CHAPTER 2

EVOLUTION OF HEAVY ELECTRICALS
INDUSTRY IN INDIA

In the last chapter we have discussed that the acceleration in public investment in the last years of the first plan and in the beginning of the second plan was one of the important factors which led to a foreign exchange crisis. The import control policy was made restrictive from 1957-58 onward to manage the balance of payment crisis. We have also discussed in the last chapter the controversy or the debate regarding the cause of delay, inefficiency etc., whether import control policy alone was responsible for it or there were other more important reasons such as lack of resources particularly foreign exchange, lack of project reports, tying of aid etc. We also went into other causes of inefficiency—whether the size of the market permitted optimum size of the plant or not.

In this chapter we will try to discuss all these issues in the light of the experience of HE(I)L—a company which was incorporated in 1956 and major part of whose construction was done in the restrictive phase of import control policy i.e. 1957-58 to 1965-66. The choice of a public sector company instead of a private sector company does not matter because it has been generally argued that public sector was
as much affected by the ills of the import control policy as was the private sector. Moreover, heavy electrical equipments are sophisticated technological products and at that time it was generally believed that India was not in a position to produce such sophisticated and highly capital intensive item efficiently. Thus HE(I)L was supposed to be the typical example of inefficiency which the control regime had produced. Thus the choice of HE(I)L will help us to discussed all the issues that we have discussed in the last chapter.

This chapter will have following sections: (i) The main reason for establishing a heavy electrical plant in India, (ii) the cause of excessive delay - first in taking decision to establish HE(I)L and then delay in construction of the plant, (iii) the question of the size of the market and the profitability of the plant. However, for a proper discussion of these issues it is necessary to understand the basic features of heavy electricals industry - economy of scales, financial requirements etc. So we will begin with a discussion on basic features of heavy electricals industry before discussing the issues outlined above in the paragraphs.

Basic features of Heavy Electrical Industry:

We will discuss the basic features of heavy electrical industry in relation to (a) financial requirements,
(b) technology, (c) market, (d) economies of scale.

(a) **Financial requirement:**

Heavy electrical equipments are large machines and they are custom made (i.e. they are not standard machines - every machine is made according to the specifications provided by the customer). It is the "heavy" and custom-made nature of the products which requires considerable investment "in handling and machining facilities". And "heavier" the equipments (e.g. a 100 MW turbine machine is heavier than a 500 MW turbine machine) higher is the investment in "larger buildings, longer lathes, heavier cranes, higher assembly shops etc." (higher assembly shops mean that assembly shops have to have higher ceilings).

Considerable amount of money is also required in training the workers to learn the skill. Finally, huge working capital is required because (i) the production cycle is quite long, 18 to 24 months - for larger equipment and 8 to 12 months for smaller equipments, (ii) the customers want equipment credit.¹

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Technology:

Because of custom-made nature of product, a heavy electrical plant requires capacity to design the product as specified by the customers, skill to interpret drawings and the capacity to do jobs on large pieces with very small tolerances (which means that degree of inaccuracy should be very small or to put it differently, the degree of accuracy should be very high). It is this requirement of very small tolerances which makes the learning process take such a long time e.g. it might take a worker ten years to operate a lathe to do accurate machining "subject to clearance of tolerance of one thousand of an inch." And there is a high degree of variation in the technology with the change in the type and the size of the product. Historically, technological progress has been directed towards designing and producing ever larger equipment (say from 50 MW turbine to 100 MW turbine to 200 MW turbine) because higher equipments reduce the cost of generation and transmission of power. Because of the long time that

2. Ibid., p.6.
3. 19th Report of the Committee on Public Undertakings on HE(I), Lok Sabha Secretariat, New Delhi, 1971-72, p.44.
5. Ibid., p.17.
the learning process takes a heavy electrical plant needs protection for every new product that it starts producing. Domestic industry might also have to be protected because of high input prices (i.e. higher than the world market price) and dumping.

**Market:**

The following points are important in relation to the market:

1) There are always certain regulations and minimum specifications for safety;

2) Every customer has his own rationale to evaluate a tender;

3) A customer's decision to buy a particular piece of equipment not only depends on its price and quality but also on the "suitability of the equipment" for his system, the experience that the manufacturers have on similar work and the relation between the customer and the manufacturers;

4) The price of a heavy electrical equipment "in fact is a package which includes many non-price elements such as speed of delivery, credit terms, ease of ordering and

quality of after sales service; 10

v) There is no continuous price information available for heavy electrical equipment in trade journals; 11

vi) Any comparison of price is "true only for the product at the time of the purchase in the country under the set of conditions." 12

A few more important points regarding market are:

i) there is a heavy concentration of production in large international concerns; 13

ii) the market of industrialized countries is heavily protected "nearly to the point of complete exclusion of import"; 14

iii) there is a large excess capacity in the world 15 and many of the firms follow marginal cost pricing strategy; 16

10. Ibid.
11. Ibid.
12. Ibid., p. 3.
13. Ibid., pp. 14-16.
15. Ibid., p. 17.
16. Ibid., p. 43.
iv) Prices under tied aid and bilateral agreements are much higher than the market prices; 17

v) Producing full line of equipment is advantageous because it offers economies of scale in selling costs, research and development, and it also makes a firm less vulnerable to fluctuations in demand. 18

Economy of Scale:

There is economy of scale in the output of a design and total output of a factory. The larger the output of a design the smaller is the cost per unit mainly because cost of special purpose machinery is spread over larger output and it is possible to use more efficient techniques. Larger output of a factory spreads the cost of special purpose plant and management and R and D cost over larger output so there is economy of scale. 19

Section I: The Main Reason for Establishing a Heavy Electrical Plant

It was the realization of the Government of India that the absence of indigenous heavy electrical equipment was one

17. Ibid., p. 23.
18. Ibid., p.
important reasons for the slow growth of power generation which made them decide to have an indigenous heavy electrical plant. India was dependent on "import for almost every item of heavy electrical machinery on the generation side though some progress has no doubt been made on indigenous manufacture of distribution equipment." This was a heavy drain in foreign exchange because "a substantial portion of the outlay nearly 25% on hydro-stations, over 50% on steam stations and about 30% on transmission - constituted the expenditure on machinery." The value of import of heavy electrical equipment in the country "ranged from Rs. 12 to Rs. 20 crores per year during the period 1950-51 to 1955-56 and from Rs. 21 to Rs. 26-52 crores during the period 1957-58 to 1961-62." This in the context of India's


22. On power and distribution transformers.

23. Ibid., p. 275.

24. This means that during 1950-51 to 1955-56 the year in which import was lowest it was Rs. 12 crores while the year when import was highest it was Rs. 20 crores. Similarly during 1957-58 to 1961-62 the year in which import was lowest it was Rs. 21 crores while the year in which it was highest it was Rs. 26-2 crores. 35th Report of the Estimate Committee on HE(I)IL, 1962-63, p. 1.
difficult balance of payment position could have been a serious cause of concern. And even before the foreign exchange crisis of 1957-58 the balance of payment position was not too good. In the first plan, the total deficit on trade account was Rs.569.94 crores. It should also be noted that up to the end of first plan, India got only Rs.19.6 crores of loan/credit for power project and utilized Rs.12.1 crores on these projects and in the second plan it got only Rs.62.3 crores for the power projects out of which it utilized Rs.29.3 crores.25 Now from the 35th Report of the Estimate Committee which we have quoted above we know that the year in which import of heavy electrical equipment was minimum during 1950-51 to 1955-56 it was Rs.12 crores. So the total import during 1950-56 was more than Rs.60 crores. While the total foreign aid utilized during the first plan for power project was only Rs.12.1 crores. Thus during the first plan India financed most of the import for power project through its own foreign exchange. Even during the second plan the year in which import was minimum it was Rs.21 crores - so the total import of heavy electrical equipment


equipment during the period 1957-58 to 1961-62 was more than Rs. 105 crores - however, the total aid utilized during the second plan period for power project was only Rs. 29.3 crores. Thus during the second plan period also India had to finance major part of import for power project through its own foreign exchange. Thus both in the first and second plans and particularly during the first plan India had to finance major part of import for power project through its own foreign exchange. This combined with, not too good balance of payments position of India in the period, definitely prevented major growth of capacity in the power for addition to capacity in power sector during the first plan.

Table 2.1: Target and Actual figures for addition to capacity creation in power sector for different years in the first five year plan (in kw)

<table>
<thead>
<tr>
<th>Year</th>
<th>Target (in '000 kw)</th>
<th>Actual (in '000 kw)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1951-52</td>
<td>57</td>
<td>51</td>
</tr>
<tr>
<td>1952-53</td>
<td>240</td>
<td>252</td>
</tr>
<tr>
<td>1953-54</td>
<td>586</td>
<td>275</td>
</tr>
<tr>
<td>1954-55</td>
<td>694</td>
<td>490</td>
</tr>
<tr>
<td>1955-56</td>
<td>790</td>
<td>644</td>
</tr>
</tbody>
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There was a shortfall in the target also in the second plan. The third plan document commented that "the total installed capacity rose from 2.3 million KW in 1950 to 5.7 million KW in 1960-61. Impressive as this increase was, it fell substantially short of the target of 6.9 million KW. The shortfall is mainly due to foreign exchange difficulties that arose during the early years of the second plan and also delays in the erection of some of the major projects". 27 It can be argued that establishing an indigenous heavy electrical industry itself would have resulted in expenditure of huge amount of foreign exchange in net terms (at least in the short term). But this was not really so because the Government of India got the loan of Rs. 35.54 crores worth of foreign exchange from the British Government upto 11.2.1966 for the purchase of capital equipment, component and raw materials for the HE(I)L and a loan of Rs. 3.6 crores worth of foreign exchange from a consortium of British Banks (M/s Morgan Grenfell Syndicate) for the same project. 28 To conclude it was the shortage of foreign exchange to import different heavy electrical machinery for faster rate of growth of capacity in power

27. The Third Five Year Plan, Planning Commission, GOI, p.43.
sector which made the Government of India decide to go for an indigenous heavy electrical industry.

Section II: THE CAUSES OF THE DELAY IN ESTABLISHMENT OF HE(I)L

(a) Causes of the delay in taking decision regarding establishment of HE(I)L:

The Government of India (the interim Government) had realized the need to establish a heavy electrical plant as far back as 1946, however no decision was taken till 1955. The first time the decision was postponed was in February 1947 because of the post-war inflationary crisis in India. In December 1947, despite the positive recommendations of the technical committee on Engineering Industries of the Industries conference, the Ministry of Industry, and Supply decided to appoint an exploratory committee before going ahead with the scheme. The exploratory committee positively recommended the establishment of an indigenous heavy electrical factory in the report that it submitted.

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31. Ibid., p.18.
in early 1950.\textsuperscript{32} However, the Ministry of Industry and Supply in the year 1950 deferred any further consideration of the project because of shortage of finance and particularly foreign exchange. The Estimates Committee (1962-63) rejected this argument because Westinghouse at that time was prepared to "offer a long-term loan to cover the foreign exchange expenditure as also some permanent investment in the country." The Estimate Committee concluded that the Government at that time did not realize the urgency of the matter.

The matter was taken up again by the Ministry of Production in 1951-52 and it was also included in the first five year plan; the Inter-Ministerial meeting convened in January 1953 also decided to proceed with the matter by approaching the foreign firms. However, the matter was deferred again to take into account the note submitted by the Ministry of Commerce and Industry in which they had argued that they had not been consulted by the Ministry of Production. The Ministry of Commerce and Industry in its note submitted in January 1953 asked for assessment of demand before foreign firms are approached for technical and financial participation. They took this stand because they felt that demand

\textsuperscript{32} \textit{35th Report of the Estimate Committee 1962-63, op. cit., p. 2.}
for heavy electrical equipment was not going to be high because of abandonment of many of the power project planned in 1949; and substantial progress in other power projects undertaken in the first plan, and expressed the fear that the proposed heavy electrical factory would imply a duplication of effort", "misdirection of funds" and would lead to a glut. The matter was finally resolved in the Inter-Ministerial meeting of 1953 which felt that "the total requirements under different heads would amply justify the establishment of heavy electrical factory as an economic concern". However they added that "it was necessary to so adjust production in the State factory that it constitutes an economic unit while at the same time not expose private enterprises to undue competition in the field." So the Government of India approached the foreign firms to submit project reports. After the foreign firms had submitted their report, the Ministry of Commerce and Industry again

33. Given the growth of heavy electricals industry in the private sector. The Ministry of Commerce and Industry pointed out "that the country was currently producing A.C. motors up to 100 H.P. and control and Switchgear production had commenced on a small scale. Besides, transformers up to 3500 KVA and 33 KV were being produced in sufficient quantities."
Khera, S.S., op. cit., p.27.

called for an assessment of existing capacity. The Inter-Ministerial meeting decided a list of items which the private sector was not at all in a position to undertake. But the Ministry of Production either wanted to include certain smaller items also in the proposed plant "to reduce the period of uneconomic working" or to take over an existing factory and gradually expand it to cover the items of production which had been decided at the Inter-Ministerial meeting of August 26, 1954. The Ministry of Production favoured the first option because it felt that "an existing firm will be handicapped to a certain extent in planning the layout and making arrangement for foreign collaboration". The Ministry of Commerce and Industry on the one hand rejected the first option because then the new State factory would be producing "certain size of equipment which were already produced in the private sector". Finally, a compromise was reached and the Ministry of Production accepted the second alternative with the suggestion that "traction equipment remain... on its programme". On the same day i.e. August 26, 1954 the matter was submitted to the Government. The appropriate committee of the cabinet considered the note of the Ministry of Production in September

35. Ibid., pp.40-43.
36. Ibid., pp.47-50.
1954 and decided that "the manufacture of heavy electrical equipment was an urgent necessity". However, before taking the final decision it decided to thoroughly investigate the matter by an expert committee. Hence, a committee headed by Shri S.A. Gadkari, Consultant (Power), Planning Commission was appointed on October 1, 1954. Given that the manufacture of heavy electrical equipment was an urgent necessity, the Committee was asked to investigate.

"(1) The extent to which these can be met by current production in India and by its positive expansion in the immediate future, taking into account the unsued capacity available in Government establishment and workshops, including the state workshops;

(2) The exact requirements of the country in the matter of heavy electrical equipment;

(3) The residue of the requirement left to be covered; and

(4) How the residue ought to be met speedily and economically and through what agency." 37

Gadkari Committee submitted its report in January 1955. The Committee observed that:

"(1) The existing production in India has been examined as also its possible expansion in the near future. Production

37. Ibid., pp.52-54.
is mostly confined to small transformers and meters. The committee finds that no heavy plant is being planned by the existing units. Nor is there any unused capacity suitable for this purpose in the Government workshops and factories.

(ii) The committee is of the firm conviction that the manufacture of heavy electrical plant in the country is essential for speeding up industrialization and that the only way of achieving it is for the State to establish a factory for the purpose. 38

Finally, the Government accepted the recommendations of the Gadkari Committee in 1955. 39

(b) Foreign Exchange crisis and the delay in construction:

In July-August 1957, Bhopal project was taken up. In this same period there was a serious problem of foreign exchange and it appeared that Bhopal project might be abandoned again. The project could be saved only after credit worth £ 2.72 millions could be arranged with British Bankers through M/S Morgen Grenfell and Co. This took a lot of time. Moreover, the loan was conditioned and to comply with that condition AEI had to be made the purchasing agent. This involved heavy service charges

39. Ibid., p.3.
(interests for the loan). Moreover, AEI had to be paid Rs. 21 lakhs for their services as purchasing agents. The Estimates Committee felt that - "All these must necessarily affect the cost of production". As the Estimates Committee observed this was a result of the Government's decision to sanction the project without arranging foreign exchange in advance.

The foreign exchange crisis also forced the Government of India to take the decision "to split its development into three phases instead of going ahead simultaneously with the installation of production facilities for all the items". Initially, the salient features of the Bhopal Project were as follows:

Fixed capital investment Rs. 35.25 crores
Foreign exchange expenditure on capital account - Rs. 17.50 crores.
Period of completion of the construction phase - 4 years.
Full turnover and the target year for its achievement - Rs. 12.5 crores in 13th year i.e. 1970.
Personnel required - 8,487.

Because of the foreign exchange crisis of 1957 the Government had to split the project into three phases. The three phases were as follows:

40. Ibid., pp. 11-12.
Phase I - Stationary equipment, Transformers, Switchgears, controlgears and capacitators.

Phase II - Rotating equipment, Traction motors and industrial motors.

Phase III - Turbines and Rectifiers.

The project was implemented on this revised basis during the rest of the second five year plan. However, the Government of India reviewed the position in 1959 "in the context of the power development likely to be thought of under the Third plan and the following years." And it was decided that "project should be executed on an integrated basis; its output should be doubled and later on raised to the level of Rs.50 crores by multiple shift operation and installation of additional plant equipment mainly of balancing nature. 41

This phasing and rephasing of the programme apart from causing delay must have raised the capital output ratio by raising cost. It should also be remembered that India got aid from Britain upto 11.2.1966 worth Rs.354.4 million for the purchase of capital equipments, components and raw materials for this project. 42 Given the fact that imports under tied aid are much more costly than import from free


market, foreign exchange bottleneck must have raised the
cost of the project by forcing the GOI to take tied aid
and to finance the foreign exchange cost of the project.

Section III: THE QUESTION OF MARKET
AND PROFITABILITY

Before the Heavy Electricals (India) Ltd. was estab-
lished, the expected demand was assessed and it was found
out that expected demand for heavy electricals would be
sufficient to have an economic unit. In this regard we
will cite only two things: (i) The Inter-Ministerial meeting
of April 4, 1953 came to the conclusion that "the total
requirements under different heads would amply justify the
establishment of heavy electrical factory as an economic
unit". 43 (ii) Gadkari Committee was asked to find out how
the residual demand (i.e. expected demand minus expected
supply from existing factories at that time) could be met
economically. And Gadkari Committee suggested that a new
factory should be established in the public sector.

However, it was argued by Bhagwati and Desai that "No
attempt appears to have been made to estimate any rate of
return on capital. These deficiencies in the Report of
the Consultant, Associated Electricals (Incorporated)

sprang from the fact that no demands for such calculations were made by their clients, the Government of India.\textsuperscript{44} This is not correct. The project report of the consultant did furnish "figures of anticipated capital expenditure including the working capital together with the operating results anticipated from year to year showing the output sale value of the product vis-à-vis the expenditure for achieving the same against the different elements of cost like salaries and wages, materials and components." And from that profit could easily be calculated. What they did not do was to give profit figures for "individual end product". And so "the overall figures of profit, loss and the cost can only be a mere guess". The Government of India certainly needs to be blamed for not demanding the anticipated profit or loss figures for individual end product but probably this was because of their lack of experience in "setting up such a project"\textsuperscript{45}. Here we should also note the finding of Ian Little. He "found that the actual figures of cost included in the blueprint showed that, even if all expectations about capacity utilization and efficiency of operations were to be fulfilled, the project would yield very poor returns". He calculated that on one shift

\textsuperscript{44} Bhagwati and Desai, \textit{India Planning for Industrialization}, pp.159-61.

and two shifts working of the plant the capital output ratio would be 14.0 and 12.0 respectively. But the finding of the estimate committee 1962-63 contradicted his calculation of capital-output ratio. The Estimate Committee on HE(I)L (1962-63) found that for the initial Bhopal project with output of Rs. 12.5 crores; even after including the township expenses which ran into Rs. 11 crores the investment-output ratio was 3.9:1 and would be 2.6:1 for an annual output of Rs. 25 crores. The Estimate Committee found it to be quite high (however, it is much less than what Ian Little predicted) because it was informed that in U.K. investment output ratio would be around 1.7:1 or 1.8:1 and the Committee was told by an electrical manufacturer that the investment-sale ratio in a heavy electrical factory should be 1:1.5 and this was so in AEI factory in U.K. However, this referred to the initial project. Government of India itself realized it and later the project was expanded - with increase in the output of earlier products and inclusion of traction motor. This considerably reduced the investment-output ratio. Bhagwati and Desai

46. Bhagwati and Desai, India Planning for Industrialization, pp. 159-61.


showed that HE(I)L was making losses in the years 1962-63 to 1966-67. However, as they conceded that this cannot be the criteria of judging the relative efficiency of public versus private sector because while there was no control on prices in the private sector, in public sector domestic prices were fixed close to the landed cost of imports. This cannot be the criteria of efficiency of HE(I)L also because the rates of duty on raw materials used by HE(I)L was much higher than duty on the final products. The Estimates Committee reported that "import duty on the raw materials used by HE(I)L worked out to 22 per cent on an average. In most cases this was stated to be higher than the rate of duty (13 per cent) levied on the finished equipments.\(^49\)

**Conclusion:**

To conclude, the delay in the establishment of HE(I)L was not a result of import control regime; rather it was a result of: (i) the conflicting opinion of Ministry of Commerce and Industry and Ministry of Production on the question of establishment of a new heavy electrical factory in the public sector, and (ii) the shortage of foreign exchange.

Secondly, the Government of India did take into account the question of sufficient size of the market which has a

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bearing on the profitability and competitiveness of the company. So far as the marginal capital output ratio of the project is concerned, though initially it was high because of inexperience in setting up such a project, later it was brought down.

To find out whether initial expectations about growth of domestic demand for heavy electricals and consequent growth of output, which has a bearing on the profitability of a firm - we discuss the growth and capacity utilization in heavy electricals industry - in HE(I)L and BHEL in the next chapter.