

Solar Thermal Energy: The Forgotten Energy Source
The Most Promising Renewable Energy Source for Tomorrow,
Cost Competitive Today

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Solar thermal power plants have been operating for seventeen years in California and have proven to be a reliable solar energy source. Unlike solar cells they can be designed with built-in storage capability by a high temperature heat transfer fluid, and with back up by fossil fuels for rainy days. The paper focuses on an additional, until now, unrecognized capability. Solar thermal power plants can be designed in a way that the heating and storage capability of the plant is decoupled from the steam power plant, which is only a small fraction of the total cost. In any other present power plant, if one wants to operate only 3 hours or 12 hours a day, the capital investment will stay constant, and capital charges per kWh will increase proportionally. In a solar thermal power plant, the investment will decrease significantly and costs for intermediate loads, 12 hours a day, will be the same as for base loads. The capability to vary instantaneous loads by a factor of three will only increase investment by 30%, assuming net total production is kept constant. The same capability in conventional power

plants would triple the investment. The paper uses cost estimates based on an engineering study done for the National Research Council. Our paper shows that present solar thermal electricity is, for base load, more expensive than coal and nuclear power, but a clean coal power plant with sequestration of CO₂ is more expensive. This is important for planning now to reduce CO₂ emissions. Building several large plants and creating a market for mass production should make solar thermal plants competitive also for base loads. Such solar plants could replace up to 80% of our total energy needs. However, they also would allow the use of large amounts of solar cells and wind energy, which due to the lack of storage, require a controllable back up to provide a reliable electricity supply.

Our paper shows that a cost of 190 billion dollars a year our society could, in 30 years, replace 55% of fossil fuels and reduce CO₂ emissions by 60%. The cost will be competitive with all present clean technologies. The paper will also present a concept of an advanced national grid based on solar cells, wind, nuclear energy, and solar thermal energy in which the main role of solar thermal energy is to provide the required storage and to compensate for the variable energy output of solar cells and wind energy, and provide control capability for variations on demand.

For intermediate and variable loads, solar thermal energy built in proper locations is competitive today. And building several large plants will allow mass production of the collectors and further reduce costs. All solar thermal energy needs to demonstrate its capability is for the Government to subsidize a few large plants, just as it did for nuclear and clean coal.

And what our society needs is the will to do something for its long-range future.