6. Mitsubishi Estate Co., Ltd.

1. Company Profile

Mitsubishi Estate Co., Ltd. was founded in May, 1937. We will strive to create a truly meaningful society through the development of a secure, safe, comfortable and appealing urban environment in each of our locations, acting as representatives of the people who live, work, and seek leisure there.

The Mitsubishi Estate Group's fundamental mission is to create a truly meaningful society through urban development. With a core in development in its Building Business operations, Residential Development operations, Architectural Design & Engineering operations, and Urban Development and Investment Management operations, the Mitsubishi Estate Group aims to increase corporate value by wielding the synergistic effects of its value chain of businesses related to real estate.

We have positioned compliance and consideration of the global environment as cornerstones of all our businesses. By constantly strengthening our foundations, we aim to continue onward as a good corporate citizen accepted by society.

During the fiscal year ended March 31, 2004, Mitsubishi Estate Co., Ltd. and its consolidated subsidiaries recorded revenue from operations of 679,918 million yen. Operating income was 103,749 million yen, net income for the fiscal year was 34,989 million yen.

In international Business operations, Rockefeller Group, inc. (RGI), a subsidiary of Mitsubishi Estate Co., Ltd., engages in the leasing and management of office buildings in such locations as New York and London, as well as real estate development across the United States. In additions, Cushman & Wakefield, Inc., an RGI subsidiary, offers comprehensive real estate services, centered on real estate brokerage worldwide.

2. Environmental Activities

As a corporate citizen, the Mitsubishi Estate Group engages in activities that has positioned protection of the global environment as a key priority of management. As a part of our environmental activities, we formulated the Mitsubishi Estate Group Environmental Charter to provide guidelines for each Group company in their environmental preservation activities and efforts to reduce environmental impact. Mitsubishi Estate Group is working hard to acquire ISO 14001 certification for environmental management systems. So far, our office building management business and residential development, architectural design & engineering, custom-built housing, and hotel business operations have all acquired accreditation.

3. Objectives

One of the most important objectives for the participation in this project is to find out the way to use JEPIX effectively. Our main business field is buildings management whose business is

remarkably different from that of production industry. The important focus for us is, therefore, making our own indicators for the business. Also, we have empirically proved that the environmental impacts differ according the age of buildings.

4. Scope

Mitsubishi Estate Group is working in various fields. For example buildings business, housing development, design management, asset development investment, international business, order housing, hotels and vacation etc. Among these fields, the building business is our main field which covers 50 % of the whole (Figure 6.1). In this project, we have conducted an analysis on our building management business.

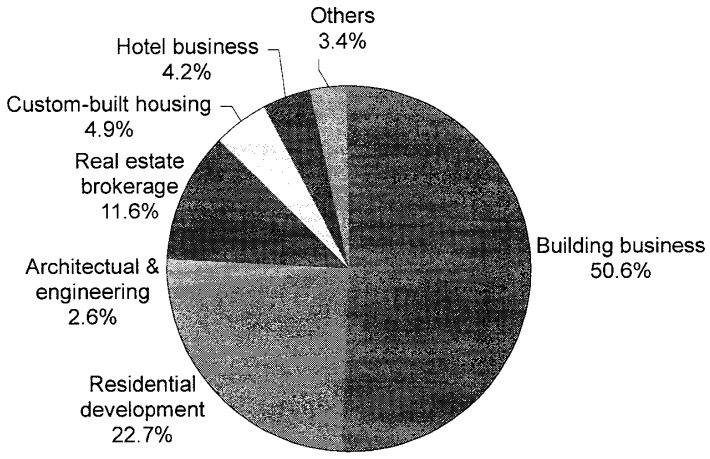

Figure 6.1: Operating profit among segments

The buildings analyzed are these 28 buildings below which are all certified with ISO 14000. For these buildings, data of 2001 and 2002 are available.

[Buildings analyzed]

Mitsubishi Building, Mitsubishijuko Building, Mitsubishidenki Building, Furukawa Building, Mitsubishishouji Building, Marunouchi Yaesu Building, Tougin Building, Shinmaru Building, Shin Yurakucho Building, Yurakucho Building, Hibiya Kokusai Building, Shin Tokyo Building, Fuji Building, Shin Kokusai Building, Kokusai Building, Otemachi Building, Shin Otemachi Building, Nihon Building, Shin Nittetsu Building, Kawatetsu Shouji Building, Shin Aoyama Building, Aoyama Building, Akasaka Park Building, Mita Kokusai Building, Harumi Park Building, New Harumi Park Building, Yokohama Landmark Tower, Sakuragicho Golden Center

5. Conditions

In building management business, it is very difficult to grasp the whole activity of each tenant. The evaluation of environmental impact, therefore, will be conducted under these circumstances below.

- Input and Output may not necessarily be linked to each other.
- Output from the electricity use is not explicit.
- Input for the waste is difficult to grasp because it results from the tenants.

▼ Input data

As shown in Table 6.1, electricity use, fuel, gas, heat, waste (incinerated), waste (unburnable) are used as input data. In these input data, the inputs for the tenants are also included. From these input data, the environmental impact causing material quantity was calculated with corresponding inventory data (LCI data) and life cycle inventory analysis (LCIA) was conducted.

Table 6.1: Input data

Names for control	Names of utilized LCI		Used amount of 2001	Used amount of 2002
Electricity	Production of electricity (Japan LCA Forum)	kWh	450,143,807	443,100,332
Fuel oil	A heavy oil (Japan LCA Forum and NIRE database)	Kl	119	114
City gas	City gas 13A (natural gas production - incineration) (Japan LCA Forum)	m^3	3,695,406	3,518,708
Heat (calorie)	CO_2 emission from communal central heating and air-conditioning	MJ	557,363,639	556,085,732
Waste (incinerated)	Waste for incineration, average CH, 2000	kg	9,954,577	9,700,568
Waste (non-flammable)	Waste to reclaimed land (Ds,Rf)	kg	1,228,732	604,487

All the consumption data include data of the 28 buildings which were analyzed.

▼ Background data

The priority of data source for inventory data was: 1) Data of Japan LCA Forum, 2) NIRE database, 3) BUWAL and 4) threshold value by the environmental ministry (only for CO_2). But the data from NIRE database was used for the LCI of fuel which relates to the inventory data of electricity production (Figure 6.2).

As for gas, the following data was used for the calculation by the tool, Regis. (Gas 39.1529 MJ/m3: source Regis). As for heat, the global warming coefficient by environmental ministry was used. (Heat: 0.067 CO_2 kg/MJ, article 1 ha: emission caused by the use of the heat provided by third party.)

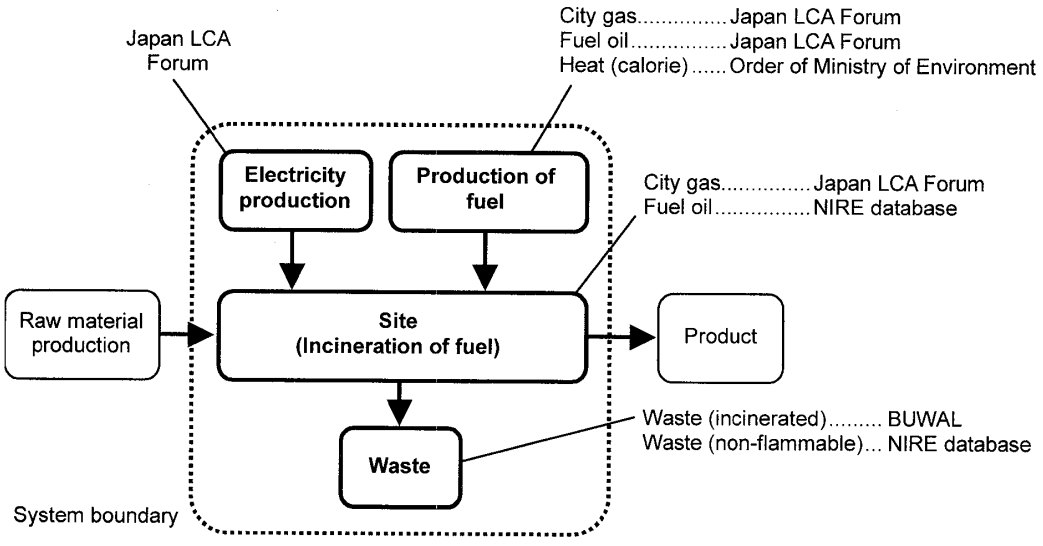

Figure 6.2: Sources of inventory data

Supplement to the inventory data of electricity production:
To complete the inventory data of electricity production, LCI data of each fuel which is consumed for the electricity production is necessary. The data of NIRE database was used for it (Figure 6.3).
If the data of LCA Forum was used for the electricity and also for the fuel for electricity production, there would be a circular use of data and the calculation would be impossible. NIRE database is, therefore, used for the downstream data to avoid this problem.

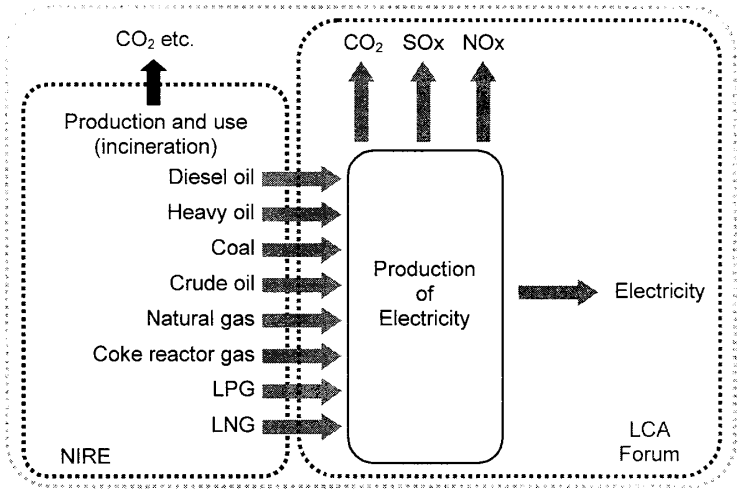

Figure 6.3: Inventory as a whole

6. Results

▼ Change in eco-efficiency

Our eco-efficiency (value added / environmental impact) is calculated as "total floor space / environmental impact." Value added could have been revenue, but we have chosen total floor space as value added. The rate of operation, such as tenant rent rate, was one of the alternatives, but because it changes too much in one year, we have decided to use total floor space.
As a result, the improvement of 3.8% was accomplished from the year of 2001 to 2002 (Figure 6.4). Because there was no change in total floor space, the improvement of eco-efficiency results from the reduction of environmental impact. Now this reduction of environmental impact will be further analyzed.

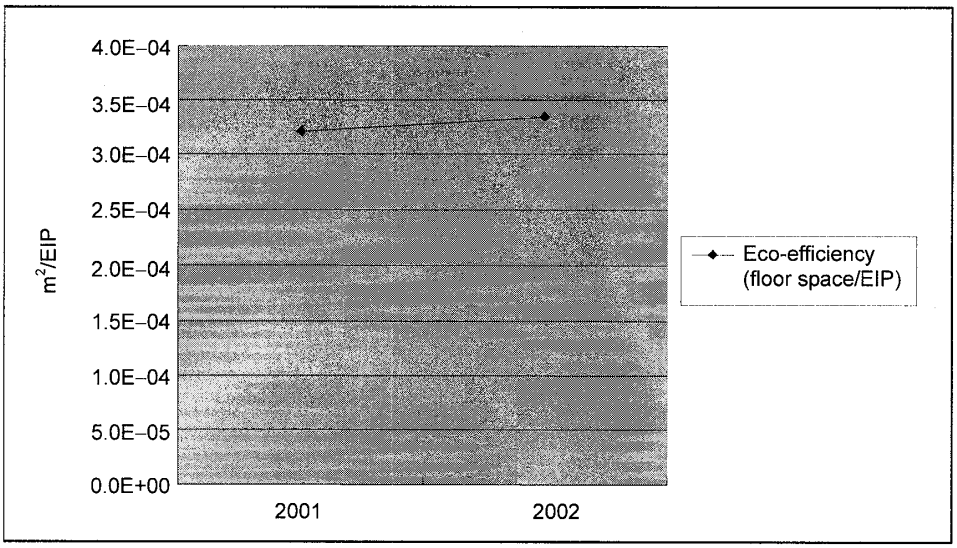

Figure 6.4: Transition of eco-efficiency

Table 6.2: Tansition of eco-efficiency

	2001	2002
Environmental impact point for company all (EIP)	6,736,514,527	6,487,104,523
Floor space (m^2)	2,166,866.58	2,166,866.58
Eco-efficiency (floor space/EIP)	0.00032166	0.000334027

▼ Change in environmental impacts at each measure point (JEPIX, 2001-2002)

The total environmental impact was divided according to the place where it was measured, and as a result it became clear that electricity (45%) and incinerated waste (45%) cover 90 % of the whole.

Then we have focused on the change between the two years (2001-2002). Unburnable waste, which causes only 1% of the total environmental impact, has been reduced to 50%.The reduction of the unburnable waste has contributed to the reduction of total environmental impact (see Table 6.3). In addition to unburnable waste, incinerated waste and electricity consumption were also reduced and it led to reduction of total environmental impact.

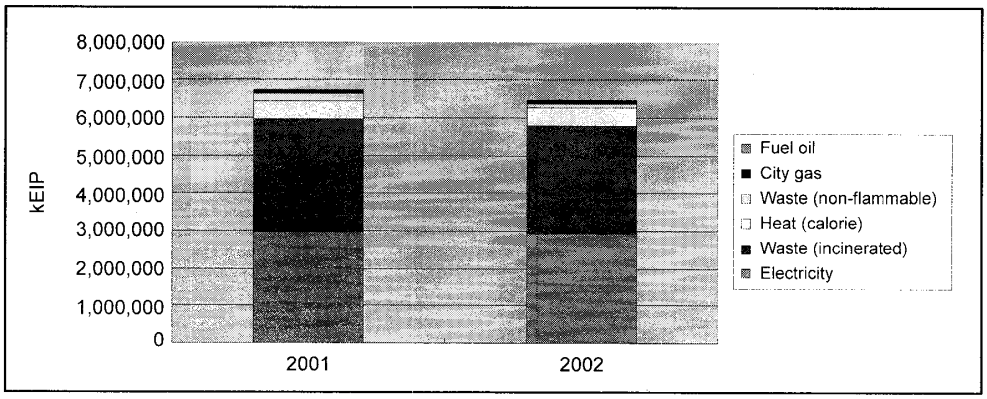

Figure 6.5: Transition of environmental impact among measurement points

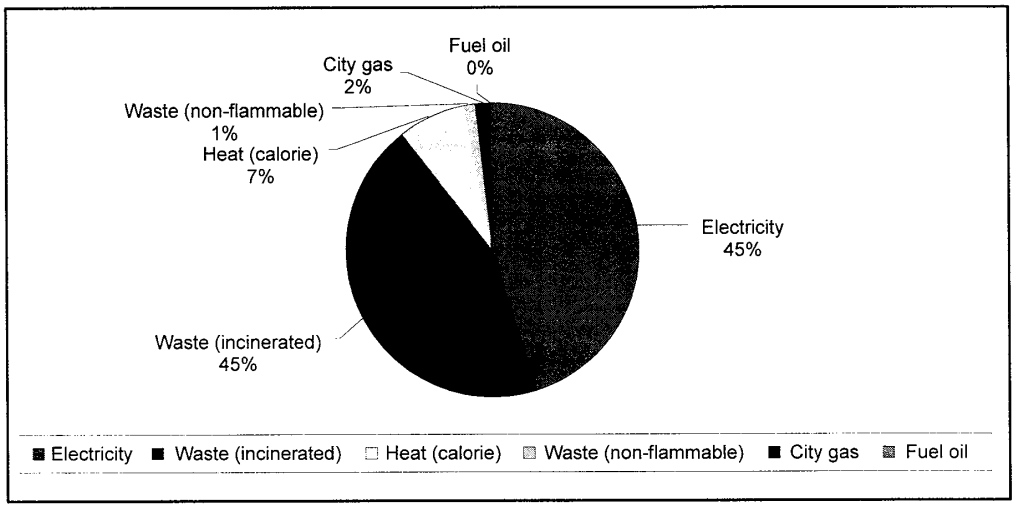

Figure 6.6: Environmental impact among measurement points (2002)

Table 6.3: Transition of environmental impact among measurement points (2002)

	2001	2002
Electricity	2,985,673,041	2,914,149,327
Waste (incinerated)	2,965,625,929	2,889,952,631
Heat (calorie)	477,995,057	476,899,124
Waste (non-flammable)	187,871,715	92,425,370
City gas	113,137,370	107,727,640
Fuel oil	6,211,415	5,950,431
Total	6,736,514,527	6,487,104,523

▼ Change in environmental impacts from each material

In Figure 6.7 and Table 6.4, the environmental impact of each material is calculated. The materials, which cause less than 1% of the total environmental impact, are omitted from here. It is now clear that CO_2 (41%) and total organic carbon (34%) cover the 75% of the whole.

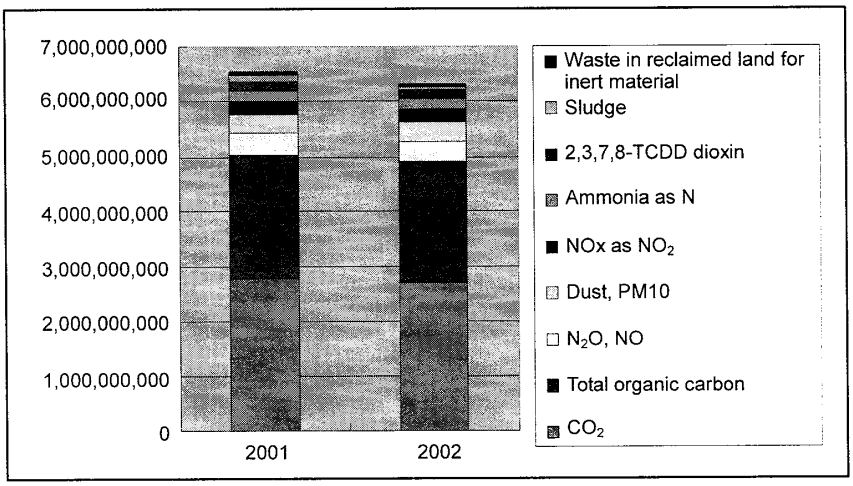

Figure 6.7: Transition of environmental impact among material

Table 6.4: Transition of environmental impact among material

	2001	2002
CO_2	2,778,014,179	2,709,028,158
Total organic carbon	2,277,163,258	2,219,057,327
N_2O, NO	367,659,631	363,464,791
Dust, PM10	349,165,736	340,811,899
NOx as NO_2	231,460,248	230,812,203
Ammonia as N	195,269,179	190,286,533
2,3,7,8-TCDD dioxin	177,796,420	173,259,623
Sludge	115,402,509	56,773,419
Waste in reclaimed land for inert material	72,126,568	35,483,387
Cadmium	32,868,321	32,029,665
PAH	25,059,798	24,420,352
Hexachlorobenzene	15,403,866	15,010,809
Hydrogenfluoride	14,545,352	14,174,201
Mercury	10,077,093	9,819,989
Total	6,736,514,527	6,487,104,523
1% cut off	67,365,145	64,871,045

Thereafter, the factor emission of CO_2 and total organic carbon, which have quite a large proportion, was analyzed. As shown in Figure 6.8, environmental impact from CO_2 is mostly caused by electricity (78%) and heat (17%). These 2 factors cover 95% of the whole.

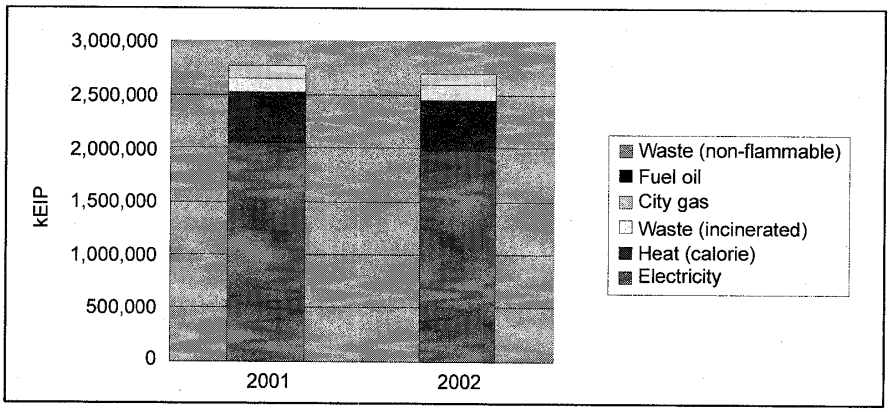

Figure 6.8: Elemental analysis of CO_2 emission

As shown in Figure 6.9, all of the total organic carbon is caused by incinerated waste.

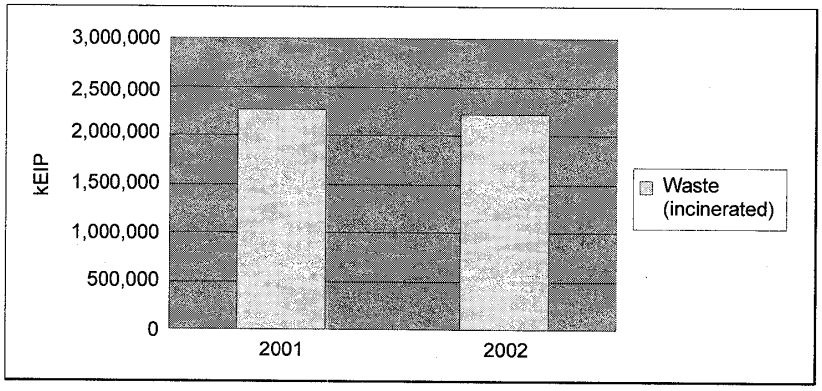

Figure 6.9: Elements of emission of total organic carbon

Table 6.5: Elemental analysis of emission among material

	Total organic carbon		CO_2	
	2001	2002	2001	2002
Electricity			2,041,161,247	1,982,492,973
Heat (calorie)			477,995,057	476,899,124
Waste (incinerated)	2,277,163,258	2,219,057,327	141,383,663	137,776,003
City gas			112,600,267	107,216,220
Fuel oil			4,819,612	4,617,108
Waste (non-flammable)			54,334	26,730

▼ Environmental impacts from each building (2002)

Here the environmental impact from each building is analyzed. Firstly, the environmental impacts from each building in absolute value were compared to each other. As a result, it became clear that H building, which has a large floor space, causes 21% of the whole environmental impact (Figures 6.10, 6.11).

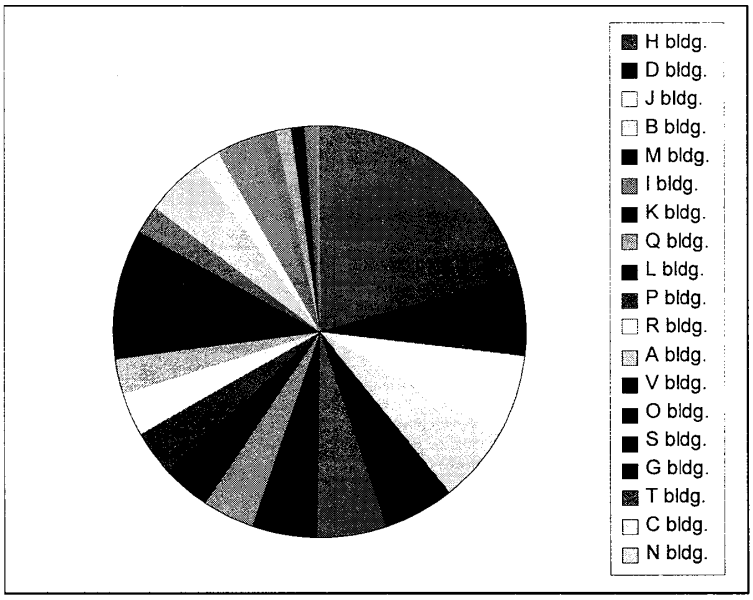

Figure 6.10: Balance of environmental impact among buildings (2002)

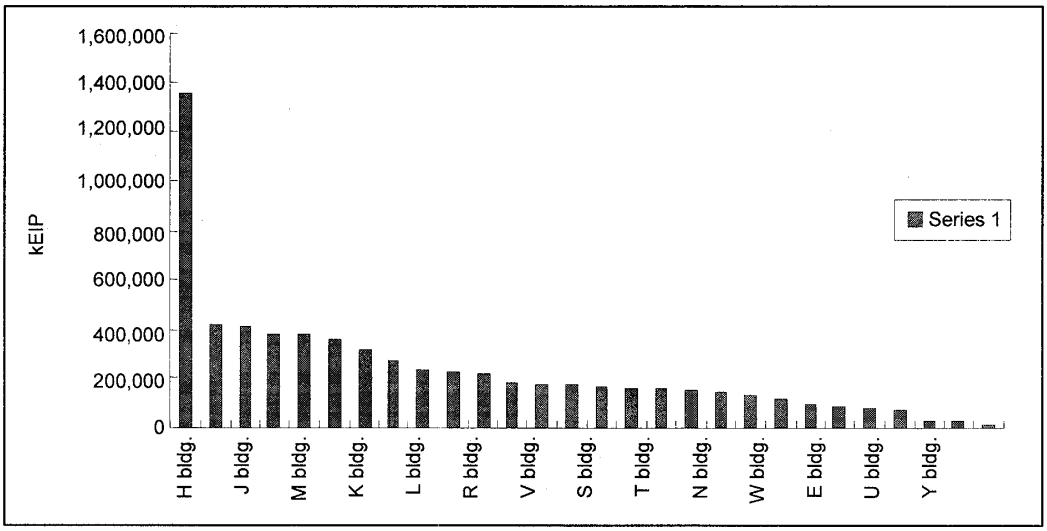

Figure 6.11: Balance of environmental impact among buildings (2002)

The environmental impacts pro floor space were compared to each other to see their efficiency. Seen in percentage (Figures 6.12, 6.13), every building has from 2 to 5% and there is no big difference among them. But seen in absolute value, the environmental impact of the building A is 3.2 times higher than that of building AA, and it can be seen that there is a fairly large difference in terms of efficiency.

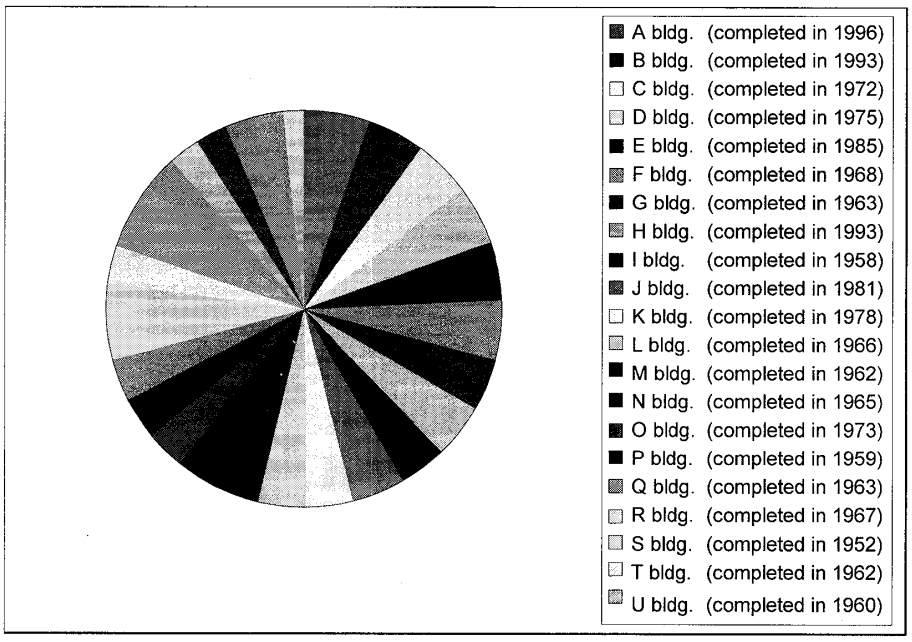

Figure 6.12: Environmental impact per floor space among buildings (2002)

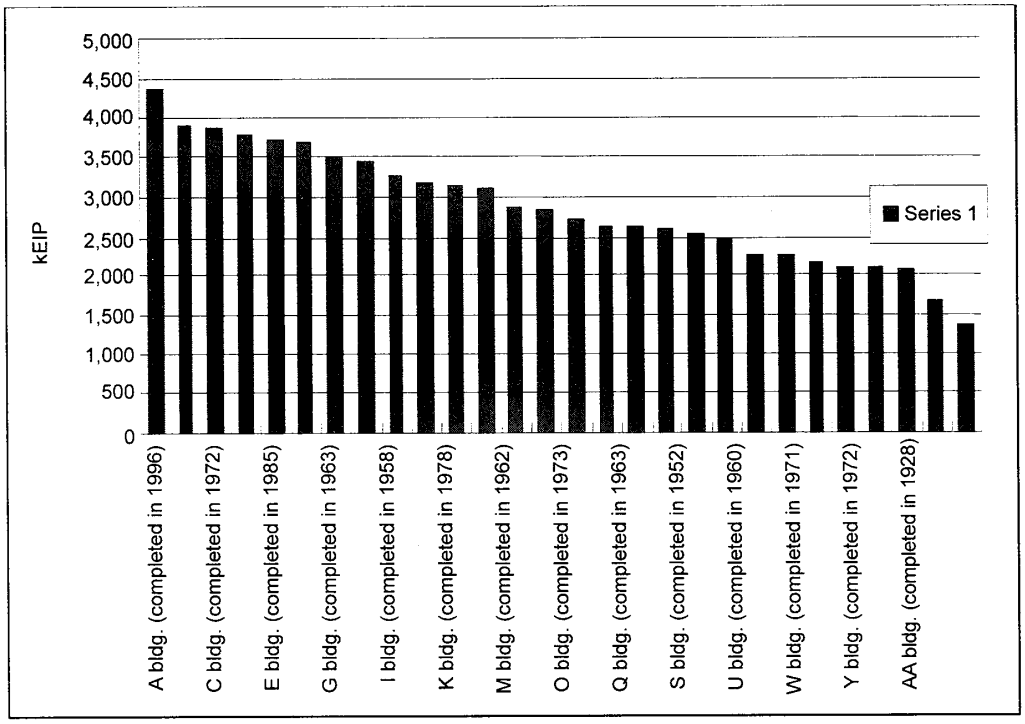

Figure 6.13: Environmental impact per floor space among buildings (2002)

▼ Relationship between efficiency and completion year

At the end of the analysis, environmental impacts of the building completed in the past and the building with the newest technology were compared to each other. In Figure 6.14, the buildings are lined according to their age (older buildings in the left).

It can be seen in this figure that the new buildings cause slightly more environmental impact pro floor space. The correlation coefficient is 0.48 and there may be a positive correlation between them. The reason for this positive correlation can be the fact that there are many IT companies in the new buildings and they may consume more electricity than other companies. Whether this really is the reason will be searched in our further analysis in the future.

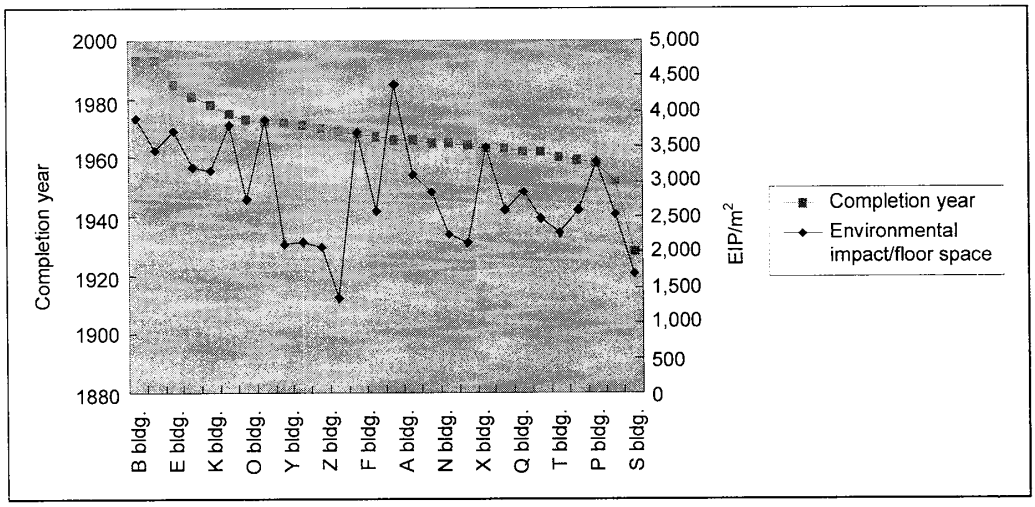

Figure 6.14: Relationship between completion year and environmental impact/floor space

7. Summary

The analysis is summarized as follows.

- Compared to the year of 2001, eco-efficiency of 2002 has been improved due to the reduction of environmental impact which was achieved through energy saving (electricity, fuel, gas and heat).
- 90% of our environmental impact is caused from electricity use and incinerated waste.
- In terms of material, CO_2 has the largest proportion of environmental impact and total organic carbon has the second.
- The largest cause for CO_2 emission is electricity use.
- The buildings with larger floor space cause more environmental impact.
- There is a slight trend that the new buildings cause more environmental impact pro floor space but the correlation is not necessarily definitive (potential reason could be that more IT companies, which may consume lots of electricity for computer use, are in the new buildings.)

Through this benchmarking project, some future task with the practice of JEPIX became clear. For example comparison with the result inclusive of housing development and hotel business, comparison between new and old buildings and grasp of revenue and environmental impact of the electricity bought from other company than TEPCO. Especially, in the comparison of new and old buildings the unexpected result has come out, and it will be interesting to analyze the reason for it.