'DE-FOSSILISING' INDIA

Time to Mainstream Renewable Energy

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India finally seems to be on the road to evolving a stable, viable and sustainable policy framework for accelerated growth of renewable sources of energy. Notwithstanding the continuing obsession at the highest levels of policy making with seemingly mega-solutions—be it nuclear or coal—a transition to a sustainable energy system seems to be emerging on the economic and political horizon. Mindsets of many continue to be fossilised and ossified. However, disparate forces—global pressures over climate change, grudging admissions of possible phase-out of fossil fuels in the not-too-distant future, consequent worries about energy security and autonomy, price volatility of fossil fuels and increasing difficulties in securitising their external supplies—have all combined to facilitate the beginnings of the emergence of an enabling framework for mainstreaming renewables in India. Our focus in this special feature is on some critical issues relating to renewable power generation. Due to limitations of space, we are unable to cover all issues in this respect or other vital areas like renewable transport. First, some myths prevailing even now about renewable power need to be demolished.

Renewable Energy (R.E.): The Real Mega Option

Despite the beginnings of a transition, there still prevails a feeling that renewables are 'peripheral' to India's future energy security. That is the reason for the continued focus on so-called conventional mega-options. Even a conservative assessment would show that renewables are the real and sustainable mega-option for future energy security. At the cost of repetition, I would like to reproduce a table published by us in earlier issues (placed below), showing a very conservative macro-estimate of the potential of renewables in India to provide grid-connected power, which is close to 7,00,000 MW!

Table: Grid-connected R.E. Potential in India: Estimate by WISE

Source	Capacity (MW)	Assumed PLF	Annual Energy Generation in billion kWh
Wind	1,00,000	25	219.0
Small Hydro	15,000	45	46.0
Bagasse	5000	60	26.3
Biomass	16,881	60	88.72
Large Hydro (existing & future)	1,00,000	60	525.6
Large Hydro in Bhutan	16,000	60	84.1
Waste to Energy	5000	60	26.28
*Solar CSP based Power Generation	2,00,000	35	613.2
Solar PV / CPV based power generation	2,00,000	20	350.4
Geothermal	10,000	80	70.1
Total	**6,62,881**		**2049.70**

Note: Resource potential of other R.E. sources including offshore, wind, wave, tidal, biogas-based power not considered.

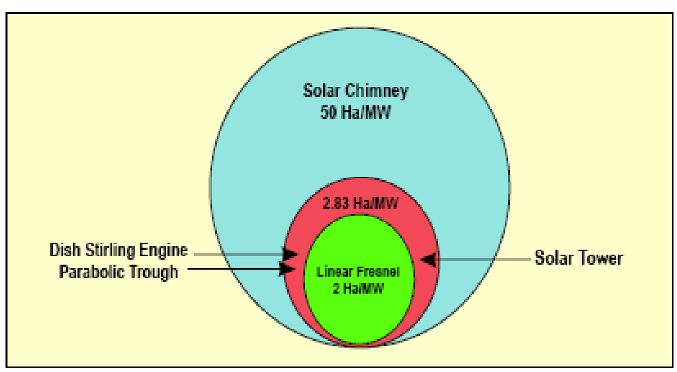
*India has a total desert area of 2,08,110 sq.km.

WISE has begun a project to make detailed state-wise assessment of R.E. potential, based on actual field research. Right now, the work is in its final stages in the three major states of Maharashtra, Karnataka and Rajasthan. This exercise is an eye-opener and shows that the potential would be much more than our erstwhile projection of seven lakh megawatts. Similarly, the potential for off-grid deployment of renewable technologies, of which numerous innovative options are under development, is as much or more. The article in this feature titled 'Micro-generation is Truly Macro' (Pg.30) is just a gateway to the massive potential of the off-grid sector. So it is time for us to realise the enormous potential of renewables and recognise them as the real mainstream option for the future.

Competitive Footprints

Another myth being perpetrated about renewables is that they require large tracts of land. This is probably true of currently commercialised biofuel technologies. As regards other renewables, the land requirements are competitive with conventional sources of power. For example, the following figure shows the land requirements for different concentrated solar thermal power (CSP) technologies.

Fig: CSP Technology Footprint Comparison



Most of the CSP projects will come up in barren desert land and there will be no serious problem of displacement of people or land alienation. Wind power requires about 10 acres of land per megawatt; in India, most of the windy areas are in degraded and unproductive or unarable hilly tracts wherein low-level vegetation can co-exist with wind turbines in areas other than the footprints of turbines and their infrastructure like roads and transmission lines. In windy sites located in the plains, like in many sites in Tamil Nadu, wind turbines co-exist with agriculture. Most of the grid and grid-interactive photovoltaic installations can and will come up on already existing rooftops. Other renewable sources like tidal or wave energy, geothermal energy, small-hydro and various types of biomass-based projects require much less land than conventional power projects.

Forgetting or obscuring all these ground realities, many people make naïve statements that renewable power projects require too much land and conventional projects require very little land. Even a person as erudite as James Lovelock (in his latest book 'The Vanishing Face of Gaia' reviewed on Pg.56) makes such a grave mistake when he writes that a 1 gigawatt coal or nuclear power station requires only 30 acres of land! He completely forgets the land required and devastated for mining of coal or uranium, for their storage, processing and transportation infrastructure, land for dumping sites for coal ash or for storage of nuclear waste, land destroyed by pollution from coal plants, land submerged by hydro-stations or diverted by their canals, etc. All these externalities of land diversion by conventional projects are conveniently forgotten while projecting renewables as land-intensive. When all these are considered, the footprint of renewable power projects are competitive with conventional projects.

The Myth of Infirmity

Power generation from renewable sources like geothermal, hydro or biomass are not intermittent. There is no denying the fact that solar and wind energy can be produced only when the sun is shining or the wind is blowing. But many technological options are emerging to solve this intermittency problem. First among them is the serious ongoing research into options for storing electricity. Electrical and thermal storage options suitable for different R.E. technologies are being developed. Some wind and solar projects using storage technologies have already been established. As R&D improves technology development in this area, costs will come down. An elaborate essay on this subject has been included in this feature (Pg.20). Other options to tackle intermittency like energy forecasting and establishment of smart grids have also been dealt with therein. Blind opposition to R.E., based on allegations of intermittency are also blind to the fact that a future grid with a variety of baseload and intermittent renewables can balance each other. This was amply demonstrated by a recent research study done by the University of Kassell in Germany which proved that a 100 percent renewable grid is both possible and feasible. It is also true that conventional projects also create intermittency and large disruption in grid stability when they suddenly stop generating for reasons of non-availability or shortage of fuel or other grid disruptions.

Subsidies, Costs and Financing

Yet another myth about conventional power is that they are not subsidised. WISE undertook a two-year research study covering 19 conventional projects from coal, gas and hydro sectors, which have been in operation for over 10 years, to find out the real extent of subsidies availed by them. The study revealed that many projects were subsidised to the extent of 150% of their capital cost. Besides, fossil fuels are subsidised across the board. The article titled 'End Conventional Power and Fuel Subsidies' in this feature (Pg.32) give brief details of these subsidies, thereby exploding the myth that renewables are the only energy technologies to be subsidised.

Higher initial cost of R.E. technologies is another widely discussed issue. Today, this is mostly true only in respect of different solar technologies. Technologies like wind power, biomass power, etc., are already commercially viable. All global studies available on the cost trajectory of various solar technologies predict that they will achieve grid parity between 2015–17. The game changers would be increased volumes and efficiencies. The impending plans for our National Solar Mission has taken into consideration these projections while planning a three-phased approach to solar energy development in India. Probably we are on the dot in launching the Mission. A detailed write-up on the Solar Mission is included in this feature, based on available information (Pg.34).

> Based on a conservative estimate, India has the potential to generate 7,00,000 MW grid-power from R.E. sources.

Besides efficiency improvements and larger volumes, innovative financing mechanisms can also play a significant role in bringing down the cost of R.E. projects. So we have included a detailed essay on the subject (Pg.47), indicating various demonstrated financial instruments, schemes and few new possibilities. Many global and Indian examples have been covered. Tremendous possibilities exist to unleash the power of Indian banks and financial institutions to facilitate the transition to a sustainable energy system. Such unleashing would have many positive and much needed fall-outs on the socio-economic front. Just to give an example, we have illustrated the potential of creation of millions of jobs through accelerated development of renewable energy (Pg.52). 'Green Jobs' are truly the next big employment destination!

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R.E. Policy Framework Now

India began its policy journey for grid-connected renewables with the tariff guidelines issued by the then Ministry of Non-Conventional Energy Sources (MNES, now MNRE) in 1993–94. The next stage came after the establishment of the state electricity regulatory commissions (SERCs). Supported by the enabling provisions in the Electricity Act, 2003, many SERCs began the process of determining preferential feed-in tariffs for grid-connected renewables. As of now, as many as 17 SERCs have announced feed-in tariffs for various renewable sources of power. Just to give an example, the tariff for wind power varies from Rs. 3.14 in Kerala to Rs.4.50 in Rajasthan. The details are given in the article titled, "Regulatory Interventions for Mainstreaming Renewables" in this feature (Pg.37) which also addresses some of the critical areas which need attention for further improvement. The recent CERC guidelines for R.E. determination is also seen as a major step forward (Pg.45).

The introduction of Renewable Purchase Obligation (RPO) beginning with Maharashtra in September 2004 was another significant development. Many other SERCs followed suit by introducing mandatory purchase obligations of green power by electricity utilities. They were called RPO or RPS (Renewable Purchase Specification or Renewable Portfolio Standard). Even though RPO/RPS orders may not have been absolute successes in the absence of penal provisions, introduction of the concept and its gradual acceptance was a major step forward. Many commissions have also gradually upgraded the systems to full-fledged RPS schemes, some even going for segmented RPS to specify technology-wise obligations. Considerable refinement of the RPS mechanism in Indian states is required, especially with the impending announcement of the National Solar Mission targets.

> It is a myth that only renewables are subsidised. A two-year research study by WISE showed that conventional power is also heavily subsidised.

Thus, though not by design, the beginnings of R.E. regulatory framework evolved as an amalgam of the European system of feed-in tariffs and the U.S. system of RPS schemes. Certain enabling provisions in the Electricity Act, 2003, did play a role in the evolution of the framework. To achieve the 15% R.E. generation target for 2020 set by the National Action Plan on Climate Change, WISE's calculations show that India will have to have an installed capacity of 1,25,000 MW of grid-connected generation from different R.E. sources by 2020. Achieving this is a monumental task and the policy and regulatory framework will have to be significantly upgraded.

Outlook for the Future

All the pieces of the policy and regulatory jigsaw puzzle have to fall in place, if we have to mainstream renewables. Feed-in tariffs, RPS, innovative financing schemes and instruments, clean energy funds, generation-based incentives, tradable renewable energy certificates, schemes for risk absorption of technology innovation, time-bound R&D initiatives, material recycling and sustainability programmes, massive human resource development initiatives, country-wide capacity building programmes, legislation for addressing climate issues along with time-bound R.E. development and for establishing the National Solar Authority, etc., all have to coalesce into a viable, workable, and stable policy framework. Going beyond electricity generation, transmission and distribution, an umbrella legislation to cover the major issues ignored in the Electricity Act, 2003, and addressing the holistic and sustainable energy management would be needed. Besides these, macro-economic policy changes like shifting of taxes and subsidies, pricing of carbon, etc., to promote environmentally benign economic activities would be required. Equally important is across-the-board awareness generation and structural changes in governments and institutions. It is time to do all these; climate change or no climate change, our future energy security, energy autonomy, equitable access to energy for all sections of our population and our ability to sustain economic development, are all dependant on how fast we are able to transition to a sustainable energy economy by mainstreaming new and renewable sources of energy. We need to 'de-fossilise' our mindsets and our economy.