

20 October 1990

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My dear Shri Satish Chandran

This is a long overdue reaction to your letter of 17 April 1990 enclosing your paper "Economics of Power Generation: Issues and Choices and to the verbatim transcript of your Chairman's remarks on 14 April 1990 reacting to my presentation of an alternative electricity scenario for Karnataka. I was abroad in May and June, and in addition, the more carefully I read the two documents, the more analysis they required.

At first, it appeared that there were just a large number of little points that needed to be rebutted, and I spent hours tackling this task. Then, it became clear that many of the points stemmed from a fundamentally different pattern of thinking that is quite distinct from mine. Your paradigm which is revealed clearly in your paper "Economics of Power Generation: Issues and Choices consists of seeking an optimum solution " without introducing resource constraints from the very beginning. Obviously, the solutions that emerge from such a constraintsfree "optimization" cannot be optimum solutions.

Your approach is so obviously in violation of the optimization techniques of operations research that I became curious regarding its origin. I cannot help but thinking that your constraints free "optimization" approach is a necessary and inescapable concomitant of the process of bureaucratic planning in our country. If you are the Energy Secretary, then it is your bounden duty to get the maximum for your Energy Department irrespective of the resource constraints of the state. In fact, if you show concern for the resource constraints of the Planning Department and limit the demands of your department, then you are betraying its interests. On the other hand, if you are the Planning Secretary, then you must limit the requests of all the departments in the light of the overall constraints. The main result of this process is that resource constraints are introduced "post optimization. So, the exercise is not an optimization process at all; it is a bargaining process in a resource market involving various demand making departments and a few resource supplying departments.

The crucial question is whether the solution that emerges from such a two step bargaining process (involving (1) constraintfree "optimization" and (2) exogenous imposition of resource constraints) is better than a true optimum solution in which the constraints are introduced into the optimization problem from the very start. The answer depends upon whether or not the resource constraints permit the businessasusual approach that has been adopted in the past. If the resource constraints are not severe, then a conventional approach will work. If, however, the resource position warrants an innovative and radically different solution, then the bureaucratic paradigm of pursuing a constraintfree "optimization" exercise is inherently incapable of coming up with innovative solutions that work in the face of severe resource constraints. Those who cannot accept the reality of resource constraints will not find a solution that overcomes these constraints.

I must confess that your Chairman's concluding remarks were very disappointing because you did not "start your critique with the resource constraints operating in the present environment and spell out another scenario superior to mine. But I did not realize then that, given your bureaucratic paradigm of constraintfree "optimization", you could not avoid ending on the note of extreme pessimism.

I have made bold to express these views for two reasons. Firstly, I have such great respect for your objectivity, integrity and honesty that I am sure that you will correct my views if they are in the wrong in which case I would very grateful. Secondly, the energy system in our country is in such a mess that it would benefit greatly from a debate between you as a doyen of the energy establishment and me as a proponent of the new development focussed endues oriented service directed (DEFENDUS) paradigm. This debate is specially important because it is being conducted without any personal animosity. I sincerely hope that this personal relationship will be maintained and that you will respond with the same analytical spirit with which I have expressed my views.

Regarding your paper "Economics of Power Generation: Issues and Choices, I have made detailed comments as I would if I were refereeing the paper for publication in a journal. I hope you will take my comments into account when you are publishing the paper. Incidentally, if you have already published the paper, could you please send me a reprint.

I am sorry that I missed your workshop on rural energy, but unfortunately, I was lecturing in Berkeley on the same day. I would be grateful if you could send me the papers from the workshop.

I would also like to seek your help in the following matter. I recall your once telling me that there was an Indian Committee report on the Brazilian alcohol programme. I would very much like a copy of this report because I am updating the section of my book dealing with that programme.

With best personal regards,

Yours sincerely,

(Amulya Reddy)

REPLY TO THE CHAIRMAN'S REMARKS OF SHRI T.R. SATISH CHANDRAN
ON PROF.A.K.N. REDDY'S PRESENTATION AT THE KPC WORKSHOP OF 14
APRIL 1990

NOTE: The paragraph numbers refer to the numbers introduced in the left margin of the verbatim transcript of the concluding remarks of Shri T.R. Satish Chandran (TRSC) who chaired the workshop. References are also made below to section numbers in the companion document entitled "Comments by A.K.N. Reddy on ECONOMICS OF POWER GENERATION: ISSUES AND CHOICES by T.R. Satish Chandran

(1) The assertion regarding the freedom of Karnataka to chalk out a different growth strategy is far too sweeping. In fact, at every level of administration village, mandal, zilla, state, country there are both freedoms and constraints. Thus, it is much more useful to ask: what are the freedoms and what are the constraints at the level of the state? In the case of power, for instance, it is necessary to identify the freedoms and constraints. If one does this, then it becomes obvious that the state has considerable freedom with regard to the management of demand, the promotion of decentralized renewable sources of energy, and the dissemination of energy efficiency. The constraints are with regard to largescale centralized projects. If the growth of power is wrongly equated with the construction of largescale centralized projects and TRSC makes this common error then of course, Karnataka cannot break new ground.

(2) TRSC's statement that "..... there is much room for an appropriateness for every form of energy whether it is nuclear, thermal, or hydro or the renewables." is meaningless unless the methodology of determining the mix of sources is specified. And TRSC does not specify this methodology either in these comments or in his paper on "Economics of Power Generation.

(3) TRSC's comments on the distinction between financial analysis and resource costing have been rebutted at great length in the comments 5.4 to 5.7 (inclusive) on TRSC's EOPG paper and therefore need not be repeated here.

(4) TRSC's impression that "..... the entire costing is done in terms of energy" is "completely baseless. The paper published in "Economic and Political Weekly (2 June 1990) computes both the Rs/kW of installed capacity as well as the Rs/kWh of energy. Furthermore, the leastcost planning approach has been used both for energy as well as for installed capacity and the latter has been further differentiated into installed base capacity and peak capacity.

(5) For the same reason as discussed in (4) above, TRSC's statement that the distinction between peak and base power "..... is missing totally in the exercises done by Prof. Reddy" does not show awareness of the work that has been done.

(6) TRSC has asserted the following: The statement that "1 kW saved in terms of consumption would save 2.03 kW in terms of generating capacity would be valid if the saving takes place in the peak time. It is not valid if the saving takes place in the offpeak time." In fact, the 2.03 factor has been obtained by taking the capacity factor of "baseload stations and if peak savings are taken, then the factor is >2.03. What TRSC should have asserted is that the factor 2.03 may be too "low.

(6a) A rebuttal of the Ranganathan Kumar argument on wind energy has been given in my comments 5.14 and 5.24 on TRSC's EOPG:I&C paper and therefore need not be repeated here. Has the Ranganathan Kumar paper has been published in a standard refereed journal?

(7) TRSC's assertion: "..... comparison should be made between sources which can cater for base power and sources which can cater for peak power and you cannot mix the two" implicitly restricts the discussion to standalone systems ignores gridbacked systems. When the latter are considered, the conclusions change considerably.

(8) TRSC's point that there are differences between hydroelectric stations makes a

mountain out of a molehill. The variability of costs is not insuperable it can be taken care of with very commonplace statistical techniques.

(9) TRSC's claim "..... that if you do an economic analysis and apply a social wage factor you find hydro comes out as a very attractive option because they give employment opportunities to a large number of unskilled labourers" is a tall claim. It can be accepted only when the analysis is published and available for scrutiny. In any case, it has to be demonstrated that it is the best option.

(10) TRSC's claim that "natural gas confers much better economic benefit to the country than using natural gas to meet base power" may well be perfectly true, but it does not rule out the possibility that natural gas, because of its much shorter gestation time for construction, may be a better centralized option than say coal. And if there are penalties for CO₂ emissions, then natural gas is far better than coal. Indeed, natural gas is "relatively limited" but far more plentiful than oil. And please note that even now a large percentage (30% in 198889) is being flared.

(11) I would very much appreciate receiving your data on the relative cost of peak power, as I would like to go through the calculations.

(12) Share of Centralized Sources in meeting the Total Energy (or Capacity) Requirement: The cost supply curves used by us to identify the components of the mix of technologies necessary to reach the energy (or capacity) requirement in the year 2000 "start from the base energy (or installed capacity). Other audiences to whom I have made this presentation clearly understood that the shares refer to the contributions to the "additional energy (or capacity). My assistants pointed out to me, however, that TRSC was upset at the 7% contribution of centralized sources to the energy requirement probably because he thought that we were suggesting that centralized sources would only contribute 7% to the "total energy in 2000 AD.

This misunderstanding must be corrected by stating that the shares of centralized sources in the total energy requirement, the total baseload goal, the total peakload goal and the total installed capacity for the year 2000 are 54%, 68%, 44% and 56% respectively. The large difference between the contributions to the total requirement and to the additional requirement is of course because the contribution of centralized sources to the base is 100%, there being zero contributions today from efficiency improvements and decentralized sources.

(13) TRSC's statement that "the entire production of photovoltaic itself in India is less than 1 MW per year" is as misleading as a statement before ASIAD that the production of colour TVs was minuscule. Everything depends on the rate of dissemination of a technology which in turn depends on a number of factors but all this ceased to be a mystery after the work of Griliches on the diffusion of hybrid corn and its interpretation in terms of logistic curves.

(14) TRSC's statement: "Here, I see an antithesis to Prof. Reddy's basic proposition that energy should be a policy oriented instrument to serve the cause of the rural poor" merits careful examination. The fundamental question is: what is the cause of the rural poor? If the answer is: the cause of the rural poor consists of meeting their energy demands "as defined by them, then the experience of ASTRA (as one of the few groups that have really tried over a decade to develop energy systems in response to the demand of the poor) is that in areas where there is no fuelwood crisis (as demonstrated by the absence of burning of dungcakes) the first priority energy

demand of the rural poor is the lifting of drinking water and the second priority demand is lighting. Both these energy demands are well served by electricity as ASTRA has demonstrated in Pura.

Incidentally, precisely because electricity forms only a small part of rural energy consumption, it does not matter that a small amount of wood is used for conversion into electricity. Furthermore, wood can be used renewably in Hosahalli village, the lighting needs of all the houses in the village are being met with about 10 kg wood per day.

(15) TRSC's statement "..... decentralized sources cannot produce energy on the scale we need for industrial consumption" tilts at windmills (battles with enemies who are imaginary) like Don Quixote. No one and certainly not AKNR ever suggested that INDALCO can be run on cowdung.

(16) I wish TRSC had not dismissed the suggestion that LPG cooking should replace electric cooking in such a superficial fashion. I have given considerable thought to India's oil problem and published a strategy for resolving our oil crisis almost a decade ago. TRSC's suggestion that LPG cooking will undermine an otherwise selfreliant oil strategy is just not true. Our oil problem is primarily a dieselkerosene problem. If we are importing LPG at a time when we are flaring 30% of our natural gas, it is because our energy decision makers did not make the investments to convert natural gas to LPG. They preferred to allow some cooking (by the elite?) to be done with electricity.

(17) I am sorry that TRSC has not been sufficiently well informed on the subject of compact fluorescent lamps (CFLs). They are available in India through amongst other, Philips. They are already being incorporated into standby power supplies even a Bangalore manufacturer supplies such systems. They cost about Rs.200. 40 residential programmes in Sweden, Denmark, the Netherlands and West Germany resulted in 4.9 million households acquiring 2 million CFLs at an average cost of \$9 per CFL.

(18) TRSC's statement "..... with the high initial investments they would be viable only if they are used for long periods of time...." does not show awareness of the imaginative methods of financing/leasing that are being adopted by at least 50 electricity utilities in the West. We ourselves have proposed a scheme that shows that even after paying Rs.1.33/CFL/month towards repayment of principal and loan (12% over 7 years), a nonAEH connection can save Rs.3/month on its monthly bill.

(19) TRSC's statement "..... the market, given the purchasing power of the people, would remain limited" is invalid if imaginative marketing is done.

(20) The statement "What is the kind of investment you need to replace all the existing motors?" is meaningless in isolation even though it is typical of the obsolete approach to energy decision making. The correct question is: what is investment to replace inefficient motors with efficient motors? How much energy, base power and/or peak power will be saved? What investment would be required to set up equivalent generating facilities.

(21) It is quite insufficient for TRSC to say "..... as long as we under price energy". Since TRSC must have been on innumerable tariff committees, it is incumbent on him

to enlighten the public with regard to why energy is being underpriced and what steps were attempted to prevent this under pricing. Those who were involved in the decision making must not act detached with regard to the consequences of decision making.

(22) The conventional macroeconomic approach is to use the GDP elasticity of electricity to compute the electricity demand. What has been done in the alternative scenario is to aggregate the enduses to give the requirement on a year by year basis, and to use this enduse aggregated electricity demand to derive the electricity GDP coefficient. If it turns out to be as low as 0.7, then it only means that the extent of efficiency improvements envisaged will lead to far lower coupling of electricity and GDP than observed with projections that do not incorporate these efficiency improvements. Whether there is a precedent for such a low figure is irrelevant except within a bureaucratic frame of mind which is afraid to depart from precedents. In fact, the argument is the other way around if the coefficient has a conventional value of 1.5 to 2.0, then precedent has shown that the capital resources will be unavailable. Incidentally, it is not widely known that China achieved an energy GDP ratio of 0.5 in the period 1979-85 as a result of deliberate energy policy (cf. Levine, M.D. and Xueyi, Liu, "Energy Conservation Programs in the Peoples Republic of China, Lawrence Berkeley Laboratory, May 1990)

(24) Efficient use of electricity reduces the increases of electricity necessary to achieve given increases in GDP and high elasticities do not necessarily mean that all the electricity increase is necessary and essential for the GDP increase. And the high elasticities for agriculture and households includes enormous inefficiencies in electricity use. To assume as TRSC does that those high elasticities are inescapable is to accept that inefficiencies are unavoidable and the only option is to increase supplies to bridge the demand supply difference.

(25) Economic development necessarily requires increasing levels of energy services, and therefore greater amounts of useful energy. But, the useful energy utilized by devices can be increased by increases in energy supplies and/or increases in efficiency. It is only when efficiency increases are excluded that conventionally high GDP elasticities are unavoidable. If efficiency improvements are exploited, then the elasticity can be brought down much below conventional levels. We have carried out a mathematical analysis of this matter, and it can be shown that "efficiency improvements can give you a "greater GDP bang for a smaller energy buck". Your assertion that if there is a "focus on agriculture and meeting basic needs and so on, we still need a high GDP elasticity" is invalid if efficiency improvements are exploited.

(26) TRSC's assertion: "What kind of funding we can get from the World Bank is not really a very material factor as far as our whole policies are concerned" may have been perfectly valid in the preIMF loan period, but I am not sure whether it is valid now and whether it will be valid in the future. Our recent pleas to the World Bank indicate that we may have entered a new period characterized by dependence.

(27) Your concluding comment that there was no use planning because of the serious resource crisis shocks me. I would have expected a person with TRSC's high level experience of energy affairs to make the nature and dimensions of the resource crisis the "first sentence of his comments and then to spell out another resource constrained scenario that would be superior to mine. The point is that the electricity sector cannot decide either the size of the plan allocation or the percentage share of the electricity

sector. Hence, energy analysts and planners must accept as an "initial condition for their thinking the plan allocation that is made to them even though this allocation is turning out to be only about one quarter to one fifth what the electricity sector is dreaming of. It surprises me, therefore, that TRSC who has been at the helm of energy affairs displayed in his concluding remarks an amazing inability to "start his critique with the fundamental constraint operating in the present environment.

(28) The tragic state of affairs in official energy thinking was emphasized by TRSC's last statement in his long comment that "there was no use planning because of the serious resource crisis. In my view, it is precisely when there is a serious resource crisis that imaginative planning is crucial. If TRSC's attitude is typical of the energy establishment and I suspect it is then it is no surprise that those who cannot accept the reality of resource constraints will not find a solution that overcomes these constraints. This is why our energy affairs are in such a mess.