

POWER SYSTEM OPERATION CORPORATION LTD.
(A wholly Owned Subsidiary of POWERGRID)
NORTHERN REGIONAL LOAD DESPATCH CENTRE
NEW DELHI

HOW FOG MONITORING AND FORECASTING CAN HELP POWERSYSTEM

Northern Region power system has witnessed several incidents of multiple transmission lines outage due to transient faults caused under dense fog conditions in the region during past several years. This phenomenon has aggravated in recent years and can be attributed to all around increase in pollution level. These trippings have the potential to cause blackout / brownout in large parts of the grid for several hours. The most recent incident experienced on this account was on 2nd Jan 2010 during last winter, resulting into partial blackout in Northern Regional grid affecting Punjab, Haryana, J & K and HP. This incident was triggered by tripping of multiple lines due to transient faults caused under dense fog conditions in the affected areas.

Similar incidents of multiple lines tripping resulting in partial blackout in a large section of Northern Region have occurred earlier also, notably on 7th & 9th March 2008, 27th Jan 2007, 16th /17th Feb 2006, 23rd Dec 2005, 23rd Dec 2002 and 2nd Jan 2001, in addition to several other minor incidents. Thus fog coupled with pollution has major impact on power system and under such blackouts even essential services in affected areas are badly hit.

It has been observed that such trippings mostly occur during mid-night and early morning hours (from 0300 hrs to 0800 hrs) when the atmospheric temperature is minimum and relative humidity is very high and conditions are favourable for fog formation. Detailed investigation of the flashovers indicate that under dense foggy atmospheric conditions break down strength of the surface of the porcelain insulator reduces due to deposit of pollutant (soil dust, fertilizer deposits, industrial emissions, fly ash and construction activities, etc) over it. Depending on the proximity to highways and traffic, the wear of vehicles tyres also produces a slick, tar-like carbon deposit on the insulator surface. Exhaust from the diesel vehicles also contribute in this phenomenon.

In order to take proactive measures to mitigate the impact of fog on safety and security of electricity grid, NRLDC and SLDCs have started monitoring of the weather parameters especially temperature and humidity. Initially information about weather (especially fog) was taken from the different websites. Since the relevant information from websites which is critical for our applications is quite limited, after the incident of partial blackout on 27th Jan 2007, a decision was taken to install temperature and humidity transducers at all important substations in the Northern Region and take pro-active actions based on such

information. Experience shows that such monitoring was found to be very useful in handling contingencies arising due to fog related trippings in real time.

Based on the information about intensity, geographical location and time of occurrences about the fog, load dispatch centers and substations throughout the region are alarmed in the evening itself about the forthcoming adverse weather conditions. As tripping of transmission lines mostly occurs during mid night and early morning hours and manpower movement under such conditions is very difficult due to poor visibility on the road, the additional load dispatch engineers are called at the control centers in the early night hours itself prior to start of the line trippings on flashover. This additional manpower and information about weather also helps in the better situational awareness for effective grid management and contingency handling, if any. Several blackouts have been avoided by this type of preparedness by taking timely preventive / corrective actions by the system operators and we feel that the weather information (especially Fog, Temperature, Humidity, Wind Speed, Direction Rain etc.) is very useful for safe and secure power system operation.

In addition to monitoring weather conditions during winter nights, preventive actions like replacement of porcelain insulators by anti fog or polymer insulators having better breakdown strength under such conditions are also taken. As the power system is becoming more complex, NRLDC is looking for accurate forecast about the weather along the different transmission corridors throughout the Northern Region, at a close interval say 15 minutes. At the same time NRLDC is also looking for a long term weather forecast say week ahead or month ahead for preventive actions and strategical deployment. In the Northern Region electricity demand is also highly dependent on weather. Therefore, an accurate weather forecast can also be helpful towards optimisation of load generation balance.

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