

OCCC “Solar Project”

First-Year Energy Output and Other Benefits

Background

A total of five photovoltaic (PV) systems are installed at the Orange County Convention Center (OCCC). They were part of a county-led project called the Solar PV Demonstration Facility and Climate Change Education Center, or “Solar Project” for short. This project features a one-megawatt (1mW) solar array which is the largest rooftop PV system in the southeast U.S.

A competitive RFP was issued by Orange County for a design/build contract to install the 1mW system and other parts of this project. The contract was awarded to Johnson Controls Inc (JCI) in 2008. The 1mW system is comprised of 5,808 SolarWorld SW-175 monocrystalline silicon modules rated at 175Wp at STC. Four sub-arrays feed into four 250kW Satcon inverters that feed into the building electrical distribution system. The web-based monitoring system was purchased from Fat Spaniel Technologies ([click here](#) to view live energy production and environmental data for all 5 PV systems).

First-Year Energy Output of One-Megawatt System

Prior to installing the 1mW system, JCI projected that it would produce 1,286,948 kilowatt hours (kWh) of electricity during the first year of operation, based on an average annual solar irradiance of 2,000 kWh/m². The first full day of operation was 5/16/09. On 5/15/10 the monitoring system recorded a first-year energy production of 1,523,436 kWh which was 18% above JCI’s conservative projection (the recorded production was not adjusted for actual solar irradiance, which may have played a small part in the 18% overage). To help put the first-year energy production in perspective, it is equivalent to the annual energy use of 130 homes.

Other Benefits

a. Environmental and Socio-Political Benefits: PV systems do not produce any greenhouse gases or other air pollutants. The first-year energy production above resulted in the avoidance of 3.4 million pounds of carbon emissions. Carbon dioxide is a major contributor to climate change, which a vast majority of scientists say is leading to rising sea levels and increases in severe weather phenomena, like hurricanes and droughts, and it is leading to significant disruptions in many of the earth’s ecosystems. Producing electricity with PV systems or other renewable energy sources also helps reduce our dependence on imported energy, which helps increase our energy security and our overall national security.

b. Economic Benefits: PV systems have several economic benefits, in addition to the environmental and socio-political benefits of discussed above. A federal tax credit equal to 30% of the installation costs is available; as are various other state, local, and utility incentives. For a summary of incentives by state, go to www.dsireusa.org. In several states, there is also a financial market for the “environmental attributes” of electricity produced by PV or other clean energy sources. For a sample regional cap-and-trade program for carbon emissions, go to www.rggi.org.

Purchasing and installing PV systems results in new jobs and contributes to the growth of the economy. The production of electricity with PV provides a hedge against inflation, by avoiding fuel-related cost increases in electric bills. PV systems are highly reliable and have low maintenance costs. PV helps delay the capital investment required for new power plants. With improving product and manufacturing technologies, the cost of PV systems has been steadily decreasing. PV also results in significant cost savings on electric bills, as is discussed below in the OCCC example.

c. Energy Cost Savings and “Return on Investment”: As previously mentioned, the economic incentives related to installing and operating PV systems vary widely by state, local jurisdiction, and utility company. Return on investment (ROI) also varies with PV system size, local irradiance (sunlight), and utility billing structure. For these reasons, looking solely at “simple payback” can be very misleading. In an ideal ROI analysis, consideration should be given to net-present-value economics, energy inflation, PV performance degradation, maintenance costs, and even environmental and socio-political cost savings.

The following ROI analysis for the 1mW system at the OCCC includes the specific financial incentives for this solar project and the specific first-year energy output outlined above; along with estimates for PV performance degradation, maintenance costs, and energy inflation (it does not include net-present-value economics, or estimates for environmental or socio-political cost savings). In 2009, OCCC’s “average” cost per kilowatt hour of electricity was 11 cents. The local utility (OUC) also provides a 5-cent per kWh energy production credit for PV. Using these numbers, the value of the 1,523,436 kWh produced by the PV system during the first year of operation was \$243,750.

Projecting out to “year 10”, a system performance degradation of 1% per year will be assumed, along with a 22-cent per kWh cost of electricity, a continuation of the 5-cent production credit, and an average \$20,000 per year maintenance cost (\$10K/year basic maintenance, plus a \$300K inverter replacement amortized over the 30-year system life). Based on these assumptions, the year-10 production will be approximately 1,300,000 kWh with a value of \$331,000. In summary, this results in a return on Orange County’s investment (\$3.9M after incentives) in 12 to 14 years, depending on actual electricity costs.