

Girish Sant Memorial  
Annual Lecture, 2013

Economic Development and  
Energy Planning:  
*The Myths and the Realities*

Dr. E. A. S. Sarma

## About Girish

Girish Sant, a founder of Prayas and the coordinator of Prayas (Energy Group), passed away unexpectedly in February 2012. Throughout his professional career, Girish made immense contributions to the energy sector, primarily to serve the interests of the poor and to improve governance of the sector to prevent gross inefficiencies, earning him respect and friendship from across the spectrum. He also motivated and mentored a large number of young researchers to work in energy policy and governance issues. Several friends and well-wishers of Girish have initiated activities in memory of Girish Sant to further his work of independent analysis and advocacy to promote public interest issues in the energy sector. This memorial lecture is part of these activities.



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# Economic Development and Energy Planning: *The Myths and the Realities*

Dr. E. A. S. Sarma

I feel privileged to deliver the first Annual Girish Sant Memorial lecture. Though Girish is not with us, I feel his presence, in terms of the ideas on energy efficiency that he had relentlessly pursued and the concepts of good governance in the energy sector that he had wholeheartedly promoted.

I had known Girish for more than fifteen years. I admired his single-handed effort in building a highly dedicated team of young engineers who could critically question the erstwhile Maharashtra State Electricity Board on the way it estimated the State's demand for electricity, without taking into account the scope for efficiency improvements.

As a result of Prayas's persistent campaign, for the first time, the mindset of the electricity planners in the country shifted perceptibly from supply-orientation towards a more consumer-oriented perspective. As a former Union Power Secretary, I could

see Girish Sant and his colleagues making their presence felt at the national level. Later, along with the members of the committee set up by Maharashtra on the infamous Enron project, I had interacted with Girish and his team on the pitfalls of Enron and its crippling impact on Maharashtra's economy.

A couple of days prior to his untimely demise, Girish spoke to me on the pros and cons of Prayas getting involved in studies on climate-related issues mooted by Ministry of Environment. Girish was apprehensive that such studies would divert Prayas's attention from its core area of electricity sector reform. On the other hand, I felt that global climate concerns were going to be central to electricity planning in the coming years. The expertise available on the subject in our country is still nascent. I therefore suggested that Prayas should get involved in such work and be at its forefront. Sadly, Girish is not there today to be a part of these studies!

Today, I wish to deal primarily with the kind of questions that Girish and his colleagues in Prayas have often asked, the questions on efficiency of use of resources, the questions that revolve around consumer welfare and the questions on what constitutes sustainable development. These questions have immense relevance for the long-term well-being of the people. Since the future belongs to the youth of this country, it is the youth among you who should stand up and question our present day planners, who are more concerned with what happens *today* and, at best, *tomorrow*, than what is in store *the day after*. You should subject their doctrinaire approaches and mythical assumptions to an acid test.

The choice before the youth of the country is clearly between a business-as-usual trajectory that is most likely to foreclose the sustainable options and a trajectory more arduous in the short-term but more benign and sustainable in the long run, reminding us of the prophetic words of Robert Frost, "*Two roads diverged in*

*a wood, and I- I took the one less traveled by, And that has made all the difference."* Let me explain what I imply by the "mythical" assumptions in planning.

**Myth No. 1:** GDP, "inclusive" development and human welfare:

From the ramparts of the Red Fort on Independence Day and from the corridors of Yojana Bhavan, we are told again and again that the welfare of the people is best measured by the rate at which the Gross Domestic Product (GDP) or its alter ego, the Gross National Income (GNI) increases, that industrialisation is the sine qua non of economic development and that the benefits of industrialisation will "trickle down" in due course to increase the well-being of the vast majority of the society, who live today in a state of malnutrition and poverty. We are repeatedly told that the country's successive Five Year Plans are so wisely formulated that they will result in a rapid growth and, at the same time, correct the income disparities among the people. The available empirical evidence does not corroborate these propositions.

**First,** in the Indian context, neither GDP nor GNI is an accurately measured entity. Several economic activities, which generate gainful incomes and contribute to the welfare of the people, such as those in the unorganised sector, are not fully captured in the computation of GDP/ GNI. For example, in the energy sector, rural women and children spend long hours and trudge long distances to gather fuelwood but neither the value of their service nor the costs they incur figure anywhere in the GDP estimation exercise. Even in the case of several commodities that figure in GDP/ GNI estimation, such as agricultural products, they are under-valued and their contribution under-rated, as a result of the distortions that exist in their pricing. One should therefore view these two measures with utmost caution.

**Secondly**, is the rate of growth of either of these measures directly correlated to human development? Not really!

Analysing the trends across the countries over the last 40 years, UNDP 's 2010 Human Development Report has found that the forces driving improvements in health and education are entirely different from those driving improvements in the national income. UNDP concluded that the correlation between economic growth and Human Development Index (income-corrected) is "remarkably weak and statistically insignificant"!

**Thirdly**, to what extent are the Indian planners justified in assuring us that the development process they have put in place is "inclusive"?

India's GDP has increased steadily over the last five decades at rates ranging around 5 %. Ever since the government launched its economic reform programme in 1991, the growth process has accelerated. If the model of development we have adopted is truly inclusive, the income disparities in the economy ought have reduced. The evidence available does not corroborate this proposition.

NSSO's 50<sup>th</sup> (1993-94) and 55<sup>th</sup> (1999-00) rounds of survey revealed that the Gini coefficient for the rural households increased from 25.8 in 1993-94 to 26.3 in 1999-00 and, for the urban households, it increased from 31.9 to 34.8 during the same period [Abhijit Sen and Himanshu: Poverty and inequality in India-Getting closer to truth (2005) [www.networkideas.org](http://www.networkideas.org)]. Thus, the steady growth of the economy did not necessarily correct the income inequalities.

On the other hand, the GDP growth in our case is associated with large-scale physical displacement of the people. The UN Working Group on Human Rights reported (2012) that, as a result of "development" projects, 60 to 65 million people have got

displaced in India since Independence. 40% among them were tribals, another 40% dalits and the remaining, the "other rural poor". The vast majority of them have not been resettled satisfactorily. Once proud owners of agricultural land, their status has since degenerated to that of daily wage workers leading sub-human lives. GDP is therefore anything but inclusive; it is more apt to call it "*Gross Displacement Product*"!

India's planning is based on the premise that greater investments will lead to a higher GDP which in turn will permit a still greater investment and a still higher GDP and so on. In this calculus, neither the quality of the investment nor the quality of the growth is considered important. For example, a mining project contributes to large incomes and a higher GDP but it also displaces the people, violates their human rights and eats into the limited mineral deposits of the country, thereby affecting the sustainability of the growth process itself.

Instead, the same level of investment in education or public health would have created a far more valuable human asset that would have reduced the income disparities and contributed to the long-term sustainability of the development process.

**Myth No. 2:** The sky is the limit to GDP.

We have just observed that GDP in itself will not necessarily enhance human development. The growth of GDP cannot last long, if it is based on widening income disparities and over-exploitation of natural resources. Clearly, there are limits to growth.

The Atharva Veda (19.9.1) says "*May the past be kind; the future benign*". While our good deeds in the past will certainly safeguard our future, we cannot escape paying the price for the sins committed in the past. As long as humans tapped the bounty of the nature in tune with their need, there was no problem.

When they started exploiting the Nature for greed, the troubles started.

In 1972 and 1974, the Club of Rome came up with two prophetic studies, the "Limits to Growth" and the "Mankind at the Turning Point", cautioning the global community that the 20<sup>th</sup> century approach to development, based on rapid resource depletion is unsustainable and that the planet would hit its limits within a hundred years i.e. well before the third quarter of the 21<sup>st</sup> century. In a way, the Club of Rome echoed the somewhat pessimistic economic theory based on the interaction between resource limitations and population growth, propounded by Thomas Malthus in 1798.

Following Club of Rome's prophetic findings, during the last few years, the scientists have unequivocally established that we have reached the brink of a multi-dimensional, hydra-headed climate crisis.

The planet is warming up faster than what the solar radiation can at best account for. It was the well known mathematician and physicist, Joseph Fourier (1768-1830) who explained this phenomenon of "global warming" on the premise that increased anthropogenic emissions of CO<sub>2</sub> and other Green House Gases (GHGs) had warmed up the earth's atmosphere, causing an increase in its average atmospheric temperature. More recently, the climate scientists have gathered additional empirical evidence that has corroborated this. Even a small increase in the average global temperature could translate into large and potentially dangerous shifts in climate that could threaten the survival of the human race itself. There has been a widespread global concern at these observed climate trends.

The UN-appointed Intergovernmental Panel on Climate Change (IPCC) had recently put together the mass of empirical evidence

and theoretical findings on the subject to project a scenario that is truly scary. The intense economic activity based on fossil fuel use that followed the Industrial Revolution has released such huge quantities of CO<sub>2</sub> into the earth's atmosphere that its concentration has increased by 38% since the Industrial Revolution, as against the outer limit of 25% that the planet could bear. As a result of CO<sub>2</sub> and GHG emissions, there has been a 0.8 degree centigrade increase in the average temperature during the 20<sup>th</sup> century, of which 0.5 degrees centigrade increase took place during the last three decades itself. Even if the world community can collectively contain the GHG emissions with immediate effect, the 21<sup>st</sup> century will witness 1.1-2.9 degrees centigrade increase in temperature, whereas the maximum that can still sustain the life on the planet is around 2 degrees centigrade w.r.t. the average temperature observed prior to Industrial Revolution. If the global community fails to achieve this and allow the business-as-usual trends to continue, the increase in the average temperature will sky-rocket to around 2.4-6.4 degrees centigrade, a sure death knell for the human race. The choices before the global community are clear; correct the course of development or perish; the sooner the course correction, the less will be the social cost burden and the human trauma.

While the climate crisis has attracted a worldwide discussion, there are other equally worrisome challenges which have emerged of late.

Recently, India hosted the XI Conference of the Parties (COP) to the Convention on Biological Diversity (CBD). The planet's survival depends on the rich biological diversity it has. Any loss in the biodiversity will cause an imbalance that could pose a threat to the survival of life on the planet.

WWF's Living Planet Report (2010) computed the Living Planet

Index for the planet as a whole by considering the trends in the case of 7,953 populations and 2,544 species. The Report found that the biodiversity of the planet declined by 30% between 1970 and 2007. The Global Footprint Network's 2010 report provides a rough idea of the ecological footprint of India. The human demand on the Indian ecosystem is 1.8 times of what the ecosystem can bear, compared to 1.4 for the planet as a whole! In other words, the rate at which India is losing its biodiversity is 29% higher than the rate at which the planet is losing it. The bulk of the increased loss in biodiversity can be attributed to industrial projects taken up indiscriminately, without taking note of their impact on the delicate ecological balance. It is ironic that India should lead the way in this destructive process.

Rapid industrialisation has had several other adverse impacts on the planet. It has caused an overall increase in the toxic pollution levels in excess of what is considered to be safe. It has imposed an enormous stress on land and fresh water sources, on life-supporting nitrogen and phosphorous cycles and on acidification of the oceans.

Industrialisation has also displaced millions of farmers and fisherfolk, as already stated, violating their basic human rights. Even the latest land acquisition law trivialises human rights by treating them as a commodity that can be purchased!

Clearly, we are treading a path that is potentially dangerous for our survival as a race. Should we not change the trajectory of our growth, in Robert Frost's words, towards the "*road less travelled*"?

**Myth No. 3:** Industrialisation is "development".

In the present model of "*growth at any cost*", all kinds of industrial projects are foisted on the people, more at the instance of the project developers than in consultation with the local

communities. Those who oppose such projects are termed "anti-development" and, if they persist, "anti-national"!

How does one define "development"?

Amartya Sen, in his book, "Development is Freedom", has described "development' in these words.

*"Development can be seen.....as a process of expanding the real freedoms that people enjoy."*

Let us take a real life example to see what it implies. At a village located about hundred miles south of Visakhapatnam, a private company approached the local villagers directly and offered to buy their lands for an industrial project. The villagers insisted that the developer should first disclose the purpose for which the lands were needed. The developer explained to them that he had a proposal to set up a sugar factory there, for which he had already approached the government for environment clearance. The discerning villagers felt happy as a sugar factory would bring them a four-fold benefit. **First**, it would enable them to raise sugarcane for which the government had fixed a minimum support price and they could sell it at that price to the factory, bringing widespread prosperity to their region. **Second**, their bullock carts were not fully utilised throughout the year. Transporting sugarcane to the factory in their bullock carts would assure them additional income. **Third**, a sugar factory would provide them both seasonal and off-season employment in significant numbers, for which no special skills or training was needed. **Fourth**, they knew that the factory would create auxiliary employment opportunities. The proposed project had a provision for a begasse-based co-generation power plant. The farmers knew that such a power plant would cause minimal pollution. Thus, the villagers exercised their own due diligence and willingly sold their lands to the developer.

What followed then was disturbing. The developer, in

connivance with the government, altered the proposal overnight and started taking fresh clearances for setting up a coal-based power plant at the same location. The villagers visited a nearby coal-based power plant of a PSU and interacted with the people residing around the project. They found that the power plant belched out huge quantities of toxic fly-ash which contaminated the local water sources, including the ground water, and caused bronchial and skin diseases all around. The promises made by the PSU that it would provide a large number of jobs to the displaced proved hollow. The villagers were therefore not prepared to accept a similar power plant being set up in their midst. In one voice, the villagers opposed the power project and agitated against it. Initially, the crony capitalists had their way. The police registered false cases against the villagers who refused to relent. However, the agitating villagers finally succeeded in stopping the power project!

In this case, it was not as though the local people had opposed an industrial project for the sake of opposing it. They knew what was good for them. They would welcome an agro-based industry like a sugar factory, not a polluting unit like a power plant. *Therefore, all industrial projects do not necessarily lead to "development" in its genuine sense.* The government should draw lessons from this.

**Myth no. 4:** The government knows best what the people need.

The following real life experience has some useful lessons for us. A local Integrated Tribal Development Agency (ITDA) prepared a project report for connecting a cluster of tribal hamlets in Visakhapatnam district to a nearby weekly market in Odisha by a 7 kilometre hilly road to enable the tribals to sell their minor forest produce. The project cost was high and, therefore, it did not get sanctioned for years, as the ITDA had limited funds at its disposal

and its own priorities. The tribals were desperately hoping that the road project would be taken up. One day, a social activist, who is a tribal himself from the North East working in that area, interacted with the tribals, explained to them that it could take another four to five years for the government to take up the road project and suggested that the villagers should think of alternatives. Can the project cost be reduced? ITDA's project envisaged a pucca 40 feet wide road which explained its high cost. The tribals were opposed to such a wide road as it would attract the lorries and the trucks of land grabbers and money-lenders entering their villages. What they wanted was a narrower track that permitted them to go on foot and sell their wares at the weekly market. Apparently, ITDA's project was meant more for the contractors than for the tribals!

The activist then suggested that, if each family could contribute its labour to lay a *moora* (a linear measure equivalent to the length of an adolescent's hand), the road they wanted would be ready in seven to eight months. The tribals weighed the pros and cons of the activist's suggestion for a month or so. Once convinced that they could collectively do it, they spontaneously embarked on the mission of laying the road. They completed the road within seven months but encountered a difficult obstacle! There was a large boulder blocking the pathway, which they could not readily clear. Without the use of an explosive, it is not easy to break it and remove it. Explosives are expensive. The use of explosives required a license. Since these tribal hamlets were located in an area where there was extremist activity, it was difficult to secure a license. Even if a license were to be obtained, it would necessarily involve bribing the concerned officials. The activist tried getting a license at the district headquarters but failed to succeed. After a week, he returned to the tribal hamlets, disappointed, not knowing what to do. However, to his pleasant surprise, he found that the boulder

had disappeared altogether! It was the result of an ingenious innovation. The tribals gathered dry wood, set it on fire to heat up the boulder, poured cold water to quench the fire and beat the boulder with heavy logs to smash it into pieces that could easily be removed! It was a development project accomplished at no cost to the government, tailored to the needs of the local community and driven entirely by local leadership and innovation! No contractors, no intermediaries!

**Myth No. 5:** The only way to "reform" is to privatise.

The 1991 reform model is primarily based on "privatisation", touted by the West-trained economists as the universal panacea for all ills. What should "reform" mean?

There are three core concepts that any "reform" should address. **First**, it should aim at greater *transparency* in the functioning of the government. **Second**, it should enhance public accountability by involving the people in decision making on selection of schemes and monitoring their implementation. **Third**, it should promote greater competition to yield efficiencies. To what extent have 1991 reforms met this test?

While the Right to Information Act is indeed an important step taken to promote transparency, it has come, not as a result of the government introducing it on its own, but as a result of the pressure exerted by the civil society. Once the law was enacted, the government had tried again and again to dilute it and render it ineffective but faced a stiff resistance from the civil society. In a top-down decision making process, both public participation and public scrutiny have remained non-existent. Had the government introduced competition, in choosing power projects, in allotting mineral franchises and in selling the spectrum, the country would not have witnessed the kind of Enrons, Coalgate and the mining scams we see today.

In general, as a result of any reform, the choices available to the citizen should increase, not reduce. The manner in which the citizens are forced these days to obtain the Aadhaar cards is a case in point.

India's primary concerns revolve around poverty, malnutrition, disease, illiteracy, discrimination, mis-governance and electoral corruption. We need to re-orient our governance systems to address these concerns first, not a less pressing issue such as FDI in Retail Trade.

Private enterprise can deliver efficiency when it operates within a competitive environment. Where there is a natural monopoly, independent regulation is necessary. We seem to have successfully choked competition and allowed monopolies and oligarchies to operate, capture the regulators, penalise the consumers and hurt the public at large.

In the perception of the Indian planner, only large industrial houses and other big corporates are examples of "private enterprise", not a small farmer, a traditional fisherman or a cooperative like Anand Dairy! When an industrial project is set up, the benefits in terms of the number of jobs it creates are exaggerated but the number of small farmers or fishermen dis-employed is underplayed . Obsession with the large industrial entrepreneurs has literally eliminated all other forms of small entrepreneurship, cooperatives and so on. A mismanaged airline company could get its compounded debt restructured to Rs. 7,500 crores. A farmer in Khammam district in A.P recently requested the bank to restructure his loan to Rs 7,000, failed to get it granted and committed suicide!

India's reform model, based on ill-conceived, unbridled privatisation is nothing but a crony capitalism of the worst kind!

**Myth No. 6:** Increase in *per capita energy consumption* measures "development".

The Integrated Energy Policy (IEP) report of Planning Commission projects the energy needs of the country on the premise that GDP growth and the increase in energy needs are closely correlated. IPE uses "*elasticity coefficients*" to estimate the future energy needs. Is it a reliable basis?

In his path breaking book "Soft Energy Paths-Towards a durable peace", Amory B. Lovins (1977) provided the following insights into the way the per capita *primary* energy consumption levels in Denmark varied over the last five centuries. (I have computed the 2004 figure from a different source cited).

Year	Giga calories/year	Remarks
1500	7 to 15 **	Wood & peat used inefficiently
1800	7 **	More efficient use of wood/ peat
1900	3 **	Shift to Coal burnt in cast iron stoves (more efficient)
1950	7 **	Shift to oil; high refinery losses to run inefficient furnaces
1975	17 **	Shift to electricity with T&D losses
2004	10.4 @	Energy use with higher efficiency

@ [http://ec.europa.eu/energy/energy\\_policy/doc/factsheets/mix/mix\\_dk\\_en.pdf](http://ec.europa.eu/energy/energy_policy/doc/factsheets/mix/mix_dk_en.pdf)

Denmark's per capita primary energy use evidently declined between 1500 and 1900, not because of any negative economic growth but on account of the combined effect of a shift in the fuel base and the improvements in efficiency. The increase in the per capita primary energy use between 1900 and 1975 and the decline between 1975 and 2004 were the compound outcomes of the growth in Denmark's GDP, the fuel shifts and the efficiency improvements. These trends show that the per capita energy use

is not necessarily linked exclusively to the rate of increase of GDP.

What matters in terms of the quality of life is the *per capita useful energy use*, not *per capita gross energy use*, as the latter hides the inefficiencies down the supply chain of electricity from the generation station to the end-use appliance!

**Myth no. 7:** "Electricity development" *is synonymous with* "setting up new generation projects".

The end product of electricity is different in different sectors. It is luminosity in lighting, lifting water in irrigation, turning the wheel in industry, circulation of wind in fans and space cooling in air-conditioning. The energy required for this can come from a new MW based on a renewable or a non-renewable resource or from a saved MW through an efficiency improvement. In other words, setting up a new generation project is one among the several alternatives available and it may not be the most optimal from the point of view of cost and long-term sustainability. If the unit cost is high, the poor cannot access electricity. If the resource is non-renewable, energy security is threatened. The challenge therefore lies in choosing the alternative that ensures an affordable cost and long-term sustainability.

Our electricity system is based primarily on large projects generating electricity that is conveyed over long distances to remotely located consumers through an extensive system of transmission and distribution (T&D) network. The investment we have made in T&D has not kept pace with the investment in generation. As a result, more than one-third of the generated electricity is lost in T&D and the electricity finally supplied to the consumer is of a poor quality.

Within the generation sector itself, the investment we have made

in peak-load hydro generation has not kept pace with the investment we have made in base-load thermal projects, causing an unhealthy imbalance in it. It is an expensive way to provide electricity to the consumers whose cumulative demand has diurnal and seasonal variation. Thermal generation (coal, combined-cycle gas, nuclear) can best cater to the steady component of the demand, whereas the peaking stations (largely storage hydro) can optimally meet the peak load. As a result of the imbalance in thermal-hydro mix, the thermal capacity, though available, is not utilised fully and the shortfall in peaking capacity has resulted in peak-time shortages that have crippled the economy. These distortions have imposed a heavy cost burden on the consumer who is not only forced to pay for the high T&D losses but also forced to invest on voltage stabilisers and inverters. The high cost barrier has stood in the way of electricity reaching the poor. No wonder that it is usually the existing affluent consumers who use highly inefficient electric appliances and grab most of the additional electricity generated in the country. Meanwhile, the poor seem to remain where they are!

Between 2001 and 2011, the country added 85,000 MW of new capacity. The number of rural households who had no access to electricity in 2001 was 7.5 crores. In 2011, it was 7.8 crores! Similarly, in 2001, the number of urban households who had no access to electricity was 0.6 crores. It increased to 0.7 crores in 2011!

We have a spacious building constructed recently in Vizag, standing majestically in the salubrious environment of the beach. It is sealed on all sides with heavily tinted glass, letting neither natural light nor fresh wind to enter. It uses hundreds of inefficient electric lamps to illuminate within and a large number of heavy duty ACs to cool the space. It is a veritable energy guzzler.

Incandescent and fluorescent lamps we use have efficiencies as low as 0.7-2.0% and 5-10% respectively. We use refrigerators and A/Cs with efficiencies hovering around 20% and 30% respectively. The fans we use have efficiencies ranging around 20%.

If we mine coal with 100 units of heat value to start with, at the end of the supply chain that feeds into an incandescent lamp, the luminosity we get is equivalent to 0.39 units of the original heat energy. The rest i.e. 91.61% of the original heat energy of coal is wasted. If we can double the efficiency of the lamp, we can do with coal of 50 units of heat value and reduce displacement of people by 50%! The corresponding savings in the generation capacity would have avoided the displacement of people at the site of the generation project by 50%. Going one step farther, if we replace the conventional lamp by a solar PV-based LED, we can avoid coal mining altogether and do away with displacement of people at both the coal mine and the thermal power project, as neither would then be needed. Many of us living comfortably in towns and cities are oblivious of the disruptive genesis and the traumatic delivery of each kwh that we nonchalantly consume. Some of my friends who are pious by nature do not even wish to hear that story, as it unnecessarily disturbs them. Theirs is an ostrich-like attitude when it comes to enjoying the fruits of "development", without daring to understand its social costs.

Those who equate "electricity development" with setting up new generation capacity should pause and appreciate that what really matters is the useful energy that becomes available at the consumer's end and such useful energy can come from a range of sources including a new power plant. It is necessary that what the consumer ultimately gets is a form of energy that is of a reasonable quality and an affordable cost.

**Myth No.8:** "Nuclear" is green; the *sanjeevini* for energy security.

The Prime Minister has branded all those opposing the nuclear option as the "unthinking" lot! When the people living around Jaitapur opposed the nuclear power project that NPCIL is setting up there, Jairam Ramesh, the then Environment Minister, rubbished their resistance by saying *"from an environmental point of view, it is really tragic that nuclear energy is red rag to the green bull. ....All the greens are anti-nuclear...It's paradoxical actually."* His Ministry cut the corners to clear the project hurriedly, to time the clearance in such a way that the visiting French President should feel satisfied and compliment our rulers on their efficiency.

Why did the people of Jaitapur see a "red rag" in nuclear power?

- i. However improbable it may be, a Fukushima-like accident of a severe nature at a nuclear power plant will have disastrous consequences for the people living in its vicinity. Till date, Fukushima has cost Japan more than \$16 billion; and, the cost of the post-accident liability is still going up and up. It is not the monetary cost alone that matters. Radioactivity has seeped into the environment all around, into the air, the water, the food articles, the fish and so on. Fukushima's impact on public health will be felt by generations to come.
- ii. A severe accident can be triggered even by a human lapse or a mechanical failure, not necessarily by an earthquake or a tsunami.
- iii. Such accidents call for emergency responses within minutes, hours and days, not years. In a well organised country like Japan, even after two years after the accident, only one-third of the people affected could so far be scanned for radioactive exposure. Nuclear accidents are

far too formidable to be taken lightly. NPCIL was in a tearing hurry to start Kudankulam. It did not however display the same alacrity in conducting comprehensive emergency drills in consultation with the people so far. It was the court that reminded NPCIL of its failure to conduct mock drills as globally prescribed.

- iv. Out of 104 nuclear power plants in USA, more than 50% are reported to be contaminating the water sources with radioactive tritium. There have been incidents of varying severity in the case of the nuclear power plants in India and there have been instances of radioactive exposure suffered by both the workers and the people. Human exposure to radiation near the nuclear power plants is a common occurrence. Even low-dose radiation can cause genetic disorders.
- v. Nuclear power is certainly not going to be the manna from heaven. An imported plant will cost three times that of the conventional power plants we have. Each new nuclear project will take 12 to 15 years to complete, as has been the case with Areva's Olkiluoto EPR reactor in Finland and EDF's Flamanville EPR reactor in France. Many of the reactors that India is importing are based on technologies yet to be tested fully at the ground level. No insurance company will perhaps insure them, as the contingent accident liability is mind boggling. The cost of decommissioning an aged nuclear plant is quite high. To decommission it fully after an accident may not be feasible at all.
- vi. Since India will import both the reactors and the fuel, to say that they will contribute to energy security will amount to self-deception.

vii. Till date, there is no satisfactory technical solution to the serious problem of disposal of the spent fuel. NPCIL has constructed Kudankulam but is yet to decide on where to bury the toxic residual spent fuel!

Therefore, there is nothing paradoxical about the public resisting a nuclear power project. To brush aside the fears expressed by the people will only amount to self-deception.

**Electricity planning: Short-term compulsions should not preempt long-term options**

Prayas, in its well-analysed Discussion Paper on *"Thermal Power plants on the Anvil- Implications and need for rationalisation"*, pointed out in August, 2011 that 701,802 MW of coal & gas power plants had either been cleared or about to be cleared by Ministry of Environment & Forests (MOEF) and they were most likely to be set up during the next few years! This worked out to thrice the capacity addition required to meet the needs of the high-renewable, high-efficiency scenario for the year 2032 projected by Planning Commission's Integrated Energy Policy (IEP) study! This will preempt all efforts to remove the existing imbalance in the thermal-hydro mix and compound the problems of both the peak-time shortages and the high cost of electricity. Of course, such an extensive reliance on coal will not only have serious implications for the global climate but also impact the local environment severely.

Prayas's study further reveals that these capacity additions are largely concentrated in areas that are already categorised as "critically polluted industrial clusters" by Central Pollution Control Board (CPCB). Plants of 30,470 MW and 24,380 MW capacity will come up in two districts of Chattisgarh, namely, Janjgir-Champa and Raigarh respectively, followed by 22,700 MW within

10 km of Krishnapatnam Port in Nellore district in AP. In the districts of Rewa, Sonbhadra, Sidhi and Allahabad on MP-UP border, plants of 51,218 MW will come up in close proximity!

Such dense clusters of thermal capacity will undoubtedly impose an undue stress on land, water, the livelihoods of people and the local environment. There are studies that show the presence of toxic pollutants like lead, mercury, arsenic, cadmium and even radioactive isotopes of uranium and thorium in the fly ash spewed out by these plants. These toxic pollutants are ingested by the people living around the plants to the detriment of their health. Should we therefore continue with this kind of vandalism that will cause a widespread damage to the people's health? As Prayas has rightly suggested, the government, whose laissez faire policy has unleashed this devastation, should review and correct such unfettered electricity development without any further delay.

The capacity additions proposed, as cited above, include projects which are located in precious wetlands, irrigated tracts and fragile regions rich in biodiversity. The social costs imposed by such projects far exceed the social benefits.

Power problems in India are routinely attributed to a shortage in generation capacity, not the inefficiencies in the supply chain. Electricity planning based on such an assumption is likely to compound the problem rather than offer a solution.

During the later half of the nineties, Prof Shankar Sen, the then Power Minister of West Bengal demonstrated how the State Electricity Board could overcome the serious power problems faced by the State at that time by a systematic effort to manage the electricity demand and improve the efficiency in each segment of the electricity supply chain. We need to learn a lesson from such efforts.

The global climate concerns leave no other alternative to us

than quickly moving away from coal. From the point of view of long-term sustainability and energy security, the gas option is ruled out. Nuclear technology is inherently unsafe and any capacity expansion programme based on imported reactors and imported fuel will further compromise India's energy security. We are clearly left with only a Hobson's choice of opting for *saved MWs* (or, Negawatts as described by Amory Lovins) and *renewable MWs* or willingly tread along a trajectory that takes us nowhere!

Starting with the existing thermal power plants, down the line through the T&D system and the end-use appliances, there are negawatts waiting to be tapped readily, at much lower investments and involving negligible environmental degradation. Further down the line, there are negawatts lurking to be exploited through better insulation of buildings in the case of A/Cs and through a more energy-friendly architecture of buildings. The losses in each of these segments need to be assessed systematically and an action plan adopted to tap the full potential. In my view, the IEP study of the Planning Commission has not addressed these aspects fully.

There are several energy modeling methodologies available for carrying out an energy scenario building exercise for India on these lines. Such scenarios should focus on the human development goals we aspire to achieve, the useful energy requirements of such goals and the efficiency at which we can meet such energy requirements in a sustainable manner. For example, the late Prof. Amulya K.N. Reddy of Indian Institute of Science adopted a "development focused end use oriented service (DEFENDUS) based goals" methodology (see [http://www.amulya-reddy.org.in/Publication/89to93\\_STRATEGY.pdf](http://www.amulya-reddy.org.in/Publication/89to93_STRATEGY.pdf) ). In Planning Commission, some of us had used a different modeling approach (MEDEE-S model) that started with the end-uses and helped build possible alternate energy

scenarios from which one could choose such trajectories that minimise the adverse impact on the ecology [See "Sectoral Energy Demand in India" (August 1991) REDP, ESCAP] Some of these modeling approaches could be used to arrive at energy development scenarios that are more benign than IEP.

In this connection, let me also refer you to an illuminating article of 1985 authored by Jose Goldemberg, Thomas B Johansson, Amulya K.N. Reddy and Robert H Williams in *Ambio*, A Journal of the Human Environment brought out by the Royal Swedish Academy of Science. The title of the article was "Basic Needs and Much More with one Kilowatt per Capita". Later, these authors brought out a more comprehensive approach based on this in the form of a book. In that article and the book, the authors explored the meaning of the "quality of life" of a human being and argued convincingly that one kilowatt per capita of power output would suffice to assure each human being with a reasonable level of quality of life. Since then, there have been numerous technological advances made by the scientists and the engineers in terms of improvements in energy efficiency. Moreover, like never before, the planet is inching towards the limits of its forbearance. One should therefore take a closer look at the concepts propounded in that article, review its assumptions and build on it to arrive at a scenario that will secure an energy future that is truly sustainable. I am sure that the kw-per-capita limit, envisaged by Amulya Reddy and his co-authors, would shrink further if the latest efficiency improvement techniques were to be factored in. Our ultimate aim should be to find a harmony between energy development and ecological sustainability.

I am sure that Prayas can undertake a study on these lines. I will be glad to be associated in that exercise in one way or the other.

Post-Fukushima, Germany became the front runner to shun nuclear power and move decisively in the direction of renewables, especially solar. The study entitled "German Energy Transition: Arguments for a renewable energy future" by Craig Morris and Martin Pehnt (November, 2012) is a truly thought provoking analysis that should not only guide us in our own energy plans but also give us enough confidence and courage to opt decisively for a green energy future. In the words of the authors of this study ([www.energytransition.de](http://www.energytransition.de)),

*"A lot of people outside Germany, including environmentalists, are skeptical. But even the skeptics like Germany's goal of demonstrating that a thriving industrial economy can switch from nuclear and fossil energy to renewables and efficiency. The German can-do attitude is based on the experience over the last two decades, when renewables matured much more quickly, become more reliable and much cheaper than expected"*

Germany gets 26% of its electricity from nuclear power whereas it is only 2.7% in our case. The solar radiation we have is far more than what Germany has. There is no reason, therefore, why we should not go solar more aggressively than Germany.

The theoretical potential of solar radiation in India is 5 trillion kwh/year (Source: CERC presentation at Global Solar Investment Summit in April, 2011). Most regions in the country get more than 4kwh/m<sup>2</sup>/year of solar radiation for more than 300 days in a year. Even if we can harness solar radiation over 1% of our land area at 10% conversion efficiency, we can generate 492,000 billion kwh/year, whereas the country's total electricity requirement during 2010-11 was only 756 billion kwh/year. As a result of competition in the solar market in India, the price of solar thermal has come down to Rs.10.49-12.24/kwh and solar PV has similarly come down to Rs.10.95-12.75/kwh. India should therefore aim at

- a) An energy security law to mandate a shift in favour of renewables as a means to enhance the country's energy security and provide a guarantee that every household in the country will have access to a minimum threshold of *per capita useful energy* linked to a minimum level of quality of life.
- b) Substitution of conventional sources of energy by solar thermal and PV, preferably through distributed, roof-top sources which involve lesser losses and greater reliability
- c) A concerted effort to augment globally competitive manufacturing industry to supply solar appliances
- d) a national effort of R&D to improve solar conversion efficiencies and minimisation of the ecological footprint of solar devices through recycling and other means

Renewable sources of energy such as solar have location-specific, load-specific applications that are often overlooked by electricity planners who are busy adding new MWs through large centralised generation stations. In addition to solar, India is fortunate in having a significant potential in terms of micro-hydel power, wind power and energy from biomass. There are location-specific possibilities in terms of geo-thermal, wave and tidal sources of energy. The energy future of the country lies in tapping these sources through a systematic effort in research and technology development aimed at providing energy that is environmentally sustainable and affordable from the point of view of its unit cost.

In the ultimate analysis, even renewable sources of energy are not free from problems. As stated earlier, solar panels too leave a foot-print on the ecology of the planet and we should be fully aware of it. We should find ways to recycle the waste from the renewables. In the ultimate analysis, the lesson lies in limiting our appetite for energy to our need, not allow it to be driven by greed. As the Rig Veda (1.23.22) has stated unambiguously, the Laws of

Nature are supreme and we should be prudent enough to respect and comply with them.

I have already referred to the work of Amulya Reddy and others on the "quality of life" in relation to energy development. Is there a better way to define the "quality of life" and evaluate the factors that contribute to it? Can we develop a better conceptual basis for determining the minimum quality of life that we should aim at? Can we derive from it the minimum energy input that is needed? Of course, we cannot aim at an extravagant quality of life that oversteps the Nature's limits.

The challenge that lies ahead of us today is to come up with a strategy that aims at energy development that is contained within the envelope of long-term sustainability, a strategy that removes the energy inequalities across the population and a strategy that is based on participative decision making.

Recalling Robert Frost's prophetic words once again, perhaps, one day, we can confidently say -

*"I shall be telling this with a sigh  
Somewhere ages and ages hence:  
Two roads diverged in a wood, and I  
I took the one less traveled by,  
And that has made all the difference"*

I am sure that there are many among you who will ponder over these modest thoughts. I hope that Girish Sant's ideas and deeds will inspire you into serious action to the betterment of the society.



**Notes :**





## **About the Girish Sant Memorial Annual Lecture, 2013**

This lecture explores the questions and misconceptions that dominate the discourse on economic development and the consequent distortions that have crept into energy planning which is a part of economic planning. It concludes with a discussion of possible lines on which the future course of energy development should proceed.

## **About Dr. E. A. S. Sarma**

Dr. Sarma has held various distinguished positions in the Government of India such as Principal Adviser (Energy) to the Planning Commission, Secretary (Ministry of Power) and Secretary (Ministry of Finance). He has also been the principal of Administrative and Staff College of India, Hyderabad. Currently, he is active in campaigning against human rights violations and environmental degradation in the name of development. He is also the Convener of Forum for Better Vishakha, a civil society forum working on civic issues in Vishakhapatnam and in pursuing electoral reform at the local and national levels.

## **Girish Sant Memorial Activities Committee**

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