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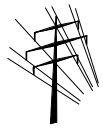

Miniwatt-Report

Efficient Use of Energy in Information Technology and in Consumer Electronics

Report of the international meeting for „Insider“ on March 19th 1993 at the Swiss Federal Institute of Technology (ETH) in Zürich

The meeting was organised by the Energy Analysis Research Group of ETH on behalf of the Swiss Federal Office of Energy

Mai 1993

Background of this Report

A team of experts from nine Swiss institutions have been concerned with an interdisciplinary research project "Stand-by losses of office and consumer electronics equipment" for the past two years. The final report was published in January 1993.

Similar research activities as well as endeavours to use the scientific results for practical purposes also exist in several other countries. International exchange of experience and results would be very beneficial to all parties involved.

With this aim in view the Energy Analysis Research Group at the Swiss Federal Institute of Technology organised a meeting for experts on behalf of the Swiss Federal Office of Energy, which took place on March 19th in Zurich. More than twenty specialists from the USA, Sweden, France, the Netherlands and Switzerland exchanged results and shared their experience. Their common goal was and still is to promote the rational use of energy in information technology. This requires internationally coordinated interdisciplinary measures.

The Swiss Federal Office of Energy would like to thank all participants for their involvement and hopes that it has contributed to improving the exchange of information in this dynamic field of research by the meeting and this report.

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The Secret Waste of Electricity - Results of the research project "Stand-by losses of office and consumer electronics equipment"

Swiss Federal Office of Energy, 3003 Bern, January 1993

Study In this study the energy losses of the most common office and consumer electronics equipment were analysed. It was initiated by the Swiss Federal Office of Energy and carried out by an inter-disciplinary team in 1991 and 1992.

Equipment The research team examined the following categories of equipment:

- office equipment
  computers, monitors, printers, photocopiers, telefaxes, switch-boards
- consumer electronics
  video equipment (TV and video recorders), audio equipment (radio, hifi-stereo sets), power supplies

Stand-by losses The energy losses in stand-by (when the machine is ready for operation) were projected by using current results and plausible assumptions concerning usage of the equipment.

Projection The annual stand-by losses of all the equipment which was tested amount to 900 million kWh according to this projection - almost 2% of the total power consumption in Switzerland in 1990. Office equipment accounts for slighty more than half of the stand-by losses.

Measurements Detailed measurements on various types of equipment showed that the power consumption in the stand-by mode in most cases was considerably higher than would be necessary to secure safe operational readiness. In many cases components which have no function in the stand-by mode are nonetheless supplied with current.

Reduction Stand-by losses can often be reduced to a few percent of the presently common values by improving the technology of monitors, printers and photocopiers. However, a survey showed that manufacturers and distributors do not attach much attention to power consumption and therefore exploit the potential for improvement with hesitation and only in individual cases.

Life cycle If modern equipment is switched on and off sensibly, life cycle is influenced only to a minor degree. Even frequent switching operations are unlikely to shorten the life cycle if the necessary technical modifications are made. Most devices can be developed

to be suitable for systematic on/off operation or for automatic power management.

User behaviour

Two independent project teams looked into the question of how design could lead users to an energy conscious behaviour. The results show that design has not yet received the attention it deserves.

Laws

Based on this study various legislative measures are presently being worked out. These should entail the following steps:

- standardized testing procedures
- declaration of the energy or stand-by consumption
- minimum demands concerning power consumption

2

Summary of the Meeting

30 - 80 % reduction possible

In theory it would be possible to reduce the power consumption of electronic equipment even with the present state of technology by 30 to 80 percent. The saving potential of technological innovation still ahead may be even greater but is hard to estimate. Experts presently believe that power management will have the greatest effect. However, new technology and new needs of users will generally increase energy consumption.

Market value

Innovations of equipment do not always use all advanced technology available. The main reason is the low market value of energy. Saving energy is only worthwile if other advantages are linked to it.

Energy consciousness

At this point efforts start to make consumers energy conscious. This may result in energy saving behaviour but it would be unrealistic to expect the drop in energy consumption to last. However, energy consciousness is a major factor in market developments. Bulk buyers especially can exert pressure on manufacturers by demanding energy saving equipment.

Testing procedures

All measures which influence the market require standardized testing procedures for equipment. Several organisations, mainly from the USA, Sweden and Switzerland, are currently working out such testing standards. The Zurich meeting was an important step towards international collaboration in this field.

Collaboration

This collaboration has to be both international and interdisciplinary. Apart from the technological areas (from individual components of equipment to the planning of office blocks) it also entails those of human behaviour, the passing on of information, the economy, legislation and politics.

3

Key Terms and their Definitions

The following terms are relevant to the understanding of the facts, the discussion and the conclusions. Therefore they are explained concisely below in the way in which they are used in this report. They are not to be considered universally valid.

Equipment

Information, office
Telecommunications
Consumer electronics

When equipment is mentioned this usually refers to (a) information and office technology equipment, (b) telecommunications and (c) consumer electronics:
a) computers, monitors, printers, scanners, photocopiers
b) phones, fax machines, modems, switchboards
c) television sets, video equipment, radio-cassette recorders, hifi-stereo sets
However, these categories cannot be clearly distinguished. For example, the same technology and components are used partly in printers, copiers and fax machines.

Energy

Electric energy
Indirect energy

Usually this refers to electric energy, i.e. to the direct energy consumption of equipment. Attention should also be directed to the "indirect" energy consumption of the infrastructure (air-conditioning system, uninterruptible power supply). This consumption is almost equal to the direct energy consumption [15]. Also the energy needed for production of hardware and materials need to be added.

Power Management

Intelligent circuits
Software

Controlling the power consumption of a piece of equipment by means of intelligent circuits and/or software, which according to requirements switch individual modules on and off. The energy requirements of a piece of equipment depends on the time it takes to become operational. Immediate availability (stand-by) requires the highest energy consumption of non-operating equipment, lower energy consumption (sleep mode) is usually coupled with waiting periods. Therefore power management is also time management.

Stand-by

Readiness
Functions

Readiness of a piece of equipment. The equipment has reached operating conditions, but it is not operating. All functions are active to the degree required for immediate operation. Depending on the individual piece of equipment the energy consumption in the stand-by mode can be considerable. In the case of equipment which is rarely used it often happens to be higher than when it is actually operating. Therefore there is a trend to define operating states with lower power consumption (for example the sleep or energy-saver mode).

Energy-Saver Mode

Low stand-by
Sleep mode
Deep-sleep mode

The condition that exists when the machine is not operating, has previously reached operating conditions but is consuming less power than when the equipment is in stand-by mode. There are different terms for different modes of equipment using less power than in stand-by: low stand-by, sleep mode, deep-sleep mode. In these modes parts of the equipment presently not needed are switched off. However, the equipment is ready to become fully operational when it receives certain signals (eg pressing a key, moving the mouse, signal input).

Market-Pull Strategy

Demand

Controlling the market by intensifying demand. This is the given strategy to reduce the power consumption of equipment since there is no stimulus for manufacturers to exploit technologies which are available beyond the frame dictated by comfort and performance. A pull strategy can only be successful if one succeeds in arousing and focusing the interest of large groups of buyers.

Testing Procedures

Controlling

A defined procedure accepted by both manufacturers and controlling organisations for measuring the power consumption of equipment at various operating states.

Standards

Power consumption

In this report this refers to values concerning power consumption or power input which have to be met by equipment in order to obtain a stamp of quality or to be admitted on the market under tighter rulings. There is a testing procedure for each type of equipment for which a standard is issued.

Target Values

Recommendations

Similar to standards, except the controlling organisation does not lay down any mandatory values for power consumption; it issues only recommendations. Could also be applied in a soft transitional phase until standards are introduced.

4

Power Consumption and Energy Saving Potential of Devices

Power Consumption of Office and Consumer Electronics Equipment

Growth rate

Surveys carried out in western countries have all come to the conclusion that office electronics belong to the electrical loads with the highest growth rate. In the USA it is estimated that presently these power requirements amount to 6 GW (the equivalent of 6 large baseload generating stations); if growth remained at this, it would result in up to a quadrupling within ten years [4]. With the present state of technology, power consumption by office electronics alone would increase in the European Community to 10 GW in the mid-nineties [12]. In Switzerland office electronics accounts for more than 5 percent of the power used in the service sector [11]. Another Swiss study based on measurements of the power requirements of equipment revealed that the devices with the highest consumption (fax, printer, copier) use between 50 and 80 percent of the energy when they are in the stand-by mode [6]. This may apply to other countries as well.

Stand-by losses

In Switzerland energy consumption figures for office and consumer electronics equipment are at about the same level. In both, stand-by losses make up between 3 and 4 percent of electricity consumption in the household and service sectors [11].

Share of Stand-by Losses
of office and consumer electronics in Switzerland.

Energy consumption	Households $13 \cdot 10^9$ kWh/year 100 %	Offices $11 \cdot 10^9$ kWh/year 100 %
Share of stand-by losses	Consumer electronics	Office electronics
Video equipment	1.8 %	
Phone, fax machine, modem		1.2 %
Printer, copier		1.2 %
Computer		1.2 %
Hifi-stereo sets	0.9 %	
Power supplies, radio-alarm clocks	0.8 %	
Other equipment		0.1 %
Share of stand-by losses totally	3.5 %	3.7 %

Potential for Energy Saving of Devices

Predictions

It is very difficult to make any meaningful statement on the potential for energy savings of devices since technology is in rapid development and present predictions may already be outdated tomorrow. With the technology to be found on the market in 1993 energy consumption could be decreased by about 30 to 80 percent. Based on technological developments it can be expected that computers and monitors will have the same level of performance, and use only a few percent of the present power consumption. The biggest saving is to be expected in the stand-by mode; according to a Swiss survey depending on the type of equipment between 30 and 60 percent of the present energy consumption of the devices tested [11].

1 Watt after 1 hour

The Swedish Board for Industrial and Technical Development (NUTEK) proposed one watt as a target value to be aimed for in an energy saving mode after one hour. The device should automatically set to this value after one hour of non-utilization [9].

Feasibility

The feasibility was discussed at the Zurich meeting. The participants agreed that these target values may prove realistic for certain groups of devices (computers, monitors). For technological reasons stand-by losses cannot now be reduced to one watt in output devices (printers, copiers). With technology being in a constant state of flux this may change in the near future. It was also pointed out that a sheet of paper of the size A4 or US-letter contains 20 Wh of energy, roughly ten times more than is needed to print or copy onto this same page of paper. The most important saving measure therefore consists in imprinting both sides of the paper [3].

5

Does Frequent Switching On and Off Impair Devices?

Zurich study

Switching off a device when it is not used is undoubtedly the most simple power saving measure. In connection with this the question whether frequent switching on and off would not impair the device is often asked. This question was examined at the Swiss Federal Institute of Technology (ETH) in Zurich with regard to PC monitors, fax machine appliances, video recorders and copiers.

PC monitors with cathode ray tubes (CRTs)

Switching on and off the monitor five times or more a day increases the frequency of faults in power transistors in the control and deflection parts only after the machine has been used 20 to 30

CRTs years. After about 20,000 switching cycles (17 to 20 years of service) emission of the cathode starts to weaken. The other components are not impaired by frequent switching. Based on the parameters measured and known from technical literature the critical operating time can be determined when wear caused by the switching cycle starts to impair the life cycle. For PC monitors this critical operating time is 15 minutes. This means that switching off the monitor is worthwile for breaks lasting more than 15 minutes [8].

Photocopiers Most photocopiers currently being made are not suited well for frequent on/off operation. However, it would be possible to adapt photocopiers to automatic on/off operation with a few technical modifications and reduce stand-by losses by 90 percent or more. Among other things a circuit would have to ensure that the heat exhaust fan remains in operation as long as the device is hot. Some other components (fixation drum, pre exposure lamp) would also have to be slightly adjusted. Switching off during long breaks or over night does not have any considerable influence on the life cycle [8].

Fax machines External devices which switch the fax off and activate it only when a signal arrives are available but have failed to catch on as yet. Among other things there are problems with the lithium type batteries, which in case of a power failure back up the memory containing the phone numbers. However, the introduction of a sleep mode might be useful. The problem of increased stress on components and failure probability can be technically resolved. Power consumption in stand-by would be reduced by about 70 to 80 percent [8].

Video recorders Complete switching off is not sensible because of the built in clock and because the various tuning and programming procedures require a considerable amount of time. However, various functions which are not required could be switched off in a sleep mode that has yet to be developed: switching power supply, tuner, terminal etc. The tuner would be activated about two minutes in advance of the programmed starting time and would be available in time. The higher frequency of switching cycles would barely impair life cycle and reliability of the device. Power consumption in stand-by would be reduced by about 80 percent [8].

Is Latch-up a Problem in Circuitry?

Latch-up Latch-up means the presence of a signal without a supply voltage in integrated circuits (IC). Certain types of ICs (CMOS) may be destroyed by latch-up. This problem mainly concerns old fax machines and video recorders. The circuits of more modern devices are probably latch-up protected [8].

Switching Off is Possible.

On balance

The investigations show that sensible switching on and off is already problem-free. However, many of the concepts for building devices used today make frequent switching on/off more difficult. This concerns purely technical aspects (wear, life cycle, reliability) as well as operating convenience. In future generations of devices this problem should be taken into account and circuits be modified accordingly. Automatic power management will decrease power consumption and improve operating convenience.

6

Information and Energy Consciousness

Aims and Means of Information Campaigns

Swiss action plan RAVEL

Switzerland promotes energy saving measures through a national action plan "Rational use of energy" (RAVEL) in various branches of industry by means of information and education campaigns. Within the framework of this programme the power consumption of more than 300 pieces of office equipment was measured with the aim of spreading the results to a large part of the population. The message was: Devices which are always switched on consume more energy while they are idle than during the time they are actually in use. This fact was not common knowledge before. The information was passed on to the media at a press conference. Leaflets, informative booklets, posters and stickers were delivered to a number of interested organisations. The response of the media was very positive (almost 100 percent of the population covered). Some companies decided after that to carry out energy saving activities. The success of this undertaking has not been evaluated yet [6]. A similar information policy is being pursued by the electric power company of Zurich (EWZ). It operates the "Elexpo", an energy advice centre at a central location, with the aim of motivating the population and experts to deal rationally and consciously with electric energy [5].

Elexpo Zurich

Does Energy Saving Behaviour Lead to Lower Power Consumption?

NUTEK Sweden

There is a success story from Sweden (National Board for Industrial and Technical Development NUTEK: "Energy efficiency in office equipment - A Swedish View", Stockholm, June 1992, referred to in [11]). The management of IBM Sweden informed the 650 employees of the headquarters and of a training centre for 500 people about energy conscious behaviour in a campaign lasting

Sweden

several weeks. Afterwards the energy consumption of office equipment was reduced by about 50 percent because the employees now switched their equipment off during non-use and over night. The experience from other similar projects shows, however, that such campaigns have a short term effect. In the long run need for convenience and laziness make the consumption grow again. Getting users to switch on and off equipments is a strategy that is needed for the time being. In the long run this behaviour will become unnecessary because intelligent power management of the devices will fulfill this function with greater reliability.

Design

Design could facilitate energy saving behaviour. In the framework of a Swiss study a team of visual designers examined whether suitable design could save energy [11]. This resulted in a number of proposals, for example: The main switch on the front panel of the device should be clearly visible, lighted when on and blinking in the energy saving mode. The computer could automatically switch peripheral equipment on and off. The operating state could be displayed on the monitor with symbols. Copiers could show the user how much time it would take to come to readiness.

Energy Consciousness as a Human Key Factor

Demand-side

Energy conscious behaviour by users will hardly decrease energy consumption considerably in the long run. However, since energy consciousness influences a number of other very effective factors, its indirect benefits should not be underestimated. Only an energy conscious buyer will ask for energy saving devices, for example. A great demand will influence the market.

7

Power Management

Energy saving potential

The energy saving potential created by power management presently amounts to about 60 to 70 percent of stand-by losses or roughly 30 to 40 percent of the total power consumption of the devices for information processing [11]. A Canadian investigation revealed that automatic power management can reduce the power consumption of PCs during the day to 40 to 60 percent [4].

Laptop Notebook

Consumption values and saving potential vary a lot depending on the category of equipment. What can be achieved if demand is sufficient has been demonstrated by the manufacturers of laptop and notebook computers. In order to achieve maximum independence from the plug socket, which was demanded by buyers, they

reduced power consumption in the sleep mode to 1 percent of the value in the operating state.

Energy Saving Potential by Power Management at the Present State of Technology

(Information from [11], summarised)

	Power requirements of components in stand-by mode	
	absolutely necessary	now available
Video recorder	1.2 ... 1.3 W	6.6 W
Fax machine	0.3 W	3.8 W
Computer (Laptop)	1 %	100 %
Copier	80 %	100 %
Laser printer	21 ... 24 W	50 W

Sleep mode

By switching off components which are not used, the load of the power supply is reduced. The built-in ac-dc converters therefore operate with less efficiency. This can be compensated by using a separate, reduced power supply in the sleep mode [8].

8

New Developments in Technology

Technology available

Power management optimizes available technology. Better use of technology available today was the main topic at the meeting. The development of new, energy saving technologies was also discussed.

3.3 V chips

A current trend is the replacement of integrated circuits with a supply voltage of 5 V with a supply voltage of 3.3 V. Generally speaking, new generations of ICs, which differ from earlier types in enhanced performance, component density and lower energy demand per switching function, are put on the market constantly. However, the increasing demand for computing power and storage capacity offsets the decreasing specific demand so that total demand is on the increase nevertheless [3].

Printer technology

Most of the technology in use today for photocopiers, also found in laser printers and laser fax machines leaves relatively little room for saving, as the fixation drum has to be heated. Energy saving keys have also proved not to be very effective. More economical printing technologies (ink jet) are already used in printers and

Ink jet faxes but hardly in photocopiers. The printing quality of ink jets is improving steadily and has already reached a resolution of 300 dpi-laser printers. With the lack of a stimulus from the market the development of energy saving output devices progresses more slowly than that of computers.

Cost-performance ratio Most technical innovations aim at better performance at a lower price and not at lower power consumption. A better cost-performance ratio can only be achieved with more efficient technology. This is an ideal condition for using innovations also to curb energy demand. Equally indispensable is a corresponding demand - see section 12. [3]

9

Networks

Trend The networking of office devices is a second important trend apart from the rapid progress regarding their performance. Integration could increase the energy demand considerably in the future compared to stand alone devices.

Power management There has not yet been enough research into the operating of devices in a network with regard to minimum power consumption. An automatic power management for networks is not in sight at present. This problem is the object of a current study on POS systems [1].

POS systems POS systems are cash desks at points of sale in the retail trade which are interconnected in a data system. Such systems replace single cash registers, now becoming obsolete. The power consumption of these systems amounts to 2 percent of total electricity demand of a branch, to which has to be added the demand for air-conditioning at similar levels.

Oversizing The study shows that managers and planners tend to oversize POS systems and leave them switched on around the clock for security reasons. An enormous source of losses is the uninterruptible power supply (UPS), which is often running to far less than 50 percent of capacity and is therefore inefficient.

Energy saving potential Detailed measurements revealed that the energy consumption of POS systems can be reduced by about 50 percent with suitable measures. In collaboration with representatives of the retail trade, manufacturers and suppliers, the authors compiled a check list for planners and users. Valuable impulses are also to be expected for the planning of networks for other uses.

10
Building Systems

Waste heat

Electric devices use energy in two ways: first when they are in operation and second when their waste heat is carried off. Therefore large scale energy saving measures are sensible only if buildings are viewed as complete systems.

Energy costs

In the Netherlands 75 percent of energy costs in an average office are used for electricity and 25 percent for heating (gas). In bigger buildings with computer rooms the cost share of electricity increases and can reach up to 90 percent in the extreme. More than half of the additional electricity is needed for the air-conditioning system in order to carry off the waste energy of electronic equipment [15].

Air-conditioning

In an office the air-conditioning system often uses as much power as does the total of office devices. If office devices produced less waste heat the air-conditioning system could be dimensioned smaller or possibly omitted completely.

Type plates

In one of the major Swiss banks [2] the information on the type plate of computers, monitors, copiers, printers and faxes was compared to the actual power consumption at various operating states. It turned out that the actual consumption was about 2 to 8 times lower than the nameplate rating. A similar measuring campaign in the framework of the Swiss programme RAVEL came to the same conclusions [11].

Sizing

The reason for the measurements of the bank was an air-conditioning system which obviously was sized incorrectly due to wrong thermal load ratings. The new data now make possible a redimensioning and provide a better basis for future planning. According to conclusions from energy analysis no air-conditioning system is needed in offices if the power consumption is also taken into consideration when choosing a device, the users' behaviour is energy conscious and the architectural design is suitable. However a lot of work has yet to be done in order to reach this goal [2].

Attitude change

According to the experience gained from their energy advisory service, Novem, the Netherlands agency for energy and the environment, users usually don't care about the power consumption of office equipment. Energy costs are also not considered. However, if users are aware of the problem, they willingly support the demand for lower energy consumption [15]. It should be quite easy to change the attitude of energy users by means of information, especially where a generally well developed environmental consciousness is already present.

Conditions

Conditions laid down by electric power companies can also be valuable impulses. The electric power company of Zurich (EWZ),

Energy analysis for example, demands an energy analysis for all newly installed connections to the grid of 110 kVA or more and from bulk users with an annual consumption exceeding 200,000 kWh once every ten years. These consumers together use more than half of the EWZ power production. Ventilators with or without cooling and lighting installations starting from 5 kVA are subject to approval [5].

11

Forces and Mechanisms of the Market

Hot market The computer and office equipment market is "hot" and dynamic, characterised by fierce competition among suppliers. Supply and demand are determined by speed of operation, operating and storage capacities, quality and cost-performance ratio. Until recently, energy consumption was of no concern but this seems to be changing. A growing number of manufacturers offers energy saving devices which are not harmful to the environment and also use this statement in advertising. IBM, for example, launched a powerful computer named "Energy Desktop" with a colour monitor using only 56 watt in operation and only 20 watt in the sleep mode. The manufacturer ICL also transfers the power management proven in notebook computers to its new desktop models.

Demand-side This development is an unmistakable sign of changes on the demand-side. In the meantime large groups of buyers are demanding devices with improved energy efficiency. Presently leading in this respect is the American government, with a yearly buying power of 8 billion dollars. They are the biggest buyer of hardware, software and services worldwide. This buying power would treble if the governments of the individual US-states and the municipalities were to participate [4].

Buyer's Guide The American Council for an Energy Efficient Economy (ACEEE), under a grant from Electric Power Research Institute (EPRI), is preparing a "Buyers' Guide for Energy-Efficient Office Equipment". The EPA Energy Star labels low power devices, see section 12 [3, 4, 9].

Market-pull The market pull strategy aims at changing the products currently available in a certain direction through specific demand. In the past state control almost exclusively relied on regulations for interventions in the market, thereby forcing manufacturers to offer products which complied with certain minimum demands (push strategy). However, it is hardly possible to work out sensible technical regulations for electronic devices since technology in this field changes rapidly. An exception would be regulations

concerning the stand-by consumption and power management in general.

Sweden inciting innovations

A manufacturer is only motivated to develop energy saving technologies and to put them on the market if he can expect a steady demand. Strong buyer groups therefore can play a key role in inciting innovations. The Swedish authority NUTEK recently succeeded in doing so by subsidising the development of a monitor that switches off automatically and offering buying guarantees. Six manufacturers accepted the offer and launched power-off monitors on the market [9].

Demand-side Management

Demand-side management has been gaining ground increasingly in a number of countries. Good examples from Switzerland are the electric power companies in Zurich [5] and Bern [10]. By means of various marketing activities they try not to increase demand but to decrease it. These measures aim at securing the electricity supply in view of ever increasing demand and limited possibilities of later extensions of power plants. The Bernese electric power company (BKW) have therefore founded an energy saving club, which more than 50,000 clients have joined. The club members commit themselves voluntarily to using energy economically in their home or business and to supervise consumption regularly. BKW also promotes the cooperation between industry and buyer groups with an interest in energy saving devices.

12

Guiding Measures

State organizations
Private organizations

Guiding measures in this context mean regulative interventions in the market by state or private organisations. These interventions are meant to decrease energy consumption. The scale extends from stamps of quality for exemplary devices accross recommendations for consumption ratings to the duty of declaration and mandatory regulations for the admission to the market.

Testing Procedures

ASTM standard

Prerequisite for any sensible guiding measure is a standardized testing procedure. This should be internationally standardized. The American Society for Testing of Materials (ASTM) has developed a standardized testing procedure for copiers: The ASTM standard F757-82 is based on a simulated customer installation and a standard copy volume per month. Consumption of the machine energy, which is the energy of the plug-in, warm-up, stand-by and energy-saver modes, and of the copying energy for

ASTM standard

a standard work month and energy per page, is calculated. The ASTM standard is not final yet in its present form and is currently being revised; a printer and fax procedure is being developed [3]. In Switzerland testing procedures were based on the ASTM procedure; changes made were similar to those made in the current revision [13]. Apart from the ASTM standard for copiers the IEC standard 107 (International Electrotechnical Commission) for television sets is common.

Common standards

Presently it is not easy to internationally standardize the various complex testing procedures, which often vary from one country to another. It is definitely sensible to elaborate different testing procedures in a first phase, then to discuss them in the international arena and to settle on common standards at a later stage. Common standards are a prerequisite for efficient cooperation with internationally active manufacturers.

The ASTM standard is a model for the elaboration of similar test cycles for other categories of equipment.

Quality Label

EPA Energy Star

The American Environmental Protection Agency (EPA) labels computers using less than 30 watts in stand-by with the stamp of quality "Energy Star". Many important manufacturers have promised to put such products on the market and the biggest group of buyers intend to support those devices. In the meantime some manufacturers of monitors and printers have also joined the Energy Star programme; corresponding products labelled with the Energy Star are to be launched on the market in June of 1993 [4].

TCO Sweden

The swedish TCO, a union of office workers, also awards a stamp of quality for office equipment not harmful to the environment [9].

Declaration

Transparency

As yet there is no duty of declaration stipulating that manufacturers declare the energy consumption data of their equipment. The prerequisite would be a standardized testing procedure. The declaration of energy consumption data would lead to more transparency on the market so that energy conscious buyers would find it easier to inform themselves. In Switzerland such a duty of declaration is planned [11].

Target Values and Standards

Discussion Setting

Officially recommended energy consumption values (target values) are discussed in various countries - especially for the stand-by mode - and are partly worked out already (EPA Energy Star). The setting of target values is well advanced in Switzerland. This is due to the energy article, which was added to the Swiss Federal Constitution by a plebiscite in September 1990. This article obligates the government to promote the rational use of energy by

suitable measures. For the time being target values are but recommendations on a voluntary basis. If the response of the market is insufficient it would be possible to transform target values into mandatory regulations. In Switzerland the Federal Office for Energy (BEW) is responsible for such matters.

Testing Procedures in Switzerland

(State in April 1993) [13]

Devices	Testing Procedure	Target Value for
Fax machines	own standard	stand-by
TV	IEC 107 (extended)	stand-by, operation
Copiers	ASTM standard (modified)	off, stand-by
PCs	in elaboration	open
Video recorders	in elaboration	open
Printer	in elaboration	open

13

International Coordination

The participants at the Zurich meeting discussed various possibilities to encourage urgently needed international cooperation. The most important goals are mutual exchange of information, measuring methods and data, monitoring of technological innovation and of market-pull strategies. The following proposals resulted from this discussion:

Testing Methods and Data

Elaborate and standardize testing methods for devices
- "purposes" and conditions (including stand-by periods)
- measurements
- standard operating cycles (with options)
- standardizing of test reports

Publish test results (data) for various categories of devices
- PCs
- monitors
- printers
- copiers
- fax machines
- power supplies
- etc.

Exchange information internationally
- on general proceeding
- on specific products
- field studies about the pattern of application
- measurements on devices

Formulate target values for device capacity
- specific to each country
- international standardization (ISO, IEC, others)

Found a “library” for technical reports, brochures etc.

Technological Development

Carry out reliability studies
- for various groups of devices

Formulate goals of development
- for hardware
- for software

Build demonstration offices with low power consumption
Carry out supervised case studies

Market Analysis and Market Monitoring

Available products
- features
- performance data

Sales figures
- changes in the course of time

Buying policies

E-mail Network

The participants established an e-mail network for the international exchange of information. The goal is to have at least one place of contact in each country which collects all the relevant information and makes it available on call. The network comprises the following stations (state 29th of March 1993):

France/ EC Jacques Roturier, Prof., Université de Bordeaux
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Programme of the Meeting

09.45	R. Brüniger	Begrüssung/Welcome
09.50	B. Aebischer	Information, Organisation
10.00	H. Prechtl	Standby-Losses of Consumer- and Office-Electronics
10.15	A. Huser	"Stromsparen im Büro" und Öffentlichkeitsarbeit
10.30	C. Dandridge	Near-Term Technology Review of Electronic Office Equipment
10.45	Discussion	
11.00	Break	
11.30	R. Schmitz	Standards and target values in Switzerland
11.45	J. Harris	U.S. "Market-Pull" Strategies for Energy-Efficient Office Equipment
12.00	O. Molinder	Swedish Procurement Programs
12.15	D. Spreng	Evaluation von Energiesparprogrammen
12.30	Discussion	
13.00	Luncheon	
14.15	B. Walhof	Energy-Audits in Computer-Centres and Office-Buildings
14.30	K.H. Becker	Ermittlung von Planungsvorgaben für HKLE-Anlagen
14.45	B. Hürlimann	Efficient use of electricity in Zürich's commercial sector
15.00	B. Aebischer	"RAVEL bei POS-Systemen" as an Example for Promoting Efficient Electricity Use in Computer- and Telecommunication-Networks?
15.15	Discussion	
15.30	Break	
16.00	F. Knecht	Swiss Bank Corporation's Environmental Strategy
16.15	M. Pfisterer	Marktorientierte Kommunikation im Energiebereich
16.30	J. Roturier	Energy-Efficient Office Technologies in Europe - OT3E: a EC Project and a Tool in a World Market
16.45	P. Burkhardt	Closing Remarks: Possibilities for International Co-operation
16.50	Discussion (open end)	

Summaries of the seminar papers and further information are available for a contribution towards expenses from:

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Seminar Papers and Literature

1

Aebischer, B.
Moser, R.

"RAVEL bei POS-Systemen" as an Example for Promoting the Rational Use of Electricity in Interconnected Data Processing and Communications Systems.

Presently the traditional cash registers at points of sale in the retail trade are modernised to a large extent (bar code readers, networks). Until now the use of energy didn't play a role. With suitable measures the energy consumption of POS systems could be reduced about by half. In collaboration with representatives of the retail trade and manufacturers/suppliers a check list for planning and operation was drawn up.

2

Becker, K.H.

Determination of Planning Figures for HKLE Installations.

Installations for heating, climates, ventilation and electricity (HKLE in Switzerland) are often oversized in office buildings because they start out from overestimated power requirements of the equipment. Oversized installations are inefficient and multiply the power consumption of office equipment. Measurements on devices offer a better basis for planning than the information on type plates.

3

Dandridge, C.B.

Near-Term Technology Review of Electronic Office Equipment

The effect of new technology on energy consumption and various successful programs are discussed. Energy consumption data of different devices have to be comparable so that manufacturers can adapt themselves to given values and buyers can easily inform themselves on the market. Prerequisite for this are standardized testing procedures. The American Society of Testing of Materials (ASTM) has developed such a procedure. It is currently being reworked.

Harris, J.

4

US "Market-Pull" Strategies for Energy-Efficient Office Equipment

The American government as the biggest buyer of office equipment worldwide increasingly exerts pressure on manufacturers, attaching much importance to energy saving operation. It is important to bring together similar endeavours in various countries and, by doing so, to get in touch with industrial companies. Increasing demand of energy-efficient devices will stimulate the offer and speed up the according technological development.

Hürlimann, B.

5

Efficient Use of Electricity in Zurich's Commercial Sector

The electric power company of Zurich requests from bulk buyers (exceeding 200,000 kWh/year) an energy analysis once every 10 years. The clients have to show that they use or plan to use energy

efficiently corresponding to the state of the art technology. This pilot project has shown promising results so far.

6

Saving Energy in Offices and Public Relations Work — **Huser, A.**

The power consumption of more than 300 office devices was measured and the interesting results of this test were made available to the public by means of a large information campaign.

7

Swiss Bank Corporation's Environmental Strategy: The strategy and the first year of implementation — **Knecht, F.**

The corporation has formulated clear cut ecological goals. Environmental awareness is part of corporate identity. In the first year of implementation all material and energy balances were examined with regard to environmental compatibility, The results will be published soon.

8

Important Findings and Conclusions Concerning the Relation between Frequency of Switching Cycles and Reliability of Electronic Devices. (in German) — **Miteff, L.**

ETH Zurich, 11.12.1992, (Appendix B of the study "The secret waste of energy", see page 3)

Four devices (fax machine, photocopier, video recorder, PC monitor) were tested to find out whether the frequency of switching on and off (manually or automatically by power management) influences reliability and life cycle of the devices and of individual components. Electric and thermal stress were examined.

9

"One Watt after one Hour in one Year", a Travel Report from North America and personal remarks on the introduction in Europe. NUTEK, Department of Energy Efficiency, Stockholm, February 1993 — **Molinder, O.**

A report about the development and the introduction of energy saving office equipment worldwide with the emphasis on monitors, PCs, printers and copiers. Formulating goals is important since technological development progresses so fast that goals are often reached more quickly than would have been expected. As a general objective regarding power consumption of office equipment NUTEK stipulates: one watt (in the sleep mode) after one hour (of non-utilization) in one year (of technological development).

10

Market-oriented Communication in the Energy Sector — **Pfisterer, M.**

Within five years the Bernese power company built up an energy saving club with more than 50,000 members. The experience shows that this helped in bringing about a more rational use of energy.

11

Prechtl, H. **Stand-by Losses of Office and Consumer Electronics Equipment**

In Switzerland the energy losses of the most common office and consumer electronics devices were analysed and a projection was made. The stand-by losses of all devices that were tested account for roughly 2% of the total yearly consumption of electric energy, i.e. roughly 900 million kWh in 1990. Between 50 and 70% of these losses could be avoided by corresponding measures.

12

Roturier, J. **Energy-Efficient Office Technologies in Europe - OT3E: an EC Project and a Tool in a World Market**

OT3E is an EC financed analysis of office technology carried out by a team of scientists from various european countries. Starting point of this study is an estimate that with technology unchanged an additional 10 GW of electric power would be needed in western european countries. Technological improvements could increase the efficiency of computers by factor 3. Apart from low power consumption these technological improvements have a few other advantages: lower costs of investment, less environmental pollution, better electromagnetic compatibility, better audio, thermal and visual conditions at places of work. The OT3E aims at international cooperation in order to reach this goal.

13

Schmitz, R. **Standards and Target Values in Switzerland**

Based on a plebiscite the Swiss authorities are elaborating a number of standards and target values for the energy consumption of office and consumer electronics equipment. Testing procedures and target values already exist for copiers, TV sets and fax machines and are prepared for PCs, video recorders and printers.

14

Spreng, D. **Evaluation of Energy Saving Programmes**

The use of energy never is an end in itself but always serves some purpose. Therefore there is a discrepancy between energy saving as an important political issue and the comparably little practical significance in everyday business life. Measures in the framework of energy politics and private activities should contribute to translating these issues into action in everyday life. Such programmes must be evaluated with suitable methods.

15

Walhof, B. **Energy-Audits in Computer Centres and Office Buildings**

Novem, the Netherlands agency for energy and the environment, carries out energy saving programmes mainly on behalf of the government. Data acquisition and data processing have not been completed yet. The Dutch environmental plan NMP+ aims at decreasing power consumption in office buildings by 30% from 1989 to 2000.

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