2004 Prize of the Chairman of ECCJ

Measures to Save Energy of Introduction of BEMS and Operational Improvement by ANA Hotel Tokyo

ANA Hotels & Resorts Co., Ltd, Facility Group

◎ **Keyword: Rationalization of heating, cooling, and heat transfer (air conditioning, hot water supply system, etc.)**

◎ Outline of Theme

Measures to save energy starting in fiscal 2001 with national subsidies have obtained far better results than expected, reducing energy consumption equivalent to an annual 86 million yen. These results may be due to an expansion of the concept of energy conservation measures into a broad range of measures for improvement of an operation of hotel equipment exceeding the scope of the initial repair work for energy conservation under the establishment of the Framework for Discovery and Settlement of New Problems featuring the introduction of BEMS and follow-up. With the ANA Hotel Tokyo, we would like to assert the importance of the measures to save energy focusing on operation of hotel equipment and the effectiveness of work.

◎ Implementation Period of the said Example

- Project Planning: June 2000 through July 2001 (14 months)
- Measures Implementation Period: November 2001 through March 2002 (5 months)
- Measures Effect Confirmation Period:
  April 2002 through March 2005 (36 months expected)

◎ Outline of the Business Establishment

- Business line: Hotel
- Employees: 700
- Annual energy consumption : Electricity 20,929,000 kWh
  (Data in fiscal 2003) Cold water (area air conditioning) 36, 113 GJ
  Steam (area air conditioning) 36,219 GJ

◎ Process of Target Equipment

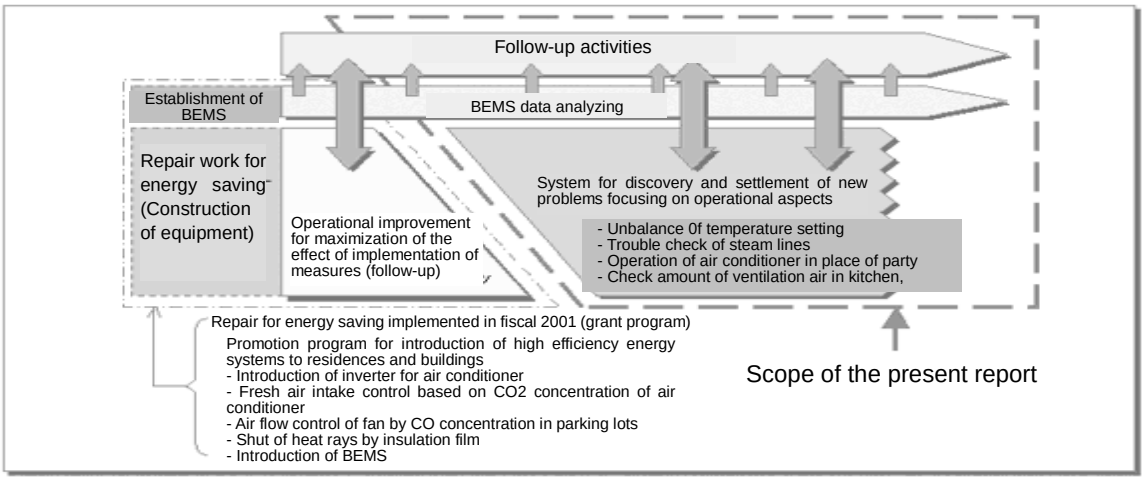

Fig. 1 Process of target equipment

1. Reason for Theme Selection

It is difficult for the hotel business to expect successful energy conservation measures that have an underlying risk of damaging image and loosing customers due to complaints of hotel users even about insignificant unpleasantness toward environment. More consideration to environment of guest rooms is required from the hotel business than public office facilities and buildings for business use. Comfort-oriented operations tend to prevail over energy saving operations. The hotel is open for 24 hours throughout a year, and air conditioning is operated for a longer time resulting in a higher level of specific energy consumption compared to buildings for general use.

Given this background, we focused our target on energy conservation measures avoiding wasteful energy consumption while maintaining a pleasant environment. We considered that a positive operational improvement can be achieved maintaining an appropriate scope of the operation through the introduction of BEMS to secure a quantitative and persuasive grasp of the current status and create opportunities (follow-up working) of active working-level discussions about applicable measures.

2. Understanding and Analysis of Current Situation

(1) Understanding of Current Situation

Fig. 2 shows a transition of energy consumption by ANA Hotel Tokyo from fiscal 1990 through fiscal 2000 (total 11 years). The average energy consumption and average specific

energy consumption for the above period are as follows:

- Maximum (fiscal 1991) …… 383,773GJ
- Minimum (fiscal 1995) …….. 357,654GJ Difference: 26,119GJ

(2) Analysis of Current Situation

The fluctuation range of energy consumption during the period from fiscal 1990 through fiscal 2000 is about 7.0% against the average energy consumption during this period.

- Maximum (fiscal 1991) …… 383,773GJ
- Minimum (fiscal 1995) …….. 357,654GJ Difference: 26,119GJ

This fluctuation is considered to depend on weather conditions and hotel occupancy rates, and no particular energy conservation measures were taken in this period.

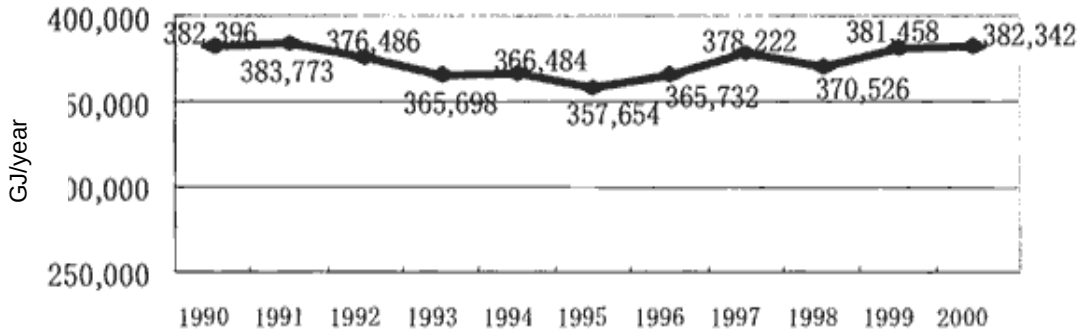

Fig. 2 Changes in energy consumption (from fiscal 1990 through fiscal 2000)

3. Progress of Activities

ANA Hotel Tokyo performed repair work for energy saving using national subsidies in fiscal 2001.

Subsidy system utilized: promotion program of the introduction of a high-efficiency energy system to residences and buildings

Description of measures: Introduction of inverter for air conditioning

Fresh-air intake control of air conditioners based on CO_2 concentration

Air volume control of fans based on CO concentration in parking lots

Ultraviolet reduction with insulation film

Introduction of BEMS

Others

Follow-up working group was organized to review operational aspects to maximize the effect of repair for these facilities, and optimized using of BEMS data and grasped quantitatively scale of effect were. These activities have been fully acknowledged for a broad review of operational issues, and led to the Framework for Discovery and Settlement of New Problems exceeding the scope of the initial repair work for energy saving.

- In this application, we will try to attract interest in implementation of our attitude for follow-up, not implementation for facility repair work.
- We will try to attract interest in the nature of the measures taken regarding clarified targets outside the scope of the initial repair work.

(1) Implementation Structure

Follow-up working group is organized for reviewing energy saving to maximize effects of measures, grasping quantitatively the performance of save energy effects and discovering and settling new targets.

Follow-up working group is now in the stages of Check (verification of effect) and Action (review) of the P-D-C-A cycle for energy conservation measures, and under practicable discussions demonstrating detailed information by BEMS.

Members: manager of facilities and manager of facility operations in the hotel, and manufacturers introducing BEMS

Frequency: about once every month

Major issues: Analysis of increase/decrease factors of energy consumption throughout the hotel

Quantification of effects by each energy conservation measure and verification of the performance status

Establishment of proper setting value in every season and confirmation of the operation

Extraction of new operational issues and review of measures

Provision of education to facility managers and enlightenment of hotel employees on energy conservation.

Others

The major target of activities is not to pursue responsibility for past inconveniences but to improve effectiveness of energy saving operations. Without the pursuit of responsibility, we have been trying to create a comfortable atmosphere where personnel may express problems they are facing.

Fig. 3-2 shows the system of BEMS of ANA Hotel Tokyo. BEMS equipment in local building monitors and controls operation of the equipment.

Energy-related data collected by BEMS is transmitted to data centers of manufacturers with BEMS through public telephone lines for data analysis by specialized staff members. (The analyzed data is submitted at follow-up working held in the next month.)

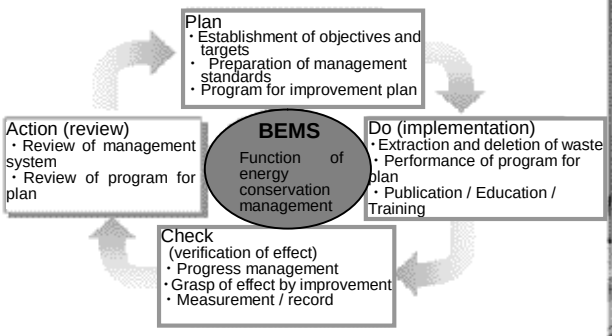

Fig. 3-1 P-D-C-A cycle for energy saving measures

Photo: Follow-up working

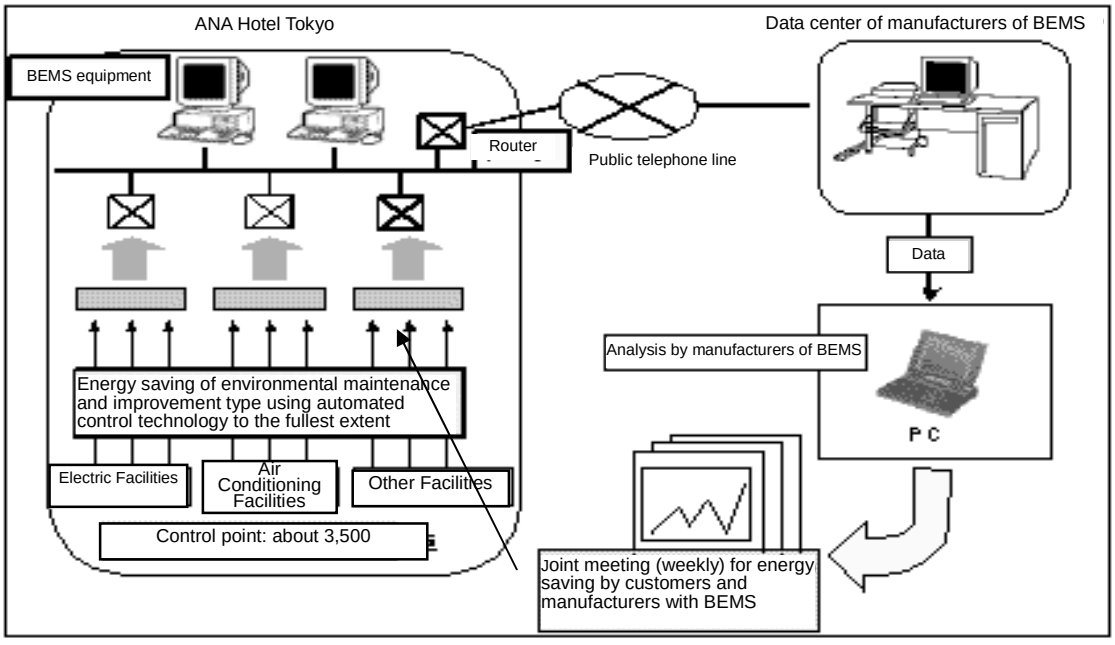

Fig. 3-2 System of BEMS

（2）Target Setting

We set up a target of energy saving measures as follows:

Targeted reduction of repair work for energy saving　　65,000GJ/year

Introduction of BEMS and targeted operational improvement by Follow-up WG

15,000GJ/year

- Trial calculation of the effect of each implemented measure is made for repair for energy saving.
- Regarding the effect of operational improvement, a nonbinding target is set at 20% of the preplanned effect of repair.

(3) Problem Points and their Investigation

Four operational issues are newly recognized as follows:

1) Unbalanced room temperature setting resulting from putting an excessive importance on the indoor environment
2) Necessity of checking troubles in the steam system
3) Wasteful operation of the air conditioning in banquet rooms at an unnecessary time
4) Necessity of reviewing an air charge/discharge volume associated with a change of the kitchen equipment

Measures for these 4 issues were reviewed by follow-up working group.

4. Details of Measures

(1) Details of Measures

1) Improvement of the unbalanced temperature setting resulting form putting an excessive importance on the indoor environment

In many cases, the hotel sets the indoor temperature at between 22 and 23°C throughout the year to minimize user complaints. Sometimes, a frequent change of the temperature setting is required from satisfying users' preference. In the operation field, an excessive temperature setting more than necessary to avoid users' complaint in advance was also found and creating the cause of energy loss.

<Measures>

According to detailed data checks on the outdoor unit for guest room systems, it turned out that there are many systems setting an air supply temperature below 10°C because of user complaints in summer. It appears that a considerable amount of energy was being consumed because equipment was operated at the maximum capacity even at night when a small energy load is sufficient.

To settle this problem, we decided to investigate the current status of equipment and operation for each system to establish a recommendable set value for each system in respective seasons. We also decided to describe a temperature setting in the Management Standards and to control an air supply temperature of the outdoor unit to the fullest extent.

<Results>

As a result of the control of a set value for the supply air temperature of the outdoor unit of the guest room systems, energy consumption was reduced by 1,600GJ (equivalent to 6.8 million yen) in three months in summer (from July to September, 2002). We will achieve the reduction of 2,800GJ per year (equivalent to 12 million yen) if this operational improvement continues even in the mid season and winter season.

Cool water consumption before and after an operational improvement will be displayed if data collected by BEMS are plotted on a correlation graph showing an external air enthalpy data (horizontal axis) and a cool water consumption for the whole building (vertical axis). (Fig. 4-1)

An improvement of about 20GJ per day can be read from the difference of characteristics between the external air enthalpy data and the cool water consumption for the whole building.

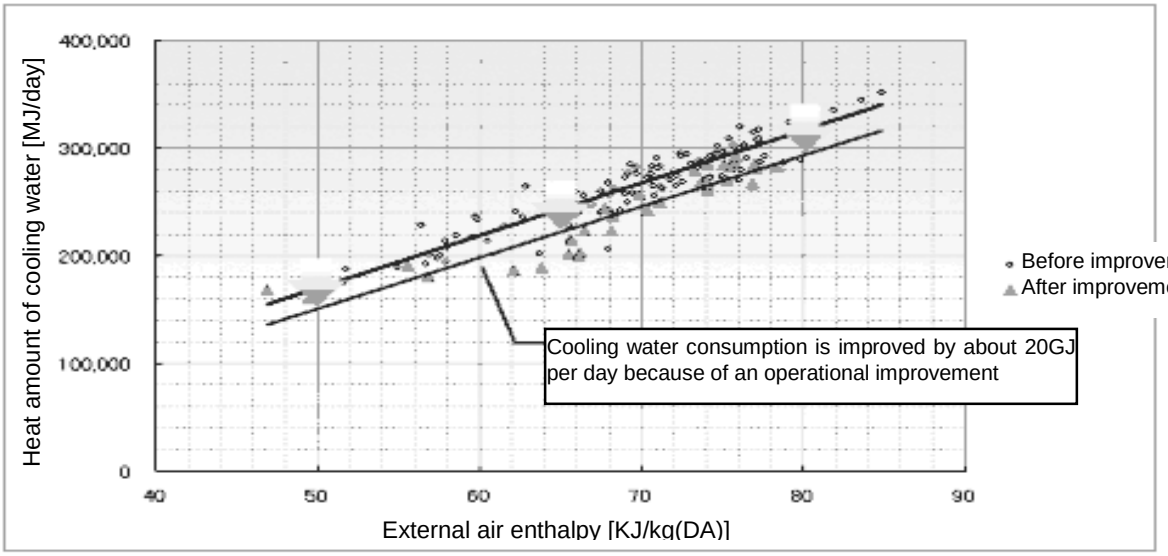

Fig. 4-1 Cooling water consumption changed in accordance with setting changes

2) Implementation of trouble checking of the steam system

A comparatively large amount of steam is consumed by the hotel throughout the year because it uses steam for the water supply and kitchen in addition to for air conditioning.

Being different from buildings for business use that consumes smaller amounts of steam in summer, a steam leakage (due to degraded steam valves and traps, etc. of air conditioners) and a mixing loss are difficult to be detected. There is a concern that a large amount of energy is wasted because these problems are overlooked.

<Actions>

By comparing the operation data of steam valve opening (horizontal axis) and the steam consumption (vertical axis) at the same time in steam system for air conditioners in lower floors, we detected unusual steam consumption and analyzed to define its cause.

As shown in Fig. 4-2-1 below, steam flow is observed in spite of the fact that the steam valve is completely closed. It was assumed that there was a steam leakage at the end of the system or any trouble in a thermal insulation of steam piping.

As a result of an investigation of the end of steam piping, aged deterioration of the bypass valve of a trap at the end of steam piping for air conditioners in lower floors was found, and a large amount of steam leakage of as much as 3 tons per day or 90 tons per month was confirmed.

An increase of 70 tons of steam consumption per month, compared to the previous year is observed from data related to the steam system for kitchen, and it was assumed that certain amount of steam corresponding to such increase had leaked (Fig. 4-2-2).

Based on this survey, an on-site inspection was conducted for all steam traps and bypass valves of steam system for the air conditioning and the kitchen.. Deteriorated and defective steam traps and bypass valves were replaced during the period from October 23 through 25, 2002.

<Results>

As the result, we could save the steam leakage of about 2,200 tons (equivalent to 20 million yen).(Fig.4-2-3)

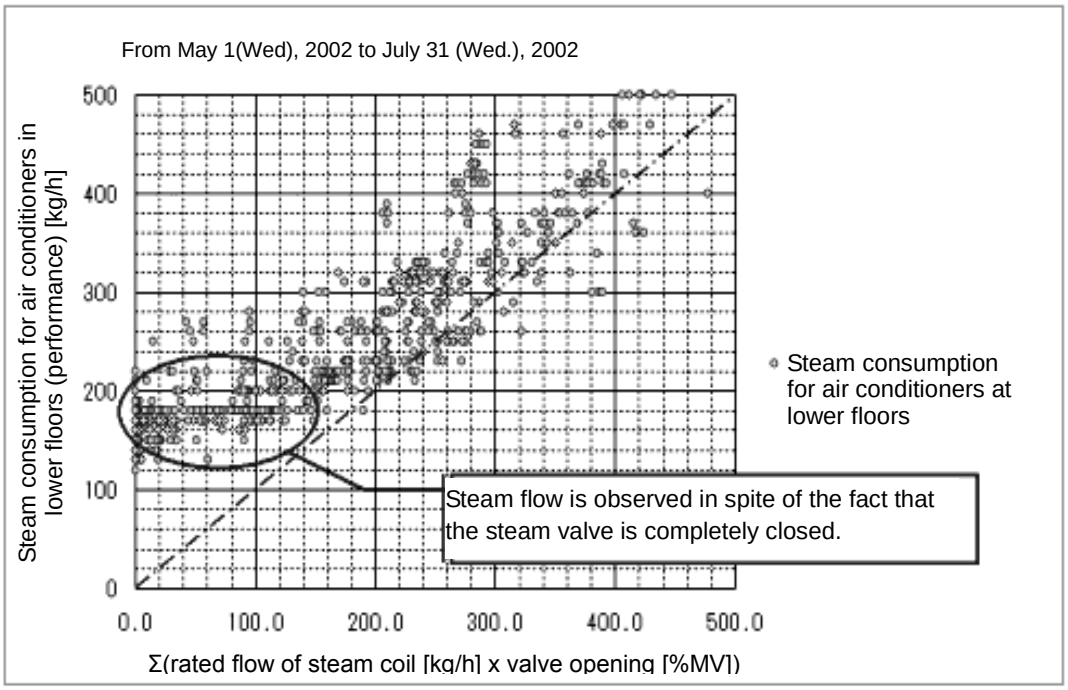

Fig. 4-2-1 Correlation graph of steam valve opening and steam consumption

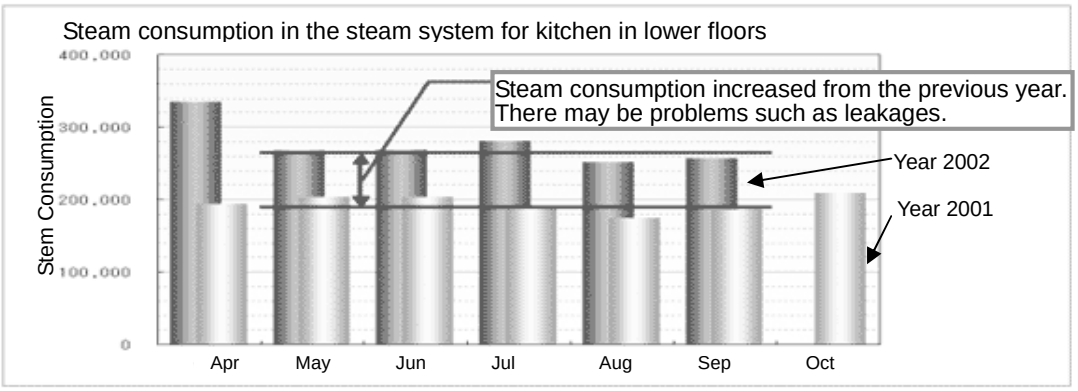

Fig. 4-2-2 Comparison with actual steam consumption in 2002 in the steam system for kitchen with 2001

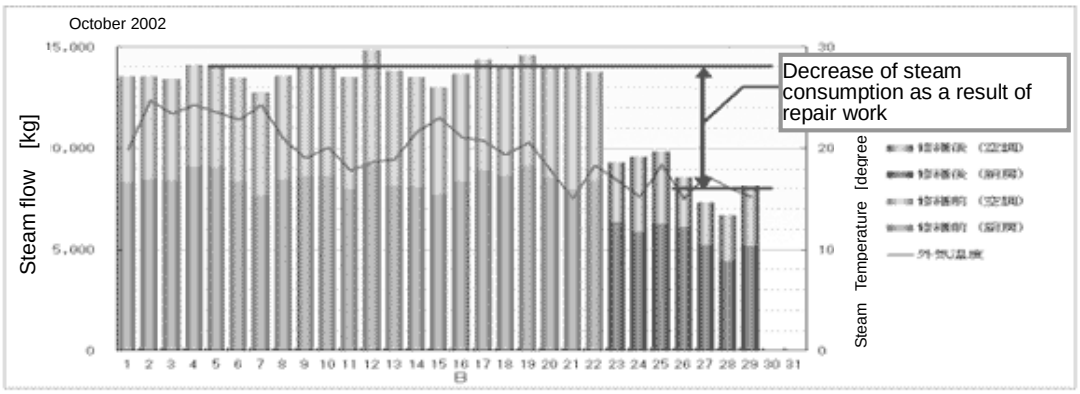

Fig. 4-2-3 Replacement of steam traps and bypass valves and its effect

3) Improvement in a wasteful operation of air conditioners in banquet rooms at an unnecessary time

Air conditioners in banquet rooms are also operated for various reasons during hours when they are not used for guests. It is quite difficult to fix adequate operation hours because air conditioners are used for various purposes such as an operation of air conditioners during the setup preparation for events, advanced cooling and heating for banquets, and odor elimination after banquets.

An operating time in the following day for air conditioners for banquet rooms is communicated to the manager of facility operations in writing in the preceding day to establish the operation schedule. However, we could not create standards for operation because a predetermined operating time changed case by case.

As a result of the introduction of BEMS, we could grasp operating hours of the air conditioning for banquet rooms and confirmed that the system was operated for a very long time for other purposes than banquets largely irrelevant to banquet room reservations. A investigation revealed that such a long operation of the system was due to forgotten shut-offs of the system because of misunderstanding between personnel in charge of banquet and the manager of facility operations. (Fig. 4-3)

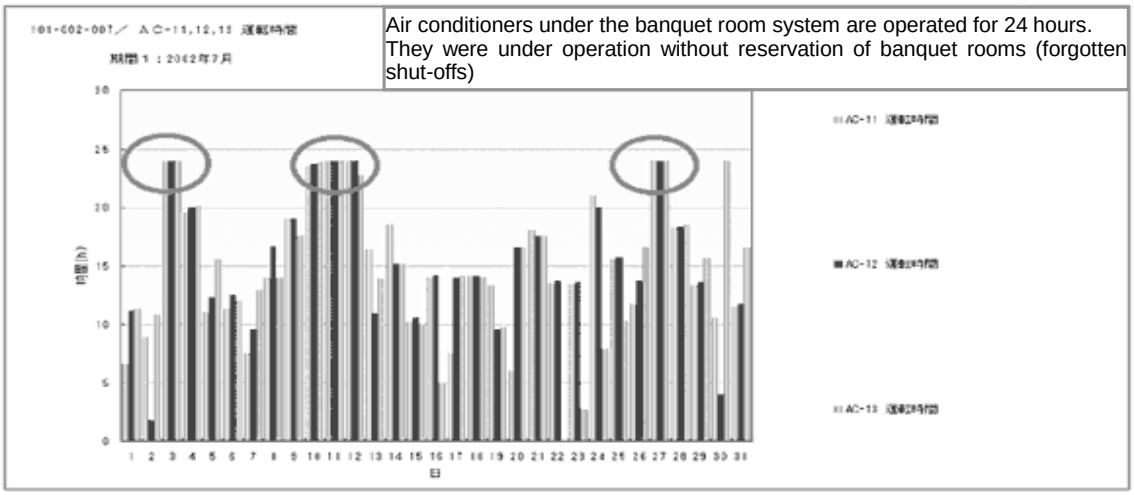

Fig. 4-3 Operation status of air conditioners in the banquet room before operational improvement

<Actions>

The following actions were taken and rules for future operation of air conditioning for banquet rooms were reviewed.

- Review of an operation schedule for air conditioners and revision of rules for extension of their operating hours
- Revision of rules for operating air conditioners for the time other than banquet time (e.g. preliminary inspection by prospective users, bringing in and removing furniture, etc.)
- Calculation of a running cost of air conditioners for banquet rooms

For the purpose of a systematic and consistent performance of these activities in a strict manner, the Save Energy Committee is organized with General Manager of ANA Hotel Tokyo as a head, and personnel in charge of the save energy program from respective unit are appointed.

<Results>

Requirements from hotel employees for a frequent change of temperature setting and operation of air conditioning reduced drastically, and useless operation such as forgotten shut-offs caused after the banquet site arrangement is not observed any longer.

As a consequence, we believe the great reduction of energy consumption is achieved.

4) Performance of the review of an air charge/discharge volume associated with a change of kitchen equipment

Using a large amount of chilled water because of a heat generation from gas stove burners, and also the air treated by the outside unit of air conditioners as ventilation fans, a kitchen is considered to be one of facilities wasting a large amount of energy.

<Actions>

A kitchen is an important facility with a function of handling food materials served to hotel users. Air conditioning was operated redundantly and a higher or lower temperature was set unnecessarily regardless of actual operating hours of the kitchen.

Then, we decided to change operating hours of air conditioning to an adequate level and a temperature setting to a lowest possible level using the BEMS data and through a thorough discussion with kitchen personnel about an operation schedule for the system in the kitchen and a temperature setting.

There were many cases observed where the same amount of air charge/discharge is maintained as before, in spite of the fact that the large-sized gas equipment has been replaced with the electric equipment.

We have introduced a control of an appropriate amount of air charge/discharge corresponding to an amount of gas currently consumed to achieve energy saving.

5. Effect achieved after Implementing Measures

We have achieved the following effects through implementation of measures to save energy.

(Total effect including repair work)

Reduced energy consumption : 80,000GJ

Reduced amount of money : 86 million yen

Reduction rate: 20.8%

(The above effect includes the following effect from an operational improvement achieved independent of repair work.)

Reduced energy consumption: 30,000GJ

Reduced amount of money : 34 million yen

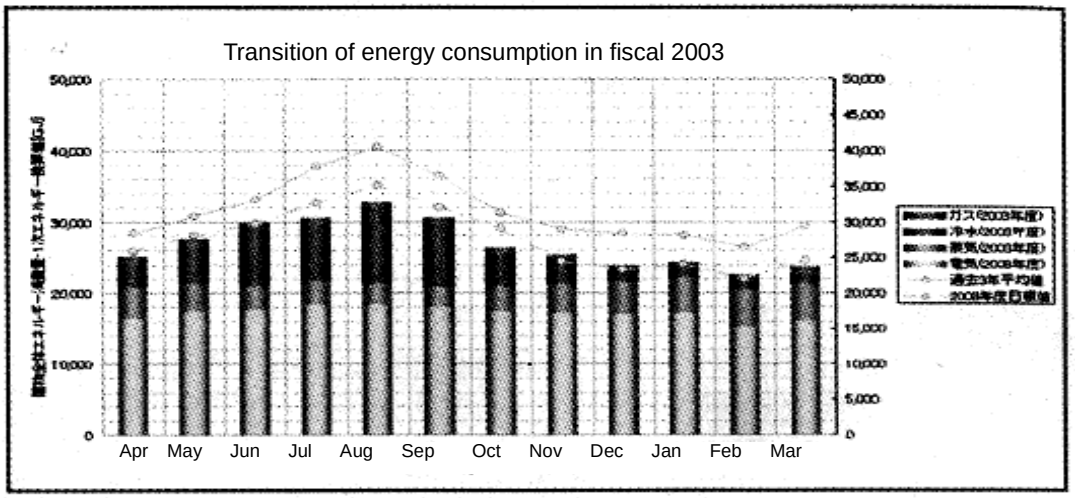

Fig. 5-1 Transition of energy consumption by month in fiscal 2003

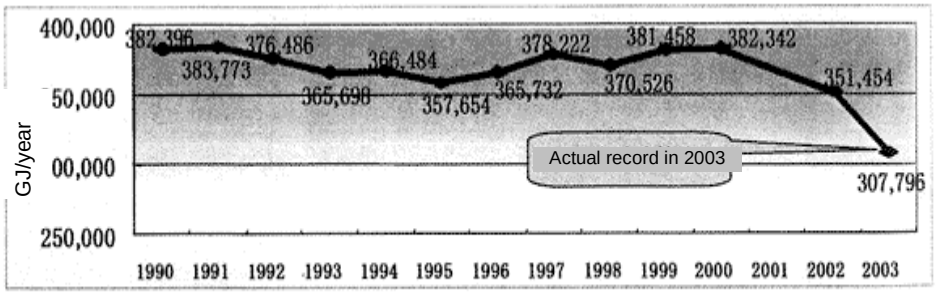

Fig. 5-2 Transition of energy consumption on and after fiscal 1990

6. Summary

The facilities in the hotel have the potential factors to promote energy saving measures, but at the same time, it is difficult to maintain a proper indoor environment of the facilities because even a little degrading of the indoor environment is not allowed. In many cases, a sufficient effect of the energy saving measures cannot be expected unless equipment is properly operated. For a hotel where it is difficult to maintain a proper operation of its equipment, it turns out that the establishment of a follow-up system at the operational stage and the practice of the P-D-C-A cycle using the BEMS data are very important.

In the case of ANA Hotel Tokyo, we would like to put emphasis on the result that the energy saving measures which started with the support of the national subsidies have developed into expanded measures for operational improvement exceeding the scope of the initial repair work for energy saving.

7. Future Plans

<Continuous activities and horizontal promotion in the whole hotel chain>

For ANA Hotel Tokyo, we will continue the activities of follow-up working and consistently to achieve cost-oriented energy saving.

We introduced BEMS in a positive manner to ANA Hotel Hiroshima and ANA Hotel Narita in fiscal 2002, and ANA Hotel Kanazawa and ANA Hotel Hakata in fiscal 2003 under the subsidies of NEDO. We intend to promote horizontally the same activities of follow-up working in these hotels as ANA Hotel Tokyo.

<Provision of information to those other than the hotel chain>

It is not easy for buildings not under the hotel chain operation to gather know-how about energy saving as stated here. We believe that knowledge about energy saving as stated here should not be exclusively held by a single company but should be widely shared with other companies including our competitors.