ENERGY MANAGEMENT
HANDBOOK

lower costs, improve performance & operate sustainably

AS THE LEADING PROVIDER OF PRODUCTS AND SYSTEMS FOR ELECTRICAL INSTALLATIONS AND INFORMATION NETWORKS WHEREVER PEOPLE LIVE AND WORK, LEGRAND DELIVERS AN UNEQUALED DEPTH AND BREADTH OF INNOVATIVE SOLUTIONS.

Everywhere electricity and information is flowing, Legrand is there to manage it from beginning to end. Our solutions are designed to help achieve the highest levels of building performance by improving energy efficiency, security, productivity, cost-effectiveness, and sustainability throughout lifetime operation.

This handbook is intended for Legrand suppliers and customers. It is not intended to serve every contingency or provide pre-scriptive advice but instead seeks to act as a blueprint for establishing energy programs within organizations.

The inclusion of company and government examples in this publication is intended strictly for learning purposes and does not constitute an endorsement of the individual companies or government offices.

Legrand utilized an external source to help shape its commitment. By joining the Department of Energy's Better Buildings, Better Plants Challenge, Legrand committed to reduce its energy intensity by 25% over 10 years.

Helping businesses become more energy efficient

Business is increasingly affected by rising energy costs and environmental concerns. From product design to distribution, energy is an integral component and differentiating factor in today's marketplace. Legrand has taken steps to curb its impact on the environment and be less affected by rising energy costs through energy conservation and efficiency projects throughout its locations. The success we've witnessed in the last two years has stemmed not only from the implementation of energy projects but from a holistic framework that includes employee and C-suite engagement, organized energy tracking and reporting, and the formalization of energy goals and processes. Legrand is pleased to provide this Energy Handbook to help our organizations jump start or improve their energy program.

From product design to distribution, energy is an integral component and differentiating factor in today's marketplace.

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No matter the size or type of organization, the common element of successful energy management is commitment starting at the top and driven by employees working across various facilities and departments. Organizations must make a commitment to allocate staff and funding to establish an energy program in order to achieve continuous improvement.

Experience has shown that the financial returns from energy management continually drive organizations to improve their energy performance and hold fast to their energy program commitments. In the case of manufacturing, industry consumes 31% of primary energy and electricity in the U.S. Additionally since the 1930's 31.8% of all manufacturing jobs have been lost between 2000-2011. Energy efficiency is a real and successful strategy for job retention and is driving the adoption of energy programs across the U.S. (sources: Annual Energy Review, 2010, US EIA and U.S. Dept. of Labor, BLS and MBG Information Services, respectively).

1.1 Get Organized

To achieve goals, organizations need to establish a working framework of people and processes that span from on-the-ground employees to an Executive Sponsor. Getting organized involves appointing the right people who can create a plan of action and capitalize on opportunities. Regular meetings are needed to motivate employees and provide the team with an opportunity to troubleshoot and adapt so that projects and initiatives can steadily progress.

1.1.1 Appoint Corporate Energy Manager

Appointing a Corporate Energy Manager is a critical component of successful energy programs. A Corporate Energy Manager helps an organization achieve its goals by establishing energy performance as a core value.

The Corporate Energy Manager is not always an expert in energy and technical systems. Successful Energy Managers understand how energy management helps the organization achieve its financial and environmental goals and objectives. Depending on the size of the organization, the Energy Manager role can be a full-time position or an addition to other responsibilities.

Typical Corporate Energy Manager Responsibilities: Schedule and facilitate energy team meetings, oversee and analyze data input, report findings and results to Management team and any outside organizations, and field both internal and external information requests. It is helpful if the Corporate Energy Manager can rely upon the expertise of finance and operations personnel when analyzing and reviewing data.

Suggestion: If the Corporate Energy Manager does not report directly to a senior manager, it is helpful for a member of senior management to serve as an executive sponsor. Having a sponsor provides a direct link to upper management and helps formalize the commitment to energy improvement.

1.0 MAKE A COMMITMENT

1.1.2 Appoint Energy Team

Decisions affecting energy use are made every day by employees in different departments and locations. Creating an energy team can help integrate energy management into daily operations and project identification. In addition to planning and implementing specific improvements, the team measures and tracks energy performance and communicates with management, employees, and other stakeholders.

The size of the energy team will vary depending on the size of the organization. Often it is beneficial to include representatives from Facilities Management, Maintenance, Environmental Health & Safety, Human Resources, Finance and Supply Chain Management. If an organization has multiple sites, the framework may consist of local energy teams with one local representative acting as part of a broader energy team that meets with and reports to the Corporate Energy Manager.

1.2 Set Goals

Performance goals drive energy management activities and promote continuous improvement. Setting clear and measureable goals helps organizations develop effective strategies that achieve intended results and reap financial gains.

Goals set the overall purpose of tracking and measuring energy use, so it is imperative that they be well-stated and defined. By applying a longer time horizon but ambitious short term targets, organizations can be motivated to make big strides towards energy efficiency. Communicating and posting these goals can motivate staff to support energy management efforts throughout the organization. To read more on communication efforts, see section 3.3, "Raise Awareness."

While the energy team might be the initial creativity for goals, the Management Team needs to be closely involved and ultimately approve and commit to the goals. The Management Team, as mentioned in the first section, must be committed to an energy program and goals for lasting success. The energy team will most likely be responsible for validating how the organization can achieve the agreed upon energy goals.

1.3 Institute an Energy Policy

An Energy Policy articulates the organization's commitment to energy efficiency by providing guidance and formalization of how the organization interacts with energy throughout its facilities and operations.

Based on the experience of ENERGY STAR partners, successful organizations have energy policies that:

- **State an objective**—Have a clear, measurable objective that reflects the organization's commitment, culture and priorities.

- **Establish accountability**—Institute a chain-of-command, define roles in the organization, and provide the authority for personnel to implement the energy management plan.

- **Ensure continuous improvement**—Include provisions for evaluating and updating the policy to reflect changing needs and priorities.

- **Promote goals**—Provide a context for setting performance goals by linking energy goals to overall financial and environmental goals of the organization.

Source: http://www.energystar.gov/index.cfm?fuseaction=guidelines.

2.0 ASSESS CURRENT STATE OF ENERGY USE

Figure 1. ELECTRIC ENERGY
Measurement and Billing

PEAK DEMAND

INSTANTANEOUS

DEMAND

TOTAL ENERGY
CONSUMED (kWh)

TOTAL DEMAND (kW)

12M   12N   12M
          TIME OF DAY

Source: www.focusonenergy.com

Understanding current and past energy use is how organizations begin to identify opportunities to improve energy performance and gain financial benefits. Often just the act of compiling how much energy is used and the subsequent money spent on energy within a facility generates motivation to find ways to reduce consumption.
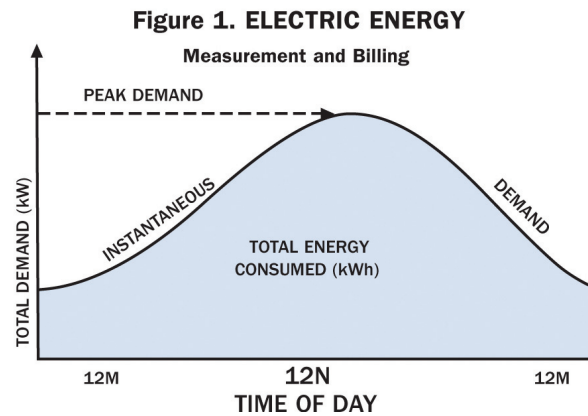
Energy information is used to establish a baseline of energy consumption and to track and analyze energy, energy expenditures and greenhouse gas emissions.

To establish a baseline an organization needs to know the following:

■ Amount of energy used

■ When the energy is used

■ Cost of energy

2.1 Establish Baselines
A baseline is a period in time from which to measure improvement, usually stated as one year. With help from the utility or your accounts payable department, gather energy information as far back as feasible. Depending on types of energy used, this could include electricity, natural gas, and other on-site fuel types used to power machinery, boilers, etc. If there are multiple sites owned by an organization, establishing the baseline year is determined by the site with the least amount of historical energy data.

2.2 Know all Energy Uses
The baseline will consist of all the different types of energy used on site, including but not limited to electricity, gas, fuel oil, and others. For more information on types of energy, see section 3.2.3.2--Tracking energy.

Utilities commonly measure two things at industrial facilities: electricity use and demand. A facility's electric meter measures total electricity consumption over time, measured in kilowatt hours, and the meter also registers electric demand, which is the maximum amount of electricity used at one specific time (usually measured every 15 minutes). The demand level indicates to the utility the highest amount of electricity needed by the facility, illustrated as "peak demand" in the graphic on this page. The organization will be charged for this level of demand, even though they may operate at this level for only one 15 minute period during a month's billing cycle. Essentially the peak demand can be thought of as overhead costs incurred for the provision of electrical infrastructure capable of meeting the largest electricity load. By reducing the peak demand an organization may be able to pay a lesser demand charge.

3.0 CREATE AN ACTION PLAN

With goals, baselines, and an energy team in place, organizations must create an action plan to determine how to best achieve its goals. An action plan is regularly updated to reflect recent achievements, changes in performance, shifting priorities and strategies. Get buy-in from management and all organizational areas affected by the action plan before finalizing it. It is important for the energy team to communicate the action plan and results to all areas of the organization to further garner support and enthusiasm for continuous energy improvement.

3.1 Identify Opportunities through Energy Audits both formal and informal

Energy audits do not have to cost money! Utilize existing employees (your energy team is a great place to start) to submit ideas of how the facility can use less energy. Additional resources include your utility and state and federal programs. Contact your local utility for energy conservation/efficiency programs that may incorporate low or no cost energy audits. Utilities frequently offer rebates on energy efficiency projects, especially to larger energy users such as manufacturers. To lessen the demand on the electricity grid, utilities are funding energy efficiency and conservation because it is a cost effective strategy compared to building additional power plants.

The federal government provides an underutilized resource known as Industrial Assessment Centers (IACs). Sponsored through the Department of Energy, these centers are based at engineering universities across the U.S. and seek to educate engineering students on energy efficiency opportunities within industrial buildings. Small- and medium-sized manufacturers may be eligible for a no-cost assessment by an IAC.

Eligibility for Assessments:

- Within Standard Industrial Codes (SIC) 20-39
- Located less than 150 miles of a participating university
- Gross annual sales below $100 million
- Fewer than 500 employees at the plant site
- Annual energy bills more than $100,000 and less than $2.5 million
- No professional in-house staff to perform the assessment

Industrial system energy efficiency projects include pumps, fan, blowers, process heating, air compressor systems, steam systems, and motors and drives. More information can be found on the Dept. of Energy's Advanced Manufacturing Office website: http://www1.eere.energy.gov/manufacturing/tech_deployment/ecenter.html

After the study is complete the company receives a report outlining the estimated costs and benefits of on-site energy efficiency opportunities. According to the Department of Energy, "each manufacturer typically identifies about $55,000 in potential annual savings on average" Learn more about the program at the following website: http://www1.eere.energy.gov/manufacturing/tech_deployment/iacs.html.

Numerous Legrand sites have taken advantage of U.S. Dept. of Energy Industrial Assessment Center (IAC) audits and have received valuable energy efficiency recommendations spanning lighting retrofits, air compressors, paint line ovens, HVAC systems, boilers, and other equipment.

www1.eere.energy.gov/manufacturing/tech_deployment/iacs.html

Energy efficiency projects for buildings are generally broken into six major categories:

■ **Recommissioning**
—the process of ensuring that existing systems are designed, installed, functionally tested, operated and maintained correctly in their current function. Energy Star recommends recommissioning every three to five years.

■ **Lighting**
—upgrading lighting systems with efficient light sources, fixtures, and controls, which can reduce lighting energy use, and in most cases improve the employee/tenant experience.

■ **Supplemental Load Reduction**
—often called Load Management, Load Shedding, Peak Shaving, Load Limiting, Demand Response and Demand Management, this is the process of controlling electrical loads so that overall peaks can be minimized.

■ **PlugLoad Reduction**
—decrease energy use through the identification and turning off of machines, lights, and peripheral appliances that are unnecessarily left on.

■ **Air Distribution Systems**
—includes the distribution system of a building's HVAC system as well as a compressed air system for manufacturing environments.

■ **Heating and Cooling Upgrades**
—evaluating the correct settings for a building's HVAC system. This category goes hand in hand with Recommissioning and Air Distribution systems because the HVAC system must be properly sized for the facility and ideally no leaks within its distribution system to function at its energy efficiency potential.

■ **Employee Engagement**
—initiatives and education that raise awareness of facility energy use. Often initiatives are composed of education and competition within or between facilities. Legrand has taken steps in each of these categories and has witnessed results within just two years of conducting dedicated energy audits within its facilities. Often projects have short payback periods, as exemplified in the examples on the following page.

LEGRAND LIGHTING

Warehouse lighting retrofit using Wattstopper occupancy sensors.

Payback period = 1 yr 2 mo

Investment = $148,000

Annual Electricity Savings = $140,000

LEGRAND RECOMMISSIONING

Participating in utility-offered recommissioning program for Environmental Control System. Utility monitors system over 12 months and covers 40% of all labor and machinery costs.

Payback period (est) = less than 1 yr

Investment (est) = $65,000

Annual Electricity & Natural Gas Savings (est) = $152,000

LEGRAND AIR
DISTRIBUTION SYSTEMS

Installation of a small air compressor to run limited machinery on nights and weekends.

Payback period = 5 mo

Investment = $4000

Annual Electricity Savings = $10,100

Compressed air system air leak ID and repair.

Payback period = less than 1 mo

Investment = $2500

Annual savings = at least $22,500

3.2 DEFINE TECHNICAL STEPS & TARGETS

ENERGY AUDITS PAVE THE WAY FOR REALIZING THE TECHNICAL STEPS
NECESSARY TO ACCOMPLISH ENERGY REDUCTION GOALS.

3.2.1 Set Targets
To ensure that an organization is on track to meet its energy goals it needs to set targets or milestones for its facilities and teams so that progress can be tracked. These targets can also be a useful tool to convey progress to Executive Management.

3.2.2 Set Timelines
An organization also needs to set timelines for projects within the pipeline, including regular meetings with key personnel to evaluate progress, necessary changes, completion dates, and expected outcomes.

3.2.3 Establish a tracking system
To head the saying, "You can't manage what you don't measure," organizations need to track the status of projects and energy use. A tracking system can be as simple as an excel spreadsheet or a Microsoft Project application, or it can be a streamlined IT dashboard. However, it must be a system that can be used by all key personnel—

a centrally housed document is crucial with multiple site tracking. The energy system should track all energy uses by volume and cost, and overall changes in consumption and intensity.

Installing submeters is a critical element of measuring energy consumption. Submeters provide transparency into where and what processes within a facility consume energy. From there energy managers can identify machinery or sections within a building that may be in need of recommissioning, upgrades, or process improvements. Additionally the installation of submeters has been shown to invoke energy savings simply through what is known as the Hawthorne Effect. When employees are aware of submeter use, general conscientiousness of energy use increases and yields savings of up to 2%, as captured in the below chart.

(SOURCE: "Guidance for Electric Metering in Federal Buildings," Federal Energy Management Program, 2006)

The DOE recommends that manufacturing organizations measure energy use as energy intensity instead of absolute usage. Intensity accounts for changes in production volume so energy goals and business growth are not juxtaposed. To calculate, divide total energy use by a throughput such as sales dollars, units produced or if in an office area, number of staff/hours worked.

Energy Intensity = Actual energy use/throughput

ACTION	OBSERVED SAVINGS
Installation of Meters	0-2% (Hawthorne effect)
Bill allocation only	2.5-5% (improved awareness)
Building tune-up	5-15% (improved awareness and identification of simple O&M improvement)
Continuous Commissioning	15-45% (improved awareness, ID simple O&M improvements, and continued management attention)

3.2.3.1 Tracking projects

Tracking projects is often referred to as a "project pipeline," or a prioritized list of energy efficiency projects and initiatives the energy team will implement. By understanding the energy impacts made by audit recommendations the energy team can prioritize the resulting projects to create a project pipeline. Having an energy team composed of various departments is crucial to this step because representatives from finance and maintenance can help justify project rankings and usher projects along.

3.2.3.2 Tracking energy

Consider the following when collecting and tracking energy data:

Determine appropriate level of detail—the level and scope of data collection will vary from organization to organization. Some may choose to collect data from submeters on individual processes while others may only look at a utility bill.

■ Account for all energy sources—inventory all energy purchased and generated on-site (electricity, gas, steam, waste fuels) in physical units (kWh, mMBtu, ccf, lbs. of steam, etc.) and on a cost basis.

■ Document all energy uses—for the sources identified above, assemble energy bills, meter readings, and other use data.

   ■ Energy data may reside in the accounting department, be held centrally at each facility, or can be acquired by contacting the appropriate utilities or energy service providers.

   ■ Gather at least two years of monthly data to ensure consistency.

   ■ Collect facility and operational data—to be able to normalize and benchmark, it may be necessary to collect non-energy related data for all facilities and operations, such as building size, operating hours, etc. This data may also be helpful to calculate the site's energy intensity (see side box).

Suggestion: In the first year or two it is helpful to prioritize the quick win projects first; those that have low costs and quick implementation timelines to gain momentum and tally success stories, which will also strengthen employee engagement.

EXAMPLE OF A PROJECT PIPELINE TEMPLATE:

Project #	Potential Energy Savings Projects	Estimated Annual Savings (kWh)	Estimated Annual Savings ($$)	Estimated Annual Savings (ccf)	Estimated Annual Savings ($$)	Cost to implement	Start Date	Completion Date	Comments/Progress

Everyone has a role in energy management.

Effective programs make employees, managers, and other key stakeholders aware of energy performance goals and initiatives, as well as their responsibility in carrying out the program. The most effective and simple way to save energy is to shut it off when not needed. All employees can participate in such an effort.

3.3.1 Communication Plan

For entire organizations to achieve a heightened energy awareness, a strategic communication plan needs to identify key audiences, information needed (goals, general energy facts, specific process improvements, etc.), and dissemination methods including email, posters, social media, and presentations.

3.3.2 Building Capacity

Through both external and internal training, access to information, and transfer of successful practices, procedures, and technologies, you can expand the capacity of your staff. Externally, there are a host of free webinars on energy management and ISO 50001 that are available through various information venues such as **www.greenbiz.com** and **www.environmentalleader.com**. Beyond webinars, have different energy team members attend energy conferences and seminars and take turns informing the group of the concepts and ideas learned.

Internally, energy teams implementing different energy projects at different sites should share the project plans, hurdles and successes across sites to ensure knowledge sharing as well as energy and money savings.

3.3.3 Recognize Achievements

Recognizing individuals and teams for their achievements is crucial to the success of the energy program although the method may vary drastically from organization to organization. To effectively raise awareness of energy consumption it is important to provide transparency into how your organization "walks the talk."

To raise energy awareness Legrand sends out three types of internal communications monthly:

1. Energy Facts—where our energy comes from, types of energy used, clean generation technologies, etc.

2. Legrand energy saving products that can be purchased through our employee purchase program

3. Operations success stories—how we've reduced energy consumption through a specific process change or machinery upgrade/retrofit.

Resources:
Energy Star Challenge Toolkit
(includes posters, templates, and ideas for energy awareness)

http://www.energystar.gov/index.cfm?c=challenge.challenge_toolkit#spread_word

American Council for an Energy Efficient Economy
(facts and resources for home energy awareness)

http://www.aceee.org/consumer

ISO 50001

ISO 50001 is a new standard released in 2011 that provides a framework for industrial facilities seeking to manage energy usage. At a high level is provides guidance on tracking, measuring, and documenting energy use, defines roles and responsibilities for energy management, builds awareness about energy use within the organization and assists in setting energy goals.

4.0 REPORTING & EVALUATING PROGRESS

4.1 Reporting

To reach strenuous goals it's helpful to be accountable to another entity or organization. There are many energy/carbon emission tracking organizations out there, such as the DOE's Better Buildings, Better Plants program, the Carbon Disclosure Project, and others. Make an effort to research an organization your business can align with and with who it can reach out. Often times joining an organization can result in added publicity or present public relations opportunities.

Reporting actual data is at the minimum conducted on an annual basis. Quarterly and monthly results will help to identify trends as they are happening and may lead to stronger annual results.

4.2 Evaluating Progress

Evaluating progress includes the review of both activities and energy use data as carried out under the action plan and their contribution to the achievement of performance goals. Specifically, regular evaluation of energy performance and initiatives allows energy managers to:

- Measure the effectiveness of projects and programs implemented

- Make informed decisions about future energy projects

- Reward individuals and teams for accomplishments

- Document additional savings opportunities as well as non-quantifiable benefits that can be leveraged for future initiatives

(SOURCE: Energy Star)

designed to be better.™

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