

37

**STANDING COMMITTEE  
ON ENERGY  
(1995-96)**

**TENTH LOK SABHA**

**PROBLEMS OF  
RAJASTHAN ATOMIC POWER STATIONS**

**DEPARTMENT OF ATOMIC ENERGY**

8

**THIRTY-SEVENTH REPORT**

**AUTHENTICATED COPY**



*Jaswant Singh*  
**CHAIRMAN COMMITTEE ON ENERGY**

LC  
328.3657R  
15.37.5

**LOK SABHA SECRETARIAT  
NEW DELHI**

February, 1996/Phalgun, 1917 (Saka)

THIRTY-SEVENTH REPORT  
STANDING COMMITTEE ON ENERGY  
(1995-96)

(TENTH LOK SABHA)

PROBLEMS OF  
RAJASTHAN ATOMIC POWER STATIONS

DEPARTMENT OF ATOMIC ENERGY

*Presented to Lok Sabha on* \_\_\_\_\_

*Laid in Rajya Sabha on* \_\_\_\_\_

07 MAR 1996



LOK SABHA SECRETARIAT  
NEW DELHI

*February, 1996/Phalgun, 1917 (Saka)*

**C.E. No. 057**

Price : Rs. 10.00

श्रीमान्श्री लोकायुक्त  
श्रीमान्श्री गौड़ पब्लिकेशन्स  
आ.सं. नं. नि. 93744-6  
दि. 20/2/96

lc  
328.3657R  
N5.37j5

© 1996 By LOK SABHA SECRETARIAT

Published under Rule 382 of the Rules of Procedure and Conduct of Business in Lok Sabha (Eighth Edition) and Printed by M/s Jainco Art India, 1/21, Sarvapriya Vihar, New Delhi-110016.

## CONTENTS

	PAGE
COMPOSITION OF THE COMMITTEE .....	(iii)
COMPOSITION OF THE SUB-COMMITTEE ON ATOMIC ENERGY (1994-95) .....	(v)
INTRODUCTION .....	(vii)

### PART—A

#### BACKGROUND ANALYSIS

(i) Rajasthan Atomic Power Station-Unit 1 .....	1
(ii) Rajasthan Atomic Power Station-Units 2 .....	2
(iii) Time Schedules and Cost overrun of RAPP 3 & 4 .....	3
(iv) Financial Problems of Nuclear Power Corporation of India Limited .....	5

### PART—B

Recommendations and Conclusions of the Committee .....	7
--	---

### APPENDIX

Extracts of Minutes of the Twelfth Sitting of Standing Committee on Energy held on 26. 2. 1996 .....	9
--	---

COMPOSITION OF THE STANDING COMMITTEE  
ON ENERGY (1995-96)

CHAIRMAN

Shri Jaswant Singh

MEMBERS

*Lok Sabha*

2. Shri Bhawani Lal Verma
3. Shri Murlı Deora
4. Shri Motılal Singh
5. Shri Khelsai Singh
6. Shri Khelan Ram Jangde
7. Shri Parasram Bhardwaj
8. Shri S. Thota Subba Rao
9. Shri K.P. Reddaiah Yadav
10. Shri Shiv Charan Mathur
- \*11. Dr. Krupasindhu Bhoi
12. Shri Dalbir Singh
- \*13. Shri Vilas Muttemwar
14. Shri P. C. Chacko
15. Shri Arjun Singh Yadav
16. Shri Virender Singh
17. Shri Laxminarain Tripathi
18. Prof. Rita Verma
19. Shri Shankersinh Vaghela
20. Shri Haradhan Roy
21. Shri Anil Basu
22. Shri Keshari Lal
23. Shri Rajesh Kumar
24. Shri Vijay Kumar Yadav
25. Dr. Venkateswara D. Rao

26. Shri Chitta Basu
27. Shri Mohan Singh (Ferozpur)
28. Shrimati Dil Kumari Bhandari
29. Shrimati Lovely Anand
30. Shri B. Shankaranand

*Rajya Sabha*

31. Shri Parmeshwar Kumar Agarwalla
32. Shri M.M. Hashim
33. Shri Bhubaneswar Kalita
34. Shri Dipankar Mukherjee
- \*35. Shri M. Rajasekara Murthy
36. Shrimati Ila Panda
- \*\*37. Shri J.S. Raju
38. Shri T. Venkatram Reddy
39. Shri Rajni Ranjan Sahu
40. Shri Viren J. Shah
41. Dr. Naunihal Singh
42. Shrimati Kamla Sinha
43. Shri Joy Nadukkara

SECRETARIAT

1. Smt. Roli Srivastava — *Joint Secretary*
2. Shri G.R. Juneja — *Deputy Secretary*
3. Shri A. Louis Martin — *Under Secretary*

---

\* Ceased to be a Member of the Committee consequent upon his appointment as Minister in the Union Council of Ministers w.e.f. 13.9.1995.

\*\* Ceased to be a Member of the Committee consequent on his retirement from Rajya Sabha w.e.f. 24.7.1995.

COMPOSITION OF SUB-COMMITTEE ON ATOMIC ENERGY  
OF STANDING COMMITTEE ON ENERGY  
(1994-95)

- Shri Jaswant Singh — *Chairman*
2. Shri Parasram Bhardwaj
  3. Shri Keshari Lal
  4. Shri Mohan Singh
  5. Shri Vilas Muttemwar
  6. Prof. Rita Verma
  7. Shri Viren J. Shah
  - \*8. Shri Matang Singh
  - \*\*9. Shri Bhubaneswar Kalita

---

\* Ceased to be a Member of the Committee consequent upon his appointment as Minister in the Union Council of Ministers w.e.f. 10.2.1995.

\*\* Nominated with effect from 25.7.1994.

## INTRODUCTION

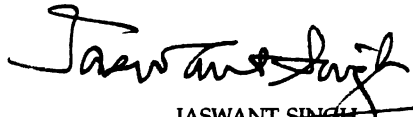
I, the Chairman, Standing Committee on Energy having been authorised by the Committee (1995-96) to present the Report on their behalf, present this Thirty-Seventh Report on the "Problems of Rajasthan Atomic Power Stations." The Sub-Committee on Atomic Energy of Standing Committee on Energy (1994-95) undertook an on-the-spot study visit to Rajasthan Atomic Power Stations at Rawatbhata (Rajasthan) on 29th April, 1995. The Sub-Committee held informal discussion with the officials on various issues concerning Rajasthan Atomic Power Stations. The Department of Atomic Energy furnished written replies on the points raised by the Sub-Committee during the study visit. The report is mainly based on this information.

2. The Committee wish to express their thanks to the Department of Atomic Energy for placing before them the requisite information in connection with examination of the subject.

3. The report was considered and adopted by the Standing Committee on Energy at their sitting held on 26th February, 1996.

4. The Committee place on record their appreciation of the work done by the Sub-Committee on Atomic Energy (1994-95) of Standing Committee on Energy.

NEW DELHI;  
26th February, 1996  
7 Phalgun, 1917 (Saka)

  
JASWANT SINGH  
Chairman,  
Standing Committee on Energy.



## **PART A**

### **BACKGROUND ANALYSIS**

#### **(i) Rajasthan Atomic Power Station–Unit 1**

The annual reports of the Department of Atomic Energy (DAE) revealed frequent shut down and closure of Rajasthan Atomic Power Stations (RAP) Unit 1 and Unit 2. The Sub-Committee on Atomic Energy of Standing Committee on Energy examined the problems of Rajasthan Atomic Power Stations in detail by visiting the site on 29th April, 1995.

2. The first unit of Rajasthan Atomic Power Station (RAPS-1) was built in collaboration with Canadians in the 60s. The unit was commissioned in 1972. This was the lead unit of Indian Pressurized Heavy Water Reactor (PHWR) Programme. The Department of Atomic Energy informed in a note that this unit developed technical problems with regard to end shield leakage due to wrong selection of end shield material which suffered irradiation embrittlement and developed cracks. Indigeneous technical solution was found and end shield was repaired and subsequently the unit was derated to 100 MWe mainly from safety consideration. During the year 1991, the Over Pressure Relief Device (OPRD) developed heavy water leak necessitating periodic long shut down for locating and identifying the leak. Similar incident had also occurred in Douglas Point generating station in Canada and repair of this took considerable time and effort. The nickel gaskets in the OPRD cover of calandria have identified to be leaking in RAPS-1. According to DAE toolings and procedures are being developed to repair this, which is in the high radiation area. The approach is to mend the leak without replacement of existing gaskets. DAE expect that the leaking OPRD can be repaired in about one year's time, after development of suitable toolings and procedure.

3. It is observed from the information furnished by DAE that RAPS-1 has already operated for 5.2 Full Power Years and the coolant channels of the reactor core have seen about 70,000 hot operating hours. It has been stated that these channels having two loose garter springs might have also developed early calandria tube pressure tube contact, in some of the channels. The Committee were informed by DAE that in RAPS-1 no post commissioning investigation have been carried out to determine the position of garter springs. Therefore, assessment of the pressure tubes is required, as the above factors limit the operating life of coolant channels. DAE indicated that these channels would have to be

subjected to exhaustive inservice inspection for evaluating the balance life. Areas have also been reportedly identified for safety upgradation and refurbishing of the items for plant life extension such as back fitting of high pressure ECCS injection, inspection of steam generator tubes and other heavy water/light water heat exchangers etc.

4. DAE have stated that while the development of toolings and equipment for replacement of end shields, schemes/engineering details for upgradation and refurbishment of safety related equipment is being reviewed as a long term objective, a techno-economic review by Nuclear Power Corporation and Bhaba Atomic Research Centre is to be completed before taking a final decision re regarding the restart of the unit.

5. The Unit I of RAP is a prototype PHWR. The unit is being operated by NPC on behalf of Department of Atomic Energy/Government of India, since the formation of the Nuclear Power Corporation.

#### **(ii) Rajasthan Atomic Power Station Unit-2**

6. The Rajasthan Atomic Power Station is a twin unit station built in the 1960s with Canadian design. The basic design features are similar to the first Canadian 220 MWe nuclear power station at Douglas Point. The RAPS Unit-2 was built and commissioned by Indian engineers and the performance of this unit has been superior to unit-1. The unit has operated at an average capacity factor of 59% and has so far generated 15 Billion units. The reactor core has completed 8.5 Effective Full Power Years of operation as on July, 1994.

7. It is observed that RAPS-2 has been shut down since July, 1994 for carrying out an exhaustive in-service inspection for an assessment for the integrity of the coolant channel pressure tubes. DAE have informed that the inspection data is being analysed presently and it is likely that en-masse coolant channel replacement in this unit may have to be taken up. It has been stated that the defueling of the reactor core has, therefore, been taken up simultaneously and as on date 63 channels have been defueled. It is expected that defueling will be completed by December, 1995, and the Primary Heat Transport System shall be decontaminated during January, 1996 before en-masse coolant channel replacement which is expected to last three years. The Committee have been informed that in addition to above, during the three years of shut down the refurbishing of other systems and equipment to bring the station to current safety requirement for the most essential items would also be completed. The coolant channel replacement jobs have to be done for the first time in India. Only a very limited information on the experience of retubing of reactors (4 Nos.) by Canadians is available. DAE have informed that the

job requires the use of remotely operable toolings, for handling of highly radioactive components and hence calls for design and development of special remotely operable toolings, qualification and training and procedures.

8. The cost for coolant channel replacement has been estimated to be Rs. 133.50 crores at 1994 prices and Rs. 153.62 crores with escalation upto the date of completion. The estimated cost of upgradation and modernisation of the other systems and equipment is Rs. 46.58 crores at 1994 prices and Rs. 53.60 crores with escalation. The total cost of project for both en-masse coolant channel replacement and refurbishing including escalation and interest during construction (I.D.C.) works out to Rs. 252.54 crores assuming an escalation rate of 8% per annum and an interest rate of 16% with a Debt Equity Ratio 2 : 1.

9. According to DAE, after completion of these works of retubing of coolant channels and upgrading of other systems, the plant life will be extended for another 25—30 years. The cost of Rs. 252.54 crores is only 23% of the cost of building a new reactor of 220 MWe, which is approximately Rs. 1100 crores at present estimates.

10. In view of the fact that the above rehabilitation project involves substantial investment, DAE have stated that the expenditure towards replacement and refurbishing has to be taken towards capitalising the cost of the station. After capitalising, the revised tariff based on the present cost estimates reportedly works out to Rs. 1.86 per unit.

**(iii) Time Schedules and cost overrun of RAPP 3 & 4**

11. The cost estimates and date of criticality as originally envisaged and as revised subsequently are indicated below :—

(Rupees in crores)			
Original sanctioned cost	Revised sanctioned cost	Original date of criticality	Revised date of criticality
711.56	2107.00*	May, 1995 (Unit-3) November, 1995 (Unit-4)	November, 1996 (Unit-3) May, 1997 (Unit-4)

\*Inclusive of IDC of Rs. 657.00.

12. Enquired about reasons for two different time Schedules for the units, DAE informed in a written reply that "when multiple units are

taken for construction at the same site, the normal practice is to have a phasing of the commissioning of individual units in order to enable optimal deployment of resources and matching delivery of equipment.”

#### **Reasons for Time overrun**

13. The Sub-Committee desired to know the reasons for time overrun. DAE informed in a written reply that though the cost estimate for RAPP 3 & 4 was prepared in 1984, the financial sanction could be issued only in November, 1986 with the criticality date of Unit 3 as May, 1995 and for Unit 4 as November, 1995. The main plant civil works could be awarded in July, 1988 as against the target of November, 1987. The Civil works were started in August 1988 and excavation for the main plant buildings was completed by July 1989.

14. It has been stated that the subsequent clearance from Atomic Energy Regulatory Board (AERB) to proceed with concreting of the raft of the reactor building could be obtained only by end February, 1990 causing a delay in civil works. Due to the revised guidelines issued by AERB, the original design had to be reviewed resulting in further delay in release of construction drawings.

15. It has been further stated that during the execution of the civil works, delays also occurred due to Gulf crisis and non availability of explosives and diesel. In June, 1991 work came to a total standstill due to the adverse cash flow and financial crunch faced by M/s. HCC, the contractor for main plant civil works. The problem was resolved by the NPCIL Board and the Civil works re-started in December 1991. These resulted in a delay of about 18 months in the project schedule requiring revision of the criticality dates to November, 1996 and May, 1997 for RAPP 3 & 4 respectively.

16. DAE informed that as a result of re-design of containment structures and dome consequent upon the Kaiga dome delamination incident, it is anticipated that there may be a further delay of 6 to 12 months in the date of criticality.

#### **Reasons for Cost overrun**

17. Asked to explain the reasons for cost-overrun the DAE indicated the reasons as follows :—

##### **(a) Escalation in price :**

In the original estimate, provision for future escalation was estimated on the basis of 4% (average) escalation per year (being the prevalent rate

that time), the project implementation time span of 8 years and the total provision for future escalation in respect of the project was of the order of 15% of total cost estimate at 1984 prices. The quantum of escalation provided for did not fully cover the actual escalation that has occurred. The increase in prices of certain major equipment like the turbo generator set, the diesel generator set and the steam generators over the prices assumed for the original estimate has been to the extent of 100%.

The consumer price index has gone up from 117 in 1984 to 229 in 1992 end. The increase in prices of structural steel, copper, lead have been significantly more than the proportionate increase in consumer price index.

**(b) Variation in Foreign Exchange rate :**

The foreign exchange rate for dollar had gradually increased from Rs. 12.5 per dollar to Rs. 20 per dollar till June 1991 and subsequently the rupee has undergone devaluation twice. At present the foreign exchange rate for dollar is of the order of Rs. 32 per dollar. This has resulted in further increase of cost mainly because major import by the Project Authority as well as by the contractors were carried out after the devaluation of rupee.

**(c) Increase in taxes and duties :**

Upto the time of recent budget proposal taxes and duties were at a rate higher than what was anticipated at the time of the proposal of the original cost estimate.

**(d) Increase in scope of work :**

It is worth mentioning that in 1984 the design of NAPP was in wet stage. Detailed engineering of the piping, electrical and instrumentation system had not been completed by then.

Afterwards major design changes were introduced to comply with the latest requirement of the International Atomic Energy Agency (IAEA). In view of commissioning experience of NAPP, the Atomic Energy Regulatory Board (AERB) recommended many changes in design to improve safety, reliability and operational flexibility of reactor operation. All these changes have resulted in the increase in the scope of work significantly.

**(iv) Financial Problems of Nuclear Power Corporation of India Limited**

18. The NPCIL was formed in September 1987 to implement the programme of installing 10,000 MWe of nuclear power capacity by the

year 2000. At the time of formation of the Corporation, the agreed pattern of funding of new projects was that "the funding of future projects including works in progress and interest during construction would be in the form of 50% as Government equity and 50% as loan. The equity portion of budgetary support amounting to 50% of project cost would be released first."

19. However, due to financial constraints, the Government could not adhere to this commitment and there had been a drastic reduction in the budgetary support year after year. As a result, NPCIL was forced to borrow funds from the open market at higher interest rates. The following table shows the funds raised by NPCIL through market borrowing till 31.3.1994.

(Rs. in crores)

Year	Equity from Govt.	Market Borrowings
1988-89	211	200
1989-90	230	360
1990-91	185	400
1991-92	131	712
1992-93	143	86
1993-94	163	658

20. The interest burden on the borrowings made so far works out to about Rs. 370 crores for the year 1994-95, in addition to the interest payable on the borrowings that would be made in 1994-95. Apart from the interest payments, repayment of loan raised in the year 1987-88 would also start from the year 1994-95 onwards. The cash flow problem is further aggravated by the recalcitrant attitude of the State Electricity Boards who are irregular in the payment of energy bills. By the end of March, 1994, an amount of Rs. 478 crores has remained as arrears to be collected from State Electricity Boards. Large borrowings at higher interest rates, low budgetary support coupled with longer gestation periods for completion of projects would lead the Corporation into a debt trap unless Government steps in with higher equity support. Due to dwindling budgetary support from the Government for ongoing projects of NPCIL, The Corporation has been forced to adopt a debt equity ratio of 2 : 1 for its ongoing projects as against 1 : 1 envisaged earlier.

## PART B

### RECOMMENDATIONS AND CONCLUSIONS OF THE COMMITTEE

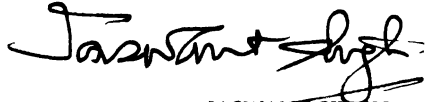
1. The Committee observe that establishment of the Rajasthan Atomic Power Station is a major effort in the country's endeavour to develop technical capabilities in nuclear power generation. Frequent shut downs and closure of Rajasthan Power Station Units-1 and 2 are a matter of concern to the Committee. The Committee are of the view that the efforts of the Department of Atomic Energy should not suffer owing to lack of financial support. The needed funding must be provided by the Government for this purpose as has been recommended by the Committee time and again in their earlier reports.

2. Rajasthan Atomic Power Station Unit-1 is amongst the oldest of Nuclear Power Stations in the country. The unit is now being operated by the Nuclear Power Corporation on behalf of the Department of Atomic Energy. In the opinion of the Committee this is essentially an Experimental Station, a Research and Development Tester. The Committee are, therefore, of the view that rather than saddling the Nuclear Power Corporation with the financial liabilities of this station, Unit-1 of RAPP, now known as RAPS-1, should be treated as a Research and Development Station and be reverted to the Department of Atomic Energy. This would also facilitate budgetary support.

3. Similarly, Unit-2 of Rajasthan Atomic Power Station which has had repeated and considerable technical difficulties should also provide an opportunity to our scientists and nuclear engineers to devise various indigenous alternatives, as also fabricate the needed machinery. If the Nuclear Power Corporation had been an establishment of long standing with commercial viability this kind of supportive, technological experimentation and innovation could have been sustained by them. The Committee feel that in light, however, of the very recent birth of the Nuclear Power Corporation of India Ltd. and its present financial constraints, the status of the Unit-2 of Rajasthan Atomic Power Station, as a commercial station should also be re-evaluated.

4. The cost estimates of Units-3 and 4 of RAPS which are presently under execution have gone up by nearly 200% on account of factors

like, price escalation, variation in foreign exchange rate, increase in taxes and duties and increase in scope of work. The commissioning schedule of these units has also been revised and is expected to be delayed atleast by another year and a half. The Committee expect the Department of Atomic Energy to monitor the execution of the projects closely and provide all necessary support to ensure that the projects are commissioned without further cost and time over runs.



NEW DELHI;  
26th February, 1996  
7 Phalgun, 1917 (Saka)

JASWANT SINGH,  
Chairman,  
Standing Committee on Energy.



## APPENDIX

### EXTRACTS OF MINUTES OF THE 12TH SITTING OF THE STANDING COMMITTEE ON ENERGY HELD ON 26TH FEBRUARY, 1996.

The Committee sat from 16.00 hrs. to 16.45 hrs.

#### PRESENT

Shri Jaswant Singh — *Chairman*

#### MEMBERS

2. Shri Bhawani Lal Verma
3. Shri S. Thota Subba Rao
4. Shri Dalbir Singh
5. Shri Laxminarain Tripathi
6. Prof. Rita Verma
7. Shri Anil Basu
8. Shri Chitta Basu
9. Shri Parmeshwar Kumar Agarwalla
10. Shri Bhubaneswar Kalita
11. Shri Dipankar Mukherjee
12. Shrimati Ila Panda
13. Shri Rajni Ranjan Sahu
14. Shri Joy Nadukkara

#### SECRETARIAT

1. Smt. Roli Srivastava — *Joint Secretary*
2. Shri G.R. Juneja — *Deputy Secretary*
3. Shri A. Louis Martin — *Under Secretary*

The Committee first took up the following draft reports for consideration :—

- (i) Draft Report on "Problems of Rajasthan Atomic Power Stations".
- (ii) Draft Report on "Finalisation of Service Conditions and absorption of Deputationists in Nuclear Power Corporation of India Ltd".

The Chairman mentioned in this connection that the Sub-Committee on Atomic Energy of Standing Committee on Energy (1994-95) undertook an on-the-spot study visit to Rajasthan Atomic Power Stations at Rawatbhata and held discussion with the officials on various issues concerning Rajasthan Atomic Power Stations. The Chairman indicated that these reports were prepared based mainly on the information furnished by the Department of Atomic Energy on the points raised by the Sub-Committee during the study visit. Thereafter, the Committee adopted the two reports mentioned above.

- |    |    |    |    |
|----|----|----|----|
| 2. | ** | ** | ** |
| 3. | ** | ** | ** |
| 4. | ** | ** | ** |

5. The Committee authorised the Chairman to finalise the reports adopted by the Committee and present them to the Parliament.

- |    |    |    |    |
|----|----|----|----|
| 6. | ** | ** | ** |
| 7. | ** | ** | ** |
| 8. | ** | ** | ** |
| 9. | ** | ** | ** |

*The Committee then adjourned.*

---

\* Paras 2,3,4,6,7,8 and 9 of the Minutes relating to consideration of two other draft Reports, matter pertaining to a Bill and Procedural Matters have not been included.