

Co-existence of Industry and Community: SO_x Emission Controls Kitakyushu (Japan)

Summary of the Practice

Keywords: Kitakyushu, Voluntary agreements, public pressure, SO_x emissions control

Strategy: Improving environmental performance of small and medium-sized enterprises (SMEs)

Environmental areas: Air pollution

Critical instruments: Regulatory instruments, institutional arrangements, self-regulation, Awareness

Country: Japan

Location: Kitakyushu

Participants: Local industries, local government, and citizens

Duration: 1970-2000

Funding: Internal (government support and self funding by the industries, which went to adapt environmental protection measures.

Background

Kitakyushu City was created in 1963 by merging the five neighboring cities of Moji, Kokura, Yahata, Wakamatsu, and Tobata. This city is located in the far northern part of Kyushu (the most westerly island of Japan's four main islands), and faces Honshu over the Kanmon Channel. In the coastal area, a large part of the lower land is artificially created or reclaimed land. Kanmon Channel links the Sea of Hibiki and the Sea of Suou. The population was initially grew rapidly but declined later and it is about 1.02 million (1993). The gross regional product of Kitakyushu in 1991 was 2.7 billion yen (0.8% of GNP of 340.6 billion yen) and tertiary industries share was 57.4% in 1993 in city's total output, while the share of secondary and primary industries was 41.6% and 1.0% respectively. Steel, chemicals, general machinery, food, and electric machinery are the main manufactured goods; however, emphasis on high-tech industries and general and precision machinery is growing.

Similar to today's situation in most of the developing countries, Kitakyushu was aiming to boost economic growth after the war by industrialization. A national income-doubling program was decided on in 1960 and measures to promote high economic growth were taken. The five cities of Kitakyushu area boosted the economy by inviting heavy industries. Kitakyushu had established itself as a center for the cement industry, combining high quality limestone produced in the area and Chikuhō coal. After the operations got underway at the government run Yawata Steel Works, large-scale factories sprung up in the area around Dokai Bay, forming the framework of the Kitakyushu Industrial Zone. The period of high economic growth was an ear of heavy chemical industrialization and remarkable development of heavy and chemical industries such as steel and machinery. This boosted the economic growth at an average rate of 20% per annum till the first oil crisis in 1973.

However, this industrialization was the main source of the pollution. However, this pollution, which began with the "seven colored smoke", was initially the symbol of prosperity (UNDP 1996). In the late 1950s, air pollution in the form of smoke and soot, offensive odors, and water pollution from factory wastewater grew serious in various locations. Air pollution was mainly due to heavy concentrations of NO_x, SO_x, suspended particulate matters (SPM), dust fall, and non-methane hydrocarbons (NMHC) in ambient air. Air pollution cause major health impacts, although, most of those impacts were not know during that time, but Kyushu University's survey showed many adverse impacts, especially on the children.

Objectives

The major objective was a co-existence of industries and community in a liveable environment. Hence the local government did want to put very strict regulations at first hand, which had might discouraged the industries to be located in this city. Hence the objective was to motivate the industries to introduce abatement measures on voluntary basis, then after some time, those could be made mandatory regulations.

Description of the activity

The motivation for the local government to act for improving SO_x and dust, in particular, goes back to women's protest movements that started with the slogan "we want our blue sky back" in mid 1960s. Such campaigns increased awareness among people who were silent for a long time towards the negative aspects of environmental pollution. Despite pressures from polluting enterprises, these women

groups petitioned and challenged local government with their own studies on the air quality. In other cities in Japan such as Kawasaki, and Osaka, citizen groups had lots of confrontations with the polluting enterprises and the local government. Anti-pollution movement had lot of political repercussion in those cities. The motivation for local political leaders to carry out the anti-pollution measures had some political consideration because of leftist political party's active environmental agenda and ongoing public awareness and protests for environmental improvements. This provided a motivation to polluting enterprises to seriously cutting emissions. The situation led to the voluntary agreement (March 1972 and January 1977) between polluting enterprises (48 companies, 57 factories) and the local government to cut down the emissions and to implement pollution control measures. These two times agreements were made in groups; however, individual agreements were made many times. The following countermeasures against the air pollution were taken by the city government:

- Strengthening of local regulations
- Enhancing institutional capacity
- Fuel quality improvement and fuel substitution
- Technical guidance and technology enhancement in the manufacturing process
- Change in industrial structure
- Financial mechanisms: subsidy measures
- Enforcement
- Public awareness

Strengthening of local regulations

Apart from the anti-pollution law of the national government (Environmental Quality Standard, Emission Standard, Area-wide Total Pollution Load Control, and Automobile Exhaust Emission Regulation), Kitakyushu City itself formulated stricter law, regulation and inspection systems. That included: (1) new plant modification order, improvement order, and stricter inspection to smoke and soot treatment facilities (2) continuous pollution monitoring and (3) emergency measures (1969-74). The emergency measures demanded the systematically cutting down of SO_x emissions by 20%, 30% and 50% from industries in the implementation period. Market based instruments (MBIs) were also tried, which include health compensation law of 1974, where industries have to compensate the patients, who got sickness due to SO_x pollution.

Enhancing institutional capacity

In order to support counter measures, the institutional capacity of environmental section, in terms of number of qualified staffs, monitoring system and equipment were enhanced. Table below shows the number of administrative and research staffs since early 1960s. Similarly, the authority of decision making for regulations and standards, and smog warning was shifted from Fukuoka Prefecture to City of Kitakyushu in 1970. This transfer of authority to local body provided opportunities to act quickly and also a sense of ownership among the city council, administration, enterprises and the citizens. After this, Kitakyushu Air Pollution Prevention Joint Council was established consisting representatives from national government, Fukuoka Prefecture and key polluting enterprises. This council played a key role in implementing a wide range of countermeasures. Decentralization of the responsibilities within Kitakyushu City was also a key institutional measure.

Table 1 Human Resources for Environmental Governance

Year	Status	Administrative	Research
1963	Subsection	4	-
1965	Section	8	9
1870	Division	22	17
1971	Bureau	25	21
1977	Bureau	75	45

Apart from local government, enterprises falling under a criterion were mandated to have pollution control managers whose job was to manage technical and managerial matters related to pollutants. Such managers were required to pass the national qualifying examination.

Fuel substitution and fuel quality improvement

One of a key component of the countermeasures was the type and quality of fuel. City government had encouraged the enterprises to shift from coal based energy system to liquid fuel and then gradually, to natural gas. Figure below shows the consumption of fuels in Kitakyushu. Therefore, the sulfur content per unit of energy consumption was decreased drastically. The process involved first to fuel switching from coal to crude oil (sulfur 1%) in 1960s. This was followed by switching to low sulfur content crude oil (0.15%) and light oil, then LPG, LDG and finally to LNG.

Cleaner production technology and end-of-pipe measures

Efficient manufacturing process can produce large amount of energy savings in the manufacturing establishments. Following technology enhancement were carried out:

- Process conversion to efficient processes such as in cement kilns
- Raw material switch such as ferric sulfide to sulfur in sulfuric acid manufacturing plants
- Phasing out of small and mid-size boilers and introducing large scale boilers
- Introduction of better equipment
- Recycling of waste energy
- Increased height of the chimney stacks
- End of pipe technology, in particular, FGD (Fluidizes gas desulfurization) installations

Financial mechanisms and subsidy measures

All the activity explained above was not possible without financial facilitation to the enterprises by the local government, particularly, in the case of small and the medium scale businesses. The financial mechanism consisted two parts: (1) public capital financing system and (2) tax incentives. The core of the control measures was the technological enhancement and the fuel switching. So the capital needed for the technical countermeasures to be carried out to meet the volunteer agreements and requirements of the regulations were provided at the low interest rate. The pay back period depended on the type of companies from 7-20 years.

Table below shows local governmental financing for the air pollution countermeasures of small and medium scale companies.

Table Local government support to small and medium scale companies

1968-95	Number of Cases	Million US\$
Air pollution	57	4.8
Odor	19	1.0
Noise	161	15.0
Water pollution	45	3.0
Others	11	0.6

Enforcement

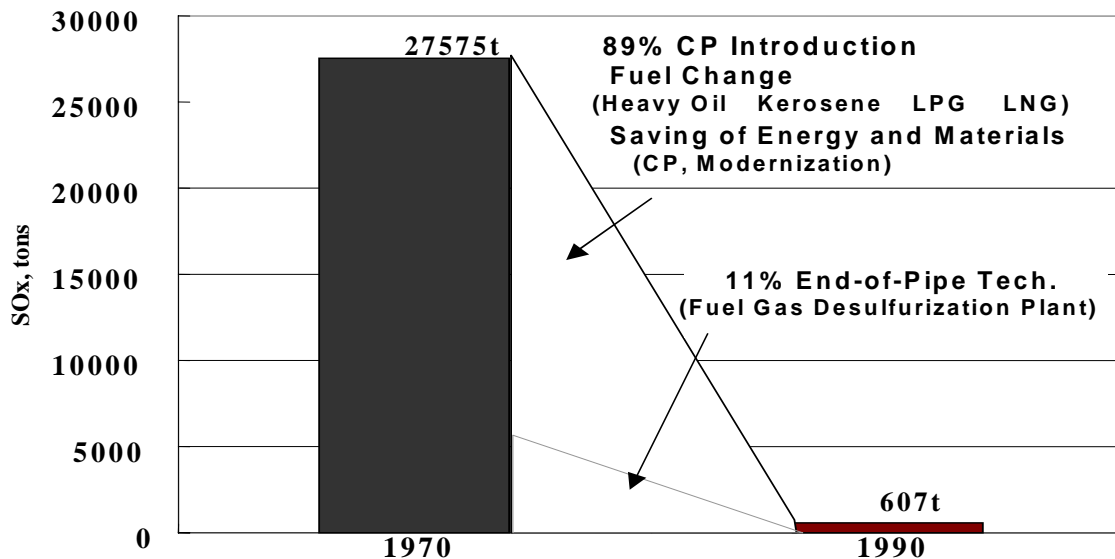
Without enforcement of the regulations and standards, real success cannot be achieved. The inspection systems developed by the local government were: spot inspections, *tele-metering* and routine inspections. The violators were first given warning and allowed to make needed modifications at two stages and, if proved unsuccessful, leading to fines and imprisonment.

Public awareness

In Kitakyushu city, women groups started campaigns to mobilize public support for forcing industries to adopt pollution control measures. Unlike other polluted cities like Tokyo-Yokohama and Kawasaki, the public pressure was weak in Kitakyushu City. However, this public awareness provided ground for communist parties to challenge the Mayor of the city. Fujikura (2001) suggests that this environmental friendly agenda led communists to win in other cities, and this made Mayor and Industries to adapt various “voluntary” measures, as if a communist Mayor may be elected, then that would create more stringent measures for the pollution control. Those agreements helped Kitakyushu City to bring back its blue skies.

Impacts

Kitakyushu City has achieved a dramatic success in controlling SO_x pollution through various measures. The understanding of those measures helped to classify them among various groups as strengthening of local regulations, enhancing institutional capacity, fuel quality improvement, fuel substitution, production technology and end-of-pipeline options, financial mechanism and subsidies, enforcement, and public awareness.



Lessons Learned

Fig. 6 Reduction of SO_x emissions by various means

- Public awareness can be transferred in the public pressure to motivate the local government and the pollution sources (industries in this case) to take appropriate measures. However, the most important lesson on this account from this study suggests that public pressure doesn't need to be negative to shut down the industries, but rather it can be positive to motivate the voluntary measures.
- Decentralization of powers to the city management, to take immediate actions against the emergency pollution levels, is a very important tool to address these challenges, as it takes time and efforts to take decisions from the national level institutions resulting into a huge economic and health related losses.
- Sometimes it is hard to address all of the environmental challenges in a one go. Hence, issue wise approach may also work, as SO_x reduction targets worked well in this case. The abatement measures for SO_x reduction also had positive impact on the reduction of other pollutants as well as these measures built the confidence of all the stakeholders that it is possible to introduce abatement measure for any pollution without losing the business.

Potential for Application

This Kitakyushu model is almost similar for all industrial pollution; however, due to limited space, we will analyze this model for Kitakyushu City's experiences in SO_x pollution management and its transferability for the existing situation in the cities of developing countries.

From self regulations to mandatory regulations:

Application of environmental regulations in developing countries could also take the same path and due to low level of awareness, high cost of technology, and priority of economic goals, these countries can follow this example, as in Kitakyushu City, the regulations were started as "voluntary agreements" between industries and the local government. This aspect is very important for the cities in

the developing countries, if there could also be an initiative with “voluntary agreements” to control the pollution. These “voluntary agreements” later became mandatory agreements or regulations.

Institutional capacity building in developing countries

Decentralization of authority, including judicial and financial, is the most important factor for building municipalities as the effective institutions (Shah 1998). Thereafter, institutional building requires proper human, technical, and financial resources and the institutional framework to optimize the output of these resources. The clear job descriptions with incentives and accountability measures are essentially required (Ostro et al. 1993). The technology to monitor the environment is lacking in most of the cities and there is no mechanism to generate financial resources to higher expertise and to acquire the new technology. In this regard, the proper institutional building is required to overcome these problems. However, to get the good start, an international cooperation, for human resource development and acquiring new technology, is vital.

Energy issues in developing countries

Fuel substitution and fuel quality improvement is the most serious concern in developing countries also. Although, in most the countries, national governments are directly involved in issuing regulations for use of cleaner fuel, but in some cities, the local level initiatives are being taken in this regard. For example, conversion of CNG engines for public buses in New Delhi (India) or lead free gasoline in Bangkok. Therefore, fuel substitution is picking up quite rapidly in comparison with the other measures, and it can further improve, if the municipalities or local governments may get legislation powers to ban polluted fuels and to motivate industries, through various incentives, to adapt the technologies with cleaner fuels.

Cleaner production technology and end-of-pipe measures

Most of these measures are usually being adapted by the multinational companies under foreign direct investment, as there are higher initial costs involved. The small industries in developing countries, cannot afford most of the new technology and end-of-pipeline measures like FGD and neither they can run their industries in profit with these spending. This leaves a lot of work to be done by the governments, as only legislations to ban dirty technology will put many people out of jobs and most of local business will come to stand still. Hence a proper evaluation of the socioeconomic impacts of such legislation is necessary to make appropriate changes. For examples, the industries may be asked to adapt these measures over time in phases, or there may be some economic incentives for the industries, including tax exemption, or government may subsidize the cost of cleaner production technology and end-of pipeline measures. The government may also extend credit or loans for the industries to buy cleaner production technology and environmental abatement technology.

Financial mechanisms and subsidy measures in developing countries

This measure should be in a total package with other measures including cleaner production technology and relocation of industries. However, most of developing countries are facing serious financial constraints and it might not be easy for them to provide subsidies. Moreover, the subsidies may decrease the economic efficiency of the resources, as it will distribute the externalities to everyone in the society, which is in contrast to polluter pay principle. Nevertheless, a proper understanding of the impact of direct tax, based on polluter pay principle, and subsidies is vital to formulate the policies. For example, Kolstad (2000) suggests that without a price system, polluter do not “see” the damage caused by the pollution they emit and if polluter pays a price for every unit of pollution, this corrects market failure, at least in theory. However, Tietenberg (1996) observes that pollution tax may be regressive as higher prices hit poor people proportionately more, who spend all their money, than the rich people, who save some of their money; therefore, subsidies are progressive to maintain vertical and horizontal equity. Hence, this issue should be dealt on the socioeconomic merit of each city.

Enforcement measure in developing countries

Enforcement of environmental policies is a major challenge in developing countries due to lack of resources and as well as due to weak institutions. Human resources in local governments are not highly skilled and it is quite expensive to higher outside expertise to fill this gap. The technology, including tele-metering system, is not widely available, as the cities lack in financial resources. Then, the weak

institutions further hamper the effective enforcements, as there is efficient way for conflict resolution and judiciary takes very long to decide on the issues. Political will also changes rapidly with a change in government. Hence for proper enforcement, the institutions should be well equipped with proper technology and human resources, and there should be quick process for conflict resolution along with high political commitment. Moreover, stakeholder participation may help towards effective enforcement.

Public awareness measure in developing countries:

In the developing countries, public awareness is being raised through NGOs and community groups. This public awareness has helped communities to work together for creating a better living environment, mainly by managing solid waste and wastewater. However, this public awareness has so far failed to make any big political impact leading towards pollution control policies. The governments in developing countries are rather giving incentives, for polluting their countries, to attract foreign direct investment (Panayotou 2000). Therefore, this type of public awareness and public pressure might still take sometime to be effective in developing countries.

Critical Instruments

All the critical instruments have been elaborated under “description of activity.” Please refer that section.

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