Blended Solar - Guidelines for Aesthetic Solar Energy Installations in Ann Arbor, MI

As Ken Butti and John Perlin's excellent book, *A Golden Thread: 2500 Years of Solar Architecture and Technology* , illustrates, solar design and architecture and related building integration have roots dating back to Roman Times, the American Southwest and before. With advancements in materials and manufacturing technology the economics of solar energy have improved to a point of cost-effectiveness with traditional fossil fuels. Communities seeking to become more climate-action friendly, however, face new barriers about how best to integrate solar technologies into their neighborhoods, common spaces and buildings and green spaces.

A common refrain often heard in Ann Arbor is that the city is a very special place where people really care for the community, its outward appearance, and its global impacts. In December 2012, with its passage of the Climate Action Plan (CAP)[1], the Ann Arbor City Council expressed an ambitious multi-strategy vision to reduce its greenhouse emissions: 8% by 2015; 25% by 2025; and, 90% by 2050 (relative to year 2000 baseline carbon dioxide equivalent (CO2e) emissions levels). As part of this vision, the CAP's *Solar Goals* call for 2.4 MW of new solar PV to be installed each year over the next ten years, to displace electric power produced from fossil fuel combustion (for a total of *24 MW in new capacity within ten years)*.

As the city and community go about the task of installing large-scale solar energy, it is important that care be taken to ensure that solar system designs and installations are aesthetically pleasing and enhance our architectural, landscaping, urban forest, and water-based assets. Towards that end, the following are suggestions for how to aesthetically blend solar systems into our community.

Building Integrated Solar Design - Building-integrated solar design integrates solar PV panels with traditional building materials and designs so that the array becomes part of the existing or new structure. Good solar PV planners/designers work hard to improve the aesthetic appeal of a building by integrating solar panels into the existing shape, fenestration, and slope sections of the roof (particularly south-facing). Solar can also be used as window awnings to provide summer shading and reduce cooling cost and glare. Because solar panels lower the operating costs of a building and can further protect the structure from weather and solar irradiation, they can also increase the value and longevity of the property. Finally, solar can be added to carports to blend with electric car charging stations.

Ecological Blending - As a direct-from-nature (and point-of-origin) power source, solar panels blend well with the environment and with habitat-friendly designs such as trees, gardens, fountains, ponds and birdfeeders. Finally, solar panels can blend well with environment and habitat-friendly construction, such as art work, vegetation including shade trees, butterfly gardens and storm water management areas.

Historical Buildings and Solar Energy - With documented applications dating back to the Roman Empire and before[2] solar energy is a proven technology that harnesses energy from the sun's light to create localized energy to produce work (i.e., heating, cooling and electricity). Solar Energy has long been integrated into American's buildings. 18th Century Elizabethan homes and structures regularly included solariums and greenhouses. Solar Hot Water – Wood Stove Hybrids were used extensively in cities to heat domestic hot water.

In modern times, it is *solar photovoltaics (PV)* that has the greatest potential as a viable, environmentally friendly, unlimited and economically sound source of energy for the world. Indeed, as Thomas Edison famously noted, *"I'd put my money on the sun and solar power."* "Photovoltaics" (PV), is a Greek term that simply means "light volt." A French scientist discovered the photovoltaic effect in 1839. In 1905, Albert

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[1] See: http://www.a2gov.org/a2energy/be-informed/pages/climate-partners.aspx.

[2] See: Ken Butti and John Perlin, *A Golden Thread: 2500 Years of Solar Architecture and Technology* (Palo Alto California: Cheshire Books) 1980.

Einstein published a paper that explained the photoelectric effect, a discovery of which led to the "quantum" revolution" and, in 1921, for which he was awarded the Nobel Prize for his *"discovery of the law of the photoelectric effect."*

In 1952 President Harry S. Truman's Material Commission Report, *Resources for Freedom*, urged that solar energy be rapidly developed by the United States. In 1953, American physicists developed the first silicon solar cell capable of powering everyday electronics. During this time, vastly improved photovoltaic cells were developed by Bell Telephone Labs (Murray Hill, New Jersey), primarily for the Space Program and NASA.

By 1956, *Look* magazine was running advertisements for Solar PV ("Bell System Solar Battery Converts Sun's Rays into Electricity"). In 1975, Michigan's own President Gerald R. Ford signed the Energy Policy and Conservation Act which, among other things, called for a dramatic increase in the use of *solar energy* as a way to achieve *energy independence*. Today, Ann Arbor's Climate Action Plan calls for 2.4 MW of new solar PV to be installed each year, for a total of *24 MW in new capacity in ten years*.

North-side Landscaping - Most would agree that the backs of solar panels are not aesthetically pleasing to the eye. Poorly designed systems have their backsides to the viewscape. Well-designed solar eliminates this backside affront by careful array placement and north-side landscaping. Shrubs, trees, berms, boulders and more!

Unobtrusive Solar - Most agree that the back side of solar panels – just like belching smoke stakes, pollution-laden sunsets, strip mining and oil rigs - are not aesthetically pleasing to the eye. Poorly designed solar systems – such as those that prominently show their backside to inhabitants – essentially show "contempt" for the community. Solar designers can reduce this backside affront to the view shed by: reducing the solar array size, innovatively positioning panels within an array, using topographic features or elevated surfaces, and growing vegetation behind an array.

Solar Access and Land Use Planning - Solar access is the ability of one property to continue to receive sunlight across property lines without obstruction from another's property (buildings, foliage or other impediment). Protecting solar access rights under existing and future land ordinances and covenants is important to Ann Arbor's meeting the CAP's solar goals. Without a set of well-coordinated solar access laws, Ann Arbor could face conflicts between stated city priorities, such as higher density development, tree preservation, and renewable energy adoption. By logically incorporating solar energy considerations into zoning codes and ordinances, Ann Arbor can clarify the responsibilities of various parties, achieve balance between city priorities, and avoid costly and time-consuming lawsuits. Towards that end, the Solar America Board of Codes and Standards published a report in October 2008 reviewing the status of solar access laws nationwide, and recommended a model state statute and best practices for local governments.[3]

Solar Energy and the Urban Forest - Solar energy and trees share a common need for sunshine. As the host of an Urban Forest, Ann Arbor is affectionately called "Tree Town." While shadowing from trees can block solar access, the urban forest provides many environmental, economic and social benefits to the community, including reduced storm water runoff, improved water and air quality, moderated summer temperatures, reducing noise, lowered utility costs, improved quality of life, and a beautified city. It is estimated that Ann Arbor's city-managed urban forest, which includes trees growing along streets and in mowed areas of parks, provides nearly $4.6 million in benefits each year.[4]

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[3] http://www.solarabcs.org/
[4] See: The Urban Forest - http://www.a2gov.org/departments/field-operations/forestry/Pages/The-Urban-Forest.aspx.

> Good solar design works in harmony and blends with urban forestry – and landscapes on the north side of all solar installations. Tree removal occurs only when there are no other viable alternatives. Good solar design includes features such as: (a) actively tilting solar panels so as to maximize their output; (b) mounting solar panels at grade versus potentially shaded roofs; (c) canopy or ground-mounting of solar panels if roofs are shaded; and (d) using open site areas (e.g., Community Solar projects) rather than removing shade trees of value.

The following are resources for those interested in a researching more about solar integration: Ken Butti and John Perlin book titled, *A Golden Thread: 2500 Years of Solar Architecture and Technology;* National Renewable Energy Institute (NREL), Implementing Solar PV Projects on Historic Buildings and in Historic Districts.[5]; and, Ann Arbor is part of the American Institute of Architects, Huron Valley Chapter[6], which has resources and information on blended and integrated solar design.

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[5] See: http://www.nrel.gov/docs/fy11osti/51297.pdf
[6] See: http://www.aiahv.org/.