

2005 Prize of Director General of Agency for Natural Resources and Energy

Knowledge and Cooperation of 21 Small -and-Medium-Sized Companies Energy Conservation Activity which Brought More Fruits than Expected

Matsue Inland Industrial Complex Cooperatives
Joint Committee on Power Receiving
Energy Conservation Promotion Group

Key Words: Rationalization of electromotive power and conversion to heat (Lighting equipment, elevators and office equipment), Others (Automatic control operation of air conditioning and refrigeration facilities)

Outline of Theme

The Joint Committee on Power Receiving “Toward Environmentally Friendly Company” formulated a five-year plan and has made efforts for energy conservation since 2002. In 2002, we understood the real condition by facility investigations and energy conservation audit then started an educational campaign. In 2003, we focused on demand measures and set the target of reducing contract demand from 1815kW to 1600kW. This target was attained by change of temperature setting of air conditioners, replacement with energy-saving lightings and introduction of demand alarming devices. In 2004, we introduced automatic control of air conditioning facilities in order to maintain reduction of 1600kW. Electricity used during that period had been flat. We investigated its cause and found out that production of each company had increased. This meant that specific consumption decreased and energy conservation and reduction in CO2 were achieved.

Implementation Period of the said Example

April 2002 - April 2007 (ongoing)

- Project Planning Period April 2002 - July 2005 (reviewed ever year) Total of 40 months
- Measures Implementation Period May 2003 - July 2005 Total of 27 months
- Measures Effect Verification Period September 2003 - July 2005 Total of 23 months

Outline of the Business Establishment

- Business Activities: Food (Japanese pickles, noodles, bread, green tea, Japanese rice wine, Japanese and Western confectionaries)
Steel products (oil tank, gears, mission, agricultural instruments)
Plastic products, and Electric machineries (electricity receiving and transforming facilities, electronically-controlled parts, etc.)
- Number of members: 673
- Annual energy usage (data of FY2004):
Electricity: 5,656MWh
Fuels, etc. (in crude oil): 226.8kL

Process Flow of Target Facility

The Matsue Inland Industrial Complex Cooperatives (herein after the Inland Industrial Complex) consists of 21 companies (9 food manufacturing companies and 12 steel product manufacturing companies) as shown by shaded part in Figure 1, and they jointly receive electricity.

It is common for industrial complexes to jointly receive electricity, however, it is very rare in the country for different industries to jointly receive electricity as in the case of the Inland Industrial Complex.

Different industries have cooperated in this activity beyond the companies' boundaries and made efforts for energy conservation.



Fig. 1 Layout of companies in the Matsue Inland Industrial Complex

1. Reasons for Theme Selection

Business performances of companies in the Inland Industrial Complex have been affected by the recent stagnation in the economy. Reduction in energy costs which account for large part of production costs was an urgent need in a situation where growth in sales cannot be expected. Furthermore, considering deteriorating global environments such as global warming, there were a number of issues surrounding companies.

The Inland Industrial Complex covers much of production energy by electricity and we thought that primary energy and CO2 as well as costs could be reduced by pursuing energy conservation with a wiser method of using electricity.

Each company shares common perceptions such as “cost reduction” and “prevention of global warming” so that we made a decision of pursuing energy conservation activities by the entire Inland Industrial Complex under a catchphrase, “Toward Environmentally Friendly Company.”

This theme was selected because a group of companies which do not have knowledge and know-how of energy conservation has cooperated to make efforts, although the Inland Industrial Complex consists of different industries with different production modes.

2. Understanding and Analysis of Current Situation

(1) Understanding of Current Situation

Tables 1 to 3 show results of hearing investigations on lighting facilities and air-conditioning equipment which each company has in common. The total load of them is just over 500kW and this accounts for about 30% of contract demand.

Fluorescent light specifications	20W	32W	40W	Total
Number of fluorescent lights	62	476	2,417	2,955
Number of equipment	31	238	1,209	1,478
Power consumption (kW/equipment)	0.043	0.069	0.087	-
Total (kW)	1.333	16.422	105.140	122.895

Table 1 Number and capacity of fluorescent lights

Mercury lamp specification	400W
Number of mercury lamps	231
Power consumption(kW per one mercury lamp)	0.415
Total (kW)	95.865

Table 2 Number and capacity of mercury lamps

Number of air conditioners	99
Capacity of air conditioners (kW)	295

Table 3 Number and capacity of air conditioners

Transitions of demand power (hereinafter demand) on August 30th when the maximum electric power was generated among measuring results of the actual situations of electricity usage during 20 days between August 30th to September 18th 2002. Although the maximum values are different from those of other days measured, the trend of demand transitions was similar.

Figure 2 shows transitions of comprehensive electric power. It is found out that time of the maximum demand occurred from 11 a.m. to 12 p.m., and there is about 400kW difference from demand between 12 p.m. and 13 p.m. Figure 3 shows demand transitions of shared refrigerators.

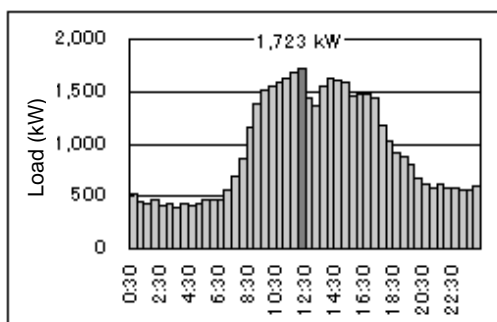


Fig. 2 Transitions of comprehensive electric power

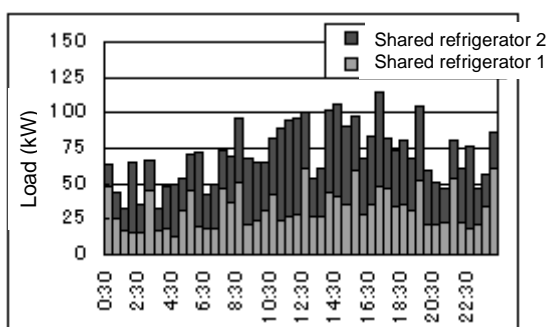


Fig. 3 Demand transitions of shared refrigerators

Figure 4 shows transitions of contract demand and the maximum demand in 2001 and 2002. It shows that the maximum demand is under 1,600kW except three months from July to September.

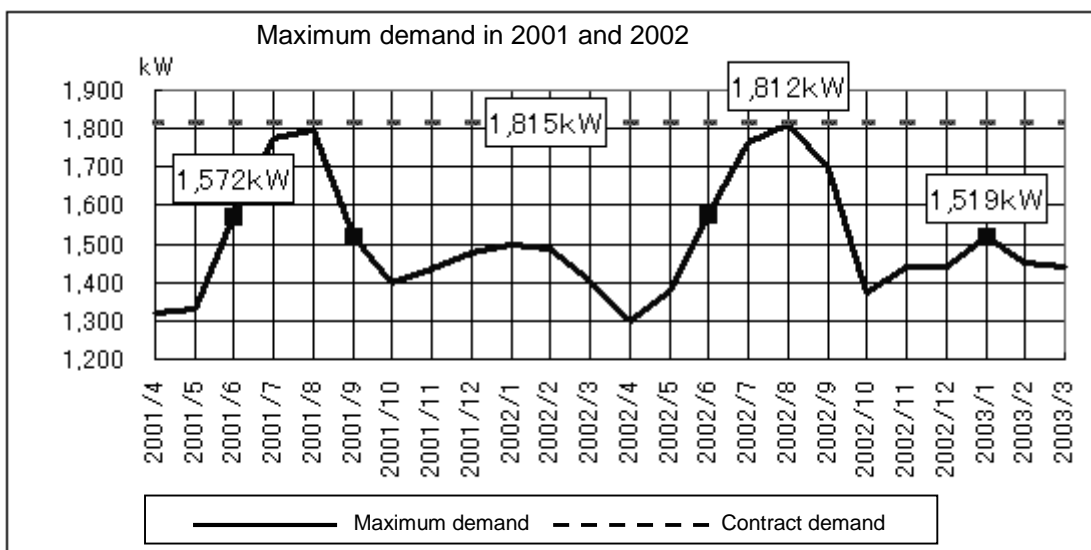


Fig. 4 Transitions of contract demand and the maximum demand in 2001 and 2002

(2) Analysis of Current Situation

The following were revealed as a result of questionnaire surveys conducted on each company based on results of understanding of current situation.

1. Lighting is on most of the time in operation.
2. Among 99 air conditioners, 22 start operating from around 11:30 at once to cool down break rooms or dining halls in advance (this is thought to be one cause that the maximum demand occurs from 11:30 to 12:00).
3. Temperatures of air conditioners are not managed (they are freely set from 20 to 24)
4. Vending machines of soft drinks are placed in each company.
5. The maximum demand is less than 1,600kW except three month in summer (from July to September)

3. Progress of Activities

(1) Implementation Structure (Figure 5)

The Inland Industrial Complex consists of 21 companies and a head office which is responsible for administration. 10 out of 21 companies form the joint receiving committee. An “energy conservation group” established in the joint receiving committee formulates policies on energy conservation and cost reduction, and submit them to the committee. The system was built in a way that the committee reviews and approves suggestions, and then expands them to all companies.

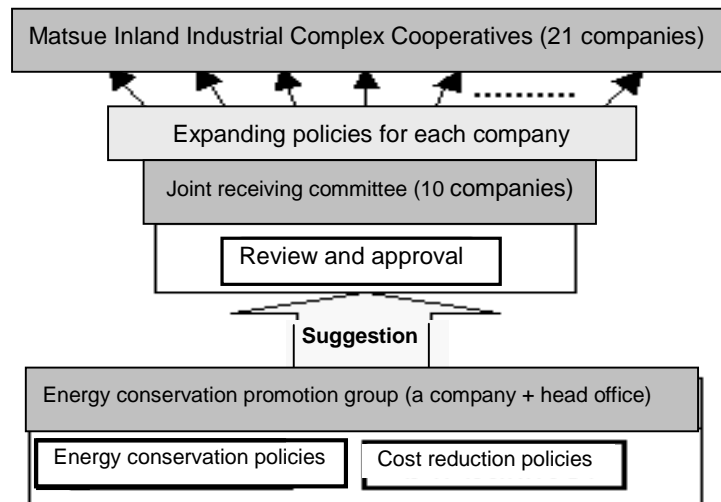


Fig. 5 Implementation Structure

(2) Target Settings

Targets for energy conservation and cost reduction were set.

1) Cost reduction target

As the maximum demand during the intermediate period remains below 1,600kW, it was set as less than 1,600kW for the purpose of reducing contract demand by controlling the maximum demand.

The maximum demand: less than 1,600kW (contract demand 1,815kW→ 1,600kW)

2) Energy conservation target

Because production items and operation conditions are different to each company, it is not possible to judge whether or not energy is saved, only by comparing electric energy used. Thus, consumption rates were compared.

Reducing electric power consumption rate per unit production by 10%

(3) Problem Points and Their Investigation

Problem areas	Countermeasures
There are no knowledge and know-how on energy conservation	Collection of materials related to energy conservation, learning of methods, introduction of energy conservation products by makers, holding of seminars
Awareness on energy conservation is lacked	Deployment of educational activities at the joint receiving committee and the general meeting.
The cooperatives consists of 21 companies and they have different views on energy conservation	Finding energy conservation measures common to companies and explaining them at the general meeting, and then requesting their cooperation.
The cooperatives consists of 21 companies and it takes time and effort to grasp implementation status of measures.	Transmission and collection of information with the head office as a contact point.
It is difficult to concurrently implement energy conservation measures, because each company has different period of capital expenditures.	Requesting cooperation after calculating the amount of cost reduced by means of introduction of energy conservation equipment and payout years by each company

Table 4 Problem areas and those investigations

4. Details of Measures

(1) Measures of FY2003

Measures of FY2003 are shown in Table 5. Investments are kept to be minimum as resistance to investments is intense in the first year of implementing measures.

- Efforts to be made by all employees in each company
 - Air conditioners should be set as 28 (room temperature).
 - Air conditioners should not be turned on before lunch break.
 - Front-loading of lunch break time (From July to September, introduction of summer time)
- Efforts to be made by each company
 - Gradually replacing with energy-saving lighting and air conditioners
 - Energy conservation measures of equipment (refrigerators, freezers, compressors) which were picked up by energy conservation audit
- Installment of demand alarm equipment and measures at a time of alarm generation.
 - Turning off air conditioners in all companies
 - Turning off vending machines and refrigerators
 - Stop of production lines which do not affect production

Table 5 Measures of FY2003

Demand Alarm System

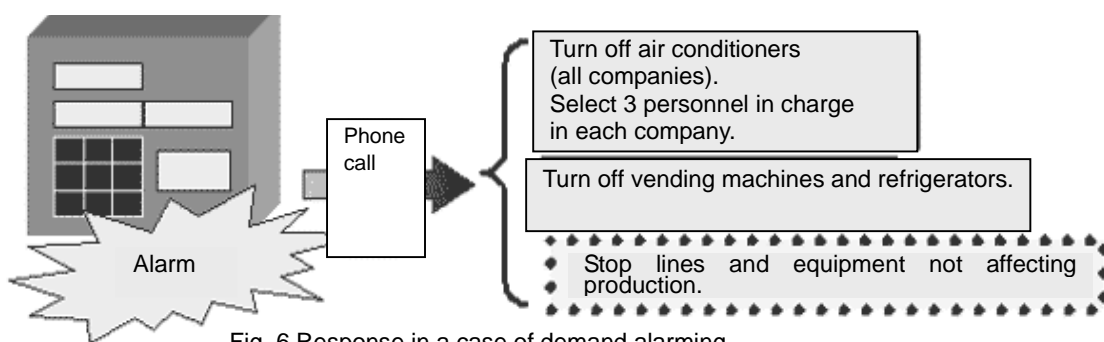


Fig. 6 Response in a case of demand alarming

(2) Measures of FY2004

As results of cost reduction of FY2003 could be confirmed, energy conservation equipment and products were adopted for reinforcing measures.

- Introduction of air-conditioning control equipment in conjunction with demand alarm system
 - Replacing demand alarm systems with demand monitoring systems
 - Controlling shared refrigerators and air conditioners of 21 companies when demand alarm rings
 - Forcefully turning off all equipment to be controlled when a limit alarm rings
- Heat-insulating coating (special heat-insulating coating)
 - Coating heat-insulating paint on roofs of shared refrigerators which consume much electricity
 - Preventing increase in attic temperature by radiation heat
 - Controlling increase in temperature in refrigerators when they are forcefully turned off by automatic control

Table 6 Measures of FY2004

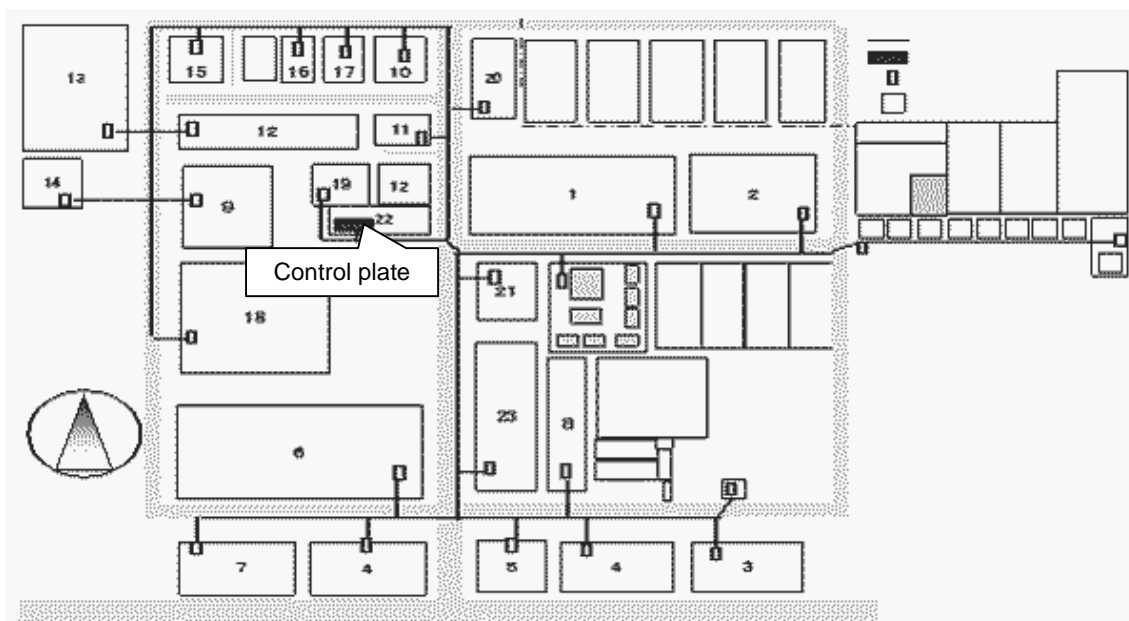


Fig. 7 Wiring diagram of air-conditioning automatic control

Demand Alarm System

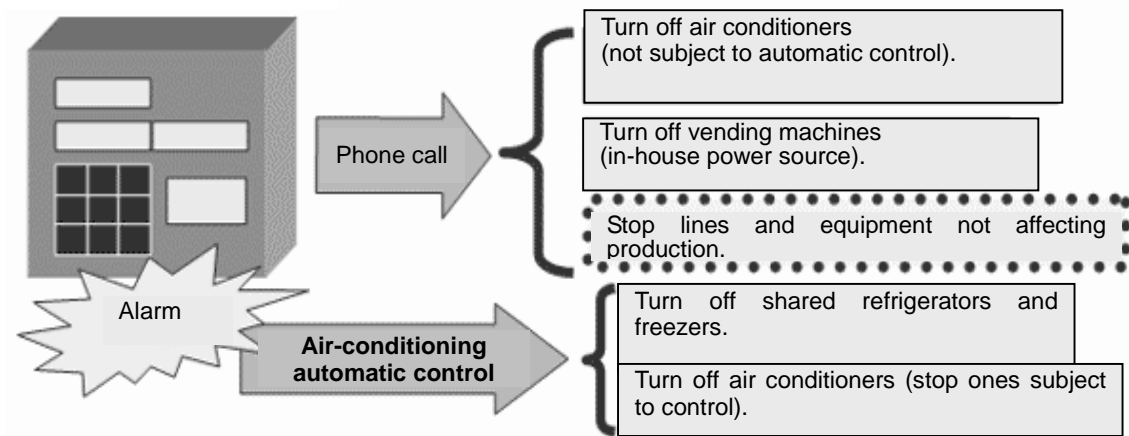


Fig. 8 Response when demand alarm rings

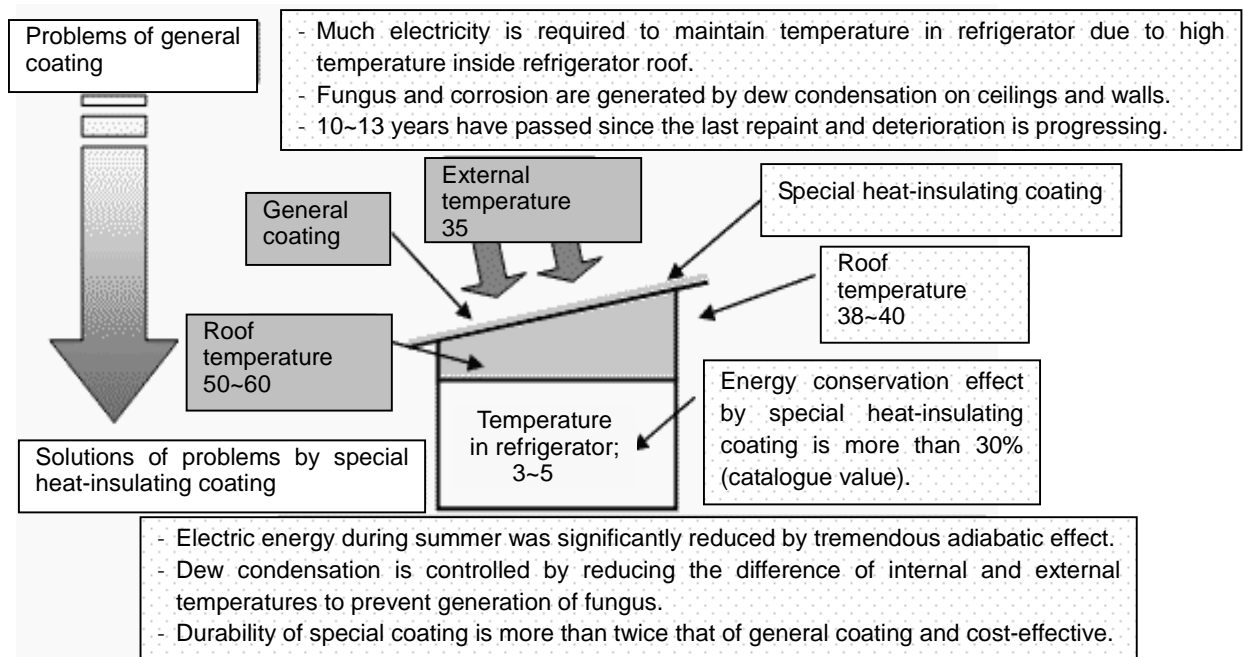


Fig. 9 Solutions of problems of shared refrigerator by applying special heat-insulating coating

5. Effects achieved after Implementing Measures

(1) Cost Reduction

Changes in the maximum demand are shown in Figure 10. It marks 1,812kW in August 2002 and 1,694kW in September. Measures started to be taken from FY2003, and the target of restricting it under 1,600kW from July to September was attained. Therefore, contract demand was changed to 1,600kW from October 2003.

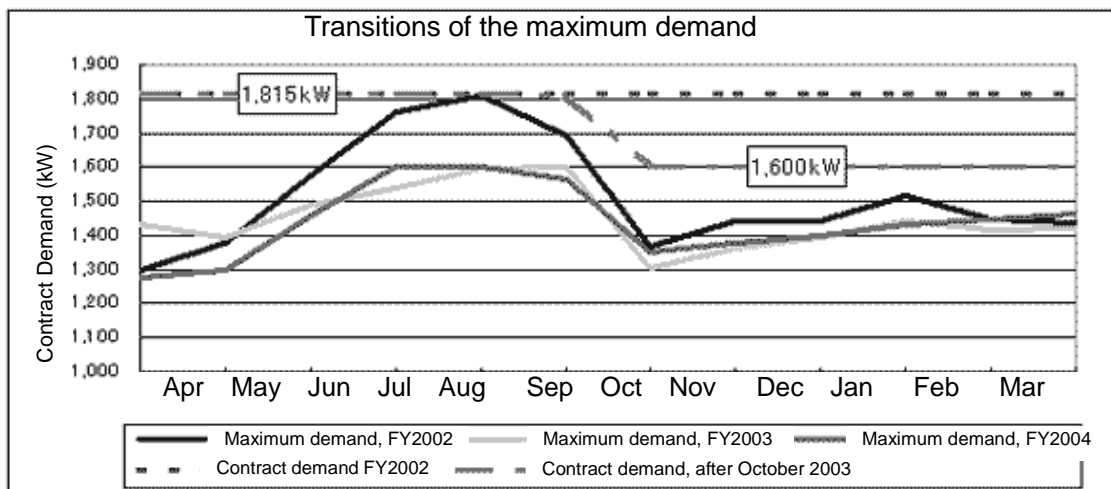


Fig. 10 Transitions of the maximum demand

Results of cost reduction during three years from 2002 to 2005 are shown in Figure 7. Comparing the case that contract demand is not changed and the case that contract demand is changed to 1,600kW from October 2003 by out efforts, about ¥7.4 million was reduced.

Base unit cost: 1,575 yen/kW per month			
Contract demand		Contract demand is 1,812kW without change	Contract demand is changed to 1,600kW from October 2003
1,815kW	Days used (months)	36	14
	Base cost (yen)	102,910,500	40,020,750
1,600kW	Days used (months)	0	22
	Base cost (yen)	0	55,440,000
Total of base cost (yen)		102,910,500	95,460,750
Amount of reduced cost (yen)		7,449,750	

Table 7 Amount of reduced cost

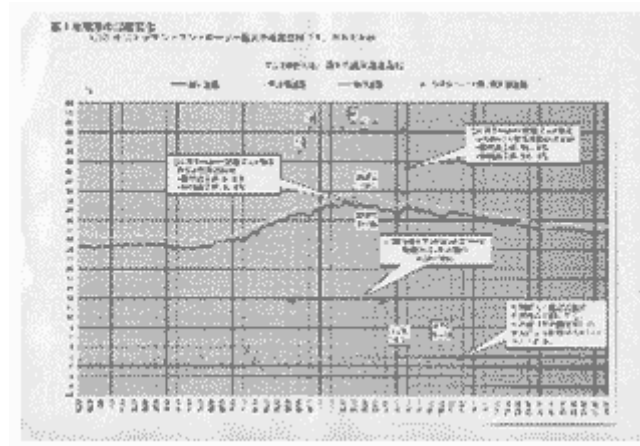


Fig. 11 Changes in temperature of refrigerator, temperature inside refrigerator and roof temperature

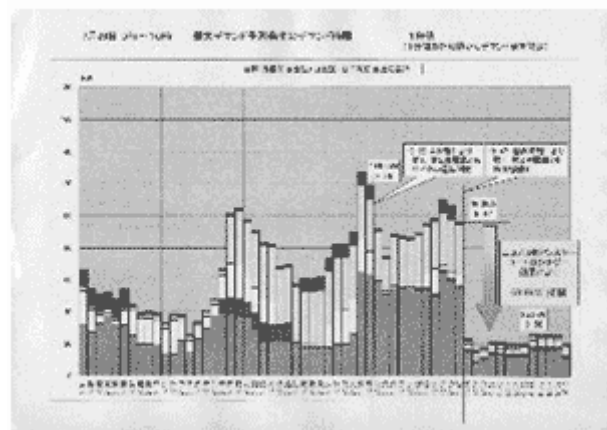


Fig. 12 Control of freezers by air-conditioning automatic control equipment

Figures 11 and 12 are graphs showing effects of air-conditioning automatic control equipment and special heat-insulating coating. Refrigerator roof temperature was reduced from about 49 to 36 by applying special heat-insulating coating, and a difference from external temperature was about 1.5. It was possible therefore to control increase in temperature in refrigerator even when a freezer inside the refrigerator was forcefully turned off by air-conditioning automatic control equipment.

(2) Energy Conservation

1) Reduction in specific consumption

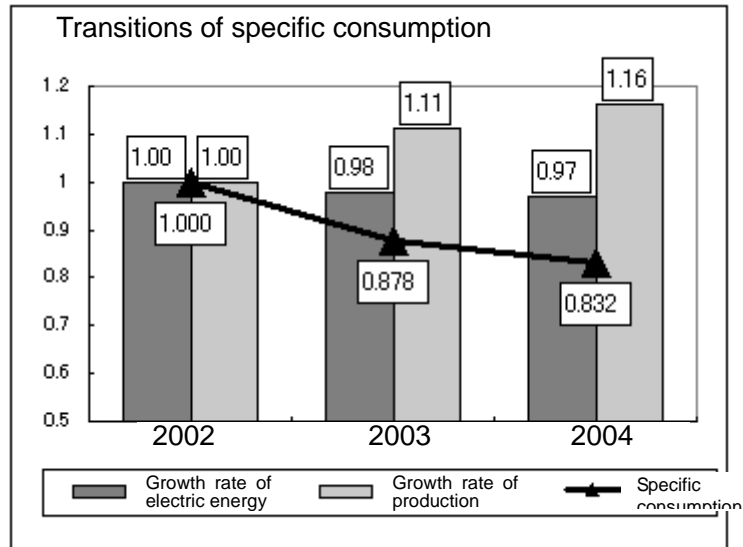


Fig. 13 Transitions of specific consumption

The Inland Industrial Complex consists of 21 companies and they have different products and operational conditions so that when their specific consumption is compared, it is difficult to compare by electric energy consumed and production because each company has different understanding on production unit. Thus, consumption was compared based on their growth rates.

Figure 13 compares specific consumption setting data of 2002 before implementing measures as 1. Although production had increased by 16% during three years, electric energy had little changed.

Specific consumption decreased 0.168 and the target of reducing it by 10% was attained.



2) Influence on energy conservation effects and the environment

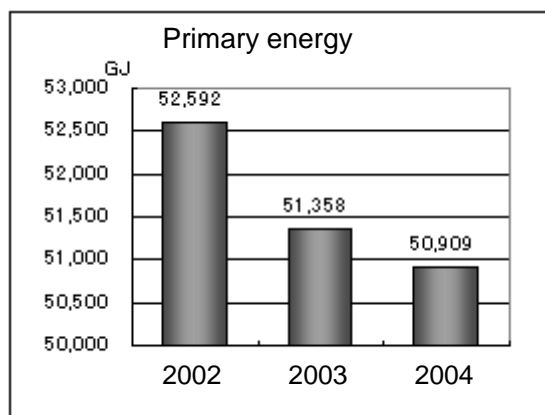


Fig. 14 Transitions of primary energy consumption

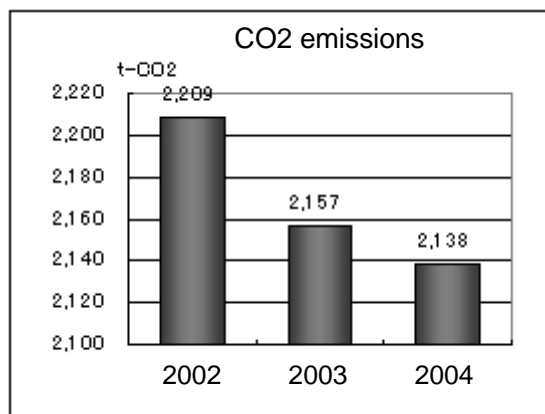


Fig. 15 Transitions of CO2 emissions

Figures 14 and 15 show transitions of primary energy consumption and CO2 emissions on an electric energy usage basis. Primary energy was reduced 1,683GJ and CO2 71t-CO2. The reduction rate was 3.2%.

Correcting the amount reduced on a specific consumption basis, values jump to 8,835GJ of primary energy and 371t-CO2 of CO2.

A major factor of reducing specific consumption is increase in the operating rates of facilities due to increase in companies' production. In addition, energy conservation measures of lightings have been implemented about 50% overall and they are almost turned on during operation according to questionnaire surveys conducted on implementation status of energy conservation measures. As for reduction in electricity used, demand value of 60kW and electric energy of 142MWh per year are reduced.

6. Summary

The bottleneck of this energy conservation activity was that the Inland Industrial Complex consists of 21 companies. This means that there are 21 leaders. Although they share recognitions such as “cost reduction” and “prevention of global warming,” it was difficult to obtain consent from them on specific measures because of difference of ideas and companies’ policies.

Under such situation, it was not an easy task to form an organization wherein 21 companies implement activities in a united manner. Collection of information on energy conservation and learning of energy conservation methods were conducted by the energy conservation promotion group, and implementation of educational activities to each company by the joint receiving committee. As for questionnaire surveys and dissemination of energy conservation measures, the energy conservation promotion group and the head office made efforts to visit each company many times and to obtain their understanding and consent.

As mentioned above, a group which does not have sufficient knowledge and know-how regarding energy conservation has learnt energy conservation from scratch and achieved the target coupled with cooperation in the Inland Industrial Complex.

7. Future Plans

Our activities are under way on according to a five-year plan. It started to produce results in the past three years so that they were introduced in this report. Table 8 shows a five-year plan formulated by the energy conservation promotion group. In the future, we will survey implementation status of energy conservation in each company and try to establish “energy conservation orientation” in each company by appealing contributions of energy conservation to cost reduction and reduction in environmental load.

Year	Plans and implementation	Remarks
FY2002	April: Establishment of the energy conservation promotion group (formulation of a five-year plan) October: Start of basic plan	Collection of information on energy conservation, basic surveys, formulation of basic plan Target 1: The maximum demand 1,600kW Target 2: 10% reduction in specific electric consumption (5 years)
FY2003	February: Start of implementation plan May: Implementation of measures	Formulation of implementation plan See Table 5: Measures of FY2003. The maximum demand from July to September was kept less than 1,690kW.
FY2004	February: Introduction plan of equipment for energy conservation measures May: Implementation of measures	Introduction of air-conditioning automatic control equipment (automatic control of air-conditioning freezers) Special heat-insulating coating (shared refrigerator's roof) The maximum demand was kept under 1,600kW in September.
FY2005	April: Surveys of implementation status of energy conservation of each company May: Promotion of specific consumption management	Replacement rate with energy-saving lightings is 50%. Formulation of expansion plan of control area of air-conditioning automatic control equipment, promotion of replacement with energy-saving lightings Strengthening of educational activities, energy conservation audit in each company Production of companies is on the increase.
FY2006 and after	Establishment of energy conservation orientation	Formulation of the second five-year plan Strengthening of environmental measures

Table 8 Five-year plan of energy conservation activities