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POLITICAL ECONOMY OF ALTERNATIVE ENERGY

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Energy made the present Industrial Civilisation tick for the past two centuries. It made enormous changes in the manner societies are organised and people live. It also thrived on the false assumption that commercial energy shall last for ever—it will be produced as along as people demanded and paid for it. It was also believed that infallibility of human ingenuity. It has and continued to cost enormous to the environment, both by way of exploitation of sources as well as residue from the production process.

Whereas the inalienable connection between per capita energy consumption and per capita GDP is a well established fact, it has also been conclusively argued by Goldemberg, Johansson and Reddy et al (1985)[1] that it is possible to achieve higher economic growth (by the developing countries) with efficient use of alternative and conventional energy resources, a level of development equivalent to that achieved by Western Europe in early seventies. They also argued for reaching greater efficiency in developing the end-use strategy, i.e., at the level of consumption efficiency than a strategy that has been overwhelmingly weighed in favour of supply (production) of commercial energy.

The concept of an alternative technology, and therefore, an alternative energy was first elaborated by Schumacher

(1973)[2]. This came about both as a reaction to the Club of Rome study[3] that argued for a Zero Growth Strategy, and thereby to seal the fate of the third world and partly due to his deep-seated convictions and mistrusts on modern industrialism and technological advances emanating from it. His argument for an alternative technology emerged from providing a *technology with a human face* (italics added).[4] This is because the modern technology, thrown upon by industrialism has culminated in three crisis for man, *psychological, environmental, and of conventional fossil energy.*[5]

What did he really mean by this alternative technology as an alternative, in practical terms?[6]

- (a) He certainly meant the scale involving the technology, i.e., reducing the gigantic, impersonal and often violence of modern technology, like the Helenics, to a *human scale*. This by no means is easy. Many types of manufacturing processes operate under conditions of increasing returns to scale, i.e., taking into account the direct costs. Environmental costs (social costs) are rarely if not entirely part of the project analysis. By inclusion of such costs, there may not be actually any increasing returns operating for such processes—the reverse may be true.[7] On the other hand, alterantive technology means miniaturisation of production processes that involve greater technical sophistication, application and ingenuity. There is little environmental damage costs and therefore true operation of IRS, in the long run.

- (b) A reduced scale of manufacturing would necessarily mean decentralisation of social organisation of production as well as de-localisation (de-concentration) of production and distribution. This may entail a whole new way that societies may have to organise themselves, new institutions and management systems.

- (c) The technologies thus promoted ought to achieve economic efficiency, i.e., high productivity—low factor use, low cost, but of high quality standard to be competitive with existing large-scale technologies.
- (d) The technology must be energy efficient, i.e., energy consumption per unit of production should be reduced in comparison to existing technologies.
- (e) Technology development need not be only supply oriented, but also to be end-use oriented—the lesser the consumption to get the same unit of out-put/utility, the greater will be saving in resources as well as the reduction in environmental damage costs.

The important fact is he believed that all the above is possible with the existing knowledge base—we ought to change the way we look at our civilisational achievements and get overtly satisfied with them. This line of thinking is also confirmed by Goldemberg et al.[8]

Why then such technologies and ideas connected with them have not really taken off? Michael Tanzier (1974) in his monumental work provided an explanation.[9] It is the power, money and authority that gigantic energy utilities enjoy under the present dispensations that is the root of their avowed reluctance in either promoting or supporting alternative technologies that may question the very logic their of existence. The initial impetus received after the first oil shock of 1973 on energy conservation, primarily in many European nations have somewhat waned in recent decade due to continuous decline in world oil prices—to a level of less than 30 per cent in real terms. It ought to be seen that the conservation measures promoted in European nations and end-use strategies employed have led to only 2-3 percent annual growth in oil demand whereas the economies have grown steadily at 4-5 per cent during the same period.

Choice of Technology

In broad economics terms the choice of technology between the conventional and alternative technologies of energy production may depend on, C_f, Fixed Costs (that include fixed capital like site and equipments, C_{fe} and Technology Development/Transfer Costs, C_{ft}), C_v, Variable Costs (that include input Costs, C_{vi} and Labour Costs, C_{vl}). There may also be the indirect costs of environmental damage caused by production of energy and an optional cost (future costs[10]) which could be put as C_n. Thus, total cost of energy.

$$C_e = C_f + C_v + C_n$$

$$= C_{fe} + C_{ft} + C_{vi} + C_{vl} + C_n$$

In terms of conventional energy like fossil based, hydro-power or nuclear, the technology related costs are minimal, since the technologies are well known (with some exception for nuclear energy sector) and could be treated as Zero. But, the environmental costs are enormous with an increasing function of scale. Thus, C_e for conventional energy could be re-written:

$$C_{ec} = C_{fe} + C_{vi} + C_{vl} + C_n$$

Where C_{ec} is the total cost of conventional energy.

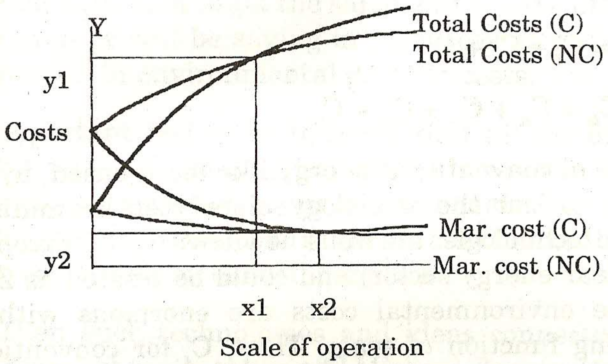
In regard to non-conventional/alternative energy like solar radiation, wind-power, wave/tidal or even, biological sources, the technologies need to be developed or the technologies available have low efficiency and therefore need upgradation and thus, at relatively high cost of development. The initial equipment cost per unit of output is also higher than the conventional sources.[11] On the other hand, the variable costs are minimal or nearly Zero. Similarly, the environmental cost is near zero or zero. Thus, the total production cost of non-conventional/

alternative energy C_{en}, can be re-written,

$$C_{en} = C_{fe} + C_{ft}$$

For making a decision about a choice of technology, one must get some idea about their long term total and marginal costs with the scale economy as given in Fig. 1.

Fig. 1: Total and marginal cost curves of conventional and alternative energy production



As can be seen from the diagram, for conventional energy the total cost curve starts from a lower intercept value compared to the alternative/non-conventional energies but over a larger scale of operation, the total costs of the latter will flatten out, intersecting the TCec due to economies of scale accounted by both direct and indirect (environmental) costs—thus, determining at what total costs the latter becomes competitive vis-a-vis the former. The marginal cost curves have negative slopes. They decline at rates commensurate with the rate of decline in total costs curve that generally would increase at a decreasing rate. On the other hand, increase in scale of operation in alternative energy projects would lead to changes in the intercept value upwards but the variable costs (inputs plus maintenance costs) would nearly remain constant whereas in case of conventional energy production both fixed costs as well as the variable costs would increase, though there may be some scale economy. A decision on the choice of the type of project would depend on the detailed cost structures as well as the type of conventional or non-conventional energy projects envisaged. A general position however remains valid—that in the long run, non-conventional energy projects would be cheaper though the initials fixed costs per unit of output may be more.

It may, however be noted that compared to the conventional energy production, the meaning of scale in case of the non-conventional is somewhat nebulous, in the sense by very character NCE is small scale, decentralised. Scale here would mean the aggregate in the national economy and the production of technology and manufacture of fixed assets however, would enjoy the scale ecnomy in the conventional meaning of the term. However, both development of technology as well as manufacture of equipments (fixed assets) would depend to a large extent on the private enterprise, though lately many governments including Government of India actively encourage such technology and their promotion, through subsidies and fiscal incentives. In this regard it may be noted that globablly, among the various non-conventional energy resources, wind energy has received commercial acceptance and many countries, India being in the forefront have gone for large-scale exploitation of wind-power at a commercial scale.

The problem also lies with the nature of alternative energy itself—it is land intensive with stronger geographical undertones. Wind-power is specific to geographical location—closeness to seas. Solar energy has specific advantage in regards to tropical countries and the duration and quantum of insolation—again location specific. Bio-energy favours the humid tropics. Tidal/wave energy by very nature is oceanic. Generally, the poor nations of the tropics have a comparative advantages.[12] But they have little capital to invest in either development of technology or manufacture of productive equipments. People are also too poor to bear the initial costs of installation, since these require widespread individualised installations to achieve economies of scale at the level of the national economy.

The greatest debilitating factor, however is that many tropical countries are densely populated with large sections of the population without any land (landless), as in India and Bangladesh. Therefore harnessing environmental resources like sunshine or wind that hinges on having land also inhibits its large-scale use. It could further aggravate the income distribution between those owning land and the landless. How could the poor, high density countries address this problem.? Compared to commercial alternative energy production technologies known, the efficacy of biological means are more efficient—plants convert the solar energy much more efficiently than any solar voltaic invented till today. Plants also create in the process of bio-mass production, resources like nutrients for soil and other direct and indirect environmental benefits accruing to the society. Strangely this simple wisdom and traditional knowledge base is even argued for by the alternative technology minded. However, this also hinges on the land question. It has been elsewhere[13] argued that the enormous wastelands that many of these countries have generated and often left at the disposal of the forest departments could be put to good use by leasing them to cooperatives of the landless on economic terms with backing of enterprise norms. The experiments of wasteland development through social forestry schemes, JFM systems and governments' departmental efforts are nonstarters as seen in India.

There is also the competing uses that land can be subjected to—food and other agricultural produce or energy? The subsidies and fiscal incentives though are effective instruments may further accentuate the income and asset distribution, since those having land can take benefit of such public largesse. In a future scenario of conventional energy prices, when if goes up, may actually lead to greater popularity of the alternative energy technology but this also would raise questions on land distribution and the already shelved land reforms programme in the country.

References

1. Goldemberg, J. Johansson, TB, Reddy, AKN and Williams, RH (1985), "An End-Use Oriented Global Energy Strategy", *Annual Review of Energy* (10), pp. 613-688. One major focus of arguement was a change in energy strategy from supply (production) orientation to improvements in technology and efficiency at the end-use of commercial energy. This has been buttressed by the experience of OECD countries in 1970s in response to the First Oil Shock of 1973 (ibid, p. 683).

2. Schumacher, EF (1973), *Small is Beautiful,* Blond and Briggs Ltd., London. (First Indian reprint in 1977 by Radha Krishna, New Delhi).

3. Meadows, D.L. and D. Meadows (1973): *The Limits to Growth,* London.

4. Schumacher said, "Technology recognises no self-limiting principle—in terms, for instance, of size, speed, or violence. It therefore does not possess the virtues of being self-balancing, self-adjusting and self-cleansing." *Ibid,* pp. 136-37.

5. He said, "... human nature revolts against inhuman technological, organisational, and politcal patterns, which experiences as suffocating and debilitating; second, the living environment which supplorts human lifes aches and groans and gives signs of partial breakdown; and, third, it is clear to anyone fully knowledgeable in the subject matter that the inroads being made into world's non-renewable resources, particularly those of fossil fuels, are such that serious bottlenecks and virtual exhaustion loom ahead in the quite foreseeable future." *Ibid.,* p. 137.

6. This is not entirely as Schumacher elaborated but as these ideas have evolved over time, including those promoted by Schumacher's Alternative Technology Group, UK.

7. Anil Makandya (1996), "Environmental Control Costs, Policy Options, Instruments and Abatements", *Report prepared for ADB,* Manila (Unpublished draft 2, limited circulation).

8. Goldemberg, J et al (1985), op. cit., pp. 681-84.

9. Tanzier, M (1974), *The Political Economy of Oil,* London.

10. Option cost is the (indirect) cost differential between the present damage cost and the future costs of such damage that may not be fully known at this stage.

11. For example by using proven solar technology, production of one MW of commercial energy may cost upwards $3 million (roughly Rs. 12 crores)—this compared to $1 million in case of most of the conventional energy systems. The conventional solar cell technology can harness about 8-10 percent of unit areas of solar flux. By improving the efficiency of the

cell to 20 per cent the unit cost of equipments can be brought down to a level of 50% or roughly, Rs. 6 crores per MW.

12. In a recent paper, J.L. Gallup and J. Sachs (1998), "Geography and Economic Growth", The World Bank *Animal Conference on Development Economics,* Washington DC, April 20-21 have emphasised the importance of locations and geographical comparative advantages that have shaped the process of world economic growth in recent decades.

13. A.C. Mohapatra (1997), "Traditional Rights and Community Participation in Forest Management in India's North-East", *Himalayan Paryavaran,* Vol. 5, pp. 35-36.