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Technical Guide on Internal Audit of Power Industry

The Institute of Chartered Accountants of India

Draft for discussion

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Foreword

Audit is one of the pillars of sound corporate governance. The concern for ensuring effective corporate governance has become more pronounced with increasing complexity, global inter-linkages and fierce competitiveness in the business world.

The basic concept that effective corporate governance leads to enduring wealth creation does not at times receive the right degree of importance from today's organizations. Good organizations and agencies always adhere to the fundamentals of corporate governance for ensuring sustainable success.

The various systems of checks and balances, of which **internal audit** is a very important one, constitute the architecture of corporate governance.

Risk based Internal Audit has been growing in importance in the Power Sector of late. This is due to the increase in the complexities of the sector in the recent times. Despite the low per capita power consumption, India's power infrastructure is among the largest in the world and the complexity and financial resources involved are enormous. Power sector being one of the key drivers of the economic and social development, it is necessary that the sector is run in line with the best business practices including the best systems of internal audit. The huge size of the sector makes this requirement all the more necessary and challenging.

The power sector in India is on an unprecedented growth trajectory. Power sector being one of the most capital intensive sectors, the financial implications of the sector's business dynamics are huge. Therefore the importance of effective internal audit in this sector cannot be undermined.

This 'Technical Guide on Internal Audit for the Power Sector' deals with the entire spectrum of conceptual and practical issues concerning internal audit. This will prove to be a very useful reference in making the process of internal audit in the power sector of India aligned to the leading practices.

Preface

Despite several challenges and constraints, the power sector has played an important role in India's emergence as a major economic force in the global context.

There is a need to further augment the contribution of the power sector to the Indian economy.

The cost effectiveness of the power sector depends largely on the effectiveness of its systems, processes and controls. Internal audit, which is monitor of systems and controls thus, has an important role in effective functioning of the sector.

Proper understanding of the legal framework relating to the power sector, the key aspects of the management in the power sector is essential for effective internal audit. This 'Technical Guide on Internal Audit for the Power Sector' focuses on these critical aspects.

This compilation, covering the context and focus areas of internal audit as a key tool of risk management and corporate governance, is aimed at being of practical value for all the professionals involved in the internal audit function in the power sector. The guidance is purported to help the internal auditor in appraising the systems and processes of Power Sector which, in turn, will result better governance of this sector.

Scope and structure of the technical guide

Internal audit is an independent management function, which involves the continuous and critical appraisal of the functioning of the entity with a view to suggesting improvements thereto and adding value to and strengthening the overall governance mechanism of the entity, including the entity's risk management and internal control system. Thus, through its appraisal of management processes, internal audit can be of great assistance on effective and efficient management of power sector.

Today, the scope of internal audit has increased from mere verification of financial transactions to reviewing of processes, risks and controls involved with the operations, financial reporting and regulatory compliance related aspects of the entities. It also focuses on proper, efficient and economical usage of resources of the entities. Therefore, it is imperative that an internal auditor familiarizes with various management aspects and technical aspects of the power sector for performing internal audit in the more efficient and effective manner.

This Technical Guide is confined to discussing the role that the Internal Audit function can play in this regard. This Technical guide is intended to assist internal auditors in carrying out internal audit in entities operating in power sector. The guide deals with various operational aspects of entities in this sector with emphasis on compliance mandated as per various regulations applicable to the specific industry.

A. Various types of Power Industry (Conventional and Non Conventional sources)

Power is one of the key support actors for running of almost any commercial venture. There can be various sources for generating power. These sources are often categorised into Conventional and Non-conventional sources.

Conventional Sources of Power

So far the most conventional sources of power have been of non-renewable form i.e., those that are not naturally replenished. Some examples of these forms are Coal, Gas, Oil and Nuclear power. Hydropower, though renewable, is also counted as another conventional source of Power.

Coal based thermal power

Coal based thermal power is a rather simple process. In most coal fired power plants, coal is crushed into fine powder and is fed into a combustion unit where it is burned. Heat from the burning coal is used to generate steam that is used to spin one or more turbines to generate electricity.

There are issues with using coal for thermal energy. Coal is a scare resource and hence more and more coal fired plants result in depletion of this natural resource. The burning of coal results in emission of gases that damage the environment.

Despite the negatives above, coal still is the most preferred source of thermal power in India.

Gas based thermal power

Natural gas is the cleanest of all the fossil fuels as evidenced in research and is therefore a more preferred source of energy. Natural gas can be used to generate electricity in many ways. The most basic natural gas-fired electric generation consists of a steam generation unit, where natural gas replaces coal. The basic steam units are more typical of large coal or nuclear generation facilities. In other types of units, instead of heating steam to turn a turbine, hot gases from burning fossil fuels (particularly natural gas) are used to turn the turbine and generate electricity.

New natural gas fired power plants often have 'combined-cycle' units. In these types of generating facilities, there is both a gas turbine and a steam unit in the same generation facility. The gas turbine operates as a normal gas turbine, using the hot gases released from burning natural gas to turn a turbine and generate electricity. In combined-cycle plants, the waste heat from the gas-turbine process is directed toward generating steam, which is then used to generate electricity much like a steam unit.

Oil based thermal power

In oil fired plants, oil is burnt instead of coal – the basic principle is very much the same. Those power stations have an oil storage system with tanks and delivering systems.

A more common method is to burn the oil in combustion turbines, which are similar to the principle used in jet engines. Another technology is to burn the oil in a combustion turbine and use the hot exhaust to make steam to drive a steam turbine. This technology is called "combined cycle" and is more efficient because it uses the same fuel source twice.

Burning oil at power plants produces nitrogen oxides, sulfur dioxide, carbon dioxide, methane, and mercury compounds. Therefore oil fired plants do have adverse environmental impact though it is lesser than coal fired plants.

Nuclear power

Nuclear energy originates from the splitting of uranium atoms in a process called fission. At the power plant, the fission process is used to generate heat for producing steam, which is used by a turbine to generate electricity. Because there is no combustion involved in the process, nuclear power generation does not emit CO_2 in principle.

Indirect CO_2 emissions from processes such as mining/transportation of fuels and development/operation of power stations are miniscule. While a natural gas-fired combined cycle plant, which is the most efficient power generation option, emits approximately 500g (on an average) of CO_2 to generate 1kWh of electricity, a nuclear power plant emits only about 20g of CO_2 and can generate the same amount of electricity.

Hydropower

Hydroelectric and coal-fired power plants produce electricity in a similar way. In both cases a power source is used to turn the propeller-like turbine. The turbine then turns a metal shaft in an electric generator, which is the motor that produces electricity. A coal-fired power plant uses steam to turn the turbine blades; whereas a hydroelectric plant uses falling water to turn the turbine producing the same result.

Generally a dam is built on a large river that has a drop in elevation. The dam stores huge quantity of water behind it in the reservoir. Gravity causes it to fall through the penstock inside the dam. At the end of the penstock (a pipe or conduit used to carry water to a water wheel or turbine) where there is a turbine propeller, which is turned by the moving water. The shaft from the turbine goes up into the generator, which produces the power.

Non - Conventional Sources of Power

Solar electricity[1]

This form of electricity is created by using Photovoltaic (PV) technology by converting solar energy into solar electricity from sunlight.

A PV cell consists of two or more thin layers of semi-conducting material, most commonly silicon. When the silicon is exposed to light, electrical charges are generated and this can be conducted away by metal contacts as direct current (DC). The electrical output from a single cell is small, so multiple cells are connected together and encapsulated (usually behind glass) to form a module (sometimes referred to as a "panel"). The PV module is the principle building block of a PV system and any number of modules can be connected together to give the desired electrical output.

Wind powered electricity

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[1] Refer www.electricityforum.com/solar-electricity.html

Wind is a renewable resource because it is inexhaustible. State-of-the-art wind power plants use large spinning blades to capture the kinetic energy in moving wind, which then is transferred to rotors that produce electricity. Currently the best wind power plant sites are those in regions where average wind speeds exceed 12 miles per hour.

Wind power generates three categories of environmental impacts: visual impacts; noise pollution; wildlife impacts. These impacts can vary immensely from site to site.

The various sources of power generation in India as of the year 2011 have been estimated by the Central Electricity Authority of India[2].

Source	**Percentage**
Total Thermal	**65.87**
Coal	55.72
Gas	9.50
Oil (Diesel)	0.64
Hydro (Renewable)	20.75
Nuclear	2.56
Renewable Energy Sources **	10.80
Total	**100.00**

** Renewable Energy Sources include Small Hydro Project, Biomass Gasifier, Biomass Power, and Urban & Industrial Waste Power.

[2] Power Sector at a Glance "ALL INDIA", As on 31-12-2011, Source: Central Electricity Authority.

B. Power Value Chain - Generation, Transmission and distribution

To make power available for running the various industrial and domestic appliances there are three key processes that the power industry undertakes.

- **Generation of Power** – Power generation implies the process whereby electrical energy is produced from various sources (conventional or non-conventional sources). Power is generated at Power Generating Station that is conventionally located near the source of power. For example a thermal power generating station would be located closer to the source of coal which is the principle input for generating thermal power. For generating wind power, wind power generating station would ideally be located where the wind speed is higher.

  The production capacity of electrical generators of a power generating company is often measured in Megawatts.

- **Transmission of Power** – Transmission implies the movement of power generated at power generators to locations from where these can be used distributed to end users. The nature of transmission systems does not depend on the source of power; the same type of transmission system could be used to transmit power generated by different sources.

- **Distribution of Power** – Distribution implies the delivery of transmitted electricity to the end users. A distribution system carries power from the transmission system to the premises of the individual end users that run electrical installations with power.

In case of a thermal power scenario, the power value chain would typically look like the following:

Generation	Transmission	Distribution
• Fuel is burnt to produce heat • Heat boils water to form Steam • Steam pressure turns a turbine • Turbine turns an electric generator • Generator produces electricity	• Transformer used to “step up” the voltage of electricity produced by generator • The high voltage electricity is transmitted through a nationwide interconnected grid of transmission lines • At substations the voltage is reduced using “Step Down Transformers” for distribution	• Distribution lines carries electricity to the premises where it is meant to be used • Transformer steps down the voltage to suit the need of the installation for which electricity will be used. • Premises are equipped with meters to record the consumption of power.

C. Power Industry in India - current and future trends and key risks in the sector

The business objectives and priorities of the auditable entity are guided by key current and emerging trends of the industry. For an internal auditor it is important to understand the dynamics in the industry to appreciate the business objectives of the entity and the strategies adopted by the entity to achieve those objectives.

The business processes of the entity should support the strategies adopted by it to fulfil its business objectives. Any change in the dynamics of the industry would need a response from the entity by a corresponding adjustment in its business objectives. This may result in changes in the way the business processes are carried out. The internal auditor therefore needs to have a very good overall view of the dynamics of the industry.

Some of the key current and emerging trends of the Indian power sector are discussed below. Depending on the part of the power value chain to which the auditable entity may belong, there may be further detailed study required, to understand the linkage between the industry and its bearing on the business objective, processes risks and controls.

Key trends in Electricity generation

Current Demand - Supply position

There has been consistent increase in availability of energy in India over the last decade. India faced an energy deficit of 8.5% and a peak deficit of 9.8% in 2010-11. It is expected that the energy deficit and peak deficit will rise to 10% and 13% respectively in 2011-12[3]. The average per capita consumption of electricity in India is a mere 478 kWh (2010), compared to the world average of 2,300 kWh. BRIC nations, which are comparable economies, have significantly higher per capita consumption

[3] *CEA Load Balance Report, 2011-12*

compared to India. The average per-capita consumption has grown steadily at 1.3% CAGR annually over the last 10 years.

Various Policy measures adopted in the sector

In India progressive evolution since Independence has led to radical changes in the power sector. These have especially been in terms of competition, private sector involvement and focus on green energy over the last decade. The passing of the Electricity Act 2003 has been very significant in the recent past.

Till early 1990's, the power sector was shielded from any private sector involvement. Repeated delays encountered by state utilities and the growing demand supply gap urged the Government of India to open the power generation sector to private participation along with country's globalization policy.

The amendment of Supply Act (1948) in 1991, followed by the enactment of Electricity Act(2003) and notification of Mega Power Policy(1995), National Tariff Policy (2005), National Electricity Policy and Integrated Energy Policy liberalised the power sector, attracting active investments from private sector across the value chain. Most of the participation by private investors has happened in generation sector, driven by de-licensing of generation, fiscal incentives for large scale capacity additions and competitive procurement of power.

Over the last decade in the areas of policy reforms, a lot has happened by way of private sector participation in generation and transmission, new manufacturing technology and capabilities. A number of challenges however, need to be tackled before the opportunities of the future can be leveraged.

Key challenges of the future

Securing fuel

India's power requirement over the years has largely been dominated by coal based generation. However, more stringent rules and norms brought about recently by the

MoEF over award of coal blocks have left many developers devoid of coal linkages. State generating companies (Gencos) are repeatedly under pressure due to lack of adequate and timely supply of fuel.

Securing fuel from imported coal market is becoming increasingly costly and uncertain. The recent change in international markets, like the enactment of the new mining law in Indonesia, has significantly impacted the cost of imported coal for Indian companies, many of which were relying on supply of coal from this south-east Asian nation.

Gas supply not adequate

Gas supply to the power sector has been lower than the requirement over the last 10 years, although the deficit for gas has reduced from 45% in FY01 to 20% in FY11.

Securing land and clearances

Land is a basic necessity when it comes to power generation projects. Projects are either cancelled or delayed due to non-availability of land or difficulties in land acquisition. A major hurdle after the identification and selection of land is securing the required clearances. There are a number of clearances required from the MoEF, Ministry of Aviation, Department of Forests and other government bodies. The major hurdles for land acquisition and securing clearances have been the following:

- Resistance from local residents due to concerns over loss of land, water and pollution;
- Resettlement and rehabilitation issues;
- Regulatory delays;
- Environmental issues like loss of forest land;
- Unavailability of supporting infrastructure;
- Rising costs of land.

Competitive bidding related issue

Competitive bidding for power generation and transmission projects has been introduced. This is a move towards a competitive market, for attracting private sector participation and also for competitive prices in a largely regulated market. In competitive bidding scenario companies quote their tariffs considering project duration of 25 years and 35 years for generation and transmission projects respectively. The duration is fixed considering the life of assets and the period within which companies would be able to recover their costs at reasonable tariffs. Tariffs discovered through competitive bidding for projects have been in most cases significantly lower than regulated tariffs.

Financial health of the distribution sector has deteriorated

The distribution sector is still largely in the hands of the state owned utilities. There are a handful of franchisees and privatized utilities. The low collections and cash deficit scenario of the distribution sector severely impacts the financial viability of generation and transmission sectors.

Project execution challenge

The major players in Power Sector in India have shown have fared poorly in project management and execution. A capacity addition of 41,110 MW was planned in the 10th five year plan period, against which only 21,180 MW was achieved.

As on 31st March 2011, 41,297 MW of capacity has been added during the 11th Plan against the revised plan target of 62,374 MW.

There are bottlenecks in manufacturing of BTG and Balance of Plant. Besides that environment clearances and land acquisition have been the major issues for delay in project execution. There is need for investment of time, effort and money in developing project planning and project execution capabilities, streamlining of business processes and adoption of advanced technologies in the sector. This would enable the investors overcome strategic hurdles to a large extent.

Competition from International OEMs

The strong demand growth in the country has led to increased competition for domestic Boiler Turbine Generator (BTG) industry from OEMs (original equipment manufacturers) based in China. Several private players are opting to import BTG sets from China due to faster delivery of equipments and lower cost of sourcing. The prices quoted by Chinese manufacturers are significantly lower than that of domestic OEMs. The Mega Power Policy has provided waiver of customs duty on import of supercritical equipments.

Significant opportunities in the future

Strong growth in generation capacity

There is strong growth opportunity in power generation led by growth in the Indian economy, increasing propensity for electricity consumption and urbanization. The Indian private sector has shown strong interest in power generation. The recent change in power procurement landscape towards competitive bidding is expected to drive investments and efficiency in the sector. In the 12th five year plan, India has planned to add close to 75 GW of power generation capacities.

Alternate sources of energy

Indian companies are largely focused on tradition sources of energy. Global investments in renewable energy has jumped 32% reaching record USD 211 billion in 2010, which is over 5 fold increase since 2004. Countries like China have ramped up their investments in alternate sources of energy. India too is looking at building a strong renewable energy portfolio in coming years. Government of India is offering a number of incentives to renewable energy developers to accelerate investments.
Several benefits like accelerated depreciation, preferential tariff and generation based incentives offer attractive incentives to developers investing in renewable energy, and aim to enhance supply through renewable energy. The increased focus of Government of India towards renewable energy has created attractive opportunities for investments in this sector.

Investment in clean technology

As the demand for electricity grows, the role of coal would remain undiminished. Indian coal has a high ash and mineral content while cleaner imported coal is very costly. Hence, there is focus on the development of clean coal technologies for India. There are a number of existing technologies like coal beneficiation, coal combustion, coal conversion, coal gasification and carbon capture.
India has made some progress in implementing super critical, pulverized coal combustion, coal gasification technologies. Since such technology choices would have a long term impact (life of the plant) these need to be chosen carefully. There may be more favourable policy initiatives that would help overcome any economic hurdles which investors might face in choosing some of these options.

Gap in manufacturing capacity

The capacity additions envisaged under 12th five year plan is 75 GW (excluding renewable energy) and almost double under the next five year plan (13th five year plan).
The demand for BTG equipments is expected to increase significantly. The domestic equipment major BHEL is already loaded with bulk orders for next 2-3 years and there is a need to enhance private sector investment in OEM space.
The current scenario presents with immense opportunities for investors in manufacturing sector (OEMs) for building up capacities to cater to the growing requirements.

Key trends in Electricity Distribution

Increased customer choices and expectations

Consumers in India are becoming demanding with exposure to improved service standards across sectors such as communication, banking and healthcare etc. The key trends in customer expectations and service domain will be as follows:

• ***Multiple service delivery options:*** With parallel licensee, open access and private participation, the end-user or consumer will have more options while choosing their power supplier. Competition will force utilities to look at innovative solutions for customer retention. This part of the value chain is expected to see customised services delivered to the customer's doorstep and other value-added services as part of the distribution business portfolio.

• ***Customer as a stakeholder:*** Customers will have a say in the manner utility operates. Feedback from customer complaints, interactions, institutions like Utilities Consumer Grievance Cell, Consumer Grievance Redressal Forum, Ombudsman, etc., will enable utilities to design services as per customer demands.

• ***Implementation of standards of supply***: Implementation of standards of performance and making utilities pay for deficient service standards will be a reality.

Smart grid interventions in distribution

In the future the electric meters in the premises of the consumers will become a complete communication channel to undertake bidirectional communication between the generator and the end consumers. This is the concept of smart metering. The focus will be on building a distribution business that is smart grid compatible and connects the proposed smart grid to the end consumer through smart metering and related technological interventions. Presently, the distribution-metering infrastructure is being used only as a one-way communication device for pulling consumption data to utility's database.

Enhanced regulatory oversight

The existing trends in electricity costs and recovery in distribution sector are showing a rising gap between cost of supply and realisation per unit. With respect to allowing genuine utility costs and undertaking tariff revisions, state regulators undertake revisions on regular or periodic basis.

The role of the state regulator has come into sharp focus in respect of the tariff determination process.

Segregation across business elements

The next decade is likely to focus on segregating each element of the existing distribution business to drive efficiencies and get the operators best suited to manage smaller segments of the business.

Specialised agencies entering these sub-segments will bring in skill and expertise not available within the utilities. The scale and scope of such engagement may differ across utility but the principles would be to define a set of service level parameters and contract it to agencies best suited to handle them.

The involvement of private sector in key elements of the distribution chain like metering services, managing revenue cycles, distribution franchisees, managing a set of customers, managing call centres, O&M outsourcing, will get more pronounced.

D. The Institutional framework and types of ownership structure

The Power sector being regulated, it is important for us to understand about the key regulatory bodies that operate in various parts of the power value chain. During our internal audit engagements, depending on the part of the value chain in which the entity operates, the auditor may need to understand in detail the bearing that the regulator has on the entity's business objectives, policies and processes.

Electricity is a concurrent subject in India, i.e., it is under the jurisdiction of both the central and state governments. Both the governments have powers to legislate on the subject. The table[4] below shows the institutional structure at the central and the state levels.

	At Central level	At State Level
Policy	Ministry of Power	State Government
Planning	Central Electricity Authority (CEA)	State Government
Regulation	• Central Electricity Regulatory Commission • Central Advisory Council	• State Electricity Regulatory Commission • State Advisory Council
System operations	• National Load Dispatch Centre (NLDC) • Regional Load Dispatch Centre (SLDC)	• State Load Dispatch Centre (SLDC)
Dispute Resolution	Appellate Tribunal	

[4] Source: Co-publication of the Energy Sector Management Assistance Program (ESMAP) and the World Bank Report no: 56849-SAS

At the central level, while the Ministry of Power is responsible for the policy-related aspects of the sector, the overall sector planning has been entrusted to the Central Electricity Authority (CEA). The regulatory aspects of the sector involving more than one state are addressed by the Central Electricity Regulatory Commission. State Electricity Regulatory Commissions (SERC) take care of the same at the state level. In line with the philosophy of a national grid, the National Load Dispatch Centre (NLDC) and the Regional Load Dispatch Centres (RLDC) are envisaged as system operators at the national and regional networks, with each state housing a State Load Dispatch Centre (SLDC).

The understanding the ownership structure of the auditable entity is important. Often the ownership structure determines how decision making will happen in the business, how business strategies will be determined and how those will be executed. To the internal auditor, therefore, while planning the audit, it is very important to consider the structure of ownership of the entity.

The ESA (Electricity Supply Act) envisaged three kinds of entities in the power-sector: State Electricity Boards (SEBs), generating companies, and licensees. SEBs are allowed to generate, transmit, and distribute electricity within a state; they enjoy all the powers of a licensee. They account for 65 per cent of the power generated in the country.

Generating companies are responsible for supplying power to the grid without the specific responsibility of retail distribution. Major players in this category are NTPC (National Thermal Power Corporation), NHPC (the Hydro-electric analogue of NTPC), and NPCIL (Nuclear Power Corporation of India Limited). Though the ESA allowed only the governments to set up generating companies till 1991, it has since been de-reserved and the Independent Power Producers (IPPs) now fall under this category.

Existing licensees are private-sector utilities licensed by a State Government for power generation, distribution, or both within a specified area.

Currently the state and Central Government-owned utilities account for 50% and 32% of the total electricity generation capacity respectively, while the private sector accounts for about 18%. Robust electricity-generating companies like NTPC and NHPC which are substantially owned by the Government of India focus on thermal and hydel power generation respectively.

Most of the transmission and distribution utilities are owned and operated by government owned entities. At the central level, Power Grid Corporation of India Limited (PGCIL), substantially owned by the Government of India, focuses on inter-state and inter-regional transmission. State government owned transmission and distribution entities dominate the State level transmission and distribution segments. The private sector has a relatively small presence in distribution and is making an entry into transmission. Opportunities for private players in the form of joint ventures or Independent Power Transmission Companies (IPTCs) are emerging in the electricity transmission segment.

Though there are over 20 private sector licensed traders in the country most of the traded power is through PTC or NTPC Vidyut Vyapar Nigam Limited. Distribution franchising offers investment opportunities for private players the in the electricity distribution segment.

E. Key regulations/Government policies and regulations in the Power Industry in India

The Power industry is a regulated industry with several legislations, regulations and policies that have a bearing on the way the sector is currently operating and is likely to in the near future. The key regulatory/policy matters that are currently in place have been summarised below.

Sl. No.	Name of regulation/policy	Summary and Salient features
1	**Electricity Act - 2003**	• Creation of independent Regulatory Commissions in the states as well as at the centre. • Freeing up of thermal generation from the requirement of any prior clearances. • Freedom for setting up captive power plants including group captive power plants and no cross-subsidy surcharge for captive consumption. • Introduction of open access in transmission and the provision for creation of power markets. • Freedom for building dedicated transmission lines. The National Electricity Policy under the Electricity Act, 2003, provided further for mechanisms to encourage private investment in transmission. • Open access in distribution to be introduced in phases. • Enabling provision for more than one distribution licenses in the same area. • Prescription of performance standards for distribution licensees and its enforcement by Regulatory Commissions. • Introduction of Multi-Year Tariff (MYT)

Sl. No.	Name of regulation/policy	Summary and Salient features
		framework for performance based regulation to incentivise efficiency gains. • Introduction of the provision for competitively bid generation tariffs to be accepted by Regulatory Commissions. Power purchase costs of customers availing open access to be market determined. • Provision for establishment of an Appellate Tribunal for quick disposal of appeals against decisions of State Regulatory Commissions / CERC
2	**National Electricity Policy – 2005**	The National Electricity Policy aims at laying guidelines for accelerated development of the power sector, providing supply of electricity to all areas and protecting interests of consumers and other stakeholders keeping in view availability of energy resources, technology to exploit these resources, economics of generation using different resources and energy security issues. • Providing access to electricity to all households in next five years. • Demand of power to be fully met by 2012. Energy and peaking shortages to be overcome and adequate spinning reserve to be available. • Supply of reliable and quality power of specified standards in an efficient manner and at reasonable rates. • Per capita availability of electricity to be increased

Sl. No.	Name of regulation/policy	Summary and Salient features
		to over 1000 units by 2012. • Minimum lifeline consumption of 1 unit/household/day as a merit good by year 2012. • Financial turnaround and commercial viability of electricity sector. • Protection of consumers' interests.
3	**National Electricity Plan**	As per the Electricity Act 2003, the CEA has been entrusted with the responsibility of preparing the National Electricity Plan, notifying such plan once every five years and revising the same from time to time in accordance with the National Electricity Policy. The plan prepared by CEA and approved by the Central Government can be used by prospective generation developers and transmission/ distribution licensees as the basis for planning investments in the sector. The National Electricity Plan presents a short-term framework of five years while giving a 15 year perspective and includes • Short-term and long term demand forecast for different regions; • Suggested areas/locations for capacity additions in generation and transmission keeping in view the economics of generation and transmission, losses in the system, load centre requirements, grid stability, security of supply, quality of power including voltage profile etc. and environmental considerations including rehabilitation and resettlement; • Integration of such possible locations with transmission system and development of national

Sl. No.	Name of regulation/policy	Summary and Salient features
		grid including type of transmission systems and requirement of redundancies; • Different technologies available for efficient generation, transmission and distribution; • Fuel choices based on economy, energy security and environmental considerations
4	**National Tariff Policy – 2006**	The Central Government notified the National Tariff Policy on January 6, 2006 with an objective of ensuring availability of affordable electricity to all consumers, while ensuring financial viability of investments in the sector through the promotion of a competitive and efficient industry operating within a transparent, consistent and predictable regulatory regime. It deals with long-term principles for fixation of tariffs and provides a uniform approach to the state electricity regulatory commissions (SERCs) and central electricity regulatory commission (CERC) in determining tariffs for licensed businesses. The policy also outlines the requirement for SERC to notify a roadmap for reduction of cross-subsidies within + 20% of the average cost of supply. It also outlines to promote procurement of energy from non-conventional sources of energy and surplus power from captive sources of generation.
5	**Integrated Energy Policy – 2006**	The Integrated Energy Policy was formulated because different sources of energy can substitute for each other in both production and consumption and an integrated approach to energy planning from the standpoint of long-term security of supply, efficiency and environmental sustainability is essential to meet India's growing energy needs.

Sl. No.	Name of regulation/policy	Summary and Salient features
6	**Mega Power Policy – last amendment in 2009**	A policy for the development of large sized mega power projects supplying power to several States was announced in November 1995. The aim of this policy was to derive economies of scale by setting up large sized power plants, especially in the private sector at pithead and transmitting power to distant regions, which are deficit in power. No fiscal incentives were, however, provided for in the policy issued on November 10, 1995. These guidelines were modified in 1998 and 2002 and were last amended on 14th December 2009. As per the modified Mega Power Policy, power projects with the following threshold capacity shall be eligible for the benefit of mega power policy: • A thermal power plant of capacity 1000 MW or more; or • A thermal power plant of capacity of 700 MW or more located in the States of J&K, Sikkim, Arunachal Pradesh, Assam, Meghalaya, Manipur, Mizoram, Nagaland and Tripura or • A hydel power plant of capacity of 500 MW or more; • A hydel power plant of a capacity of 350 MW or more, located in the States of J&K, Sikkim, Arunachal Pradesh, Assam, Meghalaya, Manipur, Mizoram, Nagaland and Tripura. The following modifications have been made to the Mega Power Projects • The mega policy benefits have been extended to

Sl. No.	Name of regulation/policy	Summary and Salient features
		brown field (expansion) projects also. In case of brown field (expansion) phase of the existing mega project, size of the expansion unit(s) would not be less than that provided in the earlier phase of the project granted mega power project certificate. • The mandatory condition of Inter-State sale of power for getting mega power status has been removed. • Goods required for setting up a mega power project, would qualify for the fiscal benefits after it is certified by an officer not below the rank of a Joint Secretary to the Govt. of India in the Ministry of Power that (i) the power purchasing States have constituted the Regulatory Commissions with full powers to fix tariffs and (ii) power purchasing states shall undertake to carry out distribution reforms as laid down by Ministry of Power. • Mega Power Projects would be required to tie up power supply to the distribution companies/utilities through long term PPA(s) in accordance with the National Electricity Policy 2005 and Tariff Policy 2006, as amended from time to time, of Government of India. • The requirement of International Competitive Bidding (ICB) has been removed for procurement of equipment for the mega projects if the requisite quantum of power has been tied up or the project has been awarded through tariff based competitive bidding as the requirements of ICB

Sl. No.	Name of regulation/policy	Summary and Salient features
		for the purpose of availing deemed export benefits under Chapter 8 of the Foreign Trade Policy would be presumed to have been satisfied. In all other cases, ICB for equipments shall be mandatory. • The present dispensation of 15% price preference available to the domestic bidders in case of cost plus projects of PSUs would continue. However, the price preference will not apply to tariff based competitively bid project/s of PSUs.
7	**Hydro Power Policy - 2008**	New hydro policy was approved by the central government in January, 2008 for inducing large private investments in development of hydro sector and to provide the level playing field for private investors. The main features of this policy are: • Inducing private investment in hydro power development; • Improving resettlement and rehabilitation; • Facilitating financial viability; • The new policy states that developers will provide the money equivalent of 1% of power generated from the project to a fund managed by the district authorities for the development of the area affected by the project; • A matching grant would be given by the state government from the 12% free power given to it by the developer. Locals affected by the project will have a say in the use of the fund; • The Policy also mandates that 100 units of free

Sl. No.	Name of regulation/policy	Summary and Salient features
		electricity per month be given to families affected by the project for 10 years. The families will be free to consume this power or sell it; • The policy has also introduced penalties for delays. If the developer is not able to complete the project within four years of its financial closure, the quantum of power available for sale as merchant power will be reduced from 40% to 35%; • A further delay of six months will reduce the merchant power available to 30%, and so on; a delay of an additional four years means the developer has no merchant power left to sell; • The new policy also asks for the project developers to implement the Central Government's ambitious rural electrification programme, the Rajiv Gandhi Grameen Vidyutikaran Yojana, in the vicinity of the project.
8	**Rural Electrification Policy – 2006**	In compliance with Sections 4 & 5 of the Electricity Act, 2003, the Central Government notified Rural Electrification Policy on August 23, 2006. This policy aims at:- • Provision of access to electricity to all households by the year 2009; • Quality and reliable power supply at reasonable rates; • Minimum lifeline consumption of 1 unit per household per day as a merit good by year 2012. • The Central Government reviewed different schemes of rural electrification and launched a

Sl. No.	Name of regulation/policy	Summary and Salient features
		comprehensive programme for capital investments under substantive grant funding for rural electrification called the Rajiv Gandhi Grameen Vidyutikaran (RGGVY) .
9	**National Solar Mission - 2010**	The National Solar Mission is a major initiative of the Government of India and State Governments to promote ecologically sustainable growth while addressing India's energy security challenge. The NSM has set several time-bound targets. By the end of the Thirteenth Plan in year 2022, it aims to achieve (a) 20 GW of grid-connected installed solar capacity, comprising large photovoltaic (PV) and solar thermal power plants and smaller rooftop PV systems, (b) 2 GW of off-grid distributed solar plants, (c) 20 million sq meters of solar collectors for low temperature applications, and (d) 20 million solar lighting systems for rural areas. The NSM has two additional goals; (a) promote R&D, public domain information, and develop trained human resource for the solar industry, and (b) expand the scope and coverage of earlier incentives for industries to set up PV manufacturing in India. The objective of the National Solar Mission is to establish India as a global leader in solar energy, by creating the policy conditions for its diffusion across the country as quickly as possible.

Sl. No.	Name of regulation/policy	Summary and Salient features
10	**CEA Regulation on Equipment and Electrical works - last amendment in 2010**	CEA (Installation and Operation of Meters) regulations 2006 provide guidelines on type, standards, ownership, location, accuracy class, installation, operation, testing and maintenance, access, sealing, safety, reading and recording, failure or discrepancies, anti tampering features, quality assurance, calibration and periodical testing of meters. Adoption of new technologies in respect of interface, consumer, energy accounting and audit meters for correct accounting, billing and audit of electricity is also deliberated in the regulation. The CEA amendment regulations, 2010 specifically provide details regarding location of the meters.
11	**CEA (Technical Standards for Construction of Electrical Plants and Electrical Lines) Regulation – 2010**	These regulations are intended to specify the Technical Standards for construction of Electrical Plants and Electric Lines. The aim of this regulation is to ensure that all Electrical Plants and Electric Lines should be constructed conforming to minimum requirements laid down in the regulations, to guarantee expected levels of performance with respect to reliability, availability, efficiency, safety and maintainability over their lifetime. The regulation also outlines the technical standards for construction of all types of Thermal (Coal or Lignite, Gas, Internal Combustion (IC) engine), Hydro-Electric Stations, Sub-Stations and Switchyards (66kV and above; 33/11kV, 33/22kV and 22/11kV; Distribution) and electric lines
12	**CEA (Safety requirements for**	These regulations apply to all the electrical plants and electric lines already commissioned as well as

Sl. No.	Name of regulation/policy	Summary and Salient features
	construction, operation and maintenance of electrical plants & electric lines) Regulations, 2011	those under construction. The main purpose of these regulations is to lay down broad safety requirements for construction, operation and maintenance of electrical plants and electric lines with the objective that all the electrical plants and electric lines put in place have a sound and scientific safety management system to ensure high levels of safety during construction, operation and maintenance.

Apart from the above, there are various laws, regulations and policies that have been issued by the state level authorities that control the power sector.

It is important for the internal auditor to understand the nature of business of the entity i.e., whether it is in generation, transmission or distribution or a combination of these. The next important step is to make an inventory of the key laws and regulations (of both Central and State authorities) applicable to its business and then assess the impact of those on its business objectives.

The audit programme should be drafted after assessing the risks that the entity faces in respect of the applicability of these regulations or policies and the control processes that are put in place to address those risks.

F. Overview of Core processes - Generation, Transmission and Distribution

It is important to understand the key operational processes of the power industry to be able to conduct an effective internal audit.

As discussed earlier the core operational processes are Generation, Transmission and Distribution of electricity. An overview of how each of these processes work and the key physical assets connected with these processes is given below.

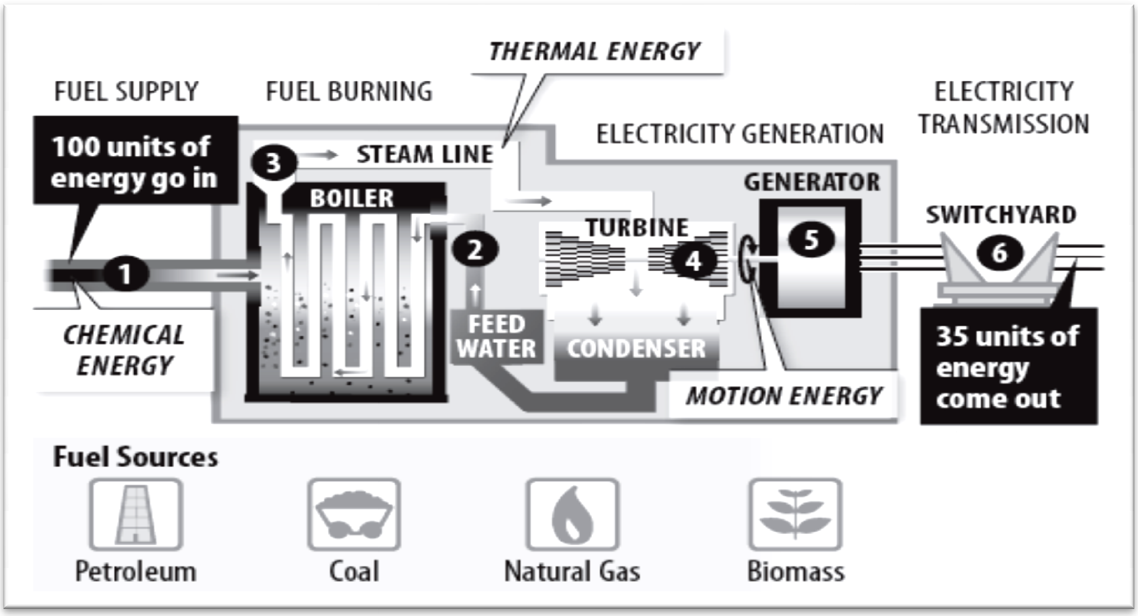
Overview of Generation process

The heart of a power generation process is the generation station. In a generation station the two most important components are (a) the turbine and (b) the generator. The turbine is used to generate a rotational motion which is used by the generator to produce electrical energy.

The rotation of the turbine can be produced by different methods. Water pressure is used in Hydro turbine and Air pressure in Wind turbines. The pressure of steam is used in turbines that are associated with coal, nuclear, bagasse and bio- gas based plants.

The most common method for generation is based on the usage of steam turbine. This is commonly used across the world and also in India. There are other methods used for power generation like photovoltaic panels. The principle based on which a Steam Turbine works is given in the schematic diagram below[5]:

[5] Reference www.need.org



In case of photovoltaic technology, there is no need of turbines and their rotational motion as that technology can directly convert solar energy to electrical energy.

Coal is the most commonly used fuel for generating power in India. The generation processes of a coal based plant would typically have the following broad steps.

- Coal is transported from mines to coal yard in a thermal plant.
- Coal is crushed and conveyed to the furnace where it is burnt
- The heated gas in the boiler is used to produce steam at high temperature and pressure.
- The high pressure of steam turns the steam turbine that in turn turns the generator producing electricity
- Part of the steam is condensed and recycled back to the boiler

The electricity generated by the above processed is at 10-15 KV. The voltage has to be stepped up by a substation that links the generating station to the transmission grid.

The key assets that are used in generation are:

- Coal Handling system
- Ash Handling system
- Boiler, Turbine and Generator
- Cooling towers

- Pumping system

Overview of Transmission process

A power transmission system is essentially a mesh of transmission lines connecting generating stations and Load Centres. There are sub stations near the Load Centres that step down the voltage of the electricity from what it is in the transmission lines.

Electricity flows [6]from power plants, through transformers and transmission lines, to substations. The system is highly interconnected. The interconnectedness of the system means that the transmission grid functions as one entity. Power entering the system flows along all available paths, not just from Point A to Point B. The system does not recognize divisions between service areas, counties, states, or even countries.

Since the voltage is very high, transmission lines have to be very tall. Lines are connected to towers by a chain of insulators. Typically there are many insulators strung up together. For 132 kV, there can be as many as 10 insulators. Lines run from one tower to another, which are 100-200 metres apart. Usually there are three power-carrying lines (corresponding to three phases) and one or two lines that are lightning arrestors. Lightning arrestors are located at the highest point of the tower and are connected to the tower and thus to the ground. A set of three lines is called a circuit. Usually a tower carries only one circuit, but it is not unusual to see towers with two circuits. At very high voltages every phase may have more than one conductor.

The current transmission grid includes not only transmission lines that run from power plants to load centres, but also from transmission line to transmission line, providing a redundant system that helps assure the smooth flow of power. If a transmission line is taken out of service in one part of the power grid, the power normally reroutes itself through other power lines to continue delivering power to the customer. In essence, the electricity from many power plants is “pooled” in the transmission system and each distribution system draws from this pool. This

[6] Reference - Public Service Commission of Wisconsin, www.psc.wi.gov

networked system helps to achieve a high reliability for power delivery since any one power plant only constitutes a fraction of the power being delivered by the power grid to meet the instantaneous demand requirements.

It is important to note that the transmission of electricity is guided by the laws of Physics and not essentially by any commercial contracts.

In India, power transmission is coordinated by a network of Load Centres (Load Dispatch centres or LDCs) at the National, Regional (North, South, East, West and North-East), State LDCs, sub LDCs and Distribution control centres.

LDCs prepare generation schedule for each generating station under it. Various parameters are used by the LDCs to prepare the schedule namely, fuel availability, cost of generation, contractual agreements, irrigation requirements etc. LDCs generate a Merit Order (sequence of generating stations having the lowest cost of supply of electricity). Merit Orders typically is based on the cost structure of the plant however any pressing contractual obligations have overriding consequence for a generating station is also considered for determination of the Merit Order.

The LDCs act as the nodal centre to control the traffic of electricity through the transmission line. Based on the intermittent instructions of the LDCs the generating stations have to adjust their generation during the day to help the LDCs balance the traffic in the network.

The key assets that are used in transmission of power are:

- Transmission towers
- Insulators
- Underground cables
- Substation equipments like transformers, bus bars, circuit breakers, isolators, protective relays, lightning protection equipment, communication equipment and a control room

Overview of Distribution process

The distribution system physically consists of the distribution lines and substations. It supplies power to consumers and is the first interface of the utility with the consumers. After restructuring, many states have three or four distribution companies.

The primary distribution system connects to the transmission system, is at 33, 22, or 11 **kV** voltage levels and forms the backbone of the distribution system. Secondary distribution is at a lower voltage of 415 **V.**

How the power distribution system works

Consumers can be domestic consumers who need power to light their homes, run their fans and other electric appliances, or they can be industrial consumers who have to run their factories when the shift begins. They can be commercial consumers like hotels, hospitals, shops etc, or agricultural consumers.

The demand for power varies throughout the day and the Power System has to respond to this varying demand for power. This involves increasing or decreasing generation, voltage corrections, ensuring that no line or transformer is overloaded and finally opening up some lines in case of emergency (which leads to load shedding).

Information like values of power generation, power flows on lines, voltages at substations and frequency are recorded at regular intervals for further analysis.

Whenever the power supply fails, the consumer informs the nearest electricity office. In towns, there are 'Fuse off Call Centres' and in big cities there are centralised complaint centres. These centres may get many calls from different consumers whose supply has been affected. Based on these calls and a survey of the area, the problem is identified and repair crew sent to solve the problem. The aim is to minimise the no-power time.

In a well planned and well-maintained system, failures are few and of short duration. However, increasing demand and improper and insufficient investments in the system have increased the failure rate, making fault handling a daunting task.

Distribution in a big city or a district may be co-ordinated from a Distribution Control Centre (DCC). The DCC will have the layout of the substations and feeders in the area and also specifications of various equipments in the distribution system. Information on the current operation status from the substations is conveyed to the DCC so that staff at the DCC gets a comprehensive view of the distribution system operation. This includes ON/OFF status of feeders, power flow on feeders, voltages, frequency values, status of important equipment etc. The DCC has to watch out for overloading of lines or transformers and take corrective action. It also has to take care of poor voltage or high phase imbalance.

Load management is one of the important functions of the DCC. This can be routine load-shedding operations, like the daily short duration power cuts implemented at different times in different areas. For agricultural pump sets, this can involve giving power to different groups of pump sets in two or three shifts for a fixed number of hours.

Emergency load shedding instructions are conveyed from the head office to the DCC, which in turn instructs the field staff to open some feeders to reduce the load. Emergency maintenance and preventive maintenance are also co-ordinated from the DCC. The DCC keeps a record of all data collected, which is used for analysing the performance of the distribution system and for planning.

Sophisticated distribution systems (like those in cities like Mumbai, Kolkata, Chennai and Hyderabad) have modern computer based DCCs that can get on-line data from the distribution system using communication media like radio. Even in these systems, switching the feeder ON and OFF is ultimately done by the field substation staff.

On the commercial side, the energy consumed is measured by energy meters installed at consumer locations. These meters have to be read periodically, to bill the consumer. This is usually done manually, by meter readers. Meters are read on a monthly basis and sometimes on a half-yearly basis.

At a domestic consumer location, meter reading is just one parameter - the cumulative value of energy consumed. At a factory location, meter reading includes the energy consumed, the maximum demand and the power factor. Meter readers are also expected to check for meter tampering or theft of power, New systems have been introduced in which the meters can be read electronically (using technology similar to the mobile phone). These readings are consolidated and the consumer billed accordingly. Bill collection centres accept payments. Faulty meters have to be identified and replaced. Requests for new connections have to be handled.

The key assets connected with distribution are:

Distribution Lines

Distribution lines consist of overhead lines or underground cables. Underground cables are common in big cities and inside factories. Unlike transmission lines, which form a mesh (providing alternate paths for power to flow), distribution lines are mostly 'radial' in nature. They start from a substation and end after supplying power to a few consumers. This is mostly true in rural areas. In cities, taking advantage of the high load density and in order to increase the reliability of supply, primary distribution can have a mesh like connection, often called 'ring main'.

The height of the distribution poles vary with the voltage of the line they carry.

33 kV is carried on the tallest pole (about 8-10 metres) and the 415 V lines on a five to seven metre pole.

Distribution Substations

Distribution substations are smaller than transmission substations. A 33 kV substation will occupy a few hundred square yards. The wayside structure with a

Distribution Transformer (DT) is an 11 kV substation. Equipment in a distribution substation is a smaller version of that present in a transmission substation.

G. Determination of sale price (i.e. tariff value) and the billing process

An understanding of the process followed for tariff determination is important from the point of view of internal audit. This is due to the fact that there are several components of costs that have a bearing on the tariff application made by the entity and often these cost elements and the processes connected with those are the subject matter of internal audit. In the regime of Tariff based competitive bidding where projects are awarded to entities that can offer services at optimum tariff rates, management of the various cost elements and working within assumptions that go into the tariff determination need is of high importance as that can make all the difference in terms of the profitability of the entity.

Determination of sale price (i.e. tariff value)

Tariff is the rate at which electricity is sold to consumers. Typically, the process has the following parts:

- The utility files a tariff application a few months before the start of a financial year. The data for the ongoing year is used to project the sales, performance and costs for the next year.

- The Regulatory Commission (RC) checks the utility's application for consistency and sufficiency of data. This process is called 'technical validation'. If additional data or corrections are required, the utility files a revised application.

- The RC then requires the utility to make public this corrected application and invite comments from the public.

- Based on the public's comments and public hearings, the commission decides the reasonability of various issues.

- Finally, the RC gives an order that announces the tariff. This tariff order is expected to be a reasoned order, wherein the logic of the RC's decision is spelt out

Different methods can be employed to regulate a utility's tariffs. The most common method is the "cost plus" method. In this method, the commission examines all costs incurred by the utility. Based on the evidence produced before the commission (by consumers or commission staff), it may conclude that some of the costs are not reasonable and may disallow these. The disallowed expenses are not counted as expenses of the utility and hence not passed on in the consumer tariff. Based on legal norms, the commission allows the utility to add its profit to the approved costs. Approved costs plus the profit is then called Annual Revenue Requirement (ARR). Hence the term 'cost plus or cost +'. The income tax is considered as an expense of the utility and is recovered from the consumers as per the Indian regulations.

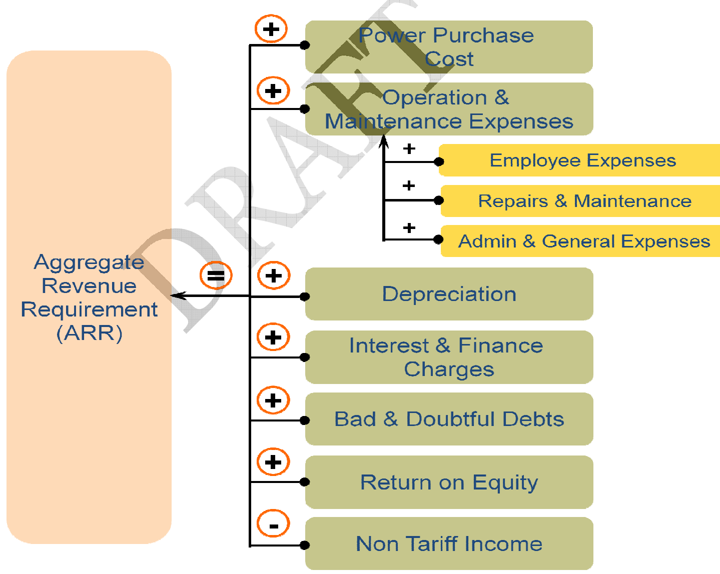


Figure: Components of Aggregate Revenue Requirement[7]

In practice, a pure cost-plus method is rarely applied. Usually, the RC examines the expenditure against two tests (i) usefulness and (ii) prudence of expenditure. The usefulness test examines the necessity of the expense. The prudence test is an evaluation of whether the asset (fuel or material) was purchased at the least possible

[7] Reference taken from publication of IIT Kanpur

cost. Hence, there is always a disincentive for utility to incur wasteful expenditure - there is a possibility of disallowance by RC resulting in reduction of profits.

Process of Tariff Approval

In the figure, it can be seen that there are six major stages in tariff determination. These are: 1) estimation of power demand, 2) deciding generation/power purchase plan, 3) estimation of capital related costs, 4) estimation of operating expense, 5) calculation of annual revenue requirement and 6) fixing the consumer tariff

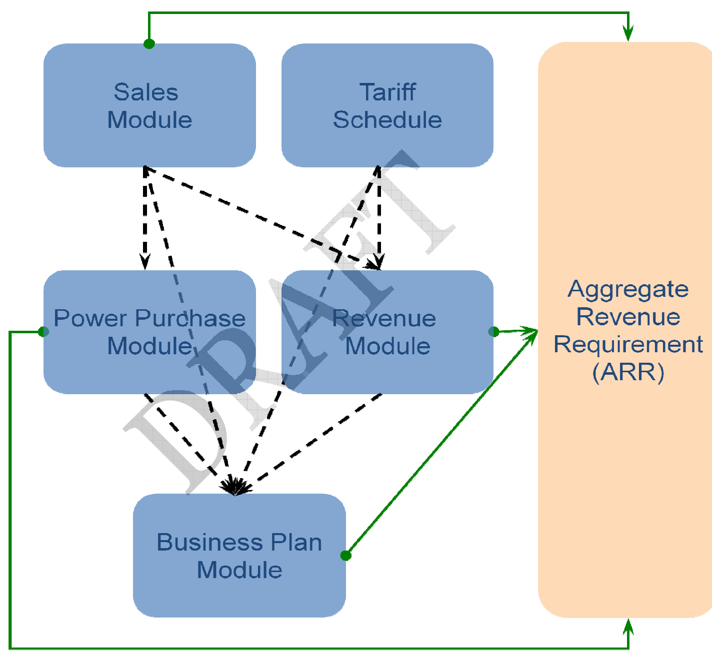


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Figure: Modules involved in Tariff filing process[8]

Demand Estimation

The power requirement for the next year has to be estimated from the available data for the preceding year. The energy demand as well as the peak load (power demand) must be assessed. Estimation of power demand is done separately by only some Indian utilities. Most utilities prepare rough estimates of power demand (in MW) from the estimate of energy demand. The energy supply requirement of the utility is

8 Reference from publication of IIT Kanpur

worked out in much more detail by estimating the sales to different categories of consumers and the T&D losses. Energy supply should be equal to the total energy sales plus the T&D losses.

Estimation of metered sales

A utility usually follows three steps to estimate the energy demand of metered consumers:-

- Consumer category: This is usually an extrapolation based on number of consumers, expected growth in number of consumers, and the past trend of consumption norm (consumption per consumer).

- Detailed study or survey: For consumers like large industry and large irrigation schemes, a detailed study or survey is sometimes carried out to anticipate their consumption.

- Leading indicators: Corrections are made to account for special drives such as meter replacement, trends in economic situations, or good/bad monsoon.

Estimation of un-metered sales and Transmission & Distribution (T&D) losses:

The energy fed into the grid is metered at generation stations and the export/import substations (where power is exchanged with neighbouring utilities). The difference between the energy fed into the grid and the total energy sold is the T&D loss. But as seen before, energy sales consist of metered sale and estimate of un-metered sale.

Several commissions have started asking utilities to meter a sample of agricultural (or other un-metered) consumers. The representative nature of sampling is a contentious issue in several states.

Power Generation and Purchase plan

The sum of the estimate of metered sales, un-metered sales and T&D loss gives the energy supply requirement (at the output point of generation stations).

To decide which plants will provide this energy the least costly mix of generation from a utility's own plants and power purchased from other utilities is taken into consideration.

In case where load cannot be made forecast of likely load shedding is done. This process gives two outputs (1) fuel requirement of utility plants and (2) the power purchase need at different times of the year.

To ensure the least cost operation, merit order sequencing of plant dispatch is followed (the low variable cost plants are operated first). This then helps calculate the likely purchase from each source and also the required load shedding.

Before approving the generation costs and the power purchase cost the Regulatory Commission (RC) checks the following factors:

Utility generation plant output: Reasonability of assumed outages/ maintenance should be, assumed plant availability and the Plant load Factor (PLF) are checked. Reasonability of the per unit fuel consumption (heat rate) and the cost of operation and maintenance of generation plants are also seen by the RC.

Utility generation fuel cost: The fuel purchase cost is a significant part of a utility's generation cost. Fuel cost is minimisation by reducing losses in fuel handling and that the fuel procurement process is appropriate in ensuring most optimum cost is seen by the RC.

Independent Power Producers (IPP): A check that the source wise power purchase follows the merit order logic that the tariff charged by IPPs is as per their agreement, and that best efforts are made to minimise their costs, is done by the RC.

Central Sector plants: CERC is the tariff regulator of these plants. The state commission has the limited role of ensuring that the utility is dispatching these plants as per the merit order, is not over drawing power in an irrational manner and the UI (unscheduled interchange) charges are in the reasonable range.

Capital Related costs

The capital related costs included in the calculation of tariff are depreciation, reasonable return (and tax on the profit), interest on working capital, insurance etc. In case of IPPs, the profit is called Return on Equity (ROE). The depreciation and profit (and tax) elements are usually decided when the RC approves the associated investment.

Reasonable Return

The electricity laws provided that the tariff should be fixed in such a way that the licensee could earn a reasonable return.

The reasonable return is determined on the basis of the capital base and the allowed rate of return.

Reasonable Return = Capital Base x Allowed Rate of Return

The Capital Base is synonymous with the equity of the company. The simplified definition of Capital Base as given in the Sixth Schedule of the Electricity Supply Act, 1948 is:

Capital Base = (Original Cost of fixed assets + cost of intangible assets + working capital + cost of work in progress) - (Consumer contributions +accumulated depreciation + consumer deposits +approved loans + adjustments for reserves

Cost of a New Power Plant

Generation is the part of the value chain where the most critical costs come in. The cost of generation of a utility owned plant or an IPP plant is largely decided at the time the plant is approved.

The full tariff formula of an IPP is decided at the time of signing the Power Purchase Agreement (PPA), for the full term of the PPA. Hence, signing the PPA is a major decision and has long term implications for the costs and the generation mix available to the utility. The same is true of a utility that decides to construct a new plant.

Operating Costs

The ARR of a utility is also dependent on its operating costs. Certain elements of this type of cost are - manpower costs, repairs and maintenance, administration and general expenditure and provision for bad debts. Estimate of these costs are based on their past trends and future plans.

Calculation of the ARR

The utility's revenue requirement, the Annual Revenue Requirement (ARR), is the sum of the approved costs of:

- Power purchase
- Capital related costs
- Utility profit and tax
- Operation related costs

Expenses that are considered of imprudent nature are often disallowed by the regulatory commission. These disallowances can at times be quite material in nature.

Certain Special Considerations in tariff setting

1. *Fuel and Other Cost Adjustments (FOCA)*

In some cases, the regulatory commission allows fuel cost variations to be passed on through the tariff (this is called a 'pass-through'), and this is called Fuel and Other Cost Adjustment (FOCA). The FOCA mechanism is designed to recover the costs of fuel used to produce electricity and energy purchased. Usually the commissions define a set of rules based on which the utility can periodically pass on changes in some of these costs.

2. *Government Subsidy*

Governments around the world are known to subsidise the power sector in form of capital subsidy like subsidy for the expansion of grid or cost of new connections.

In many countries, governments provide revenue subsidy to cover the operating loss of the utility or to reduce tariff for some classes of consumers.

3. Regulatory Asset and Liability

Regulatory Asset: A regulatory asset is a portion of utility's approved expenses, which is not recovered through the tariff immediately. Recovery of this expense is postponed to a future date, thus preventing an immediate tariff increase.

Regulatory Liability: This is a mirror-image of a regulatory asset. It is like taking a loan from consumers. These adjustment mechanisms try to reduce the tariff shock or the cash flow problems of the utility. These can be very important and can have a sizeable impact on the actual payment by consumers.

Consumer Tariff

Generally the utility also earns some amount of money from activities other than the actual sale of electricity.

These include utilisation of assets for non-electricity business, renting out premises, interest on bank accounts, penalty for delayed bill payments by consumers, interest on investments, etc. After accounting for such 'other income', government subsidy, or regulatory assets (wherever applicable), the net amount to be recovered from consumers is decided.

In addition to the tariff set by the RC, state governments usually levy a tax on the sale of electricity, called 'Electricity Duty'. This tax is indicated separately in electricity bills and collected by the utility on behalf of the state government.

Billing to consumers

1. *Billing Cycle*

The billing cycle involves four steps - meter reading, calculating and printing the bill, delivering the bill to the consumer's premises, and collecting money from the consumer.

For each of these steps the utility incurs costs. To reduce costs, the utility often adopts a billing cycle the frequency of which is more than a month. For example, household consumers are usually billed once in two months and agricultural consumers are billed twice or thrice a year. However the larger consumers are billed every month. Whereas the billing cycle reduces billing costs, cash inflow is blocked as consumers continue to consume electricity but pay only at the end of a two-month or six-month period. To overcome this, utilities are allowed to take an advance from consumers - equal to the average bill of the consumer for the billing period. This is called a **security deposit**. The security deposit also ensures that there is no loss of revenue to the utility if the consumer does not pay his bill and is untraceable, leaves the premises, or goes bankrupt. Security deposit is refundable and generally also bears interest. The payment of this interest is one of the adjustments in the bill. If the consumption of a consumer increases, the utility generally revises the security amount upward.

The bill paid by the customer includes fixed and variable charges (energy charges). The nature of these is given below.

2. *Fixed and Variable Charges*

An electricity utility has some fixed costs and some variable costs. The fixed cost includes depreciation, interest on loans, Operation and Maintenance (O&M) costs (including salaries, wages and administrative costs), fixed charges paid for power generators, and cost of meter reading-billing-collection. These costs do not depend on generation and sale of energy.

Variable cost largely includes the fuel cost for a utility's own generation and the cost of power purchase. Fixed cost is usually higher than the variable cost.

Tariffs have a fixed and a variable component as well. The fixed charges in the tariff are less than the amount required to fully recover the fixed costs of the utility. A larger share of tariff allocated linked to energy consumption (variable tariff) encourages more efficient use of electricity by the consumers. Fixed costs come in different forms and usually include meter rent and monthly fixed charges (that represent the cost of laying the line to the consumer's premises). The monthly fixed charges can be linked to voltage level, connected load (in the premises of the consumer), or maximum power demand of the consumer in the month, or a combination of these. The variable component in tariff is predominantly the Rs per kwh charge. In addition, there can be charges linked to power factor, load factor, incentives linked to consumption level and so on.

3. FOCA

The fuel cost adjustment charges are applicable on the energy consumed.

4. Fixed charge

Fixed charge is expected to reflect the fixed cost of the utility, at least partially. Hence, only a part of this is recovered through the fixed charge and the rest is charged as energy charge. The fixed cost to a utility of supplying power varies from house to house, depending primarily on its location. Fixed charge can vary from category to category of consumers and consumption pattern.

5. Minimum charge:

If a house is locked and does not use any electricity, then the utility cannot recover its fixed cost through the energy charge. Some cities have a large number of such empty dwellings. Hence, tariffs have a bottom line called 'minimum charge'. Minimum charge is calculated in such a manner that, consumers in inhabited houses would have consumption above this charge, and therefore are not be adversely affected by such a charge.

6. Meter rent

The meter is the boundary between the consumer and the utility. When the meter is owned by the utility, it is allowed to charge either a meter rent or take a meter deposit.

7. Multiplying factor

MF = Line CT Ratio / Meter CT Ratio (CT- current transformer)
Usually it is mentioned on Meter that MF = 1 if CT Ratio is 200/5 or MF = 2 if CT Ratio is 400/5. There can be an additional multiplication factor that would be mentioned on the meter.

8. Power Factor (PF)

The power factor of an AC electric power system is defined as the ratio of the real power flowing to the load to the apparent power,[1][2] and is a number between 0 and 1 (frequently expressed as a percentage, e.g. 0.5 pf = 50% pf). Real power is the capacity of the circuit for performing work in a particular time. Apparent power is the product of the current and voltage of the circuit. Due to energy stored in the load and returned to the source, or due to a non-linear load that distorts the wave shape of the current drawn from the source, the apparent power can be greater than the real power. In an electric power system, a load with low power factor draws more current than a load with a high power factor for the same amount of useful power transferred. The higher currents increase the energy lost in the distribution system, and require larger wires and other equipment. Because of the costs of larger equipment and wasted energy, electrical utilities will usually charge a higher cost to industrial or commercial customers where there is a low power factor. Linear loads with low power factor (such as induction motors) can be corrected with a passive network of capacitors or inductors. Non-linear loads, such as rectifiers, distort the current drawn from the system. In such cases, active or passive power factor correction may be used to counteract the distortion and raise power factor. The devices for correction of power factor may be at a central substation, or spread out over a distribution system, or built into power-consuming equipment.

9. Power Factor Penalty/Incentive:

As we know, the low power factor (PF) introduces a large reactive current and hence increases T&D losses, blocks the **T&D** network and also suppresses generation (reduces the output of a generation plant). Traditionally, HT industries with low PF were penalised. But once the PF crossed 90% or so, the industry was largely indifferent as there was no incentive for improving the PF beyond 90%. Some RCs have introduced an incentive for high PF, This has shown a remarkable improvement in the PF of HT industries.

H. Peculiarities in the Power Sector Accounting

Accounting for Power Utilities can have certain points of distinction. It is useful for the internal auditor to know about these aspects of accounting as that might have a bearing on the processes and controls that need to be reviewed by the auditor.

Depreciation

Govt. of India, Ministry of Power vide resolution, dated 6th January, 2006 has notified Tariff Policy in terms of section 3 of the Electricity Act, 2003[9]. The Tariff Policy provides that rates of depreciation as notified by Central Electricity Regulatory Commission (CERC) are applicable for the purpose of tariffs as well as accounting.

CERC has notified the rates of depreciation as well methodology for computing such depreciation and Depreciation is to be provided up to 90% of the cost of asset.

For Power utilities rates in the Electricity Act prevail over the rates notified under Schedule XIV of the Companies Act by virtue of section 616(c) of the Companies Act. Companies referred to in section 616(c) of the Companies Act can distribute dividend out of profit arrived at after providing for depreciation following the rates as well as methodology notified by CERC and the same shall be sufficient compliance of section 205 of the Companies Act, 1956.

Treatment of foreign exchange variation

Transactions in foreign currency are accounted for at the exchange rate prevailing on the date of transaction. Transactions remaining unsettled are translated at the prevailing rate at the end of the financial year. Exchange gain or loss arising from settlement or translation is recognised in the Profit and Loss Account.

The outstanding loans repayable in foreign currency are restated at the end of year exchange –rate. Exchange gain or loss arising in respect of such restatement is accounted for as and income or expense and recognised as recoverable or refundable.

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[9] Reference www.mca.gov.in

This is peculiar for Power Utility accounting as such amount is taken into consideration only in respect of the company's future tariff application when settled.

Capital contribution from customers

Capital contributions received from consumers are treated as capital reserve and are not adjusted against the value of the assets.

I. Internal Audit of Generation process

This part of the guidance note is concentrated on the key risks associated with Coal based Thermal Power generation (as this is the commonest source of thermal power in India). As mentioned earlier, other conventional sources of thermal power work more or less on similar principles as coal based thermal power. The change is mainly in the nature of input that goes into creating the thermal energy that is used by the turbine and generator system.

In Coal based power generation, the key risk areas are Coal (procurement, handling and consumption) and Plant Maintenance. These areas attract maximum expenditure in the running of a coal based thermal power plant.

The key risks associated with the power generation:

Coal stock management risks

- Inadequate control over measuring actual quantity of coal received at plant and analyzing reasons for shortages
- Process of unloading and performance of Boiler is affected fur to existence of high stones & boulders in Coal supplies.
- Different grades of coal are not properly segregated and stored to facilitate right mix of coal for consumption and ensuring correct physical quantity
- Delay in unloading from rake lead to high demurrage charges being levied.
- Wagons diverted to other sidings/plants or vice versa for which timely reconciliation not carried out
- High ash content giving rise to many operational problems like equipment failure, ash evacuation, etc leading to reduced capacity utilization

Ash handling risks

- High generation of ash and insufficient capacity of ash storage may lead to non compliance to environmental norms.

Plant Maintenance related risks:

- Desired plant performance not achieved because old plant equipments and improper maintenance planning and execution.
- Non adherence to maintenance schedule results in frequent breakdowns of plant equipments.
- Damaged spares not returned to stores and / or recorded on replacement.

Risks affecting generation parameters:

- Desired PLF not achieved because of improper planning, downtime of equipments, non availability of required quantity and quality of fuel.
- Old plant equipments and their improper functioning leads to high auxiliary consumption.
- Inadequate overhauling maintenance of the plant equipments may result in the possibility of total plant breakdown / shutdown
- Usage of coal of high calorific value and improper mixing of coal leads to the possibility of un-burnt coal which results in non effective utilization of Coal heat, which also impact the boiler.
- Inadequate planning for spare s and consumable may lead to operational
- Non identification and availability of adequate critical/insurance spares may lead to operational stoppages
- Inadequate Inspection may lead to poor quality of material being received and used which may hamper the production and performance of plant equipments

The above risks have to be kept in mind while understanding the processes linked to generation. The internal auditor needs to assess what control procedures are in place to mitigate the risks. A suggested audit programme is given in **Appendix 1**.

J. Internal Audit of Transmission process

Within the Power transmission process the internal auditor should look out for the key risks relating to:

Conceptualisation

- Transmission system requirements may be finalised without considering the appropriate inputs form the various sources that have a bearing on it.

- The project feasibility report may not include the appropriate considerations like details of transmission system, justification, scope of the project, technical parameters, Estimated cost of the project, details pertaining to project management, environmental impact, project completion schedule, tariff

Design, Engineering & Specification finalization

- Designs of various parts of the systems may not be co-ordinated leading to design incompatibility and diffused accountability between the various designing agencies. This may lead to re-work and additional costs.

- Sub-station designing may be done without considering social and environmental factor, accessibility constraints and physical constraints of the site.

Procurement Practices

- Procurement of Tower Package (including Supply and erection) and insulators and conductors to be supplied to contractors may not be done following the procurement guidelines.

- Qualifying requirement for each package that is to be prepared based on the technical requirement of the equipment/system to be procured, estimated cost of the package, Completion schedule and the source of finance, may not be appropriately prepared or authorised before release.

Project Management & Monitoring

- Inadequate monitoring of Project Management may lead to time and cost over-run

Construction Practices

- Construction practices may not be standardised and documented
- Non-uniform construction practices may lead to cost and quality concerns and may affect operational performance.

Operation & Maintenance

- Absence of regular assessment of equipment health may lead to sudden pre-mature failure of system
- Absence of monitoring and preventive maintenance schedule of Switchyard equipment/transmission line may lead to abnormal outages
- **Disaster Management –** Absence of system to manage major failure of equipment and transmission line may lead to prolonged outages and may lead to major financial losses /penalties
- **Spare parts – Planning and stock management –** Over /under stocking may lead to costs of inventory/prolonged outage.
- The use of old-design electromechanical meters at the substations can contribute to erratic readings and provide opportunities for corruption.

Outage management

- Outage realisation/detection may not happen in time leading to severe consequences from lack of power and customer dissatisfaction.
- Lack of robust response processes (preferably supported by appropriate IT systems) may lead to delayed outage discovery.
- Lack of coordination in the outage recovery process

The above risks have to be kept in mind while understanding the processes linked to electricity transmission. The internal auditor needs to assess what control procedures are in place to mitigate the risks. A suggested audit programme is given in **Appendix 2**.

K. Internal Audit of Distribution process

As mentioned earlier, the process of electricity distribution involves delivery of power from the transmission systems to the end consumers. This is essentially a "break-bulk" process where the high voltage electricity is broken down into different lower voltages and delivered to the different consumers.

For a distribution utility the business essentially is that of buying power from the transmission Grid and then retailing that power to the end users.

The key risks are associated with the revenue process of a Distribution utility.

Revenue Process Risks

- The company is not able to accurately assess credit risk because it does not have an integrated view of customers and open receivables.
- Extension or reduction of load is not appropriately updated in the customer database.
- Excessive implausible, estimation, billing and invoicing errors.
- Recurring errors for the same accounts.
- Billing Estimation based on the wrong criteria.
- Low percentage of accounts are billed or invoiced.
- Collections may not be accounted for.
- Write-offs are not being performed or not performed correctly.

The other key sub-processes that are related to the Distribution process and the main risks associated with those are given below.

Customer Service process

- Customer service levels are not improved.

- Review of process from applications to connection/ first billing, Estimates, Service line deposit, Service line billing, Recovery/ refund pending billing and its ageing, compliance to terms and conditions of supply.

Metering process

- In respect of Consumer metering, the provisions of the Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006 may not be complied.

- Metering may not be at the desired level / may not be accurate.

- Issues relating to Meter changes, Struck-up meters, Burnt Meters, Meters with errors etc may not be addressed in time affecting revenue and /or customer satisfaction.

Maintenance of distribution assets

- There may be absence of proper maintenance of distribution assets which may lead to outages and may result in customer dissatisfaction.

- Spares management may not optimise cost; spares may not be available when required

- Capital expenditure required for replacing damanged/over –aged /underperforming distribution assets, may not be incurred at the right time

The above risks have to be kept in mind while understanding the processes linked to electricity distribution. There could be several other risks based on the area where distribution is being done which influences the consumer profile. These risks need to be assessed on a case to case basis depending on the entity being audited.

The internal auditor needs to assess what control procedures are in place to mitigate the risks. A suggested audit programme is given in **Appendix 3**.

Appendices

Appendix 1

Audit programme for Power Generation process

The audit programme below related to a coal based thermal power plant is aimed to highlight the audit approach in the areas of key risks that have been discussed in the preceding paragraphs.

Focus Area	Key Risks	Audit Approach
Coal – Planning	Planning for coal supplies is not in line with the coal requirement	Review the coal requirement estimation process to understand the linkages with generation targets and availability of coal. Review should be aimed to highlight to management: • Deficiencies in the planning process leading to the non availability of adequate coal stock to meet the generation targets • The entity has processes to ensure compliance with key clauses of the fuel supply agreement (FSA)
Coal - Handling	Logistics, handling and storage procedures may not be adequate to handle on a day to day basis the quantity of coal required to be fed into the generation process	Review the logistics arrangement with railways and or road or other modes of transports to assess the following: • Whether the logistics is adequate to handle the volume of coal on a day to day basis • Whether agreements with logistics service providers are current and are appropriately structured to ensure that supply is uninterrupted • Damages /difference in quantity during

Focus Area	Key Risks	Audit Approach
		transit are recoverable to the extent those are attributable to the logistics agents
		Review the in-plant coal handling processes to assess whether: • Stones and boulders are likely to be segregated before the coal is input into the generation process • The coal handling system is well maintained and there is a proper maintenance schedule to ensure that abnormal stoppages do not happen for a long time
		Receiving and storage procedures followed with respect to coal needs to be reviewed to assess whether: • There are appropriate checks and balances within the plant to ensure that the exact stock received is accounted for • Storage is coal (generally in the coal yard) is such that it ensures the zero pilferage and no deterioration of the quality of coal that is used in the generation process • Weigh bridges are regularly calibrated to ensure that weighment gives accurate results and is not susceptible to any manipulations.

Focus Area	Key Risks	Audit Approach
Fuel consumption and yield (calorific value, heat rate)	Controls may not be in place to regularly monitor the handling loss, trend of calorific value, heat rates	Review the processes in place and assess whether those ensure: • Trends relating to handling losses, calorific value and heat rates are generated from authentic data sources within the plant and these are reviewed at senior management • Operations team identifies the root causes associated with abnormal trends and formulated action plans to address those
Coal inventory – physical count and valuation	Physical inventory may not be regularly measured and difference in physical and book records may not be adjusted in time therefore affecting consumption.	Review the process followed for measuring coal stock periodically and accounting for consumption to see whether: • Stock of coal is measured using appropriate methods like volumetric stock measurement – and the process is overseen by independent staff/agents • The differences in book stock and physical stock are reconciled and appropriately adjusted to consumption
Coal grade verification	Appropriate adjustments due to differences in coal grade may not be made from the suppliers	Review the process followed ensuring that there is an independent inspection of the grade of coal received and the same is acknowledged by independent agency. This is to assess whether: • Appropriate deductions are made from the vendors invoices in line with the FSA

Focus Area	Key Risks	Audit Approach
		• The management is able to correlate the plant performance to the quality/grade of coal actually used in the process
Maintenance planning	Maintenance planning made not take into account the operational cycles	Review whether a Preventive Maintenance plan exists and is revised from time to time based on the breakdown history and the age of the various parts of the power plant. Highlight instances where the linkage between the operations cycle of the various units, the maintenance plan and the maintenance procurement plans have not been aligned.
Maintenance activities	Maintenance activities may not be undertaken as per plan	Check whether all preventive maintenance schedules have been adhered to and find out the root cause of any non adherence to highlight in the report. Assess whether there are appropriate budgetary provisions to procure resources required to execute preventive maintenance jobs.
		Procurement relating to maintenance needs to be reviewed from the following angles: • Appropriate vendors exist who are able to undertake maintenance activities and have the required technological expertise to handle complex maintenance jobs

Focus Area	Key Risks	Audit Approach
		• Planning for spares is done well in advance and orders are released keeping lead time in mind to ensure that spare are available when those are required. • Proper authority structures exist within the entity to authorise any emergency expenditures that may be required during maintenance.
Ash handling process	Ash generated may not be appropriately handled	Review the logistical process in place to ensure that ash is handled in a manner that is environmentally permitted. Review whether management has considered a commercially viable alternative for disposal of ash to other industries (like Cement manufacturing plants) where the same can be used as input.

Appendix 2

Audit programme for Power Transmission process

Focus Area	Key Risks	Audit Approach
Conceptualisation of transmission systems	Due consideration may not be given to vital parameters that need to be considered for conceptualisation of transmission systems	Review whether the data for Planning Studies are to be collected from various Organizations, such as CEA, Planning Commission, Respective Electricity Boards (SEB)/Electricity Departments (ED), Regional Electricity Boards (REB), Regional Load Despatch Centres (RLDC), Power Utility's own system and operational data. Assess whether the simulation software used to determine the various transmission line options are equipped to considers the objectives of: • Minimisation of Transmission loss and costs • Optimum utilisation of energy resources The internal auditor's role in the above is largely to understand whether the company adopts latest practices in the processes followed for conceptualisation of transmission systems.

Focus Area	Key Risks	Audit Approach
	Project feasibility may not include assessment of key aspects that impact viability	Review whether the project feasibility report includes important considerations in respect of : • Tariff • Environmental impact • Technical parameters Check whether the entity has proper justifications to go ahead with the transmission lines
Design and Engineering	Design and engineering may lack coordination resulting in higher costs/delays in finalisation.	Check whether there is an appropriate coordination mechanism to ensure that the design and engineering of the various aspects of the transmission system are well coordinated. Ensure that the process followed provides for clear accountability for the various aspects of design and regular exchanges happen between the different groups to ensure that the designing of the system is seamless.
Procurement process	Procurement standards may not be followed	Check whether operating procedures have been laid out for procurement of Tower Packages and items like Insulators and conductors. Review the specifications provided to the contractors/vendors and ensure that the respective design and engineering inputs have been considered appropriately in those specifications.

Focus Area	Key Risks	Audit Approach
	Site procurement may not adhere to mandatory requirements	Review whether there exists a checklist of details to be verified for selection of site and that contains items like: • Ease of accessibility • Environmental clearance • Clearance with respect to physical factors like topography, geographic location etc Check the survey report for the land to be acquired to ensure that the right people were involved in conducting the survey and their consent is documented.
	Transmission tower procured may not be based on standardised designs	Discuss with the design department the processes followed to standardise tower design. Standardisation in design helps in : • eliminating repeated type testing of towers, Permits usage of tower of one line for other line, • reducing spare requirement • makes the data readily available for foundation design • immediate procurement of steel by the manufacturer/ fabricator of the tower without waiting for design finalization and successful type testing • quicker foundation design without waiting for design

Focus Area	Key Risks	Audit Approach
		finalization • reducing engineering time, project gestation period / line construction period
Project Management and monitoring	Lack of robustness in project management may lead to cost or time over-run	Review the system of project management for large scale capital / maintenance projects with a view to assess the following: • Accurate data and KPI measurement relating to the progress of the project is available • Project risks are assessed and mitigation action plans are put in place to ensure that over-runs are kept to the minimum • Whether process exists to ensure that decisions relating to resource augmentation if required can be taken in a time bound and structured manner.
Construction	Construction processes may not be followed uniformly across the various sites	Check whether there exists a well documented construction works manual that details the standards that are required to be followed to bring uniformity in the construction process – for towers and substations Review from documentary evidence/construction site visits, whether the provision of the manual are being followed without deviations.

Focus Area	Key Risks	Audit Approach
		Particularly the internal auditor should look out for the existence of : • System of sub vendor approval • Manufacturing Quality plan (which includes the quality requirements at the raw material stage, In process testing and final inspection and testing requirements as per Technical specifications of the contract, National and International Standards and Manufacturer's internal plant standards) • Field Quality Plan (which defines the requirement with regard to proper unloading/receipt of equipment and material at site, storage, testing requirements of erection material, sampling and acceptance norms, test report requirements, pre commissioning checks) • Clearly defined Inspection Points (where the various routine checks and technical features are certified).
Operation and maintenance	Process many not be in place to assess equipment health	Review the processes that are in place to proactively assess the health of the transmission equipments. Check whether test reports are

Focus Area	Key Risks	Audit Approach
		submitted at regular intervals and the results of the tests are considered in determining maintenance plans
	Absence of monitoring of preventive maintenance	Check whether there exists a preventive maintenance plan for key installations. Review whether a process exists to ensure that the plan takes into account the history of equipment performance and failure. Review the processes in place to ensure that the maintenance plan is strictly adhered to. Review for a few sample cases whether the procurement relating to maintenance services were done in time and at optimum costs to meet the maintenance schedules.
	Lack of proper spare parts planning and inventory management may lead to prolonged outage.	Review whether a schedule for procurement of Insurance spare and regular spares exists and is synchronised with the preventive maintenance schedule. Check whether process exists to ensure that stock of spares are optimised and spare that can be used by other locations are transferred in time.

Focus Area	Key Risks	Audit Approach
		Enquire of the management about the plans that are in place to ensure that vendor development activities are being undertaken for spares that are available from single sources.
Outage Management	Outage realisation/detection may not happen in time	Review whether the IT system and the telecommunication infrastructure support the timely realisation of outage. In the above review the internal auditor may need to consult process experts who are aware of the ideal systems available in the market for outage detection.
	Outage recovery process may not be well coordinated	Review whether : • There are clear and set parameters for response prioritisation. • Field crew have well laid out guidance to conduct the necessary repairs to restore the system, after having identified needed repairs and addressed the cause of the outage. • A final inspection is made by the team and an inspection report is communicated back to the Outage Control Centre from where checks

Focus Area	Key Risks	Audit Approach
		are made with the various accounts affected by the outage. A confirmation is sent back to the field team on whether further activities need to be carried out.

Appendix 3

Audit programme for Power Distribution process

Focus Area	Key Risks	Audit Approach
Billing system	Inaccuracies in the rate master or customer master may affect the accuracy of billing	Review of the billing application software for controls that ensure that any unusual trends are shown. Review the controls over the customer master data and the billing rate master data that ensure that the data is always authorised and accurate.
	Monitoring controls are not adequate to detect errors in billing, adjustments, consumer category change	Review the reports generated from the billing system that throw up trends indicating billing errors and any other unusual changes. Assess whether the reports are reviewed independently and action is taken to resolved unexplained differences.
	Accounts with missing/invalid meter reads may not get estimated	Review whether Estimation criteria are configured according to business rules. Check whether Management reviews usage reports for reasonableness. Review whether Reasonableness checks are applied by the system to the estimated usage to verify the usage is within defined parameters.
	Unmetered charges	Review whether Inventory is conducted

Focus Area	Key Risks	Audit Approach
	may not be calculated/may be inaccurate	on unmetered items and is used in conjunction with reasonableness checks to ensure charges are reasonable
	Billing related application controls may not be robust	Understand the data flow within the billing system and assess the key risks associated with the data flow. Identify the key configured controls within the IT based billing system to ensure that the controls address all major risks that could have an impact on the accuracy, completeness and validity of billing related data. Also assess the controls related to restricted access to the billing system. Where system based application controls are weak, auditor should look out for manual control procedures and assess whether those are adequate enough to address the risks.
Meter reading	Meter readings may not be review in detail resulting in abnormal transactions not being detected	Check whether there is a process of Review of Meter Reading and action is taken based on review. Apply analytical review procedures such as comparative analysis & trend analysis to focus on issues like: a) Meter changes b) Struck-up meters c) Burnt Meters

Focus Area	Key Risks	Audit Approach
		d) Meters with errors e) Reading not furnished f) Door Lock cases g) Consumption less than usage h) Multiple meters for single service
	Periodic meter testing may not be effective /results may not be traced back to system	Review the process of meter testing (preferably this should be on an annual basis). Check whether the there is any change in the Multiplication Factor (MF) of the meter and cross check the same with the Consumer Master. In case of Meter Change (MC) check that the MF of the new meter installed is updated in the consumer master.
Collection process	Collection centre may not bank all collections within the defined time	Review processes and controls in place to assess the following: • Whether cash is handled efficiently • Reconciliation between cash received and banked is made regularly and differences dealt with promptly • Collection efficiency of the various customer sub classes
Deposits from customers	Deposits may not be reconciled with the number of live connections	Check whether there is a periodic reconciliation of the customer deposit account with the connections to which these pertain.

Focus Area	Key Risks	Audit Approach
		Review the process of arriving at the amount of deposit that the customer needs to pay for a new/enhanced connection and the process of ensuring that the same is collected when the connection requested is granted.
	Interest on deposits may not be accurately calculated	Review the controls in place that ensures accuracy and completeness of interest calculations. Perform test check of a few large interest amounts for accuracy. Perform an analytical review of the overall interest calculation in respect of the customer deposit balance to get comfort on the completeness and reasonableness.
Maintenance of Distribution Assets	Lack of resources in maintaining substations and distribution lines can pose risks from asset deterioration and unreliable electricity supply	Review the maintenance plans for the substations. Check whether there is adherence to the plans. Assess the process followed for spares planning and check whether the planning process takes into account: • Lead time for procurement • Cost of spares • Other factor that affect holding cost and availability

Focus Area	Key Risks	Audit Approach
	Tapping of distribution lines leads to revenue loss	Understand the processes of the entity to deal with tapping of electricity lines. Take a few sample cases of power thefts reported to the entity and check whether the process has been