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MiPower™

Empowering Power System Engineers

Power Transmission and Distribution System Analysis Software Suite

POWER RESEARCH AND DEVELOPMENT CONSULTANTS NEWSLETTER

Quarterly Newsletter

January - June, 2013

Issue 1 - 2
Volume - 3

Inside This Issue

Editorial Board

From MD's Desk

Dear Friends,

The cost of un-interrupted and quality power supply is always expensive. Based on the power purchase cost, operation cost, capital investment etc. the tariff is fixed to different categories of consumers. In this communication, I thought of deliberating how much it costs to different categories of consumers to have un-interrupted, quality power supply.

The first example considered is a small house hold with monthly energy consumption of about 30 units. The monthly power bill is around Rs. 75. This household maintains two portable chargeable lights, each costing about Rs. 600. It is found that house hold replaces the portable light every year, as the life is less than one year. This implies that on an average, the house hold spends about Rs. 100 per month additionally to have un-interrupted power supply. For this small house hold, the effective power bill works out to Rs. 5.83 per unit instead of normal tariff of Rs. 2.5 per unit.

The second example is a middle class house in the rural area. The monthly power bill is around Rs. 280 with an average energy consumption of about 90 units. The household has installed an UPS system investing around Rs. 18,000. Even if one considers a maximum life of 5 years (it is generally around 3 years), the monthly burden of maintaining the un-interrupted power supply without the maintenance and interest charges is Rs. 300. The effective power cost for this household comes to Rs. 6.44 per unit.

The third example is a commercial establishment having the connected load of about 80 kW. The monthly power bill of this establishment is around Rs. 50,000 with energy consumption of about 8,650 units. The average tariff works out to Rs. 5.78 per unit. This establishment has a 30 KVA and 10 KVA UPS systems for the computer and lighting loads, respectively. Interestingly it was revealed that the UPS systems are housed in a space of 150 sqft. area and the monthly rental alone is about Rs. 7,500. The monthly establishment cost of the 40 KVA UPS system works out to around Rs. 35,000. Including the rental charge, the additional burden for the commercial establishment to have the un-interrupted quality power supply is around Rs. 42,500. The effective cost of energy is computed as Rs. 10.69 per unit.

In all the illustrative examples, the energy loss in the UPS system has not been considered which would further increase the average cost of supply. With the above three different illustrations covering different categories of consumers, the questions that arise are:

- Why not the distribution companies plan the long term power purchase, so that there is no shortage?
- Why not the utilities plan the network for maximum availability?
- Why not the authorities consider the above facts and give mandate to the utilities to improve the reliability of the system and availability of power at a marginally increased tariff?
- Can there be a market mechanism to supply un-interrupted quality power supply?

I request all my esteemed readers to ponder over these thoughts and work towards improving the power situation in the country.

Dr. R. Nagaraja
Managing Director

Technical Article

Understanding Open Conductor Faults

Raghavendra G.

1. Introduction

High impedance faults constitute a significant portion of the faults that occur in distribution networks [1]. The current magnitude depends upon the resistivity of the surface on which the conductor comes in contact with. In [2], the different magnitudes of fault currents measured for various types of surfaces have been provided. In case of dry asphalt, non-reinforced concrete and dry sand the surface current was even found to be 0 A which is as good as opening the conductor. The resulting fault current due to high impedance faults generally reduces over a period of few minutes and ceases to exist as conductor burns, moisture evaporates and sand fuses. It is practically very difficult to detect these faults with conventional overcurrent/earth fault protection schemes since the magnitude of currents observed is well below the load currents expected. It is very important to detect downed conductors since they can be fatal for public and line crewmen. Also, open conductor faults result in reduced voltages causing damage to loads [3].

In case of radial distribution lines, open conductor situations can be detected by measuring the loss of voltage at the tail end of the feeder. Open conductor faults can also be detected with the help of negative sequence quantities [2]. In this article, the modeling of one conductor/phase/pole open faults in short circuit analysis has been discussed and a case study is presented for better understanding of open conductor situations.

2. Modeling

Opening of one/two phases of a balanced three phase circuit creates unbalance in the circuit which can be analyzed using impedance matrices of the sequence networks. The equivalent network of one phase open system viewed from the point of opening is shown in Fig. 1 [4].

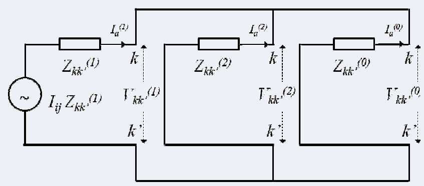

Fig. 1: Connection of Positive, Negative and Zero sequence networks for one conductor open

Where,

k and *k'* represent the open points,

I_{ij} is the current in the line between buses *i-j* before opening the phase,

$Z_{kk'}^{(1)}$, $Z_{kk'}^{(2)}$ and $Z_{kk'}^{(0)}$ are the positive, negative and zero sequence impedances of the network viewed from *k-k'* respectively,

$I_a^{(1)} I_a^{(2)}$ *and* $I_a^{(0)}$ are the positive, negative and zero sequence currents through the opened line respectively,

$V_{kk'}^{(1)}$, $V_{kk'}^{(2)}$ and $V_{kk'}^{(0)}$ are the positive, negative and zero sequence voltages across *k-k'* respectively.

In case of shunt faults, the pre-fault voltages can be assumed as the rated bus voltage. This is a valid assumption, since the currents expected in the non-faulted phase/s are insignificant compared to the faulted phase/s currents. However, open conductor fault simulation requires pre-fault voltages from load flow analysis. This is because the currents in the non-faulted phase/s cannot be ignored and the load impedance has to be considered in the formation of the network impedance matrices. From the equivalent network shown in Fig. 1, the following relations are obtained.

$$I_a^{(1)} = I_{ij} \frac{Z_{kk'}^{(1)}}{Z_{kk'}^{(1)} + \frac{Z_{kk'}^{(2)} Z_{kk'}^{(0)}}{Z_{kk'}^{(2)} + Z_{kk'}^{(0)}}}$$

$$V_{kk'}^{(1)} = I_a^{(1)} \frac{Z_{kk'}^{(2)} Z_{kk'}^{(0)}}{Z_{kk'}^{(2)} + Z_{kk'}^{(0)}}$$

The equivalent injected currents are calculated as below.

$$\frac{V_{kk'}^{(1)}}{z_{ij}^{(1)}}, \frac{V_{kk'}^{(2)}}{z_{ij}^{(2)}} \text{ and } \frac{V_{kk'}^{(0)}}{z_{ij}^{(0)}}$$

The changes in the sequence voltages at any bus *'n'* due to current injections at buses *'i'* and *'j'* are calculated using the following set of equations.

$$\Delta V_n^{(0)} = \frac{(Z_{ni}^{(0)} - Z_{nj}^{(0)})V_{kk'}^{(0)}}{z_{ij}^{(0)}}$$

$$\Delta V_n^{(1)} = \frac{(Z_{ni}^{(1)} - Z_{nj}^{(1)})V_{kk'}^{(1)}}{z_{ij}^{(1)}}$$

$$\Delta V_n^{(2)} = \frac{(Z_{ni}^{(2)} - Z_{nj}^{(2)})V_{kk'}^{(2)}}{z_{ij}^{(2)}}$$

The post fault bus voltages are calculated for all buses using superposition principle.

$$V_n^{(1)}(F) = V_n^{(1)}(0) + \Delta V_n^{(1)}$$
$$V_n^{(2)}(F) = \Delta V_n^{(1)}$$
$$V_n^{(0)}(F) = \Delta V_n^{(2)}$$

Where, $V_n^{(1)}(0)$ represents the pre-fault voltage at bus *n*.

Using the post fault voltages, the currents in all branches are computed.

3. Simulation

A typical 11 kV feeder with distribution transformers at various tap points is shown in Fig. 2. The source modeled at the feeder head has a fault level of 200 MVA. Distribution transformers with rating of 250 kVA, 11/0.433 kV, Dyn1 and leakage reactance of 5% have been considered.

The A phase of the line segment connected between buses 2-3 was opened to observe the unbalance caused. The equivalent positive, negative and zero sequence impedances viewed from bus 2 are computed.

$$Z_2^{(1)} = Z_2^{(2)} = 78.74 + j27.95 \text{ ohm}$$

$$Z_2^{(0)} = 110.84 + j34.23 \text{ ohm}$$

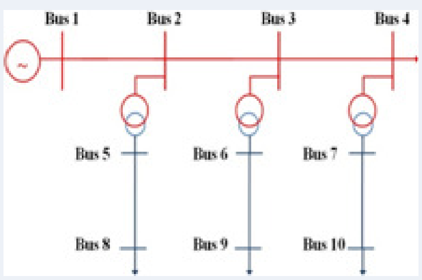

Fig. 2: Typical Distribution System

The sequence and phase currents observed in the line segment 2-3 are given in Table I. The opened phase obviously carries no current while the other two healthy phases carry currents depending upon the nature of load connected. The increase in negative sequence currents in the opened line can be seen from Table I.

Table I: Sequence and Phase currents through line 2-3

Sequence (1, 2, 0)		Phase (A, B, C)	
Mag. (A)	Ang. (deg)	Mag. (A)	Ang. (deg)
48	-18.46	0	165.96
28	160.54	73	-133.16
20	162.92	72	96.11

The sequence and phase voltages at buses 2, 4, 8 and 10 are provided in Table II. From Table II one can observe the unbalanced voltages caused in the system due to opening of phase A between buses 2-3. The phase voltages at the LT side of the distribution transformer connected to bus 2 are balanced. However, the phase voltages at the LT side of the distribution transformer connected to bus 4 are unbalanced. Phases A and B experience considerable dip in the voltage. This may cause some of the loads on the 0.415 kV system to operate with much lower efficiency or even get damaged [3]. Due to under voltages motors may run at more than acceptable temperatures and consequently fail. Therefore, it is very important to detect these open conductor faults in distribution networks and take appropriate action at the earliest.

Table II: Sequence and Phase Voltages

Bus no.	Sequence (1, 2, 0)		Phase (A, B, C)	
	Mag. (pu)	Ang. (deg)	Mag. (pu)	Ang. (deg)
2	1.000	0.11	1.003	0.40
	0.003	65.20	0.999	-120.04
	0.003	61.92	0.998	119.97
4	0.631	0.07	0.100	176.64
	0.366	179.59	0.997	-120.08
	0.365	179.60	0.997	119.87
8	0.969	-32.35	0.967	-32.20
	0.003	92.74	0.972	-152.33
	0.000	-123.30	0.967	87.49
10	0.611	-32.40	0.529	-67.68
	0.354	-152.87	0.535	-117.17
	0.000	-5.63	0.966	87.43

From Table II it can be seen that the phase A voltage at the end of the feeder, i.e. bus 4, is around 0.1 p.u. This loss of voltage can be one of the parameters that suggests an open conductor fault. However, this will not be the case in meshed networks as there will be significant voltage observed at the tail end. Therefore, an alternate approach can be adopted to detect open conductor conditions.

Table III shows the sequence and phase currents flowing in some parts of the network.

Table III: Sequence and Phase Currents

Line segment	Sequence (1, 2, 0)		Phase (A, B, C)	
	Mag. (A)	Ang. (deg)	Mag. (A)	Ang. (deg)
1-2	61	20.63	12	-22.86
	28	160.48	85	-134.56
	20	162.92	84	96.24
5-8	322	-58.90	321	-58.76
	1	66.18	323	-178.89
	0	-149.87	322	60.94
7-10	204	-58.95	176	-94.23
	118	-179.43	178	-143.74
	0	-32.19	322	60.87

From Table III, it can be seen that considerable magnitude of negative sequence current prevails in the system during one phase open faults. The negative sequence current measured at the feeder head can be used as a parameter to detect one phase open conditions. Negative sequence relays can be used for this purpose. The advantage of using negative sequence relays for detecting open conductor faults is that they need not be coordinated with phase/earth overcurrent relays since phase/earth overcurrent relays do not use negative sequence current for relaying decisions. Also, negative sequence relays can be employed for detecting one phase open faults in meshed systems unlike voltage based detection schemes.

4. References

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Consultancy Services Rendered

Grid Islanding & Load Shedding Scheme for JSPL – Raigarh

One of the key aspects in enhancing the production capacity of an industry is to provide continuous and reliable power supply to its most sensitive load. Large industrial systems generally consist of in-plant generations (Captive Power Plant) to cater to part of its load and the rest is drawn from the grid. Severe grid side disturbance can result in large violation of various electrical parameters, which can result in a total blackout of the grid and also resulting in tripping of the in-plant generation. In order to avoid blackout of plant's sensitive load during severe disturbance, proper islanding scheme has to be developed such that there is adequate coordination between grid islanding relay, load shedding scheme, generation back down scheme and generator protection setting.

One such study is carried out for Jindal Steel and Power Limited – Raigarh. It has a total steel production capacity of around 3 MTPA and consists of around 515 MW of installed captive generation, with primary power transmission at 220 kV level. For the purpose of study, the generator modeling is considered as sub transient modeling and the western power grid is modeled so as to simulate grid side disturbance. For the purpose of transient study, detailed AVR and governor modeling is also considered.

In order to arrive at the optimal network configuration for implementing grid islanding scheme, initial load flow and short circuit study is carried out considering various network configurations. The final network configuration for islanding scheme is selected considering reliability and operational flexibility of the system.

Based on transient stability study, detailed islanding scheme consisting of islanding points, inter trip arrangement and islanding relay settings is recommended. Also load shedding scheme is designed so as to trip excessive load in various stages, thus ensuring tripping of 'optimal' quantum of load. Further to have effective coordination between islanding scheme and generator protection setting, the existing settings are reviewed and revised settings provided. The various transient stability cases simulated are indicated below and the frequency plot of one of the load shedding cases is shown in fig 1.

- Grid islanding considering different loading and generation scenario.
- Grid islanding considering different grid operating condition.
- Grid islanding due to fault on non-sensitive region which not cleared within critical clearing time of generators in sensitive region.
- Various other cases considering grid side disturbance.

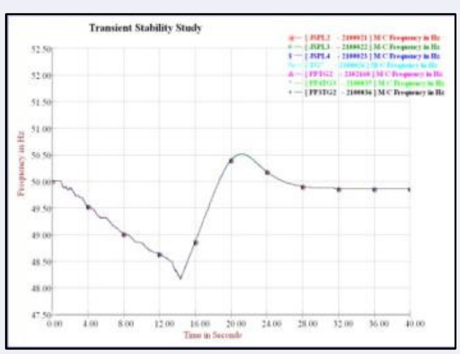


Fig. 1: Frequency plot for one case study

Power Evacuation from HEP in Sikkim

Sikkim state is geographically land locked hilly terrains with a long rainy season and this inherent feature bestows the state to develop the run of the river hydro projects. This is also attracting IPPs to develop the hydro power projects in the state of Sikkim. Around 3,000MW of power generation capacity is proposed in Sikkim to be developed by end of 12th plan. Evacuation of this quantum of power has to be well planned to transmit it to rest of India as estimated Sikkim state consumption is only around 150MW by the end 12th plan period as per draft report of 18th EPS survey. In view of this, various evacuation plans need to be explored for each proposed generation in the Sikkim state to avoid evacuation problems in the future. In this context, one of the hydro developers awarded PRDC the study of various alternative schemes to evacuate the power from a proposed run-of-the- river plant in Sikkim to the state Grid thereby transmitting the same power to rest of the Indian grid.

As part of the study, Sikkim grid network is modeled in the MiPower™ software considering all the proposed generation projects and associated transmission system in Sikkim state from year 2011-12 to 2016-17 period. This proposed transmission system of Sikkim is integrated with rest of the eastern grid transmission network, which is modeled from 765kV to 33kV buses of 132/33kV substations to evaluate the corridor availability, loading and any possibilities of congestion in the transmission network. Various alternative connectivity/evacuation schemes are studied with comprehensive system analysis and detailed recommendations were made based on techno-economical evaluations.

In this assignment, load flow studies are carried out by considering the high hydro generation in the Sikkim region with light load conditions to check the network adequacy during normal and contingency conditions with proposed generation capacity and planned pooling stations and associated transmission system in the region. With load flow study results for all the simulated alternatives, optimal option for plant connectivity with the Grid is suggested by considering any possible congestion at grid substation, future expansion plans at Hydro plant, techno-economic aspects based on the line length, available voltage level, evacuation losses and drawl point of identified beneficiary. Further, short circuit studies are simulated to assess the fault level at proposed hydro plant and grid interconnection point to evaluate the adequacy of proposed breaker ratings as per specified norms and grid codes. Transient stability studies were also simulated to assess stability of the generators and the critical clearing time of proposed hydro generators for various faults at grid and plant buses are computed. After detailed analysis involving load flow, short circuit and transient stability studies, most feasible options were recommended to the hydro developer.

Power System Stabilizer Tuning for Raj West Power Plant

M/s Raj West Power Limited (RWPL), a wholly owned subsidiary of Jindal South West Energy Limited (JWWEL) is putting up 8x135 MW lignite based pit head power plant at village Bhadresh in Barmer district of Rajasthan state. Out of these 8x135 MW units, four units are commercially operational and remaining four units are expected to start commercial operation by the end of 2012-13 fiscal year. Considering PRDC's expertise, M/s RWPL awarded the job of Power system stabilizer tuning studies for all the 8 units of their power plant and subsequent field implementation of the settings to PRDC.

Historically, transient stability has been a major concern in the system operation. It was anticipated that the introduction of the high gain and fast acting exciter will help in the improvement of transient stability in addition to the increase in the steady state stability limit. Although transient stability can be improved by fast acting excitation system with high gain AVR, this introduces a new problem of oscillatory instability of the equilibrium point. Even small perturbations in the system caused by random load changes can lead to loss of synchronism due to undamped (growing) oscillations which appear as spontaneous and cannot be predicted as the result of an observable major disturbance. In order to improve the so-called small signal stability, the cost effective solution is to use Power System Stabilizers (PSS) which is normally integrated to generator excitation system. In the majority of generating units today, PSS which is part of the excitation system is generally blocked. This is due to the fact that wrong settings of PSS parameters would result in operational difficulties and even instability. A properly tuned PSS would damp the low power oscillations over the transmission lines and aid in small signal stability of an interconnected power system.

For the study, the network of Rajasthan is terminated at the boundary busses (Jodhpur, Barmer, and Dharimanna) busses through static and dynamic equivalents. The static equivalent is done through single phase to ground and three phase fault levels and the dynamic equivalent is done through equivalent inertia constant (H) calculation. The static network (e.g. transmission lines and transformers) is modeled by its algebraic equations relating to network complex voltages and complex impedances.

The generators in the power plant are modeled by its sub transient model and the AVR and governor controls are modeled through its block diagram representation i.e. these are represented by the differential equations.

PSS Tuning Studies:

The first step is to linearize the differential equations describing the power system around an operating point then get the state space matrices, Eigen values, Eigen vectors and Participation factors from the dynamic stability module of the MiPower™; Subsequently Check if any Eigen values are on the right hand side of the s-plane. Identify the electromechanical modes using the participation factor analysis. Check if the damping of the electromechanical modes is within the specified range, if not change the PSS parameters to obtain the same without affecting the other modes of oscillation. After intense performance checks, the best performing one is selected as the optimal set of PSS parameters. Subsequently, transient stability study was carried out to check the robustness of the PSS parameters.

PRDC carried out the field measurement of the electrical power output (MW) for step change in the AVR reference voltage and ramp change in the generator mechanical power. The objective of the field measurement was to study the dynamic behavior of the excitation system of RWPL generators and the low frequency oscillations under small disturbance conditions. From the measurements, 1.4 to 1.7 Hz of oscillations is observed in the electrical power output under such small disturbances with the magnitude varying between ±3 MW, thus necessitating the tuning of the PSS.

Based on the modeling of the power system elements as mentioned above, the 1.7 Hz oscillations are found in the digital simulation, thus validating the model. The tuning methodology as explained above was followed in order to get sufficient damping to the electromechanical modes of oscillations without adversely affecting the other modes. The tuning process is done in dynamic stability module of MiPower™ software. The damping ratio for the electromechanical modes of oscillation is increased from 4.9% to 22% with PSS in service.

To verify the robustness of the set parameters of the PSS, the transient stability analysis was also carried out with various fault cases. The PSS performance is found satisfactory under different fault cases as well. To demonstrate the effectiveness of the PSS in RWPL plant, plots for a step change in electrical power output are presented in figures 1 & 2.

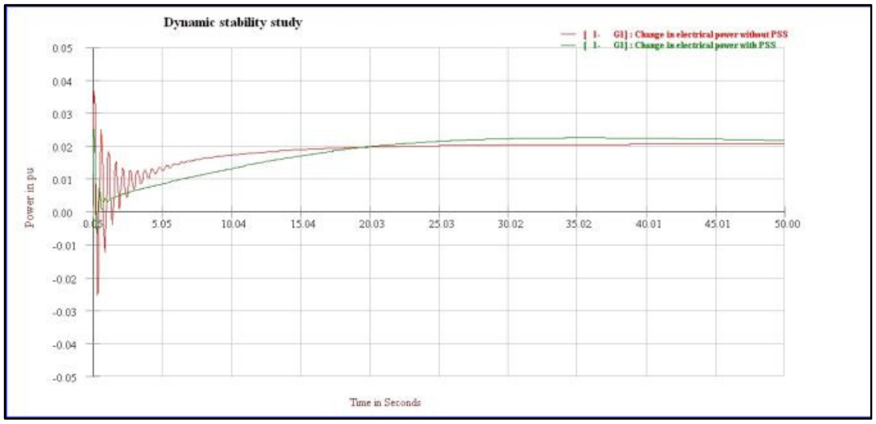


Fig. 1: Change in electrical power output of generator

Fig. 2: Electrical power output of the generator set 1

PRDC BAGS PRESTIGIOUS ASIAN DEVELOPMENT BANK CONTRACT

PRDC has bagged the Asian Development Bank (ADB) project contract for **"Advanced Project Preparedness for Poverty Reduction-Updating Load Forecast and Power System Master Plan for Assam - Consulting Services"**. PRDC has won the contract amidst stiff competition from other leading consultants in the field.

The project aims at 'Advanced project preparedness for poverty reduction – updating load forecast & Power system master plan for Assam'. The broad objectives of the study are:

- ⊕ Updating the demand forecasting to the year 2016-17 in line with the Government of India 12th five year plan and more generally to 2021-22 in line with the Government of India 13th Five year plan.
- ⊕ Preparing master plan for generation and transmission system in terms of its parameters, loading, power flow, losses and voltage profile together with consideration of shortfall between power generation capacity and unrestricted demand taking account of demand side and supply side management.
- ⊕ Distribution system master plan that revolves round loss management and voltage management plans of the Distribution companies in Assam.

Events & Achievements

PRDC Signs Agreement with KEMCO, Qatar

A sponsorship agreement was signed on January 6th 2013, between Managing Director of KEMCO, Qatar Mr. Mohammed Bin Hammam Al Abdulla and Managing Director of PRDC, Dr. R. Nagaraja, wherein KEMCO has agreed to sponsor PRDC for establishing an office at their premises and also KEMCO acting as PRDC representative in Qatar for pursuing works under the different fields of specialization like power system study consultancy, consultancy services on detailed engineering, supply of Hardware and Software products to industries and colleges in Qatar. The agreement was signed at Qatar in the presence of KEMCO

officials namely, Mr. Shiva kumar, Mr. Farid and Mr. Mohan Kumar M.J of PRDC. Khalid Electrical & Mechanical Co. (KEMCO) was established in the year 1974. Within a short span of time the company has earned a good reputation and has become a leading Electro-Mechanical contracting company in Doha, State of Qatar. Since 1985, KEMCO became a sole proprietorship company owned by Mr. Mohammed Bin Hammam Al Abdulla. Over the years, with the management's vision for expansion and diversification, this single company has become a Group of Companies offering electrical, project services, real estate, construction, trading and allied services.

Workshop on Energy Audit & Energy Conservation

PRDC organized a 2-Day Workshop on **'Energy audit & energy conservation in industrial & power sector'** in Bangalore during 1-2, March 2013. Energy Audit is an activity towards instituting energy efficiency program. It mainly seeks to identify conservation opportunities preliminary to development of an energy savings program. At the workshop, working engineers were familiarized with basics and advanced concepts of Energy Audit and Energy Conservation. During the course, the participants were introduced to Energy Audit in Power Utilities, Energy Audit in Process Industries, Electricity Act 2003, Energy Efficiency and Energy Conservation. Case studies in Energy Audit were also discussed. The workshop was successful in imparting knowledge and skills to develop awareness on Energy Audit and Energy Conservation and formulate prioritized recommendations for implementing process improvements to save energy. The workshop was attended by more than 25 engineers from Discoms of Karnataka, KPTCL, KPCL, industries, consultants and faculty of engineering colleges in around Bangalore. Faculty for the workshop included Mr. M.M. Babu Narayanan, CTA, Dr. K. Balaraman CGM and Mr. Venkat Subba Rao, Sr. Consultant, PRDC.

Achievements

- PRDC is undertaking a power system analysis project for Adhunik Power and Natural Resources Pvt. Ltd . The project focuses on Power System Study, Relay Co-ordination & recommendation of relay setting & implementation of recommended relay settings for the 2x270 MW M.P. super Thermal Power Plant at Padampur (Saraikela-Kharsawan) in Jharkhand.
- PRDC has bagged the order for supply Network Analysis module for RAPDRP project being implemented by Kerala State Electricity Board. Consolidated Gulf Company, Qatar awarded PRDC to provide consultancy services for carrying out ECS for adequacy of electrical network system for Dukhan support services area & QP support facilities area.
- BSES Rajdhani has awarded PRDC the job of undertaking protection system audit and review of relay settings in EHV and HT network of south circle of BRPL.
- PRDC has bagged orders from Bhushan Energy Limited for Power Evacuation Study for 165 MW Power Plant and Power Evacuation Study for 4x660MW units as IPP at Meramandali site, Orissa.
- PRDC has bagged the order for developing & supplying Transmission Line Simulator for National Institute of Technology (NIT), Arunachal Pradesh.

Our Expertise in Training

Upcoming Events

At PRDC, we conduct various training programmes throughout the year. The duration of the training programme varies from one to four weeks.

One Week Training

We conduct one week training programme on MiPower™. It's a Standard Course.

MiPower™ Training Level 1

Level 1 is a training programme on basic theory & simple problems (hands-on).

Level 1 Batch:

1. 2nd September 2013 to 6th September 2013

MiPower™ Training Level 2

Level 2 is a training programme which consists of only hands-on and solving own system problems, sorting out issues and clarifications.

Level 2 Batch:

1. 19th August 2013 to 23rdAugust2013

Short Term Training /Workshop

In addition to the above said programme PRDC is also conducting short term training program and workshops to impart knowledge and practical approach on specific topics, which are of relevance to power engineers in day-to-day works. Such training not only enhances their knowledge but also helps to implement in their regular routine works.
For short term and special trainings contact our marketing team:

marketingteam@prdcinfotech.com

Training Calendar - 2013

Training Schedule of PRDC Training Centre For the Year 2013

Month / Days	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
January						S	M						S	M						S	M						S	M			
February			S	M						S	M						S	M						S	M				x	x	x
March			S	M						S	M						S	M						S	M						S
April	M						S	M						S	M						S	M						S	M		x
May					S	M						S	M						S	M						S	M				
June		S	M						S	M						S	M						S	M						S	x
July	M						S	M						S	M						S	M						S	M		
August				S	M						S	M						S	M						S	M					
September	S	M						S							S	M						S	M						S	M	x
October						S	M						S	M						S	M						S	M			
November			S	M						S	M						S	M						S	M						x
December	S	M						S	M						S	M						S	M						S	M	

L1 **MiPower Client Training Level 1:** Basic Theory & Simple problems (hands on)*

L2 **MiPower Client Training Level 2:** Only hands on and solving own system problems & sorting out issues and clarifications*.

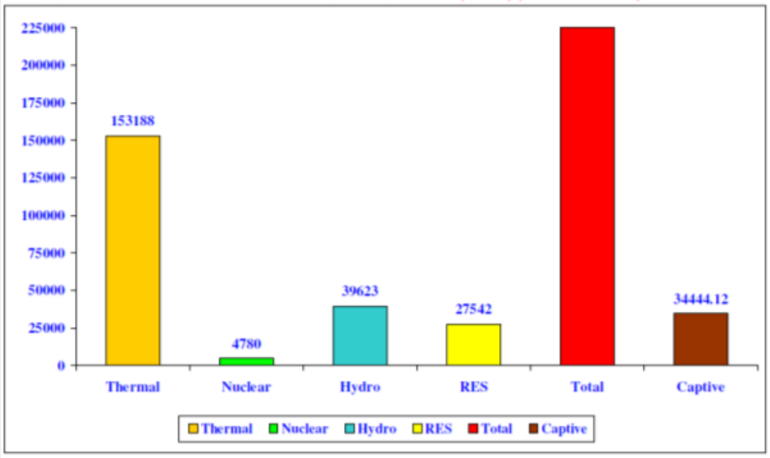
* **Participants are requested to choose the training as per their need i.e. Level 1 or Level 2**

Events

- PRDC participated in GRIDTECH 2013, which was held during April 3 -5, 2013 at Pragati Maidan, New Delhi. This is a flagship event of Power Grid Corporation of India Ltd. (Power grid)
- PRDC was a part of CII delegation and exhibitors at Power & Electricity World Africa 2013 Show which is being held at Johannesburg, South Africa during 9-10 April, 2013. The show was visited by almost all the utilities and industries across the continent of Africa.
- PRDC jointly organized a workshop on 'Modern Trends in Power System Protection' at Nirma University in Gandhinagar during 7-8 March, 2013.
- PRDC conducted a workshop on 'Computer Aided Power System Analysis using MiPower' at ITM University, Gurgaon during 4-8 March, 2013.
- PRDC organized a 3 day workshop on "**Power Quality & Mitigation**" at CIT, Gubbi, Karnataka in association with IEEE PES Bangalore Chapter during 28th - 30th January 2013. The workshop concentrated on the concepts of power quality issues related to harmonics & its mitigation, harmonic studies, utility grid code and the IEEE & IEC standards. The program was inaugurated by Dr Chidananda Gowda, former VC, Kuvempu University. Dr. R. Nagaraja, MD, PRDC was the guest of honor for the event. There were about 34 participants from utilities and academia.

Indian Power Sector Highlights

All India Generating Installed Capacity (As on 31.05.2013 Source: CEA)



Power generation for quarter ended June 2013 is 102% of corresponding quarter last year

The total power generation during the period April 2013-June 2013 has been 238.07 Billion Units [BU] which was 102.84% of the actual generation during the same period last year.

So far as actual generation is concerned, Hydro generation has been 31278.7 [BU] which is 101.81% of the program target. Nuclear generation has been 7654 [BU] which is 97.14% of the program target. However, Thermal generation has been 198194.33 [BU] which is 99.22% of the program target.

The possible total generation during April 2013-June2013 would have been 262.21 BUs [loss of generation, considering 90% PLF is 24.14 BUs] which would have resulted in achievement of 109.54% instead of 99.46% over program.

Source: Powermin.nic.in

Great potential for US investments and co-operation in Indian power sector: Jyotiraditya Scindia

Shri Jyotiraditya M Scindia, Minister of State [Independent Charge], Ministry of Power, Government of India visited Washington on July 2, 2013 with the objective of further enhancing India -US partnership in the power sector. Delivering a talk on "Indian Energy Security in the context of the Power Sector". Shri Scindia emphasized that there is great potential for US investments and co-operation in the Indian power sector. The Minister addressed the issues of growth of the Indian power sector particularly relating to challenges in the context of generation, transmission, distribution and access to electricity. He explained about the initiatives taken by him in the recent months to address these challenges and how these impact the framework of India US co-operation in power sector in general and renewable energy as well as energy efficiency matters as well as the overarching strategy for low carbon growth and clean energy adopted by India.

Source: Powermin.nic.in

India-Turkey to enhance cooperation in renewable energy

India and Turkey have agreed to enhance their cooperation in the field of Renewable Energy. This was decided at a meeting held between the Turkish Energy Minister Mr. Taner Yildiz and Dr. Farooq Abdullah, Minister of New and Renewable Energy at Ankara today. Dr. Abdullah is visiting Turkey along with a high level delegation to explore greater opportunities for cooperation and collaboration between Indian and Turkey. Dr. Abdullah briefed his counterpart on the energy situation in India and India's plans to add over 30 GW of renewable energy to its energy mix in the next 5 years. He also dwelt on the success of the wind programme as well as the significant cost reductions in solar energy through the Jawahar Lal Nehru National Solar Mission (JNNSM).

Source: MNRE

Growth of installed capacity since 6th five year plan to end of 11th five year plan Source: CEA

(in MW)

Plan / Year	Thermal				Nuclear	Hydro (Renewable)	RES (MNRE)	Total
	Coal	Gas	Diesel	Total				
End of 6th Plans	26,310.83	541.50	177.37	27,029.70	1,095.00	14,460.02	0.00	42,584.72
End of 7th Plan	41,237.48	2,343.00	165.09	43,745.57	1,565.00	18,307.63	18.14	63,636.34
End of 2nd Plans	44,791.48	3,095.00	167.52	48,054.00	1,785.00	19,194.31	31.88	69,065.19
End of 8th Plan	54,154.48	6,561.90	293.90	61,010.28	2,225.00	21,658.08	902.01	85,795.37
End of 9th Plan	62,130.88	11,163.10	1,134.83	74,428.81	2,720.00	26,268.76	1,628.39	105,045.96
March, 2003	63,950.88	11,633.20	1,178.07	76,762.15	2,720.00	26,766.83	1,628.39	107,877.37
March, 2004	64,955.88	11,839.82	1,172.83	77,968.53	2,720.00	29,506.84	2,488.13	112,683.50
March, 2005	67,790.88	11,909.82	1,201.75	80,902.45	2,770.00	30,942.24	3,811.01	118,425.70
March, 2006	68,518.88	12,689.91	1,201.75	82,410.54	3,360.00	32,325.77	6,190.86	124,287.17
End of 10th Plan	71,121.38	13,691.71	1,201.75	86,014.84	3,900.00	34,653.77	7,760.60	132,329.21
March, 2008	76,048.88	14,656.21	1,201.75	91,906.84	4,120.00	35,908.76	11,125.41	143,061.01
End of 11th Plan	112,022.38	18,381.05	1,199.75	131,603.18	4,780.00	38,990.40	24,503.45	199,877.03
End of June'13	**132,288.39**	**20,359.85**	**1,199.75**	**153,847.99**	**4,780.00**	**39,623.40**	**27,541.71**	**225,793.10**

Captive Generation Capacity in Industries having demand of 1 MW and above, grid interactive (as on 31-03-11) = 34444.12 MW

Note: Installed Capacity of RES is 27541.71 as on 31-03-2013 based on MNRE E-mail dated 10-04-2013

MiP-Wind Scheduler

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MiP-WS

Comprehensive **User Friendly** **Easy to Use**

Product Highlights

MiP-Wind Scheduler

Scheduler home page should have the provisions to

- Submit the schedule as per the requirement for next 24 hours starting from 00:00 hours
- Revise the schedule as per the provisions in the code for the valid blocks.
- Resubmit the schedule.
- Retrieve and view the schedule
- Compare the schedule with the actual generation and frequency, if actual generation and frequency is available.
- Receive the UI statement report

System operator homepage should have the provisions to

- Accept the schedule as per the requirement
- Accept the modified schedule as per the requirement
- Modify the schedule, if the schedule has come though fax or any other means with proper authorization
- Accept the actual generation against each block from the meter download or from online or from fax etc.
- Actual generation key-in provision if the generation has come via fax with authorization
- Accept the actual system frequency as per the provision against each block
- Create the UI statement for each scheduler (Batch mode).
- Send the UI statement to each scheduler (Batch mode).

UI rate homepage should have the provisions to

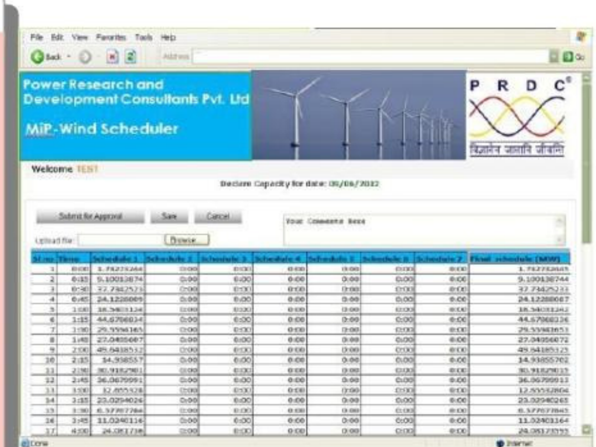
- Enter the UI charges for different blocks
- The minimum and maximum deviations as per the latest provisions (i.e. +/-30%)
- The maximum generation allowed above the schedule
- The charges for the same
- Any other data required for UI computation as and when required.

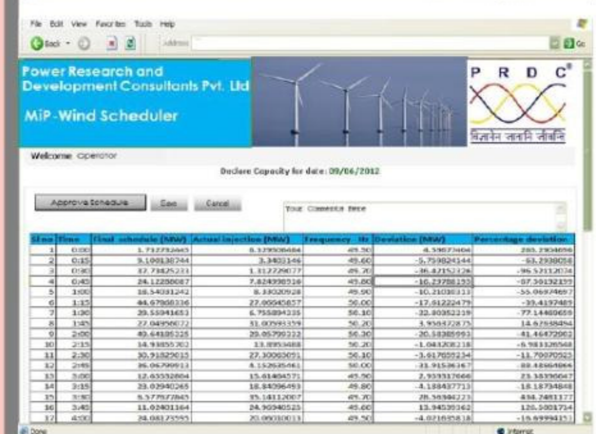
System administrator homepage should have the provisions to

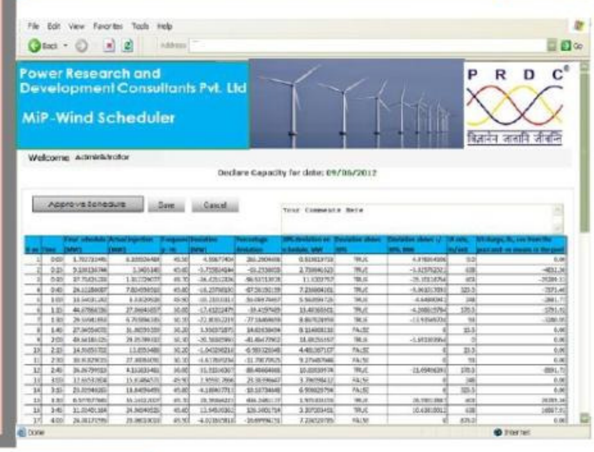
- Create the scheduler
- Create the system operator
- Send messages to them, if required
- Manage the UI rate home page.
- Mange the data backup, cleaning etc.

Advantages of MiP-Wind Scheduler

- In time submission of Schedules, easy to revise and resubmit
- Approval regarding scheduled and actual generation will be fast and transparent
- UI calculation process will be automated for quicker settlements.
- Reduces human intervention in case of number of wind farms increased.
- Possibilities of errors in UI charge settlements will be minimum as the process in fully automated.







Power Research & Development Consultants Pvt. Ltd.
5 11th CROSS 2nd STAGE, WEST OF CHORD ROAD , BANGALORE INDIA PIN: 560086
Tel: +91-80-4245-5555 / 23192209, Fax: +91-80-4245-5556 / 23192210
email: prdc@vsnl.com website: www.prdcinfotech.com

For Enquiry CALL: +91-80-4245-5555

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Power Research & Development Consultants Pvt. Ltd.
5, 11th Cross, 2nd Stage, West of Chord Road,
Bangalore - 560086. INDIA. Phone : (080) 4245 5555 / 2319 2209
Website : www.prdcinfotech.com

For feedback and subscription, please reach us at **newsletter@prdcinfotech.com**

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