

Creatively Address Rising Costs and Environmental Concerns

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In the summer of 2008, oil prices peaked at about \$150 per barrel. While this price has dropped from its highest point, Americans are nonetheless feeling the pinch of increased energy costs, both in terms of transportation fuel prices and electricity costs.

Additionally, the world is seeing mounting evidence of global climate change, causing increased concern for the environment. Building owners can respond to both of these issues by incorporating smart choices into their designs that reduce energy use, lowering costs and lessening the building's impact on the environment.

Peak Oil

Peak oil is the term that refers to the point in time when the fossil fuel extraction rate reaches its maximum. After the supply peaks, the rate of production declines and demand soon exceeds supply. As the worldwide oil supply reaches its peak, oil costs rise. Subsequent demand for other fuels will cause their prices to rise as well. As fossil fuel costs increase, utility companies that use these fuels to generate electricity pay more to operate their facilities, in turn passing this cost to customers in the form of higher utility bills.

According to the US DOE's Energy Information Administration (EIA), 85% of the nation's energy supply comes from the burning of fossil fuels, including petroleum, coal, and natural gas.

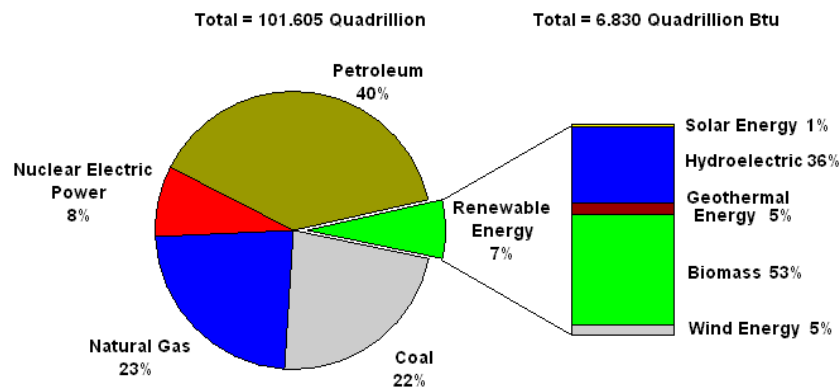


Figure 1: US energy consumption by supply, 2007 data. Source: USDOE EIA official energy statistics.

A University of Michigan study estimates that at current consumption rates, energy producers worldwide will begin to face fuel shortages in oil supply in 50-70 years. The EIA projects that by 2030, the US alone will increase its total fossil fuel consumption by up to 30%. There is no time like the present to start making smart choices about energy use and conservation.

Environmental Concerns

Fossil fuels have a negative impact on the environment. Combustion releases greenhouse gases, especially carbon dioxide (CO₂), which leads to increased atmospheric temperatures. With mounting concern about global climate change, people are looking for ways to cut energy use and reduce the level of damage they do to the environment. One concept that has received increased attention in recent years is the “carbon footprint,” a measure of the negative impact that a structure, an individual, or a process has on the environment. A building’s carbon footprint can be estimated by calculating how much CO₂ is produced by the amount of fossil fuel burned to provide the building’s energy for one year.

The Green Building movement is a paradigm that focuses on improving construction practices and commercial and industrial process to make them more environmentally friendly. This can include using renewable or recycled materials in construction, reducing waste, and improving energy management. Commercial building owners can respond to this movement by designing “green” buildings that use less energy, cutting costs and reducing the building’s impact on the environment, as well as by exploring sustainable alternative energy sources, which have a smaller carbon footprint.

Reducing Energy Usage

Building owners have a number of ways to creatively address rising costs and environmental concerns. One option is to conduct an energy audit to find ways to increase efficiency. In the auditing process, energy meters collect energy usage data for a period of time, typically 30 to 90 days. After this collection period, the data is analyzed and used to identify sources of energy waste. Building owners can use this information to adapt to more efficient usage patterns. Additionally, usage data can be compared to time-of-use costing data from the local utility provider. Utilities charge more for power at peak usage times. Building owners can choose to modify their practices to reduce their electricity usage at these peak times. After a formal energy audit, many building owners choose to have energy meters permanently installed in their facility to routinely monitor and adapt their power usage practices.

“To manage your energy, you have to be diligent and monitor your energy usage. Using the monitored data to make intelligent decisions can save time and money,” states Cheryl Kennedy, member of the Cascadia Regional chapter of the US Green Building Council and product manager at Veris Industries, Portland, OR.

Additionally, a smart BAS control design can address both rising energy costs and increasing awareness of the threats to our natural resources. Studies have shown that a well-operated control system can reduce energy use by 15 to 20%, lowering the energy bill and the carbon footprint for the building.

Environmental sensors are an integral component of a smart BAS control system. Sensors provide valuable real-time information about interior conditions, enabling the best decisions regarding the use of energy with respect to the immediate needs of the building. For example, an occupied building will accumulate CO₂, which can lead to drops in productivity. Typical comfortable CO₂ levels in commercial spaces are approximately 600 ppm. Running the ventilation system will maintain this level, but continuously running the fans and conditioning the outside air for interior comfort are costly. Incorporating CO₂ sensors into the BAS design will trigger the ventilation controls to activate only when levels are high (usually above 1000 ppm), in much the same manner as a thermostat triggers temperature controls only when they are needed. Humidity sensors work similarly to maintain comfortable interior moisture levels. The sensors also use control algorithms that use interior measurements to determine whether to draw in air from outside the building and condition it for interior comfort, or to recirculate interior air.

Temperature, humidity and CO₂ level are the three most important criteria for measuring interior comfort. Inefficient operation of a BAS system with regard to comfort levels consumes excess energy, which raises the building's utility bill and enlarges the carbon footprint. In recent years, BAS designers have been integrating the monitoring systems for all environmental comfort criteria into a single network. All data is sent to a central control system, which then makes decisions about how to balance the building's comfort needs with energy-efficient practices. Buildings that use this integrated, whole-building approach to monitoring are known as "intelligent buildings."



Figure 2: Intelligent Building design, with sensors incorporated throughout.

Incorporation of energy meters and BAS sensors adds to the initial cost of construction or retrofit. However, this cost is recuperated in energy savings over time. Higher energy costs reduce the payback time, making sustainability and environmentalism more economically viable.

Dan Brown, with Cascade Energy Engineering talks about his company's attempts to lower the carbon footprint of their own building. "We put in a new centralized HVAC and lighting system to increase energy efficiency. We are an industrial energy company, so efficiency is a core part of our business. The payback was long, but it was the right thing to do."

The US DOE acknowledges several ratings systems that can be used to qualify and quantify a building's energy use and sustainability practices. The US Green Building Council's LEED certification program and the Green Building Initiative's Green Globes rating and assessment system both offer criteria to evaluate buildings and certify them as "green" if sufficient criteria are met. Both of these organizations can trace their origins to the Building Research Establishment's Environmental Assessment Method (BREEAM), which began in the United Kingdom in 1990. Additionally, US EPA created the Energy Star rating program in 1992 to promote energy-efficient products and practices. All these programs offer incentives for building planners to meet a number of criteria to reduce the building's impact on the environment and reduce energy consumption. They can also serve as important resources for questions about Green practices, so that a building owner can be educated and make smart choices. A comprehensive energy management plan and an intelligent and efficient BAS design are crucial to meeting many of these standards.

Several states are considering legislation related to energy conservation and sustainability. The Arizona and West Virginia legislatures are considering bills that would require many new construction projects to be designed to meet LEED ratings standards. The Connecticut legislature already passed an act that will provide tax credits to building owners who build or renovate according to green standards.

Alternative Energy: The Long-Term Solution

Another way to reduce a building's carbon footprint is to explore sustainable energy sources. The fossil fuel supply is finite. Experts debate the amount that remains, but they all agree that at some point, dependence on fossil fuel energy will no longer be viable. Only 7% of the nation's energy currently comes from renewable sources such as solar, wind, geothermal and hydroelectric power. Many energy suppliers are exploring these sustainable resources to further develop and utilize them to meet the world's growing needs.

Solar power is an emerging technology in which accurate metering plays a crucial role. Photovoltaic panels collect energy from incoming solar rays, and an inverter converts that energy into electricity. An energy meter is used to quantify the energy generated and

determine whether it is sufficient to meet the building's needs. If not, power from a utility provider may be required as a supplement. If the solar panels produce excess energy, the meter can measure the surplus and potentially return power to the utility for credit.

The California Solar Initiative offers incentives to design and install solar systems in new construction projects. The resulting buildings are less dependant on the local utility provider, so the electricity bills are lower. And since most power is produced on-site in an environmentally-friendly method, the building's carbon footprint is very low.

Measures taken to reduce energy use and improve the environment can be done simply and effectively by taking a holistic approach to planning. Building owners should take this approach when designing a control system for commercial spaces. The small details of BAS design can make all the difference in improving efficiency and increasing conservation efforts.

For more information, consult these resources:

- The Energy Information Administration, www.eia.doe.gov
- ASPO International, www.peakoil.net
- The US Green Building Council, www.usgbc.org
- Green Globes, www.greenglobes.com
- BREEAM, www.breeam.org
- US Energy Star, www.energystar.gov
- The California Solar Initiative, www.gosolarcalifornia.org