

2007 Grand Prize of Minister of Economy, Trade and Industry

## Case Example of Energy Conservation Activities in Nagoya University

Nagoya University  
Facility Management Division, Facility Management Department

### Keywords: Energy management structure for each facility

Rationalization of heating, cooling, and heat transfer  
(air-conditioning facilities, hot water supply facilities, etc.)

Prevention of energy loss due to radiation, conduction, resistance,  
etc. (Prevention of electricity loss due to resistance etc.)

Rationalization of conversion of electricity to motive power, heat, etc.  
(lighting facilities, elevator machines, office equipment, and  
consumer equipment)

### Outline of Theme

Nagoya University is designated as a type 1 designated energy management factory and the Global Warming Solutions Act and Global Environment Preservation Code are applied, so we are socially responsible to reduce energy consumption and CO2 emission for global environment preservation. Based on these circumstances, we introduce the actual condition of our energy consumption and energy conservation activities.

### Implementation Period for the Said Example

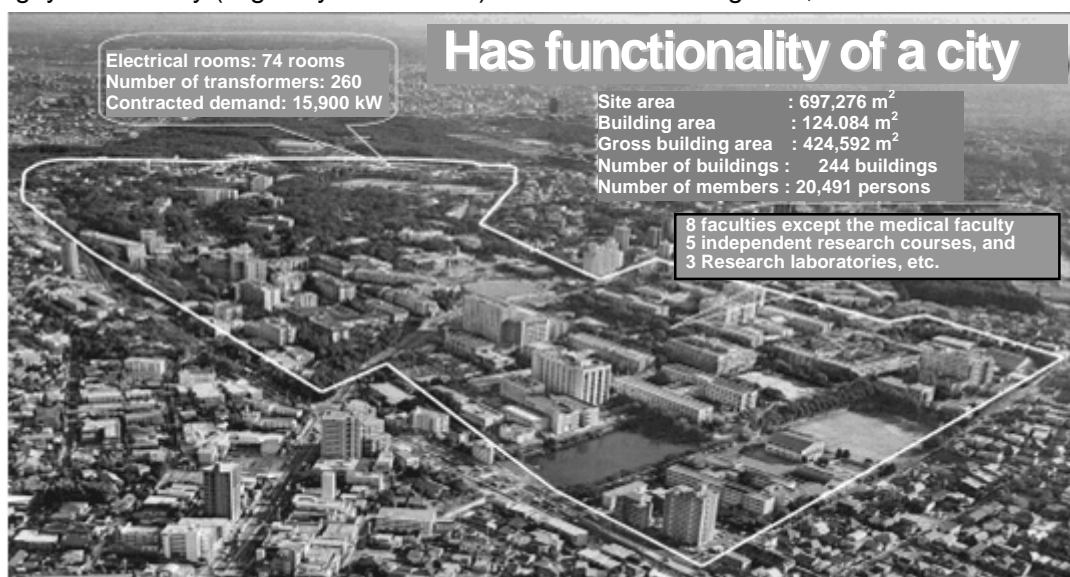
- Planning period November, 2004 - on going
- Implementation period November, 2004 - on going
- Effect verification period November, 2004 - on going

## Outline of the Business Establishment

- Detail of this establishment: University (education and research institute)
- Number of employees: faculty members: 3,349 students: 17,142 (including graduate students and foreign students)
- Type1 designated energy management factory

## Overview of Target Facilities

Nagoya University (Higashiyama District): Area of the building: 424,592 m<sup>2</sup>



### 1. Reasons for Theme Selection

Energy conservation measures in universities are considered to be different and to be more difficult than energy conservation measures in factories and general offices. There are few facilities that consume large amount of energy, but there are a large number of relatively small power consuming equipments (freezers and OA devices), which pushes up the basic power consumption. It is difficult to control these equipments according to a plan and hardware and management and operation of these equipments depend on the faculty members and students, who are not specialists of energy management. These are the reasons why energy conservation is difficult in universities.

The Energy Conservation Law imposes social responsibility on Nagoya University to reduce energy consumption (unit : m<sup>3</sup>·kWh/m<sup>2</sup>) by 1% or more annually compared with the previous

fiscal year. In addition, the University is required to submit “Global Warming Solution Plan” that describes emission of greenhouse effect gases by business activities, measures and target of reducing emission by a Nagoya City Code (abbreviated name: Environment Preservation Code). With such backgrounds, our presentation theme is efforts on energy management, organization and methods, specific achievements in Higashiyama District that contains 8 faculties, 5 independent research courses, and 3 research laboratories (excluding Tsurumai District that has a hospital and the Medical School).

## **2. Energy Management Promotion Organization**

As an organization that promotes energy management in the University, there is “Facility and safety committee” that is the core committee for university operation. Under this committee, an all-campus organization “Facility management committee” has established and which consists of representatives of agencies who is responsible for energy management to form campus-side consensus on energy management and energy conservation promotion activities. To complement and enhance the above committees, on the other hand, as an organization to research, study, and plan more effective energy conservation measures, review how energy management should function, introduce energy conservation measures on a trial basis and verify them in an investigative manner, “Energy Management Study and Investigation Commission”, consists of researchers in sciences and arts and administrative and technological staff, is established to make efforts on energy management and give presentations and reports on the accomplishment of activities to inside and outside of the university under the administration officer in charge of facility and safety. (See Fig.1)

## Energy Management Promotion Organization

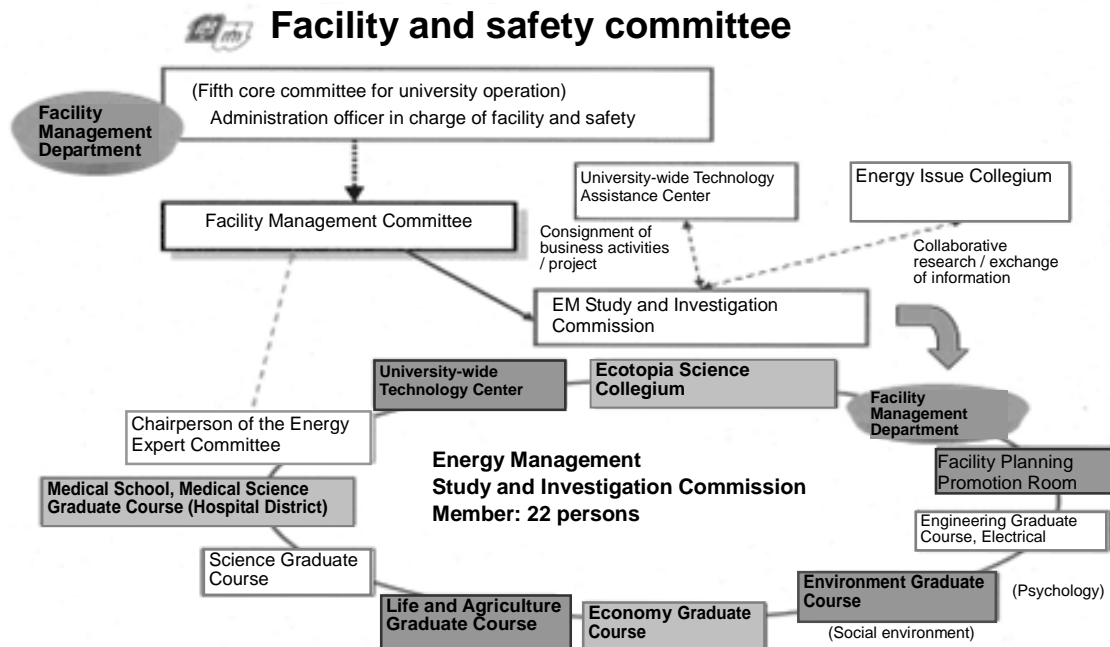


Fig.1

Specific activities of “Energy Management Study and Investigation Commission” are as follows (2005 – 2006):

- Proposal of energy conservation measures on freezers and refrigerators for experiments and consciousness survey on possibility to conserve power consumption
- Verification of effects of efficient improvement of large space air-conditioning by an air agitator system
- Trial of measuring energy consumption and evaluation for introducing beneficiary liability system
- Verification of effects of energy conservation enlightenment equipments for end users (introducing energy conservation goods, etc.)
- Verification of energy conservation capability of LED lighting
- Practice and evaluation of energy conservation enlightenment methods
- Energy-conserving control of lighting and air-conditioning facilities
- Holding presentations on research achievement and publishing achievement reports

In addition, we have established an internal code to promote energy conservation in the University (“Code on rationalization of energy consumption in Nagoya University”). Also we have established "Energy Management Manual" in Higashiyama and Tsurumai Districts, and heads of departments has been assigned as the person in charge of energy management.

### 3. Work flow of Energy Management

As methods to promote energy management, we took “understanding the current situation” as a key word and started with understanding the actual condition of energy consumption, and then summarized the actual condition of energy consumption of major five districts (Higashiyama, Tsurumai, Taiko, Togo, and Toyokawa) in the past three years and monthly usage of each year, and posted them on the home page of facility management department as energy information to improve energy conservation awareness and interest in energy bills of all members of the University. (See Fig.2 and Fig.3)

## Work flow of Energy Management

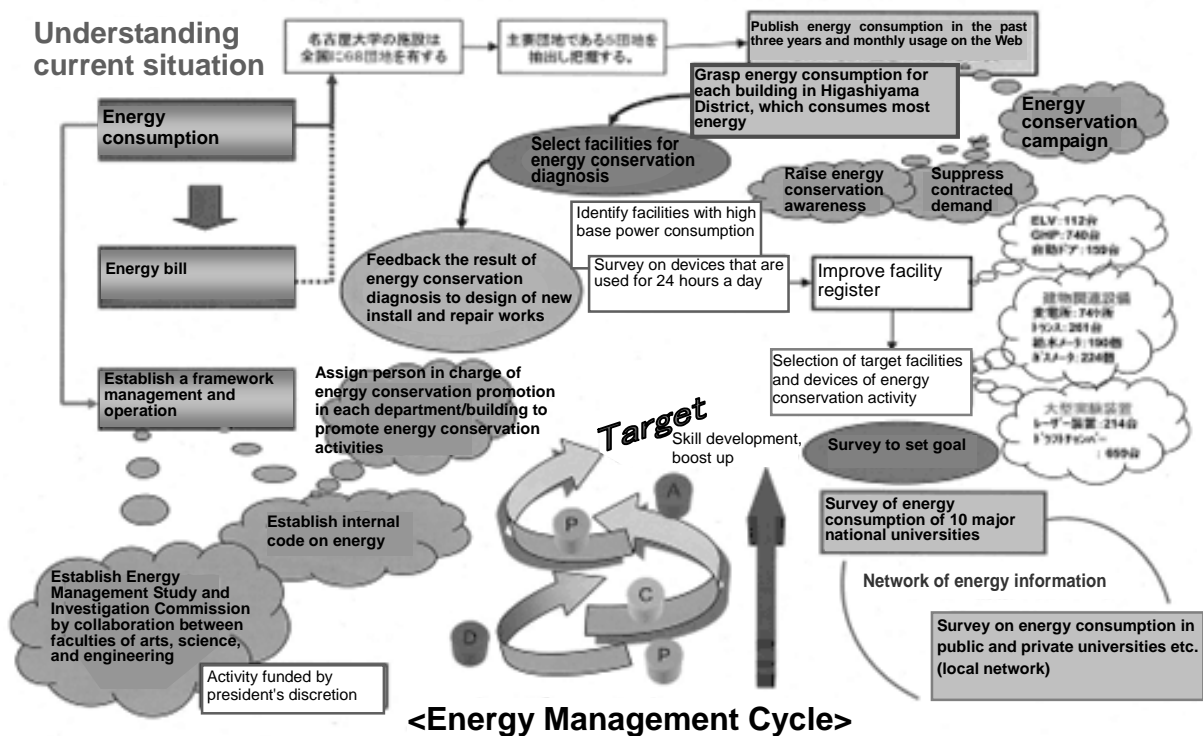


Fig.2

■ Energy information (usage situation etc.)

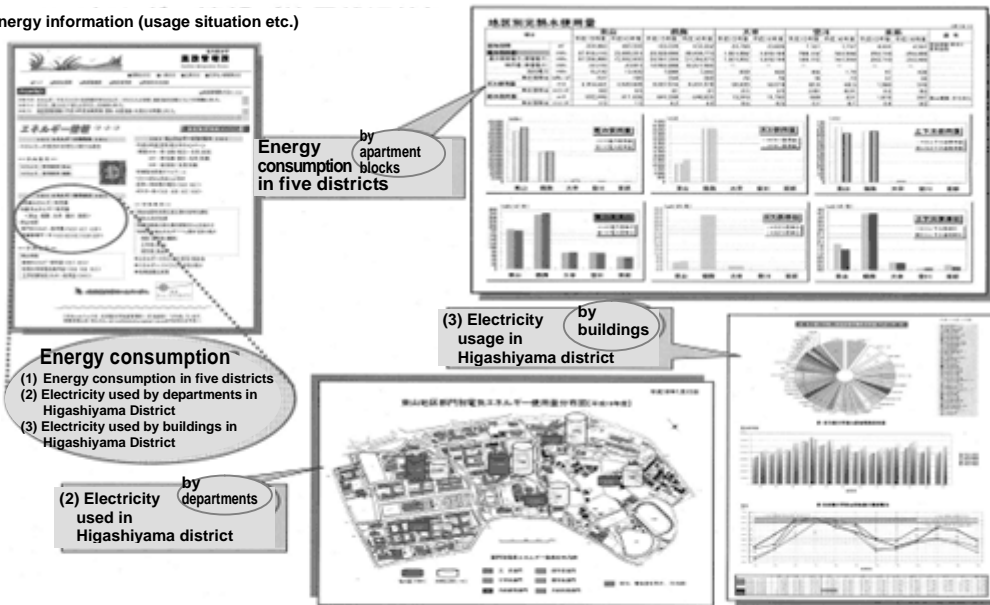


Fig.3

From the actual condition of electricity usage, we found that the base power consumption is pretty high. So, we identified buildings and facilities with high power consumption and investigated the actual condition of usage 24 hours a day (energy conservation diagnosis). (See Fig.4)

**Energy Consumption in Higashiyama District**

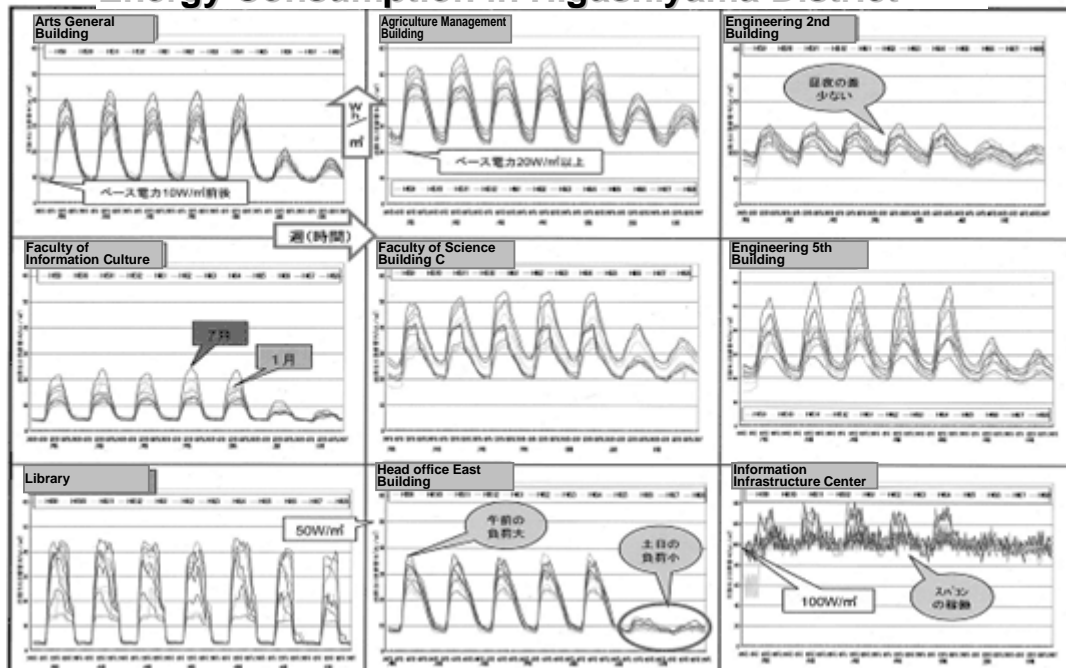


Fig.4

Then, based on the result, we researched equipments that are used for 24 hours a day in buildings and facilities with high power consumption. We found out the types and numbers of base operation equipments that are used for experiments and studies characteristic to each department and we identified target equipments of energy conservation activities. (See Fig.5)

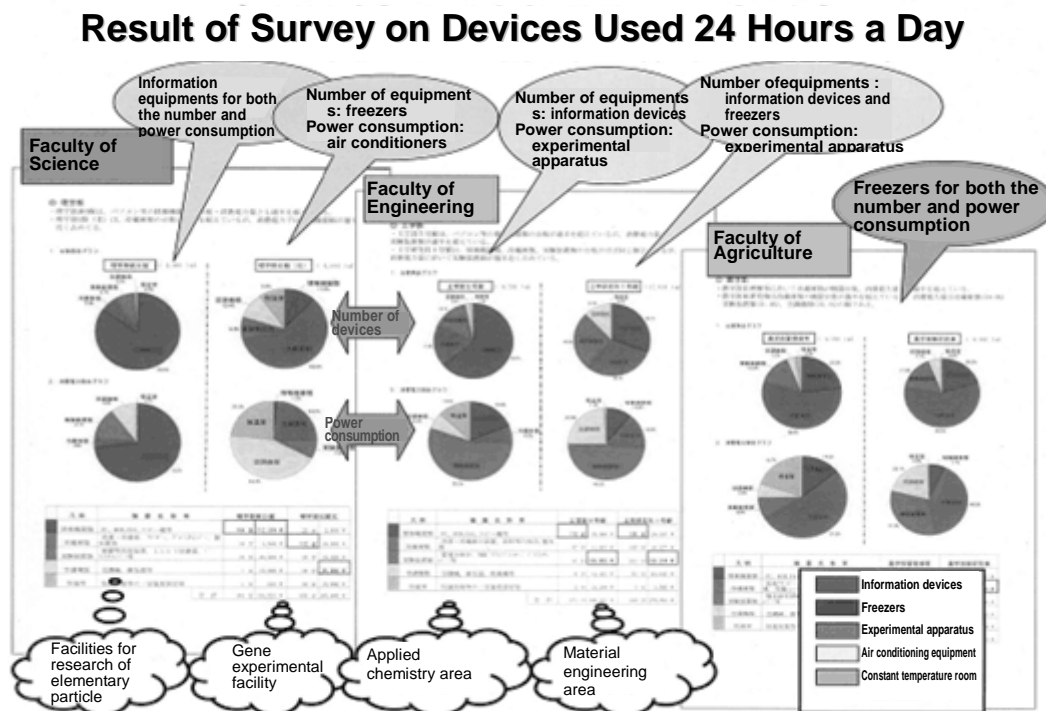


Fig.5

To continuously improve the cycle of energy management (spiral loop of PDCA), we conducted survey of actual conditions of energy consumption and specific unit (per area) in 10 major national universities of similar sizes of our university as benchmark, which enabled us to study the reference and target of energy conservation.

#### 4. Example of Energy Management

- Request of power saving to suppress contract demand at the peak time of power consumption in summer was made utilizing web pages and internal e-mails. We have run energy conservation campaign including asking to stop air-conditioning for 30 minutes by dividing the area into four blocks. (See Fig.6)

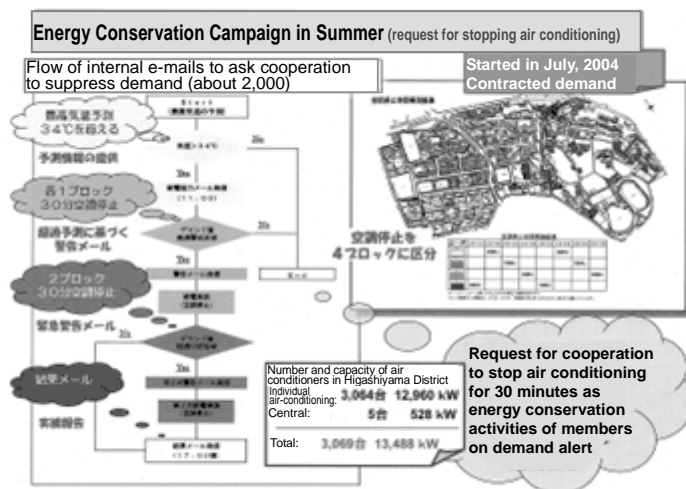


Fig.6

- To reduce standby electricity, Higashiyama District planned the elimination and consolidation of transformers and replaced with high efficiency type transformers in 2004 and set a goal to reduce the number of transformers from 260 to 221.

As of 2006, the number is reduced to 228 including replacement and update. When the plan is implemented, 1,160 MWh and 520ton of CO<sub>2</sub> can be reduced in a year. (See Fig.7)

	Former JIS	Current JIS	Top runner transformer	Total
Trend of number of transformers <2003 - 2005>				
FY 2003	71	167	22	260
FY 2004	60 (▲11)	164 (▲3)	27 (+5)	251 (▲9)
FY 2005	58 (▲1)	154 (▲12) (+1)	29 (+2)	241 (▲10)
Elimination and consolidation plan after FY 2006				
FY 2006	51 (▲7)	147 (▲8)	31 (+2)	228 (▲13)
FY 2007	34 (▲17)	138 (▲8)	49 (+18)	221 (▲7)

After 2008, we plan to replace the former JIS to top runner transformers as a countermeasure against aging of infrastructure

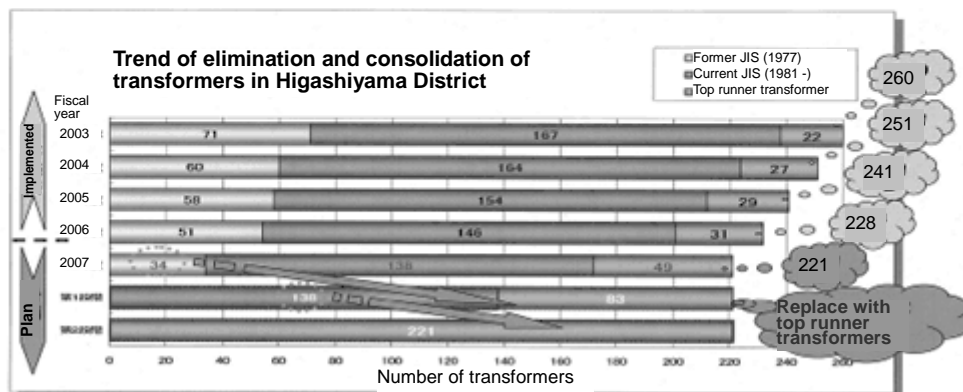


Fig.7

In addition, we measured standby electricity of PCs, TVs, copiers, electrical pots, and electrically warmed toilet seats, etc. that are used daily, calculated expected reduction and made posters to call for specific energy conservation activities. (See Fig.8)



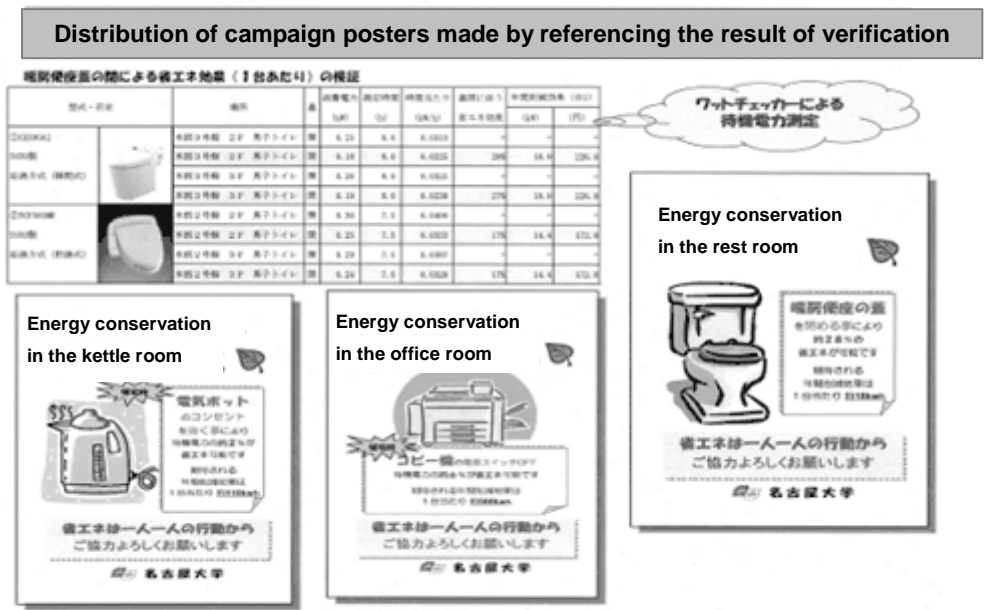


Fig.8

- We conducted research on optimization of set time (set time: 10, 6, 5, 4, 3, 2, 1 minutes) for lighting with motion sensors that was introduced as a part of energy conservation system when the restrooms were repaired to verify energy conservation rate. (See Fig.9)

**Research and verification on optimization of set time of motion sensors for lighting**

- Purpose: To review light bulb life by the number of times to turn on lighting and optimization of operation retain time
- Period of measurement for research: Monday, Oct. 30, 2006 - Friday, Feb. 2, 2007 about 98 days (excluding Saturdays, Sundays, holidays, and new year holidays)
- Location of measurement for research: Men's restrooms in the head office 3rd building (14 constant users + visitors)
- Overview of the toilet facility: Western style toilet bowl (1), urinal (2), wash basin (1), slop sink (1), Downlight (FDL 22W) (4), ceiling ventilation fan (1)
- Method of measurement for research: Visual check using measurement panel (automatic switch with hot wire sensor, accumulative on time meter, accumulative number of time of on/off meter) Measure for two weeks for each setting (10, 6 - 1 minutes)



Fig.9

- The verification of energy conservation effect in general summer holidays (two days)

before and after the Bon Festival) that was introduced in 2005 on a trial basis showed that more people took vacations before and after the general holidays and conservation of 17% of energy usage and about 5 million yen during the week was achieved.

The general summer holidays were enforced this year too, and the same effect could be obtained. (See Fig.10)

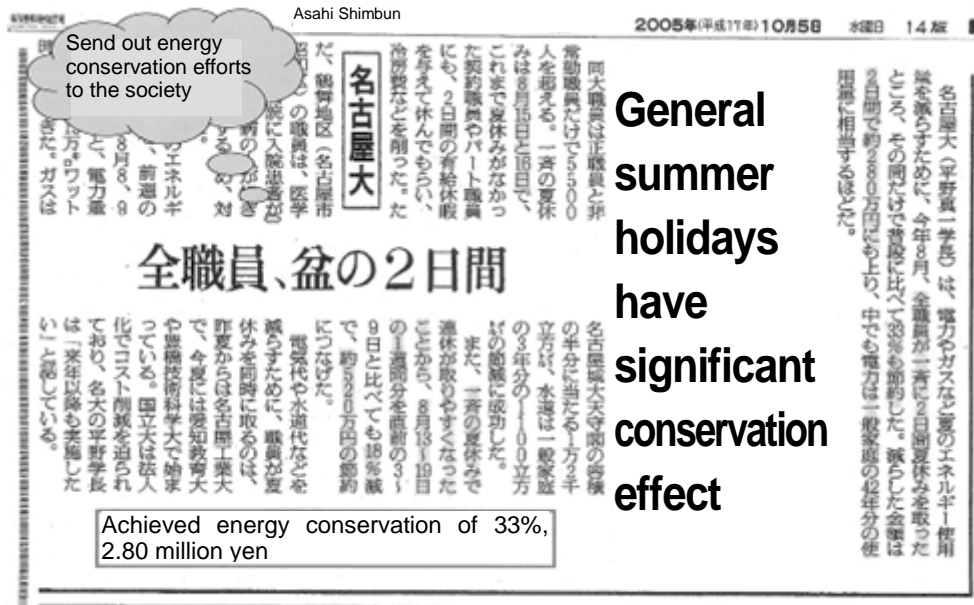


Fig.10 |

- We implemented preset temperature management and a measure to prevent forgetting turn off air-conditioning using remote monitoring of individual air conditioners in lecture rooms, study rooms, and offices and verified its energy conservation effect.
- For new management and repair works, we proactively introduce systems with energy conservation effects.
  - We adopt insulation materials and construction method including rooftop greening, pair glass, thermal barrier paints, and thermal barrier films etc.
  - We adopt high efficiency lighting, high efficiency transformers, and motion sensors, etc.
  - We adopt high efficiency air conditioning machines, water conservation equipments, remote monitoring systems, air agitator systems, etc.
- We invest cost reduced by replacement of older equipments and energy conservation activities. For example, we invest on replacing older transformers with top runner transformers to reduce cost and use the reduced cost for installments repayment. If we replace five lighting (mercury lamp) of gymnastic hall with the latest energy conserving type, longer life and reduction of electricity cost can be achieved. Therefore, we started reviewing for establishment and promotion of internal ESCO system to collect

investment money from related departments in two to three years to enable further replacement with energy conservation equipments. (See Fig.11)

## From Energy Management to Cost Management

### Promote internal ESCO

By changing tracks from burden of expense to "Investment", proactively implement energy conservation and cost reduction

Extract items to conserve based on survey of current situation → Plan ideas for improvement → Implement measures, conservation effect



Fig.11

## 5. Future Challenges

To further reduce energy consumption and contribute to global environment preservation, Nagoya University continues to regularly understand current situation of energy consumption and construct a system to analyze continuously. Furthermore, we plan to publish information on energy consumption and its cost to members of the university to raise awareness of energy conservation and aim to reduce more than 1 % of energy consumption. Using the financial resources obtained by the energy conservation effect, we invest on further energy conservation measures to actively promote cost reduction and link energy management to cost management.

Currently, we calculate energy specific unit using the area of the building as the denominator, but due to development of education and research and promotion of business-academia collaboration, energy consumption is increasing and specific unit is also increasing. Specific unit itself does not precisely reflect the situation of university activities. Therefore, Energy Management Study and Investigation Commission is conducting survey and research on denominator of specific unit that is suitable for the context of the University.