

***Comprehensive Energy
Exchange Plan***

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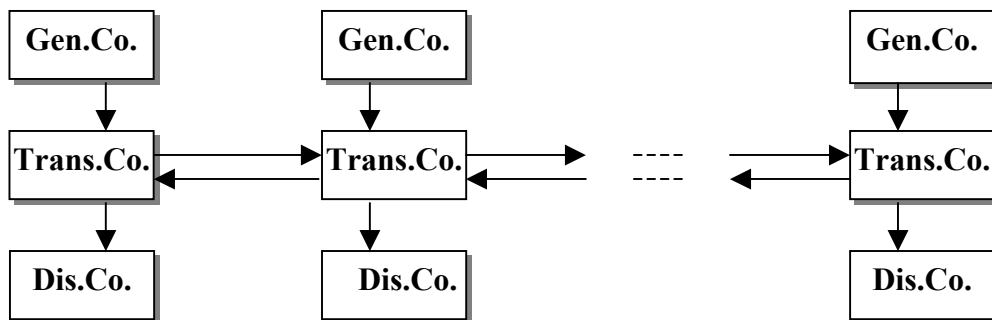
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Introduction

One of the greatest industries, which can be very influential on the stable development of the country is electrical industry, which has been active for several decades. One of the basic components of stable development is economic development, therefore, electrical industry acts as a main basis of economic development. Now, after 20 years perspective of the country approval and observing 8.6% growth per year in economic development, it's necessary to restructure the economic construction of the electrical industry in order to be adaptable with economic development.

As you know, today the electrical industry structure is natural exclusive and like a chain. This means that the generated electricity in a region will be delivered to the distribution net of the same region after transmission.

All the expenses of generation, transmission and distribution have been calculated for the customers in one tariff and then the prices will be paid based on these expenses. It may exist some regional exchanges in the distribution part of these structure.(figure 1)



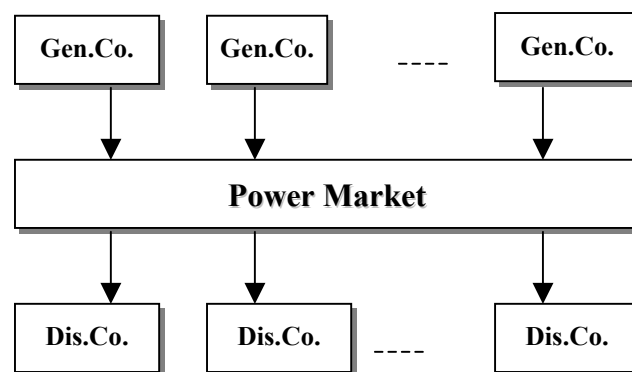
(Figure 1)

These are some problems in this structure always, such as: increasing the tariff prices, deficiency of the pricing methods, not being clear the financial work in different parts, the necessity to high investment in order to development, the absence of private investment and not being competitory the activities.

Due to these mentioned cases, it seems imperative to restructure the economic structure of electrical industry to obviate these problems and become adaptable with economic development.

An important subject that should be considered in restructure of electrical industry structure is simultaneous attention to these separate but complement aspects, privatization and creating competition. It's very important to separate these two subjects and this separation is the key point in restructure of electrical industry structure. In renewing the structure, the electricity is considers as a commodity and it's trade mechanism is to operate the power market.

In order to increase the efficiency level and optimitation the system, using the almost existing facilities and the least expenditure one memorable. It has been suggested and performed to constitute the power market plan to operate the trade mechanism of the electricity commodity, creating competition and findly necessary preparation for privatization of electrical industry. The main basis in this plan is offering the products to the market for sale and presenting the demands for buying electricity at the least price and the best quality. (figure 2)



(Figure 2)

It should be considered that power market links the physical route of electrical industry to its financial route for converting the electricity to a disposable commodity, therefore, power market can convert the technical subject of electricity to a technical economic subject by establishing suitable correlation and it can prepare the preliminary of restructuring the structure and creating competition in electrical industry after accession to the offer and demand field.

After operating power market the transit route of commodity or electricity will be the same generation, transmission and distribution route. But there is a difference in this case because of financial route existence. Power plants will have sale rate, the transmission network owners will have transit and distribution rate and the electricity consumers will have purchase rate and these three parts will constitute the main components of the market.

In an offer and demand mechanism, the prices will be specified based on sale, transit and purchase rate in a competitive environment and final costumer tariff will be defined based on selective of competitive tariff.

Now each regional electric company prepares the prime information of power market such as: its exchange quantity, the amount of generated electricity and consumption scale in form of special tables. This information is prepared manual by the market unit of each regional electric company and they are based on the information of existence miters and dispatching RTUs.

These are some reasons that cause to decrease the reliability of prime information of the power market, for example the dispatching RTU systems are not reliable so much, the miters have low accuracy or absence of appropriate measuring system and absence necessary accuracy in non comprehensive plan of energy exchange is suggested in order to obviate these problems and increase the control possibilities of the power market and now it is being performed. In these plan on of the generator outputs, the start and end point of all lines and the transmitter transformer outputs and finally the output of all 32/20/11 Kv power transformers should be equipped to appropriate measuring systems in order to receive and record the network information and transmitting them to the regional centers and national center of power market.

The received information are categorized and encoded in local centers and are send to the national center of power market in the form of the data.

To perform this plan, Tavanir Company proceeded to prepare and sell the (summon-call) documents as the main performer of the plan. Tavanir company requested the purchaser companies their suggestions and abilities to perform this plan.

The supplementary documents will be presented. Please study the documents carefully and suggest your proposal.

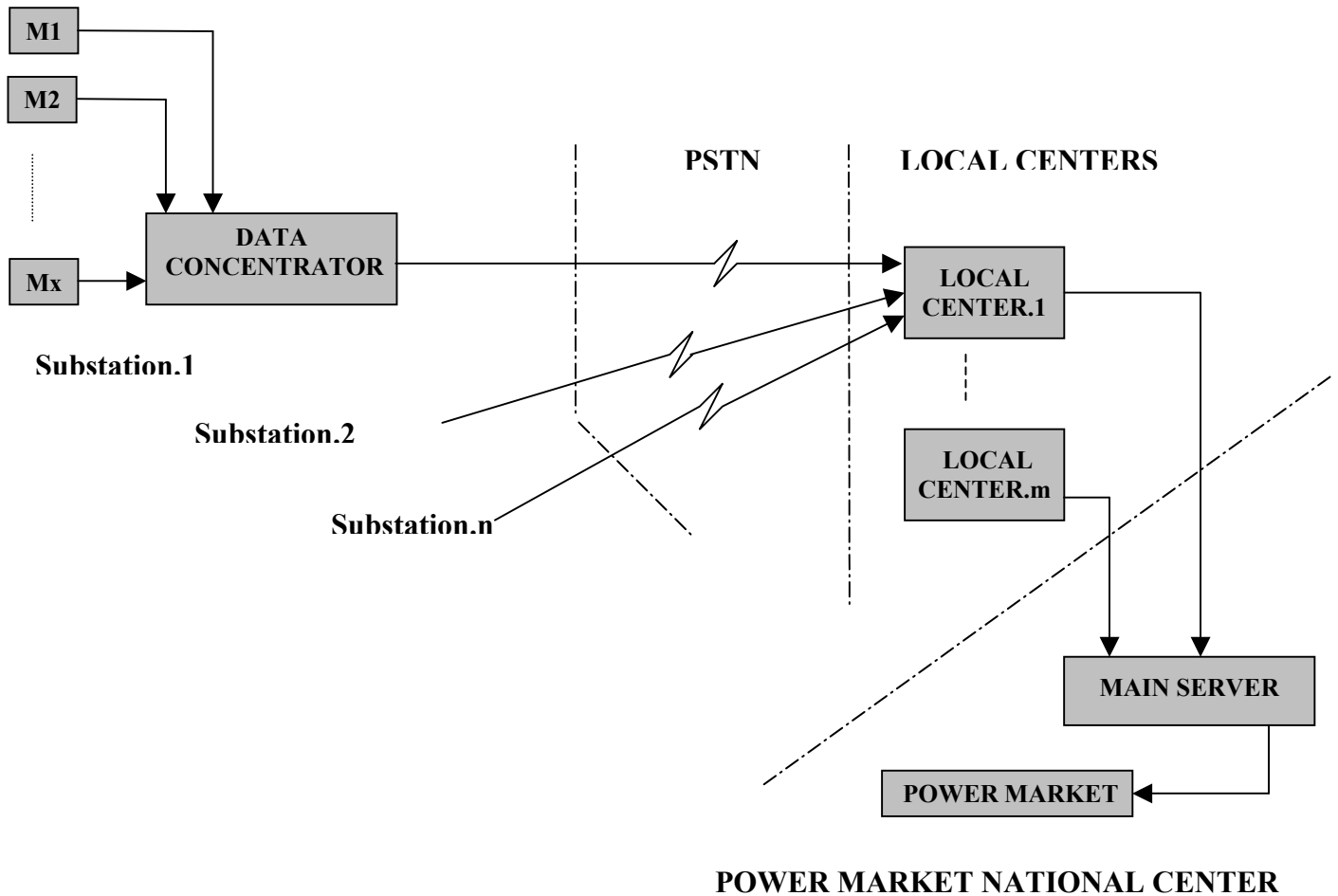
Comprehensive Plan Of Energy Exchange Introduction

As mentioned, the main purpose of performing this plan is installing an appropriate measuring system in all energy exchange terminals, such as generator outputs, the start and end point of transmission lines and the output of all 33/20/11 Kv power transformers and also is gathering and managing the data of above measuring systems in local centers and national center of power market to use in market. (figure 3)

Based on the performer's view point, all of the designing, preparing, transmitting, installing and operating stages and doing the prime tests on equipment such as measuring systems, necessary hardwares for gathering and managing the data and also complete preparing and operating the necessary softwares, installing all the relevant equipment and doing all the software part tests are the duty of the contractor under the supervision of Tavanir.

It should be considered that all necessary stages for installing the measuring systems including control or installing the appropriate voltage and current transformers in high voltage and in all energy exchange terminals and also installing these systems in all sites that have direct correction with voltage and current transformers of the network are the duty of Tavanir and all regional Electric company companies all over the country and the contractor is bound to implement all the adjustments and tests and prime delivery of the equipment after installing and wiring the measuring systems.

Contractor can suggest the schedule for implementing the project in several stages and different time ranges, because the project is very time consuming.



(Figure 3)

To illustrate that the plan dimension is too much, you can see the approximate number of transmission substations, power plants and also the number of exchange lines as follows:

- Power transformers are approximately 1900.
- Power plant units are approximately 350.
- The industrial subscribers are approximately 150.
- Regional exchange and international transmission lines are about 300.
- Transmission and substations are about 800.
- About 30 local centers are required.
- Approximately 3000 measuring systems are needed in first stage.

Consider that there should be the capability of connecting at least 20 measuring system to the suggestive data collector in each transmission substation.

Approximately 60 substations are in relation to a local center all of the substations shall be in relation to each other and should be in relation to other substations and local centers or power market national center based on preference.

The requirements of comprehensive plan of energy exchange

1- Measuring systems

The desirable measuring system in this plan is a digital 3 phase and 2 wattmeter poly phase meter which has the capability of measuring energy in 2 vectors and 4 areas (sectors). Its specification are:

1-1- General specification of measuring system

- 3 phase, 2 wattmeter power meter with the capability of measuring energy in 2 vectors and 4 phase sectors.
- Input current range is 1A and the minimum starting current is 0.001A with tolerance of 3 times nominal current in long time and 25 times nominal current in 3 seconds and 50 times nominal current in 1 second.
- Input current range is 5A and the minimum starting current is 0.005A with tolerance of 3 times nominal current in long time and 25 times nominal current in 3 seconds and 50 times nominal current in 1 second.
- Input voltage range 110/100 V. Thermal endurance is about 1.5 times nominal voltage in long time and 2 times nominal voltage in 10 seconds.
- The capability of adjustment CT and PT coefficients.
- The capability of measuring F, PF, I, V parameters for each phase and also calculating the one phase and three phase amounts of input and output. VAh, Varh, Wh, VA, Var, W.
- Measuring the current rms amounts.
- The capability of measuring the quality parameters of the network.
- 0.2% accuracy in measuring the Wh, W, I, V parameters.
- 1% accuracy in measuring reactive energy.
- 0.5% of read number accuracy in measuring PF parameter and 0.1% of read number accuracy in measuring frequency parameter.
- Being equipped to an accurate clock and calendar system, which is adjustable via GPS.
- Being equipped to memory unit to store different information based on operator requirement.
- Rated supply voltage range of meter is 85 to 330 Vac or 40 to 160 Vdc.
- Useful lifetime of backup battery is 10 years in normal condition and 1 year without any supply.
- Temperature range is between -25 and +65 C.

- Maximum rated humidity is 95% for 30 days noncontinuous in a period more than one year.
- Having the capability of being in relation to the network and having suitable software and hardware facilities for this aim.
- The capability of adjusting and testing and reading the system information by suitable software in installation site.
- The capability of adjusting and testing and reading the measuring system by suitable software remotely.
- The capability of testing and accuracy testing the measuring system by output pulse test.(Test LED)
- The results of miter test should be in accordance with guaranty tables and existing standards.
- The capability of recognizing test condition and normal work of the measuring system.

1-2- Special specification of measuring system

1-2-1- Recording and saving the parameters and alarms

- The capability of recording all basic parameters of energy in the form of numeral and diagrammatic data.
- The capability of saving the consumption amounts and other defined parameters in memory with ability of keeping the information when there isn't any supply (This memory is supplied with backup battery or it's EEPROM).
- The time period of data storing and the last time of data storage should be incoherent (Measuring system should have high content).
- The capability of saving active and reactive energy in every hour for 4 months.
- The capability of recording maximum and minimum amounts of all basic parameters of the network with the time and data of happening.
- The capability of recording every time of disturbance in each phase with the time and data of occurrence.
- Saving necessary information: the time and data of the last reading or the last adjusting of measuring system.
- Saving all the information about programming and adjusting the measuring system in the memory.

1-2-2- Recording and saving the quality parameters of the network

- The capability of measuring voltage and current harmonics of the network up to 23th harmony.
- The capability of measuring total harmonic of network voltage and current.
- The capability of measuring and recording total harmonic disturbance of network voltage and current with their occurrence date and time.

- The capability of recording the date and time of occurrence and the last time of the harmonic disturbance.

1-2-3- Communication specification of measuring system

- The capability of synchronizing with GPS system via a standard port for synchronizing with central clock.
- Be equipped to RS 232 and RS 485 ports.
- Be equipped to infrared standard port.
- Be in accordance with TCP DN P3-0 and MODBUS RTU protocols.
- Be equipped to optical port to reading data and having communication via manual terminal or computer and configuration and adjusting the measuring system.

1-2-4- Measuring system inputs and outputs

- 4 digital programmable inputs.
- 4 digital programmable outputs.
- 4 analog programmable outputs.

1-2-5- Safety specification of measuring system

- Existing different safety levels from reading the parameters to management and programming levels.
- The capability of recording the last time and date of using the password and doing system adjustment.
- The capability of saving data and continuing the normal work in emergency or interruption.
- The capability of recognizing test condition and normal work condition of the measuring system.
- The ability of recording the time and date of abnormal conditions occurrence.
- The ability of noticing the battery condition and internal failures of measuring system.
- Being equipped to suitable alarm to notice the abnormal condition of the system.

1-2-6- The specification of measuring system clock and calendar

- The measuring system should be equipped to an accurate clock and calendar, which has the ability of adjustment via GPS.
- The measuring system clock and calendar should have the ability to accord with Iranian formal clock and calendar.
- RTC chip of measuring system should have low current to supply from backup battery or super cap. While the main supply is dead. (Using the battery with capacitance is preferred)
- If there is backup battery; it should be easy to change it by allowable operator without any soldering.

- If there is backup battery, the measuring system should have the ability of showing battery conditions and reporting battery problems.
- The accuracy of measuring system clock pulse should be at least 5 PPM.

1-2-7- The specification of measuring system monitor

- The measuring system should be equipped to a suitable monitor to be in relation with the operator.
- It's prepared that the monitor is LCD kind.
- The measuring system monitor should have the capability of displaying all of the measured and calculated parameters.
- The measuring system monitor should be able to display the backup battery condition.(If it's equipped to the battery.)
- In the case of displaying several amounts by a monitor it should be possible to show all of the relevant memory amounts.
- It should be possible to identify each parameter and tariff, during showing the memory amounts.
- It is not necessary to see the monitor, when the measuring system is in no load condition.
- Other necessary points have been mentioned in IEC 687 and IEC 1268.

1-2-8- The measuring system supply specification

- The standard supply voltage of measuring system should be in accordance with IEC 1268 and IEC 687.
- If one phase of 3 phases input voltage is used for supply, there should be appropriate condition to work safe.
- While using the chargeable backup battery, the specification of the battery charge circuit should match with the specification of it's supply circuit.
- While using the super cap, the supply of measuring system should provide it's appropriate charge conditions.
- The system should be equipped to suitable safety circuit against sudden voltage variations.

1-2-9- The specification of measuring system test output

- The measuring system should be equipped to an available test output in front of equipment, which is match with the test equipment of measuring systems. It should be visible in front of equipment. (Test LED)
- More over the measuring system could be equipped to a pulse test output, which is according to the test equipment of measuring systems. This output is available from the terminal row of the system.
- In sudden variations or temporary decreasing of voltage, the test output should not generate signal more than mentioned amount in IEC 687 and IEC 1268 standards.

- The relation between test output and mentioned amounts on the monitor is based on the nominal plate of the system.
- The measuring system should provide necessary pulse in different test points in order to have maximum measuring accuracy that is 0.1 accuracy class.

1-3- Mechanical specification of measuring system

1-3-1- Measuring system case

- Measuring system should have a sealed case, which its internal parts aren't accessible without breaking the seal.
- If the case isn't transparent, it should have one or more window to read and display different parameters. This window should be transparent and should be movable only by breaking the seal.

1-3-2- Input terminals and earth connection of the measuring system

- All the terminals and the case should be designed based on IEC 1268 and IEC 687 standards.
- The distance between terminals, the width of a terminal and the distance between terminals level and terminal case should be based on IEC 687 for wattmeter and based on IEC 1268 for varmeter.

1-3-3- Necessary system resistance against heat, fire and radiances

- Terminals, terminal case and system case should withstand heat and acceptable level.
- The measuring system should not flame if a load parts have an excessive heat.
- The measuring system should have the ability of IPST safety mark, which is mentioned in IEC 687 standard against radiances.

1-4- The measuring system qualification

1-4-1- Electrical standards of measuring system

- Standard reference values of voltage, current, maximum current and frequency should be in accordance with IEC 687 for active energy and IEC 1268 for reactive energy.
- The active energy and outward consumption energy in every kind of voltage and current circuit connection should not be more than defined values in IEC 687 and IEC 1268 standards reference value of voltage, current and frequency in reference temperature.
- The defined range of measuring system operating voltage should be from 0.9 times nominal voltage to 1.1 times nominal voltage.
- Rated range for measuring system operating voltage is between 0.9 times nominal voltage to 1.15 times nominal voltage.

- Sudden variations and temporary decreasing in voltage should not vary the register values of measuring system.
- The error amount of active energy and outward consumption energy in every kind of voltage and current circuit connection should not be more than defined values in IEC 687 and IEC 1268 standards reference value of voltage, current and frequency in reference temperature.

1-4-2- Mechanical standards of measuring system

- The measuring system should be designed to prevent from all hazards during normal work, specially in following cases:
 - Personal security against electrical shocks.
 - Personal security against effects of temperature increasing.
 - Being safe again fire.
 - Being safe against water leak, dust and suspender articles.
- Keeping safe the parts, which may be damaged by corrosion.
- The measuring system cover should not be damaged in transportation or because of being adjusted to the air.
- It should be mentioned to purchase extra equipment in the contract, for measuring system, which are installed in high erosion level areas.

1-4-3- Electro magnetic standards of measuring system

- The measuring system should be designed such that electromagnetic disturbances couldn't damage it.

The main disturbances are electrostatic and electromagnetic discharges of HF fields and temporary sparks.
- The measuring system should not produce radiance or conductivity noises, which may influence on other equipments.

1-4-4- Continental and environmental standards of measuring system

- The rated range of variations in temperature should be in accordance with the mentioned values in IEC 687 and IEC 1268 standards.
- The condition of comparative humidity, which may happen to measuring system, is mentioned in table 5 in IEC 687 and table 6 in IEC 1268 standard.

1-4-5- Limitations of error percentage in measuring system

- The error percentage should be in accordance with mentioned accuracy class in table 9 and 10 of IEC 687 for wattmeter and table 10, 11 of IEC 1268 for varmeter with reference inputs in reference and suitable operating condition.(These mentioned values rms correct for the measured values of power in both vectors.)

- The error percentage increasing should not be more than mentioned rated range of accuracy class in table 11 of IEC 687 and table 12 of IEC 1268 standard with operating condition variations.
- The error range should not be more than mentioned values in table 12 of IEC 687 and table 13 of IEC 1268 with environment temperature variations.

1-4-6- The limitations of starting point and no load operation of measuring system

- The measuring system should activate 5 seconds after applying the voltage.
- If the current circuit is disconnected, after applying the voltage, the test output will not generate more than one pulse.
- The measuring system starts to measure and record the parameters with a current, which is match the mentioned specification in IEC 687 and IEC 1268 standards.
- The current vector is not important for starting system operation.

1-4-7- The specification plate of measuring system

- The measuring system plate and terminal plate should be in accordance with IEC 687 and IEC 1268 standards.
- All of the connections should be in accordance with IEC 687 and IEC 1268 standards.
- The tables of measuring system connections and cables should be in accordance with IEC 687 and IEC 1268 standards.

2 – Data concentration and management system

In fact data concentration and management system is a useful network which concentrate the measuring system saved data from all locations and deliver them to the market software as simple data packages after encoding, arranging and classifying them. The encoded data will sent to local centers from substations and will send to power market national center from thereafter classifying. It s needed to send some data from local centers to substations in order to adjust and configure some parameters of the measuring system suitable and secure methods should be selected. In addition to suitable physical base, a useful software is necessary to concentrate manage and process the data in order to have a perfect and suitable information bank set for using the power market software.

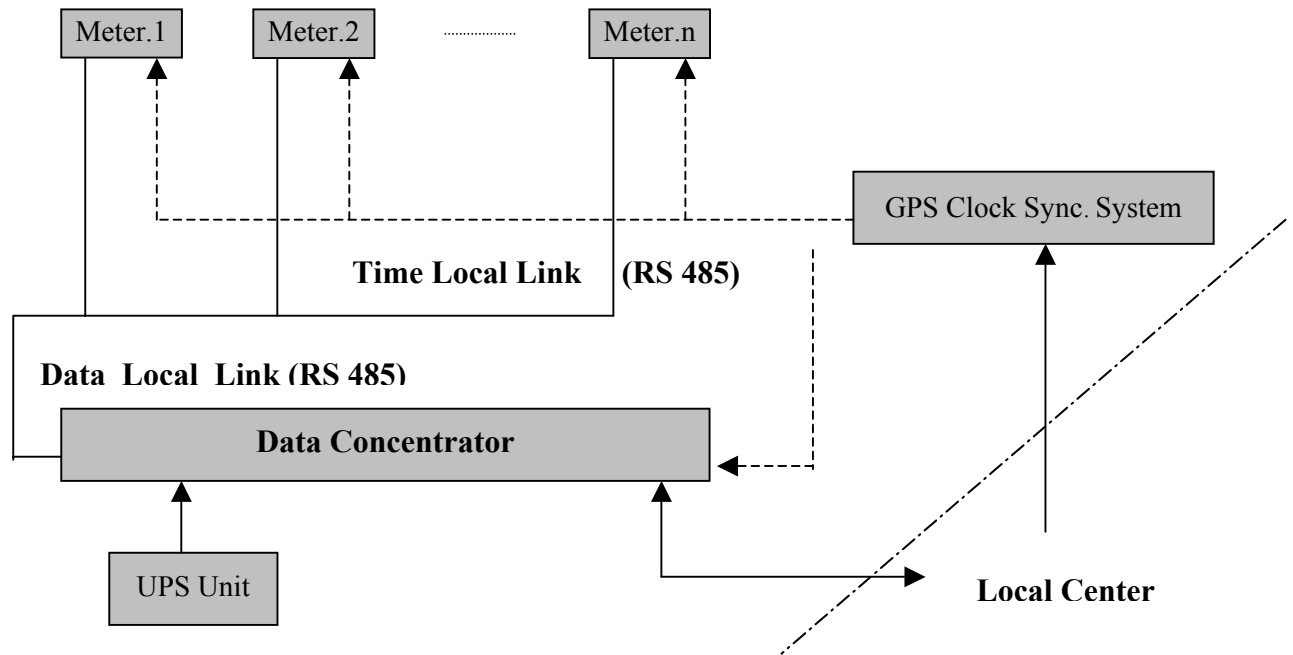
This software includes three main parts. The first part is used in local centers and the second part in power market national center. The third part is a program for testing and detecting defects in the stations. The specification and facilities of the system are:

2-1- Data concentrator system . Part one. Stations

The meaning of a station is a location that one or more than one measuring system has been installed in there. A station can be a transmission or high voltage and transmission substation, a power plant substation or a private substation for an industrial subscriber. In this section we describe the hardware and software need s of the stations. Internal schematic of stations is as follows.(figure 4)

2-1-1- The station hardware

- Data concentrator that has been suggested for the stations should have the capability of having relation with at test 10 measuring systems.



(Figure 4)

- This relation should be in accordance with IEC 870-5-103.
- Suggestive data concentrator should have the ability to relate with local center or other neighbored local centers or power market national center based on first or second preference.
- This relation should be in accordance with IEC 870-5-101 standard.
- Suggestive data concentrator should have the ability to match with different connection methods and protocols. These method may be these methods can be PLC, optic , microwave, radio, or by satellite.(Now it's recommended to use dial up method because of some limitations.)
- If other protocols are used, it should be possible to convert to standard communication protocols.
- If it's needed to survey the aversion, it should be possible to access to the measuring system data via a standard separated connector.
- This relation should not disturb the normal operation of the system.
- This relation is with a portable computer in substation and is similar to the relation with local center.
- Suggestive data concentrator should have the capability of adjusting the clock remotely and should be synchronized with the international clock.(Clock adjustment is via connecting to GPS system or via relating to local centers.)
- The mover should provide all of the equipment which are necessary for installing and operating the connections between existing measuring systems and data concentrator and also other connections, for example wires and cables, connectors and etc.

2-2- Data concentrator system . part two . Local centers

Each local center is bound to collect all the data of the area stations and present them an useful information bank after classifying them.

We can use different methods to have a mutual communication between local centers and stations and also power market national center and to exchange the data between above centers.

The used protocol in each layer of the network like physical communications, data links and information exchange, should be in accordance with existing standards.

Because of existing phone line in major stations, it's easy and desirable to use phone line for communication between local centers and stations of the station don't have phone line, we can use satellite technology. The specification of communication methods will explain later.

2-2-1- The necessary hardware for local centers

The number and capability of existing computers in local center is defined based on the number of enveloped stations in a local center to keep the real time nature of the data concentrator network.

- A main server is necessary in computer equipments in each local center.
- An application server is necessary in computer equipments in each local center.
- This equipment should have the capability of having communication with power market national center, other local centers and all the related stations via different protocols and should be match with the different communication networks inclusive optic fiber, microwave, PLC, phone line and etc.(Now it's recommended to use dial-up method to communicate with stations and leased line method to communicate with power market national center.)
- This communication should be in accordance with IEC 870-5-101.
- The communication of local centers with power market national center can be via leased line method and in accordance with IEC 870-6 standards.
- The mentioned computers should have the capability of concentrating and saving a mass of data .(At least 30 parameters of each measuring system is saved in 5 minutes period. The data of at least 20 measuring system is concentrated in each station and is added to daily information archive.)
- The system processor should be busy 25% of local capacity in normal work and 45% of local capacity in hard working.
- The computer equipment should include the behind memories, main memories and mass memories.
- The information should be restored from behind memory easily.
- The behind memory capacity should be enough to long time storage of information in compare with stable memory capacity. It should be able to store the information of at least one year.
- The computer equipment of local center should include supporting systems.
- The contractor should warrant that any kind of disturbance won't prevent the supporting system operation.
- Necessary printers should be installed in all of the local centers.
- The printers accuracy and speed should be match with operating system and other equipment.

- The printers should be the current kind of printers and should not need to a special kind of paper.
- It should be use the local network LAN to exchange the information between the computers which are in local centers.
- The suggestive LAN system should be in accordance with current standards.
- The kind of LAN should be explained completely in presented proposal.
- The mover is bound to predict and prepare all the side equipments, for example hub, cables, connections and etc.
- The local centers should be synchronized with power market national center and stations and should have the capability of connecting to GPS system.
- The system should follow valuable communication protocol to communicate with GPS system.
- A continuous supply (UPS) should supply all of the computers and local center modems.
- The local center UPS should be a real on-line mutual converter.
- The suggestive system equipment should provide above needs.
- The mover should present the specification and complete characteristics of his network software equipment in technical information table.

2-2-2- The first part of software. local center software

- The software should be in accordance with international standards.
- This software should be real time and it must be compatible with all current and valid operating system.
- The software should be modular and its different functions should work independently.
- The software should be secure against viruses.
- The software should have the capability of on-line test and detecting defects.
- This modular software should have the ability to process enormous amounts of information.
- The software should have the capability of increasing or changing the functions easily, if it's needed.
- It should have an appropriate operator environment.
- In the operator menu, the selections must be related to the subject and express the concept of operator clearly.
- The software should provide an environment for defining and receiving requests and also answering them.
- This software should have a special secondary program to control the behind system work.
- This secondary program should activate substitution systems if there is a failure in main system and it could recognize and remove the fault.
- The software should have the ability to communicate with all the correlate stations.
- To communicate with other stations, the software should be compatible with different protocols.
- The software must connect to correlate stations automatically and alternately and receive the information.

- The allowed operator should have the ability to adjust the receiving time of the information.
- The allowed operator should have the ability to receive the information of a special station always. via a valid accession code.
- If there is a failure in establishing connection with stations, the software should activate an alarm and show the problem in a message box.
- The software should have the ability to report all the failures with their occurrence date and time.
- This report could be in the form of file or a print of information table or it could be sent to national center if they request.
- The software should be able to send some information to each station in order to arrange and configure one or more than one installed measuring system in the station, if the allowed operator or Power Market national center request. (The contractor proposals about remote adjustment method of measuring system are acceptable.)
- The software should be able to report all the adjustments with the time and date.
- This report could be in the form of file or printed information table or it could be sent to Power Market national center, if they request.
- The software should be equipped to an accurate clock pulse and be able to synchronize with GPS system.
- The connection to GPS system should be via valid and standard protocols.
- The local centers software should be able to identify and process the received information include measured or calculated data from appropriate information bank.
- This software should be able to classify the information primarily based on the installation location of a measuring system and then from this information groups:
 - The group of generator measuring system information.(Generation Co. field)
 - The group of transmitter measuring system information.(Transmission Co. field)
 - The group of consumer measuring system information.(Distribution Co. field)
- The information bank of the software should include this information:
 - The value of PF, F, V, I parameters of the network related to each measuring system with time label.
 - The value of energy parameters of the network related to each measuring system with time label.
 - The value of the quality parameters of the network related to each measuring system with time label.
 - Minimum and maximum values of all the parameters, of the network related to each measuring system with time label.
 - The adjustments of all measuring systems with the last date and time.
 - A list of all failures in communication lines in a special period and programmable for at least 4 months.
- The software information bank should make a suitable archiving system to access to information by symbolic names which are translated to file names automatically.

- The software should be equipped to an accession central program which is based on operator preference to prevent from illegal accessing.
- If the accession code of allowed operator is correct, all the commands and manual functions of the software will be performed.
- External systems should be able to access to information bank with an appropriate accession code via a remote control system.
- The local centers software should be able to exchange the information with Power Market national center or other local centers.
- This relation should be mutual and compatible with IEC 870-6 standard.
- If it isn't possible to connect to national center, the software should exchange its information with the first or second local center and notify the problem.
- The software should present a list of its run programs and commands with time table.
- The software should provide the possibility of accession to the information bank and drawing diagrams of different network parameters for allowed cooperators via suitable accession code.
- If the accession code of allowed operator is correct, then it will be possible to perform all the requested commands by the software.
- The software should provide the possibility of changing some information or give some new data manual for some operators via a special code.
- It should be possible to save the information bank history or a part of it on transferable hard disks or side memories.
- It should be possible to transfer the information again from these memories to the system and process and display them.

2-3- Data concentrator system, part three – power market national center

power market national center is bound to gather and order all the information from local centers and form a suitable information bank for power market software. There are standard communication protocols for establishing manual connection between power market national center and local centers and each station. The used protocols for each network layer such as physical communications, data links and exchanging the information should be in accordance with IEC 870-6 standard.

2-3-1- The needed software for power market national center

The number and capability existing computers in power market national center should be defined accurately to keep to real time nature of the data concentrator network.

- A main server is necessary in computer equipments in power network national center.
- One or more than one operation server is necessary in other equipment in each power market national center.
- This equipment should have the capability of having communication with Power Market national center, other local centers and all the related stations via different protocols and should

- be compatible with the different communication networks include optic fiber, microwave, PLC, phone line and etc.(Leased line is recommended in this communication method.)
- The mentioned computers should have the capability of concentrating and storing a mass of data. (The information of at least 60 station are concentrated in a local center in 5 minutes and are added to daily archive.)
 - The system processor should be busy 25% of total capacity in normal work and 45% of total capacity in hard working.
 - The computer equipment should include the behind memories, main memories and mass memories.
 - The information should be restored from behind memory easily.
 - The behind memory capacity should be enough in compare with stable memory capacity to store information for long time. It should be able to store the information of at least one year.
 - The computer equipment of power market national center should include supporting systems.
 - The contractor should warrant that any kind of disturbance won't prevent the supporting system operation.
 - Several printers should be installed in power market national center to print the reports.
 - The accuracy and speed of the printer should be compatible with operating system and other equipment.
 - The printers should be the current kind of printers and should not need to a special kind of paper.
 - It should be used the local network LAN to exchange the information between the computers which are in power market national center.
 - The suggestion LAN system should be in accordance with current standards.
 - The kind of LAN should be explained completely in presented proposal.
 - The mover is bound to predict and prepare all the side equipment, such as hub, cables, connectors and etc.
 - Power market national center should be synchronized with local centers and stations and should have the capability of connecting to GPS system.
 - The system should use a valid communication protocol to communicate with GPS system.
 - A continuous supply, UPS should supply all of the computers and modems in power market national center.
 - The power market national center UPS should be a real on-line mutual converter.
 - The suggestive system equipment should provide above needs.
 - The mover should present complete specification of his network software equipment in technical information table.

2-3-2- The second part of software power market. national center software

- The software should be in accordance with international standards.
- This software should be real time and it must be compatible with all current and valid operating system.

Comprehensive Energy Exchange Plan

- The software should be secure against viruses.
- The software should have the capability of on-line test and detecting defects.
- This modular software should have the ability to process enormous amounts of information.
- The software should be modular and it must be able to process enormous amounts of information.
- The software should have the capability of increasing or changing the functions easily, if it's needed.
- It should have a suitable operator environment.
- In the operator menu, the selections must be related to the subject and express the concept of operator clearly.
- The software should provide an environment for defining and receiving requests and also answering them.
- This software should have a special secondary program to control the behind system work.
- This secondary program should activate substitution systems if there is a failure in main system and it could recognize and remove the fault.
- The software should have the ability to communicate with all local center or each station.
- To communicate with other stations, the software should be compatible with different protocols.
- The software must connect to all local centers automatically and alternately and receive their information.
- The moved software should have the ability to adjust the receiving time of the information by a valid accession code.
- The allowed operator should be able to receive the information of a special local center always, via a valid accession code.
- If there is a failure in connecting to local center, the software should activate an alarm and show the problem in a message box.
- The software should have the ability to report all the failures with their occurrence date on a time.
- This report should be in the form of file or a print of information list or it could be sent to other local centers.
- The software should be able to send some information to the station or it's related local center in order to arrange and configure one or more than one installed measuring system in each station, if the allowed operator request.
- This software should be able to report all the adjustments with their time and date.
- The report can be in the form of file or printed information list or it can be sent to correlated local center, if they request.
- The software should be equipped to an accurate clock pulse and be able to synchronize with GPS system.
- The connection to GPS system should be via valid and standard protocols.
- The national center software should be able to prepare the local centers data in the form of a perfect information bank to present to power market.

- This information bank should be useful in different standard software environments.
- The software should be able to classify the information suitably based on the installation site of a measuring system and formed information group in local centers and then it should be able to form this groups:
 - The group of generator measuring system information. (Generation Co. field)
 - The group of transmitter measuring system information. (Transmission Co. field)
 - The group of consumer measuring system information. (Distribution Co. field)
- The information bank of the software should include this information:
 - The value of PF, F, V, I parameters of the network related to each measuring system with time label.
 - The value of energy parameters of the network related to each measuring system with time label.
 - The value of the quality parameters of the network related to each measuring system with time label.
 - Minimum and maximum values of all the parameters, of the network related to each measuring system with time label.
 - The adjustments of all measuring systems with the last date and time.
 - A list of all failures in communication lines in a special period and programmable for at least 4 months.
- The software information bank should make a suitable archiving system to access to information by symbolic names which are translated to file names automatically.
- The software should be equipped to an accession central program which is based on operator preference to prevent from illegal accessing.
- If the accession code of allowed operator is correct, all the commands and manual functions of the software will be performed.
- External systems should be able to access to information bank with an appropriate accession code via a remote control system.
- The software should present a list of its run programs and commands with time table.
- The software should provide the possibility of accession to the information bank and drawing diagrams of different network parameters for allowed cooperators via suitable accession code.
- If the accession code of allowed operator is correct, then it will be possible to perform all the requested commands by the software.
- The software should provide the possibility of changing some information or give some new data manual for some operators via a special code.
- It should be possible to save the information bank history or a part of it on transferable hard disks or side memories.
- It should be possible to transfer the information again from these memories to the system and process and display them.

2-4- Data concentrator system . part four. special equipment

AS mentioned, it's necessary to use ups device to supply the equipment in all parts of the data concentrator such as national center, local centers and stations. The specification of this device and side batteries are as following.

2-4-1- Necessary test software for the stations.

- This software is supposed to do required tests and specify probable aversions in the stations.
- At first this software should be real time.
- It should be compatible with current and valid operating system and protocols.
- The software should be modular and it's different functions should work independently.
- It should be possible to change or increase different functions easily in this software.
- The software should have high level security against viruses.
- The presented software of data concentrator should encode and address the receiving data from measuring systems and then it should be able to arrange and classify then based on the measuring system kind and location.
- This software should be able to give the information about measuring system adjustments at every second.
- This software should be able to give a report and present a list of measured parameters by allowed operator with a particular period in a special time range.
- The software should be able to exchange the information with local centers and national center.
- This software should be able to send the measuring system information to correlated local center of other neighbor based on the operator need.
- The software should have the capability of sending the information to each measuring system to adjust and configure the system.
- The software should activate an alarm to announce the failures in establishing connection with one of the measuring system.
- The software should activate the suitable alarm in the case of being a failure in connection with local center.
- It should be possible for the software to send the received information from measuring systems serial to the printer. (Sending the information serial is followed one of the current protocols, for example RS 232)

2-4-2- UPS specification

UPS is an uninterrupted supply that provides the supply of all computers, modems, printers and related hardwires in local centers, national center and also in stations.

- UPS input is one phase 220 VAC voltage.
- Its output is a 220 V sinusoidal with high accuracy and capacity.

- The suggestive ups of local centers should be a real on-line mutual converter.
- The suggestive ups of the stations should be off-line and their switching delay time should be at most times.
- UPS outputs should be keep safe against short circuit and temporary abnormal currents.
- Each UPS should be equipped to these conversation parts:
 - Current limiter
 - Alarm contact for regulator input
 - Alarm contact for the converter input
 - Alarm contact for the main input
 - Alarm contact for the system output
 - Disconnecter circuits with temporary magnetic disconnection and there was disconnection for over load
 - Fuse with alarm contact
- Each ups should be equipped to these alarms:
 - Error alarm of the regulator
 - Inverter error alarm
 - Over load error alarm
 - By-pass block error alarm
- It should be provided free contacts to use the mentioned alarms.
- Each ups should be equipped to voltmeter, ampermeter and frequency meter.
- The contractor is bound to present working test evidence of the mentioned devices.

2-4-3- Battery specification

- The batteries should not need to continual maintenance and inspection.
- Their size should be suitable for the environment.
- The batteries should be mounted on metal or wood pedestal.
- There should be enough space to service and maintain them.
- The contractor is bound to do the transportation, installation, primary charge, testing, discharging and consecutive charging of the battery..
- The meter should present suitable testing device for service the above equipment.
- The nominal value of capacitance is followed this equation.

$$C = I_n * 3.75$$

I_n = discharging current (A) determined by load.

3- Information processing system and power market software

The basic aim of power market performance is based on correct information. In fact the Power Market software dose all the processing and necessary computation to competitive selling and buying the energy all Over the network based on real time information of national center information bank.

This software has some limitation, possibilities and capabilities which one mentioned in continue.

3-1- General specification of Power Market financial computation and settling software

- This software should be in accordance with international standards.
- The software should be real time and compatible with all current and valid operating system in the world.
- The software should be modular and be able to process enormous amounts of information.
- It should be possible to change the functions easily in this software.
- The software should be secure against viruses.
- The software should have the capability of on-line test and detecting defects.
- It should have an appropriate operator environment.
- The operator menu, the selections must be related to the subject and express the concept of task clearly.
- The software should provide an environment for defining and receiving requests and also answering them.
- This software should have a special secondary program to control the backup system work.
- This secondary program should activate substitution systems if there is a failure in main system and it could recognize and remove the fault.
- The software should be equipped to an accession level controller of the users to keeping the security.
- The software should provide an environment to define new and necessary functions for computing and deriving undefined parameters.
- The software should have the possibility of doing special mathematical operation on the stored information.
- It should be possible to define these operation in the software.

3-2- Particular specification of power market financial computations

There's no need to explain the details of the software because of being standard to basis of the poser market software. It's obligatory to present a practicable model of this software in a comprehensive power market system which is being implemented.

- The mover can introduce the possibilities and capabilities of his proposal standard software.

- All of the possibilities and capabilities of this software should be in accordance with current and valid standards.
- The mover should introduce a practicable model of the software.

4 – The mover's or contractor's commitments

The main good of this plan is establishing suitable communication between measuring systems in stations, local centers and power market national center to provide suitable conditions for reading parameters or adjusting measuring systems remotely.

4-1- Executive commitments

- The mover should provide appropriate physical conditions to transit the information from installed measuring systems in the stations to local centers and then to power market national center.
- The presented proposal should include designing and configuring details of the system and organizing and managing the plan implementation.
- The mover or the contractor is bound to be compatible with the employer's changes in all designing and implementing stages.
- The contractor is bound to provide and transport on the required hardwares such as measuring systems or the equipment of information concentrating and managing network, also provide all the required softwares under supervision of Tavanir.
- In addition to providing appropriate fields for installing measuring system such as installing or controlling voltage transformers or suitable current in high voltage substations and energy exchanging terminals, Tavanir and correlated regional power companies are bound to install these systems.
- The contractor is bound to all the adjustments and tests and primary delivery after installing and wiring the measuring systems.

4-2- Inspection and testing of the system

- The contractor is bound to all necessary tests after performing each stage of the work and then present the results of test to the employer.
- The contractor is bound to test all the software parts in each stage via simulation of input data.
- The contractor is bound to supply all the tables of equipment test and adjustment based on existing standards.
- The employer is allowed to be in location while final test.
- To reach this aim, the contractor is bound to announce the time and location of tests in a written letter to the employer's company at least one week before the exchange date of tests.
- Providing all the required equipment for doing tests is the duty of the contractor.

4-3- The equipment guarantee services

- The mover should present a standard guarantee service and should guarantee them at least for a year.
- One year guarantee is suitable for measuring systems.
- Two-year guarantee and after selling services are obligatory for the software.
- The presence of a representative for 5 mounts is obligatory in software part.

4-4- Presenting test equipment

- The mover should present suitable device and test method and he should express the specification of suggestive devices in technical information tables.

4-5- Implementation work shops

- The mover is bound to establishing work shops and provide all the facilities and required things for the work shop and personnel.
- In this subject the employer doesn't have any commitment.

4-6- Storing and maintenance the equipment

- The contractor is bound to deliver, store. Keep the equipment in different climate conditions, transport and install the equipment.
- All the equipment should be keep safe against erosions and transportation damages.
- The employer doesn't undertake any commitment in this case.

4-7- Presenting the schematics

- The contractor is bound to present all the electrical and mechanical schematics at the end of each stage. These schematics are as follows:
 - The schematic of measuring systems installing and writing.
 - The schematic of measuring systems diagram.
 - The schematic of related connection of measuring systems installing and writing.
 - The schematics of network equipment installing and wiring in all stations, local centers and power market national center.

4-8- Educational courses

- The contractor is bound to establish educational courses and provide education and exploitation booklets related to different parts of the system.
- The contractor is bound to do all his educational commitments during different stages.

5 – Necessary documents

The mover should present these documents:

- Primary plan for implementing comprehensive plane of energy exchanging.
- Technical information table of measuring systems.
- Guarantee tables of measuring systems.
- Technical specification of suggestive hardware to equip the stations.
- Technical specification of the software to equip the stations.
- Technical specification of suggestive hardware to equip local centers.
- Technical specification of suggestive software to equip local centers.
- Technical specification of suggestive hardware to equip national center.
- Technical specification of suggestive software to equip national center.
- A summary of previous works. (Specially presenting a practicable model of information concentrating software and power market softwares.)
- Confirmation of other employer companies about successful projects.
- Confirmation of covering with international companies.
- Present a resume of company.
- Present company personnel's previous works.
- If it's possible, present financial backgrounds of the company.

6 – Considerations

6-1- Implementing stages of the plan

- The employer should specify different stages of the plan based on preferences and import them to the contractor.
- The contractor is bound to observe the specified preferences to implement the plan and present his schedule based on them.

6-2- Exceptions

- The contractor is allowed to suggest other selections in some items in his suggestive plan with written allowance of the employer.

6-3- Employers commitments

- The employer doesn't undertake any commitment about providing required equipment in this project.

- The employer is undertake to provide suitable communication field to implement the information concentration network plan.
- The employer is undertake to provide suitable field to install measuring systems in all stations.
- The employer is undertake to give all the information of lines to the contractor in appropriate tables while adjusting the measuring systems. This information include the coefficients of correlated voltage and current transformers.

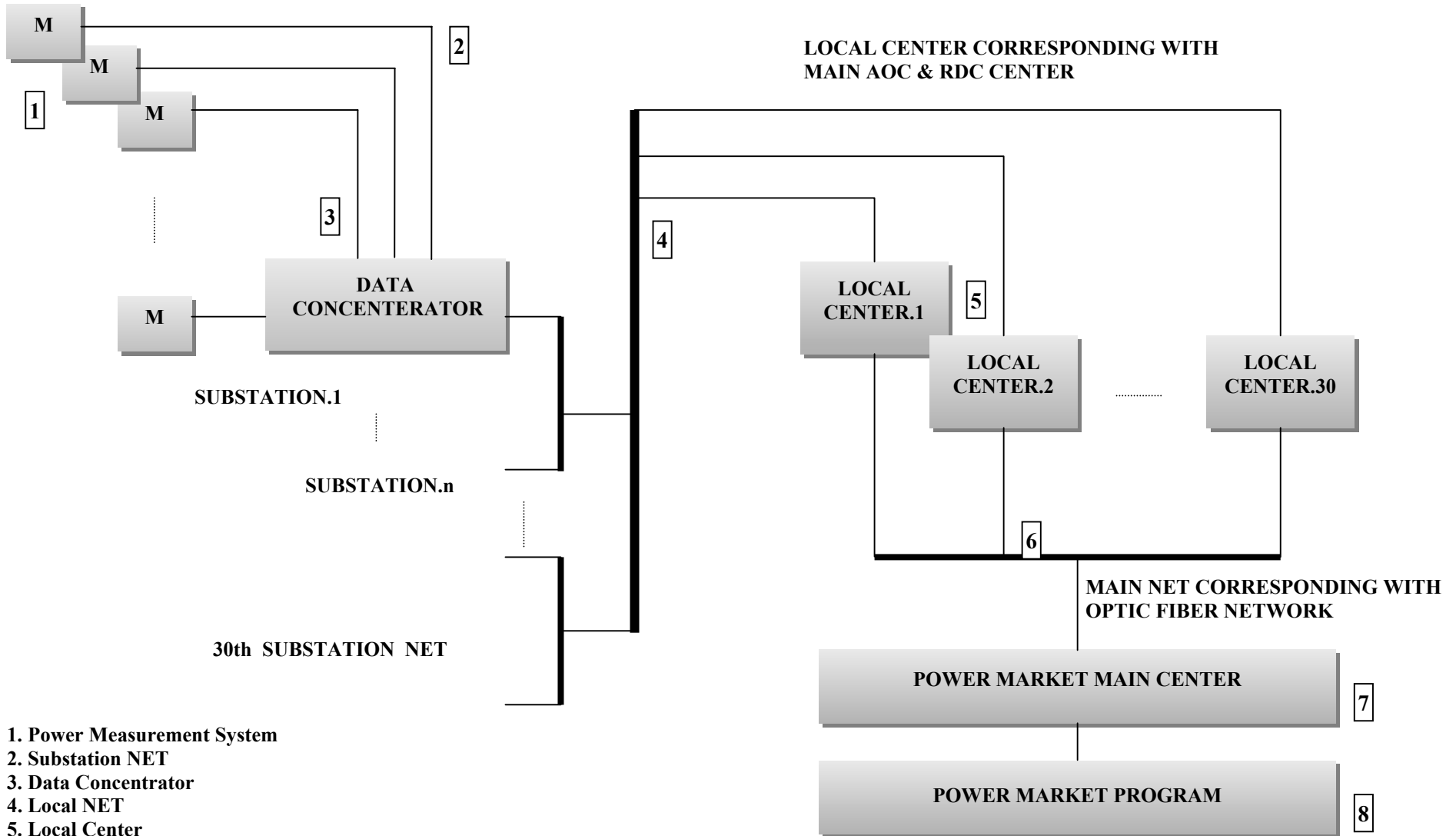
6-4- References

- This standards have been used as reference.

IEC687 IEC1268 IEC1107 IEC1361 IEC62053-31 IEC62053-61
IEC145 IEC514 IEC1358 IEC387 IEC62056-41 IEC62056-51
IEC736 IEC1354 IEC338 IEC211 IEEE1390 IEEE1377
IEC145 IEC514 IEC1358 IEC387 IEC62056-52 IEEE1390.2
IEC870. Modbus DNP3 IEC870. ITU-T V.34,

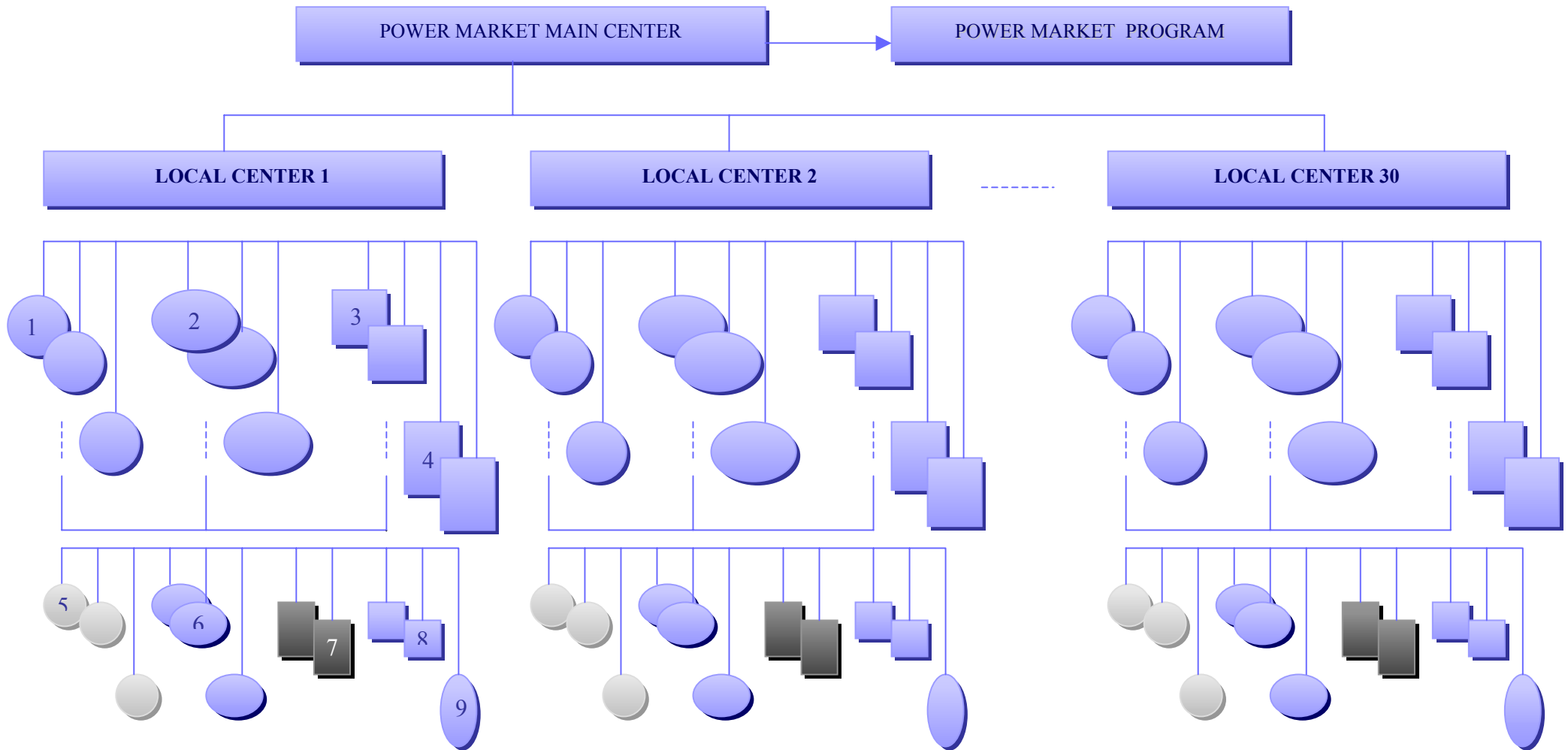
✓ Comprehensive Plan of Energy Exchange

PRIORITY OF AVAILABLE POWER METER



1. Power Measurement System
2. Substation NET
3. Data Concentrator
4. Local NET
5. Local Center
6. Main NET
7. Power Market Main Center
8. Power Market Program

✓ Comprehensive Plan of Energy Exchange



- First Priority
- Second priority
- Third priority

1. Power Transmission Substation
2. Power plane Substation
3. Power Station with Inter- regional Line

4. Power Station with Industrial costumer
5. Line & Power Transformer 's Meter
6. Generator Output Meter

7. Incoming 20 Kv Meter
8. Inter-regional Line Meter
9. Industrial costumer Meter