

solutions

From Shop Floor to Top Floor:

Best Business Practices

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in **Energy Efficiency**

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by

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ICF INTERNATIONAL



PEW CENTER

ON

Global CLIMATE CHANGE

CASE STUDY

United Technologies Corporation Integrated Approaches

Headquarters:	Hartford, CT
Chairman & CEO:	Louis Chênevert
Revenues (2009):	\$52.9 billion
Energy Costs (2009):	Less than 1 percent of revenues
Energy Savings Target:	In 1988, a UTC Energy Council formed, which set a 20 percent energy cost reduction per square foot goal by 1995 for the top 20 manufacturing sites. Subsequently, UTC set a goal to reduce energy used per dollar of revenue 25 percent below 1997 levels by 2006. This goal was realized in 2001 and reset to a 40 percent reduction by 2006. Actual 2006 savings were 56 percent, representing a 19 percent absolute reduction from 1997 usage. UTC's latest goal is to reduce absolute carbon dioxide (CO ₂) emissions 12 percent below the 2006 baseline by year-end 2010.
Key Efficiency Strategy Successes:	<ul style="list-style-type: none">• Setting aggressive targets and reaching them ahead of schedule;• Integrating seven diverse businesses through a unified energy efficiency strategy and Environment, Health & Safety (EH&S) accountability system;• Applying products and expertise to improve internal efficiency, and pursuing new business opportunities in the growing green buildings industry.

Energy Conservation Strategy Overview

UTC provides high technology products and services to the building systems and aerospace industries worldwide through seven industry-leading businesses: Carrier air conditioning, heating and refrigeration solutions; Hamilton Sundstrand aerospace and industrial systems; Otis elevators and escalators; Pratt & Whitney engines; Sikorsky helicopters; UTC Fire & Security systems and UTC Power fuel cells. Together, they form one company constantly finding new technologies that make cities more efficient, people more secure and travel more comfortable. While the products and their specific uses differ, common to all of them is the conversion of energy into useful work.

The central role energy plays in UTC's business helps explain why energy conservation and efficiency have emerged as a core element of the company's corporate strategy and culture. Senior leadership, from the CEO down, have stressed the importance of eliminating all forms of waste, and squeezing ever-increasing amounts of useful work out of the same (or less) amounts of energy. As Chairman and CEO Louis Chênevert said in a recent speech at the National Building Museum in Washington:

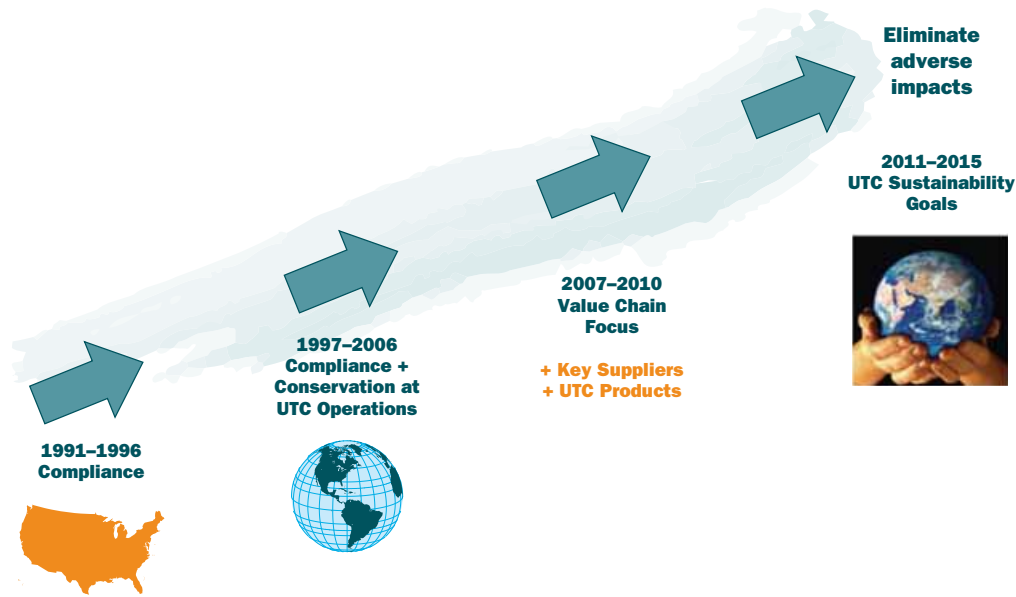
“The opportunity for improving energy efficiency in buildings is tremendous. Today, the building sector consumes about 40 percent of the energy used in the United States and is responsible for nearly 40 percent of greenhouse gas emissions. With products and technology available today, energy consumption in buildings could be cut by almost 70 percent.”

The corporate drive to minimize waste can be seen in the progression of energy efficiency goals UTC has set for itself dating back to the late 1980s when it formed the UTC Energy Council. Members representing the company's 20 largest manufacturing sites targeted 20 percent energy cost savings by 1995 and committed to sharing best practices among the business units. This evolved broadly with EH&S goals beginning in the 1990s. The company first set energy efficiency goals in 1997, aiming to reduce energy used per dollar of revenue 25 percent by 2006. When it crossed the 25 percent mark in 2001, the 2006 goal was raised to 40 percent. In 2006, the company realized a 56 percent reduction in energy use per dollar of revenue, which is equivalent to a 19 percent absolute reduction.

UTC built on its success in outperforming the 2006 goals by setting even more ambitious targets for the 2007–2010 period. At this point, UTC began measuring its targets in CO₂ terms as opposed to energy, to drive efforts to reduce direct greenhouse gas (GHG) emissions as well as energy use. The target is to reduce CO₂ emissions 12 percent by 2010 in absolute terms from the 2006 baseline. Taking into account the 19 percent absolute cut between 1997–2006, UTC's total absolute reductions will be over 30 percent from 1997–2010, or more than two percent per year for nearly 15 years. **Figure 1** illustrates the program's evolution within the larger EH&S context. From 1991 to 1996, UTC focused primarily on meeting environmental regulations. Beginning in 1997, UTC went beyond compliance to voluntarily reducing internal energy use, as demonstrated by its energy efficiency goal announced that year. After 2006, UTC expanded its energy efficiency focus into its supply chain and product impacts and will continue this with an expanded set of sustainability goals through 2015.

Over the last decade, UTC has seen the demand for energy efficient products grow tremendously, along with an ever-rising interest in business processes that are more sustainable in nature. This trend is expected to continue as the world population grows and becomes more urbanized. UTC believes that as a result, large, infrastructure-building manufacturers—those whose products support buildings, cities and air transport—will not only be expected to develop smarter, greener technologies for the future, but also to stand behind an environmentally responsible operational platform. Anticipating this trend, the company has articulated its commitment to sustainability

Figure 1

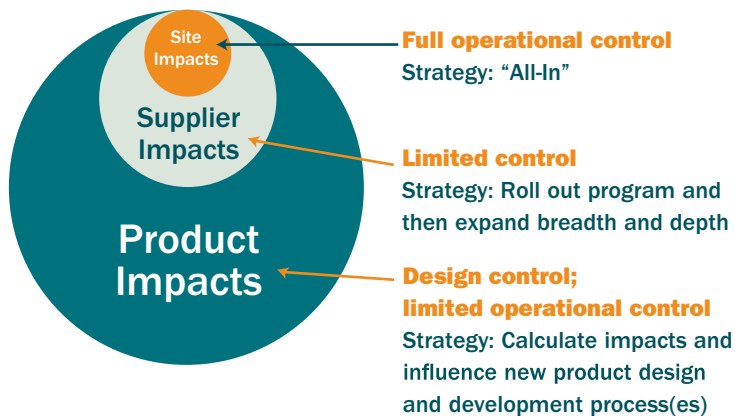
Evolution of UTC's Sustainability Program

Recreated based on image provided courtesy of UTC (2008).

through five themes: efficiency of its products; EH&S impacts of its operations; overall productivity; development of its people; as well as legal compliance and high ethical standards. +

Critical to the success of UTC's sustainability strategy has been the development of a sophisticated energy data reporting system that tracks energy use and reduction opportunities throughout its diffuse businesses. The system has been instrumental in putting the right information in front of senior decision makers, allowing them to establish priorities and identify corrective actions.

While most of UTC's efficiency gains so far have come in its internal operations, the company is expanding its efficiency strategy to cover products and services and its supply chain. This is driven by two factors. First, energy is a major cost factor in many of the markets UTC competes in; therefore UTC's energy efficient products have a competitive advantage in the marketplace. The rise in oil prices in the last decade, for example, drove increased demand for more efficient jet engines. Secondly, UTC recognizes that while the GHG impacts from its internal operations are significant, these are dwarfed by the emissions that come from its supply chain and—especially—use of its products. +

Figure 2**EH&S Impacts, Control, and Strategy**

Recreated based on image provided courtesy of UTC (2009).

UTC is taking action to minimize all of these impacts, but faces the same conundrum many other companies experience: their level of control is greatest in the area with the smallest environmental impact. **Figure 2** (not to scale) illustrates this dynamic. UTC's site GHG emissions are under its direct control, and while the company has invested considerable effort to control these emissions, they

are small relative to supplier and products impacts. Supplier impacts are larger than site impacts, but UTC's ability to effect change here is more limited. And GHG emissions from UTC's products eclipse those of both its internal operations and supply chain. UTC can influence product emissions by designing them to maximize efficiency, but the customer ultimately controls the use of the product, not UTC.



Energy Conservation and UTC's Climate Strategy

UTC has reported both energy use and GHG emissions internally since 1996. But in 2006, the company formally combined its energy savings and GHG emission reduction targets for the 2007-2010 goals. While most of UTC's facilities are not large enough to be covered directly by federal climate policies being considered in the U.S., growing government and consumer concern about climate change reinforces the operating approach of the energy and GHG reduction teams at UTC. Further, carbon prices will drive up energy prices, indirectly rewarding efficiency as a cost reduction strategy and as a product competitiveness strategy. The conversion to a GHG reduction target has reinforced UTC's emphasis on conservation, as it is typically the most cost-effective carbon mitigation strategy, with or without carbon prices. One practical effect of the move to a GHG reduction target has been the creation of carbon-equivalent lookup tables and calculations, which are integrated with the energy reporting system. This means that energy can be translated into CO₂ equivalents on a consistent basis company wide. This requires the determination of

carbon emissions for electricity used at each location, based on eGrid¹ or other accepted regional or country factors that take into account the generation mix for the applicable power grid. UTC's data reporting system also tracks direct process emissions, on-site natural gas and fuel oil combustion, and vehicle miles traveled, among other sources of emissions.

UTC does not currently plan to sell energy efficiency-based credits into carbon markets; the instances in which efficiency can qualify for CO₂ allowance credits are likely to be few, and the monetary value and verification requirements in applicable markets are too uncertain. Many of UTC's production facilities are in states that participate in the northeast Regional Greenhouse Gas Initiative (RGGI)—a cap and trade program that covers power plants. Under RGGI, savings in non-electric energy use, such as heating or boiler fuels, can be sold as offsets, but RGGI allowance prices are currently low, and the demand for offsets has not yet materialized. UTC does, however, sell efficiency credits in the Connecticut Renewable Portfolio Standards (RPS) market. Connecticut's RPS law requires that utilities acquire energy savings from customer facilities, including CHP projects, equal to four percent of utility sales each year, through 2010. UTC has been able to sell credits from some of its Connecticut combined heat and power (CHP) projects in this way.

Internal Operations

UTC has gone to great lengths to standardize its approach to energy efficiency, through its EH&S Policy, its EH&S Management System, and an Energy & GHG Reduction Standard Practice (known as SP-017). While elements of the Management System and Standard Practice identify "What" is required, a detailed Energy Management Guidebook, first issued in January 2007 provides the more detailed "How-To" guide for energy, facilities, operations and EH&S professionals. The guidebook starts with the basics:

- How to collect, understand, and use energy consumption and cost data;
- How to procure energy smartly; and
- How to manage electric loads.

¹ The Emissions & Generation Resource Integrated Database (eGRID) is a comprehensive inventory of environmental attributes of U.S. electric power systems. eGRID is based on available plant-specific data for all U.S. electricity generating plants that provide power to the electric grid and report data to the U.S. government. Emissions data from EPA are carefully integrated with generation data from EIA to produce useful values like pounds per megawatt-hour (lb/MWh) of emissions, which allows direct comparison of the environmental attributes of electricity generation. eGRID also provides aggregated data by state, U.S. total, and by electric grid boundaries.

The guidebook goes on to provide technical guidance and best-practice lists on key topics including: operating schedules; lighting; compressed air; boilers/steam systems; HVAC systems and controls; cogeneration; and building envelopes.

In developing the guidebook, UTC took advantage of existing publicly available energy management information and coupled that with UTC expertise in several of the subjects covered in the guide including Carrier, which contributed to the HVAC sections, Sullair (a division of Hamilton Sundstrand), which contributed to the Compressed Air sections, and both Pratt & Whitney and UTC Power, which contributed to the cogeneration section.

The guidebook also includes a self-assessment checklist (see **Figure 3**), enabling site managers to determine if they have the essential elements of UTC best practices in place.

Each of the topics outlined in the guidebook references specific chapters of a UTC-branded edition of the “Energy Management Handbook,”² a detailed desk reference used throughout industry. These energy management practices fall within UTC’s Standard Practice 017. EH&S practices are published in a numbered series; Standard Practice 017 is a formalized version of the practices laid out in the Guidebook and Handbook that provides more detail on best practices for reducing energy use and greenhouse gas emissions. The efficiency practices also exemplify the company’s overarching business approach, termed Achieving Competitive Excellence (ACE). Former Chairman and CEO George David developed the ACE program in 1991–1992 while he was President with UTC. It stems from the continuous-improvement techniques developed in Japanese manufacturing that are now widely emulated. ACE embodies the process of seeking out and eliminating waste, while at the same time striving to improve quality, in every aspect of the company’s businesses.

While the guidebook, handbook, and assessment checklist are important, perhaps more critical are the leadership, training, data tracking and accountability systems put in place to ensure the operating practices truly are conducted at the highest level. UTC’s energy team and corporate energy manager oversaw the energy team’s work in developing the data collection and reporting system, organizing the training and technical assistance effort, and supporting the internal communications program. The energy team includes some 10 people in all, including one from each business unit. The business unit leads work directly with the 300 facilities participating in the reporting and savings target effort. The energy team is part of a larger operations-supply management organization that specializes in commodity management. Each team has cost savings goals in a specific general procurement

² Wayne C. Turner and Steve Doty (2006). *Energy Management Handbook, Sixth Edition*. Taylor and Francis.

Figure 3

UTC **Self Assessment** Template

Energy Management Plan Self Assessment		
Questionnaire		
Site Name:		
Date:		
Completed By:		
(answer all questions in blue box, Yes or No)		
Data Management		Yes/No
1A.1	Are monthly utility bills reviewed for trends, variations in use and mistakes? (electricity, natural gas, fuel oil)	
1A.2	Are monthly consumption and cost data recorded and readily available electronically? (including all pertinent data points, on-peak, off-peak kwh & kw, load factor, power factor)	
1B.1	Are daily electric load profiles analyzed for trends and anomalies?	
1B.2	Are quarterly energy consumption targets set and compared to actual, (electricity, natural gas, fuel oil)?	
1C	Are facilities and operating units held accountable for energy consumption?	
Overall Rating	Sum of Positive Responses	0
Rate Management		
2A	Has utility company completed a rate review for all accounts? (electric and natural gas)	
2B.1	Have alternate fuels for large energy using equipment been evaluated?	
2B.2	Has co-generation been evaluated?	
2C.1	In locations where supplier choice is available for electricity, are competitive supply offers being solicited?	
2C.2	In locations where supplier choice is available for natural gas, are competitive supply offers being solicited?	
Overall Rating	Sum of Positive Responses	0
Energy Conservation		
3A.1	Have significant energy consuming systems been identified and quantified?	
3A.2	Are systems appropriately controlled when operating level or load is reduced? "Shut-it-Off" program	
3B.1	Has an energy audit been completed within the past two years to identify conservation opportunities?	
3B.2	Is there a list of completed energy conservation projects documenting cost and savings?	
3C	Is there a prioritized list of planned energy conservation projects documenting cost and savings?	
Overall Rating	Sum of positive responses	0
Organizational Integration		
4A	Is there a cross-functional site energy team responsible for each of the items listed above?	
4B.1	Does the energy team communicate goals?	
4B.2	Does the energy team track progress against stated goals?	
4C.1	Does the management team review program and progress of the energy management program?	
4C.2	Do you have a forum to participate in regulatory affairs at the Department of Public Utilities on energy issues?	
Overall Rating	Sum of positive responses	0
Total Score out of 20		0

Recreated based on image provided courtesy of UTC (2009).

commodity such as energy, factory supplies, IT-telecom and others. This centralized commodity management organization develops strategic sourcing initiatives and identifies best practices to be shared by all business units. The energy team has a specific focus on procurement savings and energy conservation.

As with most new programs, UTC's efficiency initiative called for education and training of facility staff and staff from key business unit functions. This started slowly—the first meeting consisted of six people—but grew to the point that more than 200 UTC staff members have been trained worldwide. Meetings and workshops happened in such diverse places as North Carolina, France, New Jersey, Italy, and Singapore with representation from facility management, EH&S, and supply management staff.

This training effort was aimed at both gaining participation in the energy reporting system, and in conducting site assessments to identify improvement opportunities. The UT500³ energy team started with energy audits at the 30 top energy-using sites; these drew on members of the energy team, site management, consultants, utilities and, in some cases, UTC product experts as the situation dictated. They averaged two days per site. In some cases, engineering students and consultants from the U.S. Department of Energy's Industrial Assessment Centers were involved.

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Once projects were identified, the energy team typically assisted local engineers, contractors and vendors to implement the projects. The audit results became part of the curriculum for further training events, and helped the energy team move on to the next 30 sites. The goal of the training effort was to build capacity at the major sites and in each business unit, including building relationships with suppliers and outside vendors, such that each site and business unit can become more self-sustaining in its ability to identify and implement improvements.

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Like other successful energy conservation strategies, UTC's approach relies on a company-wide, mandatory reporting system for energy use and costs. Every manufacturing site as well as any site with more than \$100,000 in annual energy and water costs must report quarterly through the online, enterprise-level data system. For UTC, this puts data from some 300 facilities into the system. For facilities with under \$100,000 energy and water spend, the team estimates energy use. Site managers must input data quarterly, which get rolled up into EH&S reports summarized at the business unit level that go to senior management. Each of the company's seven business unit leaders is accountable for reaching energy/GHG goals along with other EH&S goals.

³ UT500 is a company-wide initiative, named for its overall goal of saving \$500 million in supply costs across the entire company supply chain. Energy is one of the key costs included in the UT500 initiative.

As this study has found in other companies, the energy reports are “dashboarded” in traffic-light fashion with easy to read features like red highlights for facilities falling behind goals, and green highlights for facilities at or ahead of target. What makes UTC’s EH&S reporting system unique is the Project Module it built in alongside its reporting system, which serves as a centralized database for potential energy efficiency projects. The module requires entry of a broad range of data on efficiency projects including required investment, cost saving, usage reduction (gallons of fuel, KWH, etc.), utility incentives, and GHG reductions. At each major site system users can thus see a broad range of project opportunities and measures.

These simple reporting techniques have powerful effects: they enable busy executives to see at a glance where the problems lie. Once those problems are identified, managers can turn to a list of pre-analyzed projects to address the issues. This generates action: business unit leaders at UTC regularly communicate with site managers when a facility shows up in red. Access to details of efficiency projects with less than three-year paybacks already entered into the Project Module can be quickly analyzed and approved. The lesson is that while the project information may have existed before in accounting files or managers’ spreadsheets, until it was given visibility and turned into information that a decision-maker could quickly grasp, it may not have been approved.

As part of the company’s 2010 goals, a goal of investing \$100 million in energy efficiency projects was set. But this was not a “ring-fenced” corporate fund—UTC business units were expected to make these projects a priority and fund them out of their overall business plans. With the energy team’s help, by the end of 2009 over 1,200 projects were identified, valued at over \$170 million in implementation costs. \$116 million worth of these projects were funded, exceeding the 2010 goal early. And while economic conditions have made capital harder to come by, projects continue to be funded as demonstrated by the 788 approved projects. While those projects had an average payback of 2.5 years, paybacks as high as five years have been approved when other factors such as greenhouse gas reduction and energy price volatility were considered. Typical measures include lighting, compressed air, HVAC, process improvements, and cogeneration. See the box on the next page for an example of a cogeneration project UTC undertook in Middletown, CT.



UTC Blends Operations and Products for Major Savings

Two UTC business units, Pratt & Whitney and Carrier, collaborated in the design, planning and installation of the Pratt & Whitney Middletown cogeneration facility project. Carrier provided its expertise in heating, cooling, and powerhouse operations, and served as the lead integrator and installer for the 7.5 Megawatt (MW) co-generation facility in April 2008. The facility can generate about two-thirds of the site's electrical energy and the majority of the steam for winter heating, summer cooling, and manufacturing process equipment. Actual

operating practice is not to run the facility continuously at full electric generation capacity, but rather to optimize operations based on the plant's thermal needs. This project is estimated to reduce the plant's CO₂ emissions footprint by more than 12,000 metric tons or 12 percent annually. It also saves energy by using the waste heat from the power generation turbine to make steam while relieving the electric grid of the need to produce more than 60 million kilowatt hours (KWH) per year.

Like many companies, UTC tends to apply simple payback rules to efficiency project investments, typically seeking paybacks of three years or less. Because its business units are independent in their financial management, there is no single, uniform metric applied to all projects. Several factors appear to have driven the recent wave of efficiency investments:

- + • The effort put into identifying and providing visibility to cost effective energy conservation projects;
- The priority placed by senior management on meeting both the savings targets and the \$100 million investment target;
- The accountability for energy performance at both facility and business unit levels, driven by the reporting and tracking system. Energy and GHG objectives are sometimes tied to compensation and promotion plans for relevant employees;
- The co-benefits efficiency investments provide in terms of productivity, competitiveness, environmental impact reduction, and employee morale;
- + • The strategic and risk management importance assigned to CHP projects, which did not always meet financial criteria;
- Risk management strategy to manage volatile energy prices.

The UTC experience is similar to other companies in that they found no shortage of efficiency investment opportunities. Many energy managers have lists of cost-effective projects; the key is to make efficiency a priority in the company such that it is measured on consistent metrics, becomes visible to senior management, and can compete more effectively with other potential uses of company funds.

The UT500 energy team communicates actively within the company, via quarterly newsletters, conference calls and webinars, training sessions and posters. The company's EH&S awards now have a category for energy and climate, with winners' stories posted on the company's Internet home page, making energy efficiency a more prominent internal recognition factor. The energy team found a lot of enthusiasm among site staff for the efficiency program, and saw a wealth of creative as well as practical ideas come forth, as the savings goals, the reporting system, the training efforts and the project funding came on line.

Products and Services

Fully aware that the carbon footprint of its products outweighs its internal footprint by more than 100-fold, UTC has redoubled its efforts to squeeze more efficiency out of its product line. The company's 2010 goals include a target to improve the efficiency of its products at least 10 percent from their 2006 levels. Since its jet engine and air conditioner products make up the largest part of its product footprint, they get extra emphasis. With world oil prices driving competitive forces in the aircraft business to unprecedented levels, Pratt and Whitney engines are reaching new efficiency heights with the geared turbofan engine, a 12 percent improvement over the previous generation technology. In addition, Pratt and Whitney squeezes extra efficiency out of jet engines with its EcoPower engine wash system, which not only gives engines an efficiency-boosting cleaning, but also reclaims water and avoids harmful chemicals. Carrier's Evergreen chiller line outperforms the American Society of Heating, Refrigerating, and Air Conditioning Engineers efficiency standard by 40 percent. A typical installation at Hartford Hospital is summarized in the box on the next page.

Carrier engineers are quick to point out, however, that the nominal chiller efficiency is only part of the energy performance picture. Chillers are part of complex heating, ventilating, and air conditioning (HVAC) systems in many buildings, with pumps, fans and controls all contributing to the system's real-world performance. This whole-building, systems-oriented philosophy does not stop with chillers or HVAC systems: UTC's marketing efforts revolve around the growing "green building" industry which covers everything from energy use to flooring materials. UTC is a leader in the green building community, supporting the U.S. Green Buildings Council (USGBC), whose CEO is Carrier alumnus Rick Fedrizzi, and the World Business Council for Sustainable Development's (WBCSD) buildings initiative.

Carrier Upgrades Cooling System Efficiency at Hartford Hospital

Carrier recently completed a three-phase project for Hartford Hospital with the goal of increasing patient comfort and increasing energy efficiency by upgrading the 867 bed facility's aging and inefficient cooling system.

Starting in 1998, Carrier made system-wide improvements on the hospital's north campus, installing a Carrier Comfort Network® (CCN) controls system which allowed for automatic adjustments, precisely matching conditioned air delivery to actual building conditions, and saving the hospital \$1.2 million in

annual operating costs. In 2005, Carrier expanded the chiller plant free cooling system, improved the cooling tower air recirculation, and provided advanced lighting upgrades, which added another \$250,000 in annual savings. Most recently, Carrier installed three Evergreen® 19XRV water-cooled centrifugal chillers using non-ozone depleting HFC-134a at a cost of \$5 million. Variable frequency drives (VFDs) further increase efficiency by precisely matching motor speed with building demand. In addition, the VFDs reduce mechanical stress and motor wear, requiring less maintenance and prolonging system life.

The WBCSD buildings initiative featured a four-year, \$15 million study on energy efficiency in buildings. Co-chaired by United Technologies and Lafarge, with support from a dozen other multinational corporations, the report concluded that while buildings are the largest source of energy use in the world today, substantial and attractive investments to reduce energy consumption and carbon emissions are available now.

UTC's commitment to buildings as whole systems also shows up in its print advertising, which display a "green building of the future" schematic that contains Carrier chillers, Otis ReGen elevators that reclaim energy when they descend, UTC Power fuel cells, combined heat and power systems and advanced controls from UTC's Fire and Security business.

UTC sees tremendous opportunities for improving energy efficiency in buildings. Since it produces many components that can help building owners and operators capture those savings, it also sees significant business opportunities in the movement toward more energy efficient buildings. In support of its internal GHG goals, UTC established in 2008 a policy that all its new construction meet the USGBC Leadership in Energy & Environmental Design (LEED) certification standard with a target of LEED Gold.

In the industrial world, UTC markets combined heat and power systems like the unit it has installed at its own East Hartford location. It also sells Sullair compressed air equipment, whose new AirMetrix line can achieve savings of 15–35 percent compared to the units they replace. These savings are comparable to those Toyota experienced with its new compressor installation at its Kentucky facility.

Supply Chain

UTC has gone to some lengths to quantify its supply chain energy and carbon footprint, estimating on a first-order basis that suppliers account for a footprint five times that of the company's internal operations. UTC's supplier programs have targeted quality and delivery performance and environment health and safety. The initial supplier EH&S program establishes a set of expectations for over 1,000 key suppliers. The expectations include compliance, worker protection, EH&S management systems and EH&S impact reduction including conservation. Suppliers complete a UTC online self-assessment, develop corrective action plans in the UTC system, and report progress. 10 percent of suppliers are audited. UTC has focused first on compliance and worker protection and is not yet asking suppliers to report energy and carbon numbers. Going forward, the company expects to apply the World Resources Institute/World Business Council for Sustainable Development GHG Scope III reporting protocol to supplier reporting.

However, like any large and diversified manufacturing and service organization, UTC has thousands of suppliers on multiple continents which creates data collection and consistency challenges. Other key challenges for UTC have included acquiring data from leased space, fleet fuel usage and business travel. Like other companies operating in the absence of perfect data, UTC focuses on collecting the data that is available and coming up with a best estimate of the rest.

Conclusions

United Technologies has worked hard to unite its seven businesses, its functional groups (EH&S, supply management, engineering, facilities, finance, etc.) and the technologies they make, into an integrated sustainability enterprise. Making its internal operations energy efficiency strategy happen was a challenge, given the diversity of the business units, geography, information systems, operating practices, personnel skills and so on. The diversity and legacy factors were perhaps even more challenging on the supply chain side, as the sustainability team worked through a myriad of supplier relationships that entailed unique or inadequate data systems.

Despite these challenges, UTC's energy efficiency strategy has seen dramatic successes, reaching its original 1997–2006 goal in five years and ultimately more than doubling the 25 percent target, allowing the company to reduce total energy use while growing substantially. This built confidence in the program to the point that 2010 goals have been set as absolute reductions. UTC has also created synergies across the company, both by using its own technologies in its internal operations, and by supporting multiple products through its active engagement in the green buildings industry.



Key lessons learned from UTC's energy efficiency successes include:

- Concerted effort is needed. The energy team must be persistent, patient, and must reinforce the effort frequently.
- Senior leadership support is important. Unless people across the company believe that energy efficiency is important at the highest levels, gaining and maintaining cooperation across organizational lines is difficult.
- Provide tools and training. Do not make the mistake of imposing reporting or performance requirements without giving people the practical support they need to accomplish them. Energy team members should be clear and balanced in defining what is required and how to accomplish it.
- Make identification of projects easy. Developing the project module as part of the company reporting system is an example of ways that the energy team can help facility staff find solutions.
- Ensure visibility of projects. When a project succeeds, it should be publicized within the company, both to reinforce the program's goals, and to encourage others to pursue similar projects.

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