THERMAL SOLAR IN THE CALIFORNIA DESERT by Willem Post; dated 2 September, 2010
http://www.coalitionforenergysolutions.org/

INTRODUCTION

A recent article on the New York Times Greenwire website describes the Blythe Solar Power Project, BSPP. See below website.
BSPP is a 968 MW thermal solar plant on 9,400 acres in the California desert leased from the Bureau of Land Management; of this land 7,025 acres will be taken up by the BSPP. The plant consists of (4) 242 MW units. It has air-cooled condensers to minimize water use. Expected total energy delivered to the grid is 2,200 GWh. The capital cost will be $6 billion. It will built in stages and will take at least 6 years to complete. A more complete description can be found in the project application documents. See below website.

The BSPP will utilize solar parabolic troughs to generate electricity. Arrays of parabolic mirrors collect heat energy from the sun and refocus the radiation on a receiver tube located at the focal point of the parabola. A synthetic hydrocarbon is used as a heat transfer fluid (HTF) that is heated to high temperatures (750 degrees F) as it is piped through the receiver tubes. The HTF is then piped through a series of heat exchangers where it releases stored heat to generate high- pressure steam. The steam is fed to a traditional steam turbine generator where electricity is produced.

http://www.energy.ca.gov/sitingcases/solar_millennium_blythe/documents/applicant/afc/Volume_I/2.0%20Project%20Description.pdf
http://www.nytimes.com/gwire/2010/08/26/26greenwire-1000-megawatt-plant-in-calif-marks-new-milesto-25893.html

POWER PRODUCTION

The annual production from the plant will be = 968 MW x 8,760 hrs/y x Capacity Factor 0.26 = 2,200 GWh. The power varies daily and seasonally with the strength of the sun and is available ONLY DURING THE SUNSHINE HOURS OF THE DAY. The plant is started in the morning and shut down in the evening.

For reference: Vermont uses about 6,000 GWh/yr

The NYTimes article states this power is enough for roughly 800,000 households. As a California household uses about 6,000 kWh/yr, about 4,800,000,000 kWh/yr would be required by these households.

The NYTimes statement is grossly inaccurate, unless the writer meant that the power is enough only during the sunshine hours of the day, a sizable difference of 2,600,000,000 kWh. Other power sources, such as pumped storage hydro, nuclear, wind, stored biogas (CO2 emitting) and fossil (CO2 emitting) will be needed to supply the 2,600,000,000 kWh during low-sun and sunless hours.

INTEGRATING VARIABLE POWER SOURCES INTO THE GRID

As variable/intermittent power, such as from thermal solar, PV solar and wind, becomes a greater percentage of the power mix, a greater capacity of standby plants and spinning reserves is needed to serve the demand. The spinning reserves usually are fossil power plants that are running without sending power to the grid, but they can be called on to instantly increase their outputs as required. Spinning reserves enable the grid to maintain its required steady voltage. If there is too much voltage variation all sorts of electrical equipment will automatically shut down.

Another approach, used by nations with high percentages of wind power, such as Denmark, Spain and Portugal, is to use pumped-storage hydro plants and natural gas-fired combined cycle gas turbine, CCGT, plants to “smooth” wind power. Wind power varies daily and seasonally with the strength of the wind, and is not available at all when wind strength is too little or too much.

A third approach is detailed below under A GERMAN RENEWABLE POWER DEMONSTRATION.

ENVIRONMENTAL IMPACTS OF THE PROJECT

The land will be leveled by bulldozers to accommodate the arrays. Even though it is desert, no fauna and flora lives there?

The 11 square miles of surface will create a heat island in the desert, hotter than an equivalent desert surface that is partially covered with vegetation, as in New Mexico. Some of that heat will be radiated outwards and some of that will be reflected back. A new, hotter eco-balance will be created in that area. Building a large number of such plants in the desert will affect the local climate. It runs counter to having white roofs on buildings in urban areas to reduce heat island effects.

LEGISLATIVE MANDATES AND TAX CREDITS

The forces that drive this project is California's renewables mandate for utilities and the 30% federal tax credit; about $2 billion in this case.
If a developer has no taxable profits and thus cannot use the tax credit, he can opt to get a check for $2 billion from the federal government. i.e., that is from all of us.

THERMAL SOLAR COMPARED WITH NUCLEAR POWER

A standard 1,000 MW nuclear plant for about the same cost as the above thermal solar plant would produce = 1,000,000 kW x 8,760 hrs/yr x CF 0.90 = 7,884,000,000 kWh/yr, 3.6 times the power of thermal solar plant.

This power is steady and 24/7/365, i.e., it is available DURING ALL HOURS OF THE DAY, CO2-free, and will serve ALL the power needs of 1,314,000 California households for a year.

A US NRC list of US nuclear plants shows that most of the plants have plant sites of about 500-1,000 acres, 7% - 14% of the land area for a 1,000 MW thermal solar plant. See below website.

http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1437/v1/part02.html

Given the above, it is to be expected that the smart and knowledgeable power industry experts in at least 30 major nations, such as the US,

the UK, France, Germany, Sweden, Japan, China (building about 50% of the nuclear plants being built), India, etc., have convinced their governments to continue to opt for nuclear power as a major component of their future power mix.

To do otherwise is a folly.

A GERMAN RENEWABLE POWER DEMONSTRATION

Several German power industry experts created, for demonstration purposes, a "renewables utility company" that uses several field-mounted, sun-tracking PV solar plants in southern Germany, several wind farms in northern Germany, several biogas-fueled combined cycle gas turbine, CCGT, plants with biogas storage tanks, and several pumped storage hydro plants, all controlled from one command/control center to maintain a load following output to the grid.

The experts maintain that as it was shown to be technically feasible to maintain a load following output to the grid for a small combination of renewable power plants, it will be feasible for increasingly larger combinations as well.

http://www.unendlich-viel-energie.de/de/strom/detailansicht/article/165/the-combined-power-plant.html

THE US CONDITON

This approach works in Germany because its national grid is designed as their cars, trains, etc. It being redesigned to accommodate increasing renewable percentages of its power mix. Germany's national grid is much smaller and more compact than the US national grid. Germany's national energy policy has been in existance for decades.

The US faces major obstacles to increasing the renewables percentage of its power mix, such as:
- fragmented, outdated grids poorly suited to renewable energy.
- a grid design influenced by an historic reliance on plentiful and cheap supplies of fossil fuels, especially coal.
- powerful oil and coal industries often opposed to incentives for renewables development.
- energy policy heavily influenced by individual states.

For the "renewables utility company" approach to work in the US, its grid, with about 1,000,000 MW of power plants connected to it, will need to be rebuilt so the grid and the power plants can all be controlled from only a few command/control centers. The capital cost to implement these changes will be in the order of $200-$300 billion during the next 10-15 years. Going "variable and renewable" has its costs.

The US has about 100,000 MW of nuclear plants in operation. They produce about 20% of US electricity. As an alternative the $200-$300 billion could be used to replace 33,000-50,000 MW of the older US nuclear plants; no significant changes to the grid would be required.