DOE-Defense Program's CFC Retrofit Plan for HVAC/Chillers

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ABSTRACT

The Department of Energy's (DOE) Office of Defense Programs (DP) is responsible for the research, development, and testing of defense-related applications of nuclear energy and the operation and maintenance of facilities required to support these efforts along with any associated production activities. DP had been the landlord for hundreds of individual facilities located at principally eight sites around the United States, representing about 50 percent of DOE's capital assets. In 1994, DP established a CFC HVAC/Chiller Retrofit Program to facilitate the replacement and retrofit of chillers and to promote compliance with CFC environmental and energy conservation laws and regulations.

Through comprehensive inventories, DP found that it owns approximately 200 old and inefficient CFC chillers, which if replaced, would greatly reduce electricity consumption and costs, and reduce exposure to potential non-compliance with refrigerant leak regulations. The major domestic chiller manufacturers indicate that they are producing at or near full capacity to meet the demands of both government and private sector customers. With estimates of approximately 63,000 chillers nationally operating with CFCs, DP is concerned that market pressure will raise prices and that shop space for future orders will become increasingly scarce.

Saving energy and money while protecting the stratospheric ozone layer is the goal of the DP CFC HVAC/Chiller Retrofit Program. While working to minimize the release of ozone-depleting substances to the environment and moving to convert existing equipment to use alternative refrigerants, the installation of more efficient chillers also promotes environmental stewardship in that reduced energy consumption translates into reduced emissions of noxious gases from the generation of electricity.

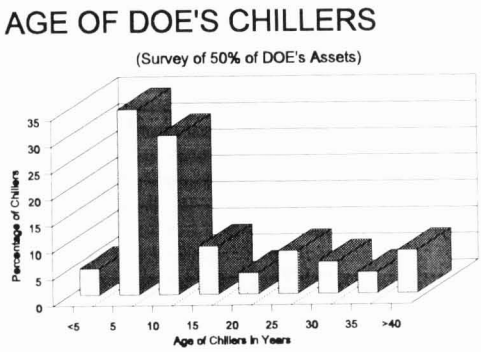
BACKGROUND

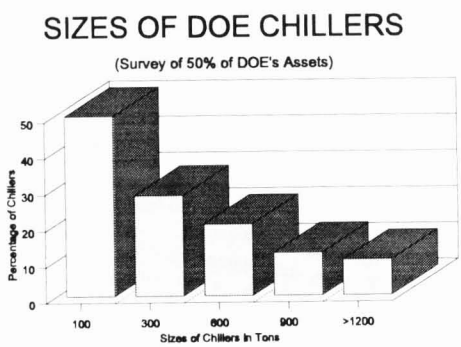
In early 1994, the Department of Energy was well on its way to coping with the impending phaseout of ozone depleting substances. The use of halons and the conversion to ozone-friendly substitutes were being addressed by DOE's Fire Protection Program. The Pollution Prevention Program had a good handle on the use of solvents and cleaning agents at DOE sites. However, at this point there was no comprehensive strategy to deal with chlorofluorocarbon (CFC) refrigerants, which constituted the largest component of use of ozone-depleting substances in the Department.

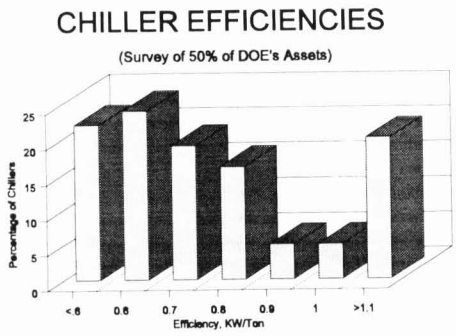
To establish a baseline in order to begin grappling with the problem, DOE conducted an inventory of chillers at all sites managed by the Office of Defense Programs. At the time, DP was responsible for just over half of the capital assets and facilities owned by the Department. Using a DOE automated system known as CAS, Capital Asset Survey, that was already in place, a fairly rapid inventory was completed. Information such as nameplate data and chiller condition was collected by on-site inspectors using hand-held units. The information was then uploaded to local personal computers and then to a mainframe at DOE headquarters. CAS enabled the chiller inventory to be completed and analyzed in an extremely short time.

The results of the CAS survey were very eye-opening. DP was found to have about 200 old and energy-inefficient chillers at its sites. The following graphics depict the ages, sizes, and energy-efficiencies of the chillers in operation at DP sites. Briefly, DP found itself with a number of very old chillers that were inefficient consumers of energy. The

average age of the chillers was 17 years. As might be expected of older equipment, the typical energy efficiency of DP chillers was 0.8 kW per ton with good number having efficiencies above 1.2 kW per ton, well below the efficiencies of 0.5 to 0.6 kW per ton that modern chillers can achieve.







The DP study, along with discussions with other federal agencies that were responsible for the operation of large facilities, has provided the basis for some sound extrapolations. The federal government as a whole will need to deal with the replacement or retrofit of approximately 4000 CFC chillers. Because of the rising price of CFC refrigerants since the cessation of their production at the end of 1995, there is a strong economic incentive to aggressively deal with this situation. DOE and other agencies also have the obligation to take environmentally responsible actions such as protecting the stratospheric ozone layer. Since the federal government is a large consumer of energy, the opportunity for monetary and energy savings from the replacement of old chillers is tremendous.

THE ENVIRONMENTAL ANGLE

The Department of Energy, as well as other U.S. government agencies, are committed to the mitigation of CFC usage. At the same time, U.S. government entities are subject to the statutory and regulatory stratospheric ozone protection stipulations that bind facility owners. Also, since the end of their production in 1995, the expectation that CFC refrigerant prices will escalate as they become scarcer is another reason for reducing dependence CFC chillers.

The end of CFC production and the economic disincentives associated with their acquisition in the future are also powerful motivations to move from the use of CFC refrigerants. The impact on chiller operating costs is tremendous, given the impact of supply and demand on price and excise taxes on the sale of CFCs.

Another automated DOE system, the Facility Information Management System (FIMS), which is for tracking data on real property within the Department, has been expanded to aid CFC refrigerant management. FIMS contains a module to collect and disseminate refrigerant information among DOE sites. Many DOE sites have local systems in place, ranging from "pencil-and-paper" to fully automated tracking systems. This is not an actual central depot of refrigerants; it is just a means for sharing of information to facilitate refrigerant redistribution by depicting potential sources of supply and demand.

THE ENERGY EFFICIENCY ANGLE

Because many of DOE's chillers are old, they consume a considerable amount of energy. More than 50 percent of DOE chillers are energy inefficient when compared to modern chiller equipment with efficiencies averaging from .5 to .6 kW/Ton. DP is examining the use of energy efficiency projects as a means to conserve the diminishing funding for maintenance and replacement projects anticipated over the next few years. Chiller replacements undertaken as energy efficiency projects yield the significant side benefits of CFC mitigation and reduced pollution due to less electricity being consumed. In this way, the goal of energy efficiency works in concert with the goal of CFC refrigerant mitigation. However, the criteria used to rank energy efficiency projects could leave out a large percentage of CFC chillers that need to be replaced due to their relative unattractiveness of energy savings projects.

INNOVATIVE PROCUREMENT STRATEGY— CHILLER BASIC ORDERING AGREEMENT

The Chiller Basic Ordering Agreement (BOA) is an integrated, federal agency-wide approach to replacing chillers that will save money and help ensure the availability of chillers when appropriations are available. This procurement vehicle was developed in conjunction with the General Services Administration (GSA), and has been available since late summer of 1996. Federal agencies, and possibly state and local governments, as well as government contractors will be able to order chillers with preapproved prices and delivery schedules, thus avoiding time-consuming and expensive individual competitive procurements.

There are multi-agency motivations associated with this strategy. EPA's goal is stratospheric ozone protection and global warming minimization (promote protection of the environment). The government's objective is to pursue environmentally friendly and energy efficient procurements per Executive Orders 12863 and 12902.

A critical component of this process is the Equipment Specification for Commercially Available Centrifugal and Rotary Screw Water-Chilling Packages that addresses a multitude of operating conditions and chiller loads. This has been developed with input from other government agencies, and has been reviewed by the 5 domestic manufacturers that

produce chillers at and above 100 tons in capacity. Their input has been considered and incorporated into the specification. Under the BOA concept, each vendor would be able to submit a bid in response to an agency's order for their best chiller that meets the specific facility's requirements. The specification reduces the need for redundant design costs. The specification when linked to the chiller BOA enables ordering of chillers, along with any adders, to meet the specific operating parameters of individual facilities. The ordering facility would select the chiller with the lowest life-cycle cost that meets its requirements.

Assuming that there are approximately 4,000 federally owned CFC chillers, DP estimates that replacing chillers in the federal government will cost approximately a billion dollars. The chiller BOA concept reduces costly, repetitive individual agency and site procurements. This approach is also in line with Executive Order 12902 language on streamlining procurements for energy efficiency technology. This approach is expected to address 90 percent of the federal water-cooled chiller procurements.

The energy conservation benefits anticipated from a coordinated procurement strategy is estimated to be 1.5 billion kWhrs per year saved, which translates to an annual monetary savings of $75 million. This type of procurement strategy ties in with U.S. government energy efficiency mandates dictating the use of life-cycle cost as the basis for procurement decisions. Lowest life-cycle cost based procurements ensure the best decisions economically.

The chiller BOA promotes the requirement to consider only ozone-friendly refrigerants that appear on EPA's Significant New Alternatives Policy (SNAP) list. The reduction of indirect pollution from electrical generation because of the installation of more efficient chillers also promotes environmental stewardship.

Energy savings are not the only monetary benefits that can be realized. A procurement mechanism where federal agencies do not have to conduct individual procurements is estimated to save $40 million over 25 years. The collective purchasing of chillers is expected to generate $50-$100 million in savings over the same period. Systematic application of life-cycle cost procurement decisions over the use of lowest first-cost will result in an additional $300 million in savings over a 25-year period. Finally, annual maintenance savings for newer chillers and the associated CFC savings are estimated at $10 million over the same 25-year time frame.

This procurement approach also accommodates those chiller replacement cases where energy savings performance contracting (ESPC) does not yield an attractive enough payback to give such projects a high priority. Early discussions with GSA's Public Buildings Service indicate that other energy conservation measures, such as replacement of lighting and windows, have already been undertaken. Because the lack of other projects with which a chiller replacement could be teamed, launching a chiller replacement project under ESPC under such circumstances seems doubtful. The Basic Ordering Agreement is an excellent alternative to these "orphaned" projects.

This method of streamlined procurement is expected to facilitate chiller replacements throughout the federal government. It also promises to yield significant environmentally and fiscally responsible results.

CONCLUSION

Saving energy and money while protecting the stratospheric ozone layer is what the DP CFC HVAC/Chiller Retrofit Program is all about. While DOE is actively working to minimize the release of ozone-depleting substances to the environment and moving to convert its equipment to using alternative refrigerants, the installation of more efficient chillers also promotes environmental stewardship in that reduced energy consumption translates into reduced emissions of noxious gases from the generation of electricity. Lastly, the monetary benefit that can be realized to the taxpayer by the DP approach over time demonstrates that environmentally conscientious efforts and fiscal responsibility are not mutually exclusive.

Mark Ginsberg, the director of the federal Energy Management Program, endorses the Basic Ordering Agreement approach. "The transition from older equipment to the new generation of environmentally sound, cost-effective cooling systems, will reduce the stress on the ozone layer of the atmosphere and reduce emissions of nitrous oxides and other noxious pollutants that result from electric generation," states Mr. Ginsberg. He has concluded that DP worked collaboratively to incorporate CFC-free specifications into a procurement process that should simplify and accelerate the procurement of this equipment. It literally can spare the Department millions of dollars and reduce global climate change.

ABOUT THE AUTHOR

Roger Snyder has been an engineer with the U.S. Department of Energy's Office of Defense Programs in Germantown, MD, for the last six years. He has been associated with major defense and environmental projects vital to maintaining the United State's nuclear defense capabilities at the headquarters and field levels. Among these endeavors is the Defense Program's CFC HVAC/Chiller Retrofit Program that he conceived and for which he serves as program coordinator. Mr. Snyder has associate degrees in accounting and general engineering from Richmond College and a B.S. in civil engineering from the University of Illinois. In addition to recognition by defense programs management on many occasions, Mr. Snyder provided leadership to the team recently recognized with a DOE Pollution Prevention Award in the Affirmative Procurement Category.

James Coyle is a program analyst with Systematic Management Services, a contractor to the U.S. Department of Energy in Germantown, MD. He provides analytical support on a variety of DOE programs. His professional background also includes 12 years of federal service with the Office of Personal Management. Mr. Coyle has a B.S. in information science and a B.A. in political science from the University of Pittsburgh. He is pursuing an M.S. in technology management, with an emphasis in environmental and waste management, at the University of Maryland. He has served as a program chairperson for the International Conference on Ozone Protection Technologies in 1995 and 1996. Mr. Coyle is part of the team recently recognized with a DOE Pollution Prevention Award in the Affirmative Procurement Category.