# ENVIRONMENTAL POLICIES IN JAPAN

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# ENVIRONMENTAL POLICIES IN JAPAN

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# PREFACE

In 1976-1977, the OECD Environment Committee conducted a Review of Environmental Policies in Japan. This was the second national review undertaken by the Committee, the first having been conducted in Sweden in 1973.(1)

The Review was based on an extensive survey conducted in Japan by the OECD Secretariat. The preliminary results of this survey were examined during an Analysis Meeting held in Japan in November 1976 attended by high level government officials responsible for national environmental policy formulation and implementation in OECD countries.

This Analysis Meeting was chaired by Mr. G. Eldin, Deputy Secretary-General of the OECD, with the assistance of four group leaders responsible for investigating the four main themes of the Review, namely:

i) Setting of Standards: Mr. A.J. Fairclough, Director, Central Unit on Environmental Pollution, Department of the Environment, United Kingdom, Chairman of the Environment Committee;

ii) Compensation Schemes: Mr. J.F. Saglio, Directeur de la Prévention des Pollutions et Nuisances, Ministère de la Culture et de l'Environnement, France;

iii) Siting of Development Projects: Mr. O.S. Saetersdal, Secretary-General, Ministry of the Environment, Norway;

iv) Economic Consequences: Mr. P.C. Endsjø, Head of Division, Ministry of the Environment, Norway.

These themes were chosen because they covered the most important or unique features of pollution control in Japan's environmental policies.

The members of the Analysis Meeting were given the opportunity of meeting with various interest groups not only in Tokyo, but also in Chiba, Yokkaichi, Kashima, Yokohama and Kawasaki. This permitted a full and thorough debate on the selected issues and account to be taken of different points of view as expressed by the Minister of Environment, Members of the Environment Agency, the Ministry for

1) See Environmental Policy in Sweden, Revised Edition, OECD, 1977.

International Trade and Industry, the Land Use Planning Agency, Representatives of Prefectures and Municipalities, Industry and the general public.

The preliminary conclusions of the Analysis Meeting were reported to the Environment Committee in May 1977 and were reviewed in detail. This Review identified a number of policy options for furthe consideration by the Environment Committee and OECD countries.

The background report for the Analysis Meeting and the subsequent concluding Review in the Environment Committee was prepared by Professor Remy Prud'homme, formerly Deputy Director for Environment in OECD, now professor at the Paris Urban Institute, University of Paris-Val-de-Marne. Professors S. Tsuru, A. Morishima (University of Nagoya), H. Uzawa (University of Tokyo), E. Reishauer (Harvard University), H. Patrick (Yale University), E. Mills (Princeton University) read earlier drafts of the report and offered valuable comments, which are gratefully acknowledged. This report, revised in the light of the Analysis Meeting and the Review, is contained in the publication which follows.

The OECD is greatly indebted to the Japanese Government for having made this Review possible and for having provided extensive information and statistics. The report which follows is published under the responsibility of the Secretary-General.

Chapter I

# INTRODUCTION

Japan like most countries, has a long history of environmental pollution. The well-known case of a copper mine located at Ashio which was seriously damaging the environment in the 1880s(1) is but one example of environmental disruption associated with industrialisation. What is interesting to note is that Japan, unlike many other countries, quickly developed anti-pollution policies. As early as 1877, Osaka Prefecture issued an ordinance entitled "Regulations on Control of Manufacturing Plants", which even today could be regarded as quite progressive. Attention was paid to the selection of industrial sites that would minimise environmental disruption; in 1895, for example, the Beshi copper refining plant was transferred, for environmental reasons, to Shizata Island in the Inland Sea. Anti-pollution measures such as production cutbacks in case of emergency, or erection of high smokestacks (a 156 meters high smokestack was constructed at Hitachi mine in 1914) were taken. Compensation of pollution-related damages also took place. Japan, therefore, has traditionally been active in the field of environmental policies.

This tradition, however was somewhat forgotten in the pre-war and post-war periods, and environmental pollution became more and more important after World War II. It affected increasingly greater geographical areas; it created not only property damage, but also health injuries. By the late sixties, Japan was becoming one of the most polluted countries in the world. This led the Japanese Government (at national and local level) to take a number of measures aimed at preventing further deterioration and at fostering the improvement of the environment. It is this policy that we shall try to analyse here. Although pollution abatement is only one aspect of environmental policies, it is a major one, particularly in Japan, and the discussion will be focussed on this particular aspect.

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1) See Hurdle, Norie and Reich, Michael, Island of Dreams, Autumn Press, Tokyo, 1975, pp. 25-33 for an account of the unsuccessful fight of Ashio area residents to halt copper pollution.

By way of introduction, it may be useful to examine the causes of environmental degradation in Japan, and to try to assess the degree of environmental pollution in the late sixties (i.e. before the development of an environmental policy).

## 1. CAUSES OF ENVIRONMENTAL DEGRADATION

The pressure of economic growth on environmental quality has been - and still is - greater in Japan than in most other countries.

First, Japan is a developed country. Economic indicators such as output (particularly industrial output), energy consumption, or car ownership, are - on a per capita basis - not low in Japan.

Table 1

SELECTED ECONOMIC INDICATORS per capita, JAPAN AND SELECTED OECD COUNTRIES, 1974 OR 1975

| | GNP[a] ($U.S.) (1975) | Industrial[a] Output ($U.S.) (1974) | Energy[a] Consumption (TOE) (1974) | Number of[b] Automobiles (1974) |
|---|---|---|---|---|
| Japan | 4,428 | 1,513 | 3.05 | 0.25 |
| U.S.A. | 7,044 | 2,067 | 8.09 | 0.62 |
| U.K. | 4,009 | 997 | 3.82 | 0.31 |
| France | 6,188 | 1,816 | 3.39 | 0.34 |
| Italy | 3,026 | 907 | 2.47 | 0.28 |
| Sweden | 8,419 | 2,226 | 5.45 | 0.35 |
| Netherlands | 5,921 | 1,600 | 4.55 | 0.28 |
| OECD | 5,291 | n.a. | 4.82 | 0.38 |

Sources:

a) OECD.

b) International Road Federation, World Road Statistics, 1975.

The rates at which outputs and associated discharges increase matters as much as the volume of output in terms of environmental degradation. Growth rates, as is well known, have been exceptionally high in Japan. This was particularly true for industry, and especially for polluting industries such as steel, power, cement, pulp and paper, foodstuffs, and chemicals, that played a key role in the process of economic growth in Japan during the sixties. Plastics production, which was only 100,000 tons in 1960, and which rose to 5,000,000 tons in 1970 - a fifty-fold increase - is an extreme case, but can be taken as an exaggerated illustration of a significant trend.

Table 2

GROWTH RATES, JAPAN AND SELECTED OECD COUNTRIES, 1960-1970 (Per cent per year)

| | GNP | Industrial Production | Energy Consumption | Stock of Automobiles in use |
|---|---|---|---|---|
| Japan | 10.8 | 14.8 | 11.6 | 25.3 |
| U.S.A. | 4.2 | 4.8 | 4.5 | 3.7 |
| U.K. | 2.7 | 2.8 | 2.3 | 6.6 |
| France | 5.6 | 5.9 | 5.3 | 8.2 |
| Italy | 5.5 | 7.0 | 8.9 | 24.1 |
| Sweden | 4.6 | 6.1 | 5.0 | 6.4 |
| Netherlands | 5.3 | 7.3 | 8.4 | 15.7 |
| OECD | 5.0 | 5.9 | 3.0 | 6.2 |

Source: OECD.

A third factor is that production and consumption activities are spatially very concentrated in Japan. Japan is a small country (about 370,000 $km^2$) with more than 100 million inhabitants. Of OECD Member countries only Belgium and the Netherlands have higher densities. Moreover, Japan is a very mountainous country; only about 25 per cent of the land has a slope less than 10 per cent. The amount of activities - polluting activities - per square kilometer of inhabitants area is therefore greater in Japan than elsewhere, as shown in Table 3.

Activities are of course not distributed evenly over inhabitable areas, but concentrated in cities. Japan is a highly urbanised country, and also a country which has urbanised rapidly over recent years, as shown in Table 4. Although it is difficult to produce comparable data on urban densities (because such data depend on definitions of "urban areas" which rest on administrative boundaries and are not comparable between countries), it seems safe to suggest that urban densities are high in Japan.(1) A final point about concentration must be mentioned: a great many of the factories built over the last twenty years have been clustered in industrial zones developed (often on land reclaimed from the sea) for that purpose by local and central governments. Such zones promoted industrial growth, but increased the pressure on the environment that is associated with physical concentration.

1) Urban densities in Japan are estimated to be about 1.5 times that in the United States by Mills and Ohta; see Mills and Ohta Urbanisation and Urban Problems in Patrick, H. and Rosovsky, H, ed. Asia's New Giant - How the Japanese Economy Works, Brookings, 1976, pp 673-751.

Table 3

SELECTED ECONOMIC INDICATORS PER $km^2$ OF INHABITABLE AREA[c)]
JAPAN AND SELECTED OECD COUNTRIES, 1974 OR 1975

| | GNP[a)] ($10^6$\$U.S.) (1975) | Industrial[a)] Output ($10^6$\$U.S.) (1974) | Energy[a)] Consumption ($10^3$ TOE) (1974) | Number of[b)] Automobiles (1974) |
|---|---|---|---|---|
| Japan | 6.05 | 2.04 | 4.12 | 331 |
| U.S.A. | 0.32 | 0.09 | 0.36 | 27 |
| U.K. | 1.04 | 0.26 | 1.00 | 80 |
| France | 0.87 | 0.25 | 0.47 | 47 |
| Italy | 0.81 | 0.24 | 0.66 | 74 |
| Sweden | 1.67 | 0.44 | 1.09 | 69 |
| Netherlands | 3.10 | 0.83 | 2.38 | 146 |
| OECD | 0.31 | n.a. | 0.27 | 21 |

Sources and Note:

a) OECD.

b) International Road Federation, World Road Statistics, 1975.

c) Inhabitable areas are defined here as utilised agricultural area + urban area + non-utilised agricultural area.

Table 4

URBAN POPULATION, IMPORTANCE (1970) AND GROWTH (1960-70), JAPAN AND SELECTED OECD COUNTRIES

| | Urban Population in 1970 as % of Total Population in 1970 | Yearly Growth Rate 1960-70 % |
|---|---|---|
| Japan | 56.3 | 4.0 |
| U.S.A. | 58.3 | 2.8 |
| U.K. | 71.7 | 0.5 |
| France | 42.6 | 3.5 |
| Italy | 29.4 | 2.8 |
| Sweden | 32.7 | 3.5 |
| Netherlands | 45.2 | 3.1 |
| OECD | 49.3 | 2.7 |

Source: K. Davis, World Urbanisation 1950-70, University of California, Berkeley, 1969 (Population Monograph Series, No. 4).

Note: Urban population is defined here as population living in cities of more than 100,000.

A fourth cause of environmental degradation is that public investments in social overheads, which in many cases reduce the

burden of pollution, had traditionally been small in Japan.(1) They remained smaller in Japan than in most other countries.

A last factor of environmental degradation is to be found in societal attitudes and values. In the post-war period, Japan gave priority to industrial development. Ambitious targets were set (income-doubling 10-year plan), and no effort was spared to reach them. As a matter of fact, Japan tried so hard that actual growth rates were higher than planned growth rates, but this meant that alternative or competing goals - such as environmental protection - were to a large extent sacrificed. In the fifties and in the early sixties, this strong commitment to industrial growth, and its corollary, a relative neglect of environmental quality, were shared by most segments of the Japanese society. This attitude, which was to change drastically at the end of the sixties, explains why there were practically no implicit or explicit environmental policies in the two post-war decades.

## 2. INDICATORS OF ENVIRONMENTAL DEGRADATION

Comparative measures of environmental quality are extremely difficult: there are so many pollutants to measure, so many places to measure them, so many time-periods for which to measure them, and so many ways of measuring them, that quantitative data can be provided to support any proposition. There are, however, some reasons to believe that, in the late sixties, just before the development of pollution abatement policies, the quality of the environment was lower in Japan than in most other OECD countries.

Ambient concentrations as well as pollution-induced damage seem to have been higher in Japan.

Dissolved oxygen (DO), for instance, is an indicator of water pollution by organic wastes; when pollution increases, DO concentrations decrease, causing fish, or rather certain kinds of fish, to disappear. Average DO levels were low in the rivers and estuaries in Japan's large cities. An investigation was conducted in 1969 at 21 sampling points in the Tokyo area;(2) DO levels were below 5.0 p.p.m. in 17 cases, and below 2.0 p.p.m. in 8 cases. The figure for the lower reaches of the Tama river, 2.5 p.p.m., is representative of the quality of streams in the Tokyo area. Similar figures for rivers in other countries are given in Table 5. Although they must be

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1) See: Government of Japan, Environmental Policy of Japan, Background Paper for the Review of Environmental Policy of Japan, 1976 /ENV/JAP/76.1/ (hereafter referred to as Japanese Report), p. 18 for comparative data on the availability of sewage in Japan and in some other OECD countries.

2) See Tokyo Metropolitan Government, Tokyo Fights Pollution, 1971 p.91

handled with great caution, they suggest that water quality, as measured by DO, was lower in Japan than in most other countries.

Table 5

WATER QUALITY IN SELECTED RIVERS, LATE SIXTIES

Dissolved Oxygen (Yearly averages in p.p.m.)

| | |
|---|---|
| Tama River, Tokyo (1969)[a)] | 2.5 |
| Seine River, Paris (1971)[b)] | 3.5 |
| Rhine River, Lobith (1969)[c)] | 5.1 |
| Delaware River, Philadelphia (1965)[d)] | 3.5 |
| Thames River, London (1969)[e)] | 3.2 |
| Rhine River, Braubach (Koblenz) (1970)[f)] | 5.9 |

a) Tokyo Metropolitan Government, Tokyo Fights Pollution, 1971, p. 91.

b) Agence de Bassin Seine-Normandie. The figure given is an indicator of water quality at Acheres, just downstream from Paris; see Ministère de la Qualité de la Vie, Environnement et Cadre de Vie, 1974, tome I, p. 243 for figures on the quality of other French rivers, which are in most cases much higher.

c) Netherlands Central Bureau of Statistics, Algemene Mitien Statistiek 1973, p. 67; average figure for four seasons; Lobith is on the Dutch-German border.

d) R. Porges, Water Quality Management in the Delaware River Basin, in: International Conference on Water for Peace, 1967, Vol. 8, p. 59.

e) Annual Abstract of Greater London Statistics, 1971, p. 260; figures for low tides, at London Bridge, average for quarter 1st July to 30th September; the average figure for the year would be significantly higher.

f) Commission Internationale pour la Protection du Rhin, Tableaux Numériques des Analyses Photochimiques des Eaux du Rhin, 1970 Table 2.

Similar comparisons can be attempted for air pollution. Levels of sulphur dioxide ($SO_2$) and particulate pollution were high in Japan in the late sixties. A map showing ground level $SO_2$ concentrations in Tokyo around 1967, for instance, suggests that all of the city centre area recorded average yearly concentrations above 0.05 p.p.m., and that one had to go quite a way from the city centre to find concentrations below 0.04.(1) Similar figures for other cities, and for other pollutants are given in Table 6.

1) See Tokyo Fights Pollution, op.cit., p.61.

Table 6

AIR QUALITY IN SELECTED CITIES, LATE SIXTIES[a)]

| | $SO_2$[c)] | CO[c)] | $O_3$[d)] |
|---|---|---|---|
| Tokyo | 0.063[e)] | 5.0[f)] | 0.27[b),g)] |
| Osaka | 0.082[e)] | 4.8[f)] | 0.26[b),g)] |
| Paris | 0.044[h)] | 24.4[h)] | n.a. |
| London | 0.088[i)] | n.a. | n.a. |
| New York | 0.080[b),j)] | 15.7[b),j)] | n.a. |
| Chicago | n.a. | n.a. | 0.07[b),g)] |

Sources and Notes:

a) All figures are for 1968, except where otherwise specified.

b) 1969.

c) Yearly average concentrations, in p.p.m.

d) Yearly maximum concentration average, in p.p.m.

e) Environment Agency, Quality of the Environment, 1972.

f) Environment Agency, Quality of the Environment, 1975.

g) OECD, Environment Directorate, Report on the Problems of Photochemical Oxidants and their Precursors, Paris, 1974.

h) Ministère de la Qualité de la Vie, Environnement et Cadre De Vie, 1974, Tome I; average of 15 stations for $SO_2$.

i) Greater London Council, 1973 Annual Abstract of Statistics, 1974, p. 29; average over 7 stations; the figure is for winter months only and should be lowered to be compared with figures for other cities.

j) OECD.

An overall measure of environmental degradation would be the cost of damages resulting from such degradation.(1)

Unfortunately, no reliable estimates of this social cost are available for Japan.(2) International comparisons are therefore impossible.

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1) See Göran-Mäler, K. and Wyzga, R., Economic Measurement of Environmental Damage, A Technical Handbook, Paris, 1976, OECD, p. 151, for a description of the methods and of the limitations of such measurements.

2) See: Environment Agency, Quality of the Environment, 1972 p. 12; Economic Council of Japan, Measuring Net National Welfare of Japan, 1973, pp. 175 seq.; T. Miyamoto, Estimates of Economic Losses caused by Environmental Pollution, Annual Report of the Tokyo Metropolitan Research Institute for Environmental Protection, 1975, pp. 75-85; for first attempts.

It seems very likely, however, that people's health and properties did suffer from environmental degradation as much or more than in most other countries.(1)

Figures relative to the number of "pollution victims" are rarely meaningful because the concept of pollution-related disease is rarely rigorously defined. One such definition has been promulgated in Japan for the purpose of the so-called "Compensation Law Scheme".(2) According to this definition, which would be considered as restrictive by many medical doctors, more than 35,000 people have been officially designated as pollution victims. There is no comparable data for other countries.

In several cases, the health impact of pollution was particularly dramatic.

In 1959, a medical team announced that an illness from which several residents of Minamata - a small city on the west coast of Kyushu - suffered, was caused by ingestion of fish contaminated by mercury discharged into the Minamata Bay from a local chemical plant. The disease, which was called Minamata disease, is particularly painful, and incurable. Several hundred people were victims, and more than 150 died. In 1965, Minamata disease was detected amongst residents of the Agano river basin, on the Japan Sea side of Honshu, again caused by the mercury discharges of a local chemical plant; the number of victims also numbered several hundred.(3)

The term "Itai-Itai" means "ouch-ouch", and characterises the extremely painful nature of the disease which struck residents of the Jintsu River basin, also on the Japan Sea side of Honshu. The disease was identified as cadmium-poisoning in 1959, and the source was identified at a local mining and smelting company. The government officially identified 123 victims, of which 32 died.

In 1968, polychlorinated biphenyls (PCBs), used as a heating medium in a factory producing rice bran oil, leaked from a hole in a corroded pipe, and mixed with the rice bran; a large number of people who ate this PCB-contaminated rice bran oil were seriously poisoned and deaths were reported.

Here again, international comparisons are difficult. But it would seem that lethal cases of environmental pollution, although not unknown elsewhere (people died from air pollution in Donora, Pennsylvania, in 1948, and in London in 1952) have been particularly numerous in Japan.

---

1) J. Gresser, "The 1973 Japanese Law for the Compensation of Pollution-Related Health Damage: an Introductory Assessment", Law in Japan (1975), Vol. 8, p. 120, reports that at least 13 per cent of the Japanese population has developed related health diseases with the percentage being as high as 16.7 per cent in the large cities.

2) See Chapter IV *infra*.

3) The number of officially designated victims of Minamata disease was, in 1975, over 1,400.

Environmental degradation was therefore serious in terms of pollution. But pollution is only one aspect of environmental degradation. The situation may well have been - and may still be - even more serious in terms of amenities. The growth of industry and of cities did change drastically the physical and cultural environment of many Japanese. Quietness and beauty are even more difficult to measure than air or water quality; but many people would argue that they suffered more. The people who used to cultivate small gardens carefully and pleasurably, who are now living in suburban apartment buildings, or the people who used to walk at leisure in de facto pedestrian streets, and who now have to share the streets with automobiles [most streets do not have sidewalks in Japan(1)] did experience a very real environmental degradation that we should keep in mind even though we focus on pollution and pollution abatement policies.

1) 90 per cent of roads in the ward areas of Tokyo do not have sidewalks.

Chapter II

# APPROACHES

## 1. DEVELOPMENT OF ENVIRONMENTAL POLICIES

Changes in environmental quality led to changes in societal attitudes, which were reflected in changes in political pressures, which brought about changes in governmental policies. Similar changes took place in most developed countries, but were probably less dramatic than in Japan.

A rather rapid change in societal attitudes towards pollution occurred in the late sixties. Japan had traditionally been (and to a large extent still is) a consensus society, where goals and actions decided by society and its leaders largely go unquestioned. In the post-war period the Japanese people accepted to pay the price of economic growth in terms of environmental degradation. In the sixties, some people began to find that the price was too high. In 1963-64, a project for a petrochemical complex at Mishima and Numazu (Shizuoka Prefecture) was rejected by local residents and local governments. In the following years, the Japanese became particularly pollution-conscious. They began to complain to regional and public bodies: the number of such complaints and petitions, which was virtually zero in 1960, increased to about 20,000 in 1966 and to more than 60,000 in 1970.(1)

To a large extent, this change can be explained in simple economic terms. Economic growth brought not only pollution, but pollution awareness. For each individual the disutility of a given amount of pollution increases with income. It can even be said that disutility increases more rapidly than income; the income elasticity of demand for clean air, clean water, quietness, etc. is greater than one. The Japanese people were therefore more and more sensitive to more and more pollution. A sort of a threshold was thus reached, where what had been accepted became unacceptable.

This awareness was precipitated by the horrible character of Minamata and "Itai-Itai" diseases. Had not such episodes - which were in a sense accidental - occurred, environmental awareness

1) Environment Agency. Quality of the Environment, 1972, p. 7.

would not have developed so strongly and so quickly. The tradition of environmental consciousness that prevailed at the turn of the century, in the early stages of industrialisation, made the change easier. It was also greatly facilitated by the media. Pollution made news. Press coverage of environmental issues increased greatly, as shown in Table 7. Editorials calling for immediate action appeared.

Table 7

PRESS COVERAGE OF ENVIRONMENTAL ISSUES, 1960-1971

| | Number of Articles [a)] | Share of News [b)] (%) |
|---|---|---|
| 1960 | 14 | 0.4 |
| 1961 | 31 | 0.7 |
| 1971 | 124 | 2.8 |

Source: Environment Agency, Quality of the Environment, 1972, p. 3.

Notes:

a) Average monthly number of articles on pollution in a single representative newspaper.

b) Ratio of space devoted to environmental issues to space devoted to all news.

This change in attitudes was immediately reflected in the political arena. Many groups and movements were created to protest against pollution from private and, to a lesser extent, at least in the sixties, public sources. By means of demonstrations, lobbying, lawsuits, etc. they tried to stop or to reduce existing pollution, and to prevent future pollution by halting, scaling down, or modifying planned developments. At both local and national levels, anti-pollution movements became an important political force.

One can probably go a little further, and note that consciously or not, the environment was selected as a "battlefield" by anti-establishment people, groups or parties. They certainly had a genuine concern for environmental protection, but they also wanted to find fault with the business leaders, bureaucrats and politicians who had been ruling the country since the war. Pollution was an ideal theme to that effect.

This in turn led to the development of an environmental policy, or rather of environmental policies. Although some pollution prevention mechanisms had been instituted in the post-war period at

both local(1) and central(2) levels, they were not very effective and did not constitute a policy.

In the late sixties and in the early seventies, a number of important decisions were taken by the Diet, the Administration, and the Courts.

The legislative foundations of this policy were set in 1967 and 1970. The "Basic Law for Environmental Pollution Control", enacted in 1967, is a seven-page document that spells out general principles regarding "the responsibilities of the enterprise, the State and the local government bodies [...] in order to promote comprehensive policies to combat environmental pollution thereby ensuring the protection of the people's health and the conservation of their living environment" (Article 1). In 1970, a special session of the Diet was devoted to environmental issues, at which no less than fourteen pollution-related Laws were revised or enacted, thus providing a solid legal basis for environmental policy.

The executive created in 1971 a new institution to carry out this policy: the Environment Agency. The Agency is not a Ministry, and reports directly to the Prime Minister, but this does not mean that its status is inferior to that of a Ministry; as a matter of fact, the Director of the Agency ranks high in the Cabinet and has the title of Minister of State. The Environment Agency is not the only Agency or Ministry interested in environmental policy. In particular the powerful Ministry of International Trade and Industry (MITI) which has created a specialised Directorate (called Industrial Location and Environmental Protection Bureau), plays an important role in policy formulation and implementation.

The Judiciary also played an important role in the development of environmental policies. In 1967-69, victims of Minamata disease, of Itai-Itai disease, and of pollution-related asthma sued the companies which they held responsible for the diseases. In these four lawsuits,(3) which were widely covered by the media, and became known as the "four major lawsuits", the Courts decided in the early seventies in favour of the plaintiffs, and found the polluters responsible. The impact of these decisions on attitudes, laws, and practices, was great.

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1) Ordinances to control "factory hazards", noise, smoke and soot were enacted by the Tokyo Metropolitan Government, Ube City, Osaka City, Kanagawa Prefecture and Fukuoka Prefecture in the early fifties.

2) Several Laws concerning Water (Industrial Water Law, Water Quality Conservation Law, Sewage Law, Underground Building Water Control Law) as well as a Smoke and Soot Regulation Law were enacted in 1956, 1958 and 1962.

3) There were two suits filed by victims of Minamata disease in different areas; for more details see Chapter IV <u>infra</u>.

What is striking in the development of environmental policies in Japan is that practically everybody was in favour of them. All political parties supported environmental laws. Established bureaucracies did not try to oppose the creation of a new Agency. Even industry had to recognise the need to reduce pollution, and to co-operate with central and local governments to that effect. Such unanimity did not exist to the same extent in most other countries.

This unanimity, however, did not last. At present (1976), environmental policy is no longer supported by everyone. On the one hand, many people (victims, members of residents' groups, local government officials, editorial staff writers of many newspapers, etc.) criticise this policy as being too "soft".

On the other hand, some people complain that this policy is too "hard"; thus, for instance, Keidanren, the Japanese Association of Manufacturers has officially criticised in 1976 important and specific aspects of this policy.(1) It would seem that the policy, which succeeded in controlling environmental degradation did not succeed in controlling societal disruption caused by environmental degradation.

## 2. CHARACTERISTICS OF ENVIRONMENTAL POLICIES

First, the Japanese approach to pollution abatement appears to be largely non-economic. Both because health damage has been greater or more visible than elsewhere and because pollution abatement has been an attack against industry as much as a defence of the environment, it is based on feelings more than on economics. The familiar proposition that a balance must be struck between environmental costs and economic benefits has even been officially rejected. The 1967 Basic Law stated that "efforts shall be made to balance pollution control against the needs for economic development". Although this provision referred only to environmental conservation and not to health protection, it was violently attacked, and was eventually deleted in 1970. More generally, the idea that a price can be put on human life (in the sense that additional expenditures on child care or on road safety would save additional lives) would be rejected by most people as unbearable.

This is why a number of the measures taken were decided irrespective of their costs. It does not necessarily mean that the costs

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1) See: Keidanren, Comments on the System for Environmental Impact Statement, 16th February, 1976; Request Concerning the System for Pollution-Related Health Damage Compensation. 4th March, 1976; Environmental Quality Standard on Nitrogen Dioxides, 1976.

were too high and the measures too stringent. It does not mean either that all the measures taken have ignored cost considerations, which certainly play an important role in the setting of specific plant by plant standards. It only describes the approach followed, which is basically uneconomic, or rather non-economic.

This lack of economic rationale also appears in the "anti-business" attitude that prevailed, and which is particularly surprising on the part of legislatures and governments which were not, on other accounts, inamicable to the business community. Industry did not appear as a source (of environmental degradation) that had to be stopped, but as a villain that had to be castigated. Hence, the success of the P.P.P. in Japan. The polluter-pays-principle states that the costs of pollution abatement should be borne by polluters, who will in most cases pass them on in the prices of their goods, rather than by governments: it is a "consumer-pays-principle", as opposed to a "tax-payers-pay principle"; it was introduced in 1972 by the OECD as an economic principle, which would

i) prevent distortions in international trade and
ii) improve the allocation of resources.

The P.P.P. immediately became very popular in Japan, and it is often referred to. But the economic objectives of the principle, and the mechanisms by which they are achieved, are not always well understood. For many, the principle just means that polluters are guilty, and must be punished. In short, it is understood as a "Punish Polluters Principle".

A second characteristic of the Japanese approach is that it was focussed on certain types of pollution, namely on pollution by mercury, cadmium, polychlorinated biphenyls, sulphur dioxide, and nitrogen oxides. These pollutants were responsible for the worst cases of pollution experienced in Japan. Their discharge into the environment has been very severely controlled. Thus, the factories which were the major sources of mercury containing effluents (factories manufacturing acetylene-based vinyl polymer chloride and acetylene-based acetaldehyde and caustic soda by means of mercury process electrolysis) were forced either to discontinue their production, to change their processes or to close off their effluents to outside. The policy relative to PCBs was particularly rigorous, and probably stricter than anywhere else in the world: manufacture and imports of PCBs were banned (although exceptions can be granted); measures were taken to recall, to store and to dispose of wastes containing PCBs; and contaminated waterbed deposits were removed and buried.

Strong policies have also been developed relative to air pollution. As a matter of fact, reduction of $SO_2$ emissions has

been an essential ingredient - probably the most important element - of environmental policies in Japan. The Japanese policy also focussed - or focusses now - on control of $NO_x$ emissions; very ambitious ambient standards and very strict emission standards (particularly for automobiles) have been established; in this field also pollution abatement efforts are probably greater in Japan than in any other country.

Other types of pollution appear to have been comparatively neglected. Water pollution by organic matters has not been a priority area in Japan. This can probably be explained by the relatively minor importance of rivers in this small and mountainous country. It would also seem that a great reliance has been placed on the assimilative capacity of the sea, and that comparatively little has been done to fight sea pollution.(1) Noise pollution is particularly difficult to control (and to measure); although exposure to high noise levels is widespread in Japan, policy in this domain has not been exceedingly active; measures have been taken to reduce the damage created around airports; standards have been set for trains; but the difficult problem of highway noise pollution has not been successfully tackled. The contrast between developed policies in certain areas and relatively less developed policies in other areas is therefore a characteristic feature of the Japanese approach.

A third characteristic relates to the policy instruments utilised: Japan has preferred direct administrative controls to indirect economic incentives. There are only two instances of pollution charges: a tax based on $SO_2$ emissions in the framework of the so-called Compensation Law Scheme,(2) and a special landing fee that varies according to the noise emitted by the aircraft.(3) They do not play a very important role. Japan - like most other countries - does not rely upon market mechanisms to reduce pollution; price signals and incentives are considered not to be sufficient. Instead, Japan utilises emission standards, i.e. direct instructions given by the Administration to polluters. As a matter of fact, with the exception of the case of toxic substances such as mercury or PCBs, emission standards are rarely general rules that apply bluntly to everyone, they are often made-to-measure prescriptions tailored to the needs and possibilities of each enterprise; in many cases they are even negotiated between governments and enterprises; similarly, enforcement is by persuasion rather than by coercion. In other

1) Several Laws were passed (Water Pollution Control Law, Marine Pollution Prevention Law), but seem not to have been very efficient.

2) See Chapter IV <u>infra</u> for a more detailed discussion.

3) See <u>Japanese Report</u>, p. 231 for additional details.

words, the Administration in Japan does not limit its role to the setting of new rules of the game for private business; it intervenes directly into the detailed operation of enterprises, or at least of major enterprises, on a plant-by-plant basis. One could go as far as saying that many laws and even cabinet orders or local government ordinances are more instructions for administrators (to help them carry out their task) than for polluters (to tell them by how much they should reduce their pollution). The Japanese approach to pollution abatement therefore relies basically on "administrative guidance" - in the spirit of a planned economy rather than in the spirit of a market economy.

One should also note here that Japan makes an important use of an instrument that is rarely, if ever, utilised elsewhere; the payment of compensation to victims of pollution. The Compensation Law Scheme, introduced in 1974, is a particularly interesting innovation, worth a special investigation.(1)

A fourth characteristic of the Japanese approach is the role played by local governments. Japan is a highly centralised country with only recent experience of local autonomy. Laws and cabinet orders provide for all cases and all places; when necessary, they discriminate between places, introduce various standards, and designate the areas where these standards will be applied. One could therefore think that there is little room for local government intervention. This would be a mistake.

Partly because they are closer to the needs and demands of the people, partly for purely political (partisan) reasons local governments have often been more innovative and more severe than the central government. Pollution control was actually initiated by local governments at a time when the central government did not think much about the problem; compensation schemes were also pioneered by local governments; so was the idea of a ceiling to the total of emissions allowed over a given area; and many local governments have set emission standards stricter than the standards set by the central government.

There is one other reason for local government intervention. The detailed "administrative guidance" that is characteristic of the Japanese approach cannot possibly be carried out entirely from Tokyo offices. In practice, a number of standards are negotiated, set and implemented at a local level.

Although it is true that local government officials are officially given the task to implement central government decisions, and that a number of laws have prescribed a role for local governments, it is not sure that all the initiatives taken by local

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1) See Chapter IV <u>infra</u> for a detailed discussion.

governments are legally founded. Some have been claimed to be hardly constitutional. But none have been challenged in courts.

The relative importance of central and local government is reflected (admittedly poorly) in the number of officials in charge of pollution abatement at the various levels of government, as shown in Table 8.

Table 8

OFFICIALS IN CHARGE OF POLLUTION ABATEMENT.

VARIOUS LEVELS OF GOVERNMENT, 1974

| | Number | % |
|---|---|---|
| Central Government | 996 | 7 |
| Prefectural Government | 5,852 | 44 |
| Municipal Government | 6,465 | 49 |
| Total | 13,313 | 100 |

Notes and Sources: Japanese Report, op.cit., p. 24.

One of the most impressive achievements of local governments is in the field of air pollution monitoring. About 70 networks have been established. A network consists of 10-40 stations where air is automatically and permanently analysed in terms of 5 or 6 pollutants ($SO_2$, particulates, CO, oxidants, NO, $NO_2$), and of a centre where the results of these analyses are immediately transferred, processed, stored, and - contrary to what happens in some other countries - publicly displayed. In addition, the most sophisticated networks monitor $SO_2$ emission at source in the main factories of the area. In some cases, computerised models can predict ground concentration levels a few hours in advance. In all cases, these networks are utilised as emergency systems. Whenever ground concentrations exceed (or are predicted to exceed) certain levels, the most important polluters are telephoned to reduce emissions, by changing fuels or by reducing operations. These monitoring systems, which are more numerous and more sophisticated than anywhere else in the world, have benefited from central government subsidies and technical assistance.

## Chapter III

## STANDARDS

In Japan, as in many other countries, standards are an important tool of environmental protection. The word "standards" is, however, somewhat confusing because it is used to describe two very different sets of prescriptions.

Some standards, usually called ambient or quality standards, lay down the levels of pollution not to be exceeded in a receptor medium; they do not, by themselves, impose constraints upon polluters who cannot be fined or punished because quality standards are not met; they are in fact policy objectives.

Other standards, such as emission standards, which specify the quantity of pollutants (or their concentration in effluents) which may be discharged from a given source per unit of time, or product standards, which prescribe the physical or chemical properties of a product, or the maximum permissible polluting emissions from the product during its use, are of a different nature; they are binding and can be enforced; they are directly policy instruments.

### 1. QUALITY STANDARDS

Three points can be made about quality standards in Japan.

First, they are usually set at the national level. The role played by the executive is often as important as the role played by the legislative. In many cases, the laws passed by the Diet are concerned with concepts, not with figures. Local governments are in most cases not allowed to change quality standards. This does not mean that all quality standards are identical all over the country. In Japan, as in most other countries, quality standards may vary over space. For some pollutants,(1) the quality required for a particular stretch of river is not the quality required for another stretch of the same river, and the quality required for one

1) Namely for pH, BOD, suspended solids, dissolved oxygen and coliforms; quality standards for cadmium, cyanides, organic phosphorous, lead, chromium, arsenic, mercury and PCB, on the other hand, are identical for all water bodies.

river differs from the quality required for another river. In other words, the principle of discrimination in quality standards is applied in Japan, at least in the fields of water and noise.

Secondly, quality standards are generally strict in Japan. Table 9, which gives daily average ground concentration values for major air pollutants, suggests that policy objectives are more ambitious in Japan than in many other countries.

Table 9

AIR QUALITY OBJECTIVES, [a] JAPAN AND SELECTED OECD COUNTRIES, 1975

| | $SO_2$ (p.p.m.) | Particulates (mg/m3) | $NO_2$ (p.p.m.) |
|---|---|---|---|
| Japan | 0.04 | 0.10 | 0.02 |
| Canada | 0.06 | 0.12 | 0.10[b] |
| Finland | 0.10 | 0.15 | 0.10 |
| Italy | 0.15 | 0.30 | n.a. |
| U.S.A. | 0.14 | 0.26 | 0.13[c] |
| Germany | 0.06 | n.a. | 0.15[d] |
| France | 0.38 | 0.35 | n.a. |
| Sweden | 0.25 | n.a. | n.a. |

Sources: For $SO_2$ and for particulates: Werner-Martin and Arthur C. Stern, The Collection, Tabulation, Codification and Analysis of the World's Air Quality Management Standards, School of Public Health, University of North Carolina at Chapel Hill, N.C., United States, October 1974; for $NO_x$: R. Kiyoura, International Comparison and Critical Analysis of $NO_2$ Air Quality Standards, paper presented at the 69th Annual Meeting of the Air Pollution Control Association, Portland, Oregon, 27th June - 1st July, 1976.

Notes:
a) All figures are average daily values.
b) The figure is for Ontario; the figure for Saskatchewan is much lower: 0.01.
c) For the United States, the $NO_2$ objective is set in terms of average yearly value (0.05 p.p.m.); the figure given is therefore an equivalent open to criticism.
d) The German standard is 0.05 p.p.m. for "long-term exposure" and 0.15 p.p.m. for "short-term exposure".

The quality standard for $NO_2$ is indeed much stricter in Japan than in other countries. It is under attack from some quarters. Its critics contend that it is not scientifically based, and that the cost of meeting it will be enormous. It seems true that available epidemiological studies on which it is based are not very convincing, and that it is not proven that concentrations somewhat above the level chosen would constitute health hazards. But the contrary (namely that such concentrations would not constitute health hazards) is not rigorously proven either. More generally,

the notion of a "scientifically-based" standard must be viewed with some scepticism. Epidemiological studies can only provide dose-effect relationships. In the best of cases, such relationships will exhibit thresholds that can suggest quality standards. In all cases they only provide information to be taken into account in the selection of a standard. But the selection is made by men, not by "science". It seems also true that costs have not been taken into account in the standard setting process; but it is also true that pollution abatement costs are often very difficult to estimate, because they are the costs of new technologies, which are yet to be developed, and which may well, in the end, turn out not to be as costly as was thought at first.

The third point to be made about quality standards is that they are taken very seriously in Japan. Although they are merely desirable administrative goals, with no binding force, they do play an important role. Measurements are often related to ambient standards, and environmental quality is defined, and compared over time, in percentages of places where standards are met. More generally, and more importantly, policy instruments are put to the service of quality standards. This is true in every country, but it is probably truer in Japan than in most countries. In Japan, when a goal has been agreed upon, it is endorsed by everyone in the administration and everyone does his best to ensure that it will be achieved. In that sense, quality standards are probably more important in Japan than elsewhere.

## 2. EMISSION STANDARDS

Nevertheless, in Japan as elsewhere, the policy instruments, i.e. the constraints placed on polluters, consist of emission standards. They raise four major issues:

a) who sets the standards?;
b) what are the standards?;
c) what relations do they bear to quality standards?;
d) how are they implemented and enforced?

a) The first question relates to the <u>standard setting process</u>. Emission standards are set by both the central government and local governments. At the central government level, just as in the case of quality standards, an important role is played by the executive. The 1970 Water Pollution Control Law for instance only deals with broad principles, and explicitly states that "the standards of an effluent shall be provided for in the Prime Minister's Office Order" (Article 3); emission standards were in fact issued in the 1971 and 1974 Ordinances of the Prime Minister's Office. Similarly, the

1968 Air Pollution Control Law prescribes that "emission standards with respect to soot and smoke generated from soot and smoke emitting facilities shall be established by Order of the Prime Minister's Office" (Article 3). The central government has therefore established many emission standards for air, water, noise, as well as products standards such as automobile exhaust gas standards.

However, these standards are often complemented by standards set by local governments (prefectures and cities). Article 4 of the Air Pollution Control Law provides that national emission standards can if necessary be replaced by stiffer standards prescribed by prefectural ordinance for the soot, dust, and toxic components found in soot and dust; by the end of 1974, 20 Prefectures, including Tokyo, had passed such ordinances.

In fact, local governments often go further than the mere setting of generic standards, that apply to all plants, or to all plants of the same type. They enter into detailed negotiations with each plant - or rather each major plant - and set for each plant specific standards to be achieved, and even the manner in which they will be achieved. Thus, for instance, the city of Nagoya - a 2,000,000 population city in the heart of the Tokyo-Osaka megalopolis prepared in 1974 a pollution abatement plan based on 68 pollution abatement contracts signed between the local authorities and the managers of 68 polluting facilities. The Tokyo metropolitan government has also taken things into its own hands. It is important to note that those detailed written agreements are made public. It would therefore appear that the role of local governments in the setting of emission standards is great, at least as great as that of the central government.

b) The nature of emission standards varies with the problems they are meant to solve. However, a few general points can be made.

Most standards are expressed in terms of concentrations, not quantities, of pollutants. This makes it possible for a polluter (particularly in the case of water pollution) to increase the amount of pollutant discharged by increasing the quantity of air or water discharged. The cases of $SO_x$ and $NO_x$ emission standards, however, are somewhat more complex.

Sulphur oxide emission standards for each sulphur oxide emitting facility are given by a complex formula of the following type:

$$q = f\ (K,H,Q,V,T)$$

in which:

q = hourly volume of sulphur oxide emitted

K = coefficient

H = actual height of stack

Q = volume of exhaust gas

V = speed of exhaust gas

T = absolute temperature of exhaust gas.

The standard is defined in terms of quantity of pollutant, but it is (partly) a function of the volume of exhaust gas, which means that even in the case of $SO_x$, it is possible to increase the quantities of pollutants discharged by means of dilution; this possibility, however, is limited by the fact that the speed and the temperature of exhaust gas (which would be modified by an increase in volume) are taken into account in the calculation of the standard.

Nitrogen oxide emission standards apply to a complex magnitude called: "converted concentration of $NO_x$" and are defined by the following formula:

$$s = g\ (N,C,O)$$

in which:

s = converted concentration of $NO_x$

N = coefficient

C = actual concentration of nitrogen oxides

O = oxygen content in the exhaust gas.

This definition of s is such that it is not possible to meet the standard and to increase quantities of $NO_x$ discharged by adding fresh air: this would increase the oxygen content, and therefore the standard.

A second point is that most emission standards do not vary with the location of the polluting facility. This is even true for water effluents, although some water quality standards are different for different types of rivers and lakes.

$SO_x$ emission standards are an important exception. The value of the coefficient K, which plays an important role in the formula, varies with the area in which the polluting facility is located. More than 100 areas, grouped into sixteen K categories have been designated. The value of K is about six times higher in the less-polluted areas than in the most polluted areas. All things equal, a given facility will therefore be allowed to pollute about six times more in Northern Hokkaido than in Tokyo or in Osaka. This is of course perfectly reasonable.

An important qualification must immediately be added: central government standards are identical over space, but local government standards are not. In many cases, Prefectures and municipalities have issued stricter generic standards, not to mention the even stricter specific standards negotiated between government and individual enterprises. The differences can be great, as suggested by Table 10.

It should also be noted that some emission standards are a function of the type, and in some cases of the size, of the polluting facility, while others are not. Standards for $NO_x$ soot and dust, cadmium, lead, and most air pollutants are defined by type of

facility.(1) For instance, concentrations (in grams per normal cubic meter) of soot and dust are: 0.40 for a coal-fired boiler, 0.10 for a large-scale heavy boiler, etc. $SO_2$ standards and water effluent standards, on the other hand, are given irrespective of the type of facility.

Table 10

SELECTED WATER EMISSION STANDARDS SET BY CENTRAL GOVERNMENT AND BY KANAGAWA PREFECTURE, 1975

(mg/l)

| | Central Government | Kanagawa Prefecture |
|---|---|---|
| BOD | 160 | 20 |
| COD | 160 | 20 |
| Suspended solids | 200 | 50 |
| Phenols | 5 | 0.005 |
| Fluorine | 15 | 0.8 |

Source: Japanese Report: op.cit. pp. 161 seq.

It is also important to note that prefecture governors are empowered to set stricter standards for new plants. The reason is that it is normally cheaper for new plants than for old plants to achieve a given standard. It is reported that many governors and even mayors do set stricter standards for new plants.

It will be clear at this point that it is difficult to say whether emission standards are stricter in Japan than in other countries. There is, however, one case in which a comparison is possible, and, in addition, particularly important: the case of automobile emission standards. Standards were introduced in 1966 and progressively strengthened.(2) In 1972 standards for passenger cars to be met in 1976 were announced as follows (in g/km):

| | |
|---|---|
| Carbon monoxide (CO) | 2.10 |
| Hydrocarbons (HC) | 0.25 |
| Nitrogen oxides ($NO_x$) | 0.25 |

Standards for CO and HC did not raise any particular difficulty. But the standard for $NO_x$ (the standard that appeared in the 1970 amendment to the Clean Air Act in the United States, and which was never implemented in the United States) was strongly criticised, as being unnecessarily strict, and above all, as being technologically

1) See Japanese Report, op.cit. pp. 93-94 and 105-113.

2) Figures given here relate to passenger cars with equivalent inertia weight of 1,000 kg or less, except when otherwise specified.

unmeetable. A less strict standard (0.60) was therefore set for 1976. But it was decided that the original figure (0.25) should be made the target for 1978. This latter decision was again criticised. But in the meantime, Japanese automobile manufacturers were actively engaged in research on ways and means of meeting this so-called 1978 standard. One after the other, they announced that they could produce cars meeting the 0.25 g/km of $NO_x$ standard. Estimates of additional costs (relative to cars meeting the 1976 standards) in terms of money, fuel consumption, and driveability are moderate, and range from zero to 10 per cent. Japanese automobile manufacturers have apparently succeeded where other automobile manufacturers have (or say they have) failed.

Automobile exhaust standards in several countries are therefore as shown in Table 11.

Table 11

AUTOMOBILE EMISSION STANDARDS[a)],
JAPAN AND SELECTED COUNTRIES
(g/km)

| | CO | HC | $NO_x$ |
|---|---|---|---|
| Japan (for 1976) | 2.10 | 0.25 | 0.60 |
| Japan (for 1978) | 2.10 | 0.25 | 0.25 |
| U.S.A. - Federal Government (for 1975) | 9.30 | 0.93 | 1.93 |
| U.S.A. - California (for 1975) | 5.60 | 0.56 | 1.24 |
| Canada (for 1975) | 15.62 | 1.25 | 1.94 |
| Canada (for future) | 2.13 | 0.25 | 1.94 |
| Sweden (for 1976) | 24.20 | 2.10 | 1.90 |

Source: OECD.

Notes: a) Testing methods vary from country to country and comparisons must be made with great care.

b) 0.85 for passenger cars with equivalent inertia weight of more than 1,000 kg.

It is easy to see that automobiles manufactured to meet European and American standards will not be admitted to Japan in a few years' time.(1) Could these strict standards be considered to have been intentionally set as a non-tariff barrier to trade? Several points can be made that suggest a negative answer. First, very low $NO_x$ emission standards for automobiles are part of the impressive

1) Japan has given periods of grace for foreign-made cars which will be required to meet 1976 standards in 1978 only, and 1978 standards in 1981 only.

Japanese effort to reduce $NO_x$ pollution. Second, imports by Japan of foreign-made automobiles are not very important, and would hardly justify barrier setting. Third, these standards have been strongly opposed by Japanese automobile manufacturers. It would therefore seem unfair to accuse the Japanese Government of having set strict standards to prevent imports of foreign automobiles.

Comparative emission standards have also been compiled for a less important case: fluoride emission in the aluminium industry. They are given in Table 12. They tend to suggest that, in this particular case, which may not be typical, Japanese emission standards are not very strict.

Table 12

FLUORIDE EMISSION STANDARDS IN ALUMINIUM INDUSTRY, VARIOUS PROCESSES, JAPAN AND SELECTED COUNTRIES

(kg/ton)

| | Horizontal stub Söderberg | Vertical stub Söderberg | Centre worked Prebake | Side worked Prebake |
|---|---|---|---|---|
| Japan | 2.0 | 0.4 | 0.9 | 0.9 |
| U.S.A. | 2.0 | 1.5 | 1.5 | 1.0 |
| Canada | 2.5 | 2.5 | 2.5 | 2.5 |
| Germany | 1.7 | 1.3 | 2.0 | 2.0 |
| Norway | 1.3 | 1.3 | 1.3 | 1.3 |

Sources and Notes:

OECD; in some countries standards are expressed in terms of gaseous fluoride emissions and in others in terms of gaseous and particulate fluoride emissions; appropriate corrections have been made and the figures given here are all in terms of kg of gaseous and particulate fluoride emissions per ton of aluminium produced.

c) The relationship between emission standards and ambient standards, between the tool and the goal, must also be explored. Emission standards are reputedly set and implemented in order to achieve quality standards.

In the case of $SO_2$, for instance, emissions per stack have been computed with the aid of diffusion models, and reflect local conditions: the more industrial the area, the stricter the standard. The relationship, however, is not very rigorous. This is shown by the fact that there is a limited number of K values, i.e. of emission standards. There is no reason to believe for instance that in each of the 8 areas for which K = 8.76 the number of stacks and their locations are such that provided they meet the same emission standard, the resulting ground concentration levels will be identical.

In most other cases, the relationship is even less rigorous. Emission standards are identical for all parts of Japan, but the densities of polluting facilities are not. Unless one assumes that emission standards have been calculated so as to ensure quality standards in the worst geographical case - a very unrealistic assumption - it is difficult to think of a formal relation between the two sets of standards. The most puzzling case is that of water: how can diversified quality objectives be reached through identical emission standards?

This is also shown by the recent introduction of the "total mass emission" concept for $SO_2$. Several Prefectures (starting in 1971 with Kanagawa Prefecture, followed by Yokkaichi City) issued ordinances indicating the total emissions of $SO_x$ that would be tolerated on their territory. The central government picked up the idea, and, in 1974 a Cabinet Order prescribed total mass emissions control of $SO_x$ for 24 areas (which were partly the areas covered by Prefectural mass emissions figures). In those areas, Prefectural governors can - and do - prescribe for each plant emission standards that are stricter than the standards resulting from the K-value system. The idea is attactive and important. It emphasizes the fact that the mere dispersion of pollutants into the environment is a strategy that has limits. Just as a quality standard, a mass emission standard is an objective of environmental policy, that is not per se binding for the polluters. It has to be translated into a set of emission standards that will be the real tools of environmental policy, because they will be binding for the polluters. The difficulty is that many different sets of emission standards can be associated with a given amount of mass emissions. The real policy problem is that of choosing one of those many sets. The total mass emission concept does not bring an answer to that problem. It is nevertheless very valuable, because it introduces a new kind of objective for environmental policies, and because it serves an important pedagogical purpose.

The total mass emission system has one other advantage. Emissions are ascribed on a plant-by-plant basis. Each plant is then faced with the task of allocating its emission between the various polluting facilities within the plant. There is every reason to believe that it does it in the least cost manner. The system therefore encourages efficiency at the plant level.

This lack of automatic links between goals and instruments is partly remedied, as we have seen, by the action of local governments. When and where centrally-decided emission standards would not be sufficient to ensure that centrally-decided quality standards will be met, local governments can and do impose stricter standards.

d) The implementation and enforcement of emission standards is the final question to be discussed. The main point here is that standards are handled with flexibility.

We have already seen that local governments can - and do - apply standards stricter than those prescribed by the central government. It must also be noted that in some cases the basic standards set by law have been temporarily suspended, and replaced by less strict standards. Thus, for instance, the 1971 Prime Minister's Office Order that set the effluent standard values for water, immediately introduced different values for a number of pollutants(1) and industries. For BOD, standards were as follows (mg/litre):

| | |
|---|---|
| Ordinary manufactures | 160 |
| Beet sugar manufactures | 520 |
| Canned and frozen sea products manufactures | 780 |
| Soluble sulphite pulp manufactures | 1,600 |
| Potato starch manufactures | 20,000 |

These looser standards were allowed for two or five years. By 1976 most of them were normalized or, at least, strengthened. It can nevertheless be said that those plants for which it would have been very difficult to achieve the regular standards have not been asked to achieve them.

A second point is that most emission standards only apply to large polluting facilities. In the case of water, for instance, "the effluents standards apply to the effluents of factories or places of work which discharge effluents in an amount of over 50 $m^3$ per day on an average" (Prime Minister's Office Order No. 35 of 1971, Table No. 2, Remark No. 2).(2) In 1975, there were about 26,000 such industrial establishments out of a total of approximately 230,000 polluting establishments. The small establishments for which it would be difficult to enforce emission standards are therefore excluded. One should note, however, that large establishments account for the bulk of pollution and that in a number of cases, small establishments will be regulated by Local Government Ordinances.

Emission standards are enforced by persuasion rather than by coercion.

Administrative guidance begins before production. According to the Water Pollution Control Law (and similar provisions can be found in the Air Pollution Control Law), anybody operating (or planning to operate or to modify) a facility that could pollute

1) Such as BOD, suspended solids, but not for mercury, cadmium and other toxic substances.

2) This, again, does not apply to mercury, cadmium and other toxic substances.

water is required to submit a report indicating the location, the kind, structure, and method of operation of the proposed establishment, as well as the proposed method of treatment of polluted water or waste liquid to be discharged by the establishment; if the Prefectural governor, to whom this report is submitted "deems that the effluent at the place of discharge does not satisfy the established effluent standard" (Article 8), he may order "the person who submitted the report to change the reported structure, the method of utilisation or the programme for the treatment".

Administrative guidance also applies to polluting facilities in operation. Again according to the Water Law, "when there is threat that /ān/ effluent does not satisfy the effluent standard, the Prefectural governor may order the person who discharges it to improve, by fixing the period, the structure of the utilising method of the facility, of the treating method of polluted water, or to stop for the time being the use of the facility" (Article 13). Similar provisions are to be found in the Air Law.

It is only in the last recourse, when the polluter does not want to comply, that penalties (penal servitude not exceeding one year or a fine not exceeding 500,000 yen) are applied.

Enforcement activities are therefore more concerned with guidance than with punishment. In fiscal year 1974, in the field of water, about 60,000 inspections were carried out; a similar figure is reported for 1975 for air pollution. They apparently resulted in more than 1,000 orders to improve waste water treatment in fiscal year 1974, and about 100 orders to improve smoke and soot emissions in 1975. Penalties, by contrast, are rather negligible. No case is reported in the field of air in fiscal year 1975; about 250 cases are reported in the field of water in 1974.

It is interesting to note here the direct involvement of environmental authorities in the control of the equipment or of the processes of polluters. This is clear from the quotations of the Water Law given above. One other clear and important case of such a control relates to the type of fuels used.

In many places local authorities regulate the sulphur content of the fuels to be used. Thus, in the Sapporo area 1,400 facilities located in a central area (of about 40 $km^2$) are not allowed to use fuel with more than 0.5 per cent of sulphur, and 1,100 other facilities, located outside this area are forbidden to use fuel with more than 1.2 per cent of sulphur. Similarly, the administrative authorities of Tokyo have requested to use fuel whose sulphur content is less than 0.8 per cent in buildings and plants in the

city's centre, and at the same time fuel with a sulphur content of less than 0.5 per cent began to be used in Metropolitan Government facilities. In the plant-by-plant agreements signed between local governments and plant managements, the sulphur content of fuels is often prescribed; thus, most of the 68 plants that signed a pollution abatement contract with the Nagoya city are required to use 0.5 per cent sulphur fuel.

Many other instances of this close and constant co-operation between industry and administration could be given. The following one is particularly striking. In August 1975, an important manufacturer submitted projected production plans for less-polluting products; later in the year, it appeared (from material submitted to the MITI by the manufacturer himself) that these plans were not being followed: the Minister then severely and publicly reprimanded the manufacturer; the manufacturer immediately apologised and revised his production plans.

Compliance and co-operation by industry cannot be entirely accounted for by good sentiments. It is also obtained by a delicate handling of sticks and carrots by the administration, who can be more or less responsive to industry's needs in terms of accelerated depreciations, of funding, of procurements, of permits, and the like. Pollution abatement efforts are part of a package negotiated between industry and administration. It has even been suggested that some segments of the Japanese administration welcomed pollution controls because it increased their bargaining power at a time when other types of controls, such as controls over imports, foreign exchange, licencing, had been relaxed.

The essence of the control-by-standards tool is to set emission standards, to let the polluters do what they want to meet them, and to make sure that they are met by punishing those who do not meet them. This is not what is done in Japan. Not only are many standards "made to measure" rather than "ready-made", but they are utilised as guidelines for the administration to provide guidance to polluters, rather than as norms that must be met by polluters. In fact, the Japanese practice appears to be somewhat similar to the British practice of "best practicable means" enforced by gentlemen's agreements between alkali inspectors and plant management. It could also be compared to the French "sectors contracts" (contrats de branches) in which detailed written agreements are passed between the French Administration and the enterprises of a sector, prescribing emission levels and pollution abatement efforts. This is not very surprising, because Japan is a society in which difficulties are settled by negotiations rather than by trials. It seems, then, safe to conclude that in Japan the role of emission standards as a tool of environmental policies is different from

what is often thought. Standards are utilised as a weapon in the hands of the administration in the negotiations it engages in with polluters rather than as prescriptions that automatically apply. There is no reason to believe that it is a less efficient way of utilising standards.

Chapter IV

## COMPENSATION

A compensation is a sum of money handed out to a person, a family, a group or an enterprise to "compensate" him (or it) for damage caused. Here we will only consider environmental damage, i.e. damage caused by various sorts of pollution.

Economists are usually very fond of compensations. Since the 19th century, they have accepted the idea that state of affairs B is "better" than state A if moving from A to B improves the situation of at least one person and at the same time does not deteriorate the situation of any person. But they did not know how to compare A and B when moving from A to B improves the situation of some while deteriorating that of others. It is only in the twenties that two British economists, Hicks and Kaldor, provided an answer to this problem. They noted that if the amount of satisfaction generated by the change from A to B is greater than the amount of dissatisfaction generated by this change, those who gain can "compensate" those who lose, and still be net gainers; we are thus back to the preceding case, and B can be said to be "better" than A. The so-called "compensation principle", which has provided the foundation of cost-benefit analysis, implies the payment of compensations.

Policy-makers, by contrast, do not like compensations. They tend to take compensations to be both immoral and impracticable, and they have, in most countries, been reluctant to pass bills granting money to victims of pollution. This is why there are not, in OECD Member countries, many examples of compensation.

Japan is an interesting exception. It offers three different types of compensation:

i) private compensation, which consists of pre-damage and after-damage compensation negotiated between polluters and polluted;

ii) judiciary compensation, which is after-damage compensation decided by the courts; and

iii) administrative compensation, which is after-damage compensation provided by a Law initiated by the Government.

## 1. PRIVATE COMPENSATION

Private compensation, i.e. compensation negotiated between private parties - along the lines advocated by economic theorists - is a significant feature by Japanese practices. A distinction can be drawn between pre-damage and after-damage compensation.

Pre-damage compensation is negotiated between private or public bodies planning to develop industrial or transportation facilities, and local residents that will (or could) be harmed by these developments. The damage to be compensated is usually economic damage, not health damage.

Local residents can only engage in this type of negotiation when grouped in strong associations. Particularly important in this respect are the fishermen's co-operatives. There are many well-organised and powerful fishermen's co-operatives in Japan, which own fishing rights. A developer has to buy these fishing rights in order to utilise the area. Strictly speaking, payments to fishermen's co-operatives are purchases, not compensation. In practice, however, they have many of the attributes of compensation.

Thus, in June 1974, two fishermen's co-operatives agreed to let Tokyo Power Company build eight nuclear reactors (8000 MW) and discharge hot water into the sea, against a 4,000 million yen compensation. In November 1975, the 175 member Tomakomai Fishermen's Co-operative decided to give up the fishing rights in favour of building a giant industrial port for 5,356 million yen compensation. There is no standard basis to figure out the amount of such compensation. In one case (that of a steel plant), the figure was reached by multiplying the surface of the fishing area by a fraction (10-20 per cent) of the market price of on-shore cultivated land. In another case of a steel plant, the amount of the compensation was the sum of annualised yearly income losses associated with the pollution. The amount of compensation seems to be the result of a negotiation process. Although negotiations are not secret - they take place under the eye, and indeed the control, of the general public - no data are available relative to the overall importance of such compensation.

It may be interesting to note, in this respect, that in the above-mentioned cases the compensation amounted to about 0.5 per cent of the construction costs of the nuclear power plant, and to about 6 per cent of the construction costs of the port; but it would be dangerous to generalise from only two examples.

After-damage compensation is meant to compensate health damage, as well as economic damage. This is also negotiated between polluters and polluted, without administrative influence, although local or prefectural officials are often reported to have played a role as

mediators in particular negotiations. The Mizushima case is particularly impressive. In 1974, in Mizushima (Okayama Prefecture), an oil tank belonging to Mitsubishi Oil Company broke down, causing a massive oil leakage into the Inland Sea; affected fishermen entered into negotiations with Mitsubishi Oil Company; the Company eventually paid compensation of 15,000 million yen. An example of health damage compensation is provided by the 124 million yen paid by Sumitomo Metal Mining Company to 45 victims of its arsenic pollution.

In 1975, Nippon Chemical Industrial Company, which seems to have caused hexavalent chromium pollution (before 1965), started to negotiate with a group of victims for compensation, and the President of the Company said he "did not think there was negligence in legal terms on the part of the firm, but it still felt social and moral responsibility for chromium pollution".

Thus, in Japan, private enterprises enter into negotiations that will lead them to pay compensation. This behaviour cannot be entirely explained by economic or legal reasons. It is to be accounted for by social reasons. In Japan, more than elsewhere, the business community wants to be loved, and to be considered as a praiseworthy part of the national community. A Japanese businessman would rather lose money than be looked down upon as a black sheep. He is willing to pay a compensation because the acceptance of the compensation by the victim will restore the climate of harmony that is vital to any Japanese, and help business maintain an image acceptable to the community.

## 2. JUDICIARY COMPENSATION

Unlike private compensation, judiciary compensation, i.e. compensation decided by courts at the end of a trial, are not typical of Japan, and can be found in most countries.

In all organised societies, someone who is harmed by someone else's actions has a right to be compensated for the harm he suffered; in other words, people are responsible for the damage they cause. Environmental harm, or damage, is no exception, but raises a number of specific problems to which different legal systems give different answers. The Japanese legal system is a written-law system (as opposed to the common-law system to be found in Anglo-Saxon countries), and the basic civil code has been patterned after the German and French civil codes. It includes in its Article 709 a general provision for civil responsibility. But this article, which was drafted in the 19th century, was not aiming at environmental damage compensation. Jurisprudence has therefore had to play an important role in "applying" the code, and has in practice developed

the law of compensation. This is why a look at some of the pollution-related lawsuits that took place in Japan is not without interest. Table 13 provides information relative to several such cases. The first four cases are particularly well-known, and often referred to as the "four major pollution lawsuits".

Four points can be made about this jurisprudence.

The first is that governments, whether local or national, and more generally public entities, can be sued and sentenced to pay compensation, just as private individuals or enterprises. In Japan, the first lawsuits, and particularly the "four major" ones, were filed against private enterprises. But the Osaka International Airport case, in which the defendant was the Government of Japan clearly shows that public entities can successfully be sued.(1) The "public interest" of public entities' undertakings - here the public utility of the airport - does not exonerate the public entity from its duty not to harm anyone, or to compensate for harm done.

The second is that the causality between the action undertaken by the defendant and the damage suffered by the plaintiff need not be very rigorous. The results of epidemiological studies were accepted, which means that a correlation was considered as a causality. In other words, the burden of proof, which rests on the plaintiff, is made relatively light.

A third is that a "fault" on the part of the defendant is hardly required. Originally, civil responsibility implied a fault; and a fault implies a norm; when norms do not exist - which is usually what happens in pollution-related damage lawsuits - they are, so to say, set by the courts. Japanese courts have set them rather strictly and have, in fact, created an obligation of cautiousness. A behaviour can be faulty by its results, and not only by its nature. Another way to express the same idea is to say that, in pollution cases, Japanese courts have extended so much the concept of fault that they have extended the concept of responsibility from the area of fault to the area of no fault.

The last point relates to "damages". The concept of damage has also been extended by the courts so as to cover not only economic and physical damage but also, and more generally, violations of "personal right" (the right to physical integrity) of Japanese citizens. As Judge Sawaī declared, in the Osaka Airport case, "the residents whose life is disturbed under such circumstances are entitled to demand that the Government do something in accordance with their rights guaranteed under Articles 13 (individual's right to life, liberty and the pursuit of happiness) and 25 (people's

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1) The Japanese Government has appealed to the Supreme Court, where the case is now pending.

Table 13

SOME LAWSUITS FOR POLLUTION-RELATED DAMAGE

| Case | Plaintiff | | Defendant | Date suit | | Compensation | |
|---|---|---|---|---|---|---|---|
| | No. | Type of Damage | | Filed | Ended | Claimed (million yen) | Awarded (million yen) |
| Niigata Minamata | 77 | Mercury poisoning | Showa Denko Ltd. | June 67 | Sept. 71 | 530 | 270 |
| Itai-Itai | | | | | | | |
| 1. First | 31 | Itai-Itai disease | Mitsui Kinzoku | Mar. 68 | June 71 | 62 | 57 |
| 2. Appeal | 34 | id. | id. | June 71 | Aug. 72 | 151 | 148 |
| Yokkaichi | 12 | Yokkaichi asthma | 6 petrochemical companies | Sept. 67 | July 72 | 200 | 88 |
| Minamata | 138 | Mercury poisoning | Chisso Ltd. | June 69 | Mar. 73 | 1500 | 937 |
| Toroku Mine | 11 | Arsenic poisoning | Sumitomo Metal Mining Co. | Dec. 75 | Pending | 191 | - |
| Yokota Air Base | 300 | Noise damage | Jap. Government | Jan. 76 | Pending | 300 | - |
| Osaka Airport | | | | | | | |
| 1. District Court | 264 | Noise damage | Jap. Government | Dec. 69 | Feb. 74 | 132 | 115 |
| 2. High Court | 263 | id. | none | Mar. 74 | Nov. 75 | 180 | 295 |
| 3. Supreme Court | 272 | id. | none | Dec. 75 | Pending | - | - |

right to maintain the minimum standards of wholesome and cultured living) of the Constitution". It should also be noted that the amounts of compensation granted by courts are not insignificant. Any judgement on this matter is bound to be subjective. But it seems fair to say that compensation, which amounted to several million yen per plaintiff, was not mere token compensation. It is also important to note that, in the Osaka Airport case, the defendant was asked to pay compensations in the future so long as noise pollution is not reduced to a certain level.

## 3. ADMINISTRATIVE COMPENSATION

Private and judiciary compensation cannot be considered as an element of environmental policies, in the sense that they developed without governmental interference. The Japanese Government, however, followed with great attention these developments, which prompted it to create its own compensation scheme.

A law entitled "Pollution-Related Health Damage Compensation Law" was passed in October 1973 and came into effect in September 1974. Compensation granted under this law can be named "administrative" because the scheme is operated by the Administration.(1)

The 1975 Law was preceded by measures taken by local governments and by a 1969 Law. Thus, Kumamoto Prefecture decided to grant financial support to victims of Minamata diseases as early as 1958; and Yokkaichi city started aiding Yokkaichi asthma victims in 1965. The 1969 Law, called Law Concerning Special Measures for the Relief of Patients with a Pollution-Related Disease, provided a "first version" of the 1973 Law.

The Law sets out in great detail:

i) who is compensated;
ii) what is compensated; and
iii) who is compensating.

Who is compensated? The beneficiaries of the Law are the victims of certain pollution-related diseases who have "lived, worked, or otherwise been present" in certain designated areas. There are seven such diseases; four are air-pollution related diseases (chronic bronchitis, bronchial asthma, asthmatic bronchitis and pulmonary emphysema), which are "non-specific" diseases in the sense that they could occur in the absence of air pollution; three are water-pollution related diseases (Minamata disease, Itai-Itai disease,

1) See Gresser, art. cit., for a detailed discussion of the Law.

and chronic arsenic poisoning), which are "specific" diseases because they occur only in the presence of specific water pollutants, e.g. mercury, cadmium and arsenic.

There are two types of designated areas: Class I and Class II areas. Class I areas are areas designated by Cabinet order as being areas where marked air pollution has arisen and where non-specific diseases due to the effects of such air pollution are prevalent. As of March 1976, thirty-seven districts, covering 1,110 $km^2$ have been designated as Class I areas. Class II areas are areas also designated by Cabinet order, where specific diseases are prevalent. There are five such areas, covering 800 $km^2$. Designation is decided on the basis of epidemiological studies, and of air (or water) pollution surveys; as can be expected, inhabitants and local governments exert pressures for designation, and express discontent when designation is not granted. Anybody exhibiting one of the specified diseases, and showing that he (or she) had lived for a certain time (one year in the case of bronchial asthma and asthmatic bronchitis, two years in the case of chronic bronchitis and three years in the case of pulmonary emphysema) in one of the designated areas will be certified as a victim and eligible for compensation.

As of March 1976, there were about 36,000 people designated as victims. Table 14 provides some data about such victims.

Table 14

NUMBER OF CERTIFIED VICTIMS FOR THE PURPOSE OF THE COMPENSATION LAW SCHEME

| | Non-specific (air pollution related) diseases | Specific (water pollution related) diseases | Total |
|---|---|---|---|
| 31st March, 1970 | 962 | 203 | 1,165 |
| 31st March, 1971 | 3,219 | 211 | 3,430 |
| 31st March, 1972 | 6,376 | 312 | 6,688 |
| 31st March, 1973 | 8,737 | 728 | 9,465 |
| 31st March, 1974 | 13,574 | 1,184 | 14,758 |
| 31st March, 1975 | 19,340 | 1,325 | 20,665 |
| 31st March, 1976 | 34,190 | 1,550 | 35,740 |
| Dead | 1,062 | 185 | 1,247 |

Four points can be made about them. First, as can be seen in Table 14, they are mostly air pollution victims; water pollution victims account only for about 5 per cent of the total. Secondly, there are many children amongst them; children below 10 years of age account for about 40 per cent of air pollution victims. Thirdly, as can be expected, most victims are located in the main large industrial cities such as Osaka, Tokyo, Amagasaki, Nagoya, Kawasaki.

Fourthly, as shown in Table 14, the number of certified victims has been increasing at a very rapid rate. This increase does not seem to reflect an increase in pollution nor in the effects of pollution; it appears to be a mere consequence of administrative delays: the process of designation of victims has taken time.

What is being compensated? The Law provides for several kinds of compensation benefits. First, medical care expenses are reimbursed. Second, a physical handicap compensation is paid monthly. The amount of the compensation paid to a victim is a function of his age, his sex, and his "class". Victims are classified into four classes; to each class corresponds a "coverage rate". Special class victims and Class I victims are people unable to work and badly hampered in daily life; the coverage for these classes is 100 per cent. Class II victims are people seriously restricted in work and impeded in daily life; the coverage rate for Class II is 50 per cent. Class III victims are people hindered in work and slightly restricted in daily life; the coverage rate here is 30 per cent. Let:

a = age of the victim,
s = sex of the victim,
c = coverage rate of the class of the victim,
Was = the average wages of a salary earner of age a and sex s,
Aa, s,c = the amount of compensation received by the victim.

The compensation paid will be:

$$Aa,s,c = 0.80 \times c \times Wa,s$$

To give an example, a Class II female aged 45 will receive about 38,000 yen monthly. The highest compensation, i.e. that paid to a special class victim, male, aged 50-54, would be 174,000 yen monthly.(1) In Fiscal Year 1975, the average monthly payment was about 32,000 yen.(2)

There are other less important types of compensation benefits, such as "child compensation allowances", paid to persons raising children under 15 years of age, designated as victims, and "survivors' compensation payments", paid to the surviving dependants of a person certified for a designated illness who dies as a result of that disease, to make up for the deceased person's lost earnings.

1) It includes 26,000 yen paid to special class victims for nursing purposes.

2) This figure is obtained by dividing the total amount of disability compensation paid, by the number of victims over 15 years of age (estimated as the arithmetic mean of the number of victims at the beginning of the year and at the end of the year).

Funeral expenses are also reimbursed. In Fiscal Year 1975, the total amount of compensation benefits (including medical expenditures) was about 15,300 million yen.

Who compensates? is the last question. By and large, compensation is paid for, or rather financed by, polluters, as shown in Figure 1. Payments to victims are actually made by local governments. Money to that effect is provided by a special agency, called the Pollution Related Health Damage Compensation Association. This Association receives a small governmental subsidy, aimed at covering administrative costs, but the bulk of its resources are provided by the polluters, in the form of "pollution load levies". The money flows related to specific water pollution diseases and those related to non-specific air pollution diseases are in fact distinct.

As far as water pollution is concerned, since polluters can readily be identified, the Association extends relief to victims first, and then collects money from the polluter in the form of a special charge.

For air pollution, polluters cannot be identified, and share a sort of collective responsibility. It is assumed that this responsibility can be divided between fixed sources (for 80 per cent) and mobile sources (for 20 per cent). As a result, 20 per cent of the costs are paid by owners of automobiles, through the automobile tonnage tax. This tax is not levied by the Pollution-Related Health Damage Compensation Association, but by the central government through the general budget; it was not created for the purpose of compensation, and its proceeds are much greater than the amount handed out to the Association; in addition, the base of the tonnage tax is only loosely associated with pollution discharge. One could therefore argue that this 20 per cent is not really provided by polluters, but by road users, or even taxpayers. In 1975, a Task Force studied "alternative methods of collecting money for health damage compensation from mobile emission sources", but did not find any better method.

The rest, i.e. the 80 per cent of air pollution related compensation, is indeed provided by polluters, in the form of a pollution charge or tax paid by smoke and soot emitting facilities. The base of the tax is the volume of sulphur oxides released during the preceding year; this volume is not actually measured, but estimated from the amount of sulphur content of the fuel utilised and from the amount of stack gas desulphurisation that takes place. The rate, or rather rates, of the tax are calculated each year (and are such that the proceeds of the tax will cover 80 per cent of the amount of compensation to be paid). They vary with the location of the polluting facility, and are much higher (nine times higher) in the areas designated for the certification of victims than elsewhere. They have increased very rapidly over recent years, as shown in Table 15.

Figure 1

MONEY FLOWS IN THE COMPENSATION LAW SCHEME

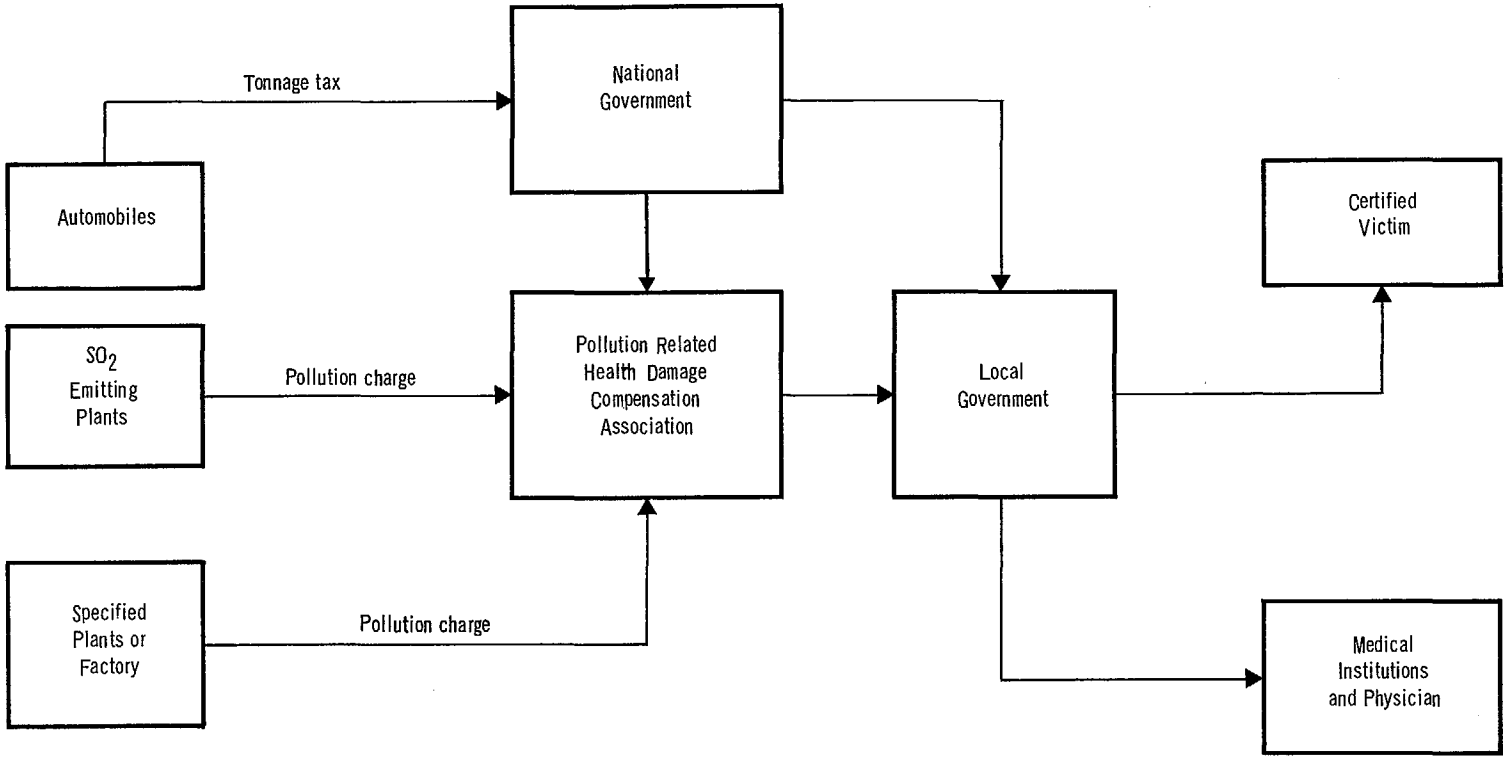


Table 15

RATES OF THE POLLUTION LOAD LEVY

(Yen per $m^3$ of $SO_2$ discharged)

| | Designated areas | Other areas |
|---|---|---|
| 1974 | 15.84 | 1.76 |
| 1975 | 77.31 | 8.59 |
| 1976 | 209.97 | 23.33 |

For practical reasons, the charge is only levied on "large" polluters (defined as facilities emitting more than 5,000 $m^3$ per hour in designated areas, and more than 10,000 $m^3$ per hour elsewhere); there are about 7,400 such facilities in Japan, but they are reported to account for more than 90 per cent of $SO_2$ discharged.

The burden of the levy is not negligible. In 1976, the proceeds were about 33,000 million yen, or a little less than 5 million yen per source taxed. One other way to look at it is to note that, in a designated area, the tax would represent about 17 per cent of the cost of a 3 per cent sulphur content fuel. The levy can therefore be regarded as a constant incentive to pollution abatement. The less a polluter discharges, the less he pays. Economists can only approve of such a scheme by which the polluters pay not only the costs of pollution abatement, but also the cost of the residual damage he causes.

The 1973 Law, however, has been severely criticised. First, polluters find it difficult to understand how their contributions, which are based on pollution discharge, increase at a time when their pollution discharges decrease. The explanation is of course that the increase in the rate of the levy has been greater than the decrease in pollution discharges; the increase in the rate of the tax has been made necessary by the increase in the number of certified victims which, as mentioned above, appears to be a mere consequence of administrative delays. The scheme would have been politically more acceptable if a clearer relationship between levies paid and pollution discharged had been established.

Secondly, polluters also criticise the nine to one difference between the tax rate for plants located in designated areas and the tax rate for plants located in non-designated areas. If the levy is to be seen as an insurance premium to be paid by all polluting enterprises, there is no reason why some should pay nine times more than others. If the levy is to be paid by enterprises responsible for pollution diseases, there is no reason why enterprises located far away from pollution disease areas should pay anything. It is true that the Law, as designed, introduces simultaneously a principle of "collective responsibility" for all polluters, and a

principle of "direct responsibility". It has tried to strike a compromise between these somewhat conflicting principles.

Finally, the Law is criticised by some as being too generous, and by others as being too restrictive for those polluted. Both claims can be substantiated. All those who live in a designated area and who suffer from one of the designated diseases are certified as victims; it is clear that some of them would have been ill even if no pollution had taken place in the area; in that sense, they do not suffer from pollution-related disease; yet, they will be compensated. Conversely, only those who live in designated areas can be certified; it is nevertheless quite sure that some of the people living in other areas are ill because of air pollution; yet, they will not be compensated. Similar criticisms are voiced about the amount of the compensation. Some argue that these amounts are not enough: a Class I victim who, by definition, cannot work, only gets 80 per cent of the average wage, and is therefore not even entirely compensated for the economic damage he suffers, let alone for the moral damage. Others will reply that people who did not work will also get 80 per cent of the average wage, and that social security programmes - which grant only 60 per cent in case of sick leave - are much less generous. It seems clear that, as a result of the scheme, some pollutees get much better treatment than others; but the nature of the problem is such that it is not possible to tell who they are. This merely reflects the difficulty, or rather the impossibility, of determining with any degree of certainty who is harmed by pollution and to what extent.

In practice, therefore, the Compensation Law Scheme raises several delicate problems. Some will be solved; others are of a more pervasive nature.

The payment of compensation for damage is an important element of environmental policies in Japan. What is particularly striking is the limited scope of judiciary compensation - which is in most other countries the main or the only form of compensation. In Japan, by contrast, most compensation is arrived at in the framework of a negotiation system which is "before" the court system, or of an administrative system which is "beyond" the court system. One could argue that this makes good economic sense because the legal system, in Japan and elsewhere, is slow, costly, and to some extent, haphazardous. But a deeper explanation is probably to be found in the notion of conflict-avoidance. Court trials are, by nature, conflictual processes in which plaintiffs and defendants fight, and in which one of them loses - case, money, and face. In a country where the desire for mutual respect and trust is so great, trials are socially disruptive, and it is not surprising that other ways have been devised to settle conflicts, or rather

to suppress them. Thus, in passing the Pollution-Related Health Damage Compensation Law, the Government was not only trying to ensure that pollutees would be compensated more quickly, more fully and more surely than they would have been by the courts; the Government was also avoiding open conflicts. This explains why the tool of judiciary compensation, although not much utilised, has been very influential. The decisions taken by the courts in the major pollution cases have played a decisive role in the development and outcome of compensation negotiations, and in the shaping of the Compensation Law.

The payment of compensation is often criticised on "moral" grounds. It is said to appear, together with pollution charges, as the sale of the right to pollute - to damage people's health. There is some truth in this. But the same can be said of pollution standards: they open the right to pollute (at least up to the level set by the standard); the difference is that this right is given, rather than sold. One does not see why this would be more acceptable. And one sees that it is less efficient, in the sense that it does not introduce a permanent incentive to decrease pollution discharges. In addition, once the pollution has occurred, it is true that people have been harmed. No damage is certainly better than damage. But compensated damage is better than non-compensated damage. Furthermore, the payment of compensation is not an alternative to the setting of standards. The two instruments can be - and are - used simultaneously.

But the real policy issue is not whether one should be in favour of or against compensation - because in all countries legal systems do provide judiciary compensation, and will continue to do so. The real issue is whether governments should, as in Japan, set up and administer systems for compensation.

Chapter V

# LOCATION

The location of pollution sources (plants, roads, airports, etc.) is an essential factor of environmental quality: a given facility that would be fairly harmless in one place could be very destructive in another place. Environmental damage is damage (to someone or something) located somewhere. Economic goods, which can be transported, exist irrespective of where they are; environmental bads do not. Two consequences follow. First, economic goods can be added, and environmental bads cannot: it makes sense to add tons of steel produced all over Japan, but it does not make sense to add decibels of noise emitted all over Japan; this makes it difficult to compare economic goods and associated environmental bads. Second, and more important, while the benefits of economic goods accrue to all, the damage brought about by related environmental bads affects only a few, but affects them severely.

Controlling the location of developments can and should help to achieve an acceptable balance between the conflicting interests of the economy and of local residents, or, to put it otherwise, between servicing consumers and servicing inhabitants. It can and should be an important policy instrument.

This issue is important for all countries, but has been particularly so for Japan. The limited availability of flat land, the exceptionally high rate of industrial growth, the very type of economic growth, and the anti-business attitudes that developed together with anti-pollution awareness, combined to make the problem particularly serious in Japan. Japan has already had to deal with some of the difficulties other OECD Member countries will have to face - sooner or later. This is why her experience in this domain is of special interest to others.

Broadly speaking, in Japan two types of control are exerted on the location of polluting facilities:

i) "residents'" controls, which consist of pressures exerted by an area's inhabitants to prevent or modify developments;
ii) "administrative" controls, i.e. official systems and procedures ensuring that locational decisions will be adequate.

The two types of control are of course related: it is because administrative controls were considered inadequate that residents' controls spread, and it is largely because residents' controls were seen as inappropriate that other administrative controls were (or rather are) introduced.

## 1. RESIDENTS' CONTROL

A "building permit" is an authorisation granted by a public authority to build a particular facility in a particular place; it protects both the prospective developer and the inhabitants around the prospective development. It would seem that, in the fifties and the sixties, this instrument was either non-existant or not utilised in Japan. Many facilities responsible for noise pollution, such as airports, highways, trains, were situated in densely populated areas. A number of factories were established on sea-shores, thus polluting traditional fishing grounds. Three factors aggravated the situation. First the size of the development was often huge, and ever-increasing (Japan was making full use of economies of scale); secondly, in Japan the public sector is highly centralised (in Tokyo) and the private sector highly concentrated; it follows that decisions relative to these developments, which were often taken by senior public or private officials in their Tokyo offices, were seen by the local residents involved as decisions that escaped their control, and were resented as such. Thirdly, the Japanese people are often passionately attached to the scarce and therefore valuable lands and sea-shores.

This largely explains the strong, and often efficient, opposition shown by residents' groups or fishermen's co-operatives to a number of public and private development projects. A brief description of some cases of such opposition may be appropriate.

The best known example is probably that of Narita Airport. In view of the growing congestion at the existing Tokyo International Airport at Haneda, in 1965, it was decided to create a new Tokyo International Airport. A site was selected near Narita City, 60 kms east of Tokyo, in Chiba Prefecture. A special quasi-public corporation, the New Tokyo International Airport Authority (NTIAA, later TIAA) was created and given the right to expropriate landowners. Phase I of the new airport (consisting of a 4,000 m runway, a passenger terminal building, cargo buildings and a central airport administration building), was completed in 1972, at a cost of about 150,000 million yen. For more than three years now, the operation of the airport has been blocked by citizens' groups. It should be pointed out that this opposition was not entirely based upon

environmental motives, and has become more and more "political" as things went on. The case is nevertheless very interesting.

First, local residents, backed by a number of other people, opposed the construction of the airport. There were battles in which three policemen were killed; opponents could not prevent the building of facilities, but they erected, in the axis of the runway, a 62 m high steel tower that made it impossible to operate the airport. Although the TIAA has a legal right to tear the tower down, it hesitated to do so.

Secondly, residents of adjacent areas opposed the transportation of aircraft fuel on their "territories"; several schemes have been proposed and rejected. A first proposal involved a pipeline going from Kashima (an industrial complex 40 kms east of Narita, in Ibaraki Prefecture), to the airport; Ibaraki Prefecture residents considered that, in the event of an earthquake (earthquakes are not infrequent in Japan), the pipeline would break, oil would spread and inflict very serious damage; they therefore opposed the scheme. A second proposal consisted also in a pipeline running from the city of Chiba, an industrial complex 40 kms south-west of Narita, to the airport. This proposal has also been opposed and - at least temporarily - defeated by Chiba residents. A third proposal is to transport the fuel by train from Kashima to a fuel depot near Narita City (and from there to the airport via a 7 kms pipeline). The proposal again met with opposition from several of the cities on the railway line. However, after lengthy negotiations, their opposition was withdrawn at the end of 1975 against "compensation", taking the form of improvements in rail and road infrastructure; but it was made clear that the authorisation was only granted for a three-year period.

In the meantime, the airport is not open to traffic. The economic waste involved is enormous. The TIAA is heavily in debt and is currently paying interest amounting to about 30 million yen per day. The Japanese Government, as well as TIAA, are doing their best to settle the remaining problems, so as to open the airport as early as possible.

A number of other cases can be mentioned. In the Osaka Airport trial mentioned in Chapter IV, the plaintiffs were asking not only for compensation, but also for a curtailment of airport activities, namely for a 9 p.m. flight cut-off. The Osaka High Court ruled in their favour. This is also considered to involve a serious economic loss. It is concerning such a curtailment - not about the amount of compensation to be paid - that the Government has appealed to the Supreme Court.

Air transportation is not the only type of transportation opposed by local residents. The Shinkansen - the so-called "bullet-

train" that links Tokyo with Osaka (515 kms) in little over three hours, and Tokyo with Fukuoka (1,069 kms) in less than seven hours - has been strongly criticised for the noise and vibrations it generates; the Shinkansen line is supposed to be extended north of Tokyo (up to Morioka), but strong opposition by local residents, particularly in the area just north of the city of Tokyo, has delayed the construction of the line. Similarly, expressways, particularly in urban areas, are being fought by environmentalist groups. Thus, for instance, the Chuo expressway, which links Nagoya to Chofu, a small city in the suburbs of Tokyo, was planned to be linked with the Tokyo Expressway No. 4, which goes from Tokyo downtown to Takaido, a small city close to Chofu. Completion of the Chofu-Takaido link provides Tokyo with a main thoroughfare to accommodate westbound traffic. However, construction of this short link has been opposed by residents who insisted that a toll-gate should be completely covered with a canopy; the expressway was eventually completed in May 1976, but the completion date was delayed by several years. In Yokohama, a large industrial city 30 kms south-west of Tokyo, the construction of a highway, which is finished except for 150 m has been temporarily stopped. Many other examples can be cited in other domains. Projects for steel mills have been postponed or scaled down (e.g. at Shibushi, in Kagoshima Prefecture, at Oga, in Akita Prefecture, or at Tomakomai, in Hokkaido Prefecture). So have petrochemical complexes (e.g. at Shibushi, in Kagoshima Prefecture). A plan to stock a quantity of oil equivalent to 90 days consumption will be very difficult to carry through, because of the difficulty of finding appropriate locations for storage tanks. Nuclear power plants are also strongly opposed - and delayed. The examples given will suffice to show that, in a number of cases, relatively small groups of people have blocked, modified, or delayed important projects.

It is important to note that the type of development being opposed is changing. In the late sixties and in the early seventies, local residents were essentially opposing <u>private</u> developments, i.e. polluting factories. Over the last few years, they are increasingly opposing <u>public</u> developments, such as airports, highways, high-speed trains, waste disposal facilities, water treatment plants, etc.

Local residents utilise two instruments: direct action and legal action. Direct action against a project includes rallies, demonstrations, and physical obstruction. Legal action is the filing of a lawsuit, in which the plaintiff asks that the project be declared unconstitutional or otherwise illegal, and stopped. Both modes of action involve confrontations. They sometimes end

in negotiated agreements, providing the payment of compensations. But they always involve high economic and social costs. Economic costs include lengthening of "gestation periods", i.e. the time-spans between the beginning of an investment and its completion, during which resources invested do not produce any good or service; maturation periods increase with the size of the investment for obvious technical reasons; if, in addition, they are increased by residents' opposition, they might become prohibitively long. Bigness ends up having an economic cost that might well offset its economic advantages (called "economies of scale" in the jargon of the economists). Economic costs of residents' opposition, when it succeeds in preventing a particular development, obviously include the benefits that would have been derived from the project. "Social" costs are associated with direct and even legal confrontations that take place between residents and developers, and also between residents themselves. They are particularly great in a country like Japan, which values social cohesion so highly.

Furthermore, such economic and social costs are uncertain. Investors can hardly know whether or not a given project will be opposed, nor how it will be opposed. The launching of any project involves a "resident opposition risk" which is in itself a cost. This certainly makes planning difficult.

Residents' control of developments does protect the environment, but it does so at great costs. There are reasons to believe that it is not the best mode of control. This is why the Government has tried to substitute other modes of control, and to introduce "administrative controls".

## 2. ADMINISTRATIVE CONTROLS

The Japanese Government has tried to control the location of polluting activities in two manners. First, it has attempted to locate polluting activities where they would be the least harmful to the environment, by means of regional planning, i.e. by indicating where they should be located. Secondly, it is trying to prevent the location of polluting activities where they would be most harmful to the environment, by means of impact assessment procedures. The first type of control could be called "positive", and the second labelled "negative". Although, in Japan "positive" controls were introduced first, we will begin with "negative" controls.

Negative administrative controls, i.e. impact assessment procedures, are gradually being introduced in Japan. Several texts have been promulgated to that effect. For instance, in June 1972, a cabinet resolution, entitled "on Counter-Measures for Environment Conservation with Regard to Public Works", was issued. It provided

for overall evaluations of ecological effects of major public works projects. A Law of October 1973 for "Inland Sea Conservation" made it mandatory for environmental impact assessments to be carried out for certain plants discharging waste waters into the Inland Sea. In addition, in 1974, an Office of Environmental Assessment was created within the Environment Agency. It is reported that in 1974 this office handled about 700 cases. Although information on the implementation of these texts is not abundant, it seems that impact assessments developed in the framework of these texts have not been entirely satisfactory. Questions such as: who should carry out the assessments, at what stage they should be carried out, what they should include, and what should be the role of local residents, apparently did not get very clear answers. Except in the case of the Inland Sea, there are no indications of projects being rejected as a result of the impact assessments. In short, this type of administrative control did not replace residents' control.

This prompted the Japanese Government to prepare a "stronger", more efficient impact assessment Law. A special Panel of the Central Council for Control of Environmental Pollution was set up to prepare a report on the matter. The report, which was completed in December 1975, is now under study by the Council.

The main features of the proposed system are as follows:

- The environmental impact assessment would be conducted for those projects, whether public or private, which "could have a marked effect on the environment". In the case of a massive regional development plan with multiple elements, an impact assessment of the entire project would be conducted before individual component plans are brought under scrutiny.
- What would be assessed is the likely environmental impact of the project on air, water, soil, living creatures, etc. and more generally on environmental quality. The concept of an "essential level of environmental quality" to be maintained by the project would be introduced. The assessment would begin, in each case, by establishing this "essential level", against which the impact of the project will be assessed.
- The role of local inhabitants would be great. It is the would-be executor of a development project who would prepare a first draft of the impact assessment. But this first draft would be made public, and reactions by local inhabitants and scientists would be solicited. Then the would-be executor, or if the project requires State approval, the State authorities, would modify the project (if necessary) and prepare a final assessment report.

The impact statement procedure proposed is very much along the lines of impact statement procedures adopted or considered in many

OECD Member countries. The efficiency of any procedure depends very much on its implementation. It is therefore impossible to know whether or not this administrative control would be efficient, and would take the place of residents' controls. As it is, however, the procedure has been opposed by several quarters. Keidanren, the Japanese Association of Manufacturers has publicly criticised it. Several Ministries have been reluctant about it. As a result of this lack of consensus, the Law has not yet been submitted to the Diet.

The Japanese Government has also introduced another, more positive, type of control, in the form of national land planning. The idea that economic development should not be concentrated in a few congested areas, but rather dispersed over the country, received early and wide recognition. A number of physical development plans were prepared and enacted - although not sufficient to balance the powerful forces leading to increasing concentration.

As early as 1950, a "Comprehensive National Land Development Law" was enacted; it designated a score of less developed areas as "specific development areas", where national investment should concentrate. Concentration of national investment however was not satisfactory.

In 1962, together with the Income-Doubling Plan, a First Comprehensive National Development Plan was formulated, again aiming at reducing regional income disparities, and at eliminating the evils arising from overcrowding. It proposed that selected local cities be fostered as "regional centres": in 1962, 15 cities were designated under the name of "New Industrial Cities". The Plan also proposed that "growth poles" be designated and fostered as strategic areas for industrial development in areas outside over-concentrated areas: in 1964, six such areas, called "Special Areas for Industrial Consolidation" were designated. But concentration did not slow down.

In 1969, a Second Comprehensive National Development Plan was issued. It proposed to "distribute the concentrated land use into wider regions by dividing total national land into seven blocks, to inject central managerial functions into the big urban centres of respective regions, and to connect them by a basic infrastructure network". The impact of the Plan does not appear to have been very substantial.

In 1972, Mr. Tanaka, then Minister for International Trade and Industry, published a book entitled "The Remodelling of the Japanese Islands", which was to be reflected in a Plan. This Plan provided for the relocation of industries: "industrial plants in overcrowded areas will be moved to sparsely populated areas, while construction of new plants will be encouraged in areas other than the Pacific coastal belt". The Plan also provided for high speed transportation

and information networks, and for the building of new medium-sized cities (the figure of 250,000 inhabitants was cited).

Several more concrete steps were taken. Public investments were directed towards the "new industrial cities" and the "special Areas for Industrial Consolidation". Economic incentives, such as taxes on activities located in congested areas, or assistance to activities located in "development" areas, were utilised.

It is not easy, however, to evaluate the impact of those various efforts. Table 16 suggests that the spatial concentration of industrial activities has indeed been stopped in Japan. But it also shows that the concentration of population has been increasing. This probably reflects the fact that policy, in Japan as in many other countries, has concentrated on industry, at a time when the main source of employment is the tertiary sector.

Table 16

SPATIAL DISTRIBUTION OF ACTIVITIES AND POPULATION, 1960, 1974

(Per cent)

| | Share of the 3 largest metropolitan areas c) | |
|---|---|---|
| | In terms of shipment a) | In terms of population b) |
| 1955 | - | 36.3 |
| 1960 | 66.7 | 39.2 |
| 1965 | 66.5 | 42.8 |
| 1970 | 65.3 | 45.6 |
| 1973 | - | 46.3 |
| 1974 | 61.3 | - |

Sources: a) MITI: Industrial Statistics.
b) Statistics Bureau, Prime Minister's Office.

Note: c) The three largest metropolitan areas are Tokyo and its suburbs (Tokyo, Kanagawa, Saitama, and Chiba Prefectures), Nagoya and its suburbs (Aichi, Mie, and Gifu Prefectures), Osaka and its suburbs (Osaka, Kyoto and Hyogo Prefectures).

The results were probably considered not to be entirely satisfactory, and in 1974 it was decided to prepare two other plans: a Land Use Plan, and a Development Plan.

A National Land Use Plan, provided for by a National Land Use Planning Act passed in 1974, was prepared and accepted by the Government in 1976. This Act also permitted Prefectural governments to establish control areas within which all land transactions will require Government permission, and will take place at prices no higher than those stipulated by the Government. A specialised

Agency, the National Land Agency, was created in 1974. Its task will be to ensure that the Plan is implemented.

In addition, a new National Comprehensive Development Plan is under preparation. A draft has been submitted to the appropriate Council and should be finalised in 1977. It is supposed to reflect and to incorporate the major elements of the National Land Use Plan.

The Japanese experience suggests two things. One is that controls over the location of developments are so necessary that, when not provided by administrative procedures and policies, they may well be introduced - at high economic and social costs - by local residents. It also appears that the selection of appropriate sites for public developments may well prove to be much more difficult than the selection of sites for private developments.

A final point to be made is that there are limits to what can be achieved by means of development location controls. A few more polluting activities can be accommodated in a country provided they are appropriately located, but only a few. Beyond a certain point no location will be found "appropriate". At that point, it will become necessary to control, not only the location of developments, but also the type of development. This has indeed been seriously considered in Japan. As early as 1971, the Industrial Structure Council of MITI, in an interim paper entitled "Trade and Industrial Policies for the 1970s", recommended "knowledge intensification in the industrial structure". The same Council, in 1975, issued another document entitled "Japan's Industrial Structure - A Long Range Vision" that no longer emphasizes the role of "Knowledge-based industries", but raises the question of the optimal "type" of development.

## Chapter VI

## ACHIEVEMENTS

It is of course difficult to find out whether an environmental policy has been successful or not. There are no overall indicators of environmental quality; and even if there were, their evolution could not be entirely attributed to the efficiency of environmental policies. It is nevertheless necessary to try and see what has been achieved by the effort developed in Japan to protect the environment. To this effect, we shall examine quantitative information showing how air and water quality has improved or deteriorated in Japan since the late sixties, and also how it now compares with other countries. Then, taking into account the fact that pressures on the environment, due to urbanisation, motorisation and industrialisation, have increased during the same period, we shall attempt to assess the efficiency of environmental policies in Japan.

### 1. EVOLUTION OF ENVIRONMENTAL QUALITY

The clearest, and probably the most important, point is that the situation concerning pollution by sulphur dioxide has improved significantly in the past few years, as shown by Table 17, and illustrated by Figure 2. Yearly average levels of $SO_2$ concentrations decreased since 1967 and were, on average lower by 50 per cent in 1974. As a result, the percentage of monitoring stations at which ambient air quality standards were met increased rapidly.

The situation concerning pollution by carbon monoxide has also improved significantly in the past few years. In 1975 ambient air quality standards were met at all monitoring sites.

Available data for Tokyo comes from two different sources, by which CO pollution is measured differently; both sources show a significant improvement in recent years (see Table 18).

Nitrogen oxides are of importance as pollutants *per se* and as precursors of photochemical oxidants. Data concerning them used to be relatively scarce. Therefore it is more difficult to assess trends concerning them, although the monitoring network is now extensive in Japan. Yearly average concentrations of nitrogen dioxide tend to grow slowly in Japan, as shown in Table 19.

Table 17

$SO_2$ POLLUTION, 1965-1974

| | Ground Concentration[a] Levels (p.p.m.) | Monitoring Stations Meeting Quality Standards[b] (%) |
|---|---|---|
| 1965 | 0.057 | n.a. |
| 1966 | 0.057 | n.a. |
| 1967 | 0.059 | 48 |
| 1968 | 0.055 | 59 |
| 1969 | 0.050 | 67 |
| 1970 | 0.043 | 72 |
| 1971 | 0.037 | 87 |
| 1972 | 0.031 | 34 |
| 1973 | 0.030 | 46 |
| 1974 | 0.024 | 69 |

Source: Japanese Report, p. 140.

Note:

a) Averages over fifteen stations in operation since 1965.

b) Quality standards for 1967-71 are different from quality standards for 1972-74.

Table 18

CO POLLUTION IN TOKYO, 1965-1974
(in p.p.m.)

| | First Source | Second Source |
|---|---|---|
| 1965 | 3.2 | |
| 1966 | 2.9 | |
| 1967 | 3.1 | |
| 1968 | 3.6 | 6.4 |
| 1969 | 4.4 | 5.9 |
| 1970 | 5.7 | 3.4 |
| 1971 | 4.7 | 3.1 |
| 1972 | 4.3 | 2.3 |
| 1973 | 3.7 | 2.7 |
| 1974 | 3.5 | n.a. |

Sources and Notes:

First Source: Environment Agency, Quality of the Environment, 1975, p. 74.

Second Source: Tokyo Metropolitan Government, Tokyo Statistical Yearbook, 1973, p. 461; average over four general monitoring stations.

Table 19

$NO_2$ AND OXIDANTS POLLUTION, 1970-1975

| | $NO_2$ a) (p.p.m.) | Oxidants ($O_3$) b) (p.p.m.) | Oxident c) Warnings (days) |
|---|---|---|---|
| 1970 | 0.032 | 0.029 | 7 |
| 1971 | 0.033 | 0.032 | 33 |
| 1972 | 0.026 | 0.029 | 33 |
| 1973 | 0.038 | 0.036 | 45 |
| 1974 | 0.040 | 0.037 | 26 |
| 1975 | 0.041 | 0.042 | 41 |

Sources and Notes:

a) Environment Agency, Present State of Air Pollution in Japan, 1976; average over six monitoring stations in operation since 1970.

b) Tokyo Metropolitan Government Report on Air Pollution Monitoring in 1975, 1976; average over three Tokyo area monitoring stations.

c) Warnings are issued when hourly oxidant concentration exceeds 0.15 p.p.m.

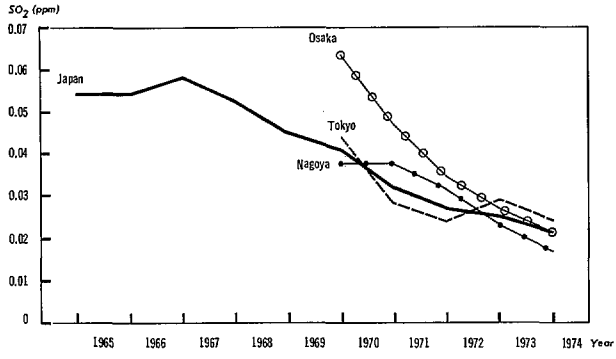
The ambient concentrations of oxidants depend to a large extent upon the concentration of precursors such as nitrogen oxides and hydrocarbons and the climatic conditions such as wind, sunlight, etc. As for nitrogen oxides, data concerning oxidants has been gathered more extensively in the past few years only. It is thus difficult to assess the objective trends. They show an increase in yearly average concentrations for a set of monitoring stations, as shown in Table 19. Increases in maximum hourly concentration averages in cities like Tokyo and Osaka are also reported. The perception of the problem in Japan is perhaps as important as the objective phenomenon, since about 43,000 complaints were reported in 1975 due to the health and annoyance effects of photochemical smog, particularly on school children.

Trends in water quality are less clear. Pollution by organic matters, as measured by biological oxygen demand in rivers over recent years, does not seem to have significantly changed, as shown in Table 20. Available data for a number of rivers, given in Figure 2, does not suggest a very clear pattern of change either; pollution levels varied from year to year; for some rivers, things improved, for others they did not. By and large, pollution by organic matter did not improve much.

As regards water pollution by harmful substances such as cadmium or mercury, a very clear improvement took place, which is shown in Table 21. The percentage of samples exceeding quality standards decreased dramatically from 1.4 per cent in 1970 to 0.20 per cent in 1974.

Figure 2

$SO_2$ POLLUTION, JAPAN, 1965-1974, AND SELECTED JAPANESE CITIES, 1970-1974




*Sources and Notes :* For Japan : Table 17. For Japanese Cities, Environment Agency, *Present State of Air Pollution in Japan*, 1975 (in Japanese) ; averages over 5 stations for each city.

Table 20

WATER POLLUTION, 1971-1974

| | BOD in Rivers a) | COD in Sea Water a) |
|---|---|---|
| 1971 | 77 | 82 |
| 1972 | 76 | 84 |
| 1973 | 76 | 84 |
| 1974 | 78 | 84 |

Source: Environment Agency.
Note: a) Percentages of samples meeting quality standards.

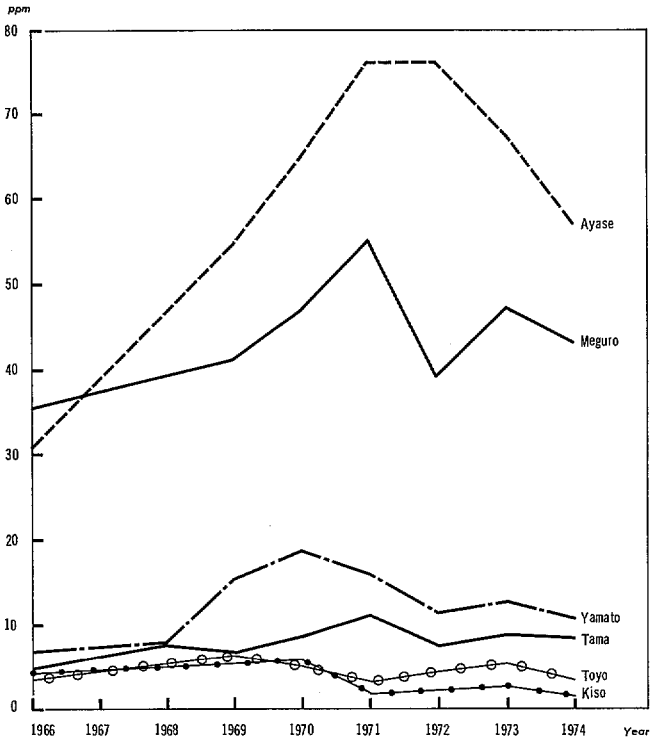
Is it possible to tell how Japan compares now with other countries in terms of environmental quality? Table 22 provides some fragile data on air quality in some major cities. It suggests that air quality in Japan is by now comparable to air quality in other countries.

It is also interesting, although equally difficult to try and compare water quality in Japan and in other countries. Data on dissolved oxygen levels in the mid-seventies was compiled for the rivers utilised in a similar comparison for the late sixties;(1) it appears in Table 23. Not much can be concluded from this table, because the Tama River in Tokyo, where organic pollution decreased significantly, is likely not to be representative of Japanese rivers. More sophisticated sets of indicators are necessary for international comparisons.

1) See Table 5 supra.

Figure 3

BOD LEVEL IN MAJOR RIVERS, 1966-1974




Source : Ministry of Construction ; Local Governments.

Table 21

POLLUTION BY HARMFUL SUBSTANCES, a) 1970-1974

| | 1970 | 1974 |
|---|---|---|
| Cadmium | 2.80 | 0.37 |
| Cyanides | 1.50 | 0.06 |
| Organic phosphorous | 0.20 | 0.00 |
| Lead | 2.70 | 0.37 |
| Chromium (hexavalent) | 0.80 | 0.03 |
| Arsenics | 1.00 | 0.27 |
| Total mercury | 1.00 | 0.01 b) |
| Alkyl mercury | 0.00 | 0.00 |
| Total | 1.40 | 0.20 |

Source: Japanese Report, pp. 166-167.

Notes: a) Percentages of samples exceeding quality standards; data is based on more than 16,000 samples for 1970 and more than 160,000 samples for 1974.

b) 1973.

Table 22

AIR QUALITY IN SELECTED CITIES, EARLY OR MID-SEVENTIES
(p.p.m.)

| | $SO_2$ [a] | CO [a] | $NO_2$ [a] | $O_3$ [b] |
|---|---|---|---|---|
| Tokyo | 0.027 [c] | 1.7 [d],[e] | 0.040 [c] | 0.38 [n],[f] |
| Osaka | 0.027 [c] | 1.9 [d],[e] | 0.047 [c] | 0.29 [n],[f] |
| Paris [h] | 0.037 | 13.0 [g] | n.a. | n.a. |
| London | 0.051 [i] | n.a. | 0.032 [j],[k] | 0.17 [j],[k] |
| New York | 0.027 [l],[g] | 5.4 [l],[g] | 0.049 [l],[g] | n.a. |
| Chicago | 0.013 [l],[g] | 4.3 [l],[g] | 0.033 [l],[g] | 0.14 [m],[e] |
| Los Angeles | 0.013 [l],[g] | 3.4 [l],[g] | 0.070 [l],[g] | n.a. |

Sources and Notes:

a) Yearly average concentrations, in p.p.m.

b) Yearly maximum concentration average.

c) Environment Agency, Present State of Air Pollution in Japan, 1975; averages over 5 stations; for 1974.

d) Environment Agency, Quality of the Environment in Japan, 1975.

e) 1973; oxidants ($O_3$) as measured by Kl method.

f) 1972.

g) 1974.

h) Ministère de la Qualité de la Vie; the technique of measurement of CO changed between 1968 and 1972 and this figure should not be compared with the figure in Table 6.

i) Greater London Council, 1975 Annual Abstract of Statistics, 1974; average over 7 stations; the figure is for winter months only and should be lowered to be compared with figures for other cities.

j) OECD. Second Report on the Problem of Photochemical Oxidants and their Precursors in the Atmosphere, 1977.

k) Average over 1972-1973-1974.

l) E.P.A., Monitoring and Air Quality Trends Report 1974, 1976.

m) E.P.A., Photochemical Oxidants in the Ambient Air of the United States, 1976.

n) OECD, Report on the Problems of Photochemical Oxidants and their Precursors, 1974.

Table 23

WATER QUALITY IN SELECTED RIVERS, MID-SEVENTIES
(Yearly averages in p.p.m.)

| | Dissolved Oxygen |
|---|---|
| Tama River, Tokyo (1974) | 5.4 |
| Seine River, Paris (1974) | 9.4 |
| Rhine River, Lobith (1972) | 4.7 |
| Delaware, Philadelphia | n.a. |
| Thames River, London (1973) | 2.6 |
| Rhine River, Braubach (Koblenz) (1973) | 4.7 |

Sources and Notes: as in Table 5.

## 2. EFFICIENCY OF ENVIRONMENTAL POLICIES

The evolution of environmental quality does not reflect correctly the efficiency of environmental policies. The efficiency of a policy should be assessed by comparing what would have happened without the policy with what actually happened. Had no environmental policies been developed in Japan, discharges associated with production and consumption activities would have increased at the rate at which production and consumption increased. So would have ground concentration levels.

This point can best be illustrated in the case of $SO_2$. As shown in Table 24, fossil fuel consumption, which is the major source of $SO_2$ pollution, increased by about 100 per cent between 1968 and 1974. But $SO_2$ pollution, that is $SO_2$ ground concentration levels, was halved instead of doubling. Pollution per unit of polluting activity was therefore decreased by as much as 80 per cent.

The case of CO, as shown in Table 25, is a little more complex. The change in CO concentration in the Tokyo area has been achieved in spite of an increase in the number of vehicles in this area. The decrease in on-street traffic in Tokyo might also have contributed to these results, although lower traffic counts due to increased congestion may reflect lower speeds and thus more CO pollution. These successful results are partly due to the early implementation of CO emission standards on new cars (1966) and their subsequent strengthening. Three years have thus been necessary to have a sufficient number of cleaner vehicles with respect to the total

Table 24

FOSSIL FUEL CONSUMPTION AND $SO_2$ GROUND CONCENTRATION, 1968-1974

| | Fossil Fuel Consumption a) (Million TOE) (1) | $SO_2$ Concentration b) (p.p.m.) (2) | $\frac{(2)}{(1)} \times 10^6$ (3) |
|---|---|---|---|
| 1968 | 211 | 0.055 | 260 |
| 1974 | 439 | 0.024 | 55 |
| Change | + 103% | - 56% | - 79% |

Sources and Notes:

a) Japanese Report, p. 137.

b) Table 17 above.

Table 25

AUTOMOBILES, TRAFFIC, AND CO CONCENTRATIONS, TOKYO
1968-1973

| | Number of Registered Vehicles [a)] | Traffic Counts at 26 Major Intersections [a)] | CO Concentration Levels [b)] |
|---|---|---|---|
| 1968 | 2,025,000 | 2,337 | 4.4 |
| 1973 | 2,600,000 | 2,076 | 3.7 |
| Change | + 20% | - 11% | - 15% |

Sources and Notes:

a) Prime Minister's Office, Research Report on Traffic in Large Cities, Tokyo, 1975 (in Japanese).

b) Environment Agency, Quality of the Environment in Japan, 1975, Tokyo; average over two automotive exhaust monitoring stations.

stock of motor vehicles to affect the ambient concentrations of CO. The development of traffic control now reinforces the emission standard approach, particularly in heavily congested and polluted areas.

There are relatively few cases in which the relationship between a particular pollutant and a particular polluting activity is straightforward. But broad economic magnitudes can be taken as indicators of polluting activities. Their increase is a measure

Table 26

SELECTED ECONOMIC INDICATORS, JAPAN AND SELECTED OECD COUNTRIES, 1970-1975
(increase in %)

| | GNP[a)] | Industrial Output[a)] | Energy Consumption[a),c)] | Stock of Automobiles[b),c)] |
|---|---|---|---|---|
| Japan | 30 | 10 | 34 | 74 |
| U.S.A. | 10 | 7 | 14 | 22 |
| U.K. | 10 | 1 | 3 | 35 |
| France | 19 | 12 | 29 | 31 |
| Italy | 11 | 9 | 36 | 55 |
| Sweden | 12 | 15 | 9 | 21 |
| Netherlands | 15 | 15 | 42 | 43 |
| OECD | 14 | | 19 | 32 |

Sources and Notes:

a) OECD.

b) International Road Federation.

c) 1969-1974.

of an increase in environmental pressures. This increase has slowed down in the seventies: the industrial production index even decreased in 1974 and 1975. Over the period 1970-1975, however, most economic indicators increased in Japan, and generally increased more than in most other countries. This is shown in Table 26. Trends in environmental quality, which range from dramatic improvements to slight deterioration, but are on the whole rather favourable, and, inasmuch as one can judge, as favourable or more favourable than in other countries, must be appreciated against this background. Pollution abatement policies in Japan therefore appear to have been fairly efficient.

Chapter VII

# ECONOMICS

Having tried to analyse the nature and content of pollution abatement policies in Japan, and having tentatively assessed its achievements, one comes to questions about the costs of these policies. Three main questions can be raised:

i) what are the costs of pollution control in Japan?;
ii) who bears these costs?;
iii) what are their economic consequences?

## 1. ESTIMATES OF POLLUTION CONTROL COSTS

Surprising as it might be, the cost of pollution control is poorly known. It is difficult to estimate because the concepts of "pollution control" and of "costs" are ambiguous.

When pollution abatement is achieved by an additional equipment or treatment, it is relatively easy to single out related expenditures as pollution control costs, but things are more difficult when pollution abatement is achieved by means of a different process. This less polluting process may also happen to be more productive, or more capital-intensive, or may require larger production units. It then becomes very difficult to disentangle cost increases due to pollution abatement from cost increases due to other considerations.

The notion of "cost" can be made more precise, by distinguishing between three cost concepts:

- investment costs, i.e. the value of pollution abatement investments made during one given year; added over time, investment costs make up a stock of pollution abatement capital;
- operating costs, i.e. the expenditures in manpower, energy, etc. made necessary by pollution abatement, also during one given year;
- economic costs, also called annualised costs, which include: operating costs, plus depreciation of pollution abatement capital, plus opportunity costs of pollution abatement capital.

Some data on pollution abatement investment costs is available in Japan, and can be utilised to analyse these costs in terms of

i) importance;
ii) trends, and
iii) structure.

The fragility of the data base, however, places severe limits on the validity of such an analysis.(1)

First, anti-pollution investment costs appear to be high in Japan. They are not well known, but can be estimated, as shown in Table 27.

Table 27

ANTI-POLLUTION INVESTMENT AND GNP, 1975

| | Million Yen | % of GNP |
|---|---|---|
| Central Government a) | 285,000 | 0.2 |
| Local Government b) | 1,200,000 | 0.8 |
| Private Enterprises c) | 1,403,000 | 1.0 |
| Total | 2,888,000 | 2.0 |

Sources and Notes:

a) Environment Agency.

b) Ministry of Home Affairs; the figure given is estimated on the basis of 1970-73 data.

c) Appendix I.

Anti-pollution investments are a significant component of GNP. They are of course an even more significant part of investment. For the country as a whole the ratio of anti-pollution investments to total investments appears to be about 7 per cent in 1975. It was higher for government investments than for private investments.

Some information on the relative importance of anti-pollution investment in various OECD countries is available and given in Table 28. The figures for Japan are much higher than for most other countries. Such data must be handled with great care but it seems safe to conclude that anti-pollution investments have been much more important in Japan than elsewhere.

1) See Annex I for two estimates of anti-pollution investments in the private sector; only the lower estimates are utilised here; figures and ratios given should therefore be seen as minima.

Table 28

RELATIVE IMPORTANCE OF ANTI-POLLUTION INVESTMENTS BY PRIVATE ENTERPRISES, JAPAN AND SELECTED OECD COUNTRIES, 1974

| | Anti-pollution Investments by Private Enterprises / Total Investment by Private Enterprises (%) | Anti-pollution Investments by Private Enterprises / GNP (%) |
|---|---|---|
| Japan a) | 4.0 | 1.0 |
| U.S.A. b) | 3.4 | 0.4 |
| Netherlands c) | 2.7 | 0.3 |
| Sweden c) | 1.2 | 0.1 |
| Germany c) | 2.3 | 0.3 |
| Norway c) | 0.5 | 0.1 |

Sources and Notes:

a) Appendix I; as stated above, the figures given here are the lower of the two estimates arrived at.

b) United States Department of Commerce, National Expenditure for Pollution Abatement and Control, 1972, Survey of Current Business, 55(2), February 1975, adjusted by the OECD Secretariat.

c) Calculated from replies to OECD questionnaire on Procedures for Notification for Financial Assistance in Relation to Pollution Control Expenditures.

Secondly, anti-pollution investment expenditures have increased very rapidly over recent years. The trend, which is shown in Table 29, can be probably ascertained with less uncertainty than the magnitude. The share of anti-pollution investment in GNP appears to have roughly doubled since 1970, and this increase seems to be caused by the rise of anti-pollution investment by enterprises much more than by governments.

Thirdly, anti-pollution investment costs are very unevenly distributed between industries. Anti-pollution investment recorded by MITI in its sample survey were distributed as shown in Table 30.

Five industries (iron and steel, oil, thermal power plants, pulp and paper, and chemicals) would undertake about 70 per cent of all anti-pollution investment. In these untypical but important industries, the ratio of anti-pollution investment to total investment would be above 20 per cent reaching nearly 50 per cent in the case of thermal power plants. Three comments can be made about such high figures. First, this ratio would be substantially lower in other industries. Secondly, 1974 was a recession year, during which productive investments were particularly low. Thirdly, most anti-pollution investments consisted of adding equipment to the stock

of existing capital. Such high ratios are therefore not significant of longer-term averages.

Table 29

ANTI-POLLUTION INVESTMENT COSTS AS A PERCENTAGE OF GNP, 1970-1975

| | Anti-pollution Investment by Enterprises [a] | Anti-pollution Investment by Government [b] | Total Anti-pollution Investment |
|---|---|---|---|
| 1970 | 0.4 | 0.6 | 1.0 |
| 1971 | 0.5 | 0.8 | 1.3 |
| 1972 | 0.5 | 1.0 | 1.5 |
| 1973 | 0.6 | 1.0 | 1.6 |
| 1974 | 0.7 | 1.0 | 1.7 |
| 1975 | 1.0 | 1.0 | 2.0 |

Sources and Notes:

a) Appendix I.

b) Ministry of Home Affairs; figures for 1974 and 1975 for local government were not available, and have been estimated on the basis of 1970-1973 data.

Table 30

ANTI-POLLUTION INVESTMENT BY INDUSTRY, 1974

(Per cent)

| | Share of Total Anti-pollution Investment | Share of Total Investment by Industry |
|---|---|---|
| Iron and Steel | 17 | 17 |
| Oil | 13 | 27 |
| Thermal Power Plants | 18 | 47 |
| Pulp and Paper | 5 | 24 |
| Chemicals | 18 | 25 |
| Other | 29 | 7 |
| Total | 100 | 14 |

Source: Survey by MITI.

This overall information on anti-pollution investments should be complemented by more detailed studies on specific sectors. One such study is available, on the cost of the retrofitting equipment necessary to meet the fluoride emission standards set in several

countries;(1) the study distinguished between the various processes utilised, as shown in Table 31. This study would suggest that anti-pollution investments in Japan are not significantly higher than in other countries. It would then contradict the overall conclusion drawn from aggregated data. Part of the explanation might be that the Japanese data on anti-pollution investment is not readily comparable to anti-pollution investment data collected in other countries.

Table 31

ANTI-POLLUTION INVESTMENTS a) IN ALUMINIUM INDUSTRY, VARIOUS PROCESSES, JAPAN AND SELECTED COUNTRIES, 1975

($/Ton)

| | Horizontal Stub-Söderberg | Vertical Stub-Söderberg | Centre-Worked Prebake | Side-Worked Prebake |
|---|---|---|---|---|
| Japan | 226 | 145 | 46 | 66 |
| U.S.A. | 233 | 132 | 72 | 126 |
| Canada | 142 | 89 | n.a. | 63 |
| Germany | 172 | 103 | 72 | 70 |
| Norway | n.a. | 126 | n.a. | 58 |

Source: OECD.

Note: a) Add on equipment necessary to meet emission standards for fluoride emission only.

It may also suggest that pollution abatement costs per unit of pollution abated are not higher in Japan, but that pollution abatement expenditures are greater because the amount of pollution abated is greater.

Data on anti-pollution investments is not very reliable; but it is the only available data. There is no published information on anti-pollution operating costs, nor on the stock of accumulated anti-pollution investment, and therefore no data on economic costs. This is unfortunate, because the concept of economic cost is in many respects the most significant cost concept; it can readily be compared with total production costs and constitutes an indication of the economic resources devoted to pollution abatement. This is why, in spite of the scarcity of data, we tried, by making

1) See Chapter III above for comparative data on fluoride emission standards in the aluminium industry; one should also note that, in some other countries, like the United States, anti-pollution investments in non-ferrous metal are particularly high; see: Council on Environmental Quality, Environmental Quality (Sixth Annual Report), 1975, p. 524.

various assumptions, to produce an estimate.(1) The economic cost of pollution abatement in 1975 according to these fragile estimates, would amount to about 1.7 per cent of GNP.

This figure is to be compared with the forecasts presented in Table 32, and which were estimates produced in 1973 of the economic costs of the pollution abatement programmes envisaged in some OECD countries.

Table 32

ESTIMATES OF ANNUALISED COSTS OF POLLUTION ABATEMENT PROGRAMMES ENVISAGED, SELECTED COUNTRIES, AS A PERCENTAGE OF GNP, 1975 AND 1980

| | 1975 | 1980 |
|---|---|---|
| Japan | 1.4 - 3.3 | n.a. |
| U.S.A. | 0.8 | 1.4 |
| Germany | 0.5 | n.a. |
| Sweden | 0.2 - 0.6 | n.a. |
| Netherlands | 0.4 | 1.2 |
| U.K. | n.a. | 0.1 - 0.4 |
| Italy | 0.3 | 1.0 |

Source: OECD, Economic Implications of Pollution Control, A General Assessment, Paris, February 1974, p. 31.

## 2. FINANCING OF POLLUTION CONTROL COSTS

The next question is: who bears the costs of pollution control in Japan? The largest part of the burden of pollution control is borne by private enterprises, in conformity with the polluter pays principle; but central and local governments contribute in the form of public investments on the one hand, and of assistance to private enterprises, on the other hand.

In Japan, as in many other countries, part of the pollution abatement effort is undertaken by central and local governments. The setting and the implementation of regulations, the operation of monitoring facilities, the promotion of environmental research and surveys, the payment of compensations, and of course, the construction of sewage works, of water treatment plants, and of waste

1) See Appendix II for assumptions and calculations; since Appendix II utilised the lower of the two series of estimates arrived at in Appendix I, the figure it produces may be regarded as a minimum; this discussion refers to total costs, not to unit costs.

disposal facilities, are all done at a cost borne by central or local government. Although they seem to be important (see Table 27) very little is known about expenditures by local governments. More data are available on expenditures made by the Central Government.(1) According to data, expenditures undertaken by the Ministry of Construction (for sewage works, water treatment plants, waste disposal facilities, etc.) are by far the most important item of central government pollution control expenditures.

Assistance to private enterprises seems to be limited to investments. It takes the form of tax benefits and of favourable interest loans.

There are a number of tax incentives for pollution abatement effort.(2) The most important is probably a 50 per cent special depreciation in the first year for pollution abatement equipment. Other depreciations (like a "shortened depreciation" for treatment of sewage and smoke and soot equipment) or deductions (like a "special reserve fund" for enterprises with specially large pollution control costs or large reduction in profits) are also allowed. The effect of such deductions is to reduce taxable income of enterprises; the corporate profit tax being about 50 per cent in Japan, this means that an enterprise purchasing anti-pollution equipment for 100 yen will get back 25 yen in the first year; this amounts to a zero interest loan of 25 yen. We attempted to calculate the subsidy equivalent of those tax cuts for 1975, and arrived at an estimate of about 2,600 million yen. If the figure given above for anti-pollution investment by private enterprise is correct, this would amount to about 0.2 per cent of anti-pollution investments.

Two other tax incentives are worth mentioning. One is a reduction in the commodity tax for low pollution automobiles. The other is a sort of subsidy to desulphurisation that takes the form of a reduction in customs duty on imported crude oil that is desulphurised.

Favourable interest loans is the second form of assistance to enterprises. There are at least four lending programmes for anti-pollution control in Japan. Table 28 presents their main characteristics, together with the amount of loans granted in 1975.(3)

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1) See: Environment Agency, Quality of the Environment in Japan, 1975, Tokyo 1976, for budgetary approximations for environmental preservation by Ministry and Agency (p. 143), and by category of expenditure (p. 144).

2) OECD, Environment Directorate, Procedure for Notification of Financial Assistance Systems.

3) New plants, even when asked to meet stricter standards than old plants, are not granted more favourable terms.

These loans play an important role in Japan. First, the ratio of owned capital to total capital is much lower in Japan than in other countries, and Japanese enterprises are more than elsewhere dependent upon banks for investments; since commercial banks are not particularly keen to grant loans for pollution control investments, the intervention of specialised institutions is very useful and in many cases necessary; without these programmes, a number of enterprises would have found it difficult to finance anti-pollution investment. Secondly, the interest rates at which these loans are granted are lower than the market rate which was about 9.1 per cent in 1975. We have attempted to calculate the "subsidy equivalent"(1) of these reduced rates, which is shown in Table 33. This subsidy equivalent appears to be a little more than 10 per cent of the amount of loans granted. The subsidy equivalent of loans granted could then be estimated, for 1975, to amount to 1.3 per cent of anti-pollution investment.

Table 33

FAVOURABLE INTEREST LOANS PROGRAMMES FOR ANTI-POLLUTION INVESTMENT IN JAPAN, 1975

| Lending Institution | Rate (%) | Terms (Years) | Limits (per firm) ($10^6$ yen) | Limits (per firm) (% of Invest.) | Amounts ($10^6$ yen) | Subsidy[a] equivalent ($10^6$ yen) |
|---|---|---|---|---|---|---|
| Small Business Finance Corp. | 7.0 | 10 | 150 | - | 18,000 | 2,500 |
| People's Finance Corporation | 7.0 | 10 | 18 | - | 1,700 | 200 |
| Japanese Development Bank | 8.0 | 10 | - | 50 | 172,300 | 15,000 |
| Environmental Pollution Control Service Corp. | 6.85 | 10 | - | 80[b] | 126,500 | 19,000 |
| Total | | | | | 318,500 | 36,700 |

Sources: Replies to an OECD questionnaire on Procedures for Notification of Financial Assistance Systems.

Notes: a) Sum of discounted values of the differences in interests to be paid; because of the complexities of the Japanese loan market, there could be a substantial margin of error in these calculations arising out of possible differences between real interest rates on loans and the subsidised rates.

b) Only 50 per cent in some cases.

1) The subsidy equivalent is the sum of the discounted values of the differences in interests to be paid.

The subsidy equivalent of the various forms of assistance to private enterprises for anti-pollution investment would then appear to be about 2.6 per cent of these investments. Similar ratios have also been estimated for other countries, as shown in Table 34.

Anti-pollution investment costs are only a fraction of pollution abatement costs, which are themselves a fraction of production costs; the impact of assistance schemes on production costs appears to be small. It seems safe to conclude that by and large the costs of pollution abatement are borne in accordance with the P.P.P. in Japan. Assistance granted is a useful incentive, but does not create significant trade distortions. Table 34 gives estimates of subsidy equivalent of assistance schemes in Japan and in other countries. Such figures should be interpreted with great care, particularly because they may vary greatly from year to year. But one can note that they tend to suggest that assistance schemes in Japan are comparable to assistance schemes in other countries.

Table 34

SUBSIDY-EQUIVALENT OF ASSISTANCE SCHEMES AS A PERCENTAGE OF PRIVATE ANTI-POLLUTION INVESTMENTS, JAPAN AND SELECTED COUNTRIES, 1975

(Per cent)

| | |
|---|---|
| Japan | 2.6 |
| Germany | 9.1 |
| Netherlands (1974) | 1.1 |
| Norway | 14.2 |
| Sweden | 5.3 |
| U.S.A. | 4.5 |

Sources and Notes:

Computations based on replies to the OECD questionnaire on Procedures for Notification of Financial Assistance Systems.

## 3. CONSEQUENCES OF POLLUTION CONTROL COSTS

Pollution control costs, particularly economic costs, are a measure of the drain on resources exerted by pollution abatement policies in a country; capital and labour resources that are being utilised to abate pollution are not being utilised to manufacture consumption goods, nor productive equipment. Pollution control expenditures have an opportunity cost. They are a price to be paid for environmental quality.

This view is correct, but in real life, things are somewhat more complex. What is expenditure for an enterprise will be income for another enterprise. Depending upon the state of the economy, upon businessmen's behaviour, upon fiscal policy, and more generally upon the whole economic machinery, pollution abatement expenditures will modify a number of economic flows, that will modify other flows, etc. In dynamic terms, environmental expenditures should not only be seen as losses of resources, but as modifications of economic flows. The net results of these modifications on GNP, on prices, on employment, on trade, etc. are difficult to predict, but the important point is that they are not necessarily negative. In some cases economic consequences may even be quite positive. The main justification for pollution abatement policies is of course that they decrease pollution, and pollution costs thereby increasing welfare; but it is important to note that, in practice, the macro-economic consequences of these policies are not as bad as is often said. It is widely recognised that GNP is not a good indicator of welfare, and environmental policies should be carried out even if they were to reduce GNP. It is nevertheless interesting to know whether they do reduce GNP or not.

The study of the past behaviour of the Japanese economy cannot be utilised to assess macro-economic consequences of environmental policies. It would be too easy to say that since 1970, the Japanese economy has done as well, or better than, most other economies, and to conclude that environmental policies have had no adverse impact. The reasoning would not be correct. Environmental expenditures have only been one of the many factors that influenced the behaviour of the Japanese economic machinery and its results. No cause-effect relationships between pollution control costs and macro-economic magnitudes can be established on the basis of past experience.

The only way to establish such relationships is to utilise macro-economic models to simulate the development of the economy with and without pollution abatement policies. All other factors being thus kept constant, differences in output can be related to differences in inputs. Several such models have been utilised in Japan. All of them embody questionable assumptions and utilise unreliable data; they are therefore open to criticism and their results should be handled with care; but they provide the only tentative answers to the very important question: what are the economic consequences of environmental policies?

One model, developed by Professor S. Shishido and A. Oshizaka,(1) combines a Leontieff-type input-output model and

1) See: Shuntaro Shishido and Akira Oshizaka, Econometric Analysis of the Impacts of Pollution Control in Japan, paper presented at the International Conference for Environmental Protection, organised by Nippon Keizai Shimbun, 26th-28th May, 1976.

a Keynesian-type macro-economic model. It studies, over a period of six years, the effects of two types of environmental policies: a "harder" policy and a "softer" policy, which are defined in terms of pollution abatement. First, anti-pollution investments required to achieve these pollution abatement targets are estimated; the amount calculated to meet the "softer" target,(1) 1.5 per cent of GNP, is quite comparable to the amount which was actually invested in anti-pollution equipment. Then, the impact of those additional investments on GNP, prices, etc., is estimated by the model.

The most striking result of this simulation is that GNP and employment are practically unaffected by environmental policy. More precisely, GNP is "reduced" by the deflationary price effects associated with non-production investment, and at the same time "increased" by the expansionary income effect resulting from these anti-pollution investments. In the first years, the positive effect is even greater than the negative one; later on they balance each other: for the 6th year, GNP is raised by 0.1 per cent (over what it would be in the absence of anti-pollution policy) by the "softer" policy.

A second interesting result of the simulation relates to the changes in the structure of output and employment that are brought about by environmental policies. The share of output and employment increases in primary and fabricated metals and in general electric machineries, whereas it declines in the food industry, textile and electricity. This is a rather surprising result: anti-pollution policies benefit polluting industries! This is because polluting industries such as the steel industry are the main beneficiaries of anti-pollution investments, although they incur high pollution abatement costs themselves; for them the income effect is greater than the price effect.

The model also yields information about prices. Anti-pollution policies do raise the price level; but this increase is modest. It is estimated to be, over six years, 1.9 per cent in the case of the "softer" policy, hardly more than 0.3 per cent per year. Of course, much higher increases appear in certain sectors, such as automobiles (5.9 per cent), electricity (6.2 per cent), primary iron (7.6 per cent), or pulp and paper (7.7 per cent).

A second model has been utilised by Professor Y. Murakami and J. Tsukui.(2) Unlike the Shishido and Oshizaka model, which is demand-oriented, this model is supply-oriented. It describes the

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1) Public works for sewages are excluded.

2) See: Yasuke Murakami and Jinkichi Tsukui, Economic Costs Prevention of Pollution. A Dynamic Analysis of Industrial Structure, paper presented at the International Conference for Environmental Protection, organised by Nippon Keizai Shimbun, Tokyo, 26th-28th May, 1976.

economic "path" necessary to maximise consumption over time under a certain number of constraints. These constraints relate to capital, labour, production functions, foreign trade, etc. Pollution abatement is introduced as an additional constraint. Here again two types of pollution abatement policies are introduced: a "harder" policy which eliminates completely (100 per cent) five major pollutants ($SO_2$, $NO_x$, BOD, industrial waste, household waste) and a "softer" policy, which eliminates partially (75 per cent) the same pollutants. The difference between the paths described by the model with and without pollution abatement policies indicates the consequences of these policies.

The model could be criticised for being a maximising model. How can we be sure that economic behaviour and policies are such that the paths actually followed approximately the best possible paths? The authors of the model reply that, in the past, actual and ideal paths have in fact largely coincided. Doubts also could be raised about pollution generation functions, and pollution abatement functions, which are indeed quite crude. In spite of its limits, the model is very interesting. Its main results are given in Table 35, for the "soft" type of environmental policy.

They again suggest that the overall impact of environmental policies is not great. Output and consumption - which are what matters - are not very significantly affected by pollution abatement. Over a period of ten years, consumption is only reduced by -0.2 per cent, i.e. is practically unchanged. The impact of the "harder" environmental policy (complete elimination of pollution) is hardly more worrying: output is reduced by 3.2 per cent (instead of 0.5 per cent) after ten years, and by 6.5 per cent (instead of 3.0 per cent) after 15 years.

A third model, on which little information is available, has apparently been utilised by the Economic Planning Agency to assess the macro-economic impact of stricter pollution abatement policies. The policy studied is defined by "an increase in the pollution prevention ratio from 10 per cent to 20 per cent". The consequences are estimated as shown in Table 36. They are not very different from the consequences simulated by the other models. The model again suggests that the macro-economic impact of stricter environmental policies would not be very great.

None of these three models is entirely satisfactory; the Shishido-Oshizaka model is purely Keynesian, ignores constraints on resources; the Murakami-Tsurkui model incorporates many doubtful hypotheses; the Economic Planning Agency model seems rather crude; all suffer from the lack of reliable data on the structure and magnitude of pollution abatement costs. Their results must therefore be interpreted with great care. It should nevertheless

Table 35

CHANGES [a] IN MACRO-ECONOMIC VARIABLES GENERATED OVER TIME BY A SOFT ENVIRONMENTAL POLICY[b], AS ESTIMATED BY MURAKAMI AND TSUKUI

(Per cent)

| | After 5 Years | After 10 Years | After 15 Years |
|---|---|---|---|
| Output | -2.8 | -0.5 | -3.0 |
| Consumption | -1.4 | -0.2 | -3.1 |
| Gross Investment | +26.9 | +1.8 | -12.9 |
| Productive Investment | +23.1 | -3.2 | -16.1 |
| Housing Construction | +11.1 | -2.5 | -16.1 |
| Resources Import | -16.8 | -2.0 | +3.7 |
| Exports | +1.8 | +8.2 | +10.7 |

Source: Adapted from Murakami and Tsukui, op.cit., Table 5-1, p.19.

Notes: a) Magnitude with environmental policy, minus magnitudes without environmental policy, divided by magnitude without environmental policy.

b) 75 per cent elimination of pollution generated without environmental policy in terms of $SO_2$, $NO_x$, BOD, Industrial Waste and Household Wastes.

Table 36

CHANGES IN MACRO-ECONOMIC VARIABLES GENERATED OVER TIME BY STRICTER ENVIRONMENTAL POLICY, [a] AS ESTIMATED BY ECONOMIC PLANNING AGENCY

(Per cent)

| | After 5 Years | After 10 Years |
|---|---|---|
| GNP | -0.3 | -2.8 |
| Productive Investment | -0.4 | -7.7 |
| Prices (GNP Deflation) | +3.1 | +2.9 |

Source: Economic Planning Agency.

Note: a) For GNP and investment, magnitude generated by a 20 per cent ratio (of pollution abatement investments to total investment), minus magnitude generated by a 10 per cent ratio, divided by magnitude generated by a 10 per cent ratio.

be pointed out that they strike an optimistic note. They suggest that the adverse economic consequences of pollution abatement expenditures are not very significant. A more complete picture would of course take into account the positive economic consequences of pollution abatement, which are the main rationale for environmental policies.

In the chain that links high pollution abatement expenditures and low macro-economic consequences, a key element is the development of a new sector, the anti-pollution equipment sector. Some information on this sector is appropriate.

In 1974, there were about 280 enterprises engaged in this line of production. Most of them, particularly large enterprises, were also producing many other kinds of equipment. The labour force employed in anti-pollution equipment production was estimated at about 30,000 people. Sales were estimated at about 500,000 million yen by one source(1) and 680,000 million yen by another.(2) The structure of the market is shown in Table 37.

Table 37

ANTI-POLLUTION EQUIPMENT MARKET, 1974

(Per cent)

| Type of Equipment | | Type of Client | |
|---|---|---|---|
| Air | 45 | Private | 67 |
| Water | 38 | Public | 32 |
| Waste | 16 | Export | 1 |
| Noise | 1 | | |
| | Σ 100 | | Σ 100 |

Table 38

GROWTH OF ANTI-POLLUTION EQUIPMENT SALES, 1969-74

| | Million yen | Index |
|---|---|---|
| 1969 | 143,000 | 100 |
| 1970 | 195,000 | 136 |
| 1971 | 302,000 | 211 |
| 1972 | 375,000 | 262 |
| 1973 | 488,000 | 341 |
| 1974 | 677,000 | 473 |

Source: Japan Industrial Machinery Association.

1) A survey by MITI.

2) A survey by Japan Industrial Machinery Association.

The market, and the industry have of course grown very rapidly over recent years, as shown in Table 38. The anti-pollution equipment industry is a growing and dynamic industry in Japan. It is a profitable industry. It is not yet much of an export industry, but it is easy to predict that it will become one, because markets for anti-pollution equipment will be created by environmental policies in foreign countries and because Japanese manufacturers will have developed a very real experience in this area at home.

Chapter VIII

# CONCLUSIONS

The experience of Japan in the field of environmental policy is particularly interesting. The concern for environmental protection that developed in Japan in the early stages of industrialisation disappeared in the thirties. In the post World War II period, there was nothing to protect the environment from the pressures resulting from rapid industrialisation. GDP per square kilometre, a rough indicator of such pressure, was greater in Japan than in any other OECD country.(1) In addition, it increased more rapidly in Japan than anywhere else. The type of growth that prevailed in Japan - heavy reliance on industry, large-scale developments, relative neglect of social infrastructure - was also environmentally disruptive. By the late sixties, Japan had become one of the most polluted countries in the world. A rather abrupt change in societal attitudes then took place. Environmental disruption, which had been, at least apparently, relatively well-tolerated became unacceptable leading to the quick development and implementation of strong and multifaceted policies. An attempt has been made to analyse these policies. If we had to summarise this experience in one sentence we would say that Japan has won many pollution abatement battles, but has not yet won the war for environmental quality.

## 1. POLLUTION ABATEMENT

Many conclusions can be drawn from the Japanese experience in pollution abatement policies. The most important ones relate to:

i) the results;
ii) the nature; and
iii) the costs of these policies.

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1) In 1974 GDP per square kilometre of inhabitable land was about 20 times greater in Japan than in the United States, 6 times greater than in the United Kingdom, and twice as great as in the Netherlands.

The first conclusion to be drawn concerning pollution abatement policies in Japan is that by and large they have been successful. Japan has undoubtedly reversed rising pollution trends for a number of pollutants, particularly in the fields of air pollution and of toxic chemicals. Ambient concentrations of $SO_2$, particles, CO (to a lesser extent), PCBs, cadmium, mercury, etc., have been greatly reduced. By now the air breathed in the main Japanese cities is quite as "clean" as the air of American, French, British or German cities, and it is definitely cleaner than the air of major agglomerations of many less-developed countries. The most important, or at least the best known, sources of pollution-related diseases appear to have been largely eliminated in Japan.

It is true that the 1974-75 recession, which hit Japan, as other OECD Member countries, made things easier. But it certainly cannot be taken as the major explanation for environmental improvements. First, marked improvements took place before the recession, at a time when economic and industrial activity were increasing at very rapid rates. Secondly, the recession did not affect all sources of pollution: the stock of automobiles in use in Japan, for instance, did increase rapidly in 1974 and 1975. The Japanese experience, therefore, brings support to the idea that there is no automatic relationship between production and pollution. There is no inherent contradiction between economic growth and environmental quality, and it is possible to increase production while decreasing pollution - provided appropriate mechanisms are developed.

However, one should also note that ambient concentrations have not been drastically improved for all pollutants. $NO_x$ pollution, BOD and COD, for instance, have not yet been significantly reduced. It is only in the fields where crash programmes were designed and implemented that great successes were scored.

A second set of conclusions relates to the nature of Japanese pollution abatement policies. They seem to have relied basically upon the setting of ambient standards by the national Government, coupled with the setting of emission standards by local governments. For most pollutants, rather strict ambient standards have been established at the national level, by the administration under very general guidance given by Law. In order to achieve these ambient standards, sets of emission standards are basic requirements, which are often made more stringent by local governments. In many cases, local governments engage in plant-by-plant negotiations and agreements to define emission allowances for each major polluting facility in the area.

Direct and often detailed interference in the economic operation of enterprises has therefore been the main tool of environmental policies in Japan. Businessmen receive "orders" from central or

local government bureaucracies as to the amount of pollution they are allowed to discharge, and the types of processes they can choose. In other words, Japan has relied to a large extent upon planning mechanisms, to reduce pollution. The market is a system where information is transmitted by prices, not by directives, and where action is motivated by profit, not by compliance. It is widely recognised that pollution is a case of "market failure", i.e. that uncorrected market mechanisms breed pollution. This leaves policy-makers with the following choice:

i) keep the market mechanism, and correct it by modifying the prices (which means in practice taxing pollution), or
ii) reject the market mechanism and replace it by planning.

Japan has basically followed the second course. It may have increased costs; there are good theoretical reasons to believe that market mechanisms are as a rule more cost-efficient than planning mechanisms; i.e. that they achieve a given objective at a lower cost. It certainly increased the power of the administration. But it worked.

The Japanese approach also appears to have had strong moral overtones. It did not attempt to nicely balance costs and benefits, along the lines advocated by environmental economists. Pollution abatement was a must, a moral obligation, backed by very strong political pressures. Stringent measures were taken with only limited knowledge of dose-effect relationships, and with even more limited knowledge of economic costs and consequences involved. Such measures were not very strongly opposed by the business community, because it felt that its image, and its place in Japanese society, was at stake.

It is interesting to note that this approach worked rather well. Many apparent decisions proved to be particularly wise decisions. Automobile emission standards are a case in point. The standards for $NO_x$ exhausts set in Japan were so stringent that they were generally considered "unmeetable"; yet, in a matter of years, several automobile manufacturers developed the necessary techniques. The standards had actually been set without a detailed examination of whether they could be met; had such an examination been conducted, the standards would probably have been less strict, and low-pollution cars would never have been developed. Similarly, the bans that were imposed on some toxic chemicals (such as PCBs) or processes (such as mercury-using processes for manufacturing caustic soda) and which were thought at first to create insuperable difficulties for the industries concerned, actually led to technological innovations.

What happened is that science and technology provided answers to most of the problems raised. The possibilities of science and

technology are such that they extend the frontiers of rationality. A rational decision is a decision that takes into consideration costs and benefits; the trouble is that it is not only very difficult to determine benefits (i.e. damages avoided), it is often impossible to estimate costs. Costs of processes that have not yet been invented cannot be estimated. They are said to be very high or even ("it can't be done") infinite, but may well turn out to be reasonable. And it is a decision based upon such overestimated costs that is irrational. The Japanese experience in the field of pollution abatement lends support to the idea that to a large extent it is not technology that should constrain policy choices, but policy choices that should constrain technology.

The third conclusion concerns the economic costs and consequences of pollution abatement policies in Japan. It is obvious that pollution abatement brought visible and invisible benefits. But it was carried out at a cost. Pollution abatement costs which are not very well known in Japan, seem to have been particularly high, higher than in other countries.

In 1975, anti-pollution expenditures (investments, plus operating costs) amounted to about 3 per cent of GNP and the economic cost (depreciation of anti-pollution equipment, plus opportunity cost of capital, plus operating costs) could be estimated to be somewhat below 2 per cent of GNP.(1) In some industries, such as pulp and paper, steel, electricity, and chemicals, pollution abatement significantly increased production costs.

But - and this is the important point - the impact of such additional costs on the Japanese economy does not appear to have been great, or even significant. Indeed the competitiveness of Japanese industry was not seriously impaired. What is a cost to one enterprise is income to another enterprise - and may well bring additional business to the first enterprise. It is not easy to pinpoint all the consequences of pollution abatement policies as they spread out through the economic machinery.

A mere look at "what happened" in the early seventies is not enough, because pollution abatement was only one of the factors that affected the economy during this period; one can note, however, that growth rates did not slow down until the 1974-75 worldwide recession, and that higher (than other countries) pollution abatement costs did not prevent Japan from achieving higher (than most countries) GNP growth rates, lower unemployment rates, and a reasonably favourable balance-of-payments.

The best way to estimate the economic consequences of pollution abatement costs is to utilise macro-economic models that simulate the behaviour of the economy with pollution abatement, all "other things constant". Japan is probably the only country

(1) See Appendix II.

where several such models have been utilised by research groups, if not by policy-makers. The outputs of these models must be handled with great care. However, it is interesting to note that they all suggest that the impact of relatively high pollution abatement costs on macro-economic magnitudes, such as GNP, employment, prices, and foreign trade, is practically negligible. This, in theory, should only take place in an economy operating below full capacity - which has not been the case of Japan, and makes the results all the more interesting.

Pollution abatement policies do introduce changes in the economy: some industries, and the areas where they are located, are hit, and the problems thus created must be taken very seriously, but the Japanese experience suggests that the overall effects should not cause particular worries.

## 2. ENVIRONMENTAL QUALITY

The Japanese experience can also show that ambient concentration levels are but one dimension of environmental quality, and that pollution abatement should be only one aspect of environmental policies. In Japan, in the late sixties, environmental discontent focussed on pollution and environmental policies concentrated on pollution abatement. The result was somewhat surprising: although these policies largely succeeded in abating pollution, they did not succeed in eliminating environmental discontent. The illness, so to speak, survived the elimination of its main cause. This would suggest that the real cause of environmental discontent was not - and is not - increasing pollution, but decreasing environmental quality. Environmental quality, or as it is often called "amenities", refers to quietness, beauty, privacy, social relations and other non-measured elements of the "quality of life". People were not so much suffering from high ambient concentration levels as from the gradual degradation of their living environment. The reasons why they complained about pollution, not amenities, are twofold. Pollution problems are fairly well defined: pollution levels can be measured, pollution sources can be identified; amenities, by contrast, are difficult to define and are a much vaguer concept. Also, pollution has an impact on health, whereas amenities "only" impinge on well-being. Politically, the abatement of pollution was, therefore, a much better battlefield than the provision of amenities. What could be called "apparent" social demand was for pollution abatement; but "real" social demand was for the provision of amenities. It is because environmental policies satisfied only this apparent social demand, and largely ignored the real social demand, that they did not eliminate environmental discontent.

The Japanese people and the Japanese authorities are now trying to develop broader-based environmental policies, dealing not only with pollution control but also with the preservation of their natural and cultural heritage and with the promotion of well-being in general.

This is indeed a new and difficult task. It will require new types of instruments and mechanisms. It is more difficult than pollution abatement, because the problems at hand are mainly of a social, not just technical nature. The setting of standards will certainly not be sufficient and technological innovations will not be of much help. What is required is careful global planning, which could be described as the use of mechanisms to prevent environmentally dangerous developments and to promote environmentally desirable developments. Mechanisms of the first type are more or less available, under the names of technology assessment and impact statement procedures, but are difficult to implement. Mechanisms of the second type are not quite ready as yet. This kind of planning has to take into account both the nature and the location of developments; it has to find out what to do, and where to do it. This is why land use planning has an important role to play.

In this new type of environmental policies to be developed the key element is probably the organisation of public participation. The possible long-term, indirect costs of a given project are often difficult to imagine; the possible long-term, indirect benefits of another project are even more difficult to think of. This can only be done if a number of people - including the people involved - participate in the decision-making processes. This is difficult to organise, and will be done at great cost. But there are some reasons to believe that Japan is well equipped to do it, and that it will in the years to come, improve environmental quality as efficiently as it reduced pollution levels.

Appendix I

## ESTIMATES OF ANTI-POLLUTION INVESTMENTS IN THE PRIVATE SECTOR, 1970-75

Anti-pollution investments in the private sector are not very well known and have to be estimated. Two procedures can be utilised. The first or direct one utilises various incomplete surveys about anti-pollution investments by enterprises. The second or indirect one is based upon surveys of anti-pollution equipment sales to enterprises. They do not give identical results.

### 1. DIRECT ESTIMATES

Total private investments can be divided into three types:

i) investments undertaken by enterprises for which MITI is responsible, i.e. enterprises with a capital over 100,000,000 yen in the main industrial sectors, hereafter referred to as "MITI enterprises";

ii) investments undertaken by other manufacturing enterprises, and

iii) investments undertaken by non-manufacturing enterprises.

Data on total private investments can be found in national accounts; in 1974 it was about 22,929 billion yen. Data on (i) is published by MITI; in 1974 it was about 5,761 billion yen. Data on (ii) and (iii) can therefore be obtained by subtraction. The ratio of (ii) to (ii) + (iii) is known to be 0.4 and can be utilised to figure out (ii) and (iii); in 1974 investments in other manufacturing enterprises were about 6,867 billion yen and investments in non-manufacturing enterprises some 10,302 billion yen.

We then estimate, for each type of investment, the amount of associated anti-pollution investments.

As regards "MITI enterprises", an annual survey is undertaken in which enterprises (at the firm's, not establishment level) are asked to report on their "anti-pollution investments", as well as on their total investments. This data is published, and even

tabulated sector by sector. It is often quoted, although citations do not always make it clear that it applies to "MITI enterprises" only, not to "Japanese enterprises". Ratios of anti-pollution investments to total investments that emerge from this survey are of course not typical of the private sector as a whole. In 1974, according to that survey, anti-pollution investments in "MITI enterprises" amounted to about 818 billion yen.

As regards "other manufacturing enterprises", data from the Small Business Finance Corporation can be utilised. This Corporation issues series of ratios of anti-pollution investments to total investments in the enterprises for which it is responsible. Those ratios can be assumed to apply to "other manufacturing enterprises". In 1974, the ratio was 7.5 per cent, and anti-pollution investments can therefore be estimated to be: 6,867 x 7.5 per cent = 515 billion yen.

As regards "non-manufacturing enterprises" anti-pollution investments can be neglected.

Calculations for 1974 can be summarised as follows:

| | Total Investments (billion yen) | Anti-pollution Investments (billion yen) | Ratio (%) |
|---|---|---|---|
| MITI enterprises | 5,761 | 818 | 14.2 |
| Other manufacturing enterprises | 6,867 | 515 | 7.5 |
| Non-manufacturing enterprises | 10,302 | - | 0.0 |
| Total, private sector | 22,929 | 1,333 | 5.8 |

Calculations for the years 1970-1975 are shown in Table A.

## 2. INDIRECT ESTIMATES

There are two sources of data on anti-pollution equipment sales. One is a survey by MITI; the other is a survey by the Japan Industrial Machinery Association. Figures estimated by the Japan Industrial Machinery Association are 30 - 40 per cent higher than figures produced by MITI.

Anti-pollution equipment sales can be broken down between sales to the private sector and sales to the public sector. In 1974, the ratio of sales to the private sector to total sales was estimated to be 67 per cent. Assuming that this ratio has been constant over the period, one can build a series of anti-pollution equipment sales to the private sector.

TABLE A. Estimates of anti-pollution investments in the private sector, direct method, 1970-75

| | (1) Total investment in private sector (billion ¥) | (2) Total investment in MITI enterprises (billion ¥) | (3) Total investment in other manufacturing enterprises (billion ¥) | (4) Anti-pollution investment in MITI enterprises (billion ¥) | (5) Share of anti-pollution investment in other manufacturing enterprises (%) | (6) Anti-pollution investment in other manufacturing enterprises (billion ¥) | (7) Anti-pollution investment in private sector (billion ¥) | (8) Share of anti-pollution investment in private sector (%) |
|---|---|---|---|---|---|---|---|---|
| 1970 | 14,494 | 3,094 | 4,560 | 164 | 1.5 | 68 | 232 | 1.6 |
| 1971 | 14,908 | 4,154 | 4,302 | 270 | 3.1 | 133 | 403 | 2.7 |
| 1972 | 16,723 | 3,891 | 5,132 | 323 | 4.6 | 236 | 559 | 3.3 |
| 1973 | 22,304 | 4,489 | 7,126 | 440 | 5.6 | 399 | 839 | 3.8 |
| 1974 | 22,929 | 5,760 | 6,867 | 818 | 7.5 | 515 | 1,333 | 5.8 |
| 1975 | 21,072 | 6,652 | 5,768 | 1,264 | 9.0 | 519 | 1,783 | 8.5 |

Sources and Notes:

(1), (2), (4) are series established by MITI.

(5) is a series established by Small Business Finance Corporation.

(3) = [(1) - (2)]0.4.

(6) = (5) x (3).

(7) = (4) + (6).

(8) = [(7) : (1)]100.

Table B

ESTIMATES OF ANTI-POLLUTION INVESTMENTS IN THE PRIVATE SECTOR
INDIRECT METHOD, 1970-1975

| Year | Total investment in private enterprises (billion yen) (1) | Anti-pollution equipment sales (billion yen) (2) | Anti-pollution investment by private sector (billion yen) (3) | Anti-pollution investment by private sector (billion yen) (4) | Ratio of anti-pollution investment in private enterprises (%) (5) |
|---|---|---|---|---|---|
| 1970 | 14,494 | 195 | 131 | 262 | 1.8 |
| 1971 | 14,908 | 302 | 202 | 404 | 2.7 |
| 1972 | 16,723 | 375 | 251 | 502 | 3.0 |
| 1973 | 22,304 | 488 | 327 | 654 | 2.9 |
| 1974 | 22,929 | 677 | 454 | 908 | 4.0 |
| 1975 | 21,072 | n.a. | n.a. | 1,403[a)] | 6.6 |

Sources and Notes:

1) is a series established by MITI.

2) is a series established by the Japan Industrial Machinery Association.

3) = (2) x 0.67; 0.67 is the ratio of sales to the private sector to total sales in 1974, which is assumed to be constant over the period.

4) = (3): 0.50; 0.50 is assumed to be the ratio of anti-pollution equipment to anti-pollution investment.

5) = /(4): (1)7 100.

a) The figure for 1975 was calculated by applying to the 1974 figure (908) the increase noted in the replies to the MITI questionnaire on anti-pollution investment (54 per cent).

Anti-pollution investments consist partly of anti-pollution equipment, and of other (mostly civil engineering) types of equipment. Officials of various institutions, such as the Japan Development Bank and the Environmental Pollution Control Service Corporation, were asked about the ratio of anti-pollution equipment to total anti-pollution investment. Although their replies were only informed guesses, it seems safe to say that this ratio is not below 50 per cent. By dividing the amount of anti-pollution equipment by this ratio, one can arrive at an estimate of anti-pollution investments in the private sector.

Calculations for the years 1970-1975 appear in Table B.

Both direct and indirect estimates are rather crude, and must be utilised with great care. Indirect estimates, which are about 20 per cent lower than direct estimates, may be more reliable (or rather less unreliable). These are some reasons why direct estimates could be on the high side. Enterprises replying to MITI might be tempted to overstate their "anti-pollution investments"; the vagueness of the concept makes it easy. The oil industry, for instance, includes in its anti-pollution investments not only the investments required to meet emission standards imposed upon the industry, but also the investments required to desulphurise the fuels it refines, and not much is known about the series coming from the Small Business Finance Corporation. Indirect estimates seems unlikely to be too low. It is true that some anti-pollution equipment production could have escaped the series either because the data does not include anti-pollution equipment which does not call for outside equipment manufacturers, or because some anti-pollution equipment manufacturers are not members of the Japanese Industrial Manufacturing Association. On the other hand, we have utilised the source that gives the highest figures; the ratio of anti-pollution equipment to anti-pollution investment that has been retained (50 per cent) appeared to be minimum; had a higher ratio been utilised, estimates of anti-pollution investments would have been lower.

## APPENDIX II. Estimate of the economic cost of pollution abatement

1. We first estimated K, the stock of anti-pollution capital at the beginning of 1975 by: (i) estimating the total yearly anti-pollution investments in current prices; (ii) transforming the series into a series in 1975 prices; (iii) accounting for the depreciation (at a rate of 10% per year) of those investments according to their age; (iv) adding the figures thus obtained for each year, as shown in the following table):

| | (1) Anti-pollution investment in MITI sample of big enterprises (current prices) | (2) Total-anti-pollution investment by private enterprises (current prices) | (3) Anti-pollution investment by government (current prices) | (4) Total anti-pollution investment (4)=(2)+(3) (current prices) | (5) Price index (machinery and equipment) | (6) Total anti-pollution investment (1975 prices) (6)=(5)x100 | (7) Remaining capital ratio | (8) Remaining Capital (8)=(6)x(7) (1975 prices) |
|---|---|---|---|---|---|---|---|---|
| 1966 | 27 | | | 94 | 64.6 | 61 | 0.1 | 6 |
| 1967 | 46 | | | 160 | 65.9 | 105 | 0.2 | 21 |
| 1968 | 62 | | | 216 | 66.1 | 142 | 0.3 | 43 |
| 1969 | 107 | | | 373 | 67.6 | 252 | 0.4 | 101 |
| 1970 | 188 | 262 | 394 | 656 | 69.9 | 459 | 0.5 | 230 |
| 1971 | 306 | 404 | 634 | 1,038 | 69.6 | 712 | 0.6 | 427 |
| 1972 | 331 | 502 | 876 | 1,377 | 71.0 | 978 | 0.7 | 685 |
| 1973 | 485 | 654 | 1,077 | 1,731 | 79.6 | 1,378 | 0.8 | 1,102 |
| 1974 | 923 | 908 | 1,320 | 2,228 | 98.9 | 2,203 | 0.9 | 2,007 |
| 1975 | 1,178 | 1,403 | 1,484 | 2,887 | 100 | 2,887 | 0.5 | 1,444 |
| TOTAL(K) | - | | - | | - | | - | 6,066 |

2. E, Economic cost, equals D, depreciation costs for the wear and tear of the stock of capital equipment utilised, plus I, opportunity cost of this stock of capital, plus O, operating costs: $E = D + I + O$.

   D can be estimated to be 10% of K.

   I can be approximated by K times the interest rate, which was also about 10% in 1975.

   O can, on the basis of data available for other OECD countries, be estimated to be about equal to D + I.

   $E = (0.1 + 0.1 + 0.2)\ K = 0.4\ K = 0.4 \times 6{,}066 = 2{,}426.$

   $\frac{E}{GNP} = \frac{2{,}426}{144{,}915} = 1.7\%$

3. As a by-product, S, anti-pollution expenditures, can be estimated. S equals N, anti-pollution investments plus O, operating costs. In 1975:

   $S = N + O \quad S = 2{,}887 + 0{,}2\ K \quad S = 2{,}887 + 1{,}213 \quad S = 4{,}100 \quad \frac{S}{GNP} = \frac{4{,}100}{144{,}915} = 2{,}83\%$

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