

2005 Prize of Director General of Regional Bureau of Economy, Trade and Industry

Reduction of Electricity Consumption by Information Sharing

Sendai City Gas Bureau, Minato Plant, Production Section

**Key words: Rationalization of electromotive power and conversion to heat,
Prevention of heat loss caused by radiation, transmission, etc.**

Outline of Theme

This plant is located in Minato District of Sendai City, Miyagino-Ku, supplying city gas made of liquefied natural gas to approximately 360 thousand households in 3 cities and 3 towns in Senshio- District. Besides, the plant delivers the liquefied natural gas to 3 business organizations within the prefecture with tank trucks. The raw material of these products is imported from overseas countries using small vessels.

The theme pursued here focuses on the control method among the electricity consumption reduction activities which we started in April 2003 as part of ISO 14001 activities.

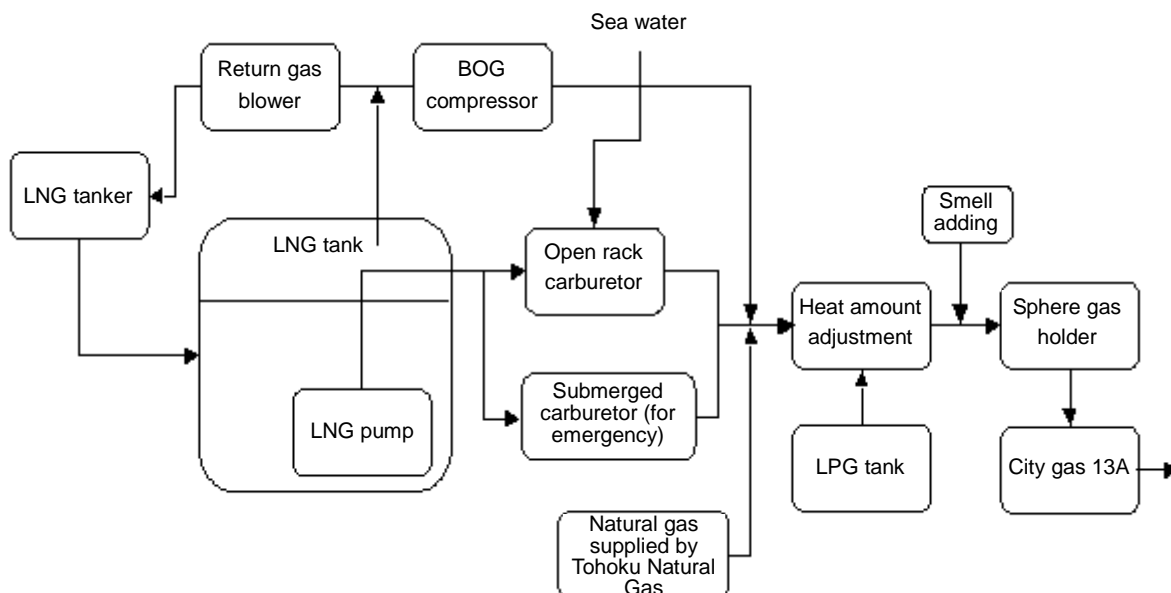
Implementation Period of the Said Example

- Project Planning Period: January, 2003 to March, 2003 (total of 3 months)
- Measures Implementation Period: April, 2003 to March, 2005 (total of 24 months)
- Measures Effect Verification Period: April, 2003 to March, 2005 (total of 24 months)

Outline of the Business Establishment

- Production items: City gas
- Employees: Our employees 31, workers from cooperation companies 20
- Yearly energy consumption: 8.43 million Kwh

Overview of Target Facilities



1. Reasons for Theme Selection

- What is the control method for reducing the electricity consumption by continually implementing the reviewing cycle proposed by ISO 14001, i.e. plan, do, check and action?
- How far can the current facilities be effectively used without further investing?
- How can the energy conservation awareness be implanted in individuals of the organization?

We thought that information sharing must be effective as the control method for solving these problems, so we chose this theme.

2. Understanding and Analysis of Current Situation

(1) Understanding of Current Situation

This plant has been designated as type 2 energy management factory. In other words, we are obligated to reduce the electricity intensity by average 1% or more within 5 years.

However, the plant cannot control the product volume as a denominator of the energy intensity fraction but the electricity consumption as a numerator of the fraction is the index reflecting the energy conservation efforts of the plant and we can control it.

(2) Analysis of Current Situation

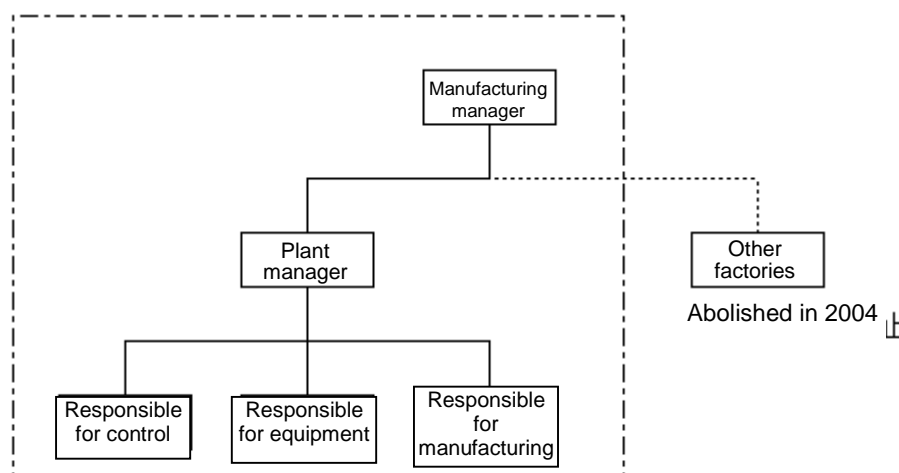
- How far has the energy conservation awareness been implanted in individuals?
- How far do individuals control the electricity they use and how well do they understand it?
- Are the energy conservation measures verified enough?

To understand these problems clearly, we need to clarify the control.

3. Progress of Activities

(1) Implementation Structure

The employees of this plant were 27 when these activities were planned (currently 31 people), and the organization was operated in 3 operating systems. So we examined the electricity consumption of each operating system and identified the use of the electricity which was likely to reduce the consumption if the control was improved. And we clarified the responsibility for doing so.



Year 2003	3 people	6 people	16 people (including 10 operators)
Year 2005	4 people	7 people	18 people (including 12 operators)

Organization chart of year 2003

Electricity meters are installed only to high voltage feeders. So we put together the electricity use in 8 operating systems and decided to control the electricity according to these 8 values plus total of them, i.e. 9 values in total.

The following chart shows the load of each operating system. The elements put in boxes were selected as the loads which were possible to reduce the electricity consumption.

Load list							
Measurement of electricity amount	Details of load		Responsibility	Measurement of electricity amount	Details of load		Responsibility
1st transforming room system	400v system	Fire fighting water pump					
		Electricity receiving/transforming equipment auxiliary machines					
		Uninterrupted power supply system (100KVA)					
		Direct current power supply unit (DC24V)					
		Electric gate	Control				
		Filthy water, rain water pump					
		Drinking water pump	Control				
		Industrial water taking pump	Manufacturing				
		Industrial water treatment system					
		Clean water shipping pump					
		Clean water feeding pump					
		Industrial water pump	Manufacturing				
		Smell adding room blower					
		Smell adding room pump					
		CNG power	Equipment				
	200v system	Office, control center lighting	Control				
		(Including outlets)	Manufacturing				
		Plaza lighting (including outlets)	Control				
		Maintenance center lighting (including outlets)	Equipment				
		Heat meter room lighting (including outlets)					
Smell adding room lighting							
Guard man room lighting (including outlets)		Control					
1st transforming lighting (including outlets)							
Electricity receiving/transforming auxiliary machines							
Outside lighting		Equipment					
Power supply board for maintenance							
Freezing prevention heater		Manufacturing					
Heat meter room air conditioning		Manufacturing					
Maintenance center air conditioning		Equipment					
1st transforming air conditioning		Equipment					
Plaza air conditioning	Control						
Absorption cold/hot water generator	Control						
Office, control center air conditioning	Control						
	Manufacturing						
CNG filling room lighting							
LNG shipping facility lighting							
LNG shipping facility instruments							
2nd transforming room system	400v system	BOG compressor	Manufacturing				
		Sea water pump	Manufacturing				
		LNG pump	Manufacturing				
		Shipping LNG pump	Manufacturing				
	400v system	Submerged vaporizer					
		Fire fighting sea water pump					
		Electricity receiving/transforming auxiliary machines					
		T-1 hot water pump					
		T-1 lifting pump					
		T-1 brine pump					
		Sampling pump					
		LPG pump					
		Re-cooling tower fan	Manufacturing				
		Re-cooling tower pump	Manufacturing				
		Drinking water pump					
		Hot water pump					
		SMV neutralizer					
		Boiler neutralizer					
		Electric valve					
		Sea water strainer	Manufacturing				
Instrument air system	Manufacturing						
Steam boiler	Manufacturing						
Hot water boiler							
Uninterrupted power supply system (50 KVA)							
Traveling screen							
RGB							
Gangway							
Loading arm hydraulic device							
Capstan							
200v system	Berth center air conditioning	Manufacturing					
	2nd transforming room air conditioning	Facility					
	Tank instrument room air conditioning	Manufacturing					
	Freezing prevention heater	Manufacturing					
	Maintenance power board						
	Outside lighting	Facility					
	Berth center lighting (including outlets)						
	BOG lighting						
	Instrument air room lighting (including outlets)						
	Boiler room lighting (including outlets)						
	2nd transforming room lighting (including outlets)						
	Sampling room, etc. lighting						

(2) Target Settings

To be as simple as possible and to easily understand the target, the monthly target and the total target of each system were made to be 100% or less of the previous year.

The final target is that the total consumption of a year is 100% or less of the previous year.

(3) Problem Points and Their Investigation

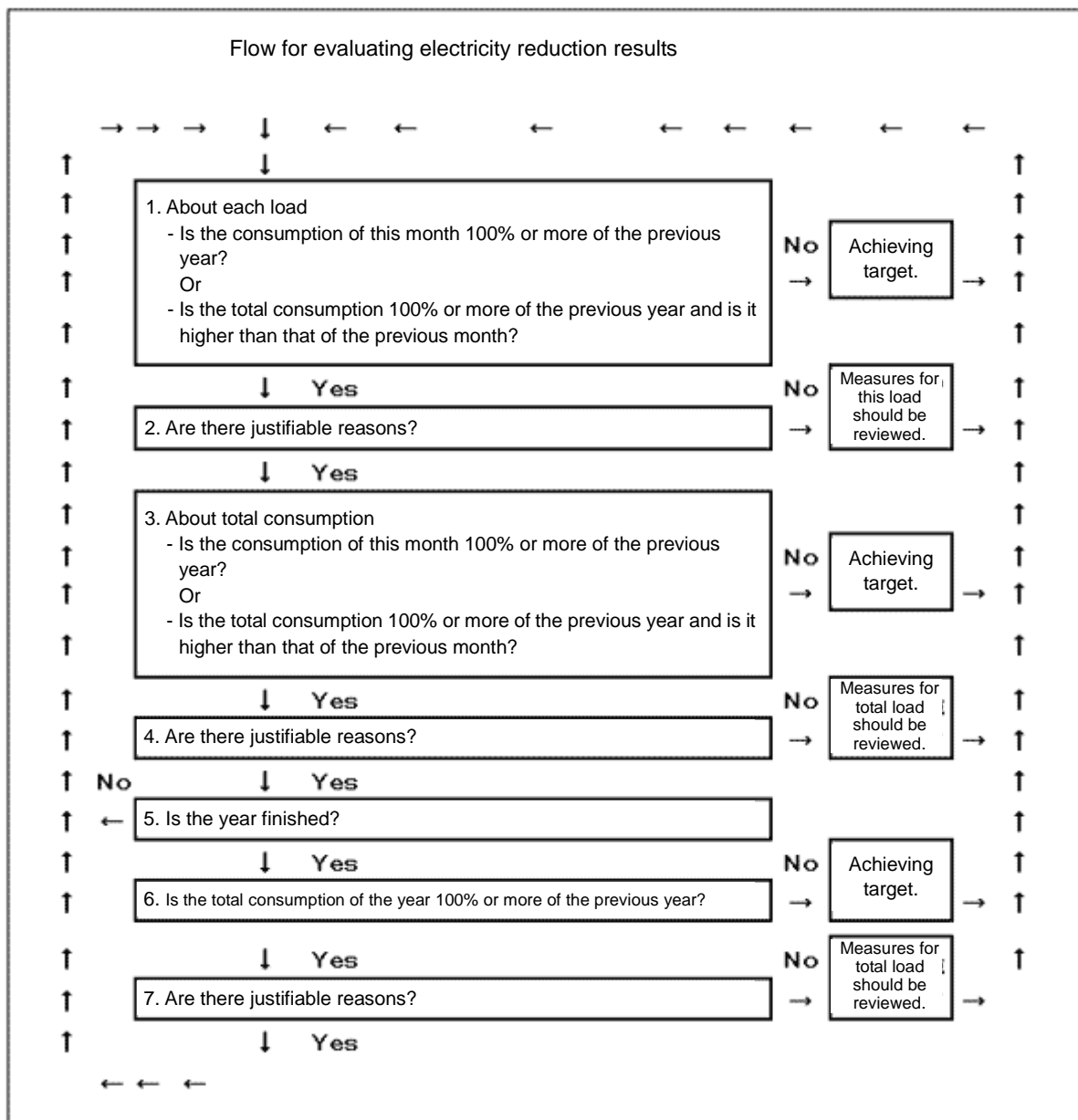
[1] The electricity amount is measured only at each feeder. Then, how can problematic loads be possibly analyzed?

[2] What will we do if the target is not achieved?

[3] How can the strength level of measures be set?

For [1], we rechecked the load in each feeder and grasped the integrated flow rate, number of operation, number of people operating and hours of operation as indices relating to the electricity amount to estimate the electricity consumption.

For [2] and [3], we made the following evaluation flow.



4. Details of Measures

[1] The total consumption, consumption of a day of each of 8 systems, and the comparison with the previous year are visualized by graphs to be watched on PC screen of each employee through the LAN of the company.

The electricity amount used is manually input from the daily data.

So each employee can know the load which they create with their electricity use and all employees can share the same information.

[2] A monthly report is made for the electricity used in the previous month to check the

progress toward the target.

If there are operating systems that have not achieved the target, the responsible people look into the load of the operating system in question and identify the cause why the target is not achieved.

[3] The action [1] above is repeated almost every day and the action [2] above is repeated every month.

[4] When the year ends, the total consumption of each operating system is checked and the achievement of the target is evaluated.

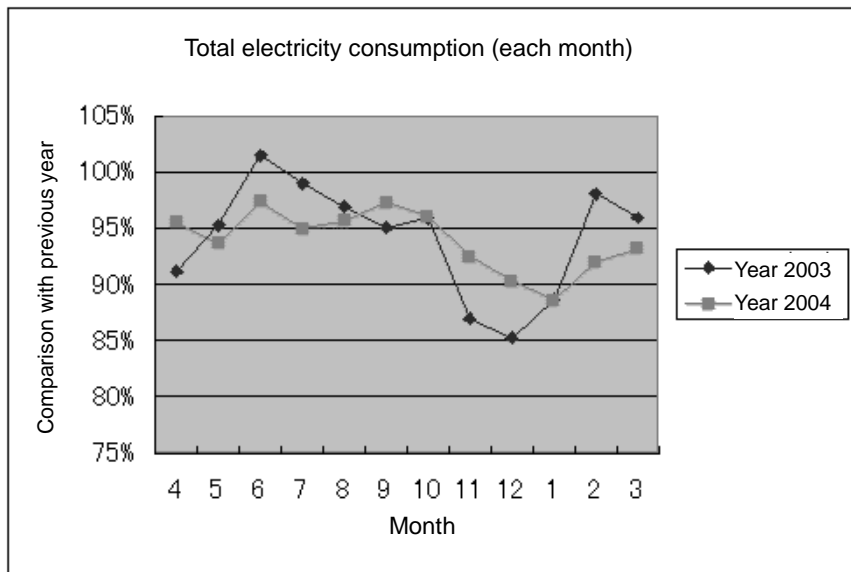
The following is, shown as an example, the monthly report made for September, 2003.

Looking into the field compared with the previous year, it is found that there are 2 operating systems which exceed 100% and there is no much room for saving in the total. Meanwhile, there are 2 operating systems whose total exceeds 100%, but if we look into their monthly consumption, we can know there were efforts made to offset the excess.

Electricity consumption monthly report, September 2003		Electricity consumption kwh		Comparison with previous year %	
		Month	Total	Month	Total
Total electricity consumption		700,780	4,387,010	95.02	96.35
1st transforming room	400v system	37,000	226,860	98.07	100.52
	200v system	47,940	257,340	99.44	98.90
2nd transforming room	BOG compressor	228,930	1,454,230	90.84	89.46
	Sea water pump	138,070	958,030	90.61	101.08
	LNG pump	89,390	553,160	101.02	99.42
	Shipping LNG pump	35,580	217,890	99.55	99.94
	400v system	98,950	613,460	93.90	98.27
	200v system	20,180	106,590	102.28	99.49

The comparisons of total electricity consumption of each month with past 2 years are shown below.

There is a month when the consumption exceeds 100% but the electricity reduction was basically good.



As an example of investigation of the operating systems which did not achieve the target, the investigation report of February, 2005 is posted below.

In this month, there were 5 operating systems that exceeded 100% of previous year (comparison of a month). The operating systems in the black boxes are those systems in question and the fields erased by black color are those which were deemed not the cause of the increased electricity consumption.

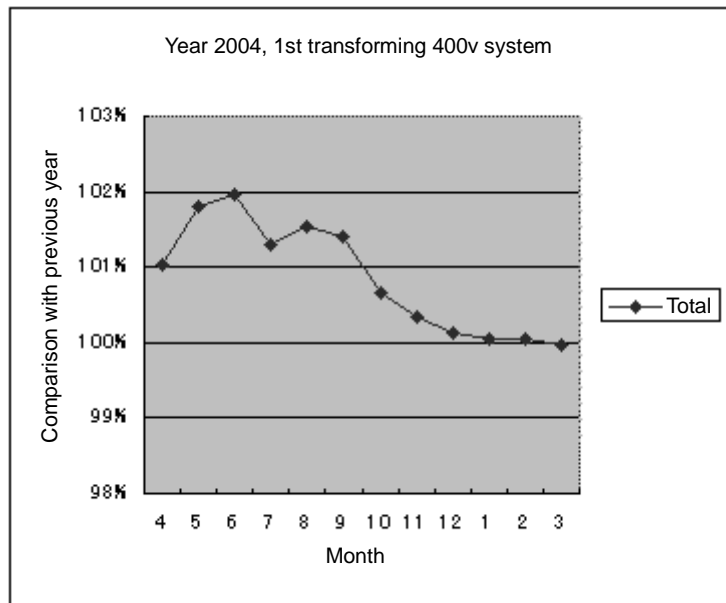
February, 2005				Investigation result	Reason
Total consumption					
1st transforming	400v system	Electric gate	Control	Number of people who entered the premise February, 2003: 506 February, 2005: 536 (106.3%)	The electric gate must have opened and closed increasingly because a lot of people entered the premise.
		Drinking water p	Control	Water consumption February, 2003: 1156.1t February, 2005: 105.7 (91%)	
		Industrial water taking p	Manu- facturing	Industrial water amount taken February, 2003: 113336 February, 2005: 11550t (101.9%)	Because of the industrial water pump.
		Industrial water p	Manu- facturing	Industrial water consumption February, 2003: 7073t February, 2005: 7333t (103.7%)	0.39t per hour. Industrial sea water was taken slightly more than the previous year. Also, industrial water sprinkled by T-1 tank was more than the previous year.
		CNG power	Equipment	February, 2005: 263kwh February, 2003: 152kwh	Because sales amount increased.
	200v system	Office, control center lighting (including outlets)	Control Manu- facturing	The number of employees is the same as the previous year, so there is no cause that increases the electricity consumption. 2/24 No fault was found with the electricity facilities.	
		Plaza lighting (including outlets)	Control	The number of groups who came to see Plaza, February, 2003: 1 group February, 2005: 4 groups	More electricity was used for air conditioning and lighting because more people came.
		Maintenance center lighting (including outlets)	Equipment	Number of people who used the maintenance center (estimated by personnel responsible for the facility) February, 2003: 32 February, 2005: 48	For equipment work.
		Guard man room (including outlets)	Control	Work and number of people are the same as those of the previous year.	

		Outside lighting	Equipment	2/24 No fault found with the electric facilities.		
		Freezing prevention heater	Manu-facturing	2/24 No fault found with the electric facilities.		
		Heat instrument room air conditioning	Manu-facturing	Average monthly temperature February, 2003: 2.9□ February, 2005: 0.9□	Electricity was used for air conditioning because the temperature was low.	
		Maintenance center air conditioning	Equipment	Total people using maintenance center (estimated by personnel responsible for the facilities) February, 2003: 32 people February, 2005: 45 people	Because of the equipment work.	
		1st transforming room air conditioning	Equipment	Not used.		
		Plaza air conditioning	Control	Number of groups which visited Plaza. February, 2003: 1 group February, 2005: 4 groups	The air conditioners were kept running because they were not working well.	
		Absorption cold/hot water generator	Control	Average monthly temperature, February, 2003: 2.9□ February, 2005: 0.9□	Electricity was used for air conditioning because the temperature was low.	
		Office, control center air conditioning	Control	Average monthly temperature, February, 2003: 2.9□ February, 2005: 0.9□	Electricity was used for air conditioning because the temperature was low.	
	Manu-facturing		Average monthly temperature, February, 2003: 2.9□ February, 2005: 0.9□	Electricity was used for air conditioning because the temperature was low.		
2nd transforming room		BOG	Manu-facturing			
		Sea water p	Manu-facturing			
		LNG p	Manu-facturing	February, 2003: 91520kwh February, 2005: 93620kwh (102.2% of the previous year)	The pump load increased because feeding amount increased.	
		Shipping LNG p	Manu-facturing	February, 2003: 18450kwh February, 2005: 25760kwh (139.5% of the previous year)	The stop time of the shipping pump was shorter than the previous year because the shipping amount increased.	
		400v system				
	200v system		Berth center air conditioning	Manu-facturing	February, 2003: Number of ships which came in. 1 ship February, 2005: Number of ships which came in. 2 ship	Another ship came in.
			2nd transforming room air conditioning	Equipment	Not used	
			Tank instrument room air conditioning	Manu-facturing	Average monthly temperature, February, 2003: 2.9□ February, 2005: 0.9□	Electricity was used for air conditioning because the temperature was low.
			Freezing prevention heater	Manu-facturing	2/24 No fault found with the electric facilities.	
			Outside lighting		2/24 No fault found with the electric facilities.	

5. Effect Achieved after Implemented Measures

- June, 2003 was the only month in which the total consumption exceeded 100% of the previous year (single month) in 2 years.
Looking into each operating system, it is found that the reduction ratio is more than 100% in one system but it is below 100% in the total consumption. Looking at the trend shown by the graphs, it is known that there may be operating systems that do not achieve the target, so kind of restraining force might have worked here.
- If an operating system does not achieve the target, the personnel responsible for the system are obligated to investigate the cause, and the investigation results are disclosed on the LAN for all employees in the plant.
The work is not asked if the target is achieved. Therefore, it is thought that this fact makes part of the restraining force said above.

The following graph shows the operating system in which the restraining force seems to have worked effectively.

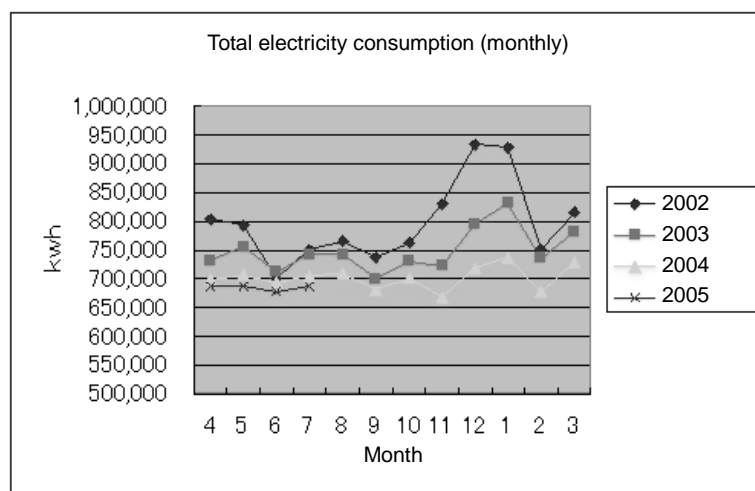


6. Summary

The total electricity consumption is steadily decreasing, i.e. 1.15 million kwh in 2004 was 12% less than the consumption of 2002.

By sharing information, the responsibility was made clear and it encouraged continual activities. The following figure shows the transition of monthly total electricity consumption since 2002.

The electricity consumption up to July, 2005 is being shown as reference and it is slightly less than the level of 2004, indicating that there is less wasteful use.



The figure on the next page shows the monthly achievement of the target in 2 years. X marks indicate that there were operating systems which did not achieve the target. The operating systems which have more months when the target was not achieved are likely to show low reduction ratio.

Achievement of target																									
		2003												2004											
		4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
Total electricity consumption				X																					
1st transforming room	400v system	X	X		X			X	X	X	X	X	X	X	X	X	X	X						X	
	200v system	X						X						X	X	X	X	X					X	X	X
2nd transforming room	BOG compressor			X																					
	Sea water pump	X	X	X				X				X	X	X	X	X	X	X		X					
	LNG pump					X	X																X	X	X
	Shipping LNG pump	X	X			X														X	X	X	X	X	X
	400v system		X						X	X		X	X	X		X		X	X	X					
	200v system			X				X							X	X	X	X	X	X	X	X	X	X	X
		2002	2003	2004	2002 / 2004																				
					Reduction total	Reduction ratio																			
		kwh	kwh	kwh	kwh	%																			
Total electricity consumption		9,586,280	8,989,060	8,430,990	-1,155,290	-12.05%																			
1st transforming room	400v system	447,890	454,360	454,290	6,400	1.43%																			
	200v system	573,310	555,410	566,410	-6,900	-1.20%																			
2nd transforming room	BOG compressor	3,085,040	2,782,940	2,616,300	-468,740	-15.19%																			
	Sea water pump	2,419,130	2,265,940	1,998,200	-420,930	-17.40%																			
	LNG pump	1,142,440	1,131,340	1,122,630	-19,810	-1.73%																			
	Shipping LNG pump	435,590	342,150	264,600	-170,990	-39.25%																			
	400v system	1,250,500	1,239,210	1,196,850	-53,650	-4.29%																			
	200v system	245,140	231,850	240,120	-5,020	-2.05%																			

7. Future Plans

The electricity consumption was effectively reduced in 2 years. It is estimated that there are more months when the total consumption exceeds 100% in the future.

The ultimate goal of this theme is to make the total consumption in a year not exceed 100% of the previous year, so we will further implement detailed investigation and make maximum effort to continually achieve the target.

Thanks to the analysis repeated, the understanding of the load was enhanced.

It must be useful when studying the direct investment to the energy conservation in the future.