PRESENTATION TO THE ROCKEFELLER FOUNDATION TRUSTEES MEETING (SEPTEMBER 14, 1992)

1. International Energy Initiative: Energy is of critical importance to development, global climate, national and regional environmental protection, balance of payments, economic growth and peace. Energy, therefore, is central to current concerns about sustainable development and environment. In fact, the efficient production and use of energy is essential to tackling these concerns and defining a path to a sustainable development based on equity, environmental soundness and economic efficiency.

The International Energy Initiative (IEI) is a newly established organization solely devoted to accelerating the implementation of the efficient production and use of energy. IEI is a Southern-conceived, Southern-led, South-North partnership -- a small and independent public-purpose non-governmental organization that networks existing institutions and groups instead of creating new institutions.

IEI was set up to deal with the predicament in which the energy systems of developing countries.

2. Crises facing the Energy Systems of Developing Countries: If a crisis is defined as a situation that does not permit continuation of old patterns of behavior, then the energy systems of developing countries are trapped in three crises.

- the capital crisis, because the capital requirements of the energy systems are three to five times more than what can be provided by the suppliers of capital -- this unbridgeable gap first highlighted at the level of the whole developing world by the World Bank in 1989 also exists at the country level and within countries at the state level. In India, the energy sector has been compared to the demon, Bakasura, of Indian mythology who had an insatiable appetite and however much he was fed, wanted more.

- the equity crisis because even though energy systems are expanded in the name of development, they bypass the poor -- for example, in my state of Karnataka in south India, half the population does not benefit directly from the electricity system primarily because of unelectrified homes in electrified villages.

- the environmental crisis involving local impacts -- submergence of forests from hydroelectric projects,

acid rain and other forms of atmospheric pollution from thermal power projects and vehicle use, and radiation hazards from nuclear power plants -- and global impacts through rising concentrations of greenhouse gases in the atmosphere, which have raised the specter of global warming. Though developing countries have contributed very little to the present high levels of greenhouse gases in the atmosphere, the current growth rates of their emissions extrapolate to dangerous levels in the atmosphere and threaten the industrialized countries. So, even though the industrialized countries are overwhelmingly responsible for the deterioration of the global atmosphere, they are pressurizing the developing countries to cut their emissions and are asking for environmental measures as quid pro quo for capital. This link between the capital and environmental crises of the energy crisis may be unfair, but it is realpolitik. It is interpreted by developing countries as a conflict between environmental protection and the advancement of development.

3. Origin of the Crises: In the ultimate analysis, the crises threatening the energy systems of developing countries and the environment-development conflict stems from the conventional energy paradigm or mind-set determining the thinking of energy decision-makers. This mind-set is based on the so-called energy-GDP correlation according to which GDP increases can only be achieved by increases in energy consumption. In this paradigm, the magnitude of energy consumption becomes the indicator of development. And once projections are made of energy requirements in the future, the attention shifts to increasing supplies to meet the energy requirement.

4. The Way out: The way out of the crisis is through a new paradigm for energy in which it is recognized that what human beings and their individual and collective activities require is not energy per se but the work that energy performs and the services that energy provides: illumination, warmth, "coolth" (to coin a word), mobility, etc. In this approach, development requires, particularly for the poor, a substantial increase of energy services but such increases can be achieved not only by increasing the supply of energy to the devices (lamps, heaters, air conditioners, vehicles, appliances, etc) but also by increasing their efficiency. It is such increases of services through efficiency improvements that led to the decoupling of GDP from energy consumption -- growth of GDP associated with

decreases of energy consumption -- that characterized the economies of many OECD countries particularly Japan during the 1980s.

Efficiency improvements have associated costs but very often the costs of saving energy are only one-third to one-half the costs of generation. Nevertheless, the costs of saving energy must be carefully compared with the costs of producing energy. Also, the magnitude of energy that can be saved must be taken into account. All this means that it is necessary to identify a least-cost mix of saving and generation options for energy.

5. The New Challenge: Thus, the new challenge to the energy systems of developing countries is to reduce the coupling between GDP growth and energy consumption by identifying and implementing a least-cost mix of saving and generation options for increasing energy services particularly for the poor. Energy, therefore, must acquire a human face and become an instrument of development. Energy planning must acquire a development focus and an end-use orientation directed towards energy services. Energy for whom? energy for what? Energy how (efficiently)? become central questions in the new approach. What is required, therefore, is a new paradigm for energy -- a development-focussed end-use-oriented service-directed or DEFENDUS paradigm to defend us against the crises.

6. Karnataka DEFENDUS Electricity Scenario: Let me now describe a concrete example of a DEFENDUS scenario for electricity.

In 1987, a committee for the Long-Range Planning of Power Projects (LRPPP) set up by the government of Karnataka State in South India (19 million hectares and home to 37.1 million people) projected that the state would require a six-fold increase in electric supplies by the year 2000 from the 1986 consumption of 7.5 terawatt (billion kilowatt) hours of electricity and the 1986 installed capacity to 2500 megawatts. This six-fold increase to 47.5 terawatt hours of electricity and an installed capacity to 9400 megawatts required the construction of a 1000 MW super-thermal plant and 2470 MW of nuclear power facilities. The infrastructure also had to be expanded by constructing transmission lines, new rail facilities, etc. The bill for this projected increase in supply was an annual carrying cost of $3.3 billion which could be achieved only by spending more than 25% of state's budget and expected borrowing from the central government and international sources.

Despite this investment and expansion of supply, the committee was frank enough to warn that energy shortages would not be eliminated; shortages would continue into the next century, with little hope thereafter. In fact, that would be an appropriate epitaph for the conventional paradigm.

In response to the LRPPP projection, a DEFENDUS scenario was constructed with a different focus than just increasing supplies

- focus on development through the electrification of homes and a shift to non-energy-intensive employment-generating industries
- focus on end-use efficiency through efficiency improvements, replacement of electricity with other heat sources and load management
- focus on augmenting electricity supply through the reduction of transmission losses, implementation of cogeneration in sugar factories, use of non-conventional sources and decentralized electricity generation at the village level.

This alternative scenario which resulted in the shelving of the LRPPP projection requires far less increase of supply -- only about 40% of the electricity and installed capacity (17.9 terawatt hours of electricity and an installed capacity of 4000 megawatts. Since the requirements of electricity and installed capacity are only about 40% of those in the conventional LRPPP projection, the annual carrying cost of the DEFENDUS scenario is only $618 million, i.e., one-third. Further, since centralized generation with its long gestation times has been reduced, the gestation time of the DEFENDUS scenario is significantly less. Finally, since the efficiency improvements, electricity substitution measures and decentralized sources are cleaner, the environmental impacts of the alternative scenario are much less.

Champions of efficiency and renewables have been arguing for the past decade or so that alternative scenarios are much quicker, cheaper and environmentally sounder than the conventional plans. But their recommendations have been ignored because they have been based on emotional pleas and hand-waving arguments. Now the situation is different. The mix of efficiency, renewables and clean centralized sources constituting the DEFENDUS scenario is the result of rigorous quantitative

exercises which have survived presentations at local, national and international fora. The scenario is so attractive that one would think that the energy establishment of Karnataka would have seized upon it with alacrity. Indeed, in September 1990, Karnataka's energy decision-makers expressed deep interest in the DEFENDUS scenario particularly with the interest shown by the World Bank FINESSE program and Swedish SIDA. The result was that the LRPPP Committee Report was quietly dropped.

Unfortunately, in October 1990, a new government came to power resulting in a completely new set of officials replacing the set that was interested in the DEFENDUS scenario. The proponents of DEFENDUS scenario have not yet succeeded in interesting the new energy establishment in Karnataka despite the attention paid to the scenario in influential national journals, The new Government has instead tried to attract foreign private capital to invest in Karnataka in the expansion of power supplies. The problem, however, is that foreign investors would like to be sure of adequate returns on capital which can only be guaranteed by tariff increases that the government is reluctant to implement. Nevertheless, the government seems to be still hoping that the centralized supply increase option is still available and as long as that is the case, the exploration of efficiency improvements and renewables will have to struggle to get on the agenda. But, the state electricity utility is in a severe financial mess and the state's and the center's finances are also in trouble -- hence, the supply options will soon run out. And, when that happens, the door will have to be opened to the DEFENDUS scenario.

7. Zimbabwe Energy Efficiency Program: This is apparently what happened in Zimbabwe where a serious energy shortage has arisen along with the evaporation of options for expanding supply. The Zimbabwe Ministry of Transport and Energy has been forced therefore to turn to energy efficiency by requesting the Rockefeller Foundation to explore the potential for an electrical energy efficiency program in Zimbabwe. The Rockefeller Foundation responded in April 1992 by requesting the International Energy Initiative (IEI) to lead a mission consisting of the Biomass Users Network and the Conservation Law Foundation.

With a population of 9 million, Zimbabwe currently has 2371 MW of installed-cum-imported capacity. Of this, 28% came from the Kariba hydroelectric dam, and until the Spring of 1992, 15% by way of imports from Zambia. Zimbabwe is currently

experiencing a 300 MW energy deficit per day, resulting in an estimated loss of industrial production of US$6 million per month, and the situation is expected to worsen significantly as a result of the drought and the stoppage of power generation from the Kariba dam. This current deficit is combined with projected future growth in electricity demand that will exceed the country's existing and planned generation capacity. To meet projected demands of 4.5% annual GDP growth, investment in the electricity energy sector, 1990-2010, is estimated to be about US$3.7 billion. Industry and mining currently utilize about 65% of Zimbabwe's electricity consumption, with motor drive systems accounting for more than 60% of this consumption.

The Foundation-supported team prepared a report on the findings of the mission and made recommendations for a comprehensive program and an action plan which addressed four priority areas: industrial efficiency; motor efficiency standards; efficient motor rewind practices and increased efficiency of domestic hot water systems. Priority studies on electricity pricing, private sector cogeneration opportunities and utility/customer co-financing were also specified. As a result of the mission's work, it is estimated that if a comprehensive electrical energy efficiency program were implemented, electricity demand could be reduced 20-40% from the projected levels, at approximately 25-50% of the cost of expanding supply.

Following widespread discussions with the Ministry of Transport and Energy, the electrical utility, public and private sector industry and the Chamber of Commerce, the Ministry has made a formal request to the Foundation to pursue the initiative. The next steps include the development of a Phase I work plan by IEI in cooperation with Zimbabwean counterparts. This work plan would set the stage for the implementation of the various project elements in 1993. An element of this work plan would include liaison with potential donors of the efficiency program, such as the World Bank and the African Development Bank.

8. Barriers to the Efficient Production and Use of Energy: Whereas in the past the energy scene was dominated by scientist and engineers preoccupied with technical fixes and technological solutions, as much attention is now being paid by energy analysts to problems of implementation. The current concerns are well illustrated by a poster in my study of a chimpanzee thinking: "Just when I understood all of life's answers, they changed all the questions!" In particular, a new field of study has grown --

barrier analysis --a specific energy measure is taken up for consideration and an analysis made of the barriers to the implementation of that measure at various levels such as the level of the consumers, the utilities, the equipment manufacturers and suppliers, the financial institutions, the governments (local, state and national), and international lending institutions. In general, barriers exist at all levels and measures are required at all levels to overcome the barriers and implement the measures.

In particular, there are eight crucial barriers:

- Growth-oriented Supply-sided Consumption-biased (GROSSCON) Paradigm of Energy Planning
- Bias towards Centralized Supplies
- Non-level Playing Field for Efficiency Improvements, Decentralized Renewables and Conventional Centralized Supplies
- Under-pricing of Energy
- First-cost Sensitivity (High Discount Rate) of Consumers and Governments
- Market Imperfections (which result in the environment, equity, infrastructure and the long-term being ignored)
- Lack of software support
- Lack of technical capacity

9. Strategy for Overcoming the Barriers: These crucial barriers also suggests a strategy for overcoming the barriers. This solution to the barriers problem involves the following initiatives:

- Promotion of a paradigm shift
- Promotion of renewable sources of energy particularly biomass sources
- Adoption of least-cost planning

- Getting the prices right
- Hardware plus Software Implementation Packages (IMPACKS) with innovative financing
- Policy-assisted Markets (PAMARKETS) with standards, labelling, regulations, etc.
- Energy service companies and other intermediaries
- Strengthening of hardware an software capability.

Thus, efforts are required at the macro, meso and micro levels and the initiatives must range from the shifting of paradigms to the detailed implementation packages for specific efficiency improvement measures. Like Antaeus, the Greek mythological hero, whose was extremely strong as long as his feet were on the earth, the vision offered by the new paradigm must be based on realistic steps that are carefully thought through and meticulously implemented. But, mere grovelling on the ground without a vision will only lead to business-as-usual which is failing.

10. Role of an US-based International Foundation in the Energy Sector: An US-based International Foundation that wishes to make an impact of the production and use of energy should, therefore, encourage institutions and initiatives to address all these tasks required to tackle the crucial barriers. What is necessary is

An International Energy Initiative like IEI to promote an energy paradigm shift, renewable sources of energy particularly biomass sources, least-cost planning, right prices, hardware plus software implementation packages (IMPACKS) with innovative financing, policy-assisted markets (PAMARKETS) for standards, labelling, regulations, etc., energy service companies, and hardware and software capability

A Biomass Initiative like BUN to promote biomass sources of energy, hardware plus software implementation packages (IMPACKS) with innovative financing for biomass supplies, hardware and software capability for biomass sources of energy

An Enterprise to arrange Developing-country Projects to package projects for lenders and technology suppliers, fund

pre-investment activity for the preparation of hardware plus software implementation packages (IMPACKS) with innovative financing, promote policy-assisted markets (PAMARKETS) with standards, labelling, regulations, etc., and assist energy service companies

A Leadership Development Program like LEAD to build project design and management (hardware and software) capability in developing countries

A US Energy Initiative like The Energy Foundation to practice, set an example and demonstrate in the US what is preached to the developing countries.

Fortunately, this is what the Rockefeller Foundation seems to have done.

11. New Areas for attention: Though the energy field seems to be covered in a rational, comprehensive and meaningful way, there are still some areas that deserve an attention that has perhaps been unfortunately lacking. Mention may be made of low-energy agriculture and transportation strategies to reduce energy consumption, pollution, greenhouse gas emissions and traffic congestion.

12. Conclusion: I have mentioned a number of issues and possible solutions. There is much more to say but "sufficient unto the day the evil thereof!". To conclude, the future is more a matter of choice than of destiny. In implementing those choices, we will find that the future is difficult to achieve but let us take courage from the fact that the present is impossible to continue.

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