-----Original Message-----
From: Richard Caputo [mailto:richardcaputo@sbcglobal.net]
Sent: Thursday, February 10, 2011 8:02 PM
To: ECOSUB
Subject: Comments on Tule Project Alternative C.5.4.1 Distributed Generation Rooftop PV

The comments are attached.

Rich

Richard Caputo
Founding Chair
San Diego Renewable Energy Society
www.sdres.org
P.O. Box 1660
Julian, CA 92036
760-765-3157

Tule Project Alternative C.5.4.1

2) Distributed Generation --- Rooftop PV

You quote San Diego fixed panel PV at a capacity factor of 0.2 Using the SAM model hosted by NREL, the capacity factor is 0.18

The Tule project projected wind capacity factor is close to 0.4 The ratio of the two would be over 2 rather than the 1.5 you use. So 100 % more PV would have to be installed compared to the wind project rather than 50%.

In addition to the lack of feasibility of installing enough city PV to match the 360 MW anticipated from the wind projects in a similar timeframe, there are other grid balancing issues. See this section of the longer statement submitted previously. If the mix of renewable energy sources capacity factor starts approaching the current grid capacity factor, then you would minimize the use of fossil energy and expensive electricity storage. These factors impact fossil use and cost impacts.

This distributed generation via rooftop PV produces the claim that there are no impacts of this approach since the buildings already exist within the urban power grid and there is no need to use transmission lines. Certainly seems like an attractive alternative. Is this really a viable choice as identifies in Alternative C.5.4.1 of the DEIS/DEIR.

Since I am representing the American Solar Energy Society, you can be assured that I support solar energy on buildings within the urban grid. This is an attractive member of the renewable energy portfolio and we support it whole heartily. Can it be the sole renewable option to the exclusion of wind farms, desert solar plants, geothermal, biomass plants including mining urban waste dumps? In a word, NO.

Solar panels on buildings is definitely a member in good standing of this team of options. The reasons that it can’t be the sole renewable option are many and varied. When the amount of clean energy becomes more than a trivial amount, it is necessary to consider the operation of entire electric grid that is required to meet the needs of a city such as San Diego. San Diego is typical of cities in this county that runs 24/7. Rooftop solar is a mid day power source that operates on average at about 18% of its rated capacity. The engineers say that its capacity factor is 0.18 and it delivers 18% of the energy it could produce if it were to operate all the time.

The current mix of power sources in San Diego have a combined capacity factor of about 0.54 and they operate 54% of rated capacity on average. It is currently made up of a mixture of baseload, intermediate and peaking power plants. The peaking plants have a low capacity factor like fixed PV, but fossil peakers are used only during times of peak load as necessary since they are more expensive and polluting. Even though fixed rooftop PV has a low capacity factor, it cannot be dedicated to peak load. It produces power when the sun shines and typically reaches maximum power at noon. This is not a very good

match to the summer time peaking load that occurs in late afternoon or early evening in San Diego. However, it is operating during the day when most of our power is used. Typically, the peaking credit for rooftop PV is from 20 to 60% of its rated capacity. For the urban grid to function you need something else to provide power 24/7 that can also meet late afternoon peaking. The something else would either be fossil powered electricity and/or expensive electricity storage. We are trying to move away from fossil energy and electricity storage is expensive and typically will double the cost of the energy that goes through storage. This is a significant impact – a cost impact.

The other way to balance the grid so that it both reduces fossil dependency and keeps cost reasonable is for a mixture of renewable power sources. This mixture would have some baseload (geothermal, bio-gas, bio-mass or small hydro), intermediate (desert concentrating solar thermal plants with cheap thermal storage), sunrise to sunset solar tracking plants, fixed solar desert plants, less expensive wind with night time and day time capability, and finally, fixed PV. The capacity factor for this mixture goes from about 0.92 for baseload, to about 0.42 for desert solar with cheap storage, to about 0.28 for tracking solar, 0.22 for desert fixed PV, and 0.18 for fixed rooftop PV. Wind is about 0.4 and is available during the night and day depending on the season and daily weather. By mixing these options, you can achieve the capacity factor that is desirable as there is greater and greater use of renewables. As you approach 80% renewables by 2050, you can envision about ¼ baseload, ¼ of the middle capacity factor tracking solar, and ¼ fixed rooftop PV and ¼ wind as a viable mix. Even this mixture could benefit from some storage capability in the 2050 time frame being available to the grid whether it be utility scale battery, hydrogen, on-board batteries in PHEV and EV vehicles, pumped hydro, or movable mass storage. The eventual amount and type of storage would need to be determined by future dynamic grid studies that are not available at this time. If you limit yourself to just fixed rooftop PV at 0.18 capacity factor, it would make the job of a balanced grid extremely difficult and expensive.

Of all the renewable options that are commercially available at this time, PV is the most expensive. Its costs have been dropping since commercial applications started in the 60s and they continue to drop. Over the last decade, the cost learning factor is about 17.5% based on global production. That is, for every doubling of global production, the cost of an installed PV system reduces by 17.5%. This rate had been about 22% in previous decades so the rate of cost reduction is still high but is reducing somewhat. If this rate of cost reduction continues for another decade, the current levelized cost of a residential PV system would go from today's 20 cents/kWh with current federal and state subsides in San Diego, to 16 cents/kWh without any subsidy in 10 years. Today's cost for residential electricity is about 17.5 cents/kWh in San Diego and has risen historically at close to 5%/yr. Clearly, the unsubsidized cost in 10 years would be attractive if a home owner had the cash to invest or could negotiate financing. This is a goal that California and federal policy is striving to attain. This would still be the most expensive form of renewable energy in 2020 since the other alternatives would be from 8 to 14 cents/kWh without subsidies. However, the extra cost of residential PV is moderated by a number of considerations such as its contribution to reducing electric distribution cost if the PV is

distributed evenly in the grid. There are other more external considerations that favor distributed PV. It will still be an attractive option and stays in the mix.

The attached graphic shows all five options as fingers that when working together as one, became a very powerful fist to make renewable electricity a real solution.

Richard Caputo
POBox 1660
Julian, CA 92036
760-765-3157
San Diego Renewable Energy Society
Chapter of the American Solar Energy Society