

SOLAR ENERGY IN INDIA TODAY

How Excited Should We Be ?

(Dr. Paul Gregorios)

Solar energy is plentiful in India. No one has as yet taken a monopoly on it. There is no tendency even to hoard it for profiteering, at least in India today.

But solar electricity is certainly not cheap. Our hydel projects and our hydro-carbon burning electricity projects are all inefficient, and therefore incredibly high in production costs and seldom reliable. But can solar electricity compete in the market with hydro-electric or hydro-carbon electric power ? Certainly not now.

Non-electrical use of solar energy seems more suited to air and water heating purposes, but this is a priority only in cooler climates than ours. Of course some of our ITDC hotels and other establishments can certainly use solar energy in larger quantities for air and water heating and I am glad that the Qutab Hotel has already done some pioneering in this regard. Maintenance problems will hit even Qutab in due course if they have not already done so. But we may, let us hope, learn to overcome these. It may also have some potential in industry where sub-sixty temperatures are needed for air or water.

The question today is, however, how to make solar or any other form of energy available to the poor ? I have no panacea for solving this problem. But I do have a few convictions that I would like to share.

1. The Priority of Wood Energy. I would submit that, planning on the national scale in India today should give a higher priority to wood fuel than to solar energy, if the needs of the poor are to receive due consideration. This does not call for any great technological innovations, and for that reason it may not appeal to the planners. If there was one thing on which Sanjay Gandhi was right, that was about the need to plant more trees. It is all right to talk about Solar and Bio-mass, but neither of these is very likely to come within the practicality and affordability range of the poor man, at least until solar photo-voltaic

What prevents solar from so coming is a good question, the needs to be answered. But in the immediate future wood energy in plentiful supply at economic rates seems to be the best way to meet the needs of the poor.

The World Bank Report on Renewable Energy Sources in the Developing Countries (Jan, 1980) cites a review which states that "about 50 million hectares of trees would need to be planted in the developing countries between now and the year 2000, to satisfy the projected demand for fuelwood for cooking and heating in the year 2000", (p.24). This means a five-fold increase in present tree-planting rates - and in some areas like Africa a fifteen-fold increase. The World Bank thinks that this particular review is understanding the problem, being too optimistic about alternate forms of energy like biogas and kerosene becoming usable. The World Bank says then that it is planning only \$ 25 million loans for wood for the 5 year period 1981-85, which obviously will not meet the need - even if wood stoves become much more efficient and charcoal production techniques are improved.

The Bank estimated (in 1980) that they would have to increase their lending to more than twice their present plans, i.e. to lend \$ 1100 m for the 5 years 81-85, if the target is planting trees on one million hectares of land over that period. And the review estimates the need as fifty million hectares in 15 years !

But firewood prices are already sky-rocketing in India, and the poor certainly cannot afford to buy firewood at present market rates. Eric P. Richolm, in his article on "The Other Energy Crisis: Firewood" in Energy in the Developing World: The Real Energy Crisis^x tells us in West Africa (Niger and Upper Volta) firewood takes 20% to 30% of the average family's income - at least those families which can afford to buy any firewood at all. In Pakistan, poor people strip the bark off the trees that line the roads. Poaching for firewood is on the increase everywhere.

x Vaclav Smil and William E. Knowland (eds),
Oxford University Press, 1980

For too many poor people in India, dung patties, the only available alternative to wood fuel, are also becoming increasingly beyond their reach; even if they were within reach, cowdung is rich fertilizer, and it is a huge waste of its plant nutrients to burn it as fuel. The estimate is that 300 to 400 million tonnes of wet dung is dried to give 60 to 80 million tons of dry dung patties. Perhaps the fertilizer so wasted is about a third of our present chemical fertilizer production ! The only solution is to plant more trees so that cowdung is returned to the soil - as nutrient and not as ash.

Excessive use of bio-gas can also be an unusual strain on the cowdung cycle, which has to be maintained for the fertility of rural land.

2. The Economic of Solar Energy.

There are very few forms in which direct solar energy can be used on a small scale, with collector focussing. The solar cooker is still a curiosity in India. They say you can make one for Rs 100 to Rs 350/-. And that is, even if it were true, more than what many poor can afford. Besides, for families where the cooking has to be done in the evening after the bread winners return from wage labour, solar cookers are no use any way. And maintenance is also more of a headache than what many poor homes can manage.

The economics of solar energy for the poor, however, is more than merely a matter of cost and maintenance. Is solar energy likely, in the near future, to help the poor at all ? If direct solar is to be used mainly for water and space heating, the Indian poor would not be interested. If cookers cannot be used when the sun is not shining, they are also going to be of little use to the poor. Photovoltaic conversion also seems now beyond their budgets. Despite all claims that photovoltaic costs have been or are being drastically reduced, in most cases solar energy, supposed to be free, remains more expensive than many traditional technologies.

— in the over-all economics of solar energy the only major factor is its renewable character. The supply is unlikely to run out. There will be no scarcity of the energy source itself.

Even for the privileged 40% of our country above the poverty line, solar energy seems to have mainly ecological-educational value. In some of our northern climates, they may have some value for room and water heating purposes; but as far as I know, no simple technology has been developed for keeping a house air-conditioned - cool in hot weather and warm in cold weather. Middle class people do use hot water throughout the year, but solar heaters are still too technologically inelegant and economically unattractive.

Commercial use of solar energy also does not seem to offer much attraction. Of course solar energy is good for drying grains, fruits, vegetables, meat and fish, tobacco leaves etc; but whether they compare economically with alternate energies is still doubtful. Solar energy may be useful in places where electric energy is as yet unavailable, but this is only a short-term use.

3. Is Solar Energy worth the effort?

These observations lead to the question whether it is necessary or wise for the Government of India to invest large amounts today in Solar Energy research. I myself used to argue that if we had put the money and effort we have put since 1947 into nuclear energy, we might very well have been ahead of others in solar technologies. I do not so argue now. Our nuclear energy programme has been severely handicapped not only by factors of international politics, but also of infrastructure and of efficiency in management. Would our solar energy research programme have fared better? I doubt it.

Only on photovoltaic conversion technology I still retain a measure of hope that significant breakthroughs can be made. With the use of non-crystalline or amorphous silicon, costs may be considerably reduced; but we still see little chance of a reduction in flat-plate or reflector area. If it is going to continue to take about two square meters of photovoltaic cells to produce one kilowatt hour a day, any large scale commercial use of photovoltaic energy seems riddled with somewhat insuperable problems of space and raw materials.

I am told that the market price of PV cells has fallen, from about \$ 100/- per peak watt (under optimum conditions) in 1970, to about \$ 10/- by 1980. There is expectation of similar dramatic reductions in this decade, but I am not sure that those calculations have taken all the relevant factors into consideration.

The World Bank judgement in 1980 was that PV power will cost not less than 55 cents US^x per kilowatt hour under optimum conditions. Small conventional generators now produce dependable electricity at about 45 U.S cents per Kwh., and in the U.S.A. diesel generator power costs about 18 cents per kwh or less. These prices will keep going up, but the same factors will also affect PV power. It is unrealistic to hope that PV can compete in the market with hydropower or oil power, at least for some years to come.

4. Is Solar Energy ecologically problemless ?

The usual argument for solar is in terms of two environmental factors of great importance - depletion of resources and pollution of ecosphere. It is clear, however, that the harnessing of solar power requires the use of finite or non-renewable sources like collector materials or silicon. When solar power is used on massive scales, it may give rise to new shortage problems in non-renewable resources. Though not as serious as oil and gas depletion, it is still a problem, and the assumption that solar energy solves the problem of finite non-renewable energy sources may be pre-mature. The idea of earth-orbiting sun-tracking solar collectors with micro-wave transmission to earth stations remains still only an idea, but if it becomes realised, it may create quite considerable environmental problems.

x. At present the costs under optimum conditions averages about \$ 2.00 per kwh.

But even if the comparatively harmless earth-based collectors are used, as the scale increases, we may find that it does create environmental problems of an unanticipated kind. It is naive to assume, before sufficient experience, that solar energy is ecologically problemless

5. Conclusion

There are certain specific areas in which solar energy can be used, but I have the feeling that some of these areas are not priority areas for India today. I shall try to list some of the areas where solar could be used, also in India, hoping that others would add to the list.

1. In certain remote areas, like unelectrified villages, solar powered generators and solar distillers, could both be useful, if maintenance problems can be handled;
2. For telecommunications repeater stations, satellites, rockets, navigational buoys and beacons, remote monitoring equipment, etc.
3. For solar flat-plate driers - fruit, tobacco, fish, grains, timber, meats and vegetables, in situations where natural solar drying is hindered.
4. For more efficient greenhouses in cold climates
5. For space and water heating in cold and temperate climates
6. For low head photovoltaic water pumps for irrigation etc.
7. For solar cookers, refrigeration, and similar domestic appliances under certain conditions (camping outdoors, on ships etc)
8. For sub sixty temperature industrial use, where needed.

As far as we can see now, it will be unrealistic for our nation, in the light of the above facts to put anything more than a moderate amount of interest and money into solar energy. That moderate amount should however be soon forthcoming.

The main thing for us to watch is how we keep up with photo-voltaic technology that is changing every week. If we get into long-term contracts for technology which can become obsolete before the ink dries on the signed contract, we will be in trouble. Western industries will be jealously guarding the more viable technologies, and unless our own research institutions are run with greater efficiency and sincere enthusiasm, we will be at the mercy of the most exploitative and unfavourable terms for transfer of solar or P.V. technology. Here it is a question of more than money. What matters is efficient management of research and the combination of integrity with enthusiasm and creativity.

The west is excited about solar energy - for two reasons. First, there is a "myth of the solar", which they want to believe will redeem them from all their energy, resource depletion and environmental problems. In what seems to be a very dark future, "solar" means the light of hope. So let it be. The myth seems extremely unrealistic. The second reason is slightly sinitier. In a world where market economy capitalism seems to be foundering on the rock of an unreceding recession, the economy as a whole is desperately looking for new markets. The main possibilities now seem to be armaments, information technology and alternative energies. We should beware that we are not taken in by the myth of the solar, which may help mostly the greedy appetites of the profit-makers, while the poor will continue to languish in their misery.