

THE NEW PARADIGM FOR ENERGY^a

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At any period in history, according to Thomas Kuhn, there is a ruling paradigm¹ within the constraints of which most thinking takes place. When its effectiveness diminishes and it begins to break down, a paradigm shift takes place and a new paradigm comes into being.

What follows is a brief account of the paradigm shift that is taking place with regard to energy, and of the perhaps unique international collaboration involving Jose Goldemberg (Brazil), Thomas Johansson (Sweden), Amulya Reddy (India) and Robert Williams (USA) whose contribution to the new energy paradigm was recognised by the award of the Volvo Environment Prize 2000.

The collaborators (popularly known in energy circles as the "Gang of Four") came together through visits to Sao Paulo and Princeton. Though they were four individuals from four countries in four continents, they discovered a great deal of like-mindedness. They had mutual respect. They also had humility in the sense that each one knew that he did not know it all and that, in order to develop greater understanding, he had to listen to the others and learn from what he heard. They worked with an equality that was quite unlike most North-South collaborations in which Northerners are more equal than the Southerners. Their chemistry worked. They have sustained their interaction for over 20 years. Even without an institutional umbrella, they created a "virtual institution" long before modern information technology with its faxes, emails, etc.

In 1980 when the "Gang of Four" came together, energy systems were based on the growth-oriented supply-sided consumption-directed paradigm that dominated the views of governments, the approach of official planners, and the thinking of most decision-makers. According to this conventional pattern of thinking, development is equated to economic growth (measured by GDP), and an increase of energy consumption is considered to be a necessary condition for an increase of GDP. So energy becomes an end in itself and the main task is to make demand projections, so that the supply of energy can be increased through various energy sources to meet that demand.

Deeply troubled by the equity, environmental and security implications of that conventional paradigm, the "Gang of Four" wanted to evolve a different perspective. To them, the human dimensions of energy were as important as the technical. They were deeply concerned about inequity between industrialised and developing countries. They were also disturbed by inequalities within developing countries, with their small islands of glaring affluence amidst their vast oceans of abject poverty. They were acutely sensitive to the environmental impacts of energy production and use. Above all, they shared a vision of energy as an instrument of development, and of technology as a crucial mechanism for energy to play this role. This unity of perspective and values was enriched by the diversity arising from differences in their

^a This commentary is based substantially on the author's acceptance speech (on behalf of Goldemberg, Johansson, Reddy and Williams) at the ceremony for the award of the Volvo Environment Prize for 2000 at Gothenburg, Sweden, on 17 October 2000.

backgrounds, cultures, experiences and expertise. As a result, they produced together what none of them could have produced alone -- the whole was greater than the sum of the parts.

In 1988, they published the book *Energy for a Sustainable World*² and several other expositions^{3,4}. These publications contributed significantly to the new paradigm for energy. It was emphasised that energy is not the only major global problem. So, the solution to the energy problem must contribute to, and be consistent with, the solutions of the other major problems such as poverty, population growth, under-nutrition, ill health, environmental degradation and security. Energy must be an instrument for advancing economically viable, need-oriented, self-reliant and environmentally sound development -- what came to be referred⁵ to as *sustainable development*.

The emphasis on basic needs meant that the focus must be on the end-uses of energy and the services that energy provides human beings. The shift in emphasis from the magnitude of energy consumption to the level of energy services as the measure of development is not a semantic device. It enlarges the domain of opportunities in so far as energy services can be increased, not only by increasing the supply (and consumption) of energy, but also by using energy more efficiently. Technological opportunities abound for enhancing energy services⁶. Developing countries can therefore leapfrog technologically avoiding a repetition of the mistakes of the industrialised countries. Developing countries can become exciting theatres of technological innovation. Further, implementation of the new energy paradigm in industrialised countries leads to the possibility of lowered energy intensities and convergence between the energy consumption of industrialised and developing countries. Above all, the goal-oriented, strategy-based policy-driven approach to energy implies that the future becomes a matter of choice rather than destiny. The "Gang of Four" were harbingers of hope, rather than prophets of doom.

All that is the good news. The bad news is that radical ideas do not become new orthodoxy overnight⁷, and certainly not without continuous struggle and persistent effort. The old growth-oriented supply-sided consumption-directed paradigm still dominates the thinking of decision-makers. This is so particularly in the developing countries where unfortunately the magnitude of energy consumption (rather than the level of energy services) is still naively viewed as the measure of development⁸ despite abundant evidence that GDP can increase even when energy consumption goes down.

The liberalisation, marketisation, privatisation and globalisation trend of the 90s has introduced into the energy situation new issues such as the following. What is the role of the public sector in a market-driven economy? How can public benefits be advanced in a situation guided by the financial bottom-line? What are the dangers of unregulated reform of energy utilities? What are the barriers to implementation and how are they to be surmounted? How is the central importance of technological innovation to be ensured? How can the emergence of a myriad of exciting technological opportunities be exploited? How can one tackle the enormous challenge of poverty with about two billion people without the modern energy services that are taken for granted in the industrialised world?

These challenges have been addressed with a flurry of fresh efforts at analysis, advocacy and action. Mention should be made of the books to which many of the "Gang of Four" have contributed: *Electricity: Efficient end-use and new generation*⁹, *Renewable Energy: Sources for Fuels and Electricity*¹⁰, *Energy after Rio: Prospects and Challenges*¹¹, *Energy*

*as an Instrument of Socio-economic Development*¹² and most recently the *World Energy Assessment*¹³.

Among their many visions for energy in the new millennium¹⁴ are the following:

- the drastic reduction, if not elimination, of the coupling between energy consumption on the one hand and economic growth (GDP), materials use and emissions on the other;
- re-examination of the assumption that energy problems can be solved without changes in life-styles in the industrialised countries -- Mahatma Gandhi said: "The world has enough for everyone's need, but not for every man's greed!"
- universal access to affordable modern energy services, particularly in developing countries and especially for the poor and for women;
- harnessing of the immense possibilities of information technology;
- increasing the scope for people's participation with decentralised energy systems;
- modernisation of rural energy systems leading to a dramatic improvement of the quality of life;
- making the 21st Century the century of sustainable development so that energy acquires a human face and contributes to "wiping every tear from every face".

To realise these visions there is a need for new people who must have human values and spiritual courage, apart from intellectual capability.

The future is difficult, but the present is unsustainable. Fortunately, ideas are powerful and when they become visionary messages, capturing the hearts and minds of the people, mighty empires crumble and powerful structures collapse.

¹ A paradigm is analogous to a raga in Indian classical music. Anybody who sings and plays an instrument in a raga adheres to its framework and pattern, but within the constraints of that framework and pattern, the musician can extemporise to any extent that she or he wants. A paradigm shift is like changing over from one raga to another raga.

² Goldemberg J, Johansson TB, Reddy AKN, Williams RH 1989. *Energy for a Sustainable World*. Delhi: Wiley Eastern. Reviewed by J. Srinivasan in *Current Science*, 10 May 1992.

³ Reddy AKN, Goldemberg J 1990. "Energy for the developing world", *Scientific American*, 262 (9): 65-74.

⁴ Goldemberg J, Johansson TB, Reddy AKN, Williams RH, 1985, *Annual Review of Energy and the Environment*, Volume 10, pp 613

⁵ World Commission on Environment and Development (The "Brundtland Report") 1987. *Our Common Future*. London: Oxford University Press

⁶ Goldemberg, J., Johansson, TB, Reddy, AKN and Williams, RH, 1985, "Basic needs and much more with 1 kW per capita", *AMBIO - A Journal of the Human Environment*, Volume 14, No.4-5, pp 190-200.

⁷ Thomson, K.S., "How a radical idea becomes a new orthodoxy", *American Scientist*, January-February 1988, pp 59-61.

⁸ Chidambaram, R, 10 July 2001, "Nuclear energy needs and proliferation misconceptions", *Current Science*, Volume 81, Number 1, pp 17.

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- ⁹ Johansson, TB, Bodlund, B, Williams RH, eds 1989. ***Electricity: Efficient End-use and New Generation Technologies, and Their Planning Implications*** Lund: Lund University Press
- ¹⁰ Johansson, TB, Kelly, H, Reddy, AKN, Williams. RH, eds. 1993. ***Renewable Energy: Sources for Fuels and Electricity***. Washington DC: Island Press
- ¹¹ Reddy AKN, Williams RH, Johansson TB eds. 1997. ***Energy after Rio: Prospects and Challenges***. New York: United Nations Development Programme (with International Energy Initiative and Stockholm Environment Institute)
- ¹² Goldemberg, J, Johansson, TB eds 1995. ***Energy as an Instrument for Socio-economic Development***. New York: United Nations Development Programme
- ¹³ Goldemberg, J, Chairman (Editorial Board) 2000. ***World Energy Assessment: Energy and the Challenge of Sustainability*** New York: United Nations Development Programme, United Nations Department of Economic and Social Affairs, World Energy Council. Reviewed by Walt Patterson in *Science*, 9 November 2001, Volume 294, Number 5645, pp 1267-268.
- ¹⁴ Goldemberg, Jose., Johansson, Thomas B, Reddy, Amulya KN and Williams, Robert H, September 2001, "Energy for the New Millennium", ***AMBIO - A Journal of the Human Environment***, Volume XXX, No.6, pp 330-337