November 10, 2003

20. A Field Study of Energy Efficient Examples – Building

ビルの省エネルギー事例視察

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-THE ENERGY CONSERVATION ACTIVITIES IN MELTEC-

◎ Enforcement Period

- 1st step Oct,1996～Sep,1998
  ····Ene. Cons. Result：13%
- 2nd step Feb, 1998～Continue
  ····Target Level at 2010 ：25%

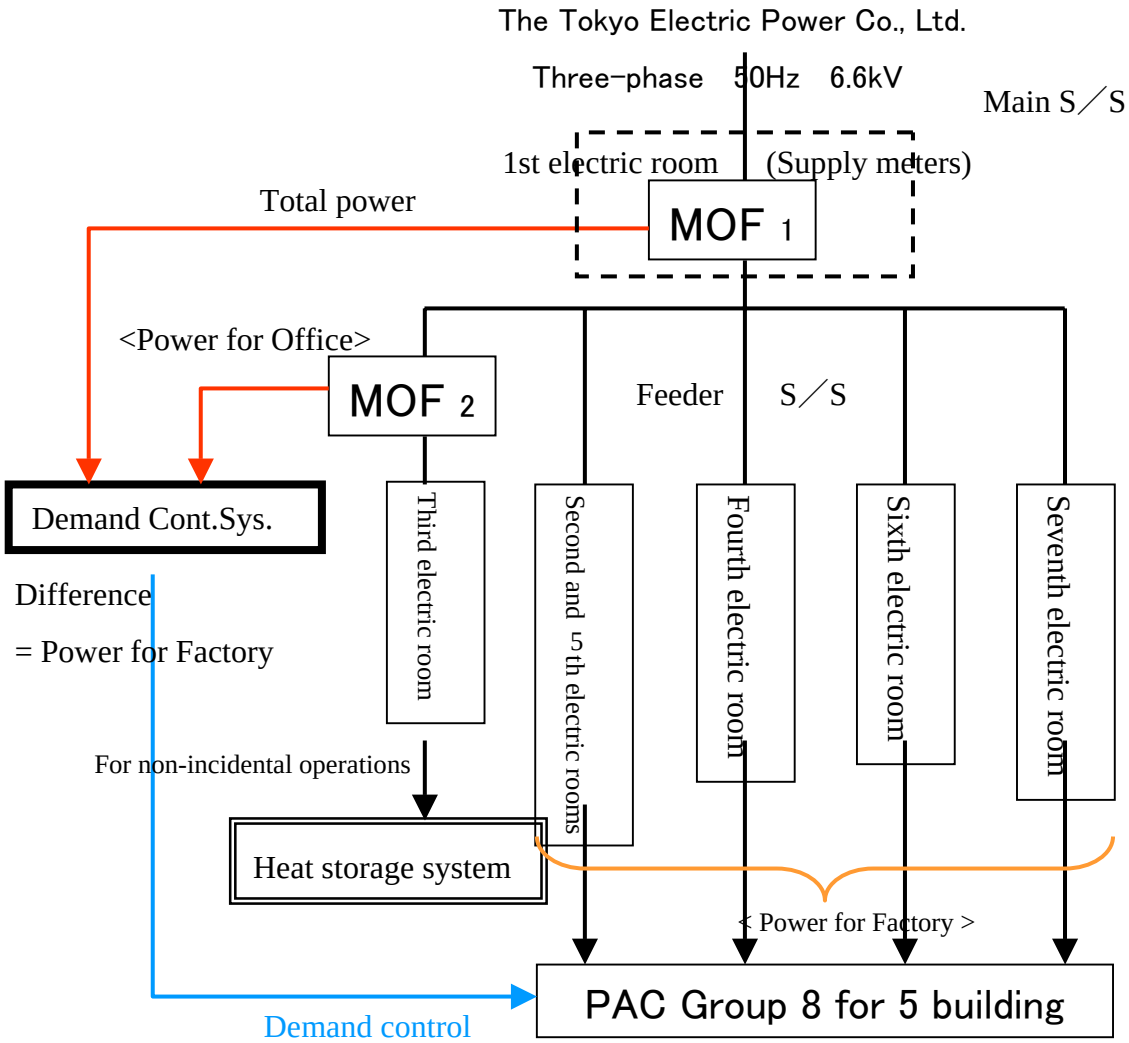
◎ Office Outline

- Products and services ：Maintenance and repair services of elevators, air conditioners, and equipment for building management
- Number of employees and buildings ：450 employees and 6 buildings (total floor space of 11,650m^2)
- Annual energy consumption (in 1999)

  Electric power ：333.8 ×10^4kWh (383.3 ×10^4kWh in 1997)

Mitsubishi Electric Building Techno-Service Co., Ltd.

-1st Step（'96～'98）-



Power for Office
Power for Factory
} Total Power

Details of Contract

'92 g subcontracting of O/H production of electric motors,

High voltage B 1,200kW→High voltage B 675kW

For non-incidental operations 480kW

'95

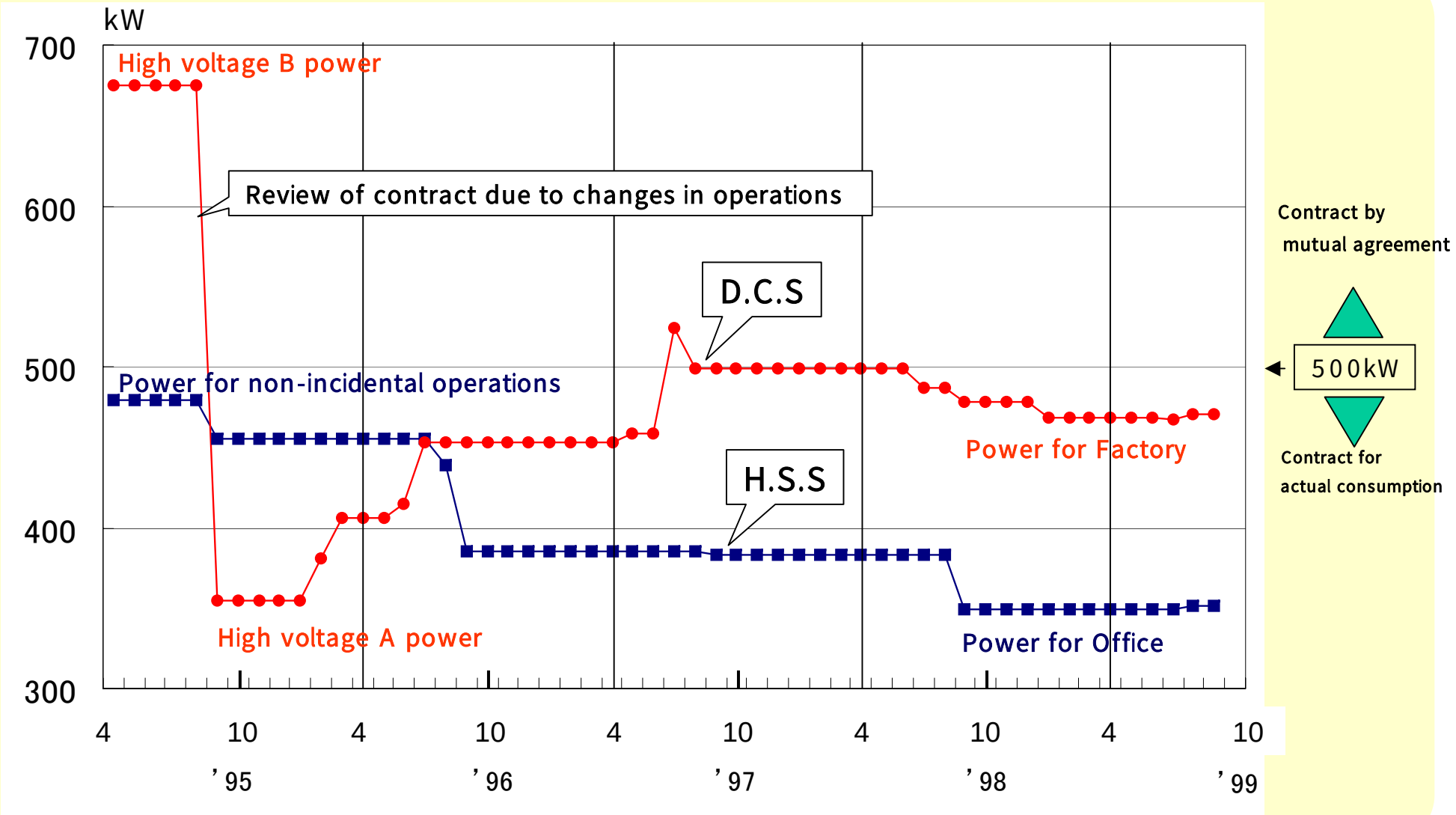
Notification to the Ministry of International Trade and Industry taking account of the actual results

Total contract demand 1,155kW → 810kW

High voltage B 675kW → 355kW High voltage A

For non-incidental operations 480kW → 455kW

-The Trend of Demand Power Level-



-Demand Control System-

- Investment ： 1,725kYen
  (Body 900„ Sensor 250, Installation work 575)

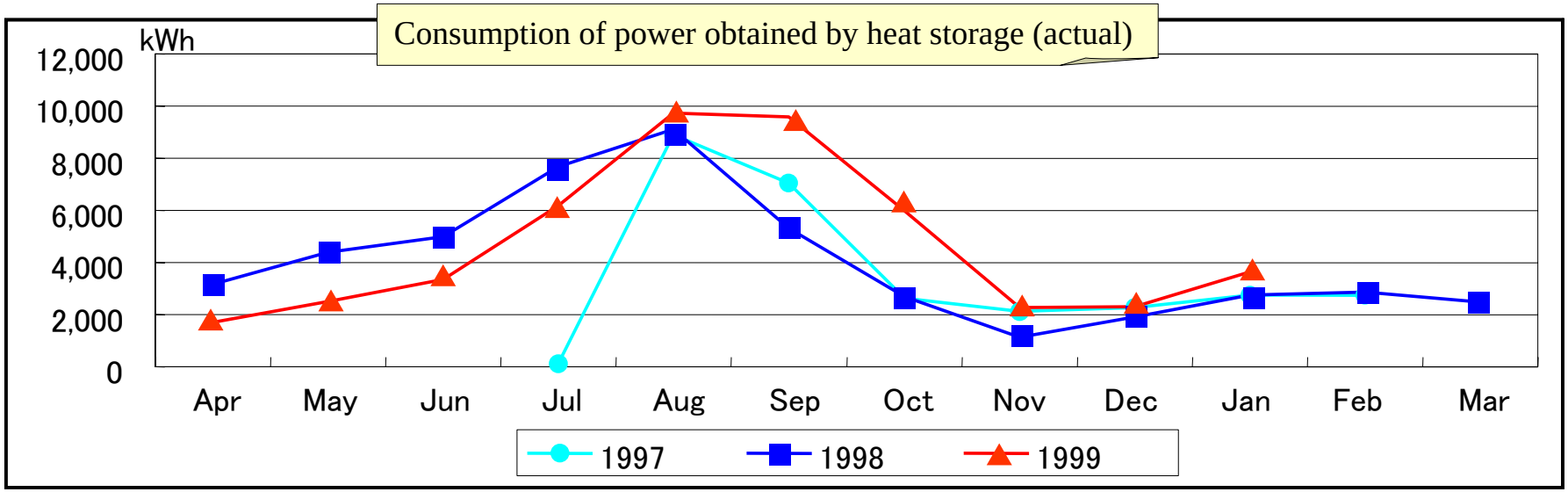
- Reduction ： 3,623kYen/Year
  The demand control system cut down demand power from 550kW to 470kW.
  (Standing charge basis) ＝（550×1.650－470×1.175）×12×0.85
  ＝3,623kYen/Year

- Term to get back the investment
  ： 0.5Year
  1,725÷3,623＝0.5Year

-Heat Storage System-

(kWh)

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total
'97				110	8,888	7,052	2,628	2,123	2,278	2,742	2,758		28,579
'98	3,170	4,384	4,982	7,678	9,095	5,316	2,672	1,148	1,924	2,751	2,858	2,470	48,448
'99	1,700	2,508	3,355	6,191	9,728	9,572	5,975	2,268	2,291	3,651			47,239



●Investment (increase) : 4,570kYen (Conventional 33,140, Heat storage 37,710)

●Reduction : 1,125kYen/Year

(Standing charge 34kW ↓ =541kYen、Charge based on consumption 48MWh ↓ =¥584,000)

●Term to get back the investment : 4,570kYen／1,125kYen=4.0years

(Subsidies for energy conservation and tax breaks not taken into account)

-The Target Level for Ene. Cons. at 2010-

- Promotion in progress with the acquisition of ISO 14001 authentication as a momentum

  (All organizations)

  - Energy conservation (reduction in power consumption)
  - Resource conservation (reduction in paper purchase)
  - Reduction of waste (separate collection of waste for recycling)

- Quantification of the goal for reasonable power consumption

  - Self-diagnosis by evaluating energy conservation potential (Understanding of the current state)
  - Evaluation of the achieved energy conservation by equipment
    (Electrical equipment, lighting equipment, air conditioners, carrier-power, elevators, etc.)
  - Evaluation of this facility ： 60 Pts (a level requiring further energy conservation)
  - Energy density ： 2,915 [MJ/m^2 per year] (694 [Mcal/m^2 per year])

In 10 years from now, aims to reduce by 15%, to 2,480 [MJ/m^2/ per year] or less.

-Energy Density Parameter-

- Power consumption in 1998 ：359.3×10⁴kWh

  (Not included in the companies specified for the 2nd class energy control)

- Energy density ：359.3×10⁴ kWh ÷ 11,651 ㎡
  (total floor space)

  ＝ 308 kWh/㎡ × 2.250 Mcal/kWh
  (in terms of primary energy)

  ＝ 2,915MJ/㎡・Year (694 Mcal/㎡・Year)

- Use of facility ：Offices 75%
  Telecommunications rooms
  (operating for 24 hours a day) 25%

  } Multi-purpose building

[National average ：Office buildings 1,806MJ/㎡・Year
Communication buildings 6,300MJ/㎡・Year] ➡ 2,932MJ/㎡・Year

-Evaluation by Ene. Cons. Potential-

Item	Evaluation by item		Comments (Outline of energy conservation measures)
Common	6 8 75	B	A power measurement system for each trunk line is necessary to promote further energy conservation in every organization
Electrical equipment	9 14 70	B	Introduction of high efficiency transformers and power saving devices and application of solar energy o outdoor lamps are desirable.
Lighting equipment	9 18 50	C	Introduction or examination of an intelligent lighting control system and high efficiency Hf lighting equipment is necessary.
Air conditioner	13 30 43	C	A system to effectively use the open air and improved awareness of temperature setting by organizations are necessary.
Carrier power (for fans)	4 8 50	C	Energy conservation-oriented equipment should be introduced when renewing.
Carrier power (for pumps)	4 6 77	B	Energy conservation-oriented equipment should be introduced when renewing.
Boiler	— — —	—	—
Elevator	2 2 100	A	—
Maintenance	10 10 100	A	—
Generalevaluation: General evaluation marks / General reference marks General evaluation marks / General reference marks	57 96 60pts	C	Introduction of lighting and air conditioning systems to promote energy conservation. It is also important to conduct thorough power measurement for each trunk line and build up the foundation for improvement by all organizations.

Item	Points to be checked	Reference marks	Evaluation marks
Electrical equipment	Introduction of high efficiency transformers 2: Introduced 1: Partly introduced or uses those of small-loss type within 10 years after manufacture 0: Not introduced	2	1
	Effective use of motors 2: Introduced 1: Partly introduced 0: Not introduced	2	—
	Load factor of transformers 2: Maximum load factor: 30% or more (all transformers) 1: Maximum load factor: less than 30 for some transformers	2	2
	Percentage of received power (confirmed with receipts of electric charge) 2: 100% 1: Less than 100	2	2
	Introduction of a demand monitoring and control system 2: Introduced and implemented monitoring and control 1: Introduced and implemented only monitoring 0: Not introduced	2	2
	Loss of distribution lines 2: Less than 200m per trunk line, or less than 40% of unbalance rate 0: 200m or more per trunk line and 40% or more of unbalance rate	2	2
	Introduction of new energy equipment 2: Introduced 0: Not introduced	2	0
	Voltage adjustment 2: Less than 100V per terminal or no equipment to be adjusted 0: 100V or more per terminal and some equipment to be adjusted	2	0
	Total	14	9

-2nd Step （’98～） -

①Air conditioner (Computer room on the 3rd floor)

<Equipment> Hybrid air conditioner

<Characteristics> Air conditioning without running a compressor, using the differences of location height and temperature of the indoor and outdoor units. Particularly effective in transition periods from a hot season to a cold season, and vice versa.

[Reduction in energy density: 5.5%]

②Lighting (4th and 5th floors)

<Equipment.> High efficiency lighting equipment (Hf inverter lighting)

Intelligent lighting control system (controllers buried in the ceiling, illumination sensors)

<Characteristics> Controls lighting load making the maximum use of daylight

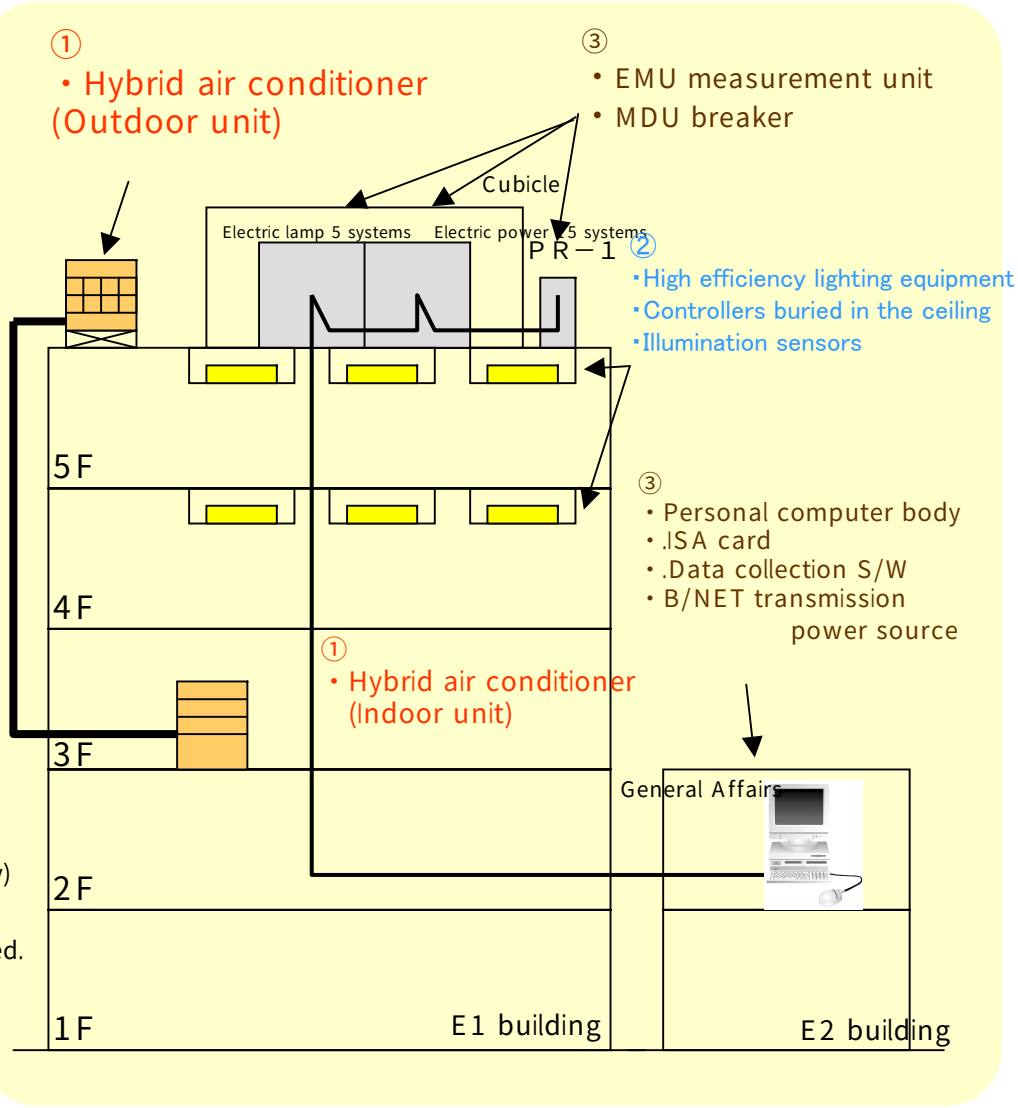
[Reduction in energy density: 1.7%]

③Measurement system (BEMS)

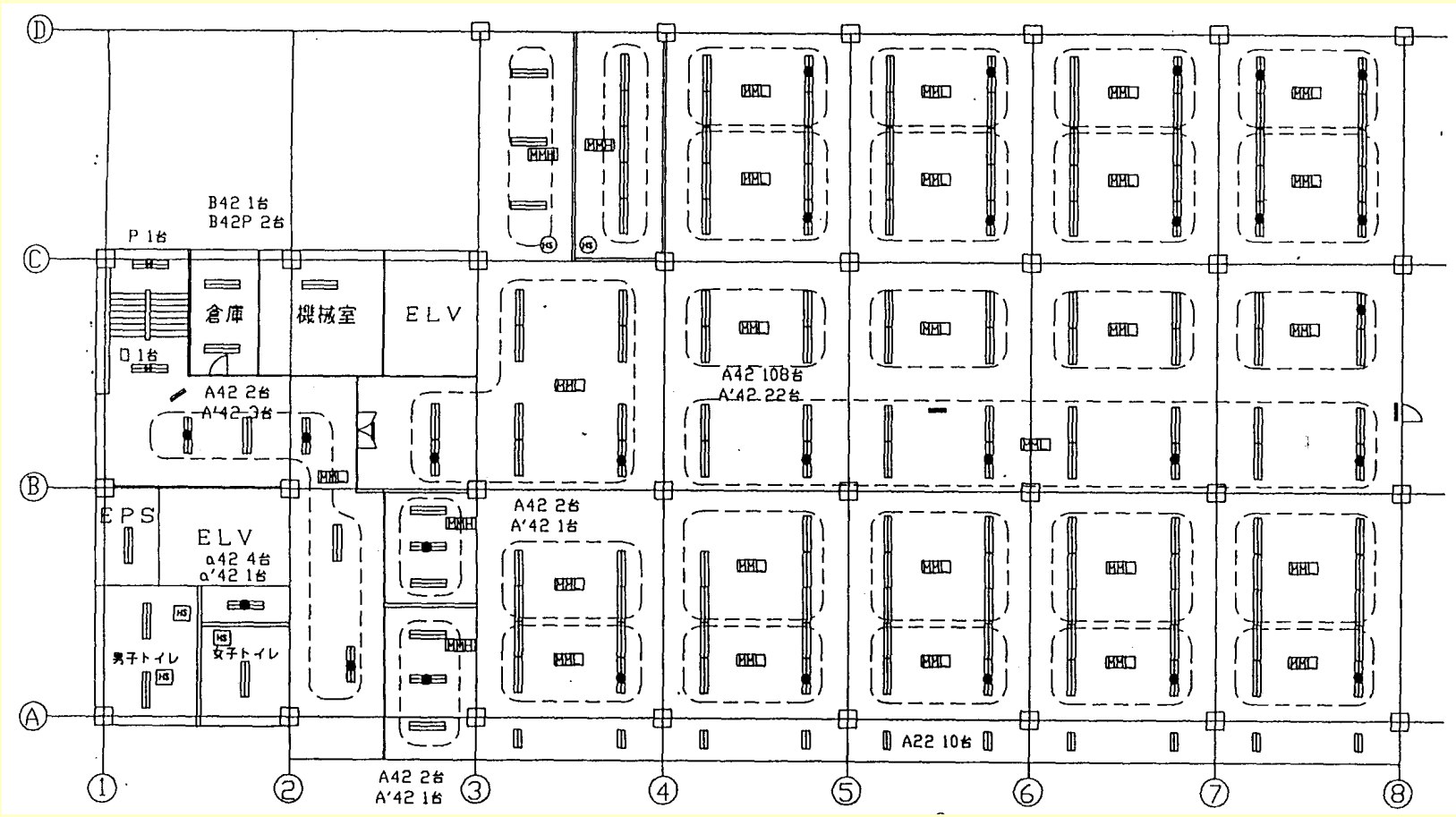
<Measurement data> Power consumption for each distribution board (monthly)

<Analysis> Trends of electric lamp receptacle load for each floor and respective power load can be grasped, and detailed measures can be planned.

[Reduction in energy density: 7.8%]



-The Intelligent Lighting Control System-



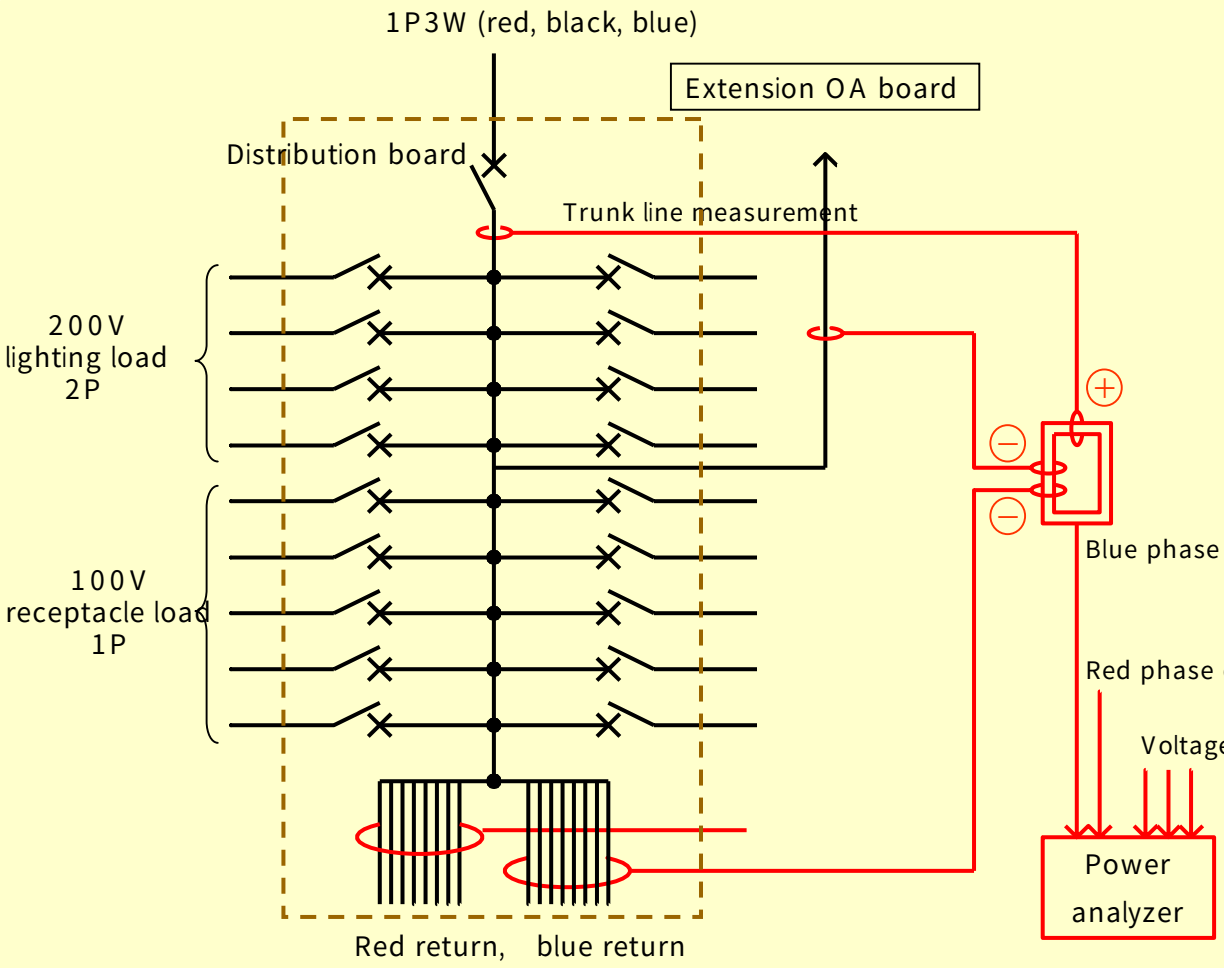
Legend ：Control zones (29 blocks)

MML ：Controllers buried in the ceiling (illumination sensory-type: 25 units)

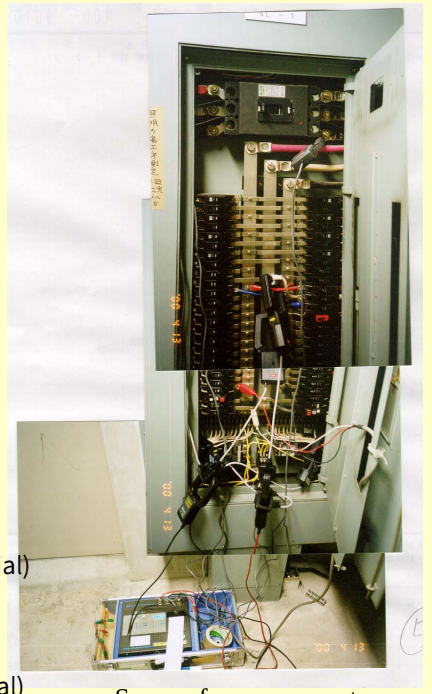
MMH ：Controllers buried in the ceiling (human sensory-type: 4 units)

HS ：Human sensory-type sensors (5 units)

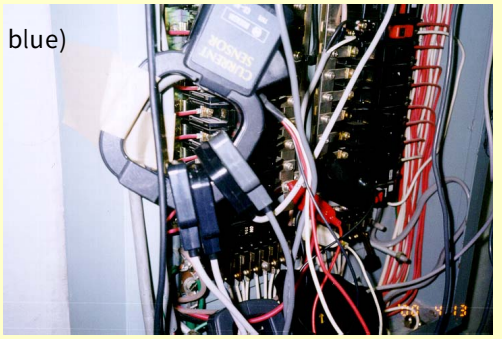
-Differential Power Measurement-



Differential measurement



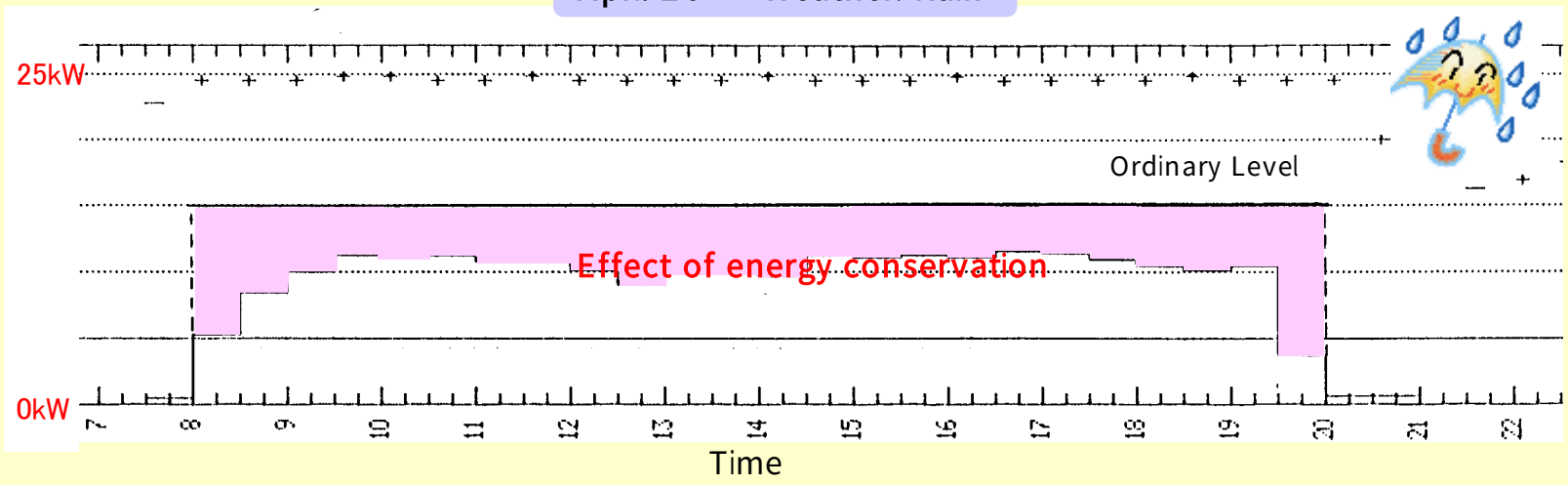
Scene of measurement



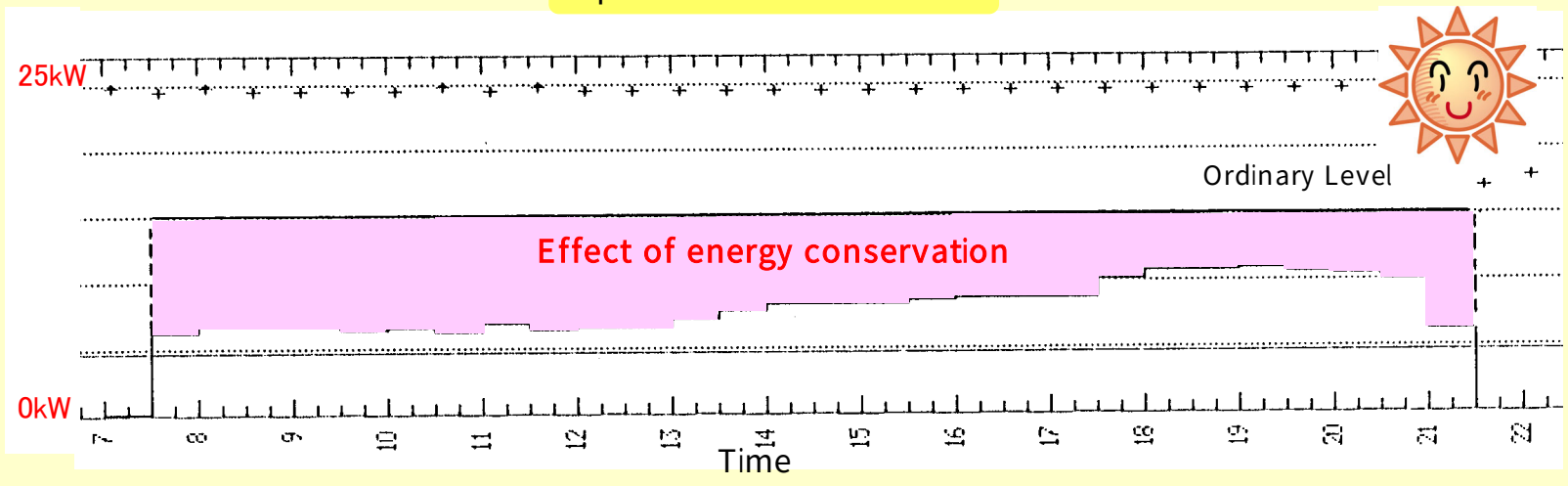
Scene of measurement (differential measurement clamp)

-The Test Results by Intelligent L. C. S. -

April 20 Weather: Rain



April 18 Weather: Fair



-Ene. Cons. Result by L. C. S for 10days-

Date of measurement	Time of lighting control	Power consumption	Average power	Rate of reduction (%)	Weather	Time zone of lighting control
H12-4- 5(Wed.)	12.5 hr	119.4 kWh	9.55 kW	42.2	Rain	9:00～21:30
H12-4- 6 (Thur.)	13.0 hr	118.4 kWh	9.11kW	44.9	Fair	8:30～21:30
H12-4- 7(Fri.)	12.0 hr	103.5 kWh	8.63kW	47.8	Fair	9:00～21:00
H12-4- 8 (Sat.)	9.5 hr	26.2 kWh	2.75kW	47.9	Fair	9:00～18:30
H12-4- 9 (Sun.)	7.5 hr	27.2 kWh	3.62kW	47.8	Fair	9:30～17:00
H12-4-10 (Mon.)	13.0 hr	120.8 kWh	9.29kW	43.7	Cloudy followed by rain	8:30～21:30
H12-4-11 (Tue.)	14.0 hr	124.9 kWh	8.92kW	46.1	Fair (strong wind)	8:00～22:00
H12-4-12 (Wed.)	13.5 hr	122.8 kWh	9.09kW	45.1	Fair	8:30～22:00
H12-4-13 (Thur.	2.0 hr	17.3 kWh	8.65kW	47.7	Fair	Date measurement ended
H12-4- 4 (Wed.)	5.0 hr	46.6 kWh	9.13kW	44.8	Fair	Date measurement started
		Average rate of reduction		45.8	Average of 10 days	

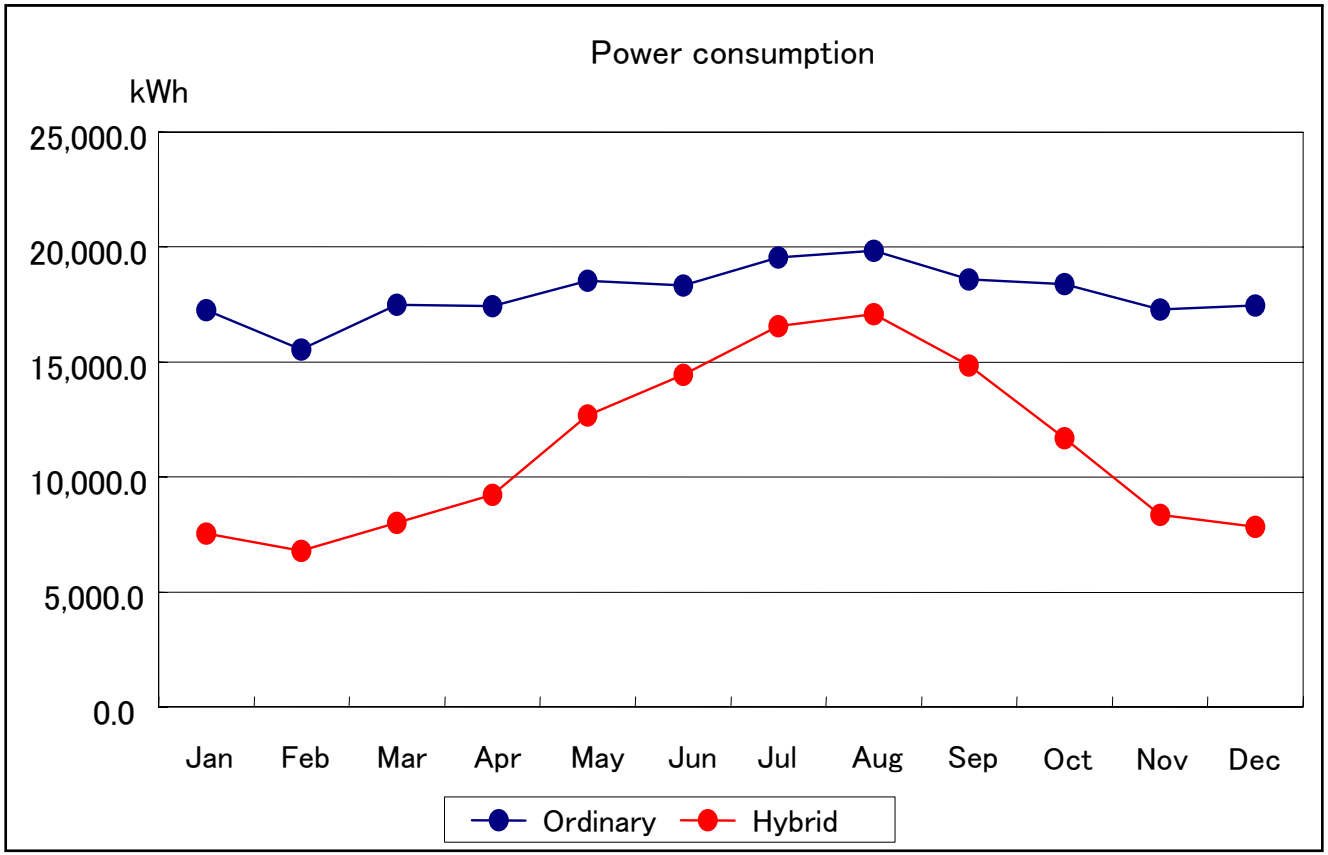
(Notes) The power reduction rate by lighting control was realized based on the following:

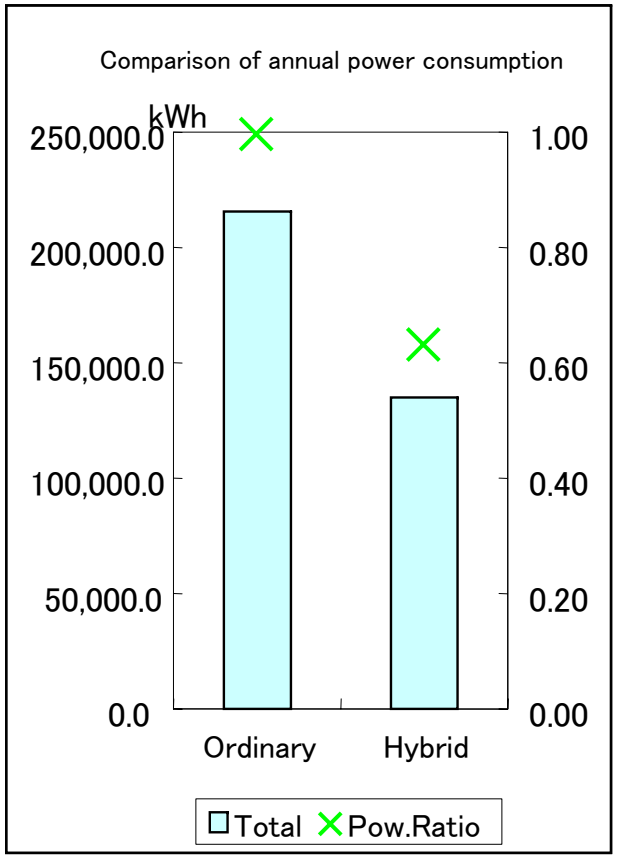
Calculation was made based on the power consumption of the conventional lighting equipment in the lighting control zone whic
155 FLR40W (rapid 2-lamp type) buried type units, 14 V-shape units, and 4 Hf32W 2-lamp V-shape units were used.
Power consumption at 206 voltages

FLR40W 2-lamp type: 95.5W/unit ´ (155+14) units = 16.14kW
Hf32W 2-lamp type: 97.0W/unit ´ 4 nits = 0.39kW
Total power of conventional equipment = 16.53kW

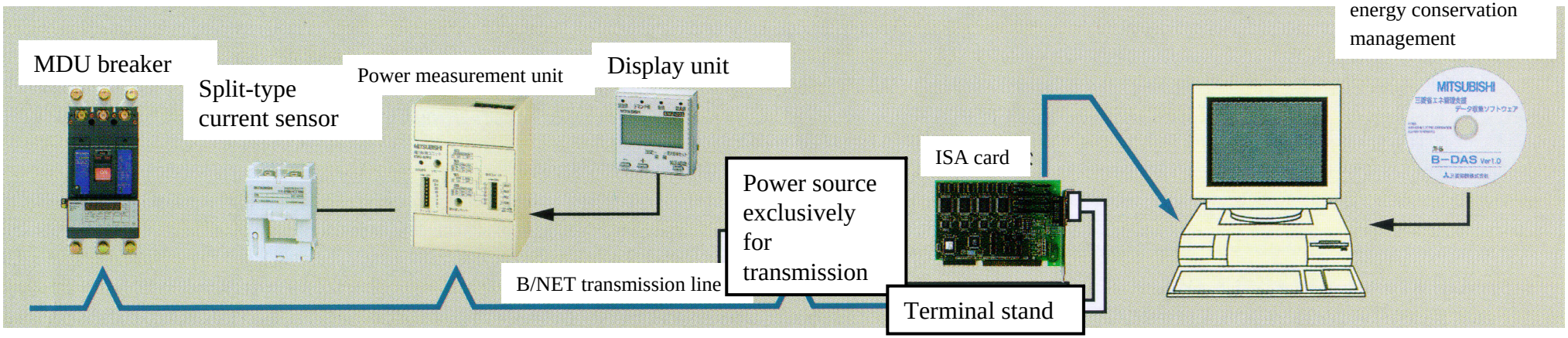
-Ene. Cons. Result by Hyblid Air Conditioner-

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Pow. Ratio	On/Off
Power consumption [kWh]	Ordinary	17,255.7	15,554.2	17,501.2	17,419.0	18,523.5	18,337.5	19,556.0	19,846.9	18,592.1	18,378.9	17,293.8	17455.5	215,714.3	1.00	24,177
	Hybrid	7,548.0	6,788.4	7,999.0	9,218.8	12,680.6	14,440.8	16,573.9	17,093.3	14,862.4	11,694.7	8,343.4	7830.4	135,073.7	0.63	7,686





-The Sequence of BEMS-



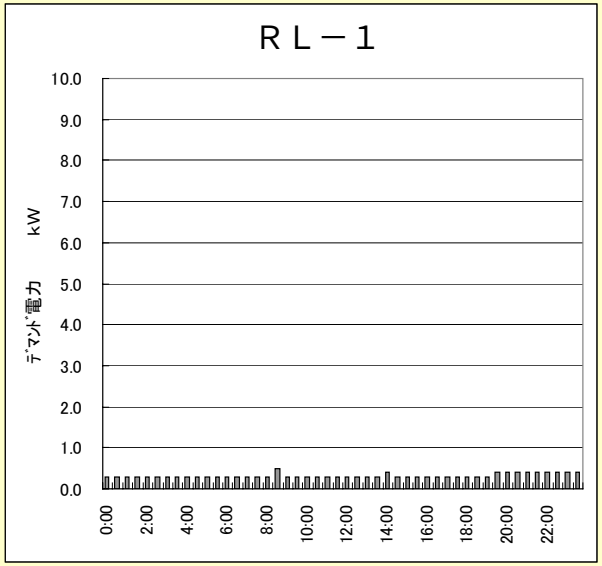
○Can easily link data such as electric power from the MDU breaker and the power measurement unit to the host personal computer.

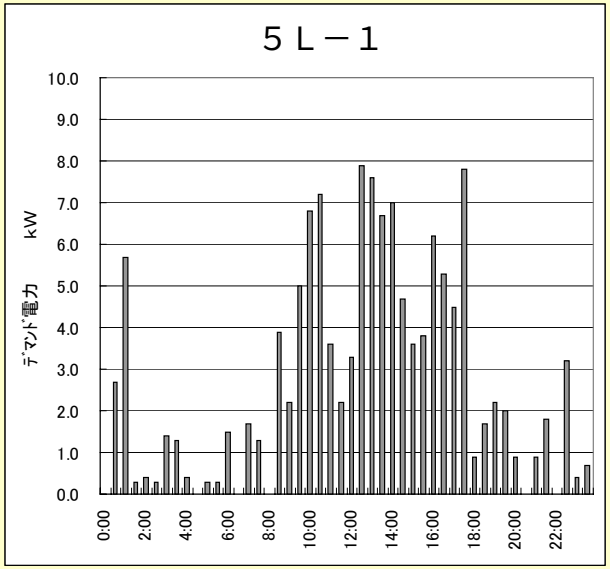
○Can support up to 4 channels with an ISA card, enabling a total of 252 terminals to be connected. (63 terminals/channel)

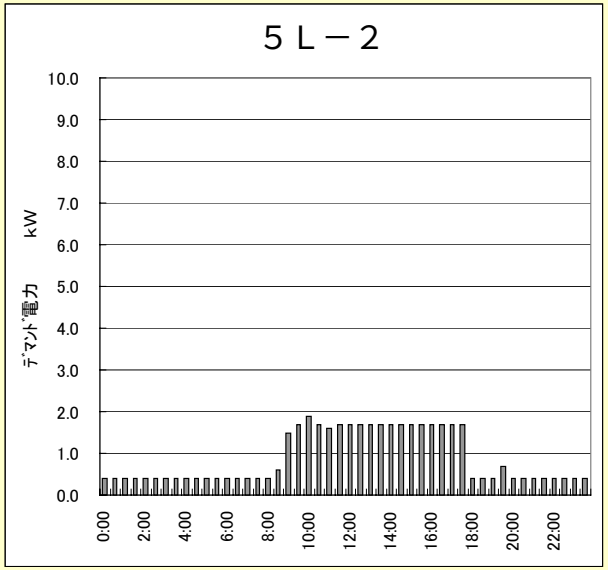
○Can easily display collected data using the software for data collection to support energy conservation management (in combination with the ISA card).

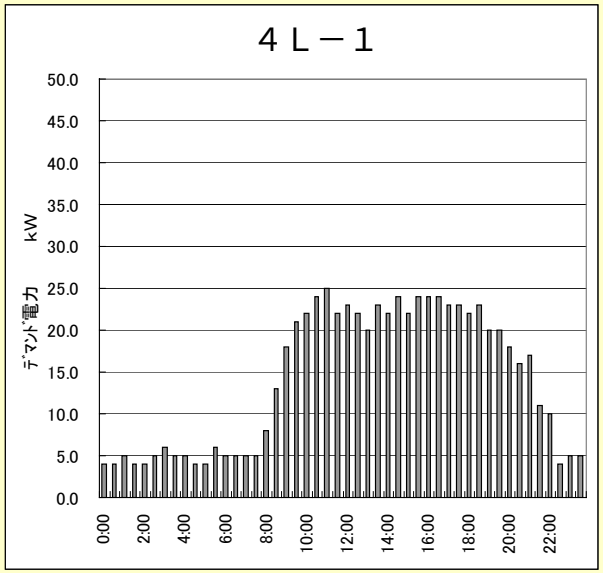
-Daily Power Curve for Each Line-

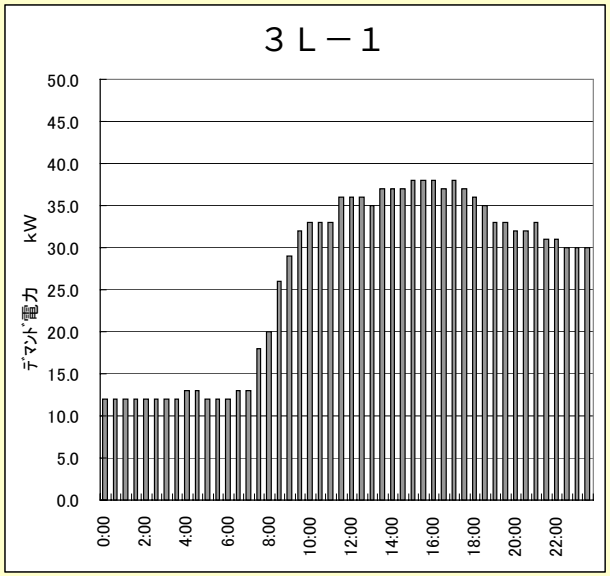
April 10, 2000

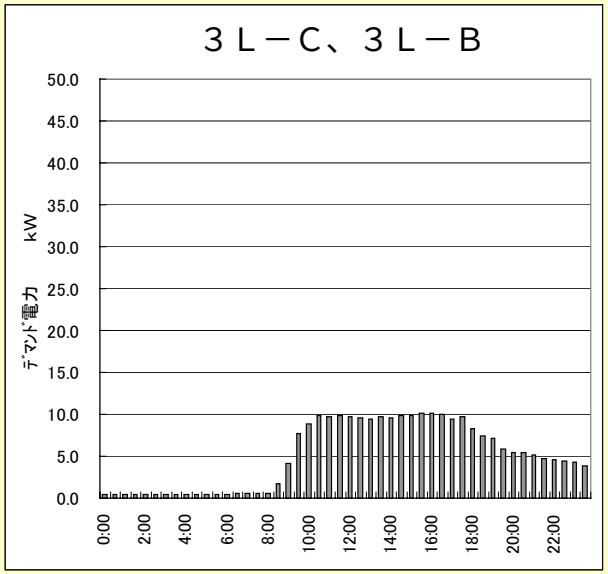












-Daily Power Curve for Each Floor-

April 10, 2000

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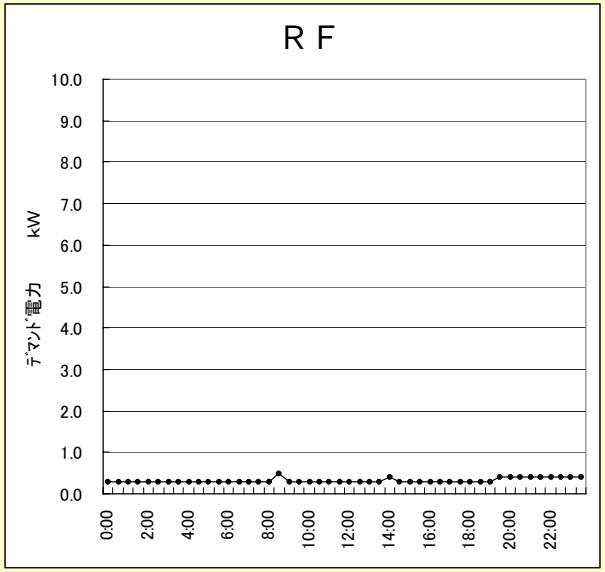

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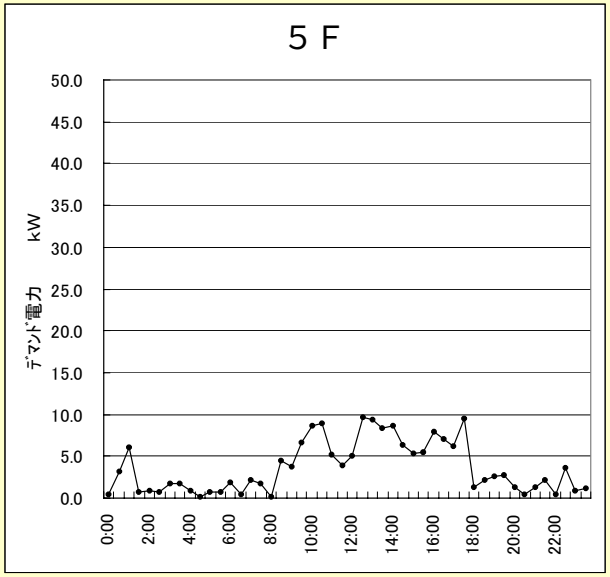

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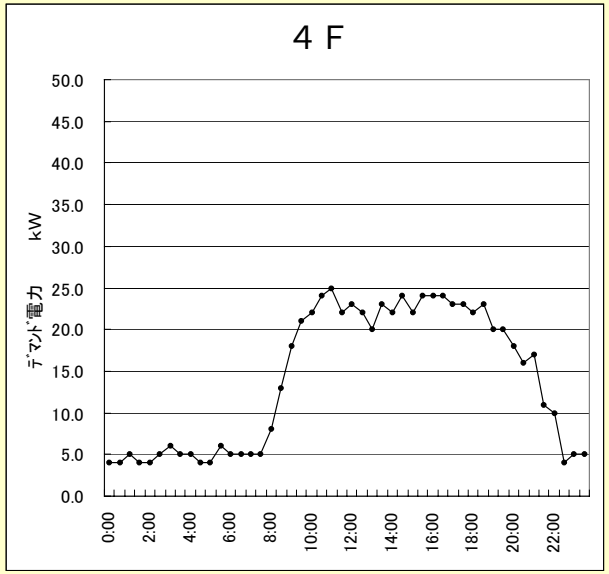

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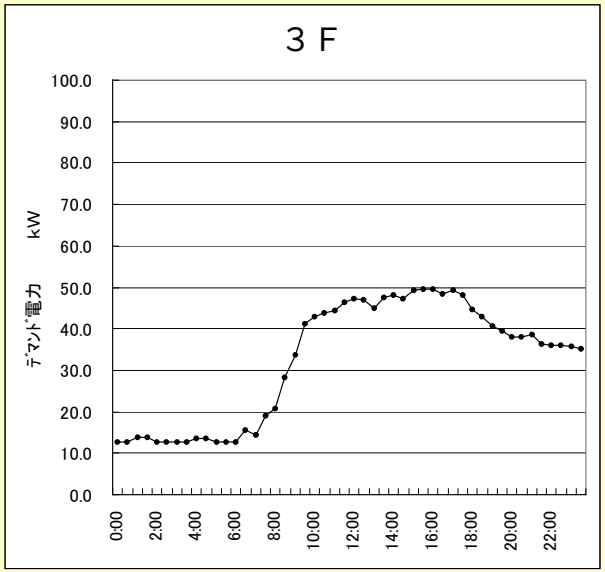

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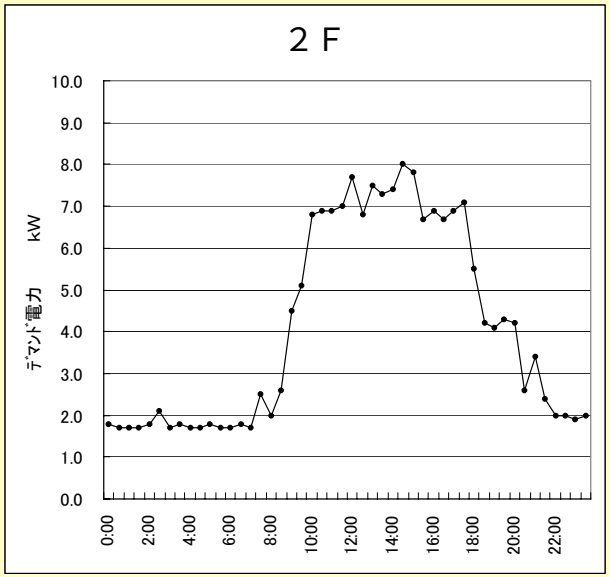

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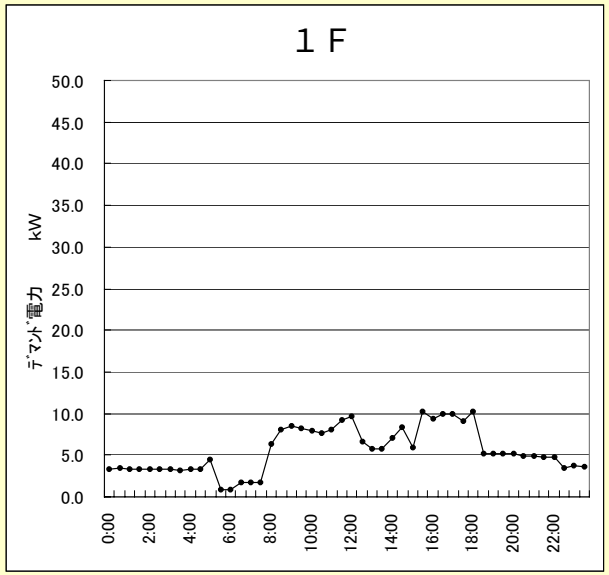
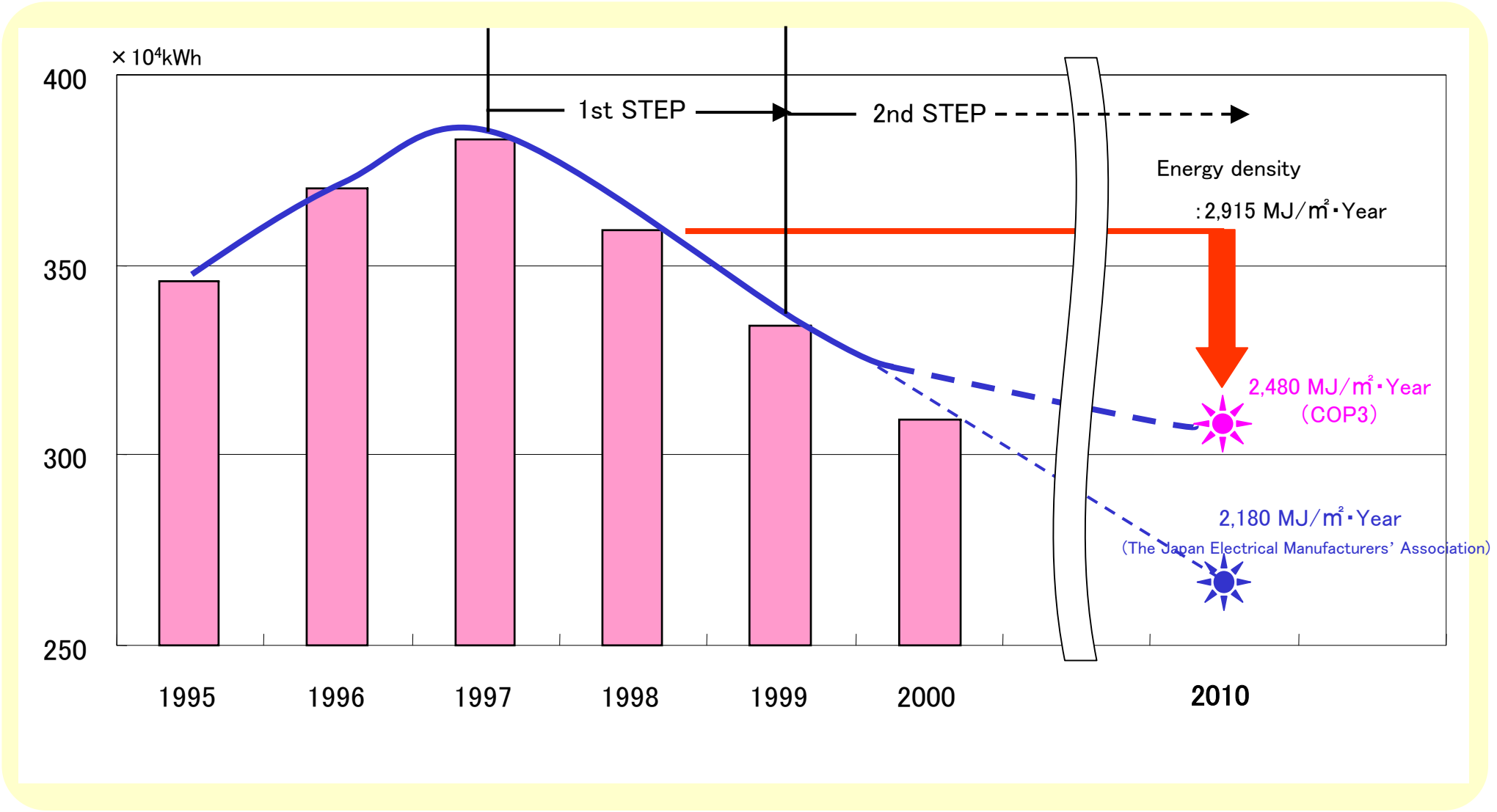


-The Trend of Energy Conservation-



-Future Planning-

(1) Strive to achieve the goal for 2010 by continuing the activities as in the past.

- Continue energy conservation activity corresponding to reorganization of places of business.
- Place importance on energy density as the evaluation index.

(2) Target level of long-term plan

- Level that must be attained (considering COP3) : 15%
- Goal that is desired to achieve (considering JEMA) : 25%
  (considering independent goal of The Japan Electrical Manufacturers' Association)

(3) Maintenance to produce the continued effect of introduction of energy conservation equipment

- Targets: the introduced heat storage tank, intelligent lighting control system, and hybrid air conditioner
- Confirm deterioration of equipment and decrease in energy conservation effect.
- Improve maintenance techniques related to recovery of the above.

(4) Support of energy conservation efforts by each division

- Utilize data of the measurement system.
- Link to the efforts for ISO14001