ENERGY TECHNOLOGIES, CLIMATE CHANGE AND SUSTAINABLE DEVELOPMENT [a]

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Discussions of energy technologies follow two distinct trends. Either, the goal is greenhouse gas abatement or prevention/minimization of climate change. Accordingly, the maximization of centralized and decentralized renewable energy technologies (RETs) and/or efficiency improvements (EIs) becomes the objective function. RETs and EIs become ends in themselves. The playing field has to be distorted to favour these technologies. And there can even be Ministries/ Departments for Non-Conventional Energy Sources -- as in the case of India. Or, if sustainable development (***Sudevelopment***[c]) is pursued as the goal, climate change becomes a vital but ***subsidiary*** concern. Roughly speaking, climate change is a preoccupation of the industrialized countries, and sudevelopment a priority of the developing countries. Here, the discussion will be based on sudevelopment as the goal.

This goal of sustainable development implies several criteria including climate. In particular, sudevelopment implies economic efficiency, equity/ access (particularly for the poor, women and rural areas), empowerment/self-reliance, environmental soundness and peace.

Energy technologies are only instruments to achieve socio-economic goals. Like all instruments, energy technologies must be appropriately designed and effectively wielded. If energy technologies advance the goal of sudevelopment, then these technologies are elevated to the status of ***sustainable energy technologies*** (SETs). SETs include "cleaner" conventional energy technologies (for example, the next generation of fossil-fuel-using technologies including "clean" coal technologies), centralized and decentralized renewable energy technologies (RETs), and efficiency improvements (EIs).

Every RET and every EI does not ***ipso facto*** ensure Sudevelopment and become a SET. If, for instance, a RET or an EI is economically unviable, restricts equity/access (particularly for the poor, women and rural areas), and disempowers people, it may have a beneficial impact on the climate, but it impedes sudevelopment. Thus, RETs and EIs must qualify as SETs by finding a rightful place in national energy policies that are compatible with the goal of Sudevelopment.

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[c] In Sanskrit, the ancient Indian language, the prefix "SU" stands for "Good"; hence, "Sudevelopment" means "Good Development".

This paper is devoted to describing how energy technologies qualify for inclusion in the set of national energy policies and become SETs.

The achievement of Sudevelopment must take into account important (global and national) trends and constraints. The main trends are globalization, marketization, democratization, corporatization (of utilities) and changes in external funding (both with respect to the magnitude and sources of this funding).

The crucial constraints are the declining availability of capital (internally from governments and externally from Official Development Assistance) and the cut-backs in government spending.

The trends and constraints lead to a set of considerations that sustainable energy strategies must take into account:

- a focus on energy services (rather than mere energy consumption) particularly for the satisfaction of basic needs;
- ensuring access to modern energy services for all (implying an obligation to serve);
- the establishment and maintenance of a level playing field (elimination of permanent subsidies and reflection of external (social and environmental) costs in pricing);
- the promotion and safeguarding of competition within the mix;
- utilizing a rationally derived mix of SETs or "cleaner" centralized sources (not only the conventional sources but also the next generation of fossil-fuel-using technologies), centralized and decentralized renewable sources, and efficiency improvements.
- indigenous capacity building (with full use of information technology);
- a role for the private sector;
- a role for stake-holders outside the private sector (environmentalists, current and potential consumers, etc.); and
- utilization of measures (including technological advances and innovative financing) that are low-cost or no-cost to the treasury.

In addition, it must be recognized that, unlike conventional centralized energy sources, most RETs and EIs have not yet matured. And, since their costs are declining because of technological advances and organizational learning, they must not be compared on the basis of their current costs. Their place in the mix must be determined on the basis of their future costs after technological advances and organizational learning. It follows that special policies for RETs and EIs must be put into place and implemented

- to ensure that the future costs of RETs and EIs are taken into account when they are compared with conventional energy technologies, and
- to promote technological advances and organizational learning. If subsidies are used as a policy instrument, they must be time-bound (and not a permanent crutch) and they must be justified on the basis that they are promoting technological advances and organizational learning.

However well-crafted the generic energy strategies, they will not succeed unless the barriers that they face are identified and specific policies designed to overcome them. In general, there are barriers to SETs (particularly RETs and EIs) earning a rightful place in national energy policies -- barriers to least-cost mixes, barriers to future costing, barriers to technological development and organizational learning.

In particular, there is a market sub-set of barriers to new SETs:

- subsidies (open and hidden) to conventional energy particularly to fossil fuels;
- market prices that do not reflect environmental costs and damage (air pollution affecting human health, land degradation, acidification of soils and waters, and climate change) and mask the striking environmental advantages of the new and cleaner energy options;
- limited access to information;
- first cost sensitivity (where decisions are based on initial, rather than life- cycle, costs);
- split incentives or the common "landlord-tenant" problem (whereby the landlord has no incentive to invest in energy efficiency because it is the tenant who pays the fuel bills);
- indifference to energy costs (because they are often a small fraction of total costs) leading to limited attention to alternative energy options.

Another sub-set of barriers consists of non-market barriers including

- the supply-biased paradigm;
- vested interests (in the private and public sector, which benefit from business-as-usual approaches and practices and, therefore, resist change);
- and institutional obstacles (include the monopoly position of utilities and the lack of appropriate fora and rules for interaction between relevant organizations).

Within an appropriate framework, energy companies, investors, consumers, and civil society can all take on contributing and mutually reinforcing roles to meet the goals of sustainable development through a public sector led reorientation to make energy an instrument of sustainable development.

Thus, the integration of sustainable development into national energy policies involves a conceptual scheme presented in Figure 1.

The future may be difficult, but the present cannot be sustained.

Figure 1: Scheme for integrating sustainable energy technologies (SETs) and sustainable development