
Power / Energy

Monitoring

System

An Overview

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Energy / Power Monitoring System

Purpose: A System used to measure Electrical Energy / Power and other parameters for any Feeder of an Electrical Distribution Network. For example, a Substation can use it to monitor Incoming Feeders and all Outgoing Feeders simultaneously in Real Time. Likewise, an Industry can monitor Grid Feeder, All Generators, and all electrical Loads simultaneously in Real Time.

System Components:

- **MFD:** This System captures the Feeder Electrical Parameters using a Multi Functional device with isolated Current Transformers. This data is captured once every second per feeder.
- **Data Logger:** This captured Data is then stored in a non-volatile memory using a Data logger. This Data logger communicates with each MFD, reads / converts and stores the data in its memory. This acts like a Black Box.
- **Server:** The logged data from the Data Logger is then transferred to a Computer / Server using Ethernet whenever the computer requests. In case the computer is not working, then the data remains in the Data logger.
- **Clients:** The data in the Computer is then converted to a SQL (Database compatible) format, by the software. This is then available to the entire Client computer to view the Management Information Reports.
- **Reports:** The reports are in any time frame, from every 5 minutes to every month. The trends are in Graphical and Tabular fashion for any Feeder or a group of Feeders.

Necessity: Any bulk user of Electrical Power needs this System for the following reasons:

- **Central Electricity Regulatory Commission (Power Market) Regulations, 2010** requires Bulk Purchasers and Sellers of Power to intimate their Consumption / Generation every 15 minutes one day in advance to the Grid monitoring Authorities. In case of under or over drawl from the Grid, the User is heavily penalized, which is inversely proportionate to the frequency of the Grid at that instant. This requires Real Time data on the Power Generation / Consumption for any User, and consolidation every 15 minutes.
- **Availability Based Tariff** will also be applicable to all Bulk Users and Generators. The ABT regime will set the Power tariff based on various parameters, mainly on the deviation of User drawl from the Grid, or deviation of Generators capacity to feed the Grid. This requires Real Time data on the Power Generation / Consumption for any User, and consolidation every 15 minutes.



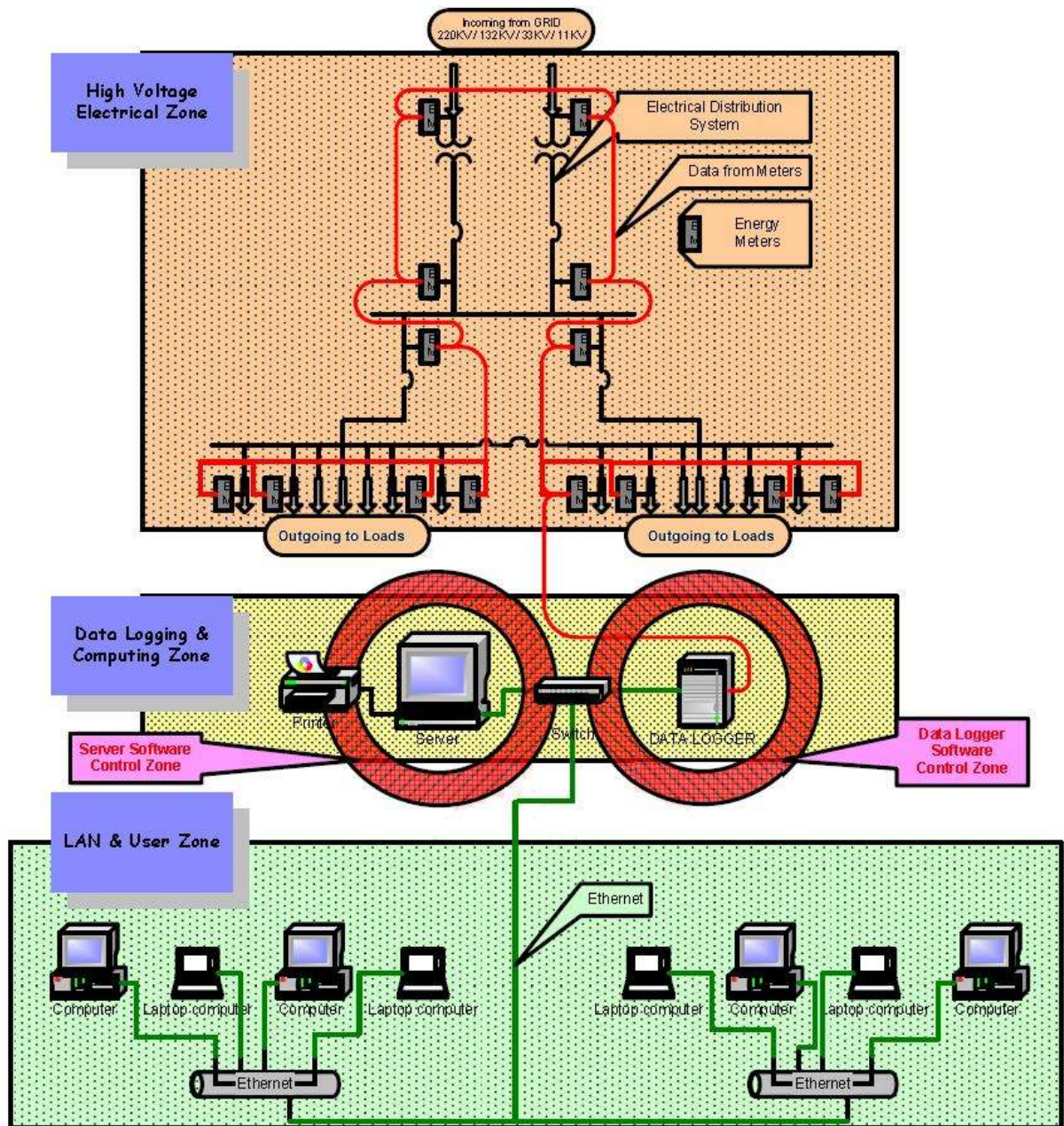
- **Energy Audit:** This System will help in identifying Energy consumed in every feeder in any time frame. This when clubbed with the production data; give the Energy per unit of production at different time zones. This identifies Energy loss in various processes, and Energy cost per unit of production.
- **Real Time Energy Consumption Scenario:** Any user on the LAN can see the Energy Flow through the various Feeders at any instant. This is useful to curb certain processes when the Demand is high or getting exceeded. It is also useful to Maintenance Engineers to identify the faults due to over heating and Electrical short circuits etc.
- **Long Term Trending of Energy Costs:** The data available can plot trends of Energy usage over prolonged time period, which enables the User to project future demand, and plan the infrastructure accordingly. It is also useful for analyzing the usage of Energy if certain process parameters are changed.

System Deliverables:

1. Data Logger with Software
2. MIS Software
3. Client Server Software
4. MFD with software for MFD Reading
5. Cabling of PC / CT / RS485
6. Computers and Peripherals
7. Customization of User Needs

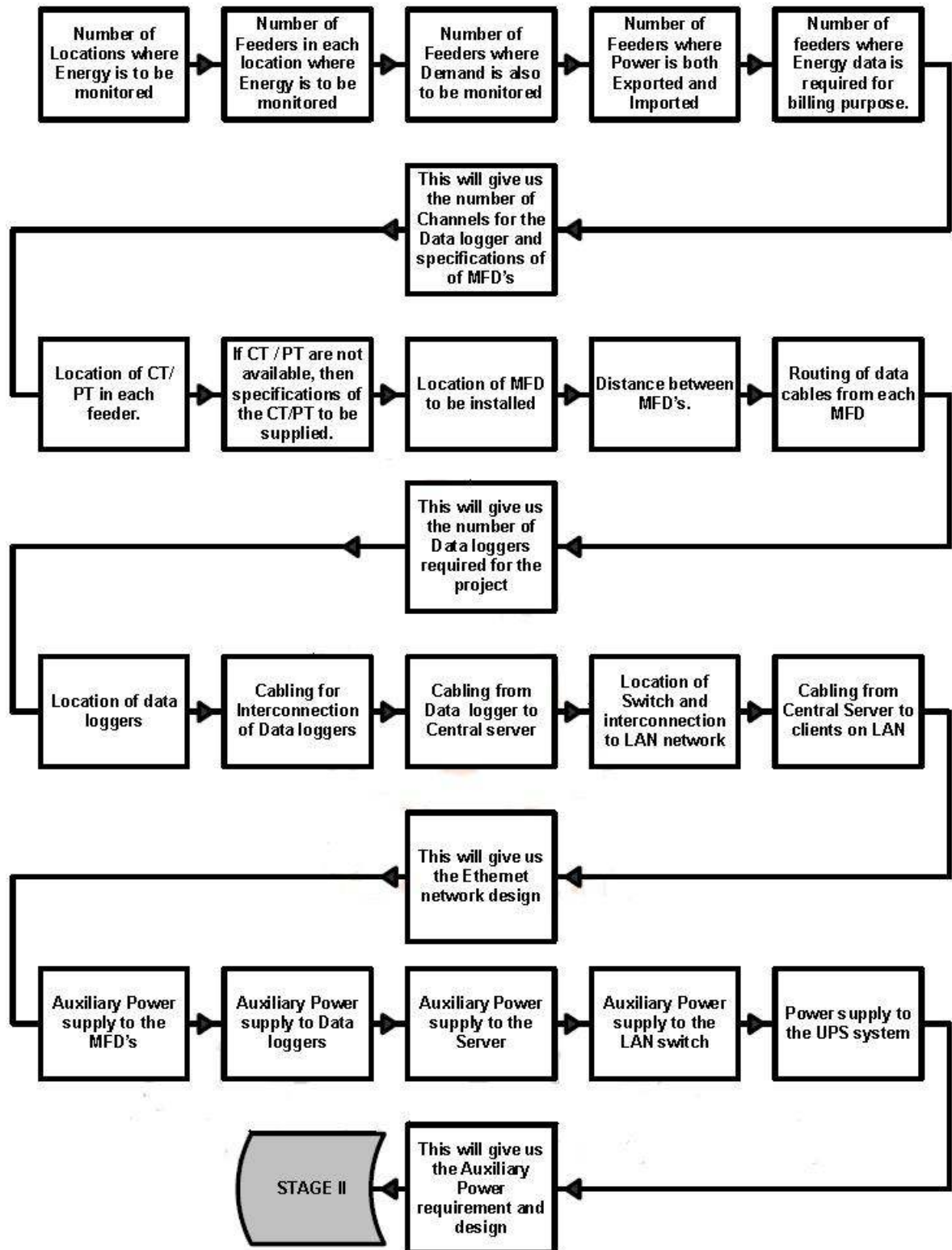


Block Diagram:



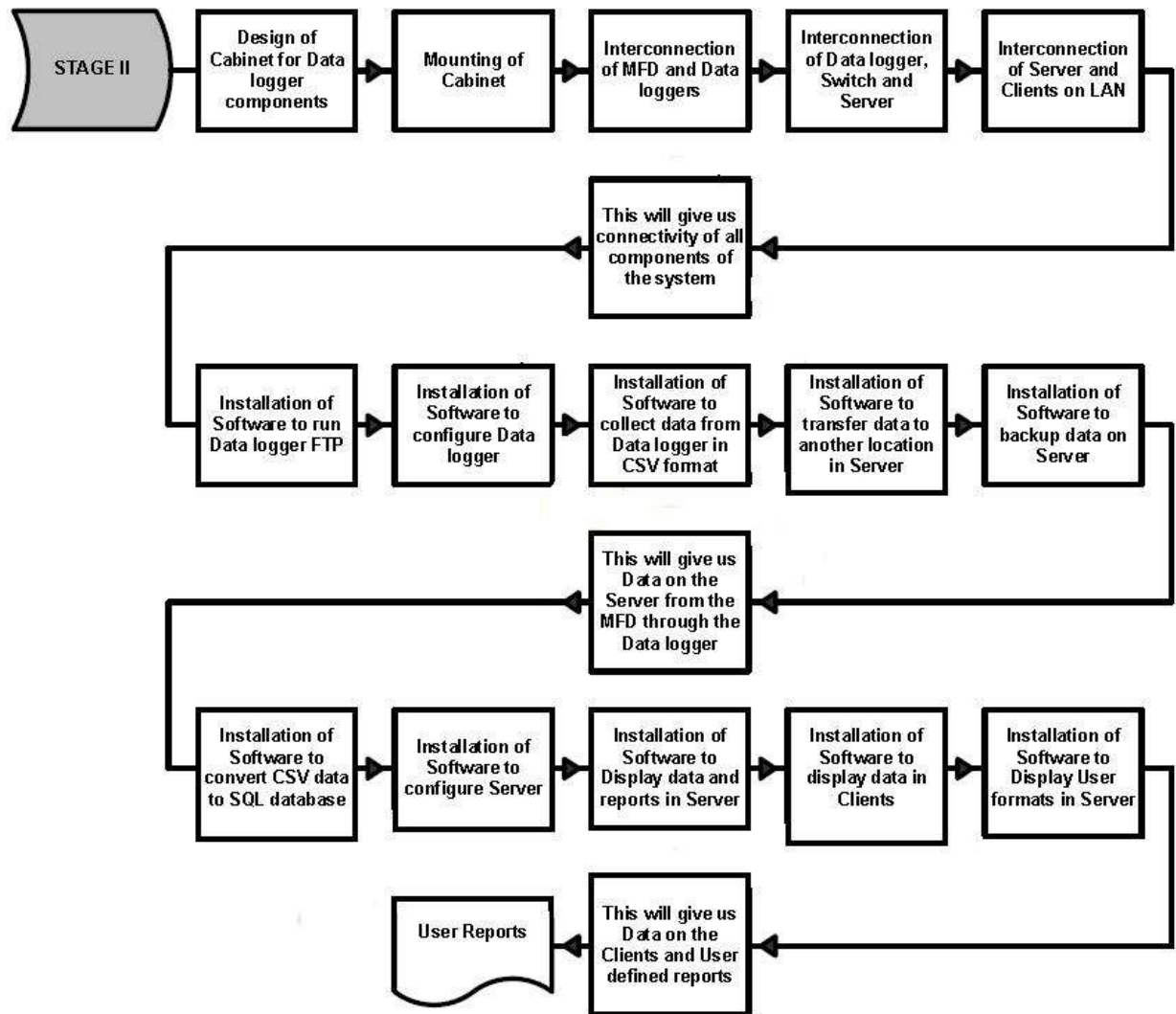


System Flow Diagram of Installation (Stage – 1)





System Flow Diagram of Installation (Stage – 2)





Graphs & Reports

Report of Generator Power Parameters at 210 MW Generator

Scan Time	Active Power	Active Power R	Active Power Y	Active Power B	Reactive Power
23:59 13/01/2010	83.946M	27.255M	29.013M	27.678M	-6617.111k
23:58 13/01/2010	84.496M	27.515M	29.201M	27.779M	-7227.75k
23:58 13/01/2010	87.509M	28.417M	30.352M	28.74M	-8901.89k
23:57 13/01/2010	90.082M	29.162M	31.178M	29.742M	-8797.298k
23:56 13/01/2010	89.516M	29.08M	30.811M	29.624M	-8728.921k
23:56 13/01/2010	89.084M	29.031M	30.437M	29.615M	-8931.202k
23:55 13/01/2010	89.207M	29.05M	30.54M	29.618M	-8046.563k
23:54 13/01/2010	89.032M	29.009M	30.488M	29.535M	-7039.556k
23:54 13/01/2010	88.799M	28.804M	30.537M	29.458M	-7532.126k
23:53 13/01/2010	87.722M	28.525M	30.202M	28.995M	-7796.386k
23:52 13/01/2010	85.102M	27.857M	29.04M	28.205M	-6969.696k
23:52 13/01/2010	82.926M	26.938M	28.502M	27.487M	-6935.91k
23:51 13/01/2010	85.222M	27.602M	29.178M	28.442M	-6451.853k
23:50 13/01/2010	87.463M	28.299M	30.011M	29.153M	-5109.066k

Report of Active Power at 210 MW Generator Feeders

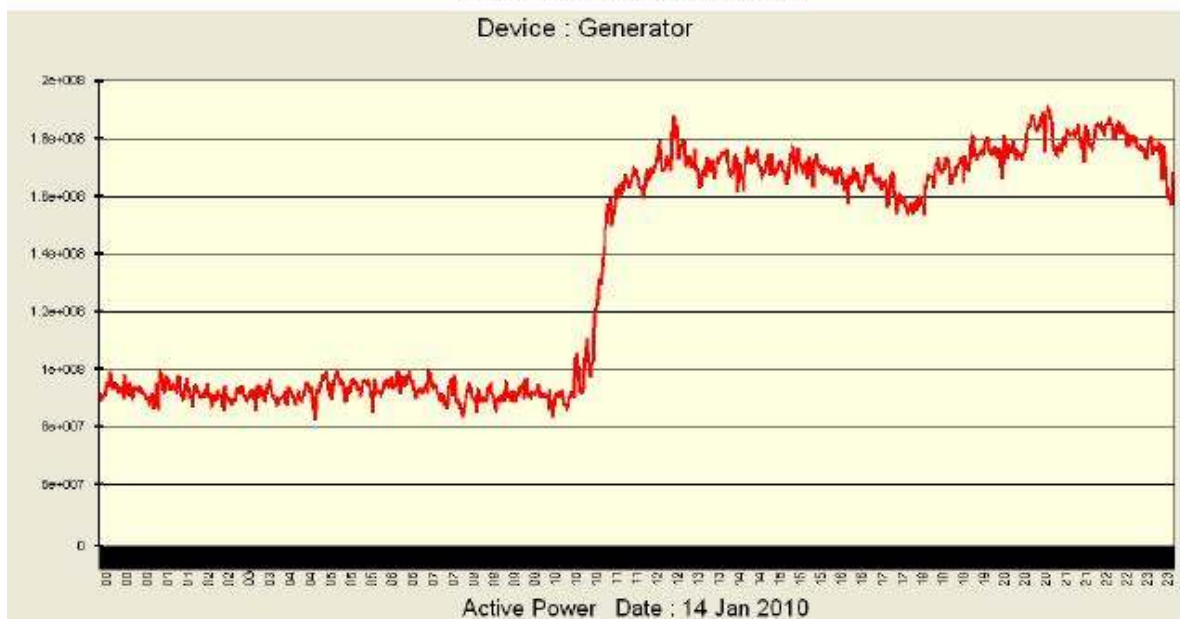
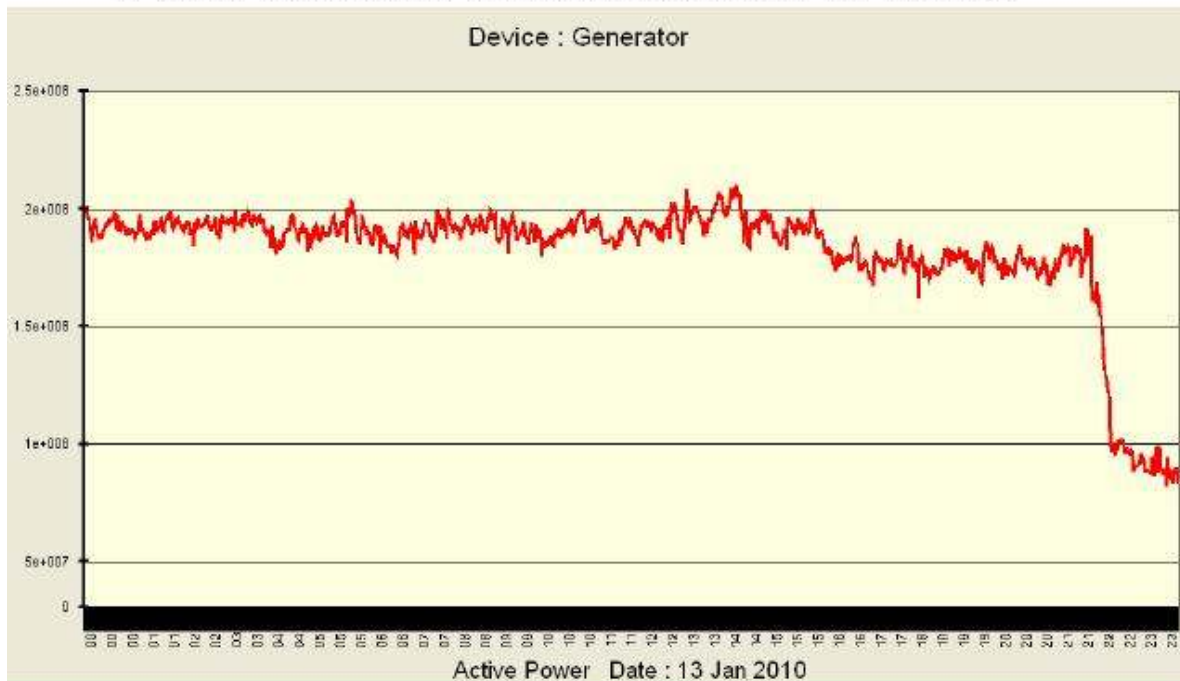
Scan Time	Generator Xmer	Generator	UAT -1A	UAT 1B	Sm Xmer	ESP Xmer 1A
23:59 13/01/2010	71.138M	83.946M	3551.454k	8180.835k	2351.572k	435.486k
23:58 13/01/2010	71.574M	84.496M	3576.585k	8371.872k	2583.044k	417.09k
23:58 13/01/2010	74.875M	87.509M	3507.658k	8289.112k	2466.364k	417.184k
23:57 13/01/2010	76.995M	90.082M	3575.217k	8260.079k	2253.001k	416.141k
23:56 13/01/2010	76.732M	89.516M	3510.801k	8219.186k	2256.411k	418.891k
23:56 13/01/2010	76.425M	89.084M	3536.525k	8176.029k	2292.638k	419.662k
23:55 13/01/2010	76.554M	89.207M	3527.806k	8142.858k	2275.406k	418.325k
23:54 13/01/2010	76.308M	89.032M	3531.519k	8156.528k	2214.832k	416.942k
23:54 13/01/2010	76.369M	88.799M	3458.413k	7988.688k	2196.822k	415.797k
23:53 13/01/2010	75.029M	87.722M	3530.001k	8070.842k	2364.202k	416.777k
23:52 13/01/2010	70.659M	85.102M	5123.633k	8181.949k	2275.955k	413.478k
23:52 13/01/2010	68.504M	82.926M	5171.762k	8292.262k	2232.299k	414.824k
23:51 13/01/2010	70.945M	85.222M	5136.284k	8209.48k	2182.191k	414.936k

Report of Generator Power Parameters at 210 MW Generator

Scan Time	Active Power	Power Factor	Frequency	Voltage LL	Current Ave.	Wh Rec.
23:59 13/01/2010	83.946M	1.000	50.13	16.411k	2963.94	932.2295G
23:58 13/01/2010	84.496M	0.990	50.13	16.413k	2989.97	932.2286G
23:58 13/01/2010	87.509M	1.000	50.15	16.413k	3093.16	932.2276G
23:57 13/01/2010	90.082M	0.990	50.2	16.407k	3189.63	932.2265G
23:56 13/01/2010	89.516M	1.000	50.19	16.412k	3183.97	932.2254G
23:56 13/01/2010	89.084M	0.990	50.2	16.408k	3151.06	932.2249G
23:55 13/01/2010	89.207M	1.000	50.2	16.415k	3151.06	932.2238G
23:54 13/01/2010	89.032M	1.000	50.19	16.41k	3144.19	932.2228G
23:54 13/01/2010	88.799M	1.000	50.22	16.409k	3137.61	932.2218G
23:53 13/01/2010	87.722M	1.000	50.18	16.414k	3097.32	932.2206G
23:52 13/01/2010	85.102M	1.000	50.10	16.409k	3003.5	932.2197G
23:52 13/01/2010	82.926M	1.000	50.14	16.413k	2929.38	932.2188G
23:51 13/01/2010	85.222M	1.000	50.06	16.413k	3012.68	932.2177G
23:50 13/01/2010	87.463M	1.000	49.98	16.412k	3084.3	932.2167G
23:50 13/01/2010	86.306M	1.000	49.89	16.41k	3041.26	932.2157G

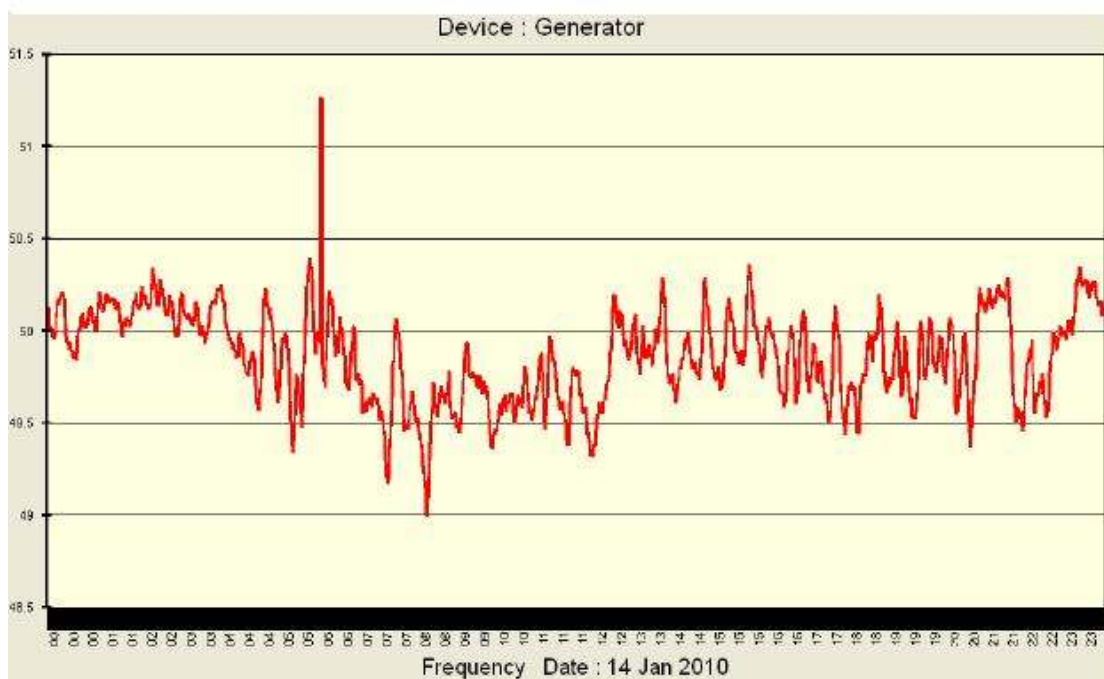
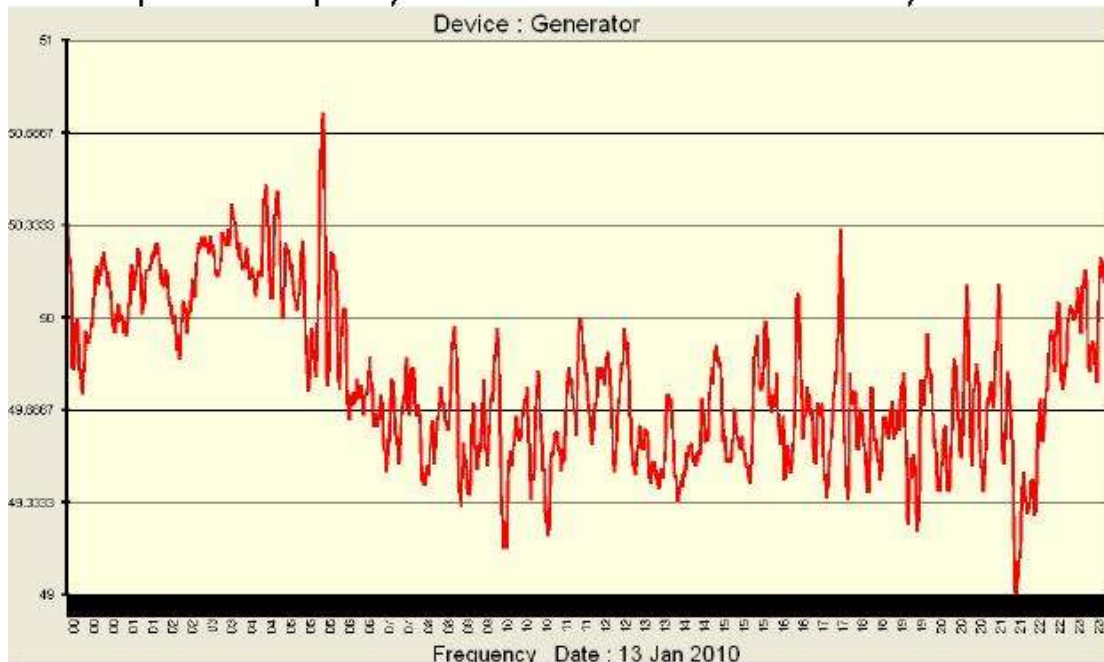


Trend of Active Power of 210 MW Generator for two days



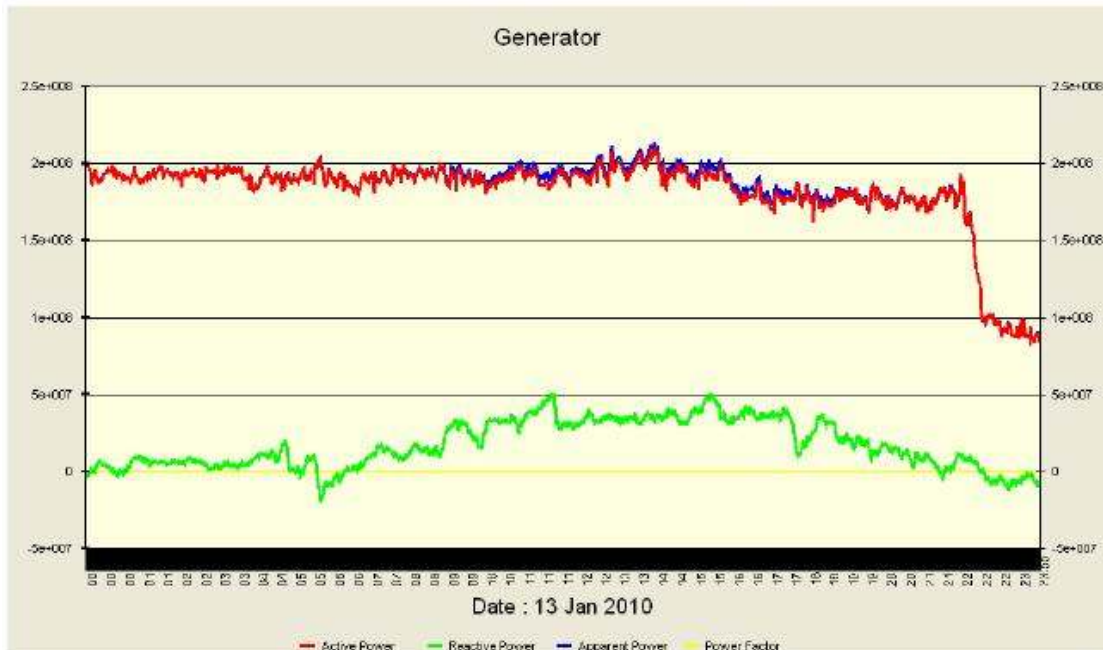


Report of Frequency of 210 MW Generator for two days





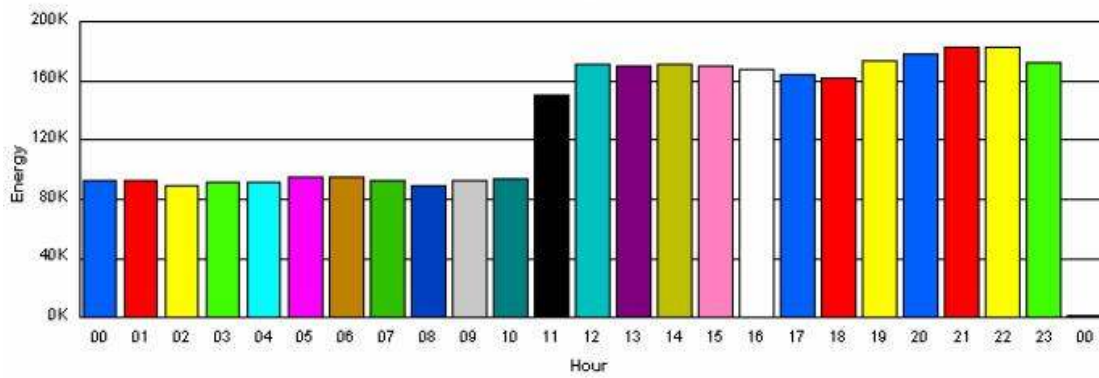
Report of Active, Reactive, Apparent Power of 210 MW Generator





Report of Hourly Energy Generation of 210 MW Generator

Hourly Energy Trend



Device : Generator

Hourly-Day Energy Report

Date : 14/Jan/2010

Hour	kWh
00:00 - 01:00	93061.12
01:00 - 02:00	93192.20
02:00 - 03:00	89653.25
03:00 - 04:00	91684.87
04:00 - 05:00	91160.58
05:00 - 06:00	94961.66
06:00 - 07:00	94896.13



Appendix – A

The New Policy for Bulk Power Generators and Users

Under the Electricity Act, 2003 and the National Electricity Policy, the Central Electricity Regulatory Commission makes a regulation called the **Central Electricity Regulatory Commission (Power Market) Regulations, 2010** w.e.f 20th January, 2010

These regulations shall apply to OTC markets and Exchange markets dealing in Electricity

- Over the Counter Market
- Power Exchange Market
- Other Exchange Market

These regulations shall apply to the following types of contracts:

1. Delivery based Short Term contracts in OTC market
 - OTC Contracts directly between buyers and sellers
 - OTC Contracts through Electricity Traders
 - Back to back deals
 - Deals with Open position
 - Contract to aggregate suppliers / buyers and sell / buy to a one or more buyers / sellers
2. Financially settled electricity derivatives contracts transacted in OTC market
3. Delivery based contracts transacted on Exchange
 - Intraday contract /Contingency contract
 - Day Ahead contract
 - Term Ahead contract
4. Financially settled electricity derivative contracts transacted on Exchange
5. Any new contracts linked with electricity generated from renewable sources
6. Any new contract in areas related to capacity, power price indices, and other areas related to electricity
7. Capacity Contracts
8. Ancillary Services Contracts

These regulations shall apply to all market participants including

1. Grid connected entities such as but not limited to Generating companies
2. Distribution Licensees, consumers who have been granted open access
3. Electricity Traders
4. Power Exchanges and Clearing Corporations approved by the Commission
5. Members of Power Exchanges
6. Members of Clearing Corporation
7. Other Exchanges and
8. Any other transacting party



Appendix – B

Availability Based Tariff:

Availability Based Tariff (ABT) is a performance-based tariff for the supply of electricity by generators owned and controlled by the central government. It is also a new system of scheduling and dispatch, which requires both generators and beneficiaries to commit to day-ahead schedules. It is a system of rewards and penalties seeking to enforce day ahead pre-committed schedules, though variations are permitted if notified One and one half hours in advance. The order emphasizes prompt payment of dues. It has three parts:

1. **A fixed charge (FC)** payable every month by each beneficiary to the generator for making capacity available for use.
2. **An energy charge** (defined as per the prevailing operational cost norms) per KWH of energy supplied as per a pre-committed schedule of supply drawn upon a daily basis.
3. **A charge for Unscheduled Interchange (UI charge)** for the supply and consumption of energy in variation from the pre-committed daily schedule. This charge varies inversely with the system frequency prevailing at the time of supply/consumption. Hence it reflects the marginal value of energy at the time of supply.

How is ABT different from normal proceedings to determine generation tariff?

The ABT proceeding has not attempted to consider most of the cost drivers like ROE, Operational Costs, depreciation rate, composition of the Rate Base, capital structure etc. Proceedings to redefine these norms are being held separately. Hence the ABT proceedings have been concerned more with tariff design rather than definition of tariff norms or determination of tariff levels.

2. Its incidence is a function not only of the behaviour of a generator but also of the behaviour of a beneficiary. Disciplined beneficiaries and generators stand to gain. Undisciplined beneficiaries and generators stand to lose.



VOLUME OF SHORT-TERM TRANSACTIONS OF ELECTRICITY (STATE-WISE) (MUs)										
Month: Dec 2009										
Name of the State/UT/Other Regional Entity	Through Bilateral			Through Power Exchange			Through UI with Regional Grid			Total Net**
	Sale	Pur-chase	Net*	Sale	Pur-chase	Net*	Export (Under Drawl)	Import (Over Drawl)	Net*	
Punjab	281.70	32.33	-249.37	7.06	17.38	10.32	10.31	185.75	175.44	-63.60
Haryana	122.08	14.63	-107.46	0.57	21.34	20.77	0.58	421.41	420.83	334.14
Rajasthan	42.39	598.17	555.78	4.61	166.04	161.43	28.42	279.84	251.42	968.62
Delhi	171.53	203.44	31.92	55.95	4.57	-51.38	191.32	2.97	-188.35	-207.82
Uttar Pradesh	2.40	385.24	382.84	0.00	85.21	85.21	136.80	62.18	-74.62	393.43
Uttarakhand	0.00	110.52	110.52	0.00	0.00	0.00	2.05	104.57	102.53	213.05
Himachal Pradesh	7.18	189.97	182.79	21.40	0.00	-21.40	29.67	30.50	0.83	162.23
J & K	37.38	206.93	169.55	0.00	0.00	0.00	19.08	78.59	59.51	229.05
UT Chandigarh	5.43	22.02	16.59	0.00	0.00	0.00	5.29	9.65	4.36	20.95
MP	12.20	278.13	265.93	8.70	0.11	-8.59	155.40	59.60	-95.80	161.53
Maharashtra	29.97	197.47	167.50	0.96	82.18	81.22	56.36	262.95	206.59	455.30
Gujarat	189.77	0.00	-189.77	79.68	2.17	-77.50	199.08	24.49	-174.59	-441.87
Chattisgarh	475.18	0.00	-475.18	116.89	0.00	-116.89	308.99	3.30	-305.69	-897.76
Daman and Diu	0.00	0.00	0.00	2.94	0.00	-2.94	53.28	0.00	-53.28	-56.22
Dadra & Nagar Haveli	0.00	0.00	0.00	0.00	0.00	0.00	46.20	1.03	-45.18	-45.18
Andhra Pradesh	194.76	1.93	-192.82	7.43	45.88	38.45	49.84	120.59	70.75	-83.62
Karnataka	319.39	1.80	-317.59	128.47	0.00	-128.47	17.49	117.48	99.98	-346.08
Kerala	110.77	17.82	-92.95	0.00	73.36	73.36	1.64	72.76	71.12	51.53
Tamilnadu	55.72	578.61	522.90	0.00	111.61	111.61	80.25	61.76	-18.49	616.02
Pondicherry	0.00	0.00	0.00	0.00	0.00	0.00	26.41	0.27	-26.15	-26.15
West Bengal	359.69	11.98	-347.71	68.85	2.97	-65.88	23.73	115.09	91.36	-322.23
Orissa	29.68	0.00	-29.68	2.15	1.32	-0.83	196.08	18.36	-177.72	-208.23
Bihar	0.00	0.00	0.00	0.00	7.85	7.85	50.05	10.54	-39.51	-31.66