BACKGROUND AND MAIN INTEREST

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1. Background

- After 18 years as a physical chemist specializing in electrochemistry, my interests turned in 1974 to the application of science and technology to rural areas and in particular to energy. Since then, I have had the privilege and the fortune of working on energy problems at the village, city, state, country and global levels.

- The global energy work was done with Jose Goldemberg, Thomas Johansson and Robert Williams. This was a unique collaboration of four individuals from four continents – South America, Europe, North America and Asia. Without an institutional umbrella, the collaborators created a "virtual institution" long before the opportunities presented by modern information technology. The diversity created by differences in expertise and perceptions was complemented by the unity of perspective and values.

- To what is often referred to as "the Gang of Four", energy was not an end in itself, but an instrument of need-oriented, self-reliant and environmentally sound development, i.e., what has now come to be known as sustainable development. End-use-oriented. Energy not the only problem. a compatible solution.

2. My contribution and initial areas of interest

- My concerns were focused on people apart from hardware, and the human dimension apart from the technical fix, strengthening endogenous self-reliance, energy alleviating, if not eradicating, poverty, the special problems of energy in the dual societies of developing countries with their islands of affluence amidst their vast expanses of poverty particularly in rural areas. innovation

3. Changes in Interest

- However creative or brilliant the energy solutions proposed, there are ***barriers*** at all levels -- at the international, government, utility, equipment manufacturer/distributor and consumer levels. The challenge therefore is to develop a multi-level and multi-target strategy with simultaneous advocacy and action at all levels addressed not only to decision-makers in government, but also to politicians, utilities, different categories of consumers, the media, and civil society.

- The top-down approach of international organizations and governments is necessary, but not sufficient. These organizations and their bureaucracies are in fact the custodians and propagators of obsolete paradigms -- they are the problem rather than

the solution. Paradigm-shifts definitely require the bottom-up pressure from civil society.

- Apart from technology generation and demonstration, what is essential is ***technology dissemination***, which is totally different "ball-game".

- Since not only technology but also economics, financing, management, training, institutions, etc., are essential, it is important to have complete hardware plus software implementation packages to guide the dissemination and replication of technology. Quite clearly therefore the evolution has to be from hardware to software to systems integration.

- If the interest is not only in analysis but also in implementation, the entire gamut of activities from information, training, analysis, advocacy and action assumes importance. A crucial part of action is going from prototypes to products in the economy, i.e., ***commercialization***.

- Energy measures require the establishment and functioning of ***institutions***, which consist of a combination of ***rules*** or ***customs*** and ***forums*** or ***organizations*** through which the concerned individuals or groups interact. Institutions become ***sustainable*** only if they are relevant, excellent, accountable, self-governing and financially self-reliant.

- The last decade of the 20th century was dominated by liberalization, privatization and globalization (LPG) and important energy institutions such as electricity utilities became the subjects of reform and regulation. In the associated marketization, the challenge of protecting public benefits that are likely to be jettisoned by the market assumed importance.

4. **Wishes for the Future**

- Another important challenge is to reduce, if not eliminate, the crucial coupling between energy consumption on the one hand and economic growth (GDP), materials use and emissions on the other.

- This decoupling/dematerialization/decarbonization must lead to convergence in energy consumption, materials use and emissions between the industrialized and developing countries -- the present disparities are unsustainable and a root cause of international conflicts.

- In the past, it was assumed/argued that energy problems can be solved without changes in life-styles in the industrialized countries. Is this position tenable? Perhaps as Mahatma Gandhi said: "The world has enough for everyone's need, but not for every man's greed!"

- Another crucial challenge is universal access to affordable modern energy services, particularly in developing countries and especially for the poor, women and the elderly.

- The immense possibilities of information technology have to be harnessed to enhance the capability of energy becoming an instrument of sustainable development.

- The optimum scale of energy systems varies with energy source and service and with energy supply and end-use. If "optimum is beautiful", there should be a mix of centralized and decentralized systems.

- The scope for people's participation will increase with decentralized systems particularly in rural areas. Decentralization of electrical power will facilitate decentralization of political power.

- Rural energy systems must be modernized with a significant enhancement of energy services leading to dramatic improvement of the quality of life and the indicators of human development.

- Southern and women energy analysts must increase in number and stature so that energy analysis will cease to be an exercise concentrated in the North and dominated by men.

- If the 20th Century was the century of economic growth, the challenge is to make the 21st Century, the century of sustainable development -- economically efficient, equitable, self-reliant and environmentally sound economic growth. Then, energy will acquire a human face.

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- The fundamental energy challenge for the new millenium is to develop an inspiring vision. This vision must consist of not only a universal paradigm but also locale-specific programs and projects involving realistic and small measures. The measures must include short-gestation quick-yielding projects that deliver outputs within the time-horizon of five years or the next election. Assured of this political return, most politicians and decision-makers will be prepared to support long-term visions.

- Abandoning command-and-control approaches involves turning to the ***market*** as an allocator of money, manpower and materials. The market, however, has both ***power and limits***. In particular, the market cannot be entrusted to deal with issues of equity (and access), empowerment and the environment. Whereas the market can ensure economic growth, it cannot ensure ***sustainable development***.