Managing Utility Costs in a Health Care Facility

Effective measures to reduce high utility costs and manage energy usage

The objective of this document is to provide guidance to energy and facility managers of hospitals and other institutions on ways to reduce energy usage and diminish high utility costs.

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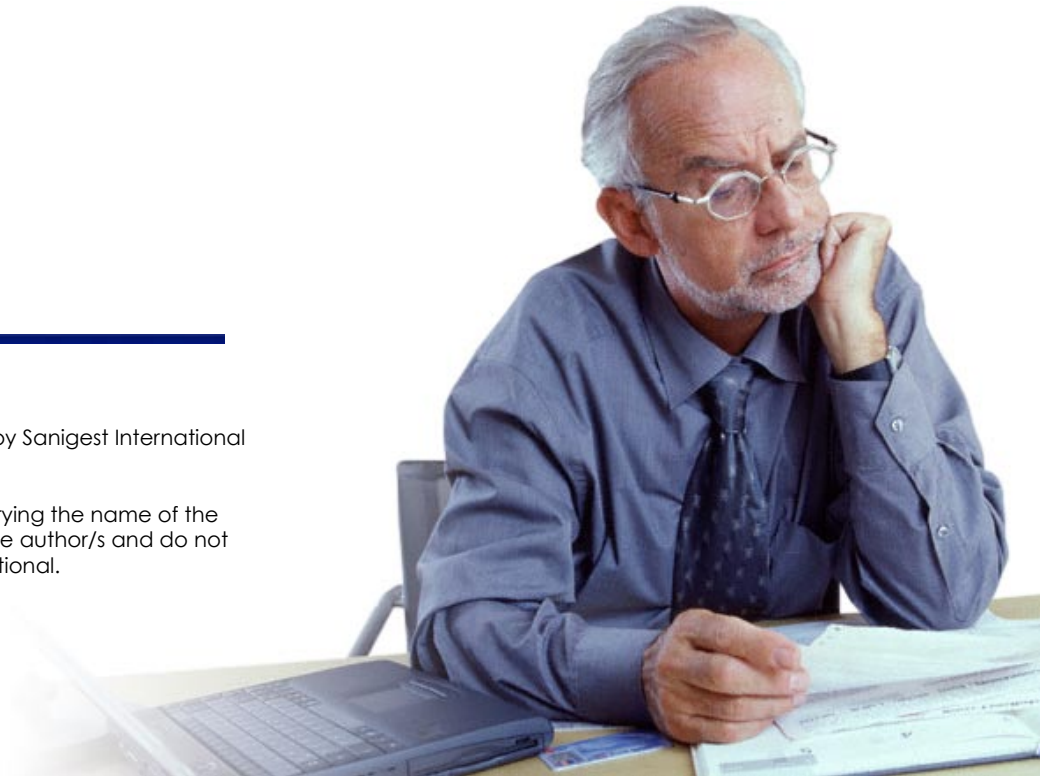

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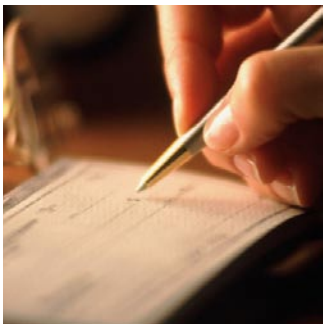
Introduction

With recent changes in health care funding, every organization is looking for ways to slash operating costs and manage energy usage, especially in today's competitive market. Pinpointing methods to control energy costs has been a priority for facility managers for years, and energy management has been a concern since the energy crisis of the late 1970's (Cotton,1999).

In fact, hospitals spend an average of **14.9 euros on electricity** and **4.3 euros on natural gas per square meter (m2)** (*Managing Energy Costs*, 2004). The good new is utility costs can be managed and controlled by performing the following **six cost saving steps**, including careful bill auditing, implementation of energy management systems, surveillance of equipment maintenance, improvements in lighting efficiency, increased employee awareness, and the introduction of electrical deregulations. In turn, facility managers will be able to cut utility costs and gain a financial advantage for their hospitals.



Step 1:
Bill Auditing

To begin with, facility managers can reduce utility costs by closely auditing energy bills received from utility companies.

This systematic procedure encourages the auditor to review beginning and ending meter readings to see if these figures coincide with the figures on the bill, recalculate a recent bill to see if the account was billed under the correct rate, research other rates the account may qualify for, as well as look for opportunities to split/ combine meters.

With regard to taxes, auditors should explore possible tax exemptions and verify sales tax rates (Laake, 1998).

Step 2:
Energy Management

Secondly, modern energy management is a complex blend of controlling energy usage and managing costs through various purchasing options. In fact, energy management is required to determine if the correct energy conservation measures are being implemented, as well as ensure that the power being purchased is both cost-effective and reliable (Cotton, 1999). Facility managers must extensively monitor and continually review the performance of various systems to determine if improvements can be achieved. In effect, these improvements will not only reduce energy usage, but also improve performance from a user's standpoint.

- Studies have shown that continuously monitoring a building's energy systems (commissioning) can lead to **reductions of 10 to 15 percent in annual energy bills.** For the typical 9,300 m2 hospital, that is equal to about **28,000 euros in savings per year.**
- Savings typically result from resetting existing controls to reduce HVAC waste, while maintaining or even **increasing comfort levels for occupants.**
- Commissioning usually costs between .45 euros to 3.6 euros/ m2 (*Managing Energy Costs*, 2004).

Explore Laundering Options

The following options are energy efficient ways to reduce the excessive amount of energy consumed while heating water during the laundering process.

- Use ozone laundering – this method removes stains such as Betadine and blood better than traditional systems, as well as saves energy, requires less detergent, and uses much less water. An ozone generator is required, along with more maintenance; however, a **two-year payback period** is often possible.
- Reduce temperatures – laundry can be safely washed at lower temperatures; modern detergents and bleaches allow laundry to be effectively washed at **49°C** instead of the traditional **71°C**.

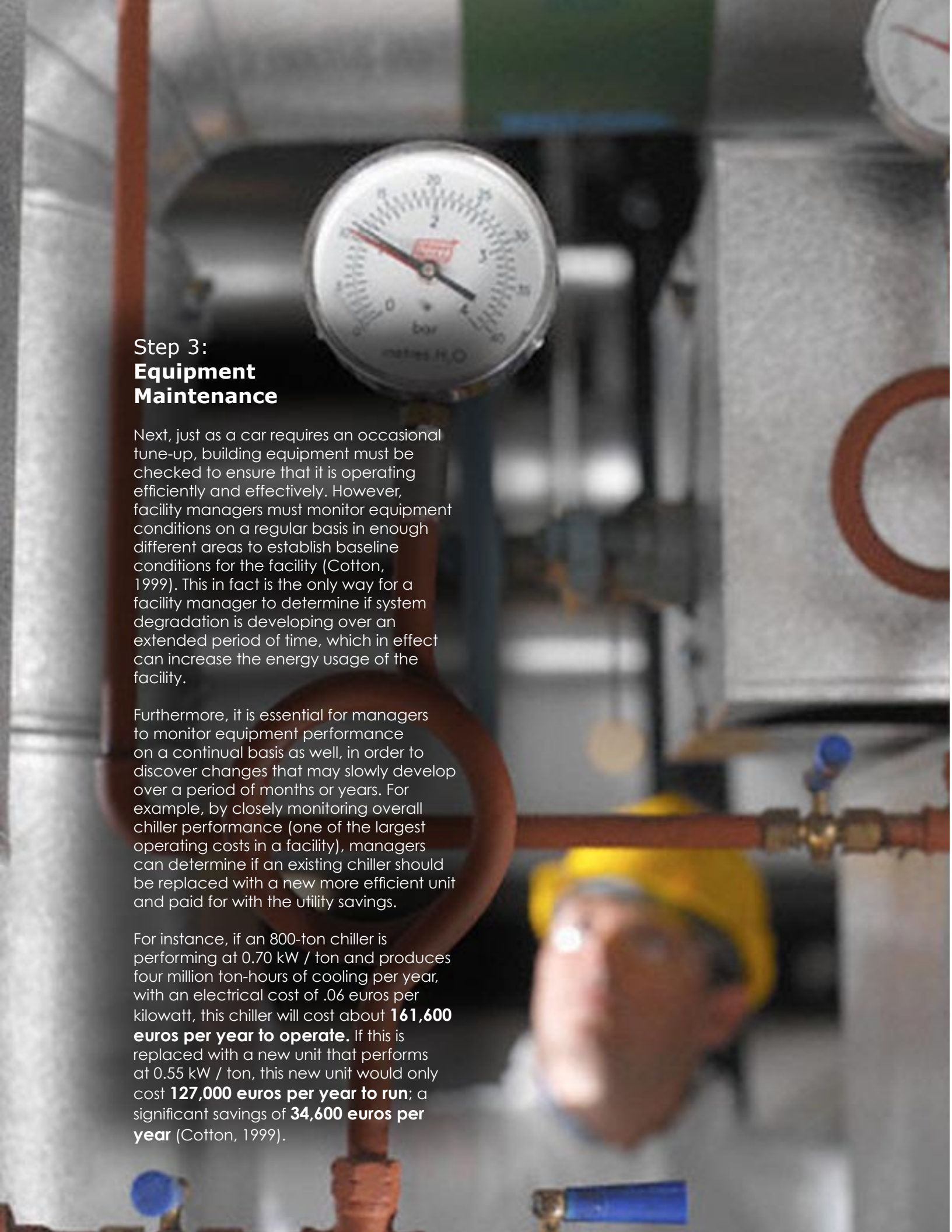
- Recycle water and heat – **saves heat energy and reduces water bills**
  - A storage tank can be used to extract heat energy from a washer's wastewater to preheat incoming raw water.
  - The final rinse water can be recovered in a holding tank and used for the first wash cycle of the next dirty load.
  - Microfiltration systems can remove particles as small as 0.5 microns from wastewater, so that water can be reused (*Managing Energy Costs*, 2004).

Consider Cogeneration and Sources of Heat Recovery

Cogeneration systems provide both heat, for space or water heating, and power; these systems offer **more savings to hospitals than for any other class of commercial building.** Likewise, advanced incineration systems can be installed to destroy medical waste; capturing and using the waste heat from the incinerators is extremely cost-effective. Using these two systems in conjunction with one another can significantly reduce utility bills, for example:

- The University of Michigan saved **330,000 euros in yearly steam bills** by coupling medical waste incinerators with cogeneration (*Managing Energy Costs*, 2004).

Waste heat from boiler exhaust stacks can also be effectively recovered and used to preheat boiler makeup water.



Step 3: **Equipment Maintenance**

Next, just as a car requires an occasional tune-up, building equipment must be checked to ensure that it is operating efficiently and effectively. However, facility managers must monitor equipment conditions on a regular basis in enough different areas to establish baseline conditions for the facility (Cotton, 1999). This in fact is the only way for a facility manager to determine if system degradation is developing over an extended period of time, which in effect can increase the energy usage of the facility.

Furthermore, it is essential for managers to monitor equipment performance on a continual basis as well, in order to discover changes that may slowly develop over a period of months or years. For example, by closely monitoring overall chiller performance (one of the largest operating costs in a facility), managers can determine if an existing chiller should be replaced with a new more efficient unit and paid for with the utility savings.

For instance, if an 800-ton chiller is performing at 0.70 kW / ton and produces four million ton-hours of cooling per year, with an electrical cost of .06 euros per kilowatt, this chiller will cost about **161,600 euros per year to operate.** If this is replaced with a new unit that performs at 0.55 kW / ton, this new unit would only cost **127,000 euros per year to run**; a significant savings of **34,600 euros per year** (Cotton, 1999).

Maintaining the HVAC System

Making sure the HVAC system is regularly cleaned and serviced can help prevent costly heating and cooling bills, for example:

- Economizers not regularly checked can potentially **add as much as 50%** to a building's annual energy bill by allowing hot air to enter during the air-conditioning season and cold air to enter during the heating season.
- Cabinet panels on rooftop air-conditioning units not checked on a quarterly basis can cost **82 euros per year** in wasted energy per rooftop unit if chilled air leaks out (*Managing Energy Costs,* 2004).

Other Simple Maintenance Measures to Reduce Utility Costs

Utility costs can also be substantially reduced by checking on various areas and equipment often easily overlooked. By performing the following simple and quick routine maintenance, utility costs can be significantly reduced:

- Change filters on a monthly basis; however, if the facility is located next to a highway or construction site where the air is much dirtier, change the filters more often.
- Inspect condenser coils quarterly for debris. Thoroughly wash the coils at the beginning and end of the cooling season.
- Monitor air conditioning temperatures. Check the temperature of the return air going to the air conditioner, then check the temperature of the air coming out of the register nearest the ac unit. If the temperature difference is less than -**10°C or more than -6°C**, have a licensed technician inspect the unit.
- Check for air flow. If there is little air flow or dirt and dust in the air registers, have a licensed technician inspect the unit and duct work (*Managing Energy Costs*, 2004).

Step 4:
Lighting

Furthermore, improvement in lighting quality and efficiency is one of most evident energy conservation measures a facility manager can employ.

The most recent strategy is to take advantage of load management options, such as daylight harvesting, occupancy control, and manual dimming that reduce energy usage even more during peak periods (Cotton, 1999). New occupancy controls can be found on the market as well, which analyze the occupancy activity and adjust to meet the needs of the area.

Another new trend is to move from the outdated on-off system and set up areas with a high-low system, to not only conserve energy, but also create a friendlier work environment (Cotton, 1999). Further savings can be achieved by implementing the following specific measures:

- A **90% drop in energy consumption** can be achieved by replacing 30-watt bulbs with 2,5-watt light-emitting diodes (LED) for exit signs and emergency lighting; these lights have a **longer service life** (Charles, 2003).

- A **35% reduction in energy consumption** can be achieved by replacing T12 fluorescent lamps with modern T8 lamps and electronic ballasts (*Managing Energy Costs*, 2004).

- A **65% reduction in energy consumption** and a savings of up to **16.5 euros per lamp** can be achieved by replacing incandescent lamps with compact fluorescent lamps (CFLs) (*Managing Energy Costs*, 2004).

- **Paybacks of one to three years** can be achieved by adding specular reflectors, new lenses, and occupancy sensors or timers (*Managing Energy Costs*, 2004).

- A **5% reduction in total electricity consumption** can be achieved by upgrading lighting systems, which also extends the useful life of equipment and reduces human resource requirements (Charles, 2003).

Step 5:
Employee Awareness

Many hospitals have tight facility budgets, so low or no cost reductions in energy expenditures are especially important and can be accomplished by creating awareness among employees on innovative energy conservation techniques. By communicating an energy management policy to all employees and encouraging their involvement through training and participation, energy bills can be **reduced by approximately 2%** (Charles, 2003).

- Every 1,000 kWh that is saved by turning equipment off or down (computers, lights, air-handling units) can generate a **savings of 82 euros off utility bills** (assuming average electricity costs .08 euros / kWh) (*Managing Energy Costs*, 2004).

Turning equipment off:

- Use "smart" power strips with built-in occupancy sensors to shut off plugged-in devices when not in use. Desktop computers, monitors, and shared printers draw about **200 watts**; the monitor alone draws about **100 watts**.
- Shut off large fan systems serving areas unoccupied at night, including cafeterias, offices, and educational areas, etc (*Managing Energy Costs*, 2004).

Turning equipment down:

- Install occupancy sensors or manual switches to reduce the operating speed of supply and exhaust fans of air handling units when rooms are unoccupied; however, make sure air pressure relationships are maintained.
- Install programmable thermostats to turn room temperature up in the cooling season and down in the heating season during hours of no occupancy (*Managing Energy Costs*, 2004).

Step 6: **Electrical Deregulation**

Moreover, the restructuring of the electric and gas industries will forever change the way electricity is purchased. Deregulation will allow a facility to purchase electricity from the local utility company or negotiate with several utility companies to establish a price that is most suitable for the facility (Cotton, 1999). To get ready for the launch of deregulation, facility managers will need to complete a comprehensive analysis of the energy usage of their facilities to ensure they will select the most cost-effective and reliable energy service.

With the deregulation of electricity, several methods of variable pricing will become available, such as real-time pricing. In effect, facility managers will be able to take advantage of hourly pricing contracts or buy energy through spot markets, which can significantly reduce electrical costs when compared to a conventional rate structure (Cotton, 1999).

Energy Innovators

It is never easy to reduce operating costs at institutional facilities; however, Kingston General Hospital and Moscow City First Clinical Hospital implemented effective energy conservation plans to reduce energy usage and in turn save a significant amount in utility bills. The following text gives a brief overview of both hospitals, as well as the energy audit summary outlining the specific potential saving measures in Moscow City First Hospital.

Kingston General Hospital

The 150-year-old Kingston General Hospital (KGH) in Kingston, Ontario, houses about 450 beds and 13 buildings with a total floor area of more than 93,000 m2 (1 million sq. ft.). In 1998, KGH undertook a detailed energy audit that proved to be a real eye-opener for management and building operation staff. It revealed many savings opportunities that could not be overlooked.

The energy audit identified at least **35 areas** in which improvements to building operations could be made, most of them very cost-effectively.

The KGH was spending about **2,100,000 euros on energy**, including:

- 1,224,000 euros on electricity
- 755,000 euros on steam
- 110,000 euros on water

The energy audit identified potential savings of about **163,000 euros per year,** for an initial capital cost of just over **815,800 euros**. The investment would thus pay for itself in only five years (*Kingston General Hospital*, 2001).

Moscow City First Clinical Hospital

The Moscow City First Clinical Hospital was built in the 20th century. Today it's the largest hospital facility equipped with 1,187 beds and with a patient clinic for 269,000 receptions per year.

Heat is supplied to the hospital by a Central Heat Supply Unit - a subscriber of the Heating Network of "Mosenergo".

The energy audit of the Moscow City Hospital showed the following information:

- Real energy consumption exceeds **two times**, and in some buildings **four times, the calculated energy consumption.**

- Overheating of buildings is caused by a lack in the regulation system of supplying heat in buildings depending on outside temperatures, as well as hydraulic non-stability of heating networks, i.e. overheating or under heating of some buildings.

- Heat costs of the hospital amount to about **254,000 euros** or **60% of total energy costs.**

According to the estimates of the energy audit conducted by ESCO "Negawatt", there is a potential energy and water savings amounting to:

- 31,000 GJ - for heat
- 665 MWh - for electricity
- 41,000 m3 - for water

The project includes implementation of the following energy saving measures:

- Installation of an automatic control system for regulation of heat supply
- Hydraulic balancing of heat demand loads
- Introduction of energy management for **no and low cost measures**

The project aims at saving heat energy through achieving uniform and adequate heat supply for various buildings, flows, and rooms depending on outdoor climatic conditions; benefits of the project include the following:

- reduction of energy costs
- reduction of maintenance costs
- increased lifetime of equipment
- higher comfort level for staff and patients
- reduction of secondary infection risks
- reduction of hazardous pollutant emissions

(*UN ECE Energy Efficiency*, 2006)

The following tables detail the measures to be implemented as part of the energy conservation project in Moscow City First Clinical Hospital, as well as reveal the associated project costs and the annual net savings.

Table 1. Profitable Measures to be Implemented

Measure	Positive Effect	Heat Savings
Installation of 13 balancing valves, area "A" and "B"	Ensure precise heat supply regulation	3500 GJ
Installation of water saving valves	Reduce hot and cold water consumption by 20% (26 600 m3) without lowering comfort level	2100 GJ
Installation of radiator valves in buildings of area "A" and "B"	Reduce heat consumption by 7%	5000 GJ
Installation of regulating valves on standpipes of the heating system of buildings in area "A" and "B"	Ensure equal distribution of horizontal heating demand	7000 GJ
Automated heat supply in building 7, area "B"	Regulate heat supply depending on the inside and outside temperature	6600 GJ
Utilization of heat of ejection air by recuperative heat exchangers in building 7, area "B"	Enable the reduction of heat loss and air humidity; avoid draft indoors and the impact of harmful substances from the outside	2400 GJ
Automation of heat and hot water supply systems and feeding system in CHSU, area "B"	Maintain temperature of a heat carrier in a feed and reverse pipeline depending on the outside temperature and fixed temperature	2500 GJ
Adjustment of regulator in Central Heat Supply Unit, area "A"	Ensure more effective operation of automated regulation system	-

Lifetime of project: 4 yrs

Source: UNECE EE 21

Table 2. Project Costs

Total project costs will amount to 82,100 euros. Cost articles are given in the table below.

Activity Total	Euros
Design and Planning	3 500
Project Management	15 600
Components	34 400
Installation	19 500
Technical Guidelines	6 300
Monitoring and Commissioning	1 600
Miscellaneous	1 200
Total Investment (*)	**82 100**
(*) excl. financial costs	

Source: UNECE EE 21

Table 3. Annual Net Savings (amount in m3, GJ)

Saving Elements	Present Situation		After New Measure		Net Savings	
	amount	euros / yr	amount	euros / yr	amount	euros / yr
Heat (centralized), GJ	148 200	291 928	115 350	227 200	32 850	64 708
Water Savings, m3	325 700	50 918	299 700	46 854	26 000	4 065
Operation / Maintenance				1 798		-1798
Total Net Savings						**66 975**

Source: UNECE EE 21

Comments:

Heat = 1.97 euros / GJ
Water = .16 euros / m3
In addition to the specified cost reductions, installation of the heat regulation system achieves the following:

- Improvement in comfort level for patients and personnel
- Renewal of the equipment over-haul period
- Reduction in secondary infection risks
- Reduction of load on electric heating

Conclusion

From lighting to energy management systems to deregulation and more, facility managers have an array of options to choose from to reduce utility budgets. The need for managing and controlling energy usage has become essential in today's competitive market. Often times the benefits that result from an energy management program are overlooked, but as the health care field continues to change, this will be a key area of concern.

Energy management can range from simple inexpensive changes to major modifications that involve a detailed study, but for the program to be successful it must consist of support from top management, short- and long-range goals, and an ongoing energy tracking and record keeping system (Cotton, 1999). By following the six energy saving steps outlined in this document, facility managers will be able to cut utility costs and gain a financial advantage for their hospitals. Remember in today's market, the management of energy is more complicated and changing more rapidly than ever before.

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