ARC WHITE PAPER

By ARC Advisory Group

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A Strategic Roadmap for Sustainable Energy Management and Energy Efficiency for Industrial, Commercial, Municipal and Manufacturing Operations

Executive Summary

Industrial and commercial facilities are all committing resources to sustainability initiatives despite a difficult economy. The U.S. Department of Commerce categorizes sustainable operations as, "ones that use processes that are non-polluting, conserve energy and natural resources, and are economically sound and safe for employees, communities, and consumers." Some organizations may delay the implementation of certain components of these sustainability programs; however, the compelling argument for better managing a facility's energy use will persist beyond this downturn. Companies should pursue sustainability efforts fully because the same powerful drivers for sustainability will strengthen over time. These drivers include the need to reduce energy usage, raw material consumption and waste, the growing recognition of climate change and limited resources, and increasing regulatory requirements. Organizations that maintain sustainability programs are well-positioned, but a failure to act could lead to additional costly governmental mandates.

Energy Management Produces Returns

Energy consumption is a dominant component of an organization's sustainability cost structure. Despite a recent drop in energy prices, costs are trending upward over the long term, and the days of relatively cheap energy are long gone. Energy efficiency has now become an imperative in every organization. Energy management practices must be realigned to accommodate a future of volatile energy prices.

Information Technology, advanced automation, and the adoption of practices for energy management are key factors for success. Organizations that obtain visibility into energy consumption and correlate this with operations can set achievable energy reduction goals. Furthermore, empowering workers at every level in the organization has a positive impact on energy consumption and has been shown to achieve the best results.

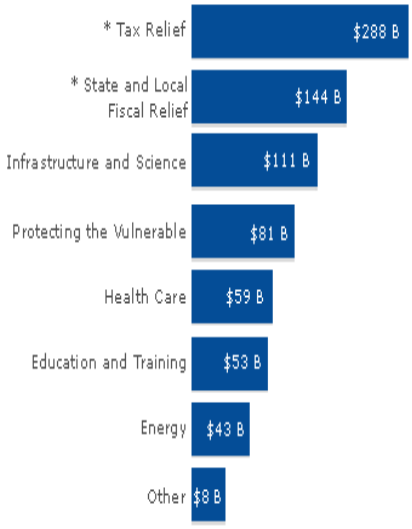
Energy Audits Provide Starting Points

This report delves into a wide range of topics on energy management and efficiency. It is comprehensive in nature in that recommendations for reduction of electrical, natural gas, and oil consumption are all covered. However, the most important recommendation is to first conduct a comprehensive energy assessment or audit that provides a basis for any energy initiative. Energy audits provide a benchmark that enables an organization to track an energy management program's progress. It also identifies the most inefficient equipment or processes, and how they affect the organization as a whole. Lastly, performing regular energy audits enables the assessment of the effectiveness of energy management programs relative to past performance as well as measuring progress in reaching energy reduction targets.

There are a variety of strategies for improving energy usage. From motors and drives, power monitoring systems, lighting control to SCADA applications and smart motor control centers, there are many solutions to help business reduce energy costs and achieve more efficient energy use.

Energy Survival Guide

Survival in today's market demands organizational efficiency both in energy, capital, and human resources. Energy is now becoming one of most critical components for reducing operating margins. The productivity gain of the 1990's created operational improvements to increase capacity in numerous industries; however, organizations need to evaluate the impact of price fluctuations on their operations to ensure survival in a volatile energy market. The key is to reduce organizational sensitivity to energy price volatility and make it part of the business culture.



American Recovery and Reinvestment Act Source: www.recovery.gov

In this difficult economic climate, businesses must reduce all extraneous costs. Energy can be one of the largest components in an operation's cost structure. Despite a recent drop in energy prices, energy costs will remain volatile, trending upward over the long term. Manufacturers cannot rely on cheap energy to meet business targets. Energy management practices must be realigned for the current

climate of expensive energy production. Now is the time to take action, and the U.S. government is strongly encouraging energy independence and efficiency.

American Recovery and Reinvestment Act

The "American Recovery and Reinvestment Act" designates $44 billion for investments in energy, particularly renewable sources. However, the stimulus plan allocates $6.3 billion to state and local governments for investments in energy efficiency, $4.5 billion for federal buildings to increase their energy efficiency, $6 billion in renewable energy power generation loans, and $11 billion is designated for the modernization of the U.S. electric power grid.

Domain	Key Attributes
People	• Management commitment and resolve • Energy management considered a core competence • Corporate energy coordinator directs and coordinates energy management activities across plants • Higher percentage of staff devoted to energy management activities
Processes	• Energy management initiative in place • Regular audits to measure progress against a benchmark • Capital projects justified based on energy savings expected
Technology	• Advanced process control or simulation or homegrown applications to manage energy • New technologies applied to the problem of energy management (i.e., new intelligent equipment) • R&D investments to change the production process and reduce energy requirements • Electrical automation integrated with process automation systems
Information	• Information shared across all sites • Processes and equipment closely monitored to track energy use and identify the problem areas • Energy prices and energy consumption consistently monitored • Energy management metrics often linked to business systems • More granular accounting methods for energy use

Business Practices Employed by Energy Efficiency Leaders

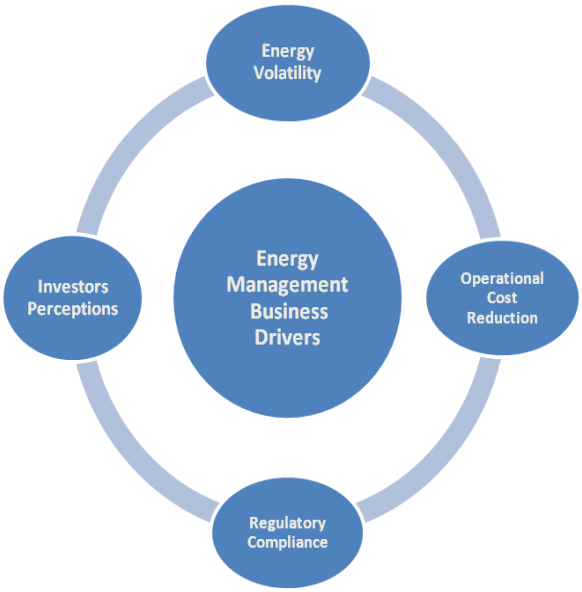
Efficiency improvements aimed at one goal, such as energy efficiency, can positively affect other aspects of an operation. Energy-efficiency initiatives have been shown to lower maintenance costs, reduce waste, increase production yield and provide safer working conditions in a wide range of operations. A comprehensive energy initiative also can drive productivity improvements and profitability for a business, which may hasten the return on investment (ROI) of the energy project itself.

Leading Business Practices in Energy Management

ARC's research has unveiled some of the practices employed to address the problem of energy management in organizations today. We identified how companies are organized to tackle energy management and what projects or initiatives can improve energy efficiency. Our research examined how companies implement initiatives, staffing arrangements, and investment decisions about projects designed to improve energy efficiency.

More than technology, adopting an optimal set of practices for energy management is one of the key factors for success. Companies that improve visibility into processes and energy use, set goals for energy reduction, and empower workers to reduce energy consumption achieve the best results. These companies have formal programs in place and dedicated staff with centralized authority in charge of their programs. They apply rigorous criteria and perform audits before making decisions on capital investments and upgrades. They benchmark performance and measure the success of their energy management initiatives. Lastly, successful businesses regularly assess program performance as part of a continuous improvement plan to meet energy reduction targets.

Energy Efficiency Remains Important as Volatility Persists



Aside from raw materials costs, energy is one of the top cost pressures affecting manufacturers today. A sound energy management strategy goes beyond simple cost reductions; it can lead to more business stability. Manufacturing and infrastructure operations are highly dependent upon today's low energy costs today in order to remain profitable. Energy efficiency is highly correlated to being a good global citizen as the increasing emphasis on being green involves every facet of our life. Energy conservation and energy independence are also regarded among the foremost leading business strategies for creating a competitive advantage.

While an effective energy management strategy is essential to address social, economic, and environmental concerns, many companies are starting to realize that a corporate focus on energy management is essential to minimizing risk. Overall, energy efficiency programs are among the most economical options to increase profitability as well as reduce vulnerability to volatile energy prices in this new economic era.

Investors Take Notice of Sustainability Initiatives

Many private and publicly held corporations and communities outside of the United States have voluntarily adopted sustainability initiatives that include energy efficiency as a component. Nearly 900 companies have joined the Global Reporting Initiative (GRI) (www.globalreporting.org) that has pioneered the development and worldwide implementation of a sustainability reporting framework. The GRI framework sets out the principles and indicators that organizations can use to measure and report their economic, environmental, and social performance. Today, sustainability initiatives are used to promote energy efficiency part of the organization's culture. Sustainability and energy efficiency policies are garnering attention from the investors as the perception of long term competitive advantages are implicit in organizations with a definitive sustainability policy. The Dow Jones Sustainability Components selects publicly held companies according to a systematic corporate sustainability assessment that identifies the sustainability leaders in each of 57 industry groups. The underlying research methodology evaluates corporations based on climate change strategies, energy consumption, human resources development, knowledge management, stakeholder relations and corporate governance. There are 162 companies from Europe while North American only has 125 companies in the Sustainability Index. Sustainability initiatives that support both the business and community are viewed as long term competitive advantages. This translates into a tremendous amount of opportunity for U.S. organizations to make improvements with energy efficiency.

Key Industry Sectors
Cement
Chemical
Food Production
Lumber
Steel
Metal Fabrication
Oil & Gas
Automotive Painting
Mining
Ports
Warehousing
Wastewater

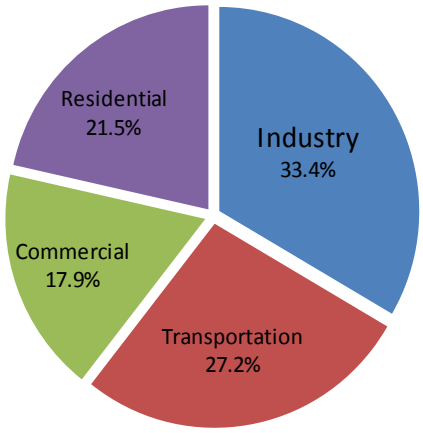
Environmental Protection Agency and Energy Efficiency

The Environmental Protection Agency has a stated mission to achieve significantly improved environmental protection and resource-efficiency in major U.S. manufacturing and business sectors. This is supported by a strategically targeted set of actions taken by government and each sector to reduce major barriers to progress and provide the most effective drivers of

performance improvement. Increasing efficiency in the conversion, delivery, and utilization of energy is an essential part of a comprehensive national energy policy. Through improved energy efficiency, we can grow the economy and mitigate the environmental impacts of greenhouse emissions.

According to the U.S. Department of Energy, industry sectors account for about one third of all energy used in the United States. These industries can directly benefit from implementing an energy management policy within their enterprise to improve the bottom line by lowering operating costs in the manufacturing, processing and building infrastructure. The process industries – oil and gas, pulp and paper, chemicals, mining, and metals – are the most energy-intensive industries, requiring large amounts of energy for heating and machine drive applications.

Energy Usage by Business Sectors



Source: U.S. Department of Energy

A number of Energy Policy Acts have been enacted in the United States during the last several years. Most of these energy policies take the form of financial incentives. Examples of these include tax breaks, tax reductions, tax exemptions, rebates, loans, and specific funding. They have provisions for energy conservation and energy development, with grants and tax incentives for both renewable and non-renewable energy. In addition to the production of energy from alternate sources, these acts help to promote energy savings and reduction of green house gas emissions.

As a result of increasing energy demand and rising energy costs, energy efficiency is becoming important to all industrial and commercial sectors. Energy conservation includes efforts to reduce or eliminate wasteful energy use as well as efforts to increase energy efficiency. Organizations need to approach energy efficiency in a holistic manner. Generally, automation, lighting, power distribution, and power generation have remained largely separate islands of functionality in today's operations.

Industry Drivers	Customer Needs
Globalization	• Centralization of decision making • Supply chain management in multiple geographies • Visibility into production and delivery capacity
Industry Change	• Update staff knowledge • Asset information management • Asset lifecycle management
Consolidation	• Integration of dissimilar systems • Consistent execution across the enterprise • Collaborative Operations Management
Governmental & Regulatory Compliance	• Execution strategy to meet mandated compliance • Expertise in mitigation of regulatory risk
Increasing Energy Costs	• Visibility into energy usage • Optimized energy management • Sustainability
Operation Risk Mitigation	• Long term service agreements • Predictable operation • Variable workforce • Asset management

Optimizing energy efficiency requires a holistic energy strategy because suboptimal performance results when only certain areas are targeted. Relevant information and accurate Key Performance Indicators (KPI) are required throughout the entire operation. This ensures that decision makers at every level are working to solve the correct problem. Using the right KPIs and basing these metrics on real-time information drives optimum potential, which can reveal hidden opportunities in certain areas of operations. Performance targets are extremely important for the successful execution of enterprise objectives. When energy KPIs are limited to historical measures or not dynamic enough to reflect changes in objectives, the energy efficiency plan will be incomplete, often resulting in poor performance.

Lower Operational Costs with Energy Efficiency

Process operators, and even maintenance personnel, have limited visibility into what is really happening in their electrical or other energy systems. Likewise, they often have little control over how much power their automation assets are consuming. Solutions for improving visibility into the power management, processes, and building automation can yield significant energy cost savings.

Benchmarking: The Beginning of an Energy Efficiency Program

For most operations, environmental responsibility is not new, in fact many have had programs and policies in place for fifty years. However, new pressures driven by price volatility and regulation are creating a stronger

Commercial, public works, industrial and retail operations cannot afford to wait for government sponsored energy audits. They need to begin these initiatives immediately.

correlation between energy efficiency and environmental responsibility. Manufacturers are beginning to see significant new constraints, regulations, and climate issues as business drivers. This will only escalate. Higher prices for carbon emissions are foreseeable, with implications for product composition, documentation, and transport. To best prepare for higher energy prices and more restrictive regulations, a company should perform an energy audit or plant assessment that will be used as an initial benchmark for energy improvement initiatives. Based on the most recent survey data from the Energy Information Administration (www.eia.doe.gov/emeu/mecs), energy audits were the leading energy management activity in both 1998 and 2002, experiencing an increase of almost 50 percent more organizations undergoing an energy audit. No other single energy management activity had similar participation.

Independent Energy Audits Create Focus

Energy Audits are the foundation for developing an energy efficiency program that will make a difference in an organization and create more efficient operations. The most significant obstacle to overcome in any organization is simply cutting across cultural divides in operations that have access to capital budgets. Energy audits and plant assessments that are conducted by independent third parties provide objective analysis on where the most effective use of limited capital should be employed to achieve energy goals. There are numerous resources available both on a government and industry basis that can be of assistance. The U.S. Department of Energy provides onsite plant assessments through the "Save Energy Now" program. [1]

This program provides assessments that help U.S. manufacturing plants improve energy efficiency and increase productivity and is primarily targeted at large, energy-intensive plants with consumption of at least 300 billion British thermal units (BTU) of combined energy per year.

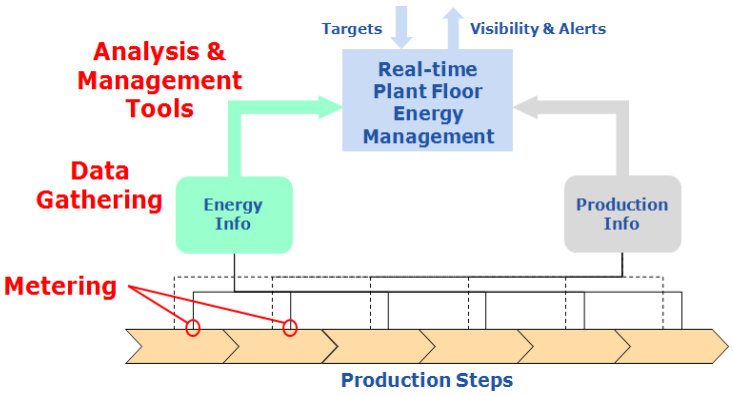
Unfortunately, there is a waiting list to participate in the "Save Energy Now" program, as well as specific requirements for energy consumption that some companies may not meet. Commercial, public works, industrial and retail operations cannot afford to wait for government sponsored energy audits; these initiatives must begin immediately. Many

[1] Save Energy Now (http://www1.eere.energy.gov/industry/saveenergynow/).

organizations choose to identify a third party partner who can support the benchmarking activity. A qualified partner must have practical experience, skilled professionals and resources within the organization. Third party audit resources can offer best practices and new creative solutions that can help remedy the "we have always done it that way" syndrome. Large automation suppliers that offer a broad portfolio of products and services are in an excellent position to perform a comprehensive energy audit.

Energy Management Key Steps

Operations must recognize that energy is a controllable operating expense and should be managed with the same expertise and resources as other parts of the business. Robust energy management processes, procedures, and practices are as effective at saving energy as technological solutions. An energy health check helps companies assess their energy management practices in comparison to best practices. It also helps identify opportunities for further improvement when used as a continuous improvement tool.



Reduce Energy Consumption by Collecting Metrics

Energy audits provide a focused approach that targets specific types of systems throughout the operation that can be optimized, upgraded or replaced. Energy audits have also helped participants focus specifically on equipment upgrades and retrofits that provided the greatest return on investment (ROI). In the area of equipment upgrades and retrofits, you should consider an automation equipment supplier with a broad range of expertise to perform an onsite inspection of your operations.

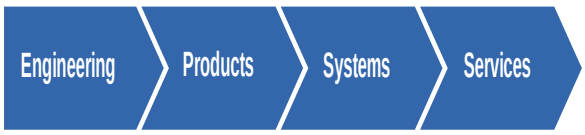
Monitoring major systems' energy consumption then correlating energy consumption with time of day and production delivers important information to support planning, scheduling, and equipment upgrade plans. The latest generation of operations scheduling algorithms explicitly take into account energy consumption and CO_2 generation. With the advancement of wireless technologies, energy monitoring equipment can be installed in a very cost effective way in an existing facility. Process data collection in 15 minute increments is generally sufficient for managing

energy and setting targets per unit produced that will help identify and reduce waste.

Energy Efficiency Guide	Key Elements of Each Step
Energy Health Check	Energy management process assessment & benchmarking Energy savings potential estimation
Analysis	Energy scoping audit (all energy sources) Energy & water balance Energy profile Technical evaluation of potential savings and implementation costs
Project development	Detailed engineering analysis with firm fixed prices Financial justification development (ROI)
Implementation	Complete installed solutions Professional project management Commissioning On-going preventative and predictive maintenance contract services
Sustainability	Measurement & verification Reduction in energy variation per unit produced Identification of new energy efficiency projects Energy health check (semi-annually) Continuous improvement methodology

Bottleneck identification and constraint removal will become more apparent and important for businesses to stay competitive. Information exchange with business and supply chain systems will have a higher priority to eliminate lag time and improve overall business processes. Energy consumption measurements and metrics will need to be put in place to help reduce energy consumption by using energy usage versus production as the key metric. In addition to new metering and data collection devices, new software functionality will be required to make the detailed production energy consumption visible to enable better decision making and control.

Professional Services: A Single Point of Contact

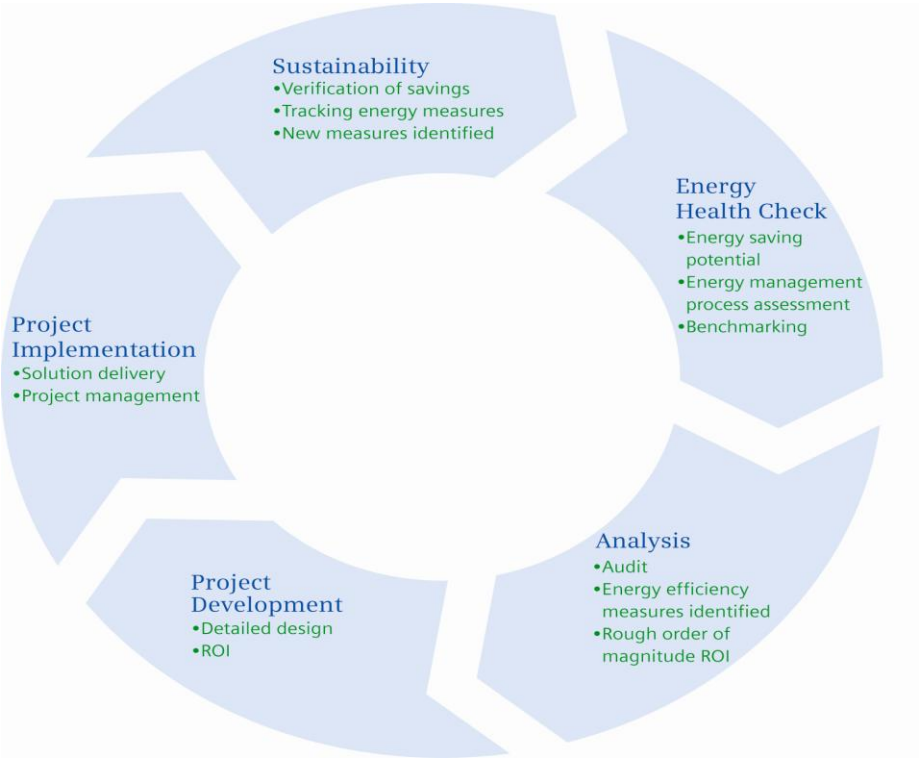


Siemens Professional Services

The challenge many companies face is identifying a qualified, independent organization to perform a comprehensive energy audit. In particular, when a market begins to grow rapidly there are many

independent contractors offering auditing services. An energy audit is not an end in itself but a first step. Companies must partner with an organization that can perform an audit then *implement* comprehensive solutions. These companies must have the competency to handle complete projects with professional project management capabilities.

Companies must also select suppliers that can provide a broad range of energy efficiency solutions. Siemens is one of the few organizations in the world that has implementation capabilities for *comprehensive and scalable energy efficiency solutions*. It is a global organization with a long history of providing services to the industrial market. Whether it is helping a machine builder improve the mechanical design during new product development or providing a strategic plan for a food and beverage manufacturer to optimize production processes, a company like Siemens can provide a complete solution beyond just products. With a global reach, Siemens is able to bring tremendous value to the customers by leveraging its Vertical Market Management teams in the Food & Beverage, Automotive, and Aerospace sectors. Several hundred global corporate accounts rely on Siemens solutions to support locations around the globe.



Siemens' Energy Management Assessment and Implementation Capabilities

Professional Services

Many product suppliers merely look at a single point solution to an energy efficiency issue. For example, replacing the motor on an air compressor with a matched motor and a variable frequency drive combination will

solve localized energy waste. This is a good step, but a thorough program should lead to improvements for the energy efficiency goals throughout the entire organization. Siemens' approach is to partner with the customer to provide an end-to-end energy management solution. Electrical energy accounts for approximately 16 percent of the energy consumption in an industrial facility, which is why Siemens takes a holistic approach to energy by looking at all energy sources, including water, gas and steam. The outcome is a plan for a comprehensive solution along with implementation services.

Energy audits performed by third parties serve to break corporate barriers and silos in order to identify a holistic energy management plan rather than a departmental energy management plan.

Both large multinational corporations with a dedicated sustainability team and midsize businesses with limited staffing should make an investment in an energy efficiency audit. Energy audits performed by third parties serve to break corporate barriers and silos in order to identify a holistic energy management plan rather than a departmental energy management plan. An approach that looks at single point will only create a localized solution that will fail to treat the organization as a whole.

Energy efficiency optimization is an organizational approach that:

- Defines energy strategy management,
- Identifies areas of inefficiency,
- Shows energy used per unit production,
- Evaluates the organization's sensitivity to fluctuations of energy pricing.

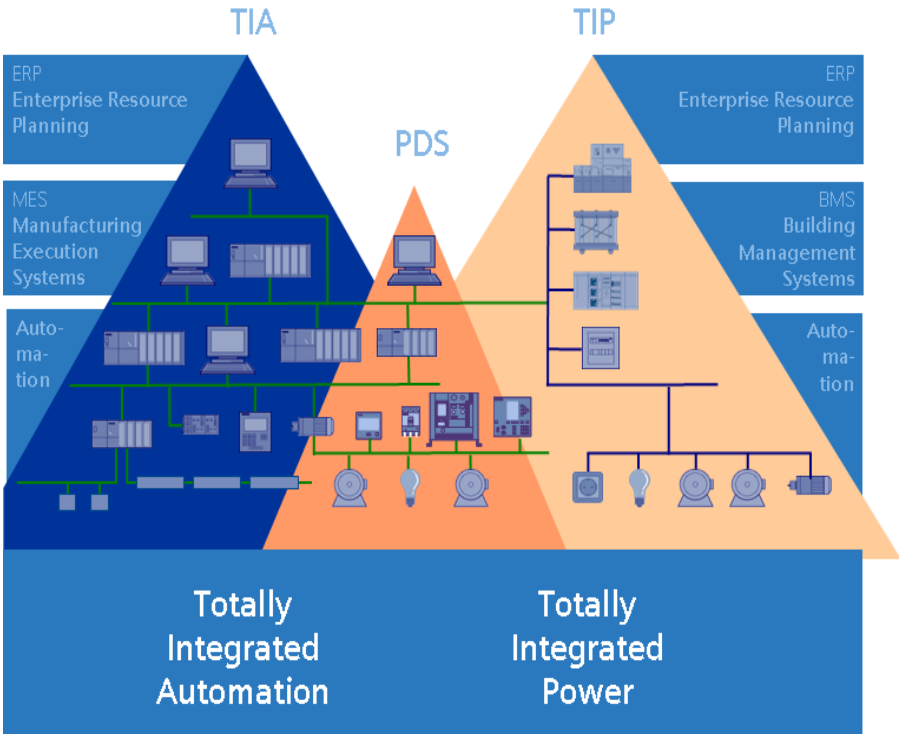
Electrical power, natural gas, oil, and coal form the components of energy consumption and cost equation. An energy audit must identify business risks and sensitivity to the sources and variability in energy pricing.

An energy management strategy and associated solutions should have a far reaching scope. The Siemens professional services group remains unbiased in terms of finding the right economically sound solutions for its customers, using either Siemens' solutions or third party products. In some instances, more structured partnerships are created with Siemens to ensure that systems will integrate properly or extend the capabilities of the Siemens' offering.

A Comprehensive Solution

Siemens' approach to an energy audit also provides a unique perspective of an integrated concept of electrical power distribution for all commercial and industrial construction projects/facilities. Siemens has embraced the concept of Totally Integrated Power (TIP) and Totally Integrated

Power Management: The Link Between TIA & TIP



Automation (TIA) throughout its product portfolio. These concepts ensure products under this umbrella use common programming standards and configuration tools and can be integrated through common visualization and reporting tools. TIA and TIP encompass all phases of the electric power distribution system (PDS) and consumption as well as the automation systems in an operation. Siemens professional services take the energy audit a step further by fully assessing the use of other energy forms (natural gas, coal, oil) to achieve a comprehensive solution. This approach facilitates the evaluation of each investment decision from planning to installation and use.

Siemens Invests in Powerit Solutions

Powerit Solutions™ provides Intelligent Demand Control solutions to enhance Siemens extensive energy efficiency solutions. Powerit Solutions provide online, predictive energy management systems that enable commercial and industrial users worldwide to reduce peak demand electricity costs without compromising production quality or human comfort. The system's automated, intelligent rules engine leverages the flexibility of IP connectivity and the economy of wireless devices to address critical emerging issues such as smart grid management, real-time pricing, and automated demand response.

Power Monitoring: Why Advanced Metering is Key

Investing in an energy efficiency infrastructure and developing energy efficient techniques needs to begin today. The current stimulus package creates "once-in-a-lifetime" opportunities for companies to invest for the future at an artificially low cost. Under the plan, $5 billion will be set aside to allow businesses to accelerate depreciation of capital assets, such as plant equipment and machinery by 50 percent from their taxable income beginning in 2009. This makes many energy efficiency investments in industrial equipment very easy to justify, especially for publicly traded companies. Investments in infrastructure are the beginning of an entire energy modernization program within an organization that will continue to provide a payback for decades to come in many cases.

On February 17, 2009 President Obama signed the $787 billion American Recovery and Investment Act into law. This package aims to rehabilitate the flailing economy by using a combination of tax cuts, direct aid to states and organizations, and investments in U.S. infrastructure.

The U.S. stimulus package is offering incentives for smart buildings and grids, making a power monitoring system essential. Power monitoring systems are the first step in determining a baseline for energy usage and where waste can be found. Often a power monitoring system can prevent costly mistakes. For example, not all energy efficient products are created equal. While it may seem obvious to replace a 100 watt bulb with a 15 watt compact fluorescent bulb, these bulbs may have power factors ranging from 0.9 to 0.75. A business with hundreds of these lights could stress the electrical system causing overheating, nuisance trips, and premature system failure, not to mention some utilities charge higher rates for low

power factors. This illustrates the need for a good power monitoring system in place that measures power use and quality. By implementing a power monitoring system, businesses can be assured their energy saving strategies are really helping them cut costs and reduce use.

Advanced Metering Solutions

To improve operations the first entry point should be to consider Advanced Metering. Today's Advanced Metering systems provide more than just confirmation the electrical consumption reported by the utilities is accurate. Advanced Metering systems offer both verification of the utilities' charges with a comprehensive report, including sags and surges, and the ability to measure power factor, harmonics and other parameters continuously. These solutions are the optimal entry point for an operation seeking to obtain metrics without making a large capital investment.

Advanced Metering Solutions

Advanced Metering does not have to be a standalone solution but can be readily integrated into existing building automation systems or other information management systems using a variety of standard networking protocols, such as the ModBus interface, a widely used protocol in North America. It provides important visibility into operations that can be used to make informed decisions for corrective action. Whether it is correctly sizing a capacitor bank to improve power factors, performing load shedding, or determining wasted energy consumption, Advance Metering offers many advantages simply from collecting accurate data from disparate sources.

Advanced Metering establishes a base line for energy efficiency even before the energy audit is performed. These systems provide time stamping for the data collection process through global positioning systems (GPS). A totally integrated energy monitoring system reports the consumption of not only electrical energy, but also natural gas, oil, water, steam, chilled air, and other forms of energy based on a common time base. This same time stamp capability enables the user to see sequence of events down to the milli-second. For example, data centers rely on redundant energy sources to ensure data is not lost as a result of a

Advanced Metering Solutions Provide Energy Visibility in Operations

power loss. If the main power source is compromised, backup generators take over. Time-stamping provides a highly detailed record of the events that occur during a power loss. If the generators do not operate properly, the time-stamped record enables a detailed root cause analysis to determine if the circuit breakers came on in the proper sequence or if another problem occurred. This promotes fine tuning for optimal performance and minimizes future production loss.

Advanced Metering is an approach to an energy management information system based on a distributed architecture and topology that will grow with an organization's requirements. The investment can be the starting point to update systems once the organization documents improvements and operational performance. It can also be a strategic tool for optimizing and evaluating present systems. Notably, most government and industry organizations' ratings and rebate programs (EPA Energy Star, tax credits for Energy Policy Act, LEED certification) require documented energy savings that can be demonstrated through an energy power monitoring system. Siemens' breadth of products enables deployment of an energy monitoring system for each area of energy usage, eliminating the challenges of integrating the real-time data from different systems.

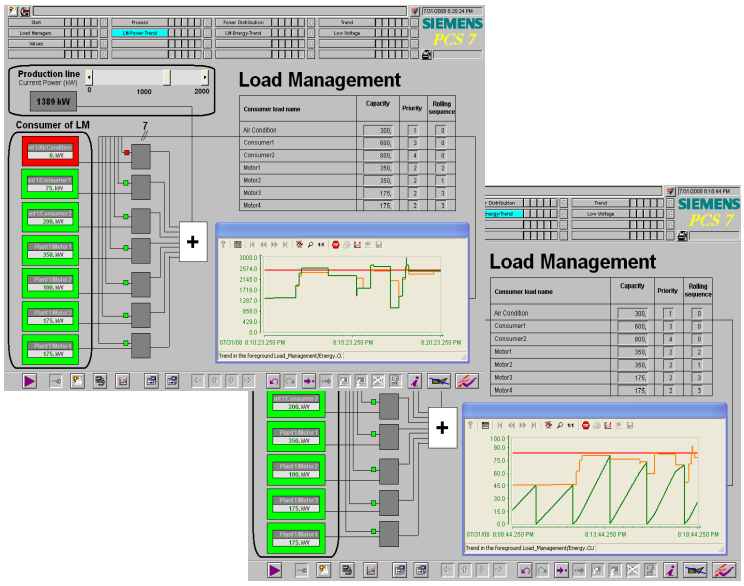
SCADA: Real-time Information for Power Monitoring

Supervisory Control and Data Acquisition Systems (SCADA)

Many companies already have systems that can be enhanced to provide data for energy efficiency initiatives. SCADA systems can often be used to gather the data required to improve energy use. The most important role of a SCADA system is to automate the access to real-time information while providing visibility to authorized users. The first generation SCADA systems offered data access and connectivity to remote terminal units (RTU) stations over a wireless, telephone, or network connection to collect data from a heterogeneous set of meters and control systems. The latest generation SCADA systems can now be used as part of an energy management infrastructure.

SCADA systems can be a cost effective, integrated, and scalable component for monitoring energy usage and providing information that enables

organizations to make informed decisions in regards to energy consumption. Through remote connectivity and control, a SCADA system can provide an integrated view of energy consumption data from equipment such as pumps, conveyors, fans, compressors, boilers, co-generators, combined heat and power systems, and furnaces.



Powerrate Extends WinCC SCADA and SIMATIC PCS 7 to Support Energy Management

Often existing automation systems for process and equipment control already have portions of SCADA or connectivity to SCADA built into their controllers and human machine interface (HMI) devices. These tools within the automation system can be leveraged to gain valuable energy monitoring information with only minimal changes or additions to existing devices. For example, by simply adding current transformers on the mains of breakers or motors and bringing them into a programmable logic controller (PLC) analog input, a connected SCADA system can easily track and calculate the signals over time, amplitude or on/off frequency. This data then can be analyzed and applied to an existing preventive maintenance program to correct improperly functioning equipment to reduce energy costs.

Examining the Power Usage Across the Organization

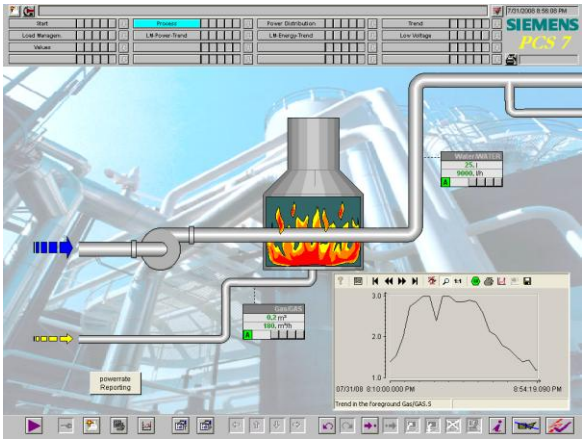
In addition to the standard SCADA systems, there are add-ons designed specifically for energy monitoring. Siemens WinCC® powerrate, an add-on package to Siemens WinCC® SCADA and Siemens Simatic PCS 7, includes load management tools specifically designed for monitoring and reporting against a stipulated utility power limit. It provides a uniform power management solution that enables users to locate potential savings by examining the power behavior of different operating units and obtaining information on the plant status, such as:

- Performance calculation and archiving of values against cost centers, rates, and budgets across definable time periods.

- Energy data forecasting in predefined graphical faceplates for easy interpretation and reporting.
- Consumption trends calculated against an energy efficiency goal, end period, or usage limit.
- Security functions for locking/unlocking of load consumers to avoid exceeding energy usage limits.

Case Study: Lehigh Cement Modernizes for Energy Efficiency

There are several alternatives in the deployment of a power monitoring infrastructure ranging from cost effective web-based access to power monitors to a full deployment of an enterprise-wide SCADA solution. In some cases where an automation system is in place, options exist to leverage the HMI in these systems to deploy a power monitoring solution. For example, Lehigh Cement Company's complete modernization of its cement manufacturing facility in Union Bridge, Maryland demonstrates how the integration of innovative process control technologies has enabled the company to optimize energy management and improve process efficiencies throughout the facility. By modernizing the facility, Lehigh was able to reduce power consumption per ton, decrease labor, and increase cement production to over 1.8 million metric tons. In the past, Lehigh Cement placed power monitoring devices in only a few key areas throughout its processes. Plant personnel had to record measurements manually in various locations. It would not be until the end of the month, after the data was calculated, that they would discover the plant had an energy consumption problem. With the new system, there is no manual collection of data; the plant operators access real-time data to act immediately to fix problems.



Energy Efficiency Benefits from Innovative Process Technologies

Lehigh's integration of power monitoring information into the PCS 7 system has proven to be extremely beneficial. According to the U.S. Department of Energy, 64 percent of the electrical energy consumed in a process plant today is used to operate

motors. This fact demonstrates how companies can improve their bottom line through the use of high-performance motors, the adoption of "smart" motor control centers (MCC), and the tight integration of motors and drives into a process automation system. Effective energy efficiency strategies cut energy costs and enable more effective maintenance techniques. Lehigh Cement uses this integration approach to lower energy consumption and cost throughout its manufacturing operations. The plant has a power monitoring system implemented by a dedicated PCS 7 controller, with 218 power monitoring devices connected via Profibus. These devices have been installed on each of the motor control centers and drives, providing real-time information about energy usage.

Energy Efficient Motors and Variable Frequency Drives

Motors are often the most common source of energy inefficiency, especially in applications such as fans, conveyors, pumps, and compressors. According to the U.S. Department of Energy, motor driven equipment accounts for 64 percent of electricity consumed by the U.S. industrial sector or about 290 billion kWh per year. Replacing an old motor with a properly matched energy efficient motor and variable frequency drive (VFD) combination can sometimes provide an ROI measured in months.

More copper
Thinner laminations
Optimized air gap
Reduced friction losses
Reduced windage losses
Reduced resistance losses
Reduced friction losses

Efficient Motors Features

Some small companies may not feel they have the funds to budget an energy audit yet still know they need to get more energy savings from their motors. For these instances, Siemens offers Sinasave, a free software evaluation tool that determines the possible energy savings for a specific application based on the proper combination of a motor and drive. In many instances the ROI is achieved in a few months. By multiplying this savings across hundreds of motors, fans, and compressors, significant savings can be achieved. Some users who used Sinasave to match the motors and drives to their applications have reduced their energy costs by as much as 50 percent.

Siemens also offers a "Try Before You Buy" program that lets customers install select general purpose drives in their plants before committing to

purchase them. This helps them verify the energy and cost savings that can be achieved with a VFD.

To learn more about Sinasave or "Try Before You Buy" visit http://www.usa.siemens.com/drives.

General Purpose to High Efficiency

Most major industrial automation suppliers offer a portfolio of motor and VFD products. A key differentiator is the supplier who offers energy efficient drives and motors. The initial investment costs are higher, but the entire life cycle must be considered. It is important to remember the purchase price of a motor only accounts for typically 10 percent of its overall lifetime costs. Compare and contrast conventional technology with energy-saving systems, and it soon becomes clear the initial capital outlay for energy-efficient drives and motors is usually recovered within a few months when operating costs are dramatically cut. Factor in the reduction in costs for other areas like maintenance, and the business case becomes more apparent.

Initial Capital Costs of Energy Efficient Motors and Drives are Recovered Within Months

The European market has some of the most stringent regulations for energy efficiency and power factor. As a European company that must adhere to these standards, Siemens has for many years dedicated the resources and R&D required to develop some of the most energy-efficient technologies, including motors and drives, available today. Even in the area of general purpose motors, Siemens has considered every possible mechanical and electrical component to produce the most efficient motor for each class. Siemens offers three product lines for energy efficient motors that exemplify its leadership position:

- Copper Die-Cast Rotors
- Aluminum Rotors
- Aluminum Frame

Copper Die-cast Rotors and Aluminum Rotors

For the North American market, Siemens clearly differentiates itself from the competition with designs that have been in operation in Europe for many years. Specifically motors with copper die-cast rotors offer

High Efficiency Copper Motors

efficiencies above the NEMA (National Electrical Manufacturers Association) Premium Standard. The new generation of NEMA motors is available in frame sizes 140 to 250 with power ratings of between 1 and 20 HP (horse power). Copper die-cast rotors minimize power losses and slightly reduce the motor length. This lowers the motor lifecycle costs through reduced energy consumption. These energy-saving motors also comply with the U.S. EPAct legislation for maximum efficiencies. Siemens NEMA Premium efficiency class exceeds the even higher efficiencies specified in the NEMA standards. The new Siemens aluminum rotor NEMA Premium motors meet 2010 mandatory efficiency requirements of the 2007 Energy Independence & Security Act to provide a high efficiency motor at a lower cost.

Aluminum Frames or Severe Duty Cast Iron Frame

Customers can select motors with light aluminum frames or rugged cast iron frames, depending on the application. Both of these versions are available with EPAct efficiency or NEMA Premium efficiency. For customers who can take advantage of the aluminum frame motor, there is the additional benefit of a bolt-on foot design that enables a rapid change to NEMA mounting positions F-1, F-2, and F-3, providing a high degree of mounting flexibility.

The entire motor product line can be fitted with cooling fins, polypropylene fans, and internal cooling schemes to minimize heat build-up within the motor to provide a much longer life. These designs are highly refined rotating assemblies that incorporate anti-friction bearings, polyurea-based grease, dynamically balanced rotor and precision-machined mating surfaces for reduced vibration. Insulation systems meet NEMA Class F standards with a Class B temperature rise at 1.0 service factor for long service life. They also meet NEMA standard MG 1-2003, Part 31 standards for compatibility with variable-speed drive operation to ensure high efficiency.

Drive Technologies

Siemens Drive Technologies offer low voltage drives, medium voltage drives, motion control systems and motors, as well as the gearboxes and couplings that comprise a complete power system. The mantra of "energy, productivity, and reliability," is far-reaching in some respects, but Siemens

There is a tremendous amount of synergy between the underlying technologies of the large drives, mechanical drives and motion control solutions that is only achievable in a very large global organization like Siemens.

makes it tangible to its customers through product technology innovation. There is a tremendous amount of synergy between the underlying technologies of the large drives, mechanical drives, and motion control solutions that requires the scope and breadth of a large, global organization to ensure R&D is leveraged across the entire product ranges.

VFDs Provide Clear ROI

To achieve improved energy efficiency, installing VFDs and energy efficient motors offers a rapid ROI as well as continued returns through lower energy consumption and reduced maintenance on these motors. Simply adding a VFD to control an existing motor will enable the motor to run more efficiently because it will only operate at the necessary speed for the application. Without a VFD, a motor will run like a driver with the accelerator pressed to the floor and the other foot on the break to control the speed.

More Efficient Drives

Quantum leaps in AC technology have resulted in Siemens' extremely competitive Sinamic family of VFDs. These drives are built with IGBT (Integrated Gate Bipolar Transistor) switches that use/regenerate energy efficiently. The new regenerative drives regulate power factor to near unity, regardless of speed, load, or AC line conditions. These VFDs keep voltage and amperage levels in virtually perfect sinusoidal synchronization, which eliminates the need for a large, costly power factor correction capacitor banks. This is important because power companies often penalize users for a low power factor.

Harmonics: Hidden Energy Waste

Harmonics are currents produced by any non-linear load (such as uninterrupted power supply or UPS systems, computers, electronic lighting, and variable speed drives). These currents provide no value and use capacity in the distribution system. As a result less equipment can be operated per circuit. Additionally, harmonic currents generate heat throughout the electrical distribution system. System heat reduces the life of the distribution system, (transformers, circuit breakers, etc.), as well as shortens the operating life of the connected equipment. The wear and tear of

Reducing harmonics enables industrial users to avoid both potential harm to their own equipment and the penalties set by power companies for introducing harmonics into the supply grid.

transformers and wiring along with higher air conditioning requirements to remove excess heat raise operating costs substantially. Reducing harmonics enables industrial users to avoid both potential harm to their own equipment and the penalties set by power companies for introducing harmonics into the supply grid.

Application	Benefit
Pumps	Eliminate mechanical throttling
Fans	Eliminate mechanical dampers
Conveyors	Intelligent use
Compressors	Increased efficiency

Improve Power Factor in Energy Intensive Applications

Because harmonics often increase as more devices are added to a common transformer, management of the resulting harmonic distortion is increasingly necessary. Harmonics are a greater concern today due to two factors: the widespread use of harmonic-generating equipment, and the common use of equipment in stand-alone machines and processing lines that are sensitive to harmonics. Harmonic distortion can result in the faulty operation of sensitive electronic equipment and generators.

New technology eliminates or significantly diminishes harmonics. Passive filters and multi-pulsed solutions are among the lowest cost solutions to reduce harmonics.

Power Factor Can Be Costly

A low power factor is expensive and inefficient. Many utility companies charge an additional fee if the power factor is less than 0.95. A low power factor also reduces electrical system's distribution capacity by increasing current flow and causing voltage drops. It is in the interest of users to improve power factor to reduce electric bills and enhance their electrical system's capacity.

When choosing motor drive systems, it is important to choose equipment that generates the least amount of harmonics while providing a high power factor.

Stable Operation on Unstable Power Networks: Active Infeed Technology

Drives with active infeed technology may be may be the most expensive in terms of upfront cost but offer an excellent energy efficient solution. In a traditional drive, an uncontrolled diode bridge is used in the line input, producing a distorted waveform. In the Siemens drive, the line voltage is actively switched, with the switching modulated to deliver a sinusoidal line current that is virtually free of harmonics. New technology compensates

power factor and voltage variations, even fast dips, to keep an even waveform.

In addition the "voltage boost" capability enables stable operation of motors on unstable networks with frequent voltage dips or sags, even to the extent of assisting to stabilize the supply voltage. This also makes it possible, for example, to operate a 600V motor on a 480V supply system without the need for a step-up transformer.

Reduce Harmonics: Medium Voltage Drives

Most drives today use PWM waveforms to control the motor. This design unfortunately increases the harmonics in the operation. To remedy this problem Siemens developed the Perfect Harmony™ drive line that uses a multi-pulse input to meet the IEEE 519 standard for both voltage and current. The medium voltage Perfect Harmony drives also employ a Power Cell topology to dramatically reduce harmonics by using nearly sinusoidal output waveforms to deliver electrical energy to the motor.

Harmonics also damage motors by creating excess heat. As a result the motor must be oversized to compensate for the additional heat created. By lowering the harmonics produced, the Perfect Harmony drive helps customers avoid motor over sizing (and the additional energy needed for the higher horsepower motor) and helps extend the life of the motor because less heat is generated. In turn, less heat means less cooling, so customers also save on cooling costs.

Regenerative Energy Solutions Put Energy Back on the Line

By leveraging the regenerative capabilities in an application, the energy used during braking periods on one motor can be put back on the line within the operation to be used by other drive systems.

Energy savings can be further increased by capturing the electrical energy that is released when stopping a motor with a VFD and returning it to the power supply system. Siemens drive technologies reduce energy usage and lower costs through regenerative technologies that capture energy that would otherwise be wasted and redirect it to useful purposes. This is where regenerative capabilities excel. Regeneration is an integral part of a complete drive solution that makes a considerable difference in achieving ROI. By leveraging the

regenerative capabilities in an application, the energy used during braking periods on one motor can be put back on the line within the operation to be used by other drive systems. While one motor is braking others may be ramping up, so you want to leverage the energy rather than generating heat in a breaking resistor (and the cooling costs associated with it).

One of the main problems with older generation regenerative drives is risk of inverter failure where a line voltage dip requires protection circuits to operate. This new generation of regenerative infeeds, including the basic "smart" infeed, is able to control such events without blowing fuses or tripping circuit breakers.

Returning 100 Percent of Continuous Braking Torque Back to the Grid: Efficient Infeed Technology

The latest generation of Sinamic drives is unrivaled in the area of regeneration efficiencies. These drives leverage the latest advances in silicon power components to achieve some of the highest efficiencies in the market. These systems are able to deliver 100 percent of the continuous braking torque to return braking energy back to either the power grid or to the line within an operation for use by other systems. At the same time this provides an electrical buffer during peak loads and a compensation for reactive currents, which can seriously degrade the power factor.

Smart Motor Control Center (MCC) to Reduce Energy Consumption

A "smart" motor control center (MCC) is an MCC whose components can communicate on a network to a PLC or DCS. In recent years, there has been strong growth in MCCs that achieve greater power and energy efficiency by integrating the domains of automation and energy management. Energy savings on the order of ten percent can be achieved in many process plants, but a successful implementation of these solutions requires changes in work processes and practices of today's personnel. Success also depends on implementing a coherent plant asset management strategy particularly for motors and mechanical subsystems.

Smart Motor Control Center	Products
VFD	Siemens MM40, 6SE70
Smart Overload Protection	Simocode Pro C/V
Reduced Voltage Soft Starters	Sirius 3RW44

Motors are a major source of electrical consumption. Many industries can significantly reduce their energy costs just by addressing inefficiencies that reside in their motor loads. A good rule of thumb is that, in a single year, a motor can consume enough energy to account for ten times its initial cost. Deploying smart MCC subsystems -- which include VFDs, soft starters, and overload protectors integrated with the automation system -- can significantly reduce energy costs by providing information for intelligent energy and maintenance decision making.

Smart Motor Control Center

Fundamentally a smart MCC is a comprehensive digital solution that can communicate on a network fieldbus back to a PLC or DCS. This ability to collect and distribute a larger amount of information creates the potential to transform a highly inefficient static MCC installation into a resource to combat energy inefficiencies and unscheduled downtime.

Today, the advantages of network connectivity are irrefutable as information from intelligent field devices can be analyzed by a SCADA system, PLC, or DCS. The MCC subcomponents collect and distribute a larger amount of energy-related information that augments maintenance and production planning strategies. Subsystems are capable of delivering historical information for charting energy-related usage as well as providing insight regarding the mechanical condition of the motor, gearing, or end devices.

Smart Motor Control Centers Provide Access to Energy Based Information

Maintenance and Energy Peaks

Using the information from a smart MCC, the higher level controlling systems (SCADA, PLC, and DCS) can decrease energy consumption, peak demand, and energy costs by reacting to the information in a continuous fashion or simply providing information visibility to maintenance and operations personnel. Secondly, maintenance activities can be predicated on trend information correlated with the mechanical components. Since performance degradation of mechanical components can now be visualized, necessary resources can be scheduled rather than requiring an emergency response. Energy efficiency and productivity are dramatically improved

Case Study: Energy Efficiency Applications for Green Hybrid Vehicles

Climate change is a global issue and many businesses and local governments are working on using energy-efficient and clean-energy products to make a measurable impact on greenhouse gas emissions around the world. Siemens' energy efficient portfolio expands into providing energy-efficient hybrid-drive systems for delivery trucks, light rail systems and city buses. Siemens works with integrators and OEMs to help the existing and new transportation infrastructure operate more efficiently, consume less energy and emit less greenhouse gas.

Vehicles currently account for 14 percent of global emissions. Siemens has a long track record in transportation systems and has implemented thousands of energy-efficient drive solutions around the globe. These solutions reduce carbon emissions and help save money through lower fuel consumption. By leveraging this experience, some public transportation systems have reduced fuel consumption by nearly 35 percent and significantly reduced emissions.

Hybrid Drive Systems

A hybrid drive system uses the combination of two different energy systems to reduce energy consumption and emissions. The flexibility of Siemens' ELFA modular and highly efficient hybrid drive systems enables the combination of nearly all common energy sources and storages. The ELFA system synchronizes the two power systems via its power electronics to optimize the energy flow, resulting in up to 35 percent less energy consumption and CO_2 emission, as well as less noise pollution and more reliable operation. Additionally, the replacement and maintenance of brake pads is reduced significantly as braking energy is recovered electrically rather than dissipating in brake shoes. In the stop and go operation of city buses and delivery vehicles, brake replacement costs are very high.

Siemens supplies its ELFA systems to integrators, who install them into vehicles and sell the complete bus to the transportation authorities. Logistic industries with a large fleet of vehicles can 'go green' and be greatly benefited by this Siemens' technology.

when down time is managed based on condition of the equipment rather than either unplanned failures or even regularly scheduled maintenance activities. Industry leaders are using these types of systems as part of a Preemptive Asset Management strategy that blends time-based and predictive-based maintenance schedules.

Today's smart MCC subsystems are distinctively more capable than systems that have been in place for over a decade. Stored program capability, interfaces for external inputs from resistance temperature detectors (RTD), and a wide range of other digital inputs/outputs characterize the features of the modern day smart MCC subsystems. Effectively, VFDs, overload protectors, and soft starters can be tailored specifically to the application requirements, motor, and load characteristics. While these systems can function autonomously, once the application is installed the introduction of a networking interface adds the dimension of continuous improvement to the smart MCC. The sequencing of soft starters can be adjusted remotely to reduce energy peaks in the operation. Overall, the improvement in energy efficiency and reduction in unscheduled maintenance provides a measurable return on the investment that can justify an overhaul of an existing MCC.

Siemens Totally Integrated Automation strategy enables it to offer three major families of networked-enabled components as part of the Siemens smart MCC for motor control:

- Overload protection: Simocode Pro C/V
- Reduced voltage soft starters: Sirius 3RW33

- Siemens VFDs: MM4, 6SE70

The Simocode Pro C/V protects, monitors, and controls the motor. It contains a program within the device that enables it to operate with or without a PLC or DCS controller. Among other features it offers, the Simocode Pro C/V provides operating statistics, complete power measurement data, and voltage unbalance measurement to help users determine if the motors are running effectively. If overload protectors are engaged in shutting down a motor starter too often, it could signal the facilities are working above design capacity.

Siemens reduced voltage soft starter 3RW44 reduces the voltage going to the motor during startup to gently bring the motor to its rated speed and voltage. It too offers operating statistics, complete power measurement data, and voltage unbalance measurement along with line and load frequency and the ability to accept a motor thermistor input.

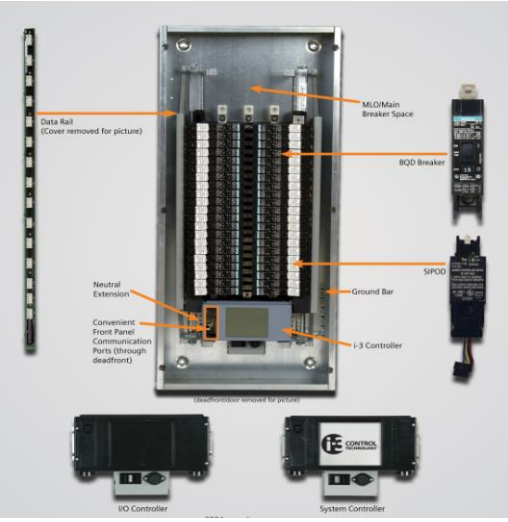
Energy Efficient Lighting Control

Unmanaged interior and exterior lighting systems can contribute significantly to electrical energy waste in many organizations. Although most organizations have made the shift to more efficient lighting forms, automated lighting and control systems are often overlooked. If they do have these systems installed, very few are integrated as an enterprise-wide solution. There is simply no concrete reason for this because automated lighting and control systems have been available for many years and provide a very fast return on investment. To combat the problem of lighting control functioning as a silo of energy management systems Siemens has introduced its i-3 Control Technology, a simple lighting control solution that reduces energy costs.

i-3 Control Technology Part of Totally Integrated Power

Siemens i-3 Control Technology™ is a flexible, compact solution for controlling lighting circuits remotely using either a time schedule or external signals. These systems can be integrated with other energy management systems, security systems, and building automation systems to form an enterprise wide solution. Overall i-3 integration and installation costs are very low, which provides an extremely fast ROI for this class of

product. It can be evaluated by an electrician in your plant or operation. Furthermore, only the integration with the building management system (in order to configure and control the system from a central location) requires external wiring.



Lighting Control Solutions Integrate Directly into Existing Electrical Panels

Capable of using some of the most widely used open protocols, the system can be integrated over BACNET or ModBus. This is one of the most practical solutions to consider for lighting control because it is available in a simple and smart solution. A simple solution might be one that consists of a single panel with a clock function and some hard wired on/off inputs such as a photocell for discerning between day and night. A smart solution would involve multiple panels being controlled via an enterprise system for scheduling as well as combining hard wired input from external control devices.

While this type of automation is not yet mandatory, changes are in the works as increasingly more buildings are required to reduce their carbon footprint. An energy audit or engineering analysis is not absolutely required to evaluate the energy savings, but an independent third party certification is required to gain LEED certification for this upgrade.

Lighting Control Requirements in the ASHRAE and IECC

Revisions and additions in the newest versions of the International Energy Conservation Code (IECC) and American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) require automatic shutoff controls for buildings larger than 5,000 square feet. This can be accomplished with whole building automatic control systems, individual occupancy sensors, or a similar automatic system. Exceptions are provided for hospital patient care areas, spaces with safety or security concerns, guest rooms (IECC), and 24-hour lighting (ASHRAE). There is also a requirement that occupants be able to override the automatic shut off for up to four hours for ASHRAE and two hours for IECC.

Lighting and Control Systems
Schedule lighting by area
Control by external inputs
Occupancy sensors

Improved Method for Lighting Control

Automatic shutoff controls

Finally, both IECC and ASHRAE require photocell or programmable time control of exterior lighting with exceptions for areas where safety and security are a concern. ASHRAE is working on the 2010 version, and many changes have been proposed and approved for the lighting section. ASHRAE 90.1-2010, for example, may require lighting controls for daylight spaces, manual-on operation for occupancy sensors, incentives for non-mandatory controls, and controls commissioning. ASHRAE also posted Standard 189.1P, Standard for the Design of High-Performance Green Buildings. This standard, developed jointly by ASHRAE, IESNA and the U.S. Green Building Council, will provide minimum requirements for the design of high-performance commercial buildings, addressing energy efficiency, sustainable sites, water use, materials and resources, and indoor environmental quality. The lighting section of 189.1 is based on 90.1 but then goes far beyond with more restrictive lighting power allowances and a number of mandatory controls requirements, some of these provisions similar to what may be in store for 90.1-2010.

Summary

Improving energy efficiency is not just good for the environment; it makes good business sense too. When companies are required to cut costs to remain competitive, eliminating energy waste can save jobs and investment dollars for new programs and technologies.

- Energy Assessments
- Investment Grade Energy Audits
- Energy Monitoring and Targeting System
- Power Systems Studies
- Arc Flash Studies
- Power Quality Studies
- Motor Management & Reliability Program
- Intelligent Demand Control
- Project Management
- Complete Project Implementation
- Process Improvements

Siemens Energy Efficiency Solution Portfolio

You cannot improve what you do not measure or understand. Therefore, the first and most important step to creating an energy efficiency initiative is to benchmark current energy use. Many companies understand this need but often take a silo approach in which only certain sectors are benchmarked. The problem with this methodology is that it may improve one area, such as replacing antiquated motors, while missing other savings that can add up to a better overall reduction in energy use. Sometimes a well-intentioned program to replace standard technologies with "energy efficient" ones can actually cause more harm than good as

considerations such as power factor are neglected. For this reason it is important to have qualified companies perform a complete energy audit on the entire facility. A third party with experience across a broad range of systems (motors, drives, automation, lighting, etc.) can perform a qualified enterprise-wide energy audit.

Although important, an energy audit is just the first step. You need to also select a company that can implement an energy efficiency strategy after performing the audit. By choosing a large company with a wide array of solutions, such as Siemens, you can get a complete solution with the latest technologies to optimize energy efficiency. Siemens has also invested heavily in its Totally Integrated Automation (TIA) and Totally Integrated Power (TIP) platforms to ensure a standard platform that encompasses all phases of electric power distribution and consumption as well as the automation systems in an operation. This greatly reduces implementation, training, and maintenance costs.

An Advanced Metering system is an optimal entry point for gathering metrics without making a large capital investment. It provides both verification of the utilities' charges with a comprehensive report and the ability to measure power factor, harmonics and other parameters continuously. Additionally, an Advanced Metering system can provide the verification required for most government ratings and rebate programs (EPA Energy Star, tax credits for Energy Policy Act, LEED certification) .

SCADA systems have come a long way since the days of simply monitoring PLCs and RTUs. Many SCADA systems have modules designed specifically for monitoring energy use, such as Siemens WinCC powerrate. Siemens WinCC powerrate works with WinCC SCADA and Simatic PCS 7 to improve energy use via its load management tools specifically designed for monitoring and reporting against a stipulated utility power limit.

Many common products, such as motors and drives, have new energy efficient models, such as Siemens NEMA Premium motors with copper or aluminum rotor options that offer superior energy savings. Pairing motors with variable frequency drives is one of the best methods to increase energy efficiency. Siemens is a leader in drive technologies offering an array of AC drives, including those with regenerative capabilities to put otherwise wasted energy back on the line to power other systems.

While energy efficient motors and drives are an obvious target for reducing energy consumption, smart MCCs provide operating statistics, complete power measurement data, and voltage unbalance measurement to help determine if the motors are running effectively. They are also very effective in establishing trends to decrease energy use or peak demand loads.

Finally, lighting should not be overlooked when creating an energy efficiency plan since much energy consumption goes to lighting. While many businesses are familiar with energy efficient bulbs, few take advantage of the latest lighting control systems, such as Siemens i-3 Control Technology. The i-3 lighting control system offers very low installation costs because it requires very little external wiring and is available in a simple or smart solution, depending on the scope of the lighting control project.

With all the new technologies available and government incentives, there is no better time for business to cut costs through the creation and deployment of an energy management plan that can be implemented in phases to achieve the maximum ROI.

About Siemens

The **Siemens Industry Sector** (Erlangen, Germany) is the world's leading supplier of production, transportation, building and lighting technologies. With integrated automation technologies as well as comprehensive industry-specific solutions, Siemens increases the productivity, efficiency and flexibility of its customers in the fields of industry and infrastructure. The Sector consists of six Divisions: Building Technologies, Drive Technologies, Industry Automation, Industry Solutions, Mobility and Osram. With around 222,000 employees worldwide Siemens Industry posted in fiscal year 2008 a profit of EUR3.86 billion with revenues totaling EUR38 billion. www.siemens.com/industry

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Acronym Reference: For a complete list of industry acronyms, refer to our web page at www.arcweb.com/Research/IndustryTerms/

ASHRAE American Society of Heating Refrigerating and Air Conditioning
BMS Building Management Systems
BTU British Thermal Unit
CO_2 Carbon Dioxide
DCS Distributed Control Systems
DOE Department of Energy
EPA Environmental Protection Agency
EPAct Energy Policy Act
ERP Enterprise Resource Planning
GPS Global Positioning Systems
GRI Global Reporting Initiative
HMI Human Machine Interface
HP Horse Power
IECC International Energy Conservation Code
IEEE Institute of Electronic and Electrical Engineers
IESNA Illuminating Engineering Society
IGBT Integrated Gate Bipolar Transistor
IP Internet Protocol
KPI Key Performance Indicators
LEED Leadership in Energy and Environmental Design
MCC Motor Control Center
MES Manufacturing Execution Systems
NEMA National Electrical Manufacturers Association
OEE Operational Equipment Effectiveness
PDS Electric Power Distribution System
PLC Programmable Logic Controller
PWM Pulse Width Modulation
ROI Return on Investment
RTD Resistance Temperature Detectors
RTU Remote Terminal Unit
ROI Return on Investment
SCADA Supervisory Control and Data Acquisition
TIA Totally Integrated Automation
TIP Totally Integrated Power
UPS Uninterruptible Power Supply
VFD Variable Frequency Drive

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