Infrastructural Analysis of Load Dispatch Centre

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ABSTRACT
Electricity is a widely used entity by each human being though it is divided by different types of consumers. It is used by each and every consumer daily like a breath. Without electricity our life will be in dark. To provide electricity up to our doors each & every component of a power system is working very efficiently & continuously. If there is malfunctioning at any stage of operation of a power system component, our switchgear is always ready to repair it again & present that component for our service.

Load dispatch center is a coordinating agency for state electricity boards for ensuring a mechanism for safe and secure grid operation. Load dispatch center is an important link between generation and transmission, which co-ordinates the power requirements of consumers of electricity. Load Dispatch center which is the nerve of our power system is used to perform various functions.

This paper explains the details of LDC, its functions, its importance in a power system & its future scenario as it is a very important factor of a power system.

Terms and Keyword used:
LDC – load dispatch center
SLDC – state load dispatch center
RLDC- regional load dispatch center
DCC – distribution control center
Act - The Electricity Act, 2003
CEA - The Central Electricity Authority
CERC - The Central Electricity Regulatory Commission
DAS- Data Acquisition System
IEGC- Indian electricity Grid Corporation

1. INTRODUCTION
Power sector is reforming day by day to give us the uninterrupted & continuous supply up to our homes. No. of new equipments are coming forth for fulfilling the above purpose along with the simulation studies like load flow, economic load dispatch, control units, tariff measurements etc.Power sector is a key infrastructure sector & is the backbone of Indian economy. Installed power generation capacity in India has grown to 87 times since independence.Until 1980's Indian power sector was in growth phase with many achievements to its credit. But by late 1980's almost all SEB's (state electricity board) started showing signs of financial technical & governance failure. But after the mergence of private companies SEB's were restructured with financial support like IPP's
(independent power producers).Before knowing about Load dispatch center it is important to know about what is about electricity and how the electricity is related with countries economy.Today electricity plays a key role in a society. In house, offices, factories or farms electricity
powers so many gadgets. It is the most versatile form of commercial energy & it has been a key input to economic growth in turn improving quality of life. It can be economically transported over long distances & easily converted to heal, light, or shaft power. It does work for us, cannot be seen, heard, smelt but still it is always with us without polluting the atmosphere.

The Indian Power System was demarcated in early sixties in five regions for the purpose of planning, development and operation with a view to optimally utilize the unevenly Distributed power resource in the country, as well as to achieve economy, reliability and
Security of supply. Five Regional Electricity Boards, viz., Northern, Southern, Eastern, Western and North-Eastern were constituted to ensure integrated operation of regional
grids formed with progressive interconnection of contiguous state power systems. Five Regional Load Dispatch Centers were also set up to coordinate the operations of the Regional girds in real time. The regional grids were strengthened with the establishment of large thermal, hydro and nuclear stations in the Central Sector in which the states of the concerned region have shares. Central Sector transmission system was constructed for
Evacuation of power from these central projects to the beneficiary states. The contiguous Regions have also been interconnected through AC and HVDC back-to-back systems with the ultimate objective of achieving a National Grid. Eastern & Northern-Eastern Regions operate in synchronous mode while other regions operate independently and exchange power asynchronously through HVDC back to back systems or through AC lines in radial mode.

2. EFFECT OF ECONOMY ON POWER SECTOR

In our country 70% of population living in villages. India is country of villages, on the other hand India has many cities with excellent infrastructure ,good industrial base $many R & D centers & excellent academic institutions. All these needs electricity continuously in villages plus in cities which shows our economic aspects.

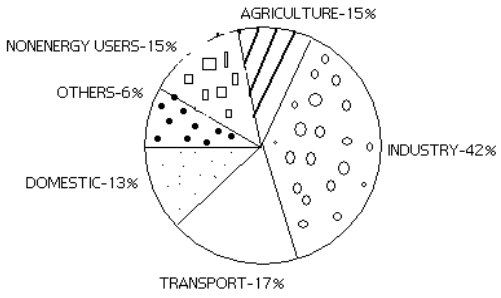


Fig 1) commercial energy consumption

Everyone needs energy in some or other form like agriculture, homes, industries, government offices, commercial buildings, transport facilities, different
operating machines etc. It is also true that half of the population of India depends upon non commercial sources of energy as they are not using any appliance or advanced equipment for their daily routines eg. Use of gobar gas in rural places, hand operated water lifting pulley etc. The main users of commercial energy are industries, agriculture, domestic users & transport sectors. Different power stations are in work to supply energy to us like Hydro, Nuclear, thermal, diesel, bio gas, bio mass, solar stations, wind farms, tidal powers etc. Following diagrams shows the Overview of commercial energy supply by sources, consumption, & consumption by different loads.

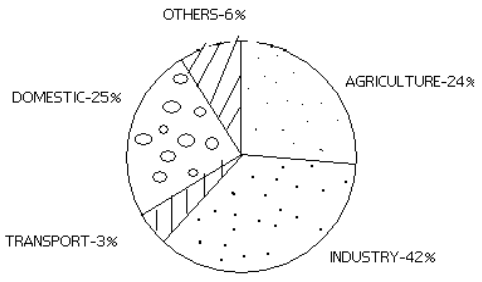


Fig 2) electrical energy consumption

We know that power is the backbone of Indian economy and power sector is also Doubling every 10-15 years like other infrastructure sectors. Before looking actually towards the LDC it is important to know about the power system, its Structure & the main components taking part to make its flow successful.

3. POWER SYSTEM AND ITS FUNCTIONS

Right from generation to distribution or up to our premises power is not directly coming but it has to go through ups and downs the whole journey. Main wonder is how electricity generated reaches up to our homes thousands of miles away.
The main contribution is by the thing called power system and to know about the power system it is essential to know its block diagram and each component.

Power system

Network of generating stations, substations, and power lines is called as power system It spans a large area. It has a 5 major blocks which are efficient in transforming power to
End user.

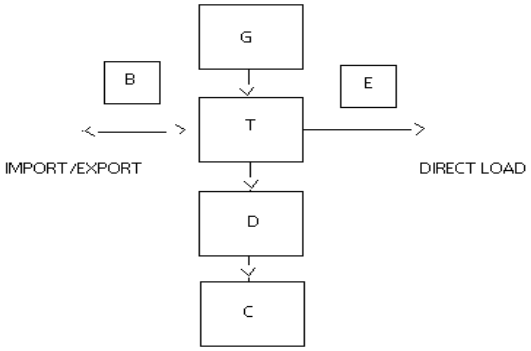


Fig 3) Basic energy flows in the following way

Electrical power production is the very important part of the complete electrical power system. Once it is produced it must be distributed to location where it will be used. Controlling of power is done by using no. of devices and
equipments. To convert it to different forms particular types of loads are used and the last block is for measurement of energy without which control & conversion is difficult. Power system may be a huge or a small network.eg. a small generating station operating
on a waterfall at the edge of village with power lines running to village square from where they branch off to village homes a small power system or a system like Niagara falls.
The whole power system also uses different devices for different functions like data loggers, data acquisition devices, SCADA, security monitoring systems etc.
monitoring of power quality is another issue which decides the thing that whether the provided power is of harmonic free or not. Loads which are creating harmonics are many so the harmonic mitigation is of utmost importance. Hence quality monitoring is essential. For this purpose many computer based measurement & automation products aid scientists and engineers in research, design, valid production testing and field monitoring of industrial power sectors.
Other things like data transmission logging, acquisition, receiving, and economic load Dispatch, load forecasting and load allocation is also important for power system.

Sub systems of the power system

The summarization of 3 major blocks of a power system are
Generation :- production of a power (fuels or inputs are different)
Transmission and distribution :- produced power is transmitted or distributed as per the consumers need.(underground or overhead)
Utilization :- use of electricity for different purposes.
Following are the block diagrams of the typical power system

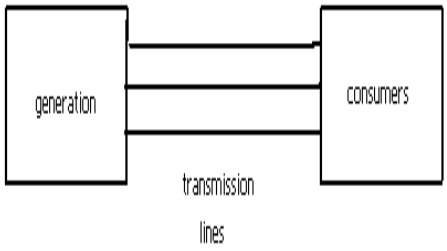


Fig 4) consumer- a small village located at very near to the generating station so no need of distribution or substation for its supply

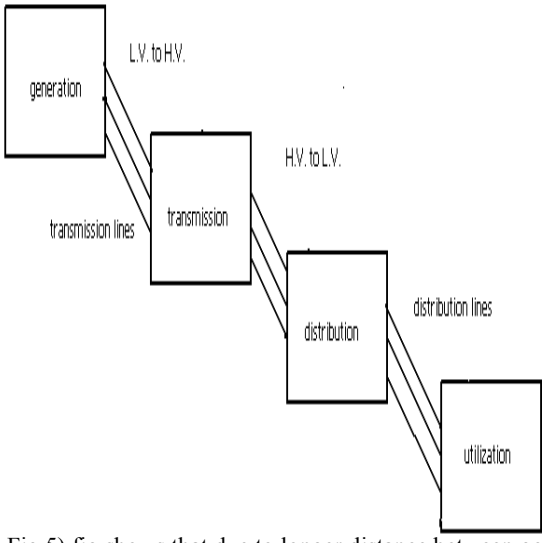


Fig 5) fig shows that due to longer distance between generating point and utilization point an intermittent stage called distribution station is used.
For the healthy operation of a power system G, T, D, and U must work in close Co-ordination. As per the requirement the generated voltage can be lowered or raised for tranmission purposes. Incase of a distribution levels are decided for different users like 33, 22, 11, 415 etc.it may be AC or DC hence distribution system is a 1st inter phase of utility with consumer. So power system is like a drama with many actors & director calling the tune. Power system performs smoothly if all actors dance to same tune. Any abnormality may lead to grid collapse as this drama is going all over the country , spread over thousands of kilometers.

4.LOAD DISPATCH CENTER

At state level minute to minute operation of a power system is Co-ordinated from a LDC which at the receiving end or load side. In one way LDC is a
Wonderland as it is handling no. of changes, demand supply irregularities daily.It gives safe and secure grid operation. It is located in state capital. It is further connected to 3/4 sub LDC's which in turn are connected to major substations and generating stations, hence LDC will get information about major changes in generating station plus whether condition information from different locations in the state. In earlier days it was only with few telephones and few engineers to keep the record. State LDC is connected to regional LDC (RLDC), where RLDC monitors a whole region eg. Southern RLDC in Bangalore monitors A.P. tamilnadu, Karnataka, Kerala and Pondichery. RLDC also gets information from generating station & substations of central utilities (NTPC,NPC, POWER GRID etc). LDC at state plus
regional level is connected to all these locations using reliable communication media that can carry information and voice.

Role of SLDC

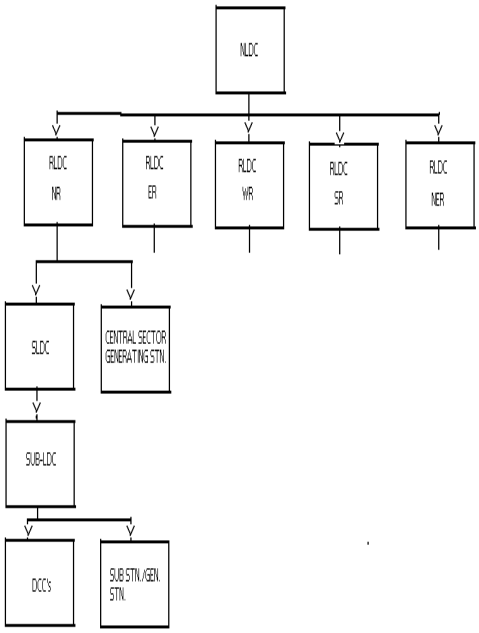
1)As per the Electricity Act, 2003, the State Load Dispatch Centre (SLDC) shall be the apex body to ensure integrated operation of the power system in a State.
2)SLDC shall exercise supervision and control over the intra-State transmission system.
3)SLDC will be responsible for carrying out real time operations for grid control and dispatch of electricity within the State through secure and economic operation of the State grid in accordance with the Grid Standards and the State Grid Code.
4)The SLDC shall comply with the directions of the RLDC.SLDC shall keep accounts of the quantity of electricity transmitted through the State grid.

LDC must be equipped with essential facilities.

*Reliable and far reaching communication network
*Accurate SCADA system
*Fast data processor and data formatting system
*Reliable power supply for LDC equipment for all the time
*Visual display of important system data
*Integrity of operating engineers
*Basic amenities, utilities and logistics

Typically LDC prepares

*An hourly generation schedule for each generating station in advance.
*Also the maintenance schedule (prepared for the year in
*Advance for any equipment failure.) which needed relative power gen. cost.
*Contractual agreements.
*Water/fuel availability
*Irrigation requirement and load requirement forecast.etc.



NLDC-NATIONAL LOAD DISPATCH CENTER

RLDC-RIGOINAL LOAD DISPATCH CENTER

SLDC- STATE LOAD DISPATCH CENTER

DCC-DISTRIBUTION CONTROL CENTER

SR- SOUTHERN REGION

ER- EASTERN REGION

WR-WESTERN REGION

NR-NORTHEN REGION

NER-NORTH EAST REGION

Fig 6) shows the T & D operating hierarchy with NLDC, RLDC'S, SLLDC'S, SUB LDC'S DCC'S AND SUBSTATION

5 RLDC's are connected to a NLDC (north, east, west, south, and north-east)

Power System operation Set-up

Regional Load Dispatch Centres (RLDC) have been given the status of apex body and all players have to comply with the directions of RLDC for ensuring integrated operation of the inter-state transmission system and achieving maximum economy and efficiency in
the operation of the power system. State Load Dispatch Centres (SLDC) have been given similar responsibility in regard to operation of the intra-state transmission system.Regional Electricity Board (REB) has representatives from SEBs/State Transmission utilities (where unbundling has taken place), Central Sector Generation & transmission companies and Central Electricity Authority and meets from time to time to
take decisions in the matter relating to integrated system operation which have to be followed by the RLDCs & SLDCs in real time operation. REBs carry out their functions through various Committees and Sub-Committees coordinated by REB secretariat, the

Staff for which is provided by the CEA and the constituent utilities. The RLDCs carry out the functions of settling up and operation & maintenance of load dispatch centre, real
time operation including day ahead operational planning, and REB Secretariats have been entrusted with operational planning (monthly & annual), coordination of protection
system, energy accounting and facilitation of trading of power, etc. Two important developments have taken place recently in Indian Power System, viz. implementation of
Indian Electricity Grid Code (IEGC) w.e.f. 1st Feb. 2000 and Availability Based Tariff (ABT) to be implemented shortly. These developments have taken place on the orders of CERC after public hearings. IEGC puts obligations on various players in the grid for maintaining security of the inter-state transmission system. It brings set of rules to be
followed by all utilities connected to the inter-state transmission system. The regional grids are proposed to be operated as loose power pools and strict control of tie line/
generation schedule is not envisaged. Deviations are allowed depending on the frequency level. If the frequency is below nominal, drawal of power less than schedule or
generation more than schedule and when frequency is above nominal, drawal more than schedule or generation less than schedule is encouraged.Incentives/disincentives to
give signals for correct grid operation are built in features of ABT. The unscheduled interchanges are to be billed at a frequency linked rate which varies linearly from 0 at 50.5 Hz to 420 paise/kwh (US $ 90/Mwh) at 49.0 Hz. The main suppliers to the bulk power system are the State utilities own power stations, Central Sector Power Stations, the entire capacity of which is allocated to States and IPPs having long term contracts with the States. There are no merchant power stations.sheduled power exchanges within the regional grids takes place in limited quantity. Inter-regional exchanges account for less than 2% of total energy consumption. Central sector transmission system associated with Central Power Stations has been planned and developed for evacuation of generating energy.

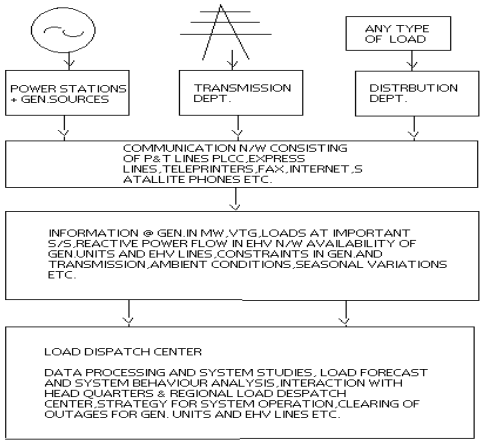


Fig 7) Information flow at LDC

Main and important functions of load dispatch center

* Load generation balance and quality of supply
* Maintenance scheduling of generating units and transmission lines
* Economic load dispatch
* Grid discipline
* Load forecasting or demand estimation
* System security and islanding facility
* Black start preparedness
* Energy distribution and load pattern study
* Communication and SCADA management
* Event analysis and preventive measures
* Coordination with neighbor grids
* Public relations and consumer interaction

Dispatchers study for load patterns

*Industrial category of consumers (industries working in all 3 shifts)
*Industries working in day time with high power demand.
*Commercial category consumers like shops , offices ,show rooms operates during day time (9 to 20.00 hrs.)
*Railway traction load have generally steady nature whole day.
*Water works require power for pumping drinking water for urban and rural areas during early morning hours.
*Farmers also requires power for irrigation during day time
*Seasonal nature industries like sugar factory, cotton ginning industries, vegetable oil industries, rice mills etc.

5.USE OF SCADA IN LOAD DESPATCH CENTER

There are multiple agencies within a state engaged in generation, transmission, and distribution of electricity. State Load Dispatch Centre monitors these operations and keeps the account of quantity of electricity transmitted through the state grid. SCADA is a part of it. Supervisory Control And Data Acquisition System (SCADA) is a high tech computer system with associated communication network that enables supervision and control o f power system network. SCADA is the technology that enables a user to collect data from one or more distant operator to stay or visit frequently to the work locations. It includes the man machine interface.It allows an operator to make set point changes on distant process controllers, to open or close valve or switches, to monitor alarms to collect measurement information

SCADA is best applicable to processes that are spread over large areas and it is suitable for

1. groups of small hydroelectric generating stations that are turned on and off .
2 .oil and production facilities ,pipelines for gas , oil, chemicals, water which are located at far distances
3 .electric transmission systems irrigation system etc.

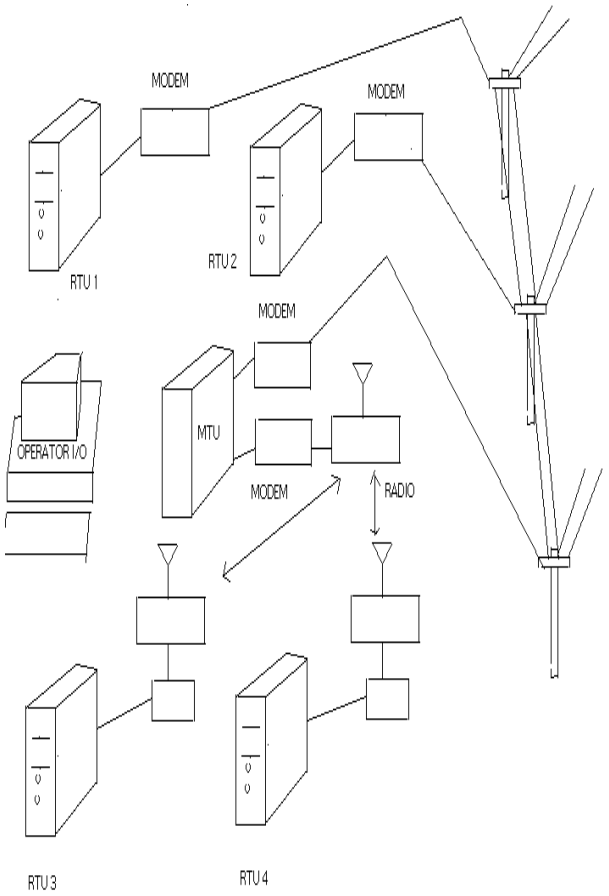


Fig 8) Communication in SCADA

The direct benefits of a modern SCADA system are:

Constant access to Real Time picture of entire network showing power system voltage,frequency, MW, MVAR, etc.

Supervision, monitoring and control of power in Real Time.

Optimal operation of power system, i.e. generation andassociatedresources.

Minimum of outage and faster restoration of the system in the event of Grid disturbances.

Improvement in the quality of supply through better control of frequency, voltage and other parameters.

Less dependence on basic telephone system.When it comes into existence

6.FUTURE SCENARIO

The main things are make load dispatch center operations more complex than earlier years are changes in system network, growth in consumer
population, mix of fuel used etc. also problems related to security , integration of various grids, forces the load dispatcher to attain new dimensions. Load dispatch center has to handle and face no. of problems regarding the electricity changes. In earlier days the

methods used to communicate oral instruction and manual intervention were somewhat
unreliable in critical situations.And this thing make necessary to adopt the new methods and
1)techniques like automatic control on generating units as well as important load centers. This is for effective and timely control to avoid the major occurances of black out.This aspect will also require the foolproof arrangement of reliable interlocks and back up protection to ensure safe grid working.
2)Also the transmission switchyard will be properly equipped and no interference of local staff except the experts.
3)Control actions taken by load dispatcher can not be bypassed.
4)The remote control of generation should be done through the governor controls to improve generation. In recent years it is done by the automatic governor control.

Now a days as we have seen SCADA is in use to control and monitor all the things Which is the most effective communication media. Also a regular and timely communication about power supply schedule and generation schedule is the heart of
healthy power system and this happens only when there is a proper communication.

7) LOCATIONS OF LDC's

Load dispatch centers in our region

1) **Maharashtra – kalwa**
2) **Goa –mapusa**
3) **Gujrat-jambuva**
4) **Delhi –gotri**

8.CONCLUSION:

Day by day the technology is changing , new trends are emerging which are definitely beneficial for utility side, power players and consumers too. In early days communication was done by the telephones only. All the changes, information transfer, fault data, generation and demand side requirement and all other data transfer depends upon the means which were not adequate but somehow it was very difficult to keep the records of all the above said things second to second as in many cases some information may gets lost.

Hence a new technique named SCADA originates which helping the power sector a lot by taking the form of load dispatch center. A real-time expert system now dergoing considerable fault case for restoration guidance. The progress so far indicates a hopeful future for a quick and accurate fault restoration support system. The system will continue to be thoroughly tested in the field until it can be introduced into practical service. Also automation in communication process gives quick information and response and all this happens at Load dispatch center.Hence this presentation conclude that Load dispatch center is a very important and most useful factor of a power sector in all sense.

9 .REFERENCES:

[1] K. Tomsovic et al., **"An** Expert System as a Dispatchers' Aid for the Isolation of Line Section Faults," IEEE Transactions on Power Delivery, **Vol.**PWRD-2, NO. **3,- -PP-. 736-743.** July **1987.**
[2] Mariani, E. and S.S.Murthy, 1997a, ***Advanced Load Dispatch for Power Systems,*** Springer-Verlag,
London.
[3] K. Hotta, **H.** Nomura, **H.** Takemoto K. Suzuki, **S.** Nakamura, **S.** FukuiKansai Electric Power Co.,
Inc.3-3-22, Nakanoshima, Kita-ku Osaka, Japan.
[4] "Electricity act 2003" , Ministry of power ,
Government of India , New Delhi ,India, Jun.2003
[5] J.P. Conti, "Let the Grid do the thinking" , IET
Power Engineer ,April-May 2006 ,vol. 20 pp. 34-37.