QUESTION

SUBJECT: your opinion please

Hey Doc!

How's life? I tried calling you but you didn't pick up. I hope you aren't stuck in Oak Ridge with your Geiger going crazy due to lingering effects of the Manhattan Project.

Can you please look at this and tell me what you think? Pros, cons, etc. Thanks.

http://thesolarproject.com/

R.S.

RESPONSE

As for the solar panels, these appear similar to the design that Southern California Edison is using at their Four Corners Solar Generating Facility off HWY 395. They are a bit more efficient than the standard semiconducting solar panels and they produce no arsenic pollution during their construction. However, there is a limit to the power one can generate from the sun.

Assuming that you are 100% efficient and capture all the energy from sunlight, sunlight only contains 1366 Watts / square meter (Solar Constant). (*)

Recalling it is night ½ the time, you would average 683 Watts/m^2 over a 24 hr period. The atmosphere also absorbs ~30% of the energy otherwise we would all die from UV induced skin cancers. That now reduces the average to 478 Watts/m^2. Assuming it is clear 80% of the time (this never happens except in the California-Arizona-New Mexico deserts), you can expect 382 Watts/m^2 at a maximum. This again is an optimistic number for a desert assuming 100% conversion efficiency. Typical solar panels are only ~30% efficient. However, assuming 100% efficiency, how large of solar collector would one need to generate the amount of power generated from Hoover Dam? Hoover Dam is currently generating ~2100 Mega Watts. It's down from 2400 MW because the weather has been dry and the people are drinking more lake water because of the recent population growth!

Lets calculate:

2100 * 1,000,000 Watts / (382 Watts/m^2) ~ 5,500,000 m^2.

Converting this to square miles (assuming 100% efficiency):

5500000 m^2 * [$100^2 cm^2$ / 1 m^2] * [1in^2 / 2.54^2 cm^2] * [1ft^2 / $12^2 in^2$] * [1mi^2 / $5280^2 ft^2$] = 2.1 square miles.

At current efficiencies of ~30%, this converts to ~7.1square miles for each 2100 MW power generating station!

Typical power generating stations produce between 1000 MW and 2000MW. Assuming that there are perhaps 1000 or more such stations across the US, one could fill up an enormous part of Californian desert with a gigantic solar collecting power station if the conservationists would allow. Since they will not allow drilling, what makes one think that we could replace all our power generation with solar energy?

Dr. Ed

P.S. I've left off the effect of needing to store energy during daylight hours in order to provide for nighttime in the above calculations. The requirement of a cold source such as a lake for a solar collecting station has also been neglected. Including these would further degrade the optimistic calculations above.

(*) The Solar Constant is described in more detail at

http://en.wikipedia.org/wiki/Solar_radiation