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REPORT IN BRIEF

Energy Reduction at U.S. Air Force Facilities Using Industrial Processes: A Workshop Summary

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The Department of Defense (DoD) is the largest consumer of energy in the federal government. In turn, the U.S. Air Force is the largest consumer of energy in the DoD, with a total annual energy expenditure of around $10 billion. Approximately 84% of Air Force energy use involves liquid fuel consumed in aviation whereas approximately 12% is energy (primarily electricity) used in facilities on the ground. In response to a request from the Deputy Assistant Secretary of the Air Force for Energy and the Deputy Assistant Secretary of the Air Force for Science, Technology, and Engineering, the National Research Council of the National Academies, under the auspices of the Air Force Studies Board, formed an ad hoc committee to plan and convene one 3-day public workshop, which was held on November 5-7, 2012. The workshop was concerned primarily with opportunities to reduce energy consumption within Air Force facilities that employ energy-intensive industrial processes—for example, assembly/disassembly, painting, metal working, and operation of radar facilities—such as those that occur in the maintenance depots and testing facilities.

Background and Overview

The Committee on Energy Reduction at U.S. Air Force Facilities Using Industrial Processes: A Workshop planned and convened one 3-day public workshop to discuss:

What are the current industrial processes that are least efficient and most cost ineffective?

What are best practices in comparable facilities for comparable processes to achieve energy efficiency?

What are the potential applications for the best practices to be found in comparable facilities for comparable processes to achieve energy efficiency?

What are constraints and considerations that might limit applicability to Air Force facilities and processes over the next ten-year implementation time frame?

What are the costs and paybacks from implementation of the best practices?

What will be a proposed resulting scheme of priorities for study and implementation of the identified best practices?

What does a holistic representation of energy and water consumption look like within operations and maintenance?

In short, the purpose was not an in-depth analysis of energy reduction opportunities in all of the industrial processes being used at Air Force facilities, though some of the presentations touched upon opportunities in specific industrial operations—such as painting of vehicles at General Motors.

Instead, the workshop participants reviewed and discussed the status of energy reduction initiatives already taken or planned and discussed ways in which the Air Force could improve its approach in order to address the use of industrial process energy more effectively. The discussion focused on opportunities in seven areas:

- management and leadership;
- budgets and funding;
- information resources;
- metrics;
- culture change;
- personnel and training; and
- investment opportunities.

Management and Leadership

Most of the participants believe that the Air Force has a solid overall energy strategy and that the representatives from the Air Force maintenance and test depots who attended the workshop, such as Arnold Air Force Base and Tinker Air Force Base, have a nuanced and well thought out understanding of:

- energy usage in general;
- process energy, in particular; and
- opportunities for addressing associated challenges without impact to the Air Force mission.

It was the opinion of many in the workshop that with the right vision from leadership and access to resources, the facility managers the participants heard from are well positioned to implement improvements.

Budgets and Funding

No Air Force budget line is specifically devoted to energy. Several participants expressed that these diverse sources tend to lead to a fragmented, ad hoc approach to energy projects that lacks a long-term vision, is sub-optimized, and can lead to "color-of-money" constraints.

The participants generally felt that the Air Force use of Energy Savings Performance Contracts, per presidential order, is a good mechanism for providing funding for infrastructure and efficiency improvements in the absence of other funding sources. They accomplish the goal of reducing energy usage (intensity), although they do not result in cost savings to the Air Force over the near term and may actually result in cost increases if a contract needs to be "bought out" due to base closure or shifting priorities. Nonetheless, absent other funding sources, they appear to be a valid mechanism and worth implementing.

Information Resources

Several participants noted that Air Force personnel should look for opportunities to identify which processes offer the biggest energy reduction return on investment and to leverage what they know and how they do what they do through collaboration and networking with subject matter experts and consortia of organizations concerned with making processes better, faster, cheaper, safer, and more energy-efficient.

Several participants noted that the Air Force Research Laboratory (AFRL) is well positioned to help the Air Force improve its energy usage and has published a description of its energy focus. However, it appeared to several participants that the relationship between the depots and AFRL is limited. They felt that AFRL could be tasked with helping the depots. This tasking would be consistent with a focus on next-generation technologies. Improvement of industrial processes is a fertile field for innovative engineering research.

Metrics

Several participants agreed that the Air Force would benefit if it had a coherent and transparent set of metrics that related energy use to the accomplishment of the mission—the desired metric for making a value proposition to decision makers and commanders. For industrial processes, this might be energy used per unit of product—for example, General Motors uses megawatt hours per vehicle.

One way of accounting for surges in activity might be to normalize existing energy intensity metrics to the number of direct labor hours. Many participants felt that the Air Force should consider concentrating more effort on developing a set of metrics that permit it to improve its mission capability while lowering energy use and cost.

Culture Change

Culture change needs to occur throughout the organization and must be supported by the upper level of leadership. Many participants felt that the Air Force is making good progress toward metering individual facilities; however, it is imperative that the information get back to the individual users of that facility who are in the best position to enact small, incremental changes.

The Air Force estimates that behavior change can result in a 2% improvement in energy usage for buildings. However, one participant stressed that the overarching goal should be toward a culture shift at all levels of the organization—culture being defined as behaviors that individuals engage in even when no one is looking.

Personnel and Training

Many participants expressed that it is important that individuals at all levels of management and responsibility are aware of the importance of addressing energy security/surety and costs, and that, at times, improving efficiency and reliability can result in enhancement to the mission. Some participants suggested that having mandated energy training throughout the Air Force might be a driver toward greater understanding of the problem. For example, classes are offered by the Air Education and Training Command.

Another suggestion was for process managers to have energy efficiency written into their job description and performance evaluations and receive appropriate training. A key target for improving energy awareness is the acquisition community—to get lifecycle energy use to be one of the criteria on which acquisition decisions are made.

Investment Opportunities

Several speakers noted that the civil engineering (CE) community has shown the Air Force that energy reduction projects are a good investment—typically returning $2 in savings for every $1 invested. One speaker noted that specific processes, such as painting, offer opportunities for improvement, but there is no budget for it. The CE community typically does not own either the industrial process or the budget. Other noted processes for efficiencies include those that generate or transfer heat or involve rotating equipment. One participant noted several potential areas for future Air Force investment:

Work process design and associated training and audit protocols focused on business-effective energy management.

Standardization of all common, repetitive processes—such as machining, parts/equipment cleaning, and painting—across all sites.

Engineering evaluation of rotating and heat exchange equipment to establish lifecycle energy use and operating costs.

Formal assessments of current operations vs. standard protocol to identify short- and long-term improvement actions and projects.

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