

## **From Fission to Fusion: The Story of India's Atomic Energy Programme by M.R. Srinivasan, Viking, New Delhi (2002)**

Bangaloreans should be proud of the fact that Dr. M.R. Srinivasan, the author of the book under review, is a local boy who graduated from what is now known as Visvesvaraya College of Engineering and rose to the top of the prestigious atomic energy department. This achievement is all the more impressive because, in the scientific establishment, the dominant group of theoretical physicists often tend to treat mere engineers as a "lower caste". In fact, Srinivasan played a stellar role in India's nuclear power programme. He could "... look back with satisfaction on planning and executing eighteen nuclear reactors in all ..." and claim that it "is unlikely that this record will be surpassed in the future." Srinivasan, therefore, is an outstanding technocrat of our post-independence generation so that a memoir of his working life (which is what he intended the book to be) constitutes essential reading for understanding the period and its grand nuclear venture.

The book goes through the major projects and programmes of the Indian nuclear establishment. The story of the Apsara, Cirus, Tarapur, Rana Pratap Sagar, Kakrapur and Kalpakkam reactors, as well as the ancillary electronics, heavy water and nuclear fuel establishments, are described from the vantage position of an "insider". [Since the subject matter in all these cases is technical, one cannot help wishing that Srinivasan supplemented his expository skills with technical boxes and diagrams.]

Actually, Srinivasan is a very special "insider" for he differed from the rest of the post-Bhabha-Sarabhai leadership by believing that "... the DAE must release information on safety and cost projections." This sharing of information would lead inevitably to differences in assessment and therefore to a diversity of opinions regarding the role of atomic energy. This natural selection of ideas cannot arise if there is a monoculture of views. Truth cannot emerge if there is an absence and/or exclusion of dissent. Thus, in contradiction to Srinivasan's plea based on his quotation of the last stanza of the Rig Veda, we can "walk together as a group" (*sam gachadhvam*) -- the ultimate richness of democracy -- without having to "speak with one voice" (*sam vadadhvam*) and to "think alike" (*sam vo manamsi janatam*) in order to achieve the ephemeral advantage of regimentation so attractive to monolithic establishments.

Memoirs of working life are difficult to write – underplaying one's role results in the masking of truth, and overplaying it gives the impression that one is blowing one's trumpet. On balance, it may be better to err on the side of modesty and let the facts speak for themselves. By and large – but not always – it appears that Srinivasan has given a fair account. In particular, and this is really praiseworthy, he has given generous credit to the large number of individuals who contributed to the various projects.

Regarding the reliability of Srinivasan's judgements on controversies, this reviewer is knowledgeable on one issue. Srinivasan writes: "... Reddy has spoken against all dams, small or big." In fact, I wrote in *The Hindu* of 14/12/1999 that one possible outcome of a rational planning procedure is that the "...big dam .. itself proves to be the least cost solution in which case it must be accepted irrespective of prejudices

against such projects.” Hopefully, Srinivasan’s accounts of other intellectual disputes are more accurate. One also wishes that he did not mention the names of people who seem to have harmed Srinivasan’s career, if for no other reason than to avoid rebuttals that may diminish the worth of this valuable book.

It appears that Srinivasan was excluded from the development of India’s atomic weapons programme. Why? It is not clear, but this reviewer conjectures that Srinivasan’s exclusion was perhaps because of his independent, non-sycophantic personality and/or the fact that he was not a member of the physics “inner circle”. He could have made this exclusion a virtue and stood out as a champion of a peaceful atomic programme. He did not! Instead, he included in the book an insipid chapter on “The Nuclear Weapon” which unfortunately is like the writing of an ‘outsider’ with the hackneyed justifications for India’s atomic bomb found in the popular press. There is not even an insight into the reactors-bombs nexus reported to be the basis for the choice of natural uranium-heavy water CANDU reactors that produce plutonium.

All this does not lessen the importance of Srinivasan’s lifetime of dedicated work on India’s nuclear power programme along with support of the large band of home-grown nuclear scientists and technologists. The real tragedy is that after half a century of dedication from technical leaders like Srinivasan and an enormous pool of high-class technical personnel, and the vast resources expended, the nuclear power programme cannot boast of more than a trivial 3,000 MW or 3% of India’s current capacity.

Srinivasan does not give an unambiguous explanation for this miserably low return on the enormously large investment of time, effort, money and manpower. The failure to reach greater heights is obviously not because of the lack of competence or commitment on the part of our nuclear engineers. Could the poor achievement be the inevitable result of an unexpectedly prolonged learning curve, especially since Canada cut off all aid in 1974 after Pokhran I? Could it be because the programme ran into funds constraints after 1990? Could the programme have harmed itself by itself not bothering sufficiently about the cost of power production? Was it misguided by the Bhabha slogan “No power is as expensive as no power”? This cost blindness – amply illustrated by the paucity of analysis in Srinivasan’s book on the costs of nuclear power -- may be valid as long as users do not have to pay for the true costs of power. However, as soon as they have to pay cost-reflective prices, power projects have to meet market criteria. And the experience of nuclear power in the industrialized countries is that it has faltered wherever it had to survive in a market without massive government subsidies.

In retrospect, it may appear therefore that India's nuclear power programme can be justified only by the fact that it enabled the nuclear weapons programme. And if the Pokhran tests in fact decreased the security of the country, then the atomic energy programme of the country has brought neither power nor peace. That is the tragedy the consequences of which will be borne by the people of India through foregone education, health, habitat, relevant science and technology, etc.