Kannur Power Scene

A Monthly Publication of
K.S.E.B. Engineers' Association, Kannur Unit
(for Circulation among members only)

Volume 25 ✔ No 6 ✔ November 2011

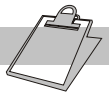
CHAIRMAN'S VOICE

Smart Grid

The major part of the electricity is generated from fossil fuels. The depleting nature of fossil fuels has led to electricity generation from alternative resources which are distributed in nature. Hybrid energy systems, integration of renewable sources at the distribution level as distributed generation and micro grid concepts have already been in practice. Smart Grid is emerging as an outgrowth of dispersed on-site and embedded generation via the application of emerging technologies in communication, power electronics and control.

Smart grid

One of the most rapidly developing means to achieve the goal of energy independence as well as energy savings, increased reliability and energy-cost savings is through a "Smart grid" which updates traditional power grid by carrying electricity using digital technology .Smart grid essentially take an electrical grid and deliver to it communications and computer technology, so that suppliers can deliver electricity to consumer in a wide range of conditions, while also accommodating wind and solar power sources. Smart grid is an umbrella term that covers modernization of both transmission and distribution grids. Smart grid, utilizing information technology, allows two way communications between suppliers and consumers in order to decide jointly or independently, decide control strategies to save energy, reduce costs and increase reliability and transparency. In general, it is focusing on the integration of new and renewable energy resources to the grid, maintaining quality, reliability and customer satisfaction.



The basic concept of Smart Grid is to add monitoring, analysis, control, and communication capabilities to the electrical delivery system to maximize the throughput of the system while reducing the energy consumption. The Smart Grid will allow utilities to move electricity around the system as efficiently and economically as possible. It will also allow the homeowner and business to use electricity as economically as possible. We will have the choice and flexibility to manage our electrical use while minimizing the cost.

Smart Grid builds on many of the technologies already used by electric utilities but adds communication and control capabilities that will optimize the operation of the entire electrical grid. Smart Grid is also positioned to take advantage of new technologies, such as various forms of distributed generation, solar energy, smart metering, lighting management systems, distribution automation, and many more.

Characteristics of smart grid

1. Increased use of digital information and control technology to improve, reliability, security and efficiency of the electrical grid.
2. Dynamic optimization of grid operations and resources with full cyber security.
3. Deployment and integration of distributed resources and generation including renewable resources.
4. Development & incorporation of demand response, demand side resources, and energy efficiency resources.
5. Deployment of 'smart' technologies for metering, communication concerning grid operations and status and distribution automation.
6. Integration of 'smart' appliances and consumer devices.
7. Deployment and integration of advanced electricity storage and peak saving technologies
8. Provision to consumers of timely information and control options
9 Deployment of standards for communication

Smart grid functions:

A modern smart grid must:

1. Be able to heal itself
2. Motivate consumers to actively participate in operations of the grid
3. Resist attack
4. Provide higher quality power that will save money wasted from outages
5. Accommodate all generation and storage options
6. Run more efficiently
7. Enable higher penetration of intermittent power generation sources

Features of smart grid

Existing and planned implementation of smart grid provide a wide range of features to perform the required functions.

1. Load adjustment –The total load connected to the power grid can vary significantly over time. In smart grid, it is possible to predict how many standby generators need to be used to reach certain failure rates. In the traditional grid, the failure rate can only be reduced at the cost of more stand by generators.
2. Demand Side Management (DSM)- By enabling DSM,consumer demand can be reduced during peak times and shifted to underutilized time. This allows utilities to use their producing assets more effectively so they can maximize the reliability while minimizing overall cost and emissions.
3. Greater resilience to loading
4. Decentralisation Power generation
5. Price signaling to consumers

Why we want to adopt smart grid?

India is a fast-emerging economy where the demand for electric power is increasing by leaps and bounds. In our economy, energy efficiency enhancement technologies such as smart grids can leapfrog development by harnessing distributed energy resources, which nature has so generously bestowed on us.

Smart grid is the next generation intelligent electricity grid enabled by the convergence of energy, telecommunications and information technology. It leverages contemporary technologies to improve power usage efficiency, enables utilities to have remote access to the location of interest and tries to isolate and restore power failures almost in real time. This increases the stability of the grid and achieves an optimal solution to supply-demand mismatches.

The consumers also can generate power, for example from renewable energy sources, and contribute to the grid. Thus, a smart grid transforms the way power is delivered, consumed and accounted for. Adding intelligence throughout the networked grid increases reliability and power quality, increases efficiency, handles current and future demand and potentially reduces costs.

Ongoing Smart Grid Activities

1. APDRP & RAPDRP for distribution reform(AT & C focus)
2. DRUM India- Distribution Reform Upgrade , Management
3. Four pilot sites(North Delhi, Bangalore, Gujarath, Maharashtra)
4. Smart Grid Vision for India
5. Smart Grid task force
6. BESCOM Project-Bangalore-Integration of renewable and distributed energy resources into the grid.
7. KEPCO Project in Kerala-$10 billion initiative for smart grid.
8. L& T and Telvent project-Maharashtra-Distribution Management System roll out
9. Distributed generation via roof top solar for 40 % in a micro grid

M.Anil,
Chairman

EDITORIAL

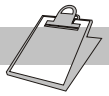
Wind Energy- Fastest Growing Renewable Energy Source

Wind Power constituted 2.5 % of worldwide electricity usage (according to 2010 figures).China has assumed the position of leader in annual & cumulative installed wind capacity in the world. Transmission access & interconnection is a problem everywhere and the inability to solve the transmission issues will jeopardize the ability to achieve renewable energy goals and will drive up the cost to reliably integrate these new resources into the energy delivery system. A long term policy frame work to solve the technical problem associated with wind energy is to be done.

Realizing the growing importance of wind energy, manufacturers have steadily been increasing the unit size of the wind electric generators since the late 1980s. Wind power has changed the face of electric power industry and has instigated fundamental changes in the ways power systems are designed and operated. Wind power blurs the traditional distinction between generating resources, which produce power according to dispatch commands from operators and system load, which is variable and uncertain but predictable by means of forecasts. Another important development has been the offshore (i.e. in the sea) wind farms, which have several advantages over the on-shore ones. Other major development has been the use of new techniques to assess the wind resource for techno-commercial viability.

Potential in India

The Indian wind energy sector has an installed capacity of 14158.00 MW (as on March 31, 2011). In terms of wind power installed capacity, India is ranked 5th in the World. Today India is a major player in the global wind energy market. The unexploited resource availability has the potential to sustain the growth of wind energy sector in India in the years to come.



Offshore wind power development

A long coastline and relatively low construction costs could make India a favored destination for offshore wind power. Off shore wind carries certain advantages over the onshore wind. They are:

1. Greater area available for setting up large projects
2. Higher wind speed than onshore locations
3. Lower turbulence intensities
4. More consistent wind speed

Barriers to higher growth

The low utilization of the country's wind power potential so far is attributable to several factors, including lack of an appropriate regulatory framework to facilitate purchase of renewable energy from outside the host state, inadequate grid connectivity; high wheeling and open access charges in some states, delays in acquiring land and obtaining statutory clearances.

National Policy & Regulatory Framework

The Electricity Act 2003 changed the legal and regulatory framework for the renewable energy sector. The Act provides for policy formulation by the Government of India and mandates the State Electricity Regulatory Commissions (SERCs) to take steps to promote renewable and non conventional sources of energy within their jurisdiction.

The Electricity Act 2003 provides that co-generation and generation of electricity from non-conventional sources would be promoted by the SERCs by providing suitable measures for connectivity with grid and sale of electricity to any person and also by specifying, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licensee. Such percentage for purchase of power from non-conventional sources should be made applicable for the tariffs to be determined by the SERC s at the earliest.

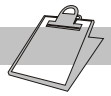
Progressively the share of electricity from non-conventional sources would need to be increased as prescribed by State Electricity Regulatory Commissions. Such purchase by distribution companies shall be through competitive bidding process. Considering the fact that, it will take some time before non-conventional technologies compete, in terms of cost, with conventional sources, the Commission may determine an appropriate differential in prices to promote these technologies.

Wind Power forecasting & Scheduling

Accurate wind power forecasting is the foundation for increasing the precision of power dispatching and enhancing the ability of the power system to accommodate wind power. It is also helpful in order to decrease the needed reserve capacity, improve the power system as a whole and thus reduce the cost of wind power development.

Although forecasting requires some initial investment, it will be beneficial in the long run. Scheduling requirements can help generators to trade power and compete with schedulable conventional power on the trading platform, allowing generators to earn significantly higher revenues. This is important for India where revenue collection is a major problem for the power sector.

In wind power forecasting, the main participants are wind farm operators and grid operators and its success depends upon close cooperation between them. Wind forecasting uses sophisticated numerical weather forecasts, wind power plant generation models and statistical methods. With accurate prediction of wind power generation, grid operators can plan effectively for the available power. This will result not only in improving the economic efficiency of grid operation but also help in planning for any maintenance and outages to be taken up by the operators. It will further help in compensating for planned outages of thermal plants, and provide additional reserve margin in case of unplanned outages. Thus, forecasting wind power is important to its cost-effective integration within the regional and national power grids.



The break-up of projects implemented in prominent wind potential states (as on March 31, 2011) is as given below:

State-wise Wind Power Installed Capacity In India

State	Gross Potential (MW)	Total Capacity (MW) till 31.03.2011
Andhra Pradesh	8968	200.2
Gujarat	10,645	2175.6
Karnataka	11,531	1730.1
Kerala	1171	32.8
Madhya Pradesh	1019	275.5
Maharashtra	4584	2310.7
Orissa	255	-
Rajasthan	4858	1524.7
Tamil Nadu	5530	5904.4
Others		4
Total (All India)	**48,561**	**14,158**

Source: Indian Wind Energy Association

While the implicit variability and uncertainty of the weather can create challenges, as reflected in the power output of wind power plants, these issues can be addressed with improved forecasting, appropriate operating assumptions, and thoughtful market design. System flexibility must be matched to the system level needs that are created not just by the wind power plants but by the entire fleet of generation and load. While many concepts are still in the process of developing and converging, power system planners and operators are making significant progress in support of the large additions of wind energy expected in the coming years.

India is one of the key emerging economies yet a highly vulnerable country to both climate change and energy market fluctuations. Wind power, through its scalability and speed of deployment, can not only help reduce India's carbon footprint but also help towards achieving energy security by reducing its dependence on fossil fuel imports in the long term.

Editor

Insulation Measurement & tan δ

Engineers' Association, Kannur Unit has arranged a Technical Session in connection with its unit meeting held on 9th November 2011.The technical session on "Insulation Measurement & tan δ" was conducted by Er M.T Biju,Assistant Executive Engineer, PET, Kanhirode.

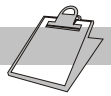
First he has discussed about the basics of electrical engineering materials including the classification as conductor, semiconductor & insulator and about the nuclear structure of each. Then he detailed the term "Insulators" and its characteristics.

Insulator is an important electrical engineering material in high voltage engineering .They are commonly known as dielectrics & are used in electrical engineering as conductor support or for separation of conductors. There are both liquid & solid dielectrics.

Measurement of insulation is a must in electrical engineering because it is needed for designing, operation/maintenance and for predicting the remaining life expectancy of equipment. Periodical measurement of insulation is needed because of the ageing of insulators. Ageing of insulators are due to :

- Electrical stress - It is associated with fault, high voltage & high current.
- Mechanical stress - Due to mechanical puncturing or damage. eg: frequent starting & stopping of generator & motor.
- Thermal stress - Too hot & too cold condition. The thermal energy will pull the outerbound electron & conduction will start.
- Chemical stress- Heavily polluted atmosphere (corrosive vapour, dirt, acid etc.) will contribute to ageing due to chemical stress.
- Environmental stress - Moisture in the atmosphere is the main reason for ageing due to environmental stress.

From manufacturing level itself, insulation measurement is done. Component level development test is done during designing. After that, type test, commissioning test, routine test and breakdown test are performed as per requirement. Routine test is important in KSEB to predict the decaying of insulator.



Different methods of Routine test

1. IR test- Most common testing equipment is IR tester commonly known as Megger. It is cheapest & easy to use. It produce DC voltage using dynamo & it is non destructive in nature. It has a dial calibrated in resistance & insulation resistance can be directly read from the equipment.
2. HV Testing-It is costlier & destructive in nature. In this test, leakage current is measured & IR is assessed according to leakage current.
3. Tan δ measurement-It is non destructive in nature.

Insulation Measurement of a transformer

The transformer is represented in terms of capacitance. Capacitance between HV winding & earth, capacitance between LV winding & earth and capacitance between HV winding & LV winding. While testing HV/LV winding, earth act as conductor and there is capacitive effect because two conductors are separated by dielectric. Voltage is applied for testing and capacitor gets charged. So it is to be discharged after testing. In modern testers automatic discharging is there.

Polarisation Index PI = $\frac{I_R \text{ at } 10 \text{ minute}}{I_R \text{ at } 1 \text{ minute}}$ (I_R-Insulation resistance)

Dielectric absorption rate DA = $\frac{I_R \text{ at } 1 \text{ minute}}{I_R \text{ at } 15 \text{ secs}}$

The Dielectric absorption rate DA, only shows a trend about the decaying of insulation. D A is sufficient in case of liquid insulators and PI is needed for solid dielectrics.

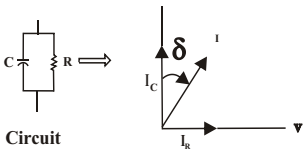
During testing there are 4 types of currents

1. Capacitive charging current - We are applying voltage between 2 conductors(plates).It will absorb a current. This current will flow until the plates are fully charged.
2. Dielectric absorption current - In case of transformer, the dielectric(oil,cellulos) will absorb some current. This current also will flow for a short duration
3. Leakage current - If insulation is strong, leakage current is very very small. PI $\leq$ 1 ,very poor insulator
4. Surface leakage current - The surface is guarded in order to ensure that surface leakage current will not enter in to measuring circuit.

• HV Testing is destructive in nature and it is not advisable to do frequently.

What is tan δ?

Tan δ, also called Loss Angle or Loss Dissipation Factor.



Circuit

If the insulation of a material is free from defects, like moisture, air pockets, etc., the material approaches the properties of a perfect capacitor. It is very similar to a parallel plate capacitor with the conductor and the neutral being the two plates separated by the insulation material.

In a perfect capacitor, the voltage and current are phase shifted 90 degrees and the current through the insulation is capacitive. If there are impurities in the insulation, like those mentioned above, the resistance of the insulation decreases, resulting in an increase in resistive current through the insulation. It is no longer a perfect capacitor. The current and voltage will no longer be shifted 90 degrees. It will be something less than 90 degrees. The extent to which the phase shift is less than 90 degrees is indicative of the level of insulation contamination, hence quality/reliability. This "Loss Angle" is measured and analyzed.

$$\text{Tan}\,\delta = \frac{\text{Sin}\,\delta}{\text{Cos}\,\delta}$$

For small values of δ, tan δ = Sin δ= Sin (90-φ)=Cos φ = P.f

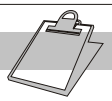
The p.f indicates the efficiency of the system. Different from the case of power triangle(KVA, KVAR & KW),p.f should be nearly zero to say that the insulator is efficient.

Measurement of Tan δ

Tan δ is measured using bridges(Schering's bridge-measure an unknown capacitance using a known capacitance).There are two tests.

1. Grounded Specimen Test(GST) &
2. Ungrounded Specimen Test(UST)

In case of transformer there are 3 capacitances.



1. C_{HE} Capacitance between HV winding & earth.
2. C_{LE} Capacitance between LV winding & earth.
3. C_{HL} Capacitance between LV winding & HV winding .

If LV winding is guarded, C_{LE} and C_{HL} are absent. Only C_{HE} is there. If HV winding is guarded, C_{HE} and C_{HL} are absent. Only C_{LE} is there. Energise LV winding and HV winding is grounded, we will get $C_{LE} + C_{HL}$ .All these capacitances are measured and tan δ is analysed.

In UST mode ,equipment test ground is abandoned. Only C_{HL} is there and it is measured.

tan δ= Cos φ, for small values of δ

W=VI Cos φ, $\quad \text{Cos } \varphi = \dfrac{W}{VI \text{ Cos } \varphi}$

W & I are measured and tan δ is calculated. If tan δ value is high, the equipment is recommended for replacement.

Capacitance and values tan δ obtained on new insulation are treated as benchmark readings. Then by measuring and comparing the periodical readings of the capacitance and tan δ of the insulating material with the benchmark readings, one can know the rate of deterioration of the health of the insulation.

In short ,tan δ measurement gives us the deterioration rate of insulation. Knowing the rate of deterioration, we can be able to

- Predict the future unexpected breakdown of the insulation of HV equipment.
- Plan the maintenance schedule.
- Repair the insulation before actual flashover, saving high cost of replacement of material .
- After repair, quality of insulation can be checked before returning the equipment to service.

The technical session concluded at 6.00 pm

14th December is an important day for all of us in the Energy Sector. **Energy Conservation Day** is observed in India on 14th December. Energy conservation means using less energy and avoiding excessive or wasteful uses. Energy efficiency, on the other hand, means using less energy while getting the same results. Efficiency is therefore a subset of conservation; one way to conserve energy is to use it more efficiently.

Through studies, it has been established that efficient use of electricity could result in saving of 23% of what we consume. The concept of doing more with less offers an approach that seems both feasible and affordable. Electricity conservation for us is not that we do not want to increase the consumption of electricity. In fact, we have a long way to go. What we mean is that what we consume, we should consume efficiently.

KSEB Engineers' Association is observing Energy Conservation Day on 14th December, 2011. CONSERVATION QUEST, an energy conservation slogan contest among School Children in Kannur Municipal area is this year's attraction. The theme of the contest is "SAVE ENERGY FOR TOMORROW".

For winners of the contest, a cash prize is proposed to be awarded on 14th December, 2011 at Engineers' House, Kannur which is also celebrated as Energy Conservation day, in the presence of eminent dignitaries.

Energy Conservation Day

Energy Conservation Day will be celebrated on 14th December 2011 at Engineers' House, Platinum Centre, Kannur. The function will begin at 5pm . All members are requested to participate.

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BOOK - POST

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