OrxaGrid Pilot Case studies

Call: +44 20 8638 5757
email: info@orxagrid.com
www.orxagrid.com

Transformer analytics at Solar Park

Challenge

Solar installations near utility substations has seen a large uptake in recent years. By being located next to a high voltage substation, long distance transmission costs from the solar plant are reduced as the solar plant feeds directly into the pre-existing electricity network.

However, transformers on the utility substation need to be closely monitored to ensure a smooth inflow of energy from the solar generation site. Solar injection into the grid, if not managed correctly can create technical losses and voltage imbalances while also leading to over loading of the transformers. All these conditions can result in reliability issues to the grid. OrxaGrid was tasked with monitoring and analysing a 1.5MVA step up transformer that fed electricity from the 5MW solar plant into the transmission grid network.

Solution

OrxaGrid deployed its unique, entirely Internet of Things (IOT) based system. The system constituted STEM for data collection and a Grid Analytics Platform (GAP) for data management, analysis and visualisation.

STEM sensor was installed on the transformer to measure transformer power parameters as well as transformer condition. The sensor communicated through HTTPS REST services using secure Machine to Machine cellular cards to the GAP software deployed at the utility's control centre. Additionally, the STEM stored backup data onboard for extra reliability. OrxaGrid enforced security using device specific logins to prevent unauthorised access and SSL Encryption for secure data transfer. The web and mobile enabled dashboards were designed to be intuitive and simplicity driven for use by both domain experts and non-technical users of the utility.

The key solutions that the OrxaGrid system offered were:

- Identifying and predicting energy violations such as over voltage, phase imbalance and excessive peak demands
- Monitoring the condition of transformers to reduce maintenance downtimes

Result

The project return on investment was apparent within days of implementation. Key results were:

- Real time visibility into the network identified daily peak loading on transformer at noon and moving to zero at night. Correlation between solar generation and weather information such as cloud cover was observed
- Solar generation was observed to be highest during the summer months and decreased during the rainy cloudy season
- Voltage drops appeared at evening times when solar generation stopped and also during faults
- Voltage levels were closely monitored to ensure they remained within permissible limits and thus prevented technical losses
- Transformer tap positions were recommended to be changed automatically based on solar generation prediction
- Energy accounting identified power generated from the solar park and the internal transformer losses which were minimal
- The transformer had adequate spare capacity and due to the low loading, its long-term healthiness showed reliable results

OrxaGrid's IoT based solution proved to be a viable solution to the distribution utility for maximising energy efficiency of the solar feed into the grid. The system was scalable through retroactive addition of sensors from other substations in other divisions of the utility. The system was also interoperable where existing data sources from metering or SCADA could be fed into the system for deriving insights

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