Power consumption is not always at the top of the developer’s list of priorities, and that often causes a problem later in the design. In industrial applications, power consumption is multiplied many times over due to the number of systems in operation at any given time, as well as the duration with which those machines operate, oftentimes 24/7.

The first step in managing energy consumption is understanding what the various terms and concepts mean. For example, energy efficiency is often misunderstood. In its most simple terms, energy efficiency is defined by how much work can be performed with a given amount of energy. But there are many other factors in play. For example, how “clean” is your electricity?

Clean electricity is defined as electrical power that’s free from voltage spikes and drops. Voltage ripple or noise that’s outside the ideal sine waveform is often referred to as dirty electricity, which can reduce power efficiency.

A second issue has to do with the time of day that power is consumed. The power generators will sometimes charge less for electricity consumed during slower periods, like in the evenings when less power is being drawn. A “smart” factory will know and understand this, and adjust accordingly.

**Energy Management**

1. Facilitators understand that energy management can be broken into four levels, each monitored and managed differently.
Energy Management Framework

As shown in Figure 1, energy management in a factory can be broken down into four levels. Level 1 represents the primary power meter in a factory. Level 2 represents the distribution board within that facility. Level 3 shows what is happening with the high energy consumption equipment, such as a water chiller and/or an air compressor. And Level 4 is a single machine on a production line, such as a CNC machine.

Because smart solutions were not previously available, like the Vecow VHub Energy Management Solution (VHub EMS) for example, factory managers had access to Levels 1 and 2, but had a difficult time calculating the effects of Levels 3 and 4. The Vecow EMS provides sensors that are installed in-line with the machines, so their power levels are calculated dynamically in real time.

2. In a factory setting, data moves from the sensors (attached to the equipment) to the VHub EMS.

As shown in Figure 2, that data is transmitted back to a gateway device, like the Vecow AIC-100, through a Bluetooth connection. Bluetooth was chosen for its low-power characteristics, as well as its ubiquity with other devices.
The AIC-100 family is built with an NXP i.MX6ULL Arm-based microprocessor. It contains ample memory and all the interfaces required for this application. It is also designed to withstand harsh environments, with temperatures ranging from -25°C to +70°C.

**Optimize Your Energy Management**

A tool like the Vecow VHub EMS can help maximize that efficiency as it provides a solution for managing and analyzing power consumption in real time. Specifically, it measures the generation, transmission, and consumption of energy to help the plant manager make the right critical decisions by helping to monitor the power consumption of each machine and provide a visualization platform. This is handled with wireless auto-charge clamp sensors. And its non-intrusive nature allows it to be installed with no down time in the factory. In addition, the EMS can help diagnose potential issues and/or problems like over-consumption and leaks across the entire plant.

In addition to maximizing efficiency, the EMS product can help prevent breakdowns and problems that can occur due to the system exceeding its power limits. While the discussion here is mostly limited to factories and manufacturing facilities, it should be noted that the EMS would also apply to a smart building or hospital, or even a smart campus or city.

**3. The features of the VHub EMS include a wide operating temperature range and fanless operation.**

One of the key features of the VHub EMS is that it does not require the services of a technical engineer to start up or shut down any of the machinery when constructing and/or installing the network and performing the setup for deployment (Figure 3). In addition, using the sensors described earlier allows the equipment to remain completely functional during the installation process. And because it’s wireless, there’s no need to run any new wiring throughout the facility. Finally, Vecow provides a user-friendly GUI on its platform, which observes the power consumption and helps in the decision making (Figure 4).
4. An example of the dashboard provided by Vecow for its VHub EMS platform.

The VHub EMS performs power-consumption ranking, which keeps the system administrator up to date with any selected interval, whether it’s daily, weekly, monthly, and so on. In other words, he has a simple dashboard at his fingertips any time he needs it. And if something is amiss, it can easily be reported to an engineer. In addition, the dashboard would raise an alarm whenever an anomaly occurs.

Hardware Integration from Server, Gateway to Sensor

At this point, you may be asking yourself, why should I choose Vecow hardware? The answer has many components. First, you can be assured of meeting all requirements for industrial environments and Vecow integrates all of the hardware and software that’s needed to quickly build an energy-management system. And, of course, there are the multitude of design tools that developers can take advantage of.

One essential hardware component is the Vecow ECX-2000 Edge Server, which is powered by a 10th generation, ten-core Intel Xeon/Core i9/i7/i5/i3 microprocessor (Comet Lake), as well as the Intel W480E chipset. Other features of the ECX-2000 Edge Server include fanless operation at -40°C to 75°C, multiple 2.5GigE/10GigE interfaces, up to six USB 3.2 connections supporting a 10-Gbit/s data rate, and 5G/WiFi/4G/3G/LTE/GPRS/UMTS wireless capability. Input voltage ranges from 9 to 50 V, with 80V surge protection. The system is optimized for modern computer vision applications at the Edge, which encompasses machine vision, factory automation, intelligent vending, intelligent transportation systems, robotic control, autonomous mobile robots, deep learning, and other AI-related applications.

The AIC-100 IoT Gateway is based on an NXP i.MX6ULL Arm Cortex-A7 processor. Built for seamless connectivity and efficient communication, the
device supports a Node-RED browser-based flow editor and is packed with I/O, including two LAN and one USB interfaces, two COM ports, and one Mini PCIe connection. It comes pre-installed with Debian Stretch R01 and offers support for a 9- to 50-V input.

For most systems, one of two sensors would be deployed, as shown in Figure 5. The clamp style is physically smaller and is used for smaller currents, ranging from 0.3 A up to 350 A and has a power-line diameter that’s under 35 mm. A. The flexible style measures higher currents, from 2 A to 3kA and has a power-line diameter of 180 mm.

5. The ECX-2000 embedded workstation and AIC-100 rugged embedded system work in collaboration with Vecow’s ESC series current sensor and TSC-100 temperature sensor to manage the energy in an industrial environment.

It’s this total package that differentiates the Vecow solution from that of its competitors. It’s rare to find both the sensors and the web-based dashboard that offers real-time alert monitoring from a single vendor. To ensure that your facility is maximizing its potential in terms of energy and power efficiency today, tomorrow, and in the future, discuss your needs with the team at Vecow. You’ll find a one-stop shop for all your needs. Learn more in this case study that shows the VHub EMS in action.
About Vecow

Vecow is a team of global embedded experts. We are dedicated to designing, developing, producing, and selling industrial-grade computer products. All of our products are leading in performance, trusted in reliability, exhibit advanced technology, and innovative concepts. Vecow offers Accelerate Platforms, Embedded Systems, Single Board Computers, Embedded Peripherals and Design & Manufacturing Services with leading performance, trusted reliability, advanced technology, and innovative concept.

Vecow aims to be your trusted embedded business partner. Our experienced service team is dedicated to creating and maintaining strong partnerships and one-stop integrated solutions. Our services are specific and consider each partner’s unique needs in regards to: Autonomous Car, Robotic Control, Rolling Stock, Public Security, Traffic Vision, Smart Automation, Deep Learning, and any Edge AI applications.

Visit www.vecow.com for more information.
Contact us at info@vecow.com