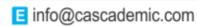# IoT for Boilers

Background

Boilers are a key building block in production processes and play a fundamental role in any refinery or plant. The management of most plants are focused on the number of units produced and the productivity of the process lines while rarely looking into key aspects such as the run time and operational efficiency of boilers. Boiler efficiency is a key parameter to monitor and control effectively in order to maintain the quality and optimum throughput. There are various parameters to be monitored, like run time, fuel temperature, fuel usage, number of boiler passes and many more, which affect the life and efficiency of a boiler. Another key aspect to be looked into is the ratio of the initial cost and the maintenance costs.

The initial investment in boilers is only a minor investment, with a majority of costs occurring on cleaning and maintenance. With regard to the above, it becomes all the more important for boiler manufacturers and industries to monitor the boilers on a real time to achieve to maximum efficiency while reducing down-time and recurring costs. We were approached by a boiler manufacturer in India to design a solution, along with a company specialising in the data analytics, working towards the optimum utilisation of boilers.

Solution Approach

Boilers are automated and controlled through programmable logic controllers (PLC's). The programmable logic controllers and the associated SCADA systems take care of the instructions and implementations of the functions associated with the boilers such as logic-sequencing – timing – counting and the management of analog and digital inputs. The PLC also provides for an easy interface for operational personnel and engineers to control the various parameters.

With the PLC being the heart of the boiler – maintaining a log of all the run-time parameters of the boilers as well as the sensors connected to the PLC, collecting data from the PLC was the right way to approach. With gateways developed in CASCADEMIC serving Industry 4.0 applications, the Industrial IoT Gateway, with is range of industrial wired interfaces such as RS485 built together with MODBUS RTU protocols, 10/100 Ethernet port with MODBUS TCP Support and the provision for 8 Analog inputs, served as the perfect fit for this application. Using the cellular connectivity options of 3G / 4G LTE, the gateway was able to poll the data from the PLC and push the data to the IoT Cloud platforms in real time, thereby enabling analytics with no latency on the data and monitoring by personnel sitting across the globe.

Challenges faced and the Value Proposition of the CASCADEMIC Gateway

There is always a big disparity between strategy and implementation as is the case in the real world; there were multiple challenges in the road ahead of implementing the solution. Listed below are the challenges and how CASCADEMIC was geared towards each of them to make the solution successful:

1. **Different PLC makes across boilers**: With different boilers controlled though different PLC makes and manufacturers, the Gateway was designed to have a modular software with an easy interface for users to map the MODBUS registers and the input data on the Gateway.

2. **Poor Network Connectivity in plants**: Many plants are located at remote locations across India and the boilers installed within thick walls, the cellular connectivity was usually unstable; leading to data transmission issues. However, the Gateway was designed with a robust 3G/4G Connectivity module, and was able to connect and push the data to the cloud platform. With the provision for an external antenna and a robust store and forward logic on the gateway, there was no allowance for data loss and an improved connectivity to the Cloud.

3. **Different Wireless Connectivity:** Some factories were equipped with Wi-Fi networks, so for these sites we had to equip the Gateway with Wi-Fi instead of the cellular connectivity. However, the Industrial IoT gateway has a modular wireless architecture: Wi-Fi / 3G / 4G / Bluetooth and NB-IoT can be integrated as per the requirement. With this modular architecture, we ensure that the core of the Gateway remains the same and only a small component needs to be re-configured.

4. **Unstable Power Supply :** With various machine being power heavy, there was unstable 24V power input to the Gateway , which was observed in the initial site installations. With a higher voltage input range design on the Gateway and sufficient surge and power protection, the Gateway was fully supported across all installations irrespective of the power fluctuations. With a modular hardware architecture as well, CASCADEMIC ensures that any tweaking and re-design on the Gateway is processed through a very short development cycle.

You can find more information on the features of the Gateway at
https://cascademic.com/products/industrial-iot-gateway/

CASCADEMIC's Industrial IoT gateway has now been installed in factories and plants across India with the Gateway on an average polling 99.5% of data on the PLC's .With stable wireless connectivity and industrial input interfaces, managers and operational teams now have a real time view of their boilers and are able to take calculated decision based on data towards achieving optimum efficiency and increasing the lifetime of the boiler while reducing cost.
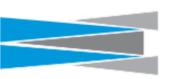
IoT for Boilers

A web view of data from a boiler