson a leader in harnessing solar energy:

1. Organizing Our Efforts
2. Leading by Example on City Property
3. Improving Policies
4. Accelerating Demand
5. Engaging Utilities
6. Supporting Economic Development

Each guidelines section also outlines the action steps needed to move Tucson towards more solar.

Finally, this plan includes an Appendix of related solar rules, regulations and policies which are critical components for a sustainable solar infrastructure and that are summarized for the Arizona market.

INTRODUCTION

The first installation of solar systems on City of Tucson facilities took place in 1999. However, the policies underlying the City's commitment to solar began even earlier and continue in a new light as the city addresses issues of global warming and greenhouse gasses. This section discusses the foundations on which our City's solar policies are built.

Establishing Tucson's Solar Policies (1980)

The Tucson-Pima County Metropolitan Energy Commission (MEC) has been the primary solar advisory committee for the City of Tucson since being established in 1980. The Commission is composed of members interested in energy policy and appointed by the Mayor and City Council and the Pima County Board of Supervisors. In the 1990's, the MEC was instrumental in establishing the Tucson Solar Village that evolved into the Civano Development. See, http://www.civanoneighbors.com/civano/bookshelf/. Every Civano residence and business must have some demonstrated solar capacity. The City of Tucson Facilities Management Administrator currently serves on the MEC. More details are available on the MEC website at http://www.tucsonmec.org/.

Sustainable Energy Standard (1998)

The City of Tucson adopted a Sustainable Energy Standard (SES) in 1998. Initially, the SES applied only to the community of Civano, but it was later expanded to all City-funded buildings. The SES is now tied to the 2006 International Energy Conservation Code (IECC) that was adopted by the City of Tucson on June 12, 2007. See Tucson City Mayor and Council Ordinance #10417 at http://www.ci.tucson.az.us/clerks/minutes_2007.php.

City General Plan (2001)

The General Plan of the City of Tucson was issued in 2001 and is currently being revised for voter approval in 2011. Support for the use of solar technology in city buildings and public housing, when economically and technologically feasible, is included in Elements 11and 14 and Policy 38 of the Plan. See, http://www.tucsonaz.gov/planning/plans/genplan/gpintro.pdf

LEED Silver and 5% Solar Energy Requirement (2006)

As of the passage of Mayor and Council Resolution #20322, on April 18, 2006, all City buildings must meet U. S. Green Building Council's Leadership in Energy and Environmental Design (LEED) Silver Certification. Solar energy is a favored strategy for attaining LEED Silver goals, and the Resolution mandates a 5% solar energy requirement. All new city financed buildings, including new hotels, a proposed new convention center, fire stations, etc., must meet 5% of their energy needs using some form of solar – photovoltaics (PV), hot water, or day-lighting. Additionally, up to 4% of the requirement can be met through cogeneration. City staff will monitor construction plans to assure this requirement is met. See http://www.ci.tucson.az.us/clerks/minutes_2006.php

Tucson Framework for Advancing Sustainability (2008)

In 2008, City of Tucson Mayor and Council adopted the Tucson Framework for Advancing Sustainability. See http://www.tucsonaz.gov/ocsd/docs/CMS1_032816.pdf. The Framework

provides guidelines under which all city programs, including our solar program, will work to implement the Kyoto protocols and the US Mayors' Climate protection Agreement. One of the twelve initiatives of the Framework is a commitment to increase the use of renewable energy as ordered by Council Resolution #20443, Measure C.4. See, http://www.ci.tucson.az.us/agdocs/20060906/20060906con.pdf Attainment measures include: a) Reviewing the yearly total renewable energy generated by City facilities; b) Determining the percent of City energy usage resulting from renewable sources; and c) Calculating the 1990 to the present reduction in City operations' greenhouse gas emissions. All solar projects on city facilities will help to meet this goal.

Solar Ready Ordinance (2008)

The City of Tucson has recently adopted a solar ready ordinance that requires all new houses and duplexes to be built with stub-outs so that PV and solar hot water heating can be installed at a later date without significant building modifications. See Tucson City Mayor and Council Ordinance #10549 (June 17, 2008) at www.tucsonaz.gov/energy/solar%20ready%20flyer030409.doc, http://www.tucsonaz.gov/dsd/What_s_New/PV_Prep.pdf, and http://www.tucsonaz.gov/dsd/GET_READY_FOR_SOLAR.pdf

El Pueblo solar dedication event (May 29, 2009).

GUIDELINES FOR ACTION

This section outlines the guidelines and action steps needed to move Tucson toward more solar.

1. Organizing Our Efforts

1.1. Inventory Existing Installations

According to TEP statistics, there were approximately 600 solar systems in place in Tucson in 2008. The City of Tucson had eight PV installations with a total capacity of 220 kW as well as five solar hot water/pool heating sites. Case studies and maps for the City's solar installations are available at http://www.tucsonaz.gov/energy/solarintucson.htm. Solar America Cities street signs have also been placed around Tucson where large solar installations are visible.

1.2. Establish Objectives

Tucson's Mayor and Council have supported additional solar projects. Now in the works are 1 megawatt (MW) of PV being installed at seven Clean Renewable Energy Bonds (CREBs) sites as well as 1 MW to be installed at the Central Avra Valley Storage and Recovery Project (CAVSARP) site under a power purchase agreement (PPA). By the end of 2009, the total city PV capacity should reach 2.2 MW. Plans are to double this to 5 MW by 2015. Residential and commercial installations should also reach an additional 3 MW by 2015.

1.3. Survey for Barriers

Informal nonscientific surveys previously taken from attendees at various public events have shown three major reasons for not yet having installed solar: a) high price, b) lack of sufficient information or 3) waiting for additional technological breakthroughs.

1.4. Build Local Infrastructure

1.4.1. Maintain funding for the City of Tucson Solar Energy Coordinator position to assure that solar policies are addressed within the City.

1.4.2. Fund a Regional Solar Coordinator position in partnership with Pima County to assure a wide distribution of solar information to the public.

1.5. Coordinate with Regional Initiatives

1.5.1. Pima Association of Governments (PAG) houses the Southern Arizona Regional Solar Partnership, a group of businesses and governmental agencies working to implement pro-solar policies. See http://www.pagnet.org/Programs/EnvironmentalPlanning/SolarPartnership/tabid/684/Default.aspx/

1.5.2. Rep. Gabrielle Giffords' Office has been a leader in sponsoring federal legislation to promote solar and in sponsoring public information sessions around Tucson

and in Phoenix called Solar 101 meetings. See http://giffords.house.gov/legis/solar-energy.shtml/

1.5.3. Arizona Research Institute for Solar Energy (AzRISE) at the University of Arizona has coordinated research on solar, sponsored conferences, and produced publications to advance solar in Arizona. See, http://www.azrise.org/

1.5.4. Tucson-Pima County Metropolitan Energy Commission (MEC) continues in its active role advising Mayor and Council and the County Board of Supervisors on energy and solar issues. See, http://www.tucsonmec.org/

2. Leading by Example on City Property

2.1. Plan Installations

2.1.1. Move ahead with plans for additional solar installations on City land and facilities. Identify, map and prioritize future city solar sites for PV and solar hot water based on electric load, hot water demand, roof structure, and location. Likely sites will include ward offices, community centers, fire stations, and recreation centers.

2.1.2. Install solar pool heating at all City Parks and Recreation Department pool sites.

2.1.3 Retrofit existing City buildings with solar hot water and/or PV whenever economically feasible

2.1.4 Develop solar street and parking lot lighting, as well as parking shade structures. Including electric vehicle charging stations, if and when possible, and make them available to city departments.

2.1.5 Develop list of the required permits for solar installations, contact information, cost and timelines and include it on the web site. Additionally, distribute all such information to solar developers.

2.1.3. Intervene early in new building design discussions with all departments to assure solar is fully considered from the beginning planning stages of all new City building projects.

2.2. Pursue Funding Opportunities

2.2.1. When funds are available, the first source of funds will be the solar portion of the City's Energy Office budget.

2.2.2. Apply for New Clean Renewable Energy Bonds (CREBs).
Given the current, difficult economic position of the City of Tucson that is projected to endure for several fiscal years ahead, obtaining funds from outside the City budget has become extremely important. Thus, building on our experience with a $7.6 million CREBs allocation to finance 2009 projects, New CREBs will be an important financial strategy for FY 2010 and beyond. The

Internal Revenue Service (IRS) allocated the original CREBs based on the smallest to largest criteria, so that the most expensive project funded was $3.2 million. That size criteria will continue with New CREBs allocations, so we must apply for City sites that fall into the range most likely to be funded. We should consider CREBs for buildings, parking shade structures and vacant land in choosing these projects.

2.2.3. Investigate other no interest bonds.
We will fully investigate the new Qualified Energy Conservation Bonds (QECBs) and related bond offerings to determine if they are appropriate solar financing tools for Tucson.

2.2.4. Apply for utility rebates.
We will give high priority to applying for Trico and TEP Renewable Energy Standard and Tariff (REST) funds - retroactively for day lighting and solar hot water projects already in place, and beforehand for future solar projects. The Production Based Incentive (PBI) approach that TEP uses for commercial projects mandates that bids must be placed with TEP for electricity to be produced in the future, with the amount paid being based on actual production. Additionally, the "self-directed" portion of the City's REST funding can be accessed in amounts matched by City funds to pay for renewable energy projects. This use of REST funds enables a portion of the City's REST assessment (approximately $300,000 per year), to be invested rather than expended. TEP has already been notified of the City's intention to utilize self-directed REST funds in 2009 and 2010. Trico has a similar but smaller REST program.

2.2.5. Utilize Power Purchase Agreements (PPAs).
Tucson Water issued a Request for Proposals (RFP) in June 2008 that resulted in a PPA contract to build a 1 MW project in later 2009. PPAs are, and will continue to be, the most likely vehicle to finance solar energy projects without utilizing City funds in the near future. Under such a PPA arrangement, which is designed to utilize tax credits unavailable to the City, a third party builds, owns, and maintains solar systems on City property. The City, in return, "rent" the space to the third party, and agrees to the long-term purchase, at a set price and for an extended period (usually 20 years), of all electricity generated by the installation(s). A legal issue concerning whether PPA providers, as sellers of electricity, are utilities which must be regulated, and if so, how is now before the Arizona Corporation Commission (ACC) and may be resolved in late 2009.

2.2.6. The City of Tucson will develop a PPA template to use in future Request for Proposals (RFPs), building on work done by Pima County in recent months. We will vet this document through the City Attorney's office as well as soliciting advice from outside counsel for the City familiar with these instruments. We will also review the PPAs being used by the University of Arizona and Davis-Monthan Air Force Base in developing ours, which could then be shared with other Arizona cities and counties.

2.2.7. Apply for appropriate stimulus funds. The City will investigate and pursue all possibilities to use federal stimulus funds for solar projects, including both Energy Efficiency Community Block Grant (EECBG) and State Energy Projects (SEP) funding.

2.2.8. The City will continue to seek federal earmark funding for specific projects, recognizing that they often require a match of non-federal funds, which could come from utility rebates, bond funds or PPAs.

2.2.9. Seek funding from Homeland Security for solar emergency backup capacity where possible; maintain portable solar generators (trailer with panels and batteries) for quick deployment in emergency situations.

2.2.10. Utilize Energy Performance Contracts (EPCs). Another possible financing method involves combining energy savings contracts with solar projects with an energy service company (ESCO). In this case, money can be saved by installing various lighting; heating, ventilating and air conditioning (HVAC); insulation; and other energy-saving devices in City buildings and using the money saved to install solar on these buildings. This can have a double payback since the electric load can be reduced and part of this reduced load can be met by solar.

2.2.11. Specific city agencies or buildings should be supported when they consider installing solar on their facilities, such as the airport and the City Transportation department using solar crosswalk flashers and considering solar street and parking lot lights. We will work with these other departments to assure they have sufficient information to fully consider the solar option. City council offices may choose to demonstrate their commitment to "Being Green" by using money from their budgets to install PV and/or solar water heating on their buildings.

2.2.12. All new city buildings must meet the LEED Silver standard and have 5% solar as part of their design. This means that all new city buildings should have solar as part of their construction budget. We will review construction plans to assure this is included in plans and budgets for these new buildings.

2.2.13. There are a few other options available for consideration that the City has not pursued to fund solar projects. One is the issuance of general obligation bonds specifically designated for solar projects. Another is the use of a specialized tax vehicle called the New Markets Tax Credits program, whereby an investor can put money into a Certified Community Development Entity and earmark the funds for solar. This needs further investigation. Another possibility with some

possible legal complications includes partnering with taxable investment entities to build and operate solar facilities. However, the City Attorney has advised that such partnerships might violate the gift clause of the Arizona constitution and an IRS ruling effectively prohibits such entities. Further research is needed on this option. See complete solar financing options for Tucson memo by DOE Tiger Team at http://www.tucsonaz.gov/energy/Tucson%20Finance%20June%2028.pdf or using a national perspective, the DOE paper found at http://www.nrel.gov/docs/fy08osti/43115.pdf/

2.3. Improve Solar Procurement Practices

2.3.1. Simplify the solar procurement process in cooperation with the City's Procurement Department staff in order to minimize confusion and delays, avoid contractual pitfalls, and minimize or eliminate later add-on costs.

2.3.2. Use the USDOE Tiger Team study, when it is completed, as a basis for improving the City's solar procurement process.

2.4. Commission and Monitor All Systems

All solar energy systems installed on city facilities must be properly and fully commissioned to assure proper initial performance. This will require some work with commissioning agents who are not normally familiar with PV or solar hot water. To the greatest extent possible, all of the city's solar systems should be placed on Fat Spaniel or some other monitoring system to allow for alarms when production fails or drops. All hot water systems need temperature and flow meters (BTU meters) and a monitoring connection. All systems should be inspected every 6 months and re-commissioned after 5 years.

2.4.1. Develop monitoring system for all solar hot water and PV systems and connect with the City's Energy Management and Control System (EMCS) when available.

2.4.2. Create and maintain an internet-based map showing all City solar installations and providing information about the systems.

2.4.3. Train City staff to install, commission, monitor and maintain City solar equipment to decrease dependence on outside vendors.

2.5. Develop Standards

The City of Tucson will develop specific standards for solar equipment to include in all Requests for Proposals (RFPs) on City solar projects.

2.5.1. Develop a mechanism to verify that the 5% solar requirement is met for new buildings.

2.5.2. Develop the PV standard.

2.5.3. Develop the solar water heating standard.

2.5.4. Develop the day-lighting standard.

2.5.5. Develop the commissioning standard for both PV and solar hot water.

2.5.6. Develop the monitoring standard for solar projects.

3. Improving Existing Policies

3.1. Streamline the Permitting Process

Tucson adopted a template for residential PV installations that have a reduced wait time for plan reviews to 1-2 days in most cases. Residential solar projects are no longer subject to zoning or equipment height requirements. Commercial installations generally are reviewed in less than 10 working days. The Template assists the City's Planning and Development Services Department to expedite solar permitting. See more details at www.tucsonaz.gov/dsd/Permit_Review_/Residential/ResidentialPhotovoltaicElectrical.pdf/

3.2. Conduct Code Official Training

As funds permit, the City will continue to offer training for code officials and installers concerning both PV and solar hot water systems.

3.3. Advocate New Initiatives

3.3.1. Require at lease 80 percent of lots in all new residential development site plans to be solar oriented, i.e., the long side of the building is within 30 degrees of an east-west line

3.3.2. Review plans and require, to the greatest extent possible, that all south facing roofs (and the southern portion of flat roofs) be kept clear of vent pipes, HVAC equipment, and other possible shading devices so the roof is available for the maximum solar installation.

3.3.3. Require all non-residential buildings to be solar ready as a transition to requiring all non-residential buildings to be equipped with solar hot water and photovoltaic (PV) systems.

3.3.4. Establish a future date by which all new commercial buildings, strip malls, houses and other residential buildings will be required to have solar PV and solar water heating unless granted a waiver.

3.3.5. Do not issue building permits for plans that do not incorporate solar use unless a waiver has been granted.

3.3.6. Give priority and/or subsidized rentals to Section 8 landlords with solar water heating or PV on their properties.

4. Accelerating Demand

4.1. Develop Financial Incentives

4.1.1. The City of Tucson currently offers a discount of up to $1,000 on all building permits for solar installations or for buildings that include solar hot water or PV.

4.1.2. The City has considered "Berkeley First" type financing (incorporating solar investments into individual property tax payments) but must wait for a state law change before such a program would be possible.

4.1.3. Align funding to reach the goals set forth in the 2008 Framework for Sustainability and other national and international agreements ratified by the City.

4.1.4. Continue research on low cost solar applications producing positive cash flow

4.2. Educate Consumers

4.2.1. Publicize the exemption of solar equipment from rooftop screening requirements in commercial or residential designs.

4.2.2. Promote utilization of electric vehicles coupled with solar charging stations

4.2.3. Create opportunities for City employees to take classes and become proficient in solar technology.

4.2.4. Publicize existing solar training opportunities on the City's Energy Office Website.

4.2.5. Make City solar facilities available for tours by educational groups of both adults and children to provide examples of best practices in solar installations.

4.3. Develop Solar Access Laws

While Arizona allows cities to pass an ordinance that regulates solar access, ARS 9-462.01 (A)(3), the City of Tucson has not done so. Passage would assist the implementation of the solar ready ordinance. State laws already exist to prevent Home Owners Associations (HOAs) from disallowing the installation of solar devices. ARS 33-1816.

4.3.1. Maximize and protect solar access to all lots by requiring variations in lot size and orientation to maximize solar access for development as a whole, and integrate solar access into Flexible Lot Development Update.

4.3.2. Evaluate solar setbacks for all buildings over one story when reviewing plans for building or remodeling; reject or modify plans that significantly impair solar access of neighbors.

4.3.3. Consider solar access when approving landscaping plans and establish a tree dispute resolution process to resolve solar access issues, e.g., when one neighbor's trees shade another neighbor's solar panels.

4.3.4. Review all zoning plans/site plans/development plans for solar access and availability.

5. Engaging Utilities

5.1. Organize a Customer Aggregation Program

The City of Tucson is involved in discussions with TEP and Pima County to establish a meter aggregation program for the City that would be a precedent for non-city customers of TEP. The City has thousands of electric meters and pays one bill. The plan would encourage TEP to aggregate our meters for purposes of solar net metering. Net metering is presently only available at each meter; thus, solar installation is restricted on buildings with small loads, even when those buildings have a large roofs or suitable adjacent ground. TEP has so far not been willing to make this change, but discussions are ongoing. The City has also engaged in discussions with One Block off the Grid, a commercial aggregator. If the City is successful in executing this change, the same policy would be available for businesses at shopping malls, neighborhoods, etc.

5.2. Support Aggregated Net Metering

We will work with TEP, Pima County and others to move toward virtual net metering, also called aggregated net metering, which would allow us to get full retail value for all electricity produced by city solar facilities, regardless of the location of the solar equipment and the load at a particular site. While not a direct financing tool, this would allow much more flexibility of location for solar within the city and make some additional projects more feasible, especially large ground mounted projects at locations with little or no electric load.

5.3. Optimize Rate Structures

The City will continue to monitor Trico and TEP's tariffs and filings with the Arizona Corporation Commission (ACC) to assure they support solar projects.

6. Supporting Economic Development

6.1. Recruit Business and Industry

Tucson Regional Economic Opportunity (TREO) is the economic development office for both the City of Tucson and Pima County. TREO has established solar industry development as a high priority. The City will work with TREO and Pima County to attract solar industry to Tucson as a means of expanding the solar circle and procuring cheaper solar equipment for installation on city buildings.

6.2. Encourage High Quality Training

A well-trained solar work force is essential for reaching the goals for growth in use of solar energy. Recent classes at Pima Community College and annual classes in Tucson put on by Solar Energy International (SEI) have provided a beginning work force that the City of Tucson can enhance in the following ways:

6.2.1. Assure a solar training/placement component to any City Green Jobs program.

6.2.2. Encourage solar contractors hired for City projects to donate their procurement-required apprenticeship funds directly to solar training programs at local institutions and offer internships where possible.

6.2.3. Encourage training programs to work with JobPath, Joint Technical Education District (JTED) and other local job placement agencies, particularly in low-income neighborhoods.

6.2.4. Use federal job training funds for solar training programs.

6.2.5. Encourage Pima Community College to institutionalize its solar PV and solar hot water classes as part of its regular curriculum that is offered at several campuses, on varying days, and at different times.

6.2.6. During the time that the City of Tucson has access to USDOE Tiger Team (technical assistance) resources, the City will sponsor additional trainings for solar technicians.

Public Safety Training Academy (PSTA) 472.5 kW single axis tracking system.

APPENDIX: Rules, Regulations & Policies

These rules, regulations and policies represent areas that the U.S. Department of Energy (DOE) has determined to be important components in the initiative to create a sustainable solar infrastructure. These rules and regulations are described in a way that supports the Arizona market. This information is current as of March 2009.

A. Net Metering

Net metering provides full retail price or an equivalent amount of kilowatt hours for all solar-generated power. The goal is to have all solar-generated power (not a limited amount) fully compensated at full retail rates, including excess production beyond the needs of the house or building where the power is generated. The rules are set by the Arizona Corporation Commission (ACC). The federal Energy Policy Act of 2005 (EPAct 2005) requires state regulatory authorities and certain non-regulated utilities to consider a net-metering standard by August 2008. On October 2008 the ACC adopted a Net-Metering rule. The rule has the following highlights:

- Utilities must connect with Net Metering Facilities.
- Excess kilowatt hours generated during any month will be rolled over to next month to offset the next month's bill
- At the end of the year, the utility must issue a check or billing credit to customers whose generated amounts exceed their demand for the past year at the utility's avoided cost (not the full retail amount).
- Each utility will submit a Net Metering Tariff in 2009
- There is no limit to the size of the net metering facility.
- To stay up to date with this proposed regulation, see http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=AZ01R&state=AZ&CurrentPageID=1&RE=1&EE=0 .
- The ACC Docket on this matter is RE-00000A-07-0608
- For a thorough overview of net metering issues and examples of model rules and best practices, see Chapter 4 of the Interstate Renewable Energy Council's (IREC's) Connecting to the Grid Handbook (2007) found at: http://www.irecusa.org/index.php?id=86 .

B. Standard Interconnection

Interconnection between solar facilities and the electric utility grid is necessary to deliver the solar-generated power. Having a standardized and simplified interconnection agreement is important so that solar installers can easily work with different utilities. Goals for such agreements include different levels of review to match the size and complexity of the solar system, standardized application forms, no external disconnection switch requirement, and no requirement of utility

insurance or indemnification. As of now, Arizona has no statewide standard interconnection agreement.

The Interstate Renewable Energy Council's (IREC's) Connecting to the Grid Handbook (2007) found at: http://www.irecusa.org/index.php?id=86 summarizes the status of interconnection policy: A stakeholder group has met for over a year under the auspices of the ACC to develop an Arizona interconnection standard. To review the current status of this project, see ACC Decision 69674 (June 28, 2007) with draft rules and ACC Docket No. E-00000A-99-0431 available at http://www.azcc.gov/divisions/utilities/electric/dg.asp .

C. Public Benefit Funds

Public benefit funds (PBF) are state-level programs typically developed during electric utility restructuring by some states in the late 1990s to ensure continued support for renewable energy resources, energy efficiency initiatives and low-income energy programs. These funds are most commonly supported through a very small surcharge on electricity consumption (e.g., $0.002/kWh). This charge is sometimes referred to as a system benefits charge (SBC). PBFs commonly support rebate programs for renewable energy systems, loan programs, research and development, and energy education programs (Database of state incentives for renewable energy and energy efficiency, http://www.desireusa.org).

In September 1999, the Arizona Corporation Commission (ACC) instructed utilities to include a Public Benefits Fund in their restructuring plans. The Public Benefits Fund provides $49.5 million in funding for low-income, demand side management, environmental, renewable and nuclear power plant decommissioning programs ($25 million spent to expand renewable energy). Over time the Public Benefits Fund has become more focused on renewable energy than on energy-efficiency. In February 2006, the Arizona Corporation Commission (ACC) increased the charge on customers from $0.000875/kw hour to $0.004988/kw hour, with the residential cap increased from $0.35 to $1.05. ACC Rule R14-2-1608.

D. Solar Access Laws

The goal of solar access laws is to assure that persons wishing to install solar devices will not have their sunlight blocked by others and will not be restricted by unnecessary laws, ordinances or rules. Arizona does not have a solar easement law to allow neighbors to grant assured solar access, as some other states do. Arizona does have a number of solar access laws that restrict homeowners associations. These regulations and laws are made at the state or local level; homeowner associations (HOA's) can establish their own solar access rules consistent with these laws. Arizona laws include several references to solar access:

- ARS §9-461.05 (C) (1)(d) requires each city to adopt and keep updated a general plan that includes a segment that considers access to solar energy as a part of all land use plans.
- ARS §9-462.01 (A) (3) permits any city to pass an ordinance that regulates access to solar energy. Tucson has not passed such an ordinance.

- ARS §33-439 invalidates any deed or contract restriction (entered into after 1980) which "effectively prohibits" the installation or use of solar devices, including PV systems and hot water systems.
- ARS §33-1816 prevents home owner associations (HOA's) from prohibiting the installation or use of solar devices, but allows HOA's to adopt reasonable rules for solar if they do not impair the functioning of the system or adversely affect cost or efficiency of the solar system. If an HOA breaks this law, the homeowner can sue the HOA and if successful, recover attorney fees and court costs for the suit. For an Arizona Court of Appeal case on this topic, see http://www.cofad1.state.az.us/opinionfiles/CV/cv000570.pdf .

E. Building Energy Standards with Solar Mandates

The goal of solar mandates and energy standards is to assure energy-efficient buildings as an important prelude to solar development. Such mandates should require a large portion of any building's energy be provided by solar energy. Such regulations could be adopted at the local, state or national level. Tucson has taken steps regarding public buildings but has not adopted requirements that privately owned new buildings be energy efficient or include solar equipment.

The City of Tucson adopted a Sustainable Energy Standard (SES) in 1998, initially for the community of Civano, and later expanded its applicability to all City-funded buildings. The SES is now tied to the 2006 International Energy Conservation Code (IECC) that was adopted by the City of Tucson on June 12, 2007. See Tucson City Mayor and Council Ordinance #10417; http://www.ci.tucson.az.us/clerks/minutes_2007.php .

The City of Tucson has recently adopted a solar ready ordinance which will require all new houses and duplexes to be built with stub outs so that solar electric (PV) and solar hot water heating can be installed at a later date without significant building modifications. See Tucson City Mayor and Council Ordinance 10549 (June 17, 2008).

All City buildings now must meet LEED Silver certification per Mayor and Council Resolution #20322, adopted April 18, 2006, which could include solar. See http://www.ci.tucson.az.us/clerks/minutes_2006.php . All city funded commercial buildings must meet a 5% solar requirement which can be met through solar PV, solar water heating or day-lighting or by cogeneration (up to 4%).

The State of Arizona requires all new state buildings to derive 10 percent of their energy from a renewable resource (solar, wind, etc) by Executive Order #2005-05 of the Governor. See http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=AZ16R&state=AZ&CurrentPageID=1&RE=1&EE=0

ARS § 34-452 also requires all public buildings including schools over 6,000 square feet to include a written evaluation of solar features including active and passive solar space heating, solar day-lighting and solar water heating.

F. Solar Set Asides in Renewable Programs

The goal of solar set-asides in RPS policies is to assure that solar devices are used to meet a portion of a utility's required renewable portfolio, rather than allowing a utility to meet its full obligation from wind or another renewable resource. In theory, this should be a driving force for more solar installations in a state.

In Docket No. RE-OOOOOC-05-0030, ACC Decision 69127, November 14, 2006, the Commission established the Renewable Energy Standard and Tariff (REST) which ordered all regulated utilities in the state to obtain an increasing amount of their electricity from renewable resources, up to a total of 15 percent of residential load by 2025. Of this percentage, 30 percent (4.5 percent of total retail sales in 2025) must come from distributed renewable (DR) resources by 2012 and thereafter. One-half of the distributed renewable energy requirement must come from residential applications and the remaining one-half from nonresidential, non-utility applications. See http://www.azcc.gov/divisions/utilities/electric.asp.

There is no explicit solar set-aside in the Arizona REST. While the distributed generation requirement is likely to be met primarily by solar applications, this is not required by the REST language.

G. Incentive Programs

The goal of incentive programs is to reduce the cost of solar energy systems for homes and businesses through grants, rebates or performance-based payments. These have been adopted by some states and some utilities as an effective way to make solar more affordable. In the Tucson area, local utilities have provided all of the direct financial incentives other than tax rebates. Because of state and federal caps on tax credits, however, the value of the total rebate and other incentive declines as the cost of the system increases. For 2009, Tucson Electric Power (TEP) offers these incentives in exchange for the renewable energy certificates (REC's) they generate. Incentives are as follows:

- Residential PV (on-grid): $3.00/W up front payment for qualified systems.
- Residential PV (off-grid):$2.00/W.
- Non-Residential PV (on-grid):$2.50/W for systems 20kW or less. Systems greater than 20kW must take a performance based incentive (PBI) and bid for the per kWh payment and duration up to a predetermined level.
- Non-Residential PV (off-grid): $0.121/kWh of estimated annual production.
- Residential Solar Water Heating and Solar Space Heating: $0.25/kWh equivalent, plus $750 up to a maximum incentive of $1,750. Or residential customers can elect to receive a 10, 15, or 20 year PBI.
- Non-Residential Solar Water Heating and Solar Space Heating: PBI.

See http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=AZ15F&state=AZ&CurrentPageID=1&RE=1&EE=0 and http://www.tep.com/Green.

TRICO Electric Co-op has similar programs and offers rebates for PV systems as well as solar water heating. Through the SunWatts Program, Trico Electric Co-operative offers home and business owners a rebate of $4/W DC for installing photovoltaic systems and $0.50 per expected first year kilowatt hour savings for solar water heaters. The incentive can not exceed 50 percent of the total system cost. Eligible PV systems may be either grid-tied or off-grid. See http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=AZ25F&state=AZ&CurrentPageID=1&RE=1&EE=0 and http://www.trico.coop/sunwatts_information.html .

H. Loan Programs

The goal of loans for solar devices is to provide another means for homeowners and businesses to handle the high upfront costs of PV systems. These loans may be from a utility, a statewide solar advocacy group, the state or local government itself. There are currently no loan programs available statewide or in the immediate Tucson area from TEP or Trico Electric Co-op, although two other Arizona utilities do offer such programs. Sulfur Springs Valley Electric Co-op provides loans of $2.00 per watt up to a maximum of 25 percent of the total cost of the project at an interest Rate of 3 percent. See http://www.ssvec.org/programs/energySunWatts.php.

I. Tax Credits

The goal of tax credits, both state and federal, is to provide an additional incentive for taxpayers to purchase solar energy devices by reducing their tax liability. The federal investment tax credit of 30 percent applies to the system cost after utility rebates with no cap. This investment tax credit was recently extended through 2016. For a current listing of federal tax credits and incentives see http://www.dsireusa.org/library/includes/genericfederal.cfm?CurrentPageID=1&state=us&ee=0&re=1 . The state of Arizona offers a number of tax credits for solar including:

- Commercial/Industrial Solar Energy Tax Program- Income tax credit of 10 percent of installed cost of solar up to $25,000 per building in the same year and up to $50,000 in total credits. Maximum statewide credits per year are $1 million, although this limit has not been approached in any year yet. Perhaps most significantly, this credit can be transferred by a tax-exempt entity to the solar installers, financers or manufacturers of the system. See ARS 43-1085, 43-1164 and 41-1510.01.
- Residential Solar Energy Tax Credit-Income tax credit equal to 25 percent of the cost of a solar system up to a maximum of $1,000. See http://www.revenue.state.az.us/Forms/2006/310%20instructions.pdf for the appropriate forms to use.
- See also http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=AZ18F&state=AZ&CurrentPageID=1&RE=1&EE=0

J. Property Tax Incentives

Property tax credits are another incentive to purchase solar equipment. Special rules apply to solar installations.

- Solar equipment in Arizona is valued at 20 percent of its depreciated value for property tax purposes. See ARS 42-14155
- For property tax assessment purposes, solar equipment is determined by law to add no value to the property. See ARS 42-11054.
- See also: http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=AZ30F&state=AZ&CurrentPageID=1&RE=1&EE=0 .

K. Sales Tax Incentives

The goal of removing sales tax from solar equipment is to reduce the effective price to the customer and promote the sales of solar equipment. Arizona provides a 100 percent sales tax exemption on all solar equipment. See, http://www.azleg.gov/FormatDocument.asp?inDoc=/ars/42/05061.htm&Title=42&DocType=ARS .; http://www.azsolarcenter.com/benefits/solarsalestax.html ; and http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=AZ08F&state=AZ&CurrentPageID=1&RE=1&EE=0 .

L. Expedited Permitting and Fee Waivers

City of Tucson Building permit fees are waived up to $1,000 for solar installations. Plan review fees and impact fees are not waived. Building credits under this program shall not exceed 10 percent or $10,000 for any single project of the credit amount provided under this program. A project shall be defined as lots in subdivisions or Planned Area Developments or buildings or shell buildings under ownership by one entity at the time of application for a permit that contains a solar energy system. A condominium project shall be considered under single ownership. http://www.tucsonaz.gov/dsd/Permit_Review_/Solar_Fee_Incentive_Waiver.pdf . The City of Tucson has developed a residential photovoltaic template to simplify solar permit applications. http://www.tucsonaz.gov/dsd/Permit_Review_/Residential/ResidentialPhotovoltaicElectrical.pdf

Parks Store 47.3 kW Solyndra installation.