

Trends in energy efficiency in office technology: Case studies from Europe and the United States

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1. ABSTRACT

This paper makes a comparison between several European countries and the United States in the area of energy efficient office technology. Different programs, including government procurement programs, and research projects that these countries have instigated are examined.

2. INTRODUCTION

In commercial and institutional buildings, office equipment is one of the fastest growing electrical loads in the U.S. and possibly in the world. The load due to office equipment in the U.S. is the equivalent to 6 large baseload generating stations, equal to or exceeding power requirements for office lighting. This could increase by as much as fourfold in the next few years (Norford et al 1990).

There are many opportunities for improving energy performance in office equipment, and several countries have already started to explore different options. Denmark, England, the Netherlands and France are at the beginning stages of involvement, with the European Community enlarging on that concern. The policy makers in Sweden, Switzerland and the United States have active programs promoting energy efficiency in office technology.

This paper will discuss this involvement, focusing on those countries actively involved. Also, the role international standards play in energy efficient office technology, and what is being done with them will also be discussed.

3. SWITZERLAND

The Swiss government, through the Swiss Federal Office of Energy, has introduced a broad scope of regulations for the field of office equipment (Schmitz, R. 1993). In 1990, they introduced the Energy Article into the federal constitution. This article requires the government to define principles for a rational use of energy and to issue regulations of the energy consumption of equipment. In 1991, the Federal Decree on the Use of Energy, which will be replaced in 1998 by an Energy Law, was issued. With this decree, the federal government may issue regulations on standardized and comparable declarations of energy consumption of different equipment, first defining testing methods for energy efficiency with regard to international standards and recommendations. It may be up to the sector involved to provide data and documents needed to control the effectiveness of the regulations. The Federal Regulation on the Use of Energy finally determines the energy saving measures in detail.

The Message to accompany the Federal Decree on the Use of Energy, has two steps, but only the first involves office equipment at the moment. Here, target values for energy relevant groups of equipment are defined. It may come to pass that if these target values are not reached within a given time period, mandatory standards will be issued in a second step. At the moment, standards are not up for discussion for office equipment. Target values are favored, due to their short lifetime; they also would not influence trade restrictions, so are EC compatible. However, Japanese companies tend to react more quickly to regulations. Therefore, minimum standards could be a powerful measure.

For target values to be introduced to Switzerland, the Federal Office of Energy attaches great importance to the collaboration with the manufacturers concerning the definition of target values. Therefore, the types of equipment which consume an essential part of the Swiss electricity consumption have to be identified. To do this, a database has to be compiled which allows a projection for energy losses. Market leaders of the sector, the Federal Office of Energy, and independent experts, form a working group which defines the necessary testing methods proposals for target values. Based on these proposals, the Federal Office of Energy will prepare the corresponding appendix of the Federal Regulation on the Use of Energy which will be sent to the Swiss sector of industry for comments. Then, an adapted version of the appendix will be sent to the other sectors of the Swiss Government and to EC, EFTA and GATT countries for comments and notification. After comments are incorporated, the appendix will be signed by the Federal Council and implemented.

For office equipment, the target values will be concentrated on standby losses in communication devices such as fax machines, data processing devices such as PCs and monitors and output devices such as copiers and printers.

Development of methods has already started. They first revised the American Standards for Testing and Materials, but are now reviewing the ASTM revised version of the method. They have not scheduled a time when there will be a testing method for PCs. One has been written for fax machines, and is currently up for review; one for printers should be written shortly.

In preparing these standards, they work closely with the economic sector, so as to clear up misunderstandings early, and so technical knowledge from the industry could go directly into the work. They found that solutions to standby losses are known, the only barrier is price.

Switzerland does not have a strong market pull. On the other hand, Switzerland is often seen as a test market. They would like to see pressure brought to the other countries, a collaboration with other European countries, and decrees and regulations they perform to be translated into English.

Several studies are being performed on various levels in Switzerland. The Swiss Banking Corporation (SBC) has an environmental strategy that was implemented the summer of 1991 (Knecht 1993). A task force was formed to analyze the environmental situation, evaluate opportunities and risks, and define key environmental activities. Key fields could be targeted to find strategic options for the bank as a whole, and proposals organized for the implementation of the strategy. They found that integration of ecological issues into company strategy was not a diversion of earning targets but rather a way of securing the Banks' future by utilizing cost advantages and opening up new market opportunities.

The SBC first performed an environmental audit, with an environmental consultant, to determine the situation and establish priorities for, among other things, office equipment and supplies. They also raised consciousness among the staff, by integrating the ecological dimension into all aspects of the company training.

SBC signed the UN environment program "Banking and the Environment" Declaration in preparation for the UNCED conference in RIO, and the "Business Charter for Sustainable Development" of the International Chamber of Commerce which aims to enforce the ecological awareness in Chamber companies.

Another study is one being performed for the Schweizerische Bangesellschaft (Swiss Banking Society) by Karl Heinz Becker in which a database is being formed of the energy consumption of various office equipment (Becker 1993). This will be used to help size the infrastructure for the building, and possibly to search for office equipment with a higher energy efficiency.

Also, many laws have formed in the various cantons in Switzerland. For instance, in March 1989, Zurich imposed the Electricity Conservation Decree. In this decree, the electric utility for the town of Zurich (EWZ) is required to provide energy and electricity consulting services, help with building and installation improvements, provide tariff measures and conditions and restrictions for electricity supply (Hurlimann 1993). EWZ imposes an energy concept for all new buildings that use more than 110 kVA and for old

buildings consuming more than 200 MWh/year. They ask for a status report of the concept every ten years. EWZ also looks if the cooling of the building is really needed or if it could be avoided by a different building design or more efficient equipment.

Several projects regarding efficient use of energy in the office are in effect now with EWZ. For instance, they completed a project with drinks and vending machines so the machines now have standby operation during off periods. EWZ is currently working on a PC network server which switches off at night and on weekends. They will have an exhibition including office equipment opening in the summer of '93. Also, they are supporting development of cost-effective methods of electricity consumption analysis in commercial buildings.

The main concern for the Energy Analysis Research Group at ETH is to study the area of new information technology (NIT) (Aebischer 1992). They did an energy demand scenario for the "Communication Society" up to the year 2020, and are continuing the project by working on an analysis of the electricity consumption in the service sector of the town of Zurich. In this context they analyzed the energy use in a large computer center and showed in a power flow diagram the importance of indirect energy use. Another concern of the group is the energy use incorporated in NIT equipment.

ETH is also participating in a government project called RAVEL, in which 15 million ECU's is being used to prepare a continued formation for professions in RAtional Use of ELectricity. ETH collaborating with industry and retail stores in order to improve electricity use in Point Of Sale Network Systems, mainly by reducing standby losses and correct configuration of UPS. This project should give indications for power management in other networks.

Also at ETH, there is a group at Reliability Engineering Laboratory that is working on lifetime of equipment and power-management. At the Integrated System Laboratory, the development of a box for automatic power management for a particular manufacturer's workstations has been developed.

4. SWEDEN

By 2010 the Swedish government wants to phase out nuclear power plants completely, halt the expansion of the country's large hydroelectric system, minimize dependence on energy imports, and sustain anticipated 1.9%/year real economic growth (Mills 1991). Nuclear power provides half the power to Sweden now. The Swedish State Power Board Vattenfall outlines three stages to prepare the phase out. The first is to concentrate efforts on marketing measures, technical development and the procurement of new energy sources. The most intensive part of this phase lasts from the present until 1995, when stage two begins. During this phase, new power stations will be constructed; this will last until the beginning of 2000. Then, new electricity generation facilities will be commissioned and nuclear power plants will be shut down. This will last until 2010.

Swedish utilities, like US utilities, are emerging as promoters of energy efficiency, by providing users with information and financial incentives. For instance, Stockholm Energi has plans for a utility operated retail store for energy efficient equipment, and provides energy audits, among other things.

Different procurement programs have already started in Sweden, with varying results. In the spring of 1992 a procurement program concerning printers took place, in which energy usage of different modes was to be provided by the vendor. However, in some cases, the vendor did not actually provide measured data, but instead used nameplate ratings, which has been proven to be as much as three times higher than measured energy usage (Norford et al 1990). This again reiterates the need for standard test methods. But there were two cases in which the printers were found to go down to a very low power state, thus supporting possibilities for energy efficiency in printing technology.

Other procurements and standards set by Sweden have been very successful. The standard for radiation from monitors, MPRII is now internationally recognized. Some organizations, such as Statskontoret which runs the central procurement programs on all equipment for all federal agencies, are including energy issues

in office equipment as part of their procurement programs.

Nutek, the National Board for Industrial and Technical Development is very involved in promoting energy efficiency in office technology (Nutek 1992). Nutek's Department of Energy Efficiency is responsible for technology procurement and demonstration activities, and for the market introduction of technology. This department also works closely with the Swedish Council for Building Research (BFR) and the National Board of Consumer Policies and the National Housing Board.

The objective of the department is to demonstrate possibilities for improved efficiency through better products and working methods. This includes products and services that are competitive with lower efficiency products.

Another program that has been successful is Nutek's program for self-adapting monitors (Nutek 1993). In order to comply with this program, manufacturers have to produce monitors that either meet their specifications for having an Automatic Standby Mode or an Automatic Power Off Mode. With Automatic Standby, the screen should black out in a specified time, and be readable with input from keyboard or computer. The monitor automatically powers off within a specified time for Automatic Power Off, with no power being provided to the monitor. Again, the screen should be readable with input.

So far, six companies have been successful in manufacturing monitors that satisfy Nutek's specifications, and three have been actively marketing these products. They have received a lot of attention, and many purchases. Other large monitor manufacturers have showed interest in Nutek's programs, and seem ready to manufacture monitors that could comply.

Nutek has also worked with Video Electronics Standards Association (VESA), (see below) on solutions to power management in monitors.

Besides the program for monitors, Nutek is also beginning to establish specifications for energy efficient PCs, and is planning to address copiers and printers. They also are interested in promoting automatic switches that act as power management devices, switching off equipment when not in use. These switches are being very well received now in Sweden. In the area of PCs, Nutek is currently talking with two PC manufacturers about promoting their energy efficient desktop machines that use PCMCIA technology.

TCO set standards for monitor EMCs, which is now internationally used. They launched a labelling program in 1992 which uses the Nutek specifications as one of their conditions. They are now beginning to establish specifications that include recycling.

5. USA

Several major corporate and government purchasers of office equipment in the United States and Canada have created an informal consortium with industry, electric utilities, state and federal energy research agencies and non-profit groups. The group's aim is to quickly bring to the market new types of computers, printers, copy machines and other electronic office equipment that are more energy efficient (Harris 1993).

The consortium envisions a new approach for the government; helping to create and strengthen the market rather than replace market mechanisms with regulations. In order to do this, industry-wide international standard methods for testing and rating relative energy performance for each type of equipment need to be produced, then followed by programs to assure that the resultant data are accurate and made available to interested parties. A Buyer's Guide and Technical Assessment has been developed by ACEEE (Ledbetter, Smith 1993) and MIT (Norford, Dandridge 1993) that will help customers choose energy efficient features. Another Buyer's Guide is forthcoming from the Ministry of Energy, Mines and Resources in Canada.

In order to establish entry markets for the most efficient new products, the General Services Administration (GSA) will direct its purchases towards energy efficient products. This agency has major buying power, since it purchases over 10 percent a year of the world's office equipment; it is the single largest buyer.

This market pull strategy for energy efficiency in office equipment was reinforced by several provisions in the 1992 Energy Policy Act. This new law directs the Department of Energy (DOE) to work with industry on an energy testing and information program for office equipment, requiring federal purchasing agencies to select these products using life-cycle cost criteria. There is also a strong emphasis on research, development and demonstration of advanced materials, manufacturing processes and energy using technologies that are efficient and environmentally sound.

The Environmental Protection Agency (EPA) has also established the Energy Star labelling program as part of its program for pollution prevention and reduction of greenhouse gas emissions. This labelling program is for personal computers, terminals and printers with automatic controls that power-down to 30W or less when not in active use. It will be formally introduced in June 1993. Manufacturers representing over half of the market for PCs and printers have already joined this program.

There are also many workshops and technology update reports performed by various members of the consortium. The Computer and Business Equipment Manufacturers' Association (CBEMA) has been active in developing legislative provisions, industry-based energy testing and information programs. They are also working with government agencies and utilities on other programs already mentioned. The Video Electronics Standards Association (VESA) is developing "sleep" modes of terminals based on signals from the computer host. The Imaging Committee of the American Society for Testing and Materials (ASTM) is updating its 1987 version of a test method for energy use of photocopiers and duplicating equipment, and is beginning to develop similar methods for printers and fax machines.

6. DENMARK, ENGLAND, FRANCE AND THE EC

There are several countries that are just beginning to explore options for programs and project supporting energy efficiency in office equipment. The Directorate-General for Energy in Denmark has proposed a preliminary study for a database for office equipment, in which the translation of a buyer's guide the group behind the application has finished, and an evaluation of an open and effective European office equipment database will be performed (Jensen 1993). In England, a study has been performed on the consumption of electricity by office equipment in various office buildings (Hill 1993). In France, a group is evaluating possible energy efficient actions for office technology (Roturier, et al 1993). The EC has formed a task force called Energy Efficient Office Technologies in Europe, which will be finished this year.

7. TEST METHODS AND STANDARDS

As has been mentioned, a standard way of evaluating energy consumption of office equipment is very important in order to make valid comparisons between machines. Also, these test methods need to be internationally recognized to avoid conflicts in data as is the case with the Swedish procurement of printers, or as is the case with the group in Switzerland and the ASTM procedure, to avoid duplicated work.

A revised version for the ASTM method for energy consumption for copiers is currently under review. Also, new versions for printers and fax machines are under way. Once there are standard methods for collecting data, manufacturers will be able to test their machines accurately for energy consumption, thus giving many of the procurement programs mentioned above a greater base for comparison. Focus on these methods is taking priority.

7. CONCLUSION

As electric loads rise around the world, decision makers are forced to look for new energy resources. In the mid-1980s, scientists began to look at a new form of conservation potential, that of energy efficiency (Norford et al 1990). Now, as environmental concern grows, the subject of increasing efficiency in office technology is attaining wide attention.

Users cannot be expected to opt for energy efficiency on their own. Often, the words energy and power are associated with performance. Thus when phrases such as less energy and lower power are employed, the user may choose a less efficient model.

The policy makers of the government and electric utilities in the United States and two European Free Trade countries, Switzerland and Sweden are strongly supporting energy efficiency in office technology. With the help of government procurement programs and the focus of utilities and research groups on this area, manufacturers are increasingly concentrating development efforts on more efficient products without inhibiting technological innovation. User awareness has been increased through such programs, and with the help of purchasing guidelines and criteria being developed (Norford and Dandridge 1993; Ledbetter and Smith 1993), and various test methods. Thus, manufacturers are finding a strong response in these countries to marketing efficient models by stressing increased efficiency and environmental awareness.

It is important for these criteria to be followed in the European Economic Community. In Denmark, the Netherlands, England and France, it is the public agencies that are involved, not the policy makers. In order to push users and manufacturers towards using and producing more efficient models, policy makers need to become involved. Also, purchasing guidelines and test methods need to be international, to avoid confusion and to reinforce their use with manufacturers.

As policy makers focus more on making energy efficiency a more viable energy resource, we will increasingly be able to choose office equipment not only for high performance, but also for increased energy efficiency.

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