METHODS OF EVALUATING BENEFITS OF SOLAR FUEL AND POWER PRODUCTION

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Historically, the cost targets for large-scale solar-electric power production have been expressed as matching the average bulk power costs of fossil-fueled plants. The units of comparison are power costs, $/kWh. Solar plants were expected to reach target costs by the year 2000 on the basis of the high oil prices of 1973-1985, projected to escalate faster than general inflation. It appears now that fossil fuel prices are much below these projections, and they are likely to stay low for many years. Solar power has been unable to meet these targets: in this paper I suggest alternative methods of evaluating the benefits of bulk solar energy production.

The Israel Electric Company has published tariffs payable to private producers of electricity that vary from time of day and time of year. An analysis is presented that calculates the financial performance of solar-fossil hybrid plants feeding electricity into this grid. Any deficit can be balanced by a credit for avoided CO_2 emission. This credit is compared to published estimates of other methods of avoiding CO_2 emissions. Luz-type LS-3 plants and advanced solar gas-turbine power plants are used as examples.

Technology is also available for solar-assisted reforming of natural gas. One potential application of this technology would be as a fuel-extender, the solar heat increasing the calorific value available to a gas-turbine cycle, for example. A financial analysis similar to the solar power plant analysis can establish a credit for avoided CO_2 emissions.

The solar reforming technology can be used for closed-cycle energy storage coupled to a steam turbine power block. Alternatively, sensible heat storage schemes are also being developed. These strategies are compared to the solar-fossil hybrid reference.

Finally, more advanced solar technology can be used to gasify carbonaceous feedstocks such as biomass, organic wastes, oil shale and coal. These processes would be environmentally clean except for limited CO_2 emissions. In the long-term the economic standard of comparison would be conventional coal gasification. In the near-term, solar gasification applications would be limited to waste processing where conventional alternatives are not environmentally desirable.