Chapter 5

The objective of this chapter is to know the current functionality of the organization and how information is flowing to the strategic level in Distributor Network of PSPCL.
CHAPTER 5

5.1 INTRODUCTION

This study primarily focuses on the distribution network of the PSPCL. The aim of the study is to first streamline the operations in the distribution network of the PSPCL and then develop a model for Strategic Information System. For PSPCL to be cost efficient, it has to be able to streamline its operations, reduce downtime, reduce input and carrying cost, reduce wastage, analyze losses and realize revenue. During the course of the study in depth interviews were conducted at various levels to understand the business processes of all the units. Information gathering phase included extensive brainstorming sessions to understand the working of the Sub Division, Division, Circle, Zones and head office, documentation of the information flow and collection of the reports and statements. The information collected has been compiled and has formed the basis to design the model for the strategic information system.

The study highlights all the salient features of the proposed implementation of the information systems in the PSPCL and suggests a model for the strategic information systems. PSPCL today find itself in a period of transition as it is undergoing restructuring. Development in the power sector is compelling the State Electricity Boards to place greater emphasis on the asset utilization in order to operate more efficiently and render better service to consumers. Recognizing this, PSPCL is planning to invest in IT infrastructure and computerization. Information has to accessible across the enterprise for the utility to gain complete advantage of the computerization. Isolated computer systems each designed to serve the needs of the single department cannot provide the information synergy and the collaborative capabilities that efficiency demands. In this study an
endeavor has been made to envision a plan for making a model for Strategic Information System in the distribution network of PSPCL. For successful development of a model for Strategic Information System in the distribution network of the PSPCL, it is very important that various important activities in various departments in PSPCL has to be identified and a basic IT plan should be implemented in those departments. So the study is not only limited to the distribution network of the PSPCL. Of course, the emphasis is on the distribution network of the PSPCL. In this study, an effort was made to segment various functions and activities performed by the PSPCL personnel for the development of a model that will be best suited for the present set up.

5.2 **UNBUNBLING OF PSEB**

As per the electricity act of the Punjab, PSEB is unbundled and made into separate entities. PSEB is unbundled into two different companies— one Holding company Punjab State Power Corporation Limited (PSPCL) which is responsible for the generation and distribution of the electricity and one smaller corporation named as Punjab State Transmission Corporation Limited (PSTCL) which is responsible for the transmission of the electricity.

5.3 **BUSINESS PROCESS RE-ENGINEERING AND CHANGE MANAGEMENT**

Many processes may need re-engineering to adapt to technology as well as improve efficiency. Some areas have been suggested in this study. Apart from the technology, changes in the roles and responsibilities of PSPCL personnel, changes in hierarchies and in organizational structures necessitate a change management plan.
Power is an essential part of the infrastructure for the growth of any country or state economy. Acceleration in the economic growth will depend on the financial and commercially viable power sector that is able to attract fresh investments. The Indian power sector is changing significantly in the past decade with unbundling of the state electricity, deregulation, most recently privatization and entry of new competitors. The electricity act 2003 paved the way for drastic and significant changes, which are more consumer centric, efficient operation and improve profits.

Punjab State Power Corporation Limited (PSPCL) needs to a change its way of functioning so as to attract and regain the confidence of its consumers. Moreover PSPCL has to improve its operational efficiency and turn around their financial status, leveraging new technology, upgrading existing transmission and distribution lines and revenue collection is critical than ever. PSPCL should equip to face challenges, need to rely on availability of information for easier and quicker decision making and to manage their activities better. Availability of information at ease facilitates PSPCL to maintain profitable and lasting relationship with consumers. Information technology has taken a big stride in India in past few years but its benefits haven’t made in roads in the electricity industry. However the need of the hour remains that the utilities move towards adopting suitable technologies to optimize their systems. Use of technology is now the key for PSPCL to go for flexible, reliable and speedy innovation, which would make them ready to respond to the drivers of deregulation and the competition effectively.

PSPCL needs to streamline its traditional processes to cut costs and effectively manage assets to ensure flexibility in pricing and provide quality service to their consumers. Appropriate IS implementation can help to achieve these myriad requirements and in turn
can assist the utility in focusing on developing its core business rather than worry about information availability and analysis of the existing information.

The IT task force set by the Ministry of Power (MOP) had the following observations to make in its report for power sector.

“Enabling the core business operation at the transaction level using information system would lay the foundation for sustainable reforms. This will ensure world class practices and controls at the operational level and would enable substantial improvement in the overall health of the utilities. The overall quality of the data will improve and thereby an overall improvement in the flow of information for decision support. Information System would thus become the key enabler in the initiatives under the reform process. IS would not only enable the success of reforms process; it would also act as the catalyst by providing an information infrastructure essential to the reform process and practices”.

5.4 PSPCL AS AN ORGANISATION

The erstwhile Punjab State Electricity Board (PSEB) now PSPCL is a statutory body formed on 1st Feb 1959 under the Electricity Supply Act, 1984. Subsequently with the re-organization of the erstwhile State of Punjab under the Punjab Re-organization act 1966 the PSEB in the present form came into existence w.e.f 1st May 1967. PSEB is an organization responsible for the generation, transmission and distribution of the electric power in the state of Punjab. But on 15th April 2010, PSEB was divided into two separate corporations namely PSPCL which looks after the generation and distribution and PSTCL which looks after the transmission of electricity. Starting with the modest
installed capacity of 62 MW, the PSPCL has grown by leaps and bounds with the metered sales of 20741.60 MW in 2009-10 and 5446.21 till June 2010-11

The specific objectives of the PSPCL are as under-

1. To arrange, in co-ordination with the Generating Company or Generating Companies if any, operating in the state, for the supply of the electricity that may be required within the State and for the distribution of the same, in the most efficient way and economical manner with the particular reference to the those areas which are not for the time being supplied or adequately supplied with the electricity.

2. To supply electricity as soon as practicable to a licensee or other person requiring such supply if the boards is competent under this Act to do so.

3. To exercise such control in the relation to the generation, distribution and utilization of electricity within State as is provided for by or under this Act.

4. To collect data on the demand for, and the use of, electricity and to formulate perspective plans in co-ordination with the generating Company or Generating Companies, if any, operating in the State, for the generation, distribution of the supply of electricity within the State.

5. To prepare and carry out the schemes for distribution and generally for promoting the use if electricity within the State and

6. To operate the generating stations under its control in co-ordination with the Generating Company or Generating Companies, if any, operating in the State and with the government or any other Board or agency having control over a power system.
The PSPCL is thus charged with the general duty of promoting the coordinated development of the generating, supply and the distribution of the electricity in the most efficient way. In order to discharge the duty effectively the PSPCL operates its own generating stations, maintains its distribution network and employs a work force of more than 65,000 persons of all ranks to operate this system efficiently. It has a full fledged accounts and audit wing to ensure efficient financial management on the commercial lines for the proper accounting of its financial transactions. As the demand for power increases at a rapid pace, the PSPCL also undertakes planning from the appropriate authorities and executes them through its proper organizational set up. The Distribution network is headed by Director Distribution.

The Director Distribution has the following officials reporting to him.

- CE/D-S PATIALA
- CE/D-N JALLANDHAR
- CE/D-C. LUDHIANA
- CE/D-BORDER AMRITSAR
- CE/D-W BATINDA
- CE-METERING
- CE-RE&APDRP
- CE-STORES & DISPOSAL
- CE- MATERIAL MANAGEMENT

### 5.5 DEPARTMENTS

The PSPCL is divided into various departments on the functional lines. PSPCL has the following departments:

- V&S (Vigilance & Securities)
• Finance
• Cost Control & Reduction
• Accounts
• Revenue
• Audit
• FA & CAO (Procurement)
• Planning
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• Material Management
• D.S.A (Dispute Settlement Authority)
• EA & Enforcement
• Hydel Projects
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• Civil Design & Construction
• Civil Hydel Design & Construction
• Sub Stations
• HRD
• S & D (Stores and Disposal)
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• Workshops
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• Distribution West
• GGSSTP Bathinda
• GNDTP Ropar
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5.6 MAJOR ACTIVITIES CARRIED OUT BY PSPCL

- Generation
- Distribution
- System Operation & Communication
- Commercial
- Planning
- Material Management
- Finance, Accounts and Audit
- Human Resource Development
- Administration
- Enforcement
- Industrial and Public Relations
- Rural Electrification

This study focuses on the Distribution network of PSPCL.

5.7 DISTRIBUTION

Poor distribution systems are one of the main reasons for the poor financial and operational performance of the State Electricity Boards because distribution utilities are unable to recover the expenses from consumers of electricity. Extremely high commercial losses coupled with the technical losses means that only about 50% of the energy input is available for sale. Inadequate billing systems and procedures along with poor collections leads to recovery of only about 40% of the energy, which is input to the system. Distribution reforms have been identified as the key area in the power sector reforms process as maximum revenue loss is occurring in this part of electricity industry. For the success of this process, reliable and sufficiently detailed data must be provided to
facilitate decision making process in all the activities of the Distribution System Management. Controlling cost, improving efficiency and reducing commercial losses has become essential for a utility in order to be successful in the highly competitive environment as a result of new electricity act where distribution is open to competition from the private utilities and distribution companies. With the complex geographically diverse networks having number of spur lines and alternative feeds from the different sources and creation, updating and management of distribution data is a challenge. Huge data volumes and need for the faster response to consumers mandates use of extensive Information Systems in the power distribution. In a distribution network, IS solution can help to manage load, maintain quality, detect theft and tampering and achieve efficient billing and collection and high customer satisfaction. So an ordinary Information System would not serve the purpose but here there is need of specialized IS which should be very dynamic. So the answer is the development of Strategic Information Systems, which can provide best solution to current problem. Because here the solution is not only reached by scanning the internal environment but also we have to keep in the mind the external environment. The development of this type of system will also guide the basic strategy framework of the distribution system in the PSPCL. Many of the distribution utilities do not have required systems and infrastructure in place. This is critical block in the process of the distribution reforms and provides a unique opportunity for high investment and allocation of funds to different areas of the distribution management. The study provides detailed outlook on all hierarchies, information flows, processes, block and supporters for effective modeling of Strategic Information System in the distribution network of PSPCL.
5.8 PHYSICAL HIERARCHY

At the field level, the organizational units are

- Zone
- Circle
- Division
- Sub-Division
  - Zone is headed by Chief Engineer (CE)
  - Circle is headed by Superintending Engineer (SE)
  - Division is headed by Senior Executive Engineer (XEN)
  - Sub-Division is headed by Assistant Executive Engineers and Sub-Divisional Officers (SDO)

The distribution system has 5 Zones, 20 Circles, 103 Divisions and 491 sub-divisions. 77% of the PSPCL staff is in the distribution area.

![Figure 5.1 Physical Hierarchy](image-url)
As mentioned in the above diagram it is clear that Director Distribution is at the top of the hierarchy while there are five zones of PSPCL comes at the second level namely

1. Chief Engineer North Jallandhar
2. Chief Engineer Central Ludhiana
3. Chief Engineer South Patiala
4. Chief Engineer Border Amritsar
5. Chief Engineer West Bathinda

These 5 Chief Engineers directly report to the Director Distribution. At the third level there are 20 Circles headed by Superintending Engineers namely

1. SE Kapurthala
2. SE Nawashahar
3. SE Jallandhar
4. SE Hoshirpur
5. SE Khanna
6. SE Ludhiana West
7. SE Ludhiana East
8. SE Ludhiana Suburban
9. SE Patiala
10. SE Ropar
11. SE Sangrur
12. SE Mohali
13. SE Gurdaspur
14. SE Amritsar Suburban
15. SE Amritsar City
16. SE Tarn Tarn
17. SE Bathinda
18. SE Ferozpur
19. SE Faridkpot
20. SE Muktsar

At the fourth level there are 103 Divisions headed by Senior Executive Engineer and at the fifth level there are 491 subdivisions headed by Sub-Divisional Officers. The zones, circle and division have supervisory and control functions. They have to monitor collections and look at the default list. They have to ensure the smooth running of the supply for the next level. The Zone has to interact with Inventory/Stores/Workshop. The stores requirements come to the Zone from Sub-division, Division and Circle. Occasionally, they might have to make some spot purchases. The zone is responsible for the layout of transformers and lines. The zone analyses figures on Unit billed/revenue assessed and revenue realized for each circle every month. The zone also looks into Charge Sheets/Complaints and reply to them. Each level takes care of all establishment functions. The Zone has to compile data from circles to prepare the monthly returns. The circles get the data from their divisions, who in turn collect the figure from the sub-divisions.

5.9 DIVISIONS

There are two types of divisions

- Conventional Divisions
- Special Divisions

Conventional divisions follow a 4 tier structure. The second type that is Special Divisions there is a 2 tie structure and the functioning of the division and the sub-division is combined. In the conventional system, the division is distinct from the sub-division. The division has the XENs who perform both the commercial and the technical functions. The division functions similarly. In the special divisions, the sub-divisions have been merged
into the divisions and the different officials perform the commercial and the technical functions.

5.10 SUB-DIVISION

The norm for creating an operational sub-division is the number of connections, which is dependant on the density and spread of the territory. The number of sub-divisions dictates the number of divisions, which in turn dictate the number of circles in the state. Most customer interaction and the operational transactions takes place at the sub-division level. This is the face of the PSPCL to the customers and needs to be strengthened. As per the government of India guidelines, PSPCL must focus on making its attitudes and operations customer-centric. Besides, since all the transactions take place at his level, the IT infrastructure at his point must be capable of taking care of the load. The data captured at this point is then processed for the further applications. IS implementation and most importantly, training must start from here. Other than the customer interaction, the sub-division has to develop and maintain the system for all the connections. The sub-division does the meter reading. It has to detect theft and conduct surprise checks. It has to procure supplies from the stores. The sub-division has Sub-Divisional officer (SDO) who is in charge for all the meters issuance for the new connections. Meters are under the preview of Chief Engineer (METERING), who procures meters for the entire PSPCL. The SDO’s make daily, weekly and quarterly reports which they send to the Division. These reports are manual in nature. At the level of Division the XEN’s consolidate these reports and send them to the Circle headed by SE’s. The SE’s consolidate all the reports received from the Division and send them to the Zone headed by CE’s. The CE from the different zones sends reports to the Director Distribution.
5.11 INFORMATION FLOW-

As discussed earlier the five zones are headed by five Chief Engineers. These five CE are in constant touch with the Head Office located at Patiala. As shown in the following figure 5.2. These CE are also in contact with the CE (Metering), CE (Material Management), CE (Rural Electrification and Accelerated Power Development Reform Program) and CE (Store & Disposal). Every Zone requires meters for new connection and also to replace the old damaged meters. So it is very important for the respective CE’s to be in constant with the CE metering who is in charge of issuing meters. Also it is very important to have communication with the CE Material Management for smooth flow of materials required for the proper Distribution of power. The CE Material Management also procures various materials for the distribution of electricity e.g.

- Poles
- Disc Insulator
- Pin Insulator
- Shackle Insulator
- Guy Insulator
- Transformers (6.3 KVA to 500 KVA)
- Wires
- Stay Wires
- Earth Wires
- Conductor (20mm square to 100 mm square)
- Aluminum Thimble
With the growing number of losses the Central as well as State government has started with the schemes to curtail the losses especially in the distribution network. The CE (RE...
and APDRP) looks after this aspect. They have started with few new schemes so as to curtail losses. The respective CE for every Zone is in constant touch with the CE (RE and APDRP) so that they may able to reduce losses in their respective Zones.

The APDRP has started with new schemes for example

1. HVDS
2. Reclosures; Sectionalisers ,Switched Capacitor Banks and Auto Voltage Boosters
3. SCADA

1. The HVDS stands for High Voltage Distribution System in which are applicable in the rural areas where predominantly pump sets are used for the lifting of the water which operates at low power factor and low load factor. Also the load density is low due to the dispersal of load. The existing distribution system consists of three phase 11 KV line and large 3rd Phase 11KV/ 33KV volts distribution transformers with the lengthy L.T. lines. The system is unsuitable to cater to the Indian conditions, as voltage profile is poor; losses are high. To improve the quality of the supply, one of the recommendations is the implementation of single phase H.T. distribution system with the small capacity single phase distribution transformers. Under this system H.T. line i.e. 11KV line is extended up to or as near the load as possible and erect small capacity distribution transformer say 5, 10, 15 KV extend supply to the consumer through a short length of L.T. line preferably insulated over head cable popularly known as aerial bunched cable. The idea is to have a LT less system or at least “Less LT System” to begin with. (Source: Brinchi)
2. The advent of pole mounted Reclosures; Sectionalisers, Switched Capacitor Banks and Auto Voltage Boosters can make it possible to modernize the existing distribution systems. The above latest additions into the family of distribution equipment have their own special features and specific application. Their usage in conjunction with each other in the appropriate form only can bring in the desired results. The Auto Reclosers are the low rupturing capacity circuit breakers which open out on faults sensed by inverse time relays with instantaneous provision and recluse at present number of times at preset time intervals and get locked in open position if faults persist. Sectionalisers are those who do not interrupt fault but the line can be sectionalized into various sections using them. The fault section gets pressed into service. These operate by sensing whether the line is ON of OFF and various types of fault detecting relays and control boxes make these adoptable for radial, loop and ring feeders etc. Switched Capacitor is switched on and off automatically to put them into service when needed only and avoid over compensation during light load periods. The control system is by sensing current. Automatic Voltage Boosters are essentially autotransformers with a shunt and series winding with the taps provided on the series winding and the taps are automatically selected based on voltage levels. (Source: Brinchi)

3. The SCADA stands for the Supervisory Control and Data Acquisition. It involves net working of a group of substations for data collection in respect of all equipment at a host station. The distribution system can be monitored on real time and also controlled by issuing commands to stations where RTU’s (Remote Terminal Units) are located. The aim of the system is effective load management of the distribution
system to improve reliability and efficiency of the supply. Apart from achieving efficient distribution management, accurate fault analysis and prompt restoration of supply, it will be possible to identify malfunctioning of equipment in advance for taking the corrective action. (Source: Brinchi)

The last part of the above information chain is the CE (Store & Disposal) who manages the inventory. The zonal Chief Engineers are in touch with the CE (Store & Disposal) in case some breakdown occurs, then adequate inventory can be supplied to the respective zone.

Chief Engineers are in constant contact with other zonal Chief Engineers. The Chief Engineers receive information from circle which in turn gets information from division and division gets information from sub division. Various reports are made at different levels e.g.

- Installed distribution type transformers
- Damaged distribution transformers
- Estimate of damaged distribution transformers
- Register of damaged distribution transformers
- Replacement against damaged distribution transformers
- Pending against damaged distribution transformers
- Installed Power transformers
- Damaged Power transformers
- Replacement against Damaged Power transformers
- Pending for replacement against Damaged Power transformers
- Final report for distribution transformers
- Final report for Power transformers
- Replacement of damaged transformers at the end of the month
- Inspection of the sub station
- Overloading of primary and secondary transformers
- Work progress for the Sanctioned packages
- Final Report for the state tube well due to Electrical fault
- Theft of conductor for month
- Final report for the theft for conductor
- 11 KV and lower voltage work progress under extension and improvement work plan
- Status of defective electronic meters on 11 KV I/O feeders at secondary sub stations
- Progress of installation of electronic meter on 11 KV I/O feeders at secondary sub stations
- Final report for the progress of installation of electronic meter on 11 KV I/O feeders at secondary sub stations
- Report of 11 KV feeder details at secondary sub stations
- Final report for 11 KV details at secondary sub stations
- Rural electrification work progress
- New 11 KV capacitor installations
- Damaged and repaired capacitor
- New 33 KV sub station work progress
- Augmentation of 33 KV sub stations progress
- New link Line work progress
- Work program under APDRP and other scheme
• Sample meter installation for un metered consumers
• Major equipment make list for secondary sub stations
• Report for tripping of 33 KV and 11 KV lines
• Daily log sheets
• Register format for battery inspection
• Max/Min load register
• Inspection and testing register
• Stoppage register
• Tripping and testing register
• Breakdown and shutdown register
• Damage of distribution transformers (Location, feeders wise)

The Chief Engineers from the respective zones then send these reports to the Head Office where all the reports from all the zones are tabulated to get the final data for Punjab. As discussed earlier these fives zonal Chiefs are also in contact with the Chief Engineer (Metering) for issuance of new meters, Chief Engineer (Material Management) for the purchasing of material for their respective zones, CE (Store & Disposal) for managing the inventory and also with the Chief Engineer (RE and APDRP) for the continuous upgrading of their distribution systems in their respective zones so as to reduce losses. All these reports are then sent to Director Distribution. The Director then sends the summarized reports to the Regulatory Bodies and to the MoP. The Regulatory Bodies and the MoP on the basis of these reports then takes critical decisions e.g. increasing the tariffs of electricity. Theoretically the system gives a very accurate picture, but without the presence of proper reporting mechanism, this chain often breaks down. In the coming
chapters, the study highlights various critical issues that PSPCL is facing and also provides possible remedies to overcome all strategic problems.

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- Material Management
- D.S.A (Dispute Settlement Authority)
- EA & Enforcement
- Hydel Projects
- Thermal design
- Civil Design & Construction
- Civil Hydel Design & Construction
- Sub Stations
- HRD
- S & D (Stores and Disposal)
- Metering
- RE & APDRP
- Workshops
- Distribution South
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- Rural Electrification

This study focuses on the Distribution network of PSPCL.

5.7 DISTRIBUTION

Poor distribution systems are one of the main reasons for the poor financial and operational performance of the State Electricity Boards because distribution utilities are unable to recover the expenses from consumers of electricity. Extremely high commercial losses coupled with the technical losses means that only about 50% of the energy input is available for sale. Inadequate billing systems and procedures along with poor collections leads to recovery of only about 40% of the energy, which is input to the system.

Distribution reforms have been identified as the key area in the power sector reforms process as maximum revenue loss is occurring in this part of electricity industry. For the success of this process, reliable and sufficiently detailed data must be provided to
facilitate decision making process in all the activities of the Distribution System Management. Controlling cost, improving efficiency and reducing commercial losses has become essential for a utility in order to be successful in the highly competitive environment as a result of new electricity act where distribution is open to competition from the private utilities and distribution companies. With the complex geographically diverse networks having number of spur lines and alternative feeds from the different sources and creation, updating and management of distribution data is a challenge. Huge data volumes and need for the faster response to consumers mandates use of extensive Information Systems in the power distribution. In a distribution network, IS solution can help to manage load, maintain quality, detect theft and tampering and achieve efficient billing and collection and high customer satisfaction. So an ordinary Information System would not serve the purpose but here there is need of specialized IS which should be very dynamic. So the answer is the development of Strategic Information Systems, which can provide best solution to current problem. Because here the solution is not only reached by scanning the internal environment but also we have to keep in the mind the external environment. The development of this type of system will also guide the basic strategy framework of the distribution system in the PSPCL. Many of the distribution utilities do not have required systems and infrastructure in place. This is critical block in the process of the distribution reforms and provides a unique opportunity for high investment and allocation of funds to different areas of the distribution management. The study provides detailed outlook on all hierarchies, information flows, processes, block and supporters for effective modeling of Strategic Information System in the distribution network of PSPCL.
5.8 PHYSICAL HIERARCHY

At the field level, the organizational units are

- Zone
- Circle
- Division
- Sub-Division
  - Zone is headed by Chief Engineer (CE)
  - Circle is headed by Superintending Engineer (SE)
  - Division is headed by Senior Executive Engineer (XEN)
  - Sub-Division is headed by Assistant Executive Engineers and Sub-Divisional Officers (SDO)

The distribution system has 5 Zones, 20 Circles, 103 Divisions and 491 sub-divisions.

77% of the PSPCL staff is in the distribution area.

Figure 5.1 Physical Hierarchy
As mentioned in the above diagram it is clear that Director Distribution is at the top of the hierarchy while there are five zones of PSPCL comes at the second level namely

6. Chief Engineer North Jallandhar
7. Chief Engineer Central Ludhiana
8. Chief Engineer South Patiala
9. Chief Engineer Border Amritsar
10. Chief Engineer West Bathinda

These 5 Chief Engineers directly report to the Director Distribution. At the third level there are 20 Circles headed by Superintending Engineers namely

21. SE Kapurthala
22. SE Nawashahar
23. SE Jallandhar
24. SE Hoshirpur
25. SE Khanna
26. SE Ludhiana West
27. SE Ludhiana East
28. SE Ludhiana Suburban
29. SE Patiala
30. SE Ropar
31. SE Sangrur
32. SE Mohali
33. SE Gurdaspur
34. SE Amritsar Suburban
35. SE Amritsar City
36. SE Tarn Tarn
37. SE Bathinda
38. SE Ferozpur
39. SE Faridkpot
At the fourth level there are 103 Divisions headed by Senior Executive Engineer and at the fifth level there are 491 subdivisions headed by Sub-Divisional Officers. The zones, circle and division have supervisory and control functions. They have to monitor collections and look at the default list. They have to ensure the smooth running of the supply for the next level. The Zone has to interact with Inventory/Stores/Workshop. The stores requirements come to the Zone from Sub-division, Division and Circle. Occasionally, they might have to make some spot purchases. The zone is responsible for the layout of transformers and lines. The zone analyses figures on Unit billed/revenue assessed and revenue realized for each circle every month. The zone also looks into Charge Sheets/Complaints and reply to them. Each level takes care of all establishment functions. The Zone has to compile data from circles to prepare the monthly returns. The circles get the data from their divisions, who in turn collect the figure from the sub-divisions.

5.9 DIVISIONS

There are two types of divisions

- Conventional Divisions
- Special Divisions

Conventional divisions follow a 4 tier structure. The second type that is Special Divisions there is a 2 tie structure and the functioning of the division and the sub-division is combined. In the conventional system, the division is distinct from the sub-division. The division has the XENs who perform both the commercial and the technical functions. The division functions similarly. In the special divisions, the sub-divisions have been merged
into the divisions and the different officials perform the commercial and the technical functions.

5.10 SUB-DIVISION

The norm for creating an operational sub-division is the number of connections, which is dependant on the density and spread of the territory. The number of sub-divisions dictates the number of divisions, which in turn dictate the number of circles in the state. Most customer interaction and the operational transactions takes place at the sub-division level. This is the face of the PSPCL to the customers and needs to be strengthened. As per the government of India guidelines, PSPCL must focus on making its attitudes and operations customer-centric. Besides, since all the transactions take place at his level, the IT infrastructure at his point must be capable of taking care of the load. The data captured at this point is then processed for the further applications. IS implementation and most importantly, training must start from here. Other than the customer interaction, the sub-division has to develop and maintain the system for all the connections. The sub-division does the meter reading. It has to detect theft and conduct surprise checks. It has to procure supplies from the stores. The sub-division has Sub-Divisional officer (SDO) who is in charge for all the meters issuance for the new connections. Meters are under the preview of Chief Engineer (METERING), who procures meters for the entire PSPCL. The SDO’s make daily, weekly and quarterly reports which they send to the Division. These reports are manual in nature. At the level of Division the XEN’s consolidate these reports and send them to the Circle headed by SE’s. The SE’s consolidate all the reports received from the Division and send them to the Zone headed by CE’s. The CE from the different zones sends reports to the Director Distribution.
5.11 INFORMATION FLOW-

As discussed earlier the five zones are headed by five Chief Engineers. These five CE are in constant touch with the Head Office located at Patiala. As shown in the following figure 5.2. These CE are also in contact with the CE (Metering), CE (Material Management), CE (Rural Electrification and Accelerated Power Development Reform Program) and CE (Store & Disposal). Every Zone requires meters for new connection and also to replace the old damaged meters. So it is very important for the respective CE’s to be in constant with the CE metering who is in charge of issuing meters. Also it is very important to have communication with the CE Material Management for smooth flow of materials required for the proper Distribution of power. The CE Material Management also procures various materials for the distribution of electricity e.g.

- Poles
- Disc Insulator
- Pin Insulator
- Shackle Insulator
- Guy Insulator
- Transformers (6.3 KVA to 500 KVA)
- Wires
- Stay Wires
- Earth Wires
- Conductor (20mm square to 100 mm square)
- Aluminum Thimble
With the growing number of losses the Central as well as State government has started with the schemes to curtail the losses especially in the distribution network. The CE (RE

Figure 5.2 Information Flow Diagram
and APDRP) looks after this aspect. They have started with few new schemes so as to curtail losses. The respective CE for every Zone is in constant touch with the CE (RE and APDRP) so that they may able to reduce losses in their respective Zones.

The APDRP has started with new schemes for example

4. HVDS

5. Reclosures; Sectionalisers ,Switched Capacitor Banks and Auto Voltage Boosters

6. SCADA

1. The HVDS stands for High Voltage Distribution System in which are applicable in the rural areas where predominantly pump sets are used for the lifting of the water which operates at low power factor and low load factor. Also the load density is low due to the dispersal of load. The existing distribution system consists of three phase 11 KV line and large 3rd Phase 11KV/ 33KV volts distribution transformers with the lengthy L.T. lines. The system is unsuitable to cater to the Indian conditions, as voltage profile is poor; losses are high. To improve the quality of the supply, one of the recommendations is the implementation of single phase H.T. distribution system with the small capacity single phase distribution transformers. Under this system H.T. line i.e. 11KV line is extended up to or as near the load as possible and erect small capacity distribution transformer say 5, 10, 15 KV extend supply to the consumer through a short length of L.T. line preferably insulated over head cable popularly known as aerial bunched cable. The idea is to have a LT less system or at least “Less LT System” to begin with. (Source: Brinchi)
2. The advent of pole mounted Reclosures; Sectionalisers, Switched Capacitor Banks and Auto Voltage Boosters can make it possible to modernize the existing distribution systems. The above latest additions into the family of distribution equipment have their own special features and specific application. Their usage in conjunction with each other in the appropriate form only can bring in the desired results. The Auto Reclosers are the low rupturing capacity circuit breakers which open out on faults sensed by inverse time relays with instantaneous provision and recluse at present number of times at preset time intervals and get locked in open position if faults persist. Sectionaisers are those who do not interrupt fault but the line can be sectionalized into various sections using them. The fault section gets pressed into service. These operate by sensing whether the line is ON of OFF and various types of fault detecting relays and control boxes make these adoptable for radial, loop and ring feeders etc. Switched Capacitor is switched on and off automatically to put them into service when needed only and avoid over compensation during light load periods. The control system is by sensing current. Automatic Voltage Boosters are essentially autotransformers with a shunt and series winding with the taps provided on the series winding and the taps are automatically selected based on voltage levels. (Source: Brinchi)

3. The SCADA stands for the Supervisory Control and Data Acquisition. It involves net working of a group of substations for data collection in respect of all equipment at a host station. The distribution system can be monitored on real time and also controlled by issuing commands to stations where RTU’s (Remote Terminal Units) are located. The aim of the system is effective load management of the distribution
system to improve reliability and efficiency of the supply. Apart from achieving efficient distribution management, accurate fault analysis and prompt restoration of supply, it will be possible to identify malfunctioning of equipment in advance for taking the corrective action. (Source: Brinchi)

The last part of the above information chain is the CE (Store & Disposal) who manages the inventory. The zonal Chief Engineers are in touch with the CE (Store & Disposal) in case some breakdown occurs, then adequate inventory can be supplied to the respective zone.

Chief Engineers are in constant contact with other zonal Chief Engineers. The Chief Engineers receive information from circle which in turn gets information from division and division gets information from sub division. Various reports are made at different levels e.g.

- Installed distribution type transformers
- Damaged distribution transformers
- Estimate of damaged distribution transformers
- Register of damaged distribution transformers
- Replacement against damaged distribution transformers
- Pending against damaged distribution transformers
- Installed Power transformers
- Damaged Power transformers
- Replacement against Damaged Power transformers
- Pending for replacement against Damaged Power transformers
- Final report for distribution transformers
• Final report for Power transformers
• Replacement of damaged transformers at the end of the month
• Inspection of the sub station
• Overloading of primary and secondary transformers
• Work progress for the Sanctioned packages
• Final Report for the state tube well due to Electrical fault
• Theft of conductor for month
• Final report for the theft for conductor
• 11 KV and lower voltage work progress under extension and improvement work plan
• Status of defective electronic meters on 11 KV I/O feeders at secondary sub stations
• Progress of installation of electronic meter on 11 KV I/O feeders at secondary sub stations
• Final report for the progress of installation of electronic meter on 11 KV I/O feeders at secondary sub stations
• Report of 11 KV feeder details at secondary sub stations
• Final report for 11 KV details at secondary sub stations
• Rural electrification work progress
• New 11 KV capacitor installations
• Damaged and repaired capacitor
• New 33 KV sub station work progress
• Augmentation of 33 KV sub stations progress
• New link Line work progress
• Work program under APDRP and other scheme
• Sample meter installation for un metered consumers
• Major equipment make list for secondary sub stations
• Report for tripping of 33 KV and 11 KV lines
• Daily log sheets
• Register format for battery inspection
• Max/Min load register
• Inspection and testing register
• Stoppage register
• Tripping and testing register
• Breakdown and shutdown register
• Damage of distribution transformers (Location, feeders wise)

The Chief Engineers from the respective zones then send these reports to the Head Office where all the reports from all the zones are tabulated to get the final data for Punjab. As discussed earlier these fives zonal Chiefs are also in contact with the Chief Engineer (Metering) for issuance of new meters, Chief Engineer (Material Management) for the purchasing of material for their respective zones, CE (Store & Disposal) for managing the inventory and also with the Chief Engineer (RE and APDRP) for the continuous upgrading of their distribution systems in their respective zones so as to reduce losses. All these reports are then sent to Director Distribution. The Director then sends the summarized reports to the Regulatory Bodies and to the MoP. The Regulatory Bodies and the MoP on the basis of these reports then takes critical decisions e.g. increasing the tariffs of electricity. Theoretically the system gives a very accurate picture, but without the presence of proper reporting mechanism, this chain often breaks down. In the coming
chapters, the study highlights various critical issues that PSPCL is facing and also provides possible remedies to overcome all strategic problems.