Summary of Conclusions and Suggestions
The present chapter is a culmination of brief substance of the summary of conclusions drawn from the preceding chapters. It presents very brief analysis of the observations made during the study on the subject and focusing mainly the substance of all the areas and issues discussed hither to. It is hoped that the present chapter would give brief substance of all the discussions that were made in the preceding discussions, which would facilitates to understand various issues confronting by the Thermal Stations in Andhra Pradesh. Based on the observations, some viable suggestions are offered to remedy the existing situation of the Thermal Stations in the State and to tone up the overall performance in generation of power, reducing cost of power, producing qualitative power consistently and the like.

Inventory occupies a pre-domiant position in the structure of the working capital of an organisation. Inventory constitutes one of the most important elements of any system dealing with supply, manufacture and distribution of goods and services. Not only huge investments involved on inventories but the cost of inventory also forms a major portion of the cost of production in many manufacturing enterprises. The main objective of holding inventory is to provide for smooth and efficient production in many generation plants.

The power sector is so vitally important for economic development today especially for a developing country like India and no limits can be prescribed for its necessity. It is one of the most vital infrastructures for economic development. In independent India this is one of the important sectors, which have fallen short
of demand and expectations. The reasons are as varied as its needs and uses. The production of power is regarded as a basic indicator of the level and extent of a nation’s development. Similarly power consumption is regarded as an index of economic development and a measure of progress. The standard of living of people is said to depend on the use of energy in general and the access to electricity in particular. When compared with many countries of the world, India seemed to be very much behind in production of power and per capita consumption. Correlation is seen between consumption of power and growth of economy. The per capita consumption of electricity in India is 599 KWh in the year 2001-02, one of the lowest in the world.

The power situation in the world is giving a unique picture in the power development scenario. Because of varied geographical, national situations, the power situation in the world is not same among all the countries. The world per capita use of energy is 1.9 times whole equivalent (TCE). Developed countries like USA, UK and Japan have their respective per capita consumption at a much higher level of 11.1 TCE, 5.4 TCE and 3.2 TCE respectively. The developing countries like China and India have a per capita energy consumption of 0.5 TCE and 0.2 TCE respectively.

In the power sector key organisations are Bharat Heavy Electrical Limited, Central Electricity Authority, National Thermal Power Corporation, National Hydel Power Corporation, Power Grid Corporation of India Limited, Power Finance Corporation, Tehri Hydro Electric Development Corporation and Nathpa Jakri Power Corporations etc. Hydel, thermal, nuclear power generation are conventional methods and non-conventional methods are wind, solar, biogass, biomass, tidalwaves, geo-thermal which are in operation in India.
The power situation in India as a whole, Andhra Pradesh in particular has not been satisfactory. There are states like Andhra Pradesh which are rich in natural resources for power generation but which are not tapped and exploited chiefly for want of the necessary financial resources. The available financial resources are not prudently and rationally managed by the power generation corporation of APGENCO. They lacked proper planning and foresight with an eye on the growing needs and demands for power by ever increasing consumes of various categories. The consumers are naturally left disappointed and frustrated. The successors to the Andhra Pradesh Power Generating Corporation, the autonomous corporations have not yet been able to come to grips with all the issues facing the power sector.

Ultimately all the problems the power sector, the erstwhile APSEB and the newly formed corporations APGENCO / APTRANSCO and their successors boil down to finance to finding adequate funds for power generation and development and proper distribution, for the increasing installed capacity. Finance has been the most formidable stumbling block to the management of the power sector. There are other problems created by the consumers, some of whom are given to stealing power, have unauthorised connection which are not accounted for at all, and meddle with meters to give false readings. There are abnormal losses in transmission and distribution. More than these political parties in power pursuing populist policies to please the potential voters and supporters offer subsides on power or exempt some from paying for the power they consume. The absence of honesty and integrity and a sense of responsibility in among many personnel of the power sector, of all ranks, has bred corruption in the set up and fostered by vested interest. All these damage the financial base of the power sector.
To tide over power shortage, because of shortage of production, because of failure of rains, or because of want of facilities and resources for power generation, many states, Andhra Pradesh includes, have had to buy power from their sources at heavy price, which would mean a drain on the already meager financial resources.

The stores organisation in the APGENCO has been divided into three levels - Main stores, Thermal stations area stores and pit /departmental stores. The main store is set up at Hyderabad at corporate level to cater to the material requirements of the thermal stations and corporate offices of APGENCO.

The main stores have been divided into various sections on the basis of use and the size of materials. The thermal stations, area stores are created in each area of the APGENCO to cater to the material requirements of various thermal stations and stores departments of the area concerned. Presently, the APGENCO has five store depots at a different areas to cater the needs of its user stations. Several lakhs of diverse nature of inventory items are stored in open yard and oil drums.

The spare parts are stored in self erected racks with the facility of locking system. The storage methods in the corporation vary according to the type of materials. Small items are stored in pigeon hole racks and heavy and bulk items are placed on the floor itself.

It is observed that the APGENCO has a sufficient storage facilities in the main stores and thermal station stores. Depending upon the nature of the use and size and characteristics of material, the equipment and materials are classified
into various categories. These items are classified into coal, specific oil, consumables hard wares etc. All the items stored in the stores are codified and code numbers are given with main sub-codes to avoid duplication of items and a provision is made in the code book to give code numbers for the items to be stored in future. The corporation has both centralized and decentralised store system, so that it can enjoy the benefits of both systems.

The APGENCO has been following two systems of storage viz., closed open storage system. In open storage system the raw materials of coal which are fast moving and heavy in quantity are stored. Most of the engineers are satisfied with the existing storage system in the APGENCO.

It is observed that the corporation has been maintaining stores management manual for a long period to bring uniformity in the functions of all stores in APGENCO and also ensure that all user departments are aware of the stores procedures. Another important feature of stores management is that the receiving section is under the control of the stores department. The stores department of the corporation is headed by chief of stores (COS). The main stores at Hyderabad is under the control of the Dy. Controller of stores (DE stores), who is assisted by various stores officers working under his control.

In APGENCO, the internal audit department is responsible for verification of stores material, and spare parts. All the items of stores are verified periodically. The departmental stock verification will be carried out by the stores personnel once in two years under their own arrangements. After the auditor have certified the inventory, the value of materials in stores will be taken into final accounts.
In the APGENCO, the computerised stores management has been introduced in a phased manner. The first step in computerised stores management is proper codification and classification. The computers help in maintaining up to date position of receipts, issue and stock position. They help in the preparation of the list of over stocked / under stocked items, quantity receipt control statement, half-yearly unmoved items list area-wise, the list of items having no movement for two years. The online computer system is highly useful to analyses consumption variations, to maintain stores ledgers of up to date and current information by daily posting of stores transactions in the computer files.

The security of the stores is ensured by the security department with the help of vigilance wing.

There is no uniform policy on the working of material management departments of various thermal stations in India. The management of inventories leads to improvement in the profitability of the concern. Inventory constitutes the largest proportion of working capital in the thermal stations. The existing organisational set up practices and systems of inventory control are inadequate to ensure an efficient management of inventory of power industry in general and the APGENCO is particular.

For an effective inventory control, the APGENCO has applied and adopted different techniques and methods. They are fixation of inventory levels, analysing consumption pattern, determining economic order quantities, budgetary control, ratio analysis, ABC analysis, FSN analysis, XYZ analysis, codification, standardisation, perpetual inventory system and continuous
inventory stock verification. It is observed that the perpetual inventory control is the most prominent technique of inventory control in the APGENCO. The other techniques of control are also in vogue in the APGENCO.

ABC analysis, FSN analysis and XYZ analysis are carried out in the APGENCO, for the control of inventory. The monthly material consumption statements are prepared for each thermal station showing the class of inventory items consumed and based on such statements annual consumption figures are estimated and controlled. It is also observed that a small percentage of inventory items constituted a major portion of the total consumption. Thus, by exercising a stringent control on a small number of items which contribute for a very large value of inventory, it would be possible to control the overall inventory in the organisation.

Movement of various items of inventory forms the basis for FSN classification. Based on consumption pattern of various inventory items they are classified as fast moving, slow moving and non-moving items. FSN analysis is specially useful to control the accumulation of obsolete and moving items of inventory. To look into the various aspects of FSN analysis, an inventory committee has been constituted in the corporation. The committee has identified certain items as non-moving items and a list of such items was circulated to all the area stores to ensure that further orders are not placed in these items. In view of the significance of selective inventory control techniques in the control of inventory investment, the efforts were initiated in the corporation to implement the techniques with the help of computerisation.
The practice of selective inventory techniques, the ABC analysis and FSN analysis are not up to the mark. The effective implementation of these techniques with the help of computerisation would certainly help in improving the present position of inventory control in the thermal stations in particular and other power sector undertakings in general.

Various levels of inventory are fixed for inventory control according to the importance of the materials. The safety stock level in the corporation in case of imported items and spares is six months and three to four months for indigenous items. In the APGENCO, the safety stock is calculated on the basis of consumption depending upon the critically and availability of stores. The minimum level is higher than the safety level. The maximum level varies from 3 months consumption depending upon the lead time and safety stock level. It is ascertained that the maximum level stock is seldom followed in the APGENCO.

It is observed that all scrap and unserviceable materials in the thermal stations are periodically collected and sent to the scrap yard. The survey of scrap and unserviceable material will be carried out periodically as per the procedure laid down in the stores management manual.

In the APGENCO, Inventory Management Cell (IMC) has been formed at corporate main stores, Hyderabad. IMC maintains the record pertaining to purchase orders, re-order quantity. Other functions to be performed by IMC are (a) Data collection and codification, (b) Listing out standards specification, (c) Listing the purchase orders and (d) Preparation of list of vendors.
The efficiency of inventory management in thermal stations in Andhra Pradesh are focus trends and levels of inventory investment, structure of inventory turnover, and computerised inventory management. Accumulation of inventories in the corporation resulting in blockage of funds, will deprive the corporation of the productive use of such funds. Apart from this, the excessive investment on inventories will have its own opportunity cost. Accumulation of inventories results in heavy amount of carrying costs, which increase cost of production and effect the profitability of the corporation.

The inventory turnover ratio acts as an indicator of the liquidity of inventory. This ratio helps in judging in efficiency of inventory management. Inventory turnover in APSEB/APGENCO is varying between 0.87 and 1.06 times.

In APGENCO follows computerised inventory management system. The computers can handle various data such as price, lead time, cost of ordering, cost of carrying, historical data on delivery performance and so on very easily. Various techniques such as ABC analysis, EOQ etc., can be easily programmed in the computers so that tedious and time consuming calculations are avoided. The factors such as reserve stock, safety stock and re-order points require statistical and mathematical analysis programmed by computers easily.
SUGGESTIONS

Basing on the observations made hitherto, some suggestions are offered to tone up the performance of the thermal stations in Andhra Pradesh. The suggestions are offered in a brief that they are applicable. At they are implemented effectively the thermal stations could improve their performance. It is also felt that the improved performance through the application of remedial measures suggested would improve certainly the services to the public and the economy would also benefit out of it.

As thermal stations in Andhra Pradesh are suffering from multi farious problems for want of required infrastructure and other government support to augment the generation of power in order to meet ever increasing demand, it is suggested that the thermal stations should be strengthened its infrastructural base and the government should extend its co-operation in terms of policies and make them an independent bodies to work on their own atmost capacities and capabilities. The thermal stations should be given an independent status to plan, execute and operate on its own at the international standards and quality. These thermal stations should have broader outlook into various aspects that are taking place in the world over and apply the latest technology in the generation of power. This would go a long way in strengthening the thermal stations to generate more qualitative power consistently to meet the ever increasing demand from the public. This would lead to attaining self-sufficiency in generation of power at most cost effective and efficiency. The inventory management is an important area wherein the thermal stations investing lot of funds every year and the results expected out of it are not much encouraging. It is dire necessity to utilise the inputs of the inventory
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on more scientific lines with improved efficiency. As the major chunk of investment is invested on various components of inventory is very necessary to focus attention on improved Inventory Management systems. To be more scientific, the following suggestions are offered to improve the existing system and to remedy the meleady in thermal stations in Andhra Pradesh in particular and India in general.

1. The cost of generation of power should be reduced by application of various scientific Inventory Management tools like ABC Analysis, VED Analysis, FSN Analysis, XYZ Analysis. These tools should be applied by taking lot of care in valuing inventory at each and every stage more accurately. The effectiveness of the inventory tools should be checked from time to time with the standards already fixed and ensure the perfection in application of all these tools to have an effective inventory management system in thermal stations.

2. There should be a separate inventory management department in thermal stations. The existing Inventory Management Cell should be strengthened and the personnel who are looking after the management of inventory should be trained properly with updated technology. The personnel who are responsible to handle the inventory should be accountable for their responsibilities. Unless the personnel in the Inventory Management Cells are accountable for their activities, results would not be as desired. Therefore, serious and strengthened efforts should be taken to improve the existing inventory management department by imparting required training to them. Every personnel in the inventory management department should be assigned the task oriented responsibility and monitor the performance of
them from time to time. This would create some sort of responsibility and accountability on their jobs in the mind of personnel in the department.

3. The cost of inputs purchased should be reduced. The raw materials are purchased from Singareni Collieries Company Limited (SCCL) and its sister concerns. There is a limited scope for reducing the cost price as there is no alternatives of suppliers for the coal, therefore the focus can be made on reducing the transportation cost and wastage handling cost.

4. Though the thermal stations are applying the Economic Order Quantity (EOQ). It is observed that they are not serious and metricules in calculating accurately over the period of time. It is advised that EOQ should be calculated accurately and orders may be placed on the accurate calculation of EOQ. This would save lot of investment on inventory. If they fail to do so, the inventory will file up in stock yard leading to blocking of investment. Contrary to this, sometimes they have to suffer shortage of inputs. This problem can be avoided with the application of EOQ technique on more scientific manner.

5. The computation of safety stock level is very much important in the thermal stations though they are having a practice of calculating and maintaining safety level, in practice, some of the thermal stations are suffering from either shortage or excess of stock level. It is observed that the thermal stations are having stock for 8 hours in Vijayawada Thermal Power Station (VTPS), 3 days in Kothagudem Thermal Power Station (KTPS), 6 days in Rayalaseema Thermal Power Project (RTPP) abnormally stock in Nellore Thermal Station (NTS), i.e., 99 days in the year 1995-96. In the year 2002-
03, Vijayawada Thermal Power Station (VTPS) have only 10 days, Ramagundam Thermal Station (RTS-B) 9 days, Nellore Thermal Station (NTS) 12 days, Kothagudem Thermal Power Station (KTPS) V stage 24 days. In the year 1991-92 VTPS lost 500 MU due to short supply of coal. Therefore this abnormal variation in stock levels should be minimised. There should be only one safety stock level for all the thermal stations to maintain uninterrupted generation of power. For this purpose, the scientific study should be conducted to arrive at a standard safety level in almost all the thermal stations. This exercise should certainly decrease the investment in stock and facilitate continuous generation of power.

6. The ordering cost and carrying cost should be minimized by placing an order based on the scientific calculation for the inventory. If the stocks are procured basing on actual requirement, automatically the carrying cost would also be decreased. Therefore, it is advisable to maintain the ordering and carrying cost at the minimum level at all times.

7. The ABC analysis which is an essential inventory controlling tool, should be applied on more scientific lines. The classifications of inputs should be made properly based on value and quantity in order to protect the quality of materials. It also taken in to consideration while applying ABC Analysis, the moisture content, ash content, fixed carbon, volatile matter, calorific value, UHV should be taken into account for an effective classification of inventory. For this purpose, person who is looking after the classification of inventory should be imparted training on the latest techniques and technology that exist in the world over.
8. The minimum and maximum level of inventory should be properly computed and maintained in the thermal stations. The calculations of all these techniques should be accurate and need based. This should be implemented without any compromise at all times. This should certainly reduce the cost of inventory and assures uninterrupted production process.

9. The thermal stations in Andhra Pradesh applying at present, some important techniques viz., fast moving, slow moving and non-moving analysis for spares and XYZ analysis. It is suggested that these techniques should be properly utilised continuously with required accuracy. The existing system should be improved based on changes that are taking place efficiently at organised power stations in developed countries.

10. The power stations in Andhra Pradesh are getting the fuel in barrels from different regional centres. It involves huge transportation cost. It is suggested that the fuel should get through pipe lines from regional despatch centres, there by the transportation cost may be minimised. Of course, it involves huge capital investment over the period of time. This cost can be written-off, there by the overall transportation cost of fuel may be reduced.

11. In the process of inventory of coal, some amount of by products in the form of ash is accumulating. This ash can be utilised for manufacturing of bricks and tiles, etc. As on today, all these power stations are not effectively utilising the ash. Therefore, it is suggested to make use of ash content for manufacturing of any products, so that the over all cost may be bring down.

12. At present, the thermal stations are unloading the coal on the base land, while using the coal some amount of coal balance are left over on the
ground. These ground balances should be avoided by unloading the coal on a concrete platform, which enables to make use of 100% raw material without any left over wastages. Therefore, it is advised to construct a concrete platform for stocking the coal.

13. Some thermal stations are facing acute water scarcity. For want of water, the RTPP has stopped the generation of power. Therefore, the required water should be tapped from the ground wherever it is available and get the water through some pipelines in order to mitigate the problem of stoppage of generation due to water shortage.

14. There are ample possibilities to reduce the cost of the materials purchased through competitive bidding, and value analysis. While the savings in the cost of holding inventories arise out of economic ordering, reduction in deterioration and obsolescence in storage and also reduction in the blocked up working capital take place. The APGENCO should initiate the measures for adoption and strict implementation of value analysis in a systematic manner which enables to achieve cost reduction. Value analysis should be attempted to cost reduction. Value analysis may be conducted by a team of personnel drawn from the material management, design, engineering, production, and research and development departments.

15. The stores management manual and purchase management manual which were designed long ago should be revised and reviewed periodically keeping in view the present stores and purchase management practices. It is desirable to have a comprehensive and up-to-date manuals for
department must definitely be kept in the picture. This helps in several ways. He is in a position to inform the top management of the amount of stock materials on hand that are likely to be rendered obsolete if and when the changes are introduced.

19. In APGENCO the attention is to be paid on the disposal of rejected material in the absence of claim by the supplier. In the case of rejected materials suppliers are to be advised to collect the rejected material within stipulated period. Otherwise a provision is to be made in the purchase order to dispose the same by the corporation. It enables the corporation to provide sufficient space for storing other useful items.

20. The involvement of persons who are directly responsible for maintaining inventories in fixation of norms is very much desirable. Other departments involved in fixing the norms are finance, production, marketing and materials control. The norms of inventory should be converted into specifically spell out parameters like the number of stock outs permitted, the sales to inventory ratio and inventory to consumption ratio etc.

21. The required efforts on one class of inventory items with scientific and innovative methods of inventory control helps in releasing the tied up funds for the productive purposes. Therefore it is the area that offers greater scope for the improvement and needs greater attention and research in power sector thermal stations.

22. Greater focus on professionalisation, better utilisation of resources, productivity of men, materials, improved financial and materials management and an effort to reduce inventory level will help in a greater
measure in improving the performance of the corporation. The profitability, reliability and availability of the assets are inexorably linked with the efficient spares parts management, which ultimately provides an effective maintenance at minimum cost with best available materials. This requires judicious spares planning and inventory control of their storage provisioning. Such an integrated concept of spares management today calls for an innovative and imaginative approach so that its primary objectives—cost reduction and efficient handling of spares at all stages.

23. The effective inventory control should be introduced and successfully implemented. It needs a break through in the areas of materials code, date processing, establishment of data bank, selection of suitable control systems, organising for inventory control manning by qualified cadres etc. Finally it comes essential to attach suitable importance, status and recognition to the inventory controlling function. It is suggested for formation of “Spares Bank” that will keep comprehensive and up-to-date information regarding manufacturing facilities available indigenously, materials, processes etc., for the spares and service performance of the spares development and used under different conditions in various thermal stations and work shops of the APGENCO.

24. For an efficient and effective management of inventories it is essential to review periodically the level of inventory and to effect the changes in the light of review. A review of the levels of all the items of inventory at every quarter is desirable. For an effective inventory control, the following are essential. Awareness at all the levels including the top management about the importance of inventory control (a) Ensuring
integrated inventory management, (b) Obtaining necessary performance and other data for periodic appraisal, control and decision making activities, (c) Availability of expertise for inventory control in the organisation and (d) Continuity of planning review and up-dating action throughout the year.

All the suggestions are offered based on observations made during the study on the working conditions of thermal stations are viable and practicable. Then electricity board failed on grounds for generation of power and distribution because of their inefficient management of the resources. Under restructured setup it is hoped that all the thermal stations in Andhra Pradesh state would improve its performance in terms of generation of power to meet the ever increasing demand from the public.

The APGENCO would also succeed in its efforts in improving power situation and control the cost of production to maintain the cost of power generation at the lowest level possible. It is hoped that things would change positively and the existing thermal stations would augment generation of power for the prosperity of our country and put our economic development in the forefront of global economic scenario.