



## **Green Building / Rooftop Solar Program Evaluation & Best Practices**

### **Final Report**

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This project is intended to assist the Office of Environmental Initiatives in the City of Scottsdale in exploring leading Green Building and Rooftop Solar Programs in the U.S. to rejuvenate the Scottsdale

initiatives through best practices and innovative strategies implementation. Green Building Program refers to the voluntary or mandatory requirements for new construction or remodeling of residential and commercial buildings, with performance guidelines for energy, water, and material usage of building construction and operation. Rooftop Solar Program is a set of tools and incentives to encouraging home owners and developers to engage in residential and commercial photovoltaic solar projects, in new construction or retrofiting.

## **Green Building Program**

We will begin with the overview and assessment of Scottsdale's Green Building Program. After its official formation in 1998, the Scottsdale Green Building Program (SGBP) is one of the oldest programs of its kind in the nation and its accomplishments reflect its caliber. Founded and ran by the Green Building Project Manager, Anthony Floyd, the program has gone through various stages of growth, peaking in 2005 and steadily declining to the present day. This case study utilizes various academic journals, news articles, and historical data to explore: (1) the drivers of the program's success / key takeaways and (2) current and future state analysis.

At its inception the SGBP was one of five similar programs in the nation. Building requirements were modeled after the program in Austin, Texas but took into account the unique traits of the Sonoran bioregion. In the early stages the program was entirely voluntary and included only residential buildings, until 2001 when the program expanded to include commercial buildings. The program moved past the voluntary barrier in 2005 when it became the first in the nation to require all new and renovated public facilities to be Gold LEED (Leadership in Energy and Environmental Design) certified. [Trullson][SGBAR]

The program has expanded and downsized over the years as a reflection of the community's needs. Over its life the SGBP has included a Green Building Advisory Committee, a large building expo, and considerable community education efforts (which still take place today). The guidelines of the program cover building standards including: indoor air quality, solar technology, solid waste, water usage, energy, and building materials, among others. For their participation, developers are rewarded with a green inspection, green certificate, and most notably expedited plan reviews in the permitting process. [SGBAR]

Key success factors of the program as demonstrated by two green building industry reports are examined next. Going Beyond Code: A Guide for Creating Effective Green Building Programs for Energy Efficient and Sustainable Communities, published by the Southwest Energy Efficiency Project (SWEET), focuses directly on the factors involved with starting a successful green building program in the Southwest and studied programs throughout the region (Scottsdale included). The report focuses on a range of factors, but this case study will focus on the six keys to successful implementation as outlined by the report. These six keys are: (1) Establish clear goals with specific measurable objectives, (2)

Community-wide assessment and planning, (3) Stakeholders and the decision-making process, (4) Implementation and integration (5) Incentives, and (6) Communication and partnerships. [SWEEP]

As the history of the program is reviewed, it becomes apparent that each of these aspects played a large role in Scottsdale's program as it's changed over the past 15+ years. Clear goals encompassed each of the pillars of sustainability: reduction of environmental impact, short and long term savings objectives, and community education and outreach. Community planning, stakeholder involvement, and implementation happened at a speed consistent with the city's ability to implement the changes. Overall the program's been defined by its incentives and partnerships throughout the region.

When a developer goes through Scottsdale's green building program they receive the expected benefits of participating in sustainability initiatives: brand differentiation, immersion into the local community, etc.; certainly attractive to a developer looking to expand his business. The greatest benefit to a developer, however, comes through the expedited permit and plan review process, which was especially valuable in the early 2000's building-boom. By participating in the green initiatives (already a pragmatic solution in terms of social responsibility) a developer can expedite his project approval, an attractive option regardless of his viewpoint on sustainability. The expedited review practice was so successful that in 2005 as many as half of all residential buildings fell under the green building program umbrella. Scottsdale can also contribute quite a bit of its success to its collaboration with organizations that share similar goals. A list of collaborations can be found in the appendix and while large is far from comprehensive. Collaboration has helped Scottsdale establish a communicative network that keeps the program at the forefront of best practices and establishes the city as a leader in the industry. [Appendix I]

Towards Advanced Solutions for Achieving Sustainability Goals in Buildings: Lessons Learned from Case Studies published by the American Society of Civil Engineers studied 45 building programs and project nationally and uses their findings to extrapolate on factors that lead to best practices. Their findings outline three key aspects in successful green building programs: (1) Largest Impact on success and failures falls on planning and doing in phases, (2) Integrated design, collaboration and stakeholder involvement is of utmost importance, (3) Success and failure is based on acquisition and accumulation of knowledge. [ASCE]

The findings of this report echo the sentiments in Going Beyond Compliance. Put simply, planning and stakeholder involvement from the very beginning make the ultimate difference in the long run. The report expands its findings to talk in depth about the importance of building a knowledge base and learning.

Sustainability is a relatively young field that is continually forming and developing. For that reason, best practices aren't well known. The best sustainability programs seek out innovative solutions while using the existing knowledge base to the greatest extent possible. Scottsdale has proven this by modeling

and tailoring its own program off of other cities such as Denver and Austin. As the city has remained well-connected with various organizations, it's passing along the knowledge it's gained and continuing the cycle that builds on the entire industry's knowledge base. The report asserts that case studies are currently the best method for learning best practices and lessons learned. Scottsdale's green building program has proven its value as a topic of study that will cement its value to other cities moving into the future.

Despite the success and track record of SGBP, the program has seen a decrease in utilization over the past decade. This can be generally attributed to economic downturn: less building development, city budget cuts etc. The 50% participation of 2005 has since decreased to 13% in 2013 [SGBAR]. These number shifts seem daunting at first glance, though they may actually indicate that the program has made the dramatic change it was intended for.

The Green Building Movement has generated considerable momentum over the past decade across the nation. In 1997 there were fewer than five cities with green building programs, but this number has jumped to 130+ within the last five years [AIA]. To examine the trends, it's easiest to look at the movement from a sociology perspective. Sociologists outline four stages of a movement: (1) Emergence, (2) Coalescence, (3) Formalization, (4) Decline / Institutionalization. The final stage decline has five specific traits: (1) Mainstreaming, (2) Repression, (3) Co-optation, (4) Failure, (5) Success [EBSCO].

In the case of the SGBP, it's feasible that the program is moving into the fourth stage of a movement. When emerging a movement is characterized by a group of people beginning to form opinions, as the group grows larger it begins to develop strategic goals and organization. Eventually there is enough momentum and organization that formal changes occur. This was the case with Scottsdale. What began as an informal group of people with similar ideas evolved into one of the most reputable programs in the nation that led to measurable and lasting changes on the city's codes and culture. Eventually the movement declines as it becomes institutionalized.

At this point, it seems that Scottsdale's program is still exemplifying the first trait of decline. Decline is also referred to as institutionalization, because the movement is dying down as it becomes the norm. This explains why participation has declined while a culture of green building has remained. In other words, the program accomplished its goals of institutionalizing a set of ideals.

In the future the city can expect to see the rest of the traits of the final stage. Repression occurs when various authorities will begin to lobby against programs in the interest of promoting their own agenda. Next in co-optation there will be so many supporters of green building that their beliefs begin to conflict with one another. This competition amongst these groups becomes so strong that these groups hurt themselves leading to failure. Success is the final stage and is relatively hard to predict. The hope is that the groups can unify around a singular set of ideals or idea that they can eventually accomplish.

With a sociological perspective in mind, Scottsdale can objectively look at its accomplishments and understand where it's headed into the future. The program has effectively institutionalized a movement, acted as a case study and role-model for other cities, and added to the overall learning and knowledge base of the sustainability field.

## **Rooftop Solar Initiative**

The Rooftop Solar Initiative is part of the broader Green Building Program offered by the city of Scottsdale. Just like the Green Building Program as a whole, the Scottsdale solar initiative is nationally recognized as rather innovative and advanced. It is rather difficult to advise the city of Scottsdale on improving its Green Building or Rooftop Solar programs because it basically developed or co-developed many of the industry's best practices. The most significant and burdensome aspect of any US-based rooftop solar program is the permitting process that the system installers or owners must follow. This is also the area that we will dedicate most of our research and analysis. Permitting process efficiency is critical to both solar popularity and solar system cost as seen in Appendix II. As seen in that figure Permitting, Inspection, and Interconnection costs (PII costs which are part of Soft Balance of Service costs) are a considerable financial burden for local installers and thus also for rooftop solar owners. Local governments can also most directly impact these costs through process streamlining and standardization.

First document we examined is titled [Simplifying the Solar Permitting Process](#) by the Interstate Renewable Energy Council and the Vote Solar Initiative. It outlines nine residential permitting best practices: (1) Post Requirements Online, (2) Implement an Expedited Permit Process, (3) Enable Online Permit Processing, (4) Ensure a Fast Turn Around Time, (5) Collect Reasonable Permitting Fees, (6) Do Not Require Community-Specific Licenses, (7) Offer a Narrow Inspection Appointment Window, (8) Eliminate Excessive Inspections (Scottsdale), and (9) Train Permitting Staff in Solar. These may seem intuitive and even fundamental to today's good customer service but they are not the common practice one would hope for. Scottsdale embraced the following three principles early on: online permitting, fast processing, and eliminating excessive inspections.

[California Solar Permitting Guidebook](#), published by the Governor's Office of Planning and Research in California, offers useful tools for expedited permitting of small and simple photovoltaic installations. Its solar toolkit includes: (1) Submittal Requirements Bulletin, (2) Expedited Eligibility Checklist, (3) Standard Installation Plans, (4) Structural Criteria, and (5) Plan Review & Inspection Guide.

[Minimizing Overlap in PV System Approval Processes](#) exposes the complexity of many local solar permitting programs and offers general recommendations. It emphasizes how complex and time-consuming the permitting process really is, especially for local installers. Installers must get customers, line up financing, and navigate multiple approval processes before even attempting to start the system

installation. The interconnection agreement with power utilities, building/electrical permit, historic district approval, net metering program enrollment, application for state/local rebates/incentives are all parts of the installer workload. This needs to be simplified, streamlined, and expedited.

Another useful document published by the Governor's Office of Energy Policy, [emPower Arizona](#), explores the future of solar energy in the state of Arizona. Arizona's three solar energy challenges include (1) decreasing demand due to utilities' early renewable goal achievement, (2) system financing problems due to lack of grid-parity pricing, and (3) restricted export of energy due to limited capacity of transmission infrastructure. It predicts that solar could achieve full grid-parity in Arizona at \$0.09/kWh within 10 years.

Based on our research, we anticipate residential rooftop solar in the Valley of the Sun, and specifically in Scottsdale, to significantly increase in popularity over the next 10 years. Commercial photovoltaic demand is also expected to strengthen here but not as much as single and multifamily installations. Our conclusion is based on the following trends: (1) state energy policies begin to favor solar as a locally-viable renewable energy type, (2) decreasing cost of installed simple and small-scale rooftop systems is decreasing rapidly, and (3) the combination of favorable net metering policy and declining battery costs is good for solar.

There are various factors that make the Valley of the Sun, and specifically Scottsdale, very attractive for rooftop solar. Firstly, as seen in the solar irradiance map of the US in the appendix, Arizona in general, and the Phoenix area in specific, receives more continuous sunshine than any other area of the country [Appendix III]. Secondly, dry and hot desert conditions may increase the desirability of certain emerging solar technologies like thin-film and organic thin-film cells which are more sensitive to environmental factors than glass-encapsulated silicon-based structures. Thirdly, rooftop solar has the potential to considerably reduce daytime temperatures of open spaces and buildings due to its significant shading and limited heat absorbing capabilities. Fourthly, solar power is completely water neutral meaning that it does not consume or pollute water while operating. Fresh water is a major input for all major conventional energy generation sources which are primarily hydro-thermal. Scottsdale is in the desert environment where sun is abundant, water is precious, and heat is mostly undesirable. The cost of fresh water and grid-based electricity will steady increase and the cost of installed solar systems will continue to decrease rapidly. Combined with favorable net metering technology, the future of rooftop solar in the Phoenix area looks very promising. Fifthly, photovoltaic solar generation is immune to initially cost-prohibitive economies of large scale, meaning that it is just as efficient on a small micro-grid level as it is on a utility-scale solar farm level. This is important for residential rooftop application because with the efficiency of the smaller systems being unaffected by scale, the only real economies of scale factor is procurement cost of solar panels and optional batteries.

The following are our recommendations for the City of Scottsdale to increase the value proposition and national competitiveness of its already exemplary Green Building and Rooftop Solar Programs:

1. Take bold action to show real strategic commitment to sustainable building and energy. Scottsdale has done it once before with its original Green Building Program.
2. Simplify the green and solar application, review, and approval by elimination all non-critical steps, fees, and paperwork.
3. Implement a city-wide, or even state-wide, installer certification program so that qualified installers can approve and register own green and solar projects.
4. Eliminate residential solar permitting fees. Nothing declares commitment better than “we will pay for it so it’s 100% free to you”.
5. Encourage green construction and rooftop solar by attracting green/solar customers and businesses alike. By becoming solar customer-friendly the city is also becoming installer- and manufacturer-friendly, and vice versa.
6. Take a more proactive and direct role in assisting installers and customers in planning, financing, completing, and expanding their rooftop solar systems. This could be done by offering greater discounts or assisting in the application process for all local, state, and federal rebates, credits, and incentives.
7. Support local sourcing to encourage manufacturers, installers, consultants, and financiers to operate in Arizona, and in Scottsdale, but definitely start by supporting the installers which are critical in the short-term success of rooftop solar.
8. Assist in solar project financing by helping residents and installers navigate the complex solar lending and leasing environment or even by offering city-sponsored funding options to qualified residents.
9. Become a troubleshooter for the solar-resident, offering practical planning, financing, design, engineering, permitting, procurement, construction/installation, service, maintenance, and operation advice and assistance. Help residents succeed in the rooftop solar space.
10. Collaborate with neighboring cities to standardize the rooftop solar permitting process across the entire Phoenix area, since very few installers can prosper in a very limited geographic area of a single city.
11. Lead the city and the state, once again, in an economically, socially, and environmentally-driven vision to improve our quality of live.

To become the Green Solar Capitol of the USA, located right in the middle of the famous Valley of the Sun, Scottsdale would need to truly show its full commitment to Green construction and photovoltaic solar generation. Considerable financial and human resources would have to be deployed to support such a strategic vision. Its residents deserve clean and desert-friendly energy policy and energy program. In the next ten years, Scottsdale could easily become 50% solar-based with just its residential and small commercial rooftop capacity. If utility-scale solar farms are more decisively utilized, a 100% goal over the next 20-30 years is also feasible. Electricity and water rates will not remain artificially low here for long. We live in one of the most naturally inhospitable places in the world and yet we managed to completely ignore its greatest resource—the sun!

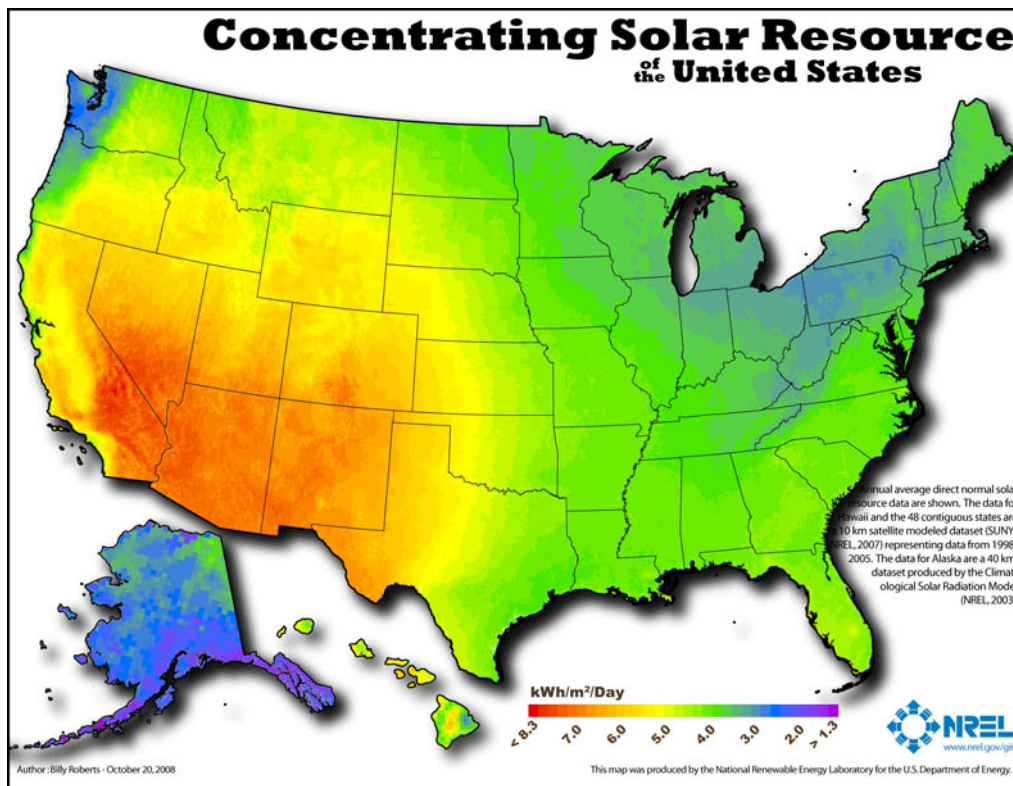
Appendix I

3 US Green Building Council, City of Austin Green Building Program, Metro Denver Green Builder Program, What's Working, Tucson Institute for Sustainable Communities, EPA Energy Star Program, ASU College of Architecture & Environmental Design, Arizona Energy Office, Arizona Department of Environmental Quality - Pollution Prevention Unit, Arizona Solar Energy Association, Arizona Vision Weavers, Southwest Gas, APS and SRP.

Appendix II



Appendix III





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