

CHAPTER-5

Execution of Manufacturing Capacity Expansion Schemes

5.1 The status of implementation of manufacturing capacity augmentation schemes for XI and XII Plans in BHEL against the targets is summarized in Table 14:

Table 14

Plan	No of Schemes planned to be executed	Capacity equivalent target of planned schemes	BHEL's target date of completion of all planned schemes	Declared date of completion of all schemes by BHEL in its Annual Accounts/Directors' Report.	Actual status (March 2013) of completion of schemes as per Monthly progress reports submitted by units to Corporate office of BHEL
XI	17	15,000 MW p.a.	December 2009	March 2011	3 out of 17 schemes were yet to be completed (September 2013). These three schemes are likely to be completed by December 2014. (Details in <i>Annexure I</i>)
XII	5	20,000 MW p.a.	December 2011	March 2012	2 out of 5 schemes were yet to be completed (September 2013). These two schemes were likely to be completed by December 2014. (Details in <i>Annexure I</i>)

Thus, achievement of manufacturing capacity addition targets of (i) 15,000 MW per annum by March 2011 as declared by BHEL in its annual accounts for 2010-11 and (ii) 20,000 MW in March 2012 as per the Directors' Report 2012 did not match actual achievements. There were delays ranging between 7 months and 62 months in implementation of 17 out of 22 schemes selected for Audit (*Annexure I*) in seven units of BHEL. Main reasons for delays were:

- No targets (in terms of time) were specified for vendors for erection and commissioning of machines procured under 16 Schemes. Consequently, longer time was taken by vendors in commissioning of machines compared to that planned by the Management as indicated in Table 15. Further, liquidated damages were not possible to be levied by the units as no such clause was incorporated in purchase orders issued to vendors.

Table 15

Name of scheme	Time taken in erection
Enhancing the manufacturing capacity of pumps HPEP-Hyderabad	28 months
To augment facilities for manufacture of 47 generators HPEP-Hyderabad	40 months
Augmentation of capacity of steam turbines HPEP-Hyderabad	52 months
Capacity augmentation of boiler shops and valve shops HPBP-Trichy	23 months

- Re-tendering for the equipments had to be resorted to in three schemes (one each executed in HPEP-Hyderabad, TP-Jhansi and HEEP-Haridwar) due to high price and single response to tenders, which took further time in award of purchase orders.
- Delays occurred in replacement of damaged equipments in execution of seven schemes at HEEP- Haridwar and one scheme at HPEP-Hyderabad.

Management stated (April 2013) that delay in installation of a few machines did not tantamount to non achievement of capacity or objective of the schemes which was borne out by the fact that physical turnover of 15,055 MW was achieved for 2010-11 corresponding to expanded capacity/ capability. Management added that some vendors had taken abnormally long time in delivering the supplies. In order to address delays in erection and commissioning, new guidelines had been implemented since May 2012 and for addressing damages in transit, packaging requirements were being reviewed. Management further stated (September 2013) that BHEL had already installed facilities mandatorily required by CEA/NTPC to be installed by JVs/tenderers to facilitate manufacture of supercritical boilers, turbines and generators.

Reply is to be viewed against the fact that physical turnover of 15,055 MW achieved by BHEL for 2010-11 included outsourcing and off loading of manufacturing activities by BHEL as discussed subsequently in para 6.1. CEA/NTPC had listed broad facilities required and not detailed list of machines. Actual capacity to manufacture to the extent of 15,000 MW and 20,000 MW was yet to be achieved as 5 out of 22 schemes remained to be completed.

5.2 Analysis of individual cases of delay in capacity augmentation under the schemes

- (i) Annual Report of CEA for 2004-05 indicated new benchmarks for synchronization of thermal units. Actual time of commissioning of thermal plants by BHEL as compared to CEA benchmarks are detailed in Table 16.

Table 16

S. No.	Turbine	Cycle time for production in months		
		Actual time taken by BHEL	CEA benchmarks for synchronisation	Proposed cycle time after Phase-II capacity augmentation schemes planned during January 2007 to September 2008.
1	500MW	42	37	36
2	250 MW	34	28	28

As actual time taken by BHEL for manufacturing thermal plants was significantly higher than CEA benchmarks, it was essential for BHEL to plan and initiate action for achieving improvement in this direction. BHEL planned to reduce manufacturing cycle time by 10 *per cent* for major assemblies such as- Turbine Generator Stator Body (500 MW and 210 MW), Low Pressure Inner Outer (500 MW) and Low Pressure Outer Casing (210 MW) of thermal plants to levels matching with CEA benchmarks as part of capacity augmentation schemes (Phase-II). These were approved between January 2007 and September 2008 for likely commissioning by December 2009. Thus, BHEL had decided to compress cycle time for commissioning of thermal plants after 21 months from CEA benchmarking. This, however, was partly achieved as the schemes were not completed due to reasons stated in paragraph 5.1 above. It is pertinent to note that BHEL stated in reply to an audit query that despite being L₁, they had lost three orders aggregating ₹ 16,998.60 crore during 2007-08 and 2008-09 (which represented 15.46 *per cent* of total orders of ₹ 1,09,948 crore booked during this period) to their competitors on account of longer delivery period quoted by them as compared to their competitors. Thus, delayed planning and preparedness for the market requirements impacted the business prospects of BHEL.

While agreeing that its own track record of delivery performance must be further improved, Management stated (April/September 2013) that:

- The manufacturing cycle of various major assemblies was reduced by over 10 *per cent*, for *e.g.* Turbine Generator stator body and low pressure inner outer casings in the case of projects like Chandrapur-Unit 8, Vallur-Unit 3 and Vizag-Unit 2 projects of 500 MW. Similarly, in the case of 210/250 MW projects, synchronization was achieved in 26 months for Raichur-Unit 7 and 30½ months in Trombay. In respect of other projects, more time was taken due to change in shop floor priorities. However, actual time taken for specific job was within the targeted reduced cycle time. As such, the objective of reduction in cycle time had been achieved.
- As per Report of Bank of America-Merrill Lynch (January 2011), Chinese deliveries were nowhere close to promise and the suppliers were quoting 6-12 months faster deliveries than BHEL just to win orders.
- In respect of orders lost, in one case (1X600 MW TNEB / Mettur order), BHEL did not accept the tender condition of paying penalty of ₹107 crore per month beyond contractual delivery schedule as it would have led to huge penalty, in case of any delay. In the case of another order (6x600 MW KSK Energy / Wardha), the customer

placed order on Chinese firm without assigning any reasons. Further, in the remaining order (4x12 MW STG of Cairn Energy India Ltd.), was not lost solely on delivery considerations.

Reply of the Management is to be viewed against the facts that:

- Targets for reduction of manufacturing cycle time was partly achieved only in 2012-13 when Turbine Generator Stator (500 MW) was manufactured in reduced time cycle in three out of total 11 cases and Low Pressure Inner Outer Casing (500 MW) in one out of total 11 cases. Reduction in manufacturing cycle time of 210/250 MW machines was achieved only in two out of 11 cases. In respect of remaining projects, details of specific jobs which were stated to have been completed within the targeted reduced cycle time were not provided to audit. The objective of reduction in cycle time was yet to be fully and effectively achieved.
 - Report of Bank of America Merrill Lynch examined delays in commissioning of projects and not the delivery of equipment. Further, CEA data²⁸ also indicates a commissioning time ranging between (i) 27 and 48 months for projects requiring 300 MW sets and (ii) 37 and 48 months for projects requiring 600 MW sets taken by other vendors including Chinese vendors. As against this, time taken by BHEL, only for delivery of sets ranged between (i) 28 and 46 months for 250 MW sets and (ii) 33 and 50 months for 500 MW sets. Considering the normal time of 24-36 months²⁹ between shop production/delivery and commissioning of the project, time taken by BHEL was longer than its competitors. Further, the Management also admitted in its Agenda for 397th meeting (30 July 2007) of their Board of Directors that market requirement was for compressed delivery cycle with penalties for delayed delivery. The capital investment proposal for steam turbines was justified to reduce the existing cycle time of BHEL to match the market demand.
- (ii) To meet the internal demand for casting and forging to match the manufacturing capacity of equipment of 15,500 MW per annum as per XI Plan targets, Steel Melting Shop (SMS) at CFFP- Haridwar required a capacity of processing 48,000 MT of liquid metal per annum. While the existing Electric Arc Furnace (EAF) at CFFP Haridwar was capable of meeting the primary requirement of 48,000 MT metal, the secondary refining capacity stood restricted to 36,000 MT per annum *inter alia* due to (a) limitation of secondary refining, as only one Vacuum Arc Degassing (VAD) unit was operational for refining Liquid Metal, (b) limitation of handling of Liquid Steel, and (c) limited availability of Vacuum Degassing (VD) Tanks for Forge Ingot.

To overcome the above problems, the CFFP- Haridwar submitted (June 2011) a 'De-bottlenecking Scheme in Steel Melting Shop' with a capital investment of ₹ 43.44 crore. The

²⁸ based on CEA data as of December 2010 for projects completed during XI plan updated by Audit to March 2012 from data compiled by BHEL

²⁹ as stated by the Management in their reply dated 2 April 2013.

scheme envisaged VAD to suit the requirements and was scheduled for completion by March 2013. After detailed analysis at corporate office, it was established that the scheme would provide a Return on Investment (ROI)³⁰ of 21.62 *per cent* (after tax) and Internal Rate of Return (IRR)³¹ of 24.09 *per cent* with payback period of 49 months. In the proposal for debottlenecking and its internal evaluation by the Management it was indicated that liquid metal produced after debottlenecking would be used for making large size rotors and hydro shafts which were being procured by the BHEL units from overseas sources. However, the scheme was yet to be approved (September 2013).

Audit observed that:

- Debottlenecking of facilities required a lead time of 21 months from the date of approval of scheme, to its completion. As debottlenecking was necessary to match the casting and forging capacity with manufacturing capacity of 15,500 MW (target for XI Plan) targeted for commissioning by December 2009, it was required to be planned in 2008 as part of the capacity expansion schemes. CFFP-Haridwar, however, delayed planning of debottlenecking scheme by more than three years (from 2008 to 2011).
- After delayed initial planning, the final decision on approval or otherwise of the scheme had also not been taken so far (September 2013). Even if the scheme is approved at this stage it would take another 21 months for completion *i.e.* would be ready by March 2015. Capacity augmentation schemes under XI Plan had been declared completed in March 2011. Unless the production capacity of CFFP-Haridwar gets increased to 48,000 MT after debottlenecking, the sister units would be forced to procure castings and forgings of 3450 MT per annum from outside sources (based on projections in the Feasibility Report) leading to a production loss of ₹ 66.12 crore *per annum* till the facility is completed. This is evident from the fact that units of the BHEL had actually procured large size rotors from outside during 2011-13.

Management stated (April/September 2013) that considering the present product mix and future projections, there was no production loss as full requirement of secondary refining had been met with the available capacity and would continue to be met in 2013-14 also. Further, entire requirement of BHEL units had not been envisaged to be met through CFFP-Haridwar only. The techno-commercial issues regarding establishing stand alone viability of the proposed SMS debottlenecking had since been finalised.

Reply is to be viewed against the fact that in the proposal for debottlenecking and its internal evaluation by the Management it was indicated that liquid metal produced after debottlenecking would be used for making large size rotors and hydro shafts which were

³⁰ $ROI = (Gain\ on\ Investment - Cost\ of\ Investment) / Cost\ of\ Investment$

³¹ *IRR is the discount rate at which the net present value of costs of the investment equals the net present value of the benefits of the investment.*

being procured by the BHEL units from overseas sources. Based on the details provided by the Management, it was observed that large size rotors aggregating ₹ 751.78 crore were procured by BHEL from outside during 2011-13. This indicates that there is a scope for minimizing procurement of large size rotors from outside to the extent of production capacity of CFFP Haridwar after completion of debottlenecking scheme and likely loss of production due to delay in implementation of scheme beyond its originally proposed completion in March 2013 cannot be denied. Data in the feasibility report further indicated that the production achieved through debottlenecking scheme was likely to generate an average post tax return of 19.78 *per cent* for BHEL which has been lost due to sourcing material from outside instead of in-house manufacture by CFFP Haridwar.

5.3 Assessment of manufacturing capacity

Capacity expansion schemes were based on existing capacity of each unit. This would make it imperative that capacity of each unit is assessed objectively and realistically. Audit observed instances of incorrect assessment of existing capacity as detailed in Table 17. This would have an adverse impact on overall production planning and capacity expansion to 20,000 MW.

Table 17

Unit	Equipment	Capacity declared by the Management	Audit observation	Management Reply	Further Remarks
HEEP-Haridwar	Steam Turbines manufacturing equipment	10,020 MW (As of March 2011 as per annual accounts of BHEL for 2010-11)	Capacity was declared commissioned in March 2011 without actual commissioning of 24 out of 135 machines.	Management stated (April 2013) that BHEL had achieved capability to supply the envisaged physical capacity in terms of MW. Actual turnover of 10,271 MW during 2010-11 at HEEP Haridwar establishes this fact.	The reply only indicates achievement of 'capacity to supply' (which also includes supply managed through outsourcing of parts) and not 'capacity to manufacture'. Full benefit of capacity expansion can only be achieved after installation and commissioning of all machines. As 24 out of 135 machines were not commissioned by March 2011, the declared capacity did not reflect true installed manufacturing capacity.
HPBP-Trichy and BAP Ranipet	Boiler and Valves manufacturing facilities	10,000 MW (December 2009)	Facilities were actually completed in July 2012 as per	Management stated (June 2012/April 2013) that due to complex nature of	The reply is to be viewed against the fact that Management was aware about

			<p>Monthly Progress reports submitted by the Unit to Corporate Office of BHEL</p> <p>The delay of up to 290 days was due to late ordering and up to 690 days due to late installation.</p>	<p>equipment and delay in vendors responding to queries, considerable time was taken for finalizing the orders.</p>	<p>complexity of the machines and accordingly timely action to freeze the technical requirements was required to be initiated well in advance to meet the targets.</p>
HPBP-Trichy	Supercritical boiler manufacturing facility	One boiler per annum in December 2007 and two boilers per annum in December 2009	<p>Out of 4 super critical boilers due for delivery against orders received in 2008-09, the unit supplied only one boiler (Sept 2012), that too after a delay of 14 months.</p> <p>This indicated that though HPBP-Trichy had declared (December 2009) enhancement in its capacity, from one to two boilers, it was yet to fully absorb the technology of producing super critical boilers.</p>	<p>Management stated (April/Sep 2013) that there was delay in absorption of knowledge by supervisors as super critical boiler manufacturing was being done for the first time. Training for engineering and design group was completed in 2007-08 and training in manufacturing was availed in 2009-10 when manufacturing was taken up.</p>	<p>Reply of the Management is to be viewed against the fact that training available under the Technical Collaboration Agreement (28th October 2005) for manufacturing process of supercritical boilers was availed only in 2009-10 <i>i.e.</i> after more than three years and much after orders of super critical boilers were received in 2008-09. Thus, the process of acquiring manufacturing knowledge was delayed.</p>

Execution of manufacturing capacity augmentation schemes was thus, delayed and whatever capacity was declared commissioned up to March 2011 was not actually physically commissioned. It is clear that, BHEL would benefit through institution of a system of declaration of installed manufacturing capacity that matches physically commissioned capacity.