



A Bright Future for Renewable Energy

Alternative Energy Revolution is on Its Way with Advanced Computer Technology

25 years ago, attitudes concerning renewable energy started to change as environmental concerns became more apparent. Coupled with the scarcity of natural resources; technological advancements made a large push to create new and more convenient ways of obtaining renewable energy like wind power, hydroelectric power, or solar power in homes and businesses.

In order to make the transition to renewable energy possible, technology is the key factor in successfully managing the process of converting these alternative energy sources, delivering and regulating the converted power supply for daily usage. The more advanced the technology becomes, the cheaper, more efficient and attractive renewable energy is.

Renewable Energy Solutions

Computer technology solutions such as those innovated by Intel® and its partner, Axiomtek, is one of the reasons for the rise in popularity of renewable energy consumption. It is responsible for less expensive, easier to access and highly reliable energy alternatives. Axiomtek provides embedded controllers and IoT gateway devices, with Intel® processor options, that have been selected by world-renowned renewable energy corporations to control the operations of solar energy power as well as other forms of renewable energy alternatives.

An example of how computer technology delivers convenient and cost saving ways for renewable power, not to mention reducing the greenhouse effects. Storing solar energy can now be achieved with energy storage batteries, which can be used to absorb energy at various times during the day and provide electricity for homes or large facilities' energy consumption. Axiomtek's embedded controllers, like the ICO or rBOX DIN-rail series, can be programmed to prevent overcharging, monitor operational functions, communicate key data and status and optimize energy use based on usage patterns and setting preferences.

Business Challenge: Making Renewable Energy Easily Accessible by All



Companies are constantly looking for new ways to utilize other forms of alternative energy, like solar power- which is being used by homes and businesses to power various machineries, building energy and home appliances. Solar panels, which are made up of a series of small semiconductors, can convert direct sunlight particles into electrons and can then be converted into electricity. This electricity can then be stored or delivered directly for usages/applications such as manufacturing facility electricity, HVAC, lighting fixtures, charging stations for electric vehicles and more.

Over the years, solar cells have been made with different material including different types of silicon, which has led to improved efficiency in capturing and converting sunlight. Early silicon solar cells had 6 percent efficiency in the 1950's but now reach more than 44 percent in recent years- meaning higher sunlight absorption and increased electricity wattage. Furthermore, the creation of the energy storage battery gives homes and businesses the ability to use solar energy to power their facilities at any time of the day, not just when the sun is shining. These batteries and energy conversion processes require computers to control the operations and various functionalities that affect the bottom-line performance. The controllers selected for these processes are required to deliver high level of reliability. Desirable features include scalable performance, extensive communications capabilities, rugged designs that can withstand harsh operating conditions and more. Past technology offered less scalability, low computing power, restricted communications capabilities and low reliability. That makes renewable energy an expensive short term choice and not highly popular due to its inconsistent quality and energy delivery.

Hardware solution choices, in the current IoT era, have evolved. The needs of the industry to provide better and accessible energy alternatives has driven many computer design and manufacture companies to serve the market with solutions that will answer all of their requirements. This includes the desire for data analytics – for any business to have the ability to capture and transfer crucial operational data for future analysis. The IoT phenomenon demands for a solution of hardware and software – end-to-end solutions that can provide easy access to relevant data and safely transfer them through the cloud for further analysis. A variety of communications options for a controller, from 3G/4G/GPRS/Wi-Fi, Ethernet for LAN connection, and RS232/422/485 ports are now required by many operations. These solutions are expected to be pre-tested and pre-validated for compatibility and ease of deployment.

Business challenges arose from the need to make renewable energy less expensive, more reliable and delivery and operations monitored for constant improvement. IoT has influenced directions of the renewable energy market by offering them better ways to manage their assets and operations with higher reliability, speed and greater understanding of their customers.

With Intel's current innovative technology, collaborating with Axiomtek's advanced embedded computing technology and design; controllers can now deliver scalable performance, great computing capability, remote management functionalities and a wide variety of communications options. These industrial-grade computers meet many required world safety standards that are important for the energy and power utilities industry, including anti-explosive (ATEX) directives from the European Union (EU). They are often robust, designed to withstand operations in harsh conditions and deliver continued reliability. They are an integral part of a network of connected devices, created to convert and deliver renewable energy from various source as well as provide operational insights.

IoT gateway controllers are now pre-tested and pre-validated with software stacks such as those of Intel's IoT Gateway Solution to ensure great connectivity, security and manageability. Data captured can be programed to transfer to data centers for further analysis. This available technology allows renewable energy companies to go beyond their past capacity and deliver more efficient and cost-effective renewable energy to their customers.

Use Case: Solar Power Battery Management for Buildings and Homes

Power/energy derives from solar panels' "smart grids," can be stored in a battery for later use. It can help reduce electricity bills and allowed for programmable delivery during peak periods when electricity is the most expensive. It can also be programmed to be a backup power source in case of blackouts and help prevent surges that can occur in the grid to provide a steady stream of current for smooth operations. Information about the solar conversion, energy delivery, storage, programmed features such as those mentioned are crucial and required to be captured, reported and transferred for examination and analysis.

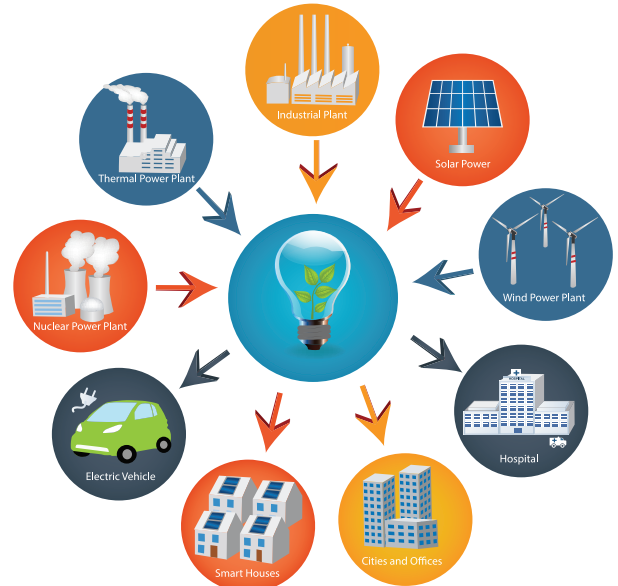
Optimizing the process and battery performance requires a gateway controller that can perform all of the above requirements and with high level of reliability and flexibility. Real-time information is instrumental in collecting data for usage patterns – so that the system can be an intelligent one. Predicting usage patterns allows for charging and discharging cycles to be scheduled to ensure sufficient supply of power, especially during the peak usage period.

The major battery manufacturer enlisted Axiomtek's design engineering services team to customize its ICO300 IoT gateway controller for the operation. This DIN-rail, fanless, rugged controller offers wireless, Ethernet, serial and Wi-Fi communication options. It can operate in wide temperature range of -20°C to +70°C with heavy-duty aluminum/steel enclosure. This allows for the controllers to be placed in warehouse cabinets or outdoors where temperatures may fluctuate and get extreme, depending on its location. The embedded system selected offered a low-power consumption feature of the most advanced Intel® Atom™ processor at the time. It also offered the processing memory capacity the client desired. Certain key features on the controller were customized to perfectly fit the needs, both physical space and operational requirements.

There are currently many new versions of the controller including the rugged rBOX, another of Axiomtek's robust and advanced embedded controller product line. The rBOX product line is designed and manufactured to serve the power utility and renewable energy market. Intel® Core™ I family, Celeron® as well as the low-power consumption Atom™ CPU options are offered for scalability and cost-efficiency.

Axiomtek delivered design support, customizability and standard features that met all of the requirements of this world-renowned battery manufacturer. The product was originally designed with interoperability in mind and was pre-validated with Intel® IoT Gateway Solution. The result was a perfect system that was easy to integrate and deployed with the client's existing technology. The system provided great value to the client and high level of satisfaction.

The solutions provided the client with the ability to launch their product in a short period of time with its special design aiming at fast deployment and compatibility with Intel® IoT Gateway software solution as well as other hardware. Axiomtek's design assistance engineering team was instrumental in this fast and efficient process.



Customer Benefits	Solution Features
Advanced processing capabilities:	With Intel® Atom™ processor.
Ease of deployment:	Expert design assistance, designed for easy integration with other peripherals.
High interoperability:	Pre-validated with Intel® IoT Gateway solution. The client was focused on collecting operational information of the battery and usage and safely transfer them to the data center.
Feature-rich:	A wide-range of key features with many optional communication and storage options.
Rugged:	Operational stability with extended temperature range of -20°C to +70°C, no moving parts, and IP40-rated.
Compact design for space-constrained environment:	Fits easily in a narrow cabinet with ultra-light weight design of only 2.2 lbs.
Cost efficient:	Competitive pricing.

The Right Solution: Axiomtek's IoT Gateway Controller for Smart Energy Applications

Deployed Faster and with Ease



Axiomtek and its ecosystems of technology partners are helping system integrators achieve faster time to market with their collaborated solutions. Axiomtek's partners are software, hardware and technology leaders in their industries. Together with Axiomtek, the team will fully support developers and

integrators to offer better products that can be intelligent real-time, end-to-end solutions. Axiomtek can provide design assistance and integration services with COTS-based products that will accelerate the process, offer high ROI for the customers, get their products into the market fast and start to generate revenue quickly. Additional value-added services are available – including pre- and post-product launch services.

High Quality and Reliability

Axiomtek's products offer longevity and high reliability. The company stands by their products for 7 years and has been proven to provide assistance to their customers beyond their expectations.

Real-time processing capable

The ICO product line has been selected for integration with different leading real-time OSes.

Comprehensive Resources



Axiomtek is in compliance and certified with a variety international quality and safety standards (i.e., ISO9001). The company's global footprint offers accessibility of product and services support to corporations with locations in various parts of the world. Expert R&D resources are available and ready to

support their customer's projects. Regional local engineering teams are on standby to support the customer's technical needs.

Product Designed with You in Mind



The ICO product line was designed for IoT use – i.e., the ICO300-MI based on Intel® Gateway Technology is constantly upgraded with the newest Wind River Intelligent Device Platform and newer Intel CPU technologies to deliver what is needed with the newest and best available technology. It

provides enterprise-grade security and intelligent manageability, yet simplifies the development process for IoT-related applications.

Axiomtek's Embedded Controllers and IoT Gateway Devices Deliver Quality, Reliability, Flexibility and Exceptional Customer Support

Renewable energy popularity is on the rise, partly due to the availability of advanced and accessible technology such as those of Axiomtek's IoT Gateway Controllers. It is predicted to surge, especially in the US, over the next three years as reported by the Worldwatch Institute. This growing market with complex demands is shaped by available technology that will constantly allow dramatic improvements of energy conversion, storage, delivery and usage. Axiomtek understands the importance of designing and manufacturing products that will help propel technologies in this industry and have gained businesses and confidence from renewable clients all over the world. Axiomtek's main focus has been on providing value to the customer and helping them succeed in their market, resulting in higher ROI and efficiencies in all areas of operations.

Solutions Proven by Your Peers

Solution architects are technology experts who work with the world's largest and most successful companies to design business solutions that solve pressing business challenges. These solutions are based on real-world experience gathered from customers who have successfully tested, piloted, and/or deployed these solutions in specific business use cases. Solution architects and technology experts for this solution brief are listed on the front cover.

Product Showcase

ICO300-MI

- Low power consumption Intel® Atom™ processor E3815
- Intel® IoT Gateway Solution including software stack for manageability, security and connectivity
- Reliable communication options with two isolated 10/100/1000Mbps
- Operational stability with wide operating temperature range of -20°C to +70°C

