Choosing the right data acquisition solution for implementing an intelligent energy saving system in factories is important to reduce costs and increase competitiveness.

Introduction

In recent years, energy saving solutions have attracted a lot of attention worldwide, especially for industrial applications such as factory automation, solar power, and intelligent transportation systems (ITS). Companies that adopt an energy saving system can benefit from reduced energy costs, and help make their products and services more competitive in the market. For these reasons, engineers are always on the lookout for easy-to-implement, cost-effective solutions for saving energy in factories.

In the past, energy monitoring systems in factories only focused on reducing total energy consumption, making it impossible for engineers to analyze the energy used by individual devices. With the increased development of industrial Ethernet networks, engineers can now use IP-based remote I/O devices to monitor essentially every machine and device in a factory. Power consumption information and data processed by the machine or device can now be collected and sent in real time to the control center for further analysis. Since devices and sensors are usually located some distance from the control center at remote field sites, how to easily and effectively connect every device in the factory to the factory network is a critical issue in implementing an efficient energy management system.

In this article, we cover the following three topics:

- Efficient Installation and Deployment of a Highly Scalable, Integrated System
- Efficient Data Collection Using Push Technology for Real-Time Data and a Data Logger for Historical Data
- Efficient Local Intelligence with Click&Go Plus for Faster Responsiveness

Efficient Installation and Deployment of a Highly Scalable, Integrated System

One of the most troublesome aspects of a factory energy saving system is the fact that large numbers of I/O channels are needed to transmit field site data related to lighting, production lines, and environmental monitoring back to the control center. In addition, the channel types used for different applications may not all be the same, and could include digital I/O, analog I/O, and temperature sensors (TC/RTD). With devices and sensors scattered all over the factory, it is difficult for engineers to link all of the I/O channels to a centrally located energy saving system.
Moxa’s ioLogik 2500 is an ideal solution for this kind of complex data collection and data transmission system. The ioLogik 2500 can be cascaded with as many as eight E1200 units, which are available in different I/O combinations, including digital channels, analog channels, and RTD/TC channels. The ioLogik 2500 serves as a multi-functional “head unit,” and only requires one IP address and one dynamic MODBUS address for the entire ioLogik 2500 plus E1200 array. Using a daisy-chain topology between the ioLogik 2500 and E1200 units makes it much easier to collect data from multiple monitoring sites located in the same factory, but separated from each other by tens or hundreds of meters.

A comprehensive energy saving system needs to monitor many devices, including production machines, environmental sensors, and meters. Since not all machines and sensors transmit data using the same interface—with some using a serial interface (MODBUS RTU: RS-232, RS-422, or RS485) and others using an Ethernet (MODBUS TCP) interface—one of the biggest challenges is how to ensure that all of the data can be transmitted over the same network and analyzed by the same system. Eliminating the need to invest in extra-specialized devices to integrate different data types can significantly reduce the cost of building an energy saving system.

The ioLogik 2500 provides a good MODBUS gateway solution that acts between the serial interface (MODBUS RTU) and Ethernet interfaces (MODBUS TCP). In addition, the serial information (MODBUS RTU) can be converted to MX-AOPC tags for use with MX-AOPC UA server.

In the energy saving system illustrated below, the ioLogik 2500 connects to serial meters and Modbus RTU devices, from which it receives digital input data and analog input data, respectively, and Click&Go Plus logic rules trigger output signals to HVAC systems, lighting, pumps, and compressors. In addition, data collected by the ioLogik 2500 is sent to MX-AOPC server for further use in the company’s database.
Efficient Data Collection Using Push Technology for Real-Time Data and a Data Logger for Historical Data

An important requirement for energy saving systems is being able to obtain information in real time for further analysis. Engineers often use OPC servers to gather information from I/O devices and then transmit it back to the energy saving system. However, traditional OPC servers collect data by “polling,” which makes it difficult to meet the real-time requirement since polling hundreds or thousands of devices can introduce significant time delay. The ioLogik 2500 comes with Moxa’s patented MX-AOPC UA suite, which uses “push” technology to ensure that sensor readings are received in the central control room as soon as they are generated by the sensor.

For example, the ioLogik 2500 can be used with an energy saving system to monitor a factory’s power consumption, in real time. If any of the factory’s power sources are overloaded, engineers will be notified immediately so they can take appropriate action.
In addition to real-time information, access to historical data is also an important requirement for energy saving systems. Historical information can be used for data analysis, such as creating trends charts that show energy consumption or the status of field site devices as a function of time. Analysis results are important since this kind of historical information can be used to help optimize energy usage.

Since a data logger is used to collect and store historical information, engineers should make sure that their choice of data logger can be integrated with the energy saving system, and in particular make sure that the data can be easily uploaded to the data center. It is important to keep in mind that the data logger itself could use a significant amount of network bandwidth.

A big advantage of the ioLogik 2500 is that it comes with a built-in data logger function that can be easily configured using the ioLogik 2500’s user-friendly configuration utility. Logging conditions can be easily controlled with Moxa’s Click&Go Plus logic, and the ioLogik 2500 also supports FTP server and client modes so that users can easily access the historical data.

An important data logger application is determining peak and off-peak energy usage times, and discovering which devices are consuming the most energy. With this information, engineers can further optimize energy usage in the factory.
Efficient Local Intelligence with Click&Go Plus for Faster Responsiveness

Traditionally, sensor data generated at field sites was sent back to the control center for processing and determining what action was required. However, since sensor data is now transmitted over a multi-purpose network, requiring all data processing to be done at the control center can result in excessive delays between when a sensor sends a signal, and a control action is executed.

Since the computing power and data storage used for this type of application are relatively inexpensive, it makes more sense to localize certain aspects of the control system by deploying inexpensive yet powerful controller units at remote field sites. With field site devices taking an active role in collecting and analyzing data, energy consumption of the entire system can be reduced. For example, an intelligent field site device could determine that too many lights are turned on, and in response turn off some of the lights to save energy.

The ioLogik 2500 supports Moxa’s patented Click&Go Plus front-end control logic, which makes it easy for engineers to design and implement control rules that specify what kind of action should be taken when certain information is received. For example, since lighting and air-conditioning systems account for a large percentage of a factory’s energy usage, the ioLogik 2500 can be connected to ambient light sensors, temperature sensors, and motion detectors, and then programmed to control lighting conditions, adjust air conditioners, and even close curtains to keep the sun out. All of these actions can further reduce energy usage.
Conclusion
When choosing a data acquisition solution for an energy saving application, engineers should keep the following important points in mind:

- Hundreds or thousands of I/O channels will need to be monitored
- Monitoring sites tend to be scattered around different parts of a factory
- Information transmission should be real-time
- Access to historical information is important
- Different information protocols are used by different devices

Properly addressing all of these issues can greatly reduce your factory’s energy costs, and increase the competitive power of your product or service.