Creating efficient factories by “effective monitoring of power quality”

Power Quality Analytics for Ashok Leyland

Good power quality has tremendous financial potential, because it helps prevent problems. A state-of-the-art industrial production facility contains a large number of electronic devices and automation systems. Not only are these sensitive to voltage fluctuations in the power supply system, but they can also cause faults themselves, and feed them back into the supply system. According to Electric Light and Power Magazine, 30-40% of all business downtime is related to power quality problems.

Business Problem
Our customer had been facing the following pain areas:
• Frequent CNC machine breakdown avoidance. Lack of information related to Power Quality issues.
• Comparison of CNC machine profiles (new and old). Monitoring the power through automated mechanism.
• Evaluate machine utilization factor by creating transparent energy flows to support energy management systems in determining potential savings.

Siemens Offering
Siemens offered a complete, proven portfolio of power quality solutions that seamlessly measured and recorded the continuity of the power supply, enabling users to foresee potential problems and initiate timely countermeasures. Siemens used SICAM Q200 PQ recorders which are developed in accordance with IEC Standard 61000-4-30 and deployed them at critical nodes of the factory. The data recorded was stored in MindSphere (Siemens IoT platform for Industrial Data Analytics). The analysis performed for Ashok Leyland provided the following: plant power quality optimization, energy optimization, Accurate monitoring of production efficiency vs consumption, recommendations for suitable counter measures to avoid problems during operation, downtimes, equipment failures and equipment damage.

Key Commercial Impact
• Saving potential up to 320000 units per year due to presence of harmonics and reactive power losses (1 shift and 25% loading considered)
• Saving potential of 400nos of higher production (2 CNC machines considered)
• Saving on annual power quality audits: estimated 10 man-days effort for plant evaluation and analysis

* Above commercial impact is calculated for 3 transformers and 2 CNC machines only. At overall plant level monitoring, potential savings will be much higher.
Power Quality Solution Package with Data Analytics

CNC Machine Breakdown
Anomaly Detection: CNC machine breakdown conditions correlated with PQ events – voltage dips were found. The key findings included breakdown and production losses due to voltage dips and overloading of transformer. Appropriate voltage conditioning technique was recommended to overcome the occurrence of voltage disturbances.

Higher Harmonics at CNC Machine
Anomaly Detection: Harmonic distortion levels were 16% at CNC1 machine and 20% at CNC2 machine. Key findings observed were transformer and cable heating, malfunctioning of protection circuits, damage and mal-operation of sensitive electronic components resulting in machine downtime. Suitable filtering technique suggested to mitigate the harmonic levels in the network.

Equipment and Operator Safety
Anomaly Detection: Increased neutral current resulted in current unbalance at the CNC machine. This led to large zero sequence current of about 75% resulting in excess heating of machine components and neutral conductor. Thus sensitive electronic devices were undergoing damage affecting the machine life cycle and threatening operator safety. Unbalance correction technique was suggested to rectify the issue.

Asset Utilization – CNC Machine
Daily shift wise active power consumption of CNC1 and CNC2 machines were studied and analyzed. Utilization of CNC1 machines was found to be relatively better than CNC2 machines across all the shifts. A transparent view of asset utilization with recommendations to improve it were provided.

Reduction in Utility bill
Anomaly Detection: Significant reactive power requirement was observed across the plant electrical network. The key findings included higher kVA demand on the utility, possibility of exceeding the sanctioned kVA during peak load conditions and magnetic and winding losses of transformer. Filtering technique was suggested to balance reactive power.

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