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Negawatts

...and How to Produce Them

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Given the increasing public concern about the energy shortage and the impact of industrial and commercial activity on the ailing environment, many have pointed to alternative energy as a solution to the problem. A big (and inexpensive) part of the solution may be immediately available through an oft-ignored form of "alternative energy": the "negawatt." The "negawatt" is a term coined by Amory Lovins, founder of the Rocky Mountain Institute.

> ***"A negawatt is a... megawatt that a power plant never has to generate"***

A negawatt is a unit of conserved energy, a megawatt that a power plant never has to generate because the demand for it has been eliminated through efficiency and conservation. The cheapest and cleanest megawatt of electricity is one that was never produced. Every negawatt produced is another megawatt made available to the grid and to new businesses without the corresponding need to increase capacity at the power plant.

The National Action Plan for Energy Efficiency has stated that energy efficiency programs could do the following:

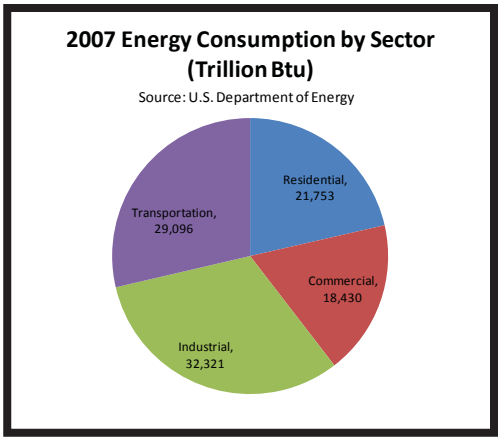
•Realize a 20% reduction in total electrical demand nationally by 2025.

•Create $20 billion/year in energy bill savings.

•Defer the need for 20 gigawatts of power (40 new 500 megawatt power plants).

•Reduce emissions from energy production by more than 200 million tons of carbon dioxide, 50,000 tons of sulfur dioxide, and 40,000 tons of nitrous oxide annually.

Negawatts do not sound as innovative or as exciting as other clean resources such as wind, solar, or biofuels; however, the above facts show that the former has a more immediate and dramatic impact, and should be drawing the attention of the best and brightest professional engineers. Many opportunities for professional engineers and engineering firms lie in the production of negawatts in the commercial and industrial sector. Commercial and industrial facilities use 50% of the nation's energy resources. Reducing energy consumption by 20% in this sector would have the same effect as increasing the contribution of wind and solar power to ten times its present level.



The keys to producing negawatts in these industries are a comprehensive energy management program, an effective O&M program (Operations and Maintenance), and a detailed performance measuring system such as the EPA's Energy Star Program.

Energy Management Programs

An Energy Management Program is a systematic approach to controlling a facility's energy consumption. It reduces energy waste to the absolute minimum necessary to sustain the businesses' core functions while taking into account the climate where the building is located and the physical characteristics of the building itself. As Albert Thumann, P.E., C.E.M relates, "In short, an effective Energy Management Program establishes and maintains efficient balance between a business's functional energy requirements and its actual energy consumption - no more, no less."

In order for any management program to be successful, it requires a defined method for gathering and interpreting information, as well as mechanisms to ensure its continued existence and effectiveness. Thumann describes a very effective seven-step program in his Energy Conservation in Existing Buildings Deskbook. The following outline describes the seven steps that will pull together all the aspects of energy management into a logical progression for implementation. Professional mechanical and electrical engineers should play an important part in each step. The methodology is as follows:

Step 1: Form an Energy Management Team

Step 2: Survey the Business or Facility

Step 3: Tabulate Present Energy Usage

Step 4: Identify Energy Conservation Opportunities

Step 5: Analyze Costs and Benefits

Step 6: Set Goals

Step 7: Implement and Monitor the Impact of the Program

In order for an Energy Management Program to be successful, this Seven-Step process must be initiated and directed by a competent management team. The Energy

Management Team should consist of individuals who are aware of energy use in their respective areas of daily responsibility and who can keep the program focused on its goals. The energy management team should meet on a monthly basis, preferably in the middle of the month. This allows time for bills to arrive and be entered into the energy management reporting program. The makeup of the team should include the overall business manager, key operating personnel, a professional engineering consultant, the accountant responsible for energy-related accounts payable, and, periodically, expert guests (e.g., architects, vendors, manufacturers, etc.). The idea behind the makeup of this team is to bring together persons of various disciplines that have first-hand experience with the mechanical and electrical requirements of the business and the facility that houses it.

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The professional engineer would play a major role by interpreting the information and Energy Conservation Opportunities provided by the other participants. Many energy management teams fail to get off the ground because they do not have a solid understanding of where their power is going, and cannot accurately define the return on investment of their Energy Conservation Opportunities. The complex interrelationships of lighting, heating, cooling, and industry-specific systems necessitate professional engineers to help managers discern whether a specific conservation initiative will be successful - or whether it will produce a situation that will actually end up using more energy.

Operations and Maintenance Programs (O&M)

Another key element in achieving optimum energy efficiency, reliability, and safety in a business or facility is the development of a comprehensive O&M (Operation and Maintenance) program. It has been estimated that O&M programs targeting energy efficiency can save 5% to 20% on energy bills without significant capital investment. An effective O&M program also aids in compliance with federal laws such as the Clean Air Act and the Clean Water Act. O&M encompasses Operational Procedures, Reactive Maintenance, Preventive Maintenance, Predictive Maintenance, and Reliability-Centered Maintenance. Unfortunately, the professional engineer is frequently underutilized in these areas. Businesses that build facilities spend countless hours working with their engineering teams through the design, construction, and commissioning phases. Too often, the relationship is put on hiatus until the business expands or changes, and at which time a professional engineer is engaged again. There is a great benefit to businesses, as well as a great opportunity for professional engineers, in the continuity of their relationship through the operation and maintenance phase of the business life cycle. Newer and more sophisticated technologies require an approach to their operations and maintenance that equals the professionalism involved in their design and installation.

Energy Star

If you can't measure it, you can't manage it. How can facilities measure their energy efficiency improvements, and how can they benchmark the efficiency of their operations against others? For professionals working in the commercial building sector, the EPA's Energy Star Program for professional buildings can provide the answer to both of these questions. Once a commercial building's energy profile is assessed, the results are sent to the EPA, and the energy data is entered through the EPA's Portfolio Manager.

The Portfolio Manager is an online, interactive software tool that makes benchmarking energy performance easy and accessible. Portfolio Manager is based on statistical models gathered by the EPA that correlate energy data to operational characteristics, identifying key energy drivers in the facility. Based on the facility's physical and operational characteristics, such as location, size, number of workers, hours of operation per week, number of PCs, etc., the rating system evaluates a given facility, and then compares its energy performance to others with similar characteristics in the U.S. Those that score within the top 25% or earn an Energy Star score of 75+/100 are eligible to apply for an Energy Star Rating.

"The Professional Engineer is essential in the Energy Star certification process"

The Professional Engineer is essential in the Energy Star certification process. The EPA requires that the Statement of Energy Performance section of the Portfolio Manager be verified by a PE. Once validated, the Statement of Energy Performance becomes an official document that is used to apply for the Energy Star rating. Professionals wanting to learn more about their role in the program should consult "The 2007 Professional Engineer's Guide to The Energy Star Label for Commercial Buildings".

Negawatts as an Energy Resource

Energy efficiency and conservation obviously play an important role in the solution to our nation's energy problems. They reduce electrical demand, reduce the need for more fossil fuel plants (thus reducing pollution and greenhouse gas emissions), and can help minimize the occurrence of brownouts and blackouts. Negawatts should be regarded as a significant energy resource, and the role of those producing negawatts should not be ignored nor underestimated in the quest for energy independence.

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