

Raytheon Company's Energy Conservation Program

Steve Fugarazzo, Raytheon

ABSTRACT

The Raytheon Company maintains a commitment to corporate sustainability and the reduction of industrial energy intensity. The company recognizes employees as a driving factor behind this commitment and has pursued an ambitious and comprehensive approach to engage employees in its energy strategy. Raytheon has also formed an Enterprise Energy Team which is responsible for the development and implementation of many of the company's energy conservation measures and sustainability programs. The team consists of lead energy engineers from Raytheon's six businesses and has successfully incorporated energy and efficiency into Raytheon facilities design, construction contracting, and capital planning. This paper details the critical aspects of the company's corporate energy management plan that motivates employees to participate in efficiency and energy-related activities, including employee engagement and awareness programs, incentives and awards, training and education, communication and outreach, and the implementation of best practices.

Raytheon is a technology and innovation leader specializing in defense, homeland security and other government markets throughout the world. With a history of innovation spanning 88 years, Raytheon provides state-of-the-art electronics, mission systems integration and other capabilities in the areas of sensing; effects; and command, control, communications and intelligence systems, as well as a broad range of mission support services.

With a workforce of 72,000 employees in nearly 35M square feet of facilities, Raytheon sales in 2010 were \$25B. Raytheon is aspiring to be the most admired defense and aerospace systems company through our world-class people and technology.

One of the attributes that distinguishes Raytheon scientists and engineers is the fact that they're never completely satisfied with a particular solution. That's because in today's ever-changing global market, new customer requirements are always emerging. This mindset inspires us as we operate our energy conservation for a competitive advantage program.

Raytheon Energy Conservation Program

The 2010 the Raytheon energy conservation program produced a 3% energy intensity reduction. This was accomplished by utilizing the Raytheon Six Sigma principles and tools to help sustain and accelerate continuous improvement with our program to achieve even greater results than previous years while the business continued to grow.

STEP 1: Commit to Continuous Improvement

1.1 Appoint an Energy Director – Since 2004, Steve Fugarazzo of the Integrated Defense Systems (IDS) business has led the Enterprise Energy Team (EET). During 2010, Steve was aided by strong support from the Facilities Leadership Council (FLC), the Operations Council, and the corporate offices, including the Executive Office and CEO Bill Swanson. Steve is well recognized outside the company as the leader of Raytheon's energy program, and continued to

reach out to the Environmental Protection Agency, Department of Energy and to other companies and beyond during 2010. Steve and other Raytheon representatives participated in mentoring efforts that influenced over 800 people external to Raytheon.

1.2 Establish an Energy Team – The EET has continued to provide energy conservation program direction, strategies, tools and best practices for all Raytheon businesses and their respective locations. The EET has grown into a team of twenty-six energy professionals representing each of the six major Raytheon businesses and corporate functions. The EET has several sub-teams with responsibilities for five different key focus areas, as well as special ad-hoc teams and sub-teams within key focus area teams as needed. The EET meets bi-weekly via conference call and 3-4 times each year in person, while the sub-teams meet on a regular basis or as needed. Supplementing the EET, each business location maintains and enhances their local energy teams to review monthly data and metrics per company policy, and to ensure building occupants reduce energy consumption. All major locations rely on a team of Energy Champions to take responsibility for specific building areas and provide feedback to site leadership. There were 1500 Energy Champions recruited by year end, 2010.

1.3 Institute an Energy Policy –The Raytheon energy policy, which is sponsored by the Corporate Vice President of Operations, is enforced by the Operations Council, Facilities Leadership Council and EET in cooperation with each business location.

STEP 2: Assess Performance

2.1 Gather and track data – Major enhancements to our home-grown energy data management system during 2010 involved tracking and reporting greenhouse gas emissions by site and fuel source. These enhancements have made it considerably easier for our greenhouse gas reporting efforts to management, the Environmental Protection Agency and other organizations to which we have made greenhouse gas reduction and reporting commitments.

2.2 Establish Baselines – With any Six Sigma initiative, baselines are required to measure performance, establish goals and track progress against the goals. For annual enterprise and business specific goals, current year consumption is compared to the previous year on both an absolute basis and adjusted for business revenues.

2.3 Benchmark – Benchmarking efforts with our portfolio of 57 US locations helps spark healthy competition among the businesses within the enterprise and brings positive visibility to high performers. Businesses and facilities with exemplary achievements are required to share their lessons learned and best practices across the Enterprise through the EET, which helps ensure continuous improvement.

2.4 Analyze – The company wide energy database makes it possible to analyze energy consumption and cost data at the enterprise, business and site level for each energy source. Through the database we can show consumption from 2007-2010 on a monthly basis at the enterprise level, which clearly indicates a downward trend each month. Similar charts at the business or site level can easily be created by changing the parameters.

At the site level, the database is complemented with a variety of analysis tools. One such tool is the home-grown Virtual Business System where real-time data can be displayed to specific machine operators so that changes in operation can be made where energy waste becomes evident. The Virtual Business System tool was also deployed effectively at many Raytheon locations to drive participation in the 2010 Energy Citizens campaign. The Virtual Business

System tool is the primary method of communication between production and lab personnel, and has made it possible to bring data analysis directly to the end user to drive continuous improvement.

2.5 Technical Assessments and Audits – Each year Raytheon Facilities personnel complete a comprehensive energy assessment of select facilities within our six businesses, which is an enterprise-wide endeavor. During 2010 Intelligence and Information Systems held an assessment for the 1.3 million square foot campus in Garland, Texas, including people from multiple locations and multiple businesses. Each assessment is led by a business other than that of the host site to ensure objectivity, avoid bias due to over-familiarity, and ensure better accountability and visibility to leadership (similar to hiring an outside consultant). The assessment tool deployed captures all opportunities and prioritizes them based on cost and ease of implementation and payback period. This creates a comprehensive project list which becomes the basis of an annual Energy Project Plan.

The EET database is continuously populated with best practices and numerous energy conservation measures identified in past assessments, and the assessment tool continues to help expedite management approvals of funding expenditures and other necessary resources.

STEP 3: Set Goals

3.1 Determine Scope – The Raytheon CEO, Corporate VP of Operations, and the Operations Council have continued to support and reinforce our publicly stated 10% absolute GHG emissions reduction goal from 2008 through 2015. Our energy program is the key component to reaching this aggressive goal since 90% of our carbon footprint results from energy consumption.

3.2 Estimate Potential for improvement – The EET deploys a process during the fourth quarter of each year to evaluate anticipated changes in operations together with expected energy efficiency gains from capital expenditures. This process allows each site to estimate consumption targets for the following year, and each business utilizes this data to establish consumption and cost targets. The resulting analysis by location and business enables the EET to estimate improvement potential with confidence.

3.3 Establish Goals – With the support of the Operations Council and the Facilities Leadership Council, the EET established the following goals during 2010:

- 1.0% absolute energy consumption reduction (2.0% stretch), even though the business projected a 5% increase in 2010 sales
- 50% Energy Citizen participation
- 100% of all owned buildings to be purchased or constructed to be LEED certified

The absolute energy reduction goal was developed to continue progress towards our 10% absolute greenhouse gas reduction goal from 2008 to 2015.

STEP 4: Create Action Plan

4.1 Define Technical Steps and Targets – During our quarterly face-to-face EET meeting in March 2010, the ENERGY STAR Energy Management Assessment Matrix was completed to determine major elements for EET focus during the year. Creating and implementing action

plans were the elements receiving the most focus. The key focus area teams then took responsibility for specific actions to address each element in the matrix. For example, the Communications & Outreach team had developed a tactical plan for the 2010 Energy Citizens campaign, as well as a more comprehensive annual strategic communications plan needed each year to effectively manage energy awareness efforts across the enterprise. At the business and site level, the Best Practice feature developed for the enterprise database was again utilized effectively by the Network Centric Systems business. The Network Centric Systems business has continued to utilize this tool to deploy Best Practices at all locations. Each practice is documented as Past Due, Complete, In Process, Not Applicable or New. This practice ensures that a comprehensive upper management review of opportunities and progress takes place at all locations on at least an annual basis.

4.2 Determine Roles and Resources – To identify, track and implement energy conservation measures, each business has a large group of individuals committed to supporting their energy program at both the business and site level along with a person accountable for the program at each location. Each of the business energy leads is supported by a wide array of personnel from organizations including Manufacturing and R & D Operations Management, Procurement, Facilities, Financial Services, IT, Human Resources, Communications, Environmental, Health & Safety (EHS), Maintenance and Engineering. This support also includes more than a dozen certified LEED Accredited Professionals (AP). Each business energy manager works with their management and capital planning groups to obtain necessary resources to meet established goals. These additional resources are paramount to accelerating accomplishments for energy reduction both at the business and enterprise level.

STEP 5: Implement Action Plan

5.1 Create a Communication Plan - The EET's Communication and Outreach team ensured consistency of communications activities across the enterprise such that our program is "branded" and recognized by all employees. Specific examples are discussed throughout this report. Each business deployed tactics that built upon this enterprise plan. Many of the messages were endorsed by and sent from the business president or the vice president of operations to show the importance of energy conservation.

5.2 Raise awareness – As in 2008 and 2009, the most prominent aspect of our energy conservation initiatives during 2010 has been the Energy Citizens campaign. Through early December, there were over 36,000 qualified Raytheon Energy Citizens, exceeding our 50% goal for the year (compared to 27,000 in 2009). The tool includes a hotlink to our Enterprise Energy Program website, which has hotlinks to the ENERGY STAR and Department of Energy web pages.

5.3 Build capacity – The EET developed new tools which were developed during 2010 to track data, report results and share best practices among the EET, Facilities Leadership Council, Operations Council, Energy Champions and Energy Citizens networks, including the Raytheon Sustainability eRoom, the enhanced Enterprise Energy Database, the Enterprise Energy Program web site and enhanced communication methods and protocols. Employees were engaged through interactive games, vendors and Energy Champion displays during April Earth Day and October Energy Awareness Month events. In regard to training, many businesses held a variety of training sessions for Energy Champions and other employees, including the popular video entitled, "Who Left the Lights On?"

The EET continued to partner with many internal organizations in 2010, including our Information Technology (IT) organization through its “Green IT” project. The initiative was recognized by the U.S. Department of Homeland Security and by Info World with another “Green 15” award. Another important partnership strengthened in 2010 was the Raytheon “Double Green” Technology Interest Group (TIG). The EET and Double Green TIG co-hosted an October workshop on Raytheon Sustainability initiatives, including a significant focus on energy topics covering R&D, manufacturing, supply sources, field operations and recycling some of our end products. As in past years, the EET continued to partner with the Environmental Health and Safety organization on a variety of initiatives. This included greenhouse gas emissions reporting, Raytheon Sustainability employee engagement efforts, and water conservation initiatives (we exceeded our 10% reduction goal in one year).

5.4 Motivate – As in past years, Raytheon effectively utilized performance tracking “scorecards” to motivate businesses, their leadership teams and all of their employees to improve results. Similar reporting practices are in place at the business level to motivate each business location. This creates healthy competition between the business units. Upper level management personnel are eligible for bonuses through the Result Based Incentive (RBI) program, and energy performance is one of the key criteria used to determine bonuses. At the business level, a wide variety of motivational practices are used to engage employees not eligible for RBI rewards. Most businesses use the Spotlight on Performance (SOP) program to immediately reward efforts of an employee or team of employees involved in exemplary energy conservation projects or activities. In addition to financial incentives, business newsletters and web sites often highlight specific people and teams for their accomplishments with energy conservation. This often motivates other employees to take action, while recognizing exemplary performance. Another effective method is when business presidents and vice presidents speak to employees during the quarterly web casts or “town meetings” or “all hands” events. Each Raytheon business president discusses the importance of energy conservation to their respective employees, and the messages are recorded at business web pages for employees to view at a later time. It should also be mentioned that the business presidents and corporate office continue to cite outside recognition in many contract proposals to demonstrate that Raytheon is a leader within the Defense and Aerospace industry in regard to energy conservation and environmental protection.

5.5 Track and monitor - At the business level, various approaches are used to monitor and report progress. As with all businesses, the Network Centric Systems report provides management and employees performance against goals, including Energy Citizens participation and water consumption. As mentioned, the enterprise database is used to track and report energy and water consumption data for a location, business, or at the enterprise level. It allows many people to monitor energy performance data, which has further increased awareness and ownership of energy reduction goals and informal competition among various groups.

STEP 6: Evaluate Progress

6.1 Measure results – Another important 2010 performance metric that has been tracked each month is the percentage of employees that have qualified as Energy Citizens. Over 36,000 or 50% of employees across the enterprise have qualified, exceeding our 2010 goal. Some Raytheon businesses have achieved even greater participation due to the competitive spirit derived from strong top down messaging and some creative recruitment methods.

6.2 Review action plan – The EET strengthened its “Action Item Tracker” during 2010 reviewed on an ongoing basis to monitor specific tasks and due dates. Each EET sub-team has a tab in this Excel file and updates the status of each item during conference calls held on a weekly or bi-weekly basis. This file is also reviewed at quarterly EET face to face meetings, and new items are added as appropriate.

STEP 7: Recognize Achievements

7.1 Providing internal recognition –The most widely received communication is our annual Corporate Responsibility Report, reaching both internal stakeholders and external audiences including stockholders. It includes significant portions on energy and environmental issues and Raytheon’s partnership with ENERGY STAR is discussed in detail. Corporate recognition of our energy program occurred again in 2010 through Raytheon’s annual Excellence in Operations Awards. Select Energy Champions were profiled during October in company-wide articles.

7.2 Receiving external recognition – Raytheon was recognized by the Environmental Protection Agency ENERGY STAR for Sustained Excellence in Energy Management in March of 2010, and replicas of the award are proudly displayed in lobbies of the business locations and our Waltham, MA, global headquarters. Raytheon’s 2009 Annual Report released in April 2010 mentions this honor as one of eight award highlights. Raytheon was also recognized in the second annual Newsweek Green Rankings, where we improved to 75th place from 208th in 2009 and 3rd in our industry. Hundreds of metrics were considered, including those measuring greenhouse gas emissions, energy and water usage and pollution performance. We believe that continued ENERGY STAR and Department of Energy recognition contributed heavily to this ranking.

Raytheon’s partnerships with organizations such as the Association of Energy Engineers (AEE), the International Facilities Management Association (IFMA), and local utilities, led to participation in several forums during 2010. In January, Raytheon once again hosted the annual Association of Energy Engineers New England forum entitled, “Annual Energy Outlook.” We also provide important input as members of state and regional industry associations, including the Associated Industries of Massachusetts (AIM), The Massachusetts Governor’s Clean Energy Program and the Arizona Association of Industries. Raytheon has members in local chapters of several organizations, including the US Green Buildings Council (US GBC), the International Facilities Management Association (IFMA), the Association of Energy Engineers (AEE), and the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE). Raytheon employees are most active with local chapters in Arizona, California, Massachusetts and Texas.

Nationally, we were invited to chair a session and present our energy program at the 33rd annual World Energy Engineering Congress (12/8/10), and we presented our program at the annual Facilities Management Association Congress. We were also recognized by the Massachusetts Toxic Use Reduction Institute (TURI) for our energy conservation program, which reduced CO₂, SO_x, NO_x, and other emissions that pollute our environment.

In addition to those discussed above, a wide array of government sponsored resources continue to be utilized by the EET and site energy contacts, including the ENERGY STAR web site, Department of Energy and ENERGY STAR web casts and periodic “Brown Bag” sessions. We invited our Department of Energy consultant/representative to join our September 2010 EET

meeting, where we were provided an overview of best practices by other companies. During that meeting, we also learned of the ENERGY STAR Challenge for Industry initiative. Raytheon also takes advantage of a yearly membership to ESource, which provides Raytheon employees with a range of information such as technology publications and energy pricing updates. Environmental Protection Association's Green Power Partnership and the former Climate Leaders program also provided our teams with excellent sources of information on energy topics.

Organization-Wide Improvements

The EET has consistently demonstrated performance across the enterprise and for each business over the past four years. Energy performance at the enterprise and business level continues to be measured in relation to annual business revenues. Raytheon has improved 3% in the past year, which is impressive considering business growth that has led to additional off-shift work and the expansion of infrastructure systems to support this growth. Performance has improved an impressive 22% since 2007.

Most businesses have demonstrated continuous improvement each year with energy performance. The aggregate absolute one year energy reduction is projected at 0.4%, despite a projected \$1.3 billion increase in revenue (5%) during 2010. Since 2007, energy consumption has decreased by more than 6% on an absolute basis.

The web based tool allows for tracking progress over time with energy intensity at the enterprise and business level, however, it is not possible to compare individual locations using this BTU per output metric because sales figures are only available at the business level. There is a wide disparity of space types in our portfolio, ranging from office space to laboratory clean rooms to manufacturing, with most facilities being a combination of all three. With this in mind, Raytheon continues to evaluate various benchmarking tools to track energy performance progress at the facility level and is considering various BTU per output metrics. The Portfolio Manager tool has been used for the Raytheon locations, yet most are non-ratable space types since they have less than 50% of a ratable space type. Only a few of our facilities qualify to be rated for the office category, and are included in Portfolio Manager. Our most recent benchmarking approach is to take advantage of the ENERGY STAR Challenge for Industry initiative, which we believe will suit a wider range of our facilities. Both of these methods will be utilized to track annual performance by facility.

As mentioned above, Raytheon achieved a projected 18,038 MMBTUs of total energy reduction on an absolute basis when comparing 2010 consumption to that used in 2009. We implemented hundreds of energy projects during 2010. When considering business growth over the past year, many projects might be considered as "consumption avoidance", rather than savings from the previous year. With this in mind, the value of all our 2009 projects inherently exceeded 18,038 MMBTUs. The 2010 energy reduction resulted in a cost avoidance estimated at \$400,000, which equates to an additional \$4 million in revenue (assuming a 10% profit margin) that would have been required during 2010 to maintain business growth. The 2010 energy reduction includes electricity consumption savings of almost 2 million kilowatt-hours, equal to removing almost 3 million pounds of CO₂ emissions or about 250 vehicles. The electricity saved would power a community of approximately 200 U.S. homes.

Promoting and Communicating Success

Raytheon places a high value on energy efficiency and environmental stewardship. We expect and encourage our employees, customers, suppliers, vendors and communities to make a commitment to reduce energy usage as much as possible. Raytheon is very proud of its accomplishments and communicates our achievements and commitments both internally and externally. Every year we raise the bar in an unending quest for continuous improvement.

Because our first priority is minimizing Raytheon's costs and environmental footprint, and plug load is our largest energy usage category, employees are the primary target audience for our energy and sustainability initiatives. Our most visible initiative has been the Energy Citizen campaign, which aims for total employee engagement. In 2010, we have exceeded our aggressive goal of 50% participation (over 36,000 employees). As mentioned above, the 2010 Energy Citizen learning tool encourages employees to visit our Enterprise Energy Program web page. We know these efforts are engaging employees in energy conservation at both work and home, as we receive feedback during energy awareness events throughout the year as well as through an internal social networking tool called RSpace. We also find that employees are passionate about purchasing ENERGY STAR products during these events, which often include the sale of ENERGY STAR rated light bulbs or other home conservation products. We often target outreach efforts at suppliers and contractors, and the Integrated Defense Systems businesses hosted an April 2010 forum that included discussions on various energy topics.

To support efforts aimed directly at our employees, we include activities for employees' family members on energy conservation and environmental protection. Space and Airborne Systems, El Segundo facility, held a children's drawing contest during 2010. Over 100 entries were received from children sponsored by Space and Airborne Systems, El Segundo employees, including the contest entry form and prize winning drawings.

Raytheon takes great pride in sharing experiences with business stakeholders, partners and other organizations to help others improve their programs. During the past year we reached out to over 800 people during mentoring sessions, two Department of Energy webinars, conferences and seminars. Raytheon also presented slides on our employee engagement efforts to the steel industry and also hosted day-long face to face mentoring meetings with energy partners, including Juniper Networks, Delphi, Exxon-Mobil and Alcoa. Raytheon also participated in a July workshop focused on data center benchmarking hosted by Juniper Networks. Outreach was also provided via phone and web to other companies such as, including Arcelor-Mittal Steel, Ingersoll-Rand and Metlife. These are just a few examples of Raytheon reaching out with lessons learned to the community.