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Division 402
Environmental Protection, Conservation of Natural Resources, Dissemination of Appropriate Technologies (GATE)

Pollution Prevention Through Market-Based Incentives

Two Case Studies on Thailand

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Preface

The discussion on environmental policy in Industrialised as well as in Developing Countries is increasingly acknowledging the importance of policy instruments relying on the economic self-interests of actors involved. These include market based incentives for pollution control and prevention (e.g. taxes, levies, tradable permits etc.), compensation mechanisms, deposit systems, liability regulations as well as questions related to resource pricing, subsidies and land tenure.

The use of these instruments is tied to certain institutional and legal prerequisits. The choise of instruments depends to a large extent on the specific situation. Experience shows that economic instruments of environmental policy are normally used in combination with regulatory instruments. There can be no doubt that - at least within the framework of the implementation of the UNCED results - the instrumentation of environmental policy in Developing Countries is under scrutiny. It is to be expected that this will result in new tasks for development cooperation.

It is foreseeable that the need for technical assistance and training will increase in future with respect to the design, the implementation and development of appropriate institutional structures for market based incentives in environmental policy. However, the specific demand and scope for cooperation in this area is yet to be defined within a broad concept of capacity development and institutional development in the environment.

The German Agency for Technical Cooperation (GTZ), through its Pilot Program on Institutional Development in Environment (PVI) has commissioned case studies on different aspects of economic instruments in environmental policy in Benin, Chile, Mexico and Thailand. They are meant to serve as an orientation towards defining the scope and practical approaches of technical cooperation in this field and adressed to practitioners in environmental as well as development cooperation agencies. However, they might be of interest to a wider audience working on related issues and are therefore published in this format.

Stephan Paulus
GTZ-Pilot Program on Institutional Development in Environment (PVI)

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1 Introduction

This report is part of a series of case studies funded by the Pilot Programme on the Development of Institutions in Environmental Protection of GTZ. They are are embedded in a major research effort to investigate generally the scope for institutional assistance, and are not meant to identify specific projects. The research reports are designed as case studies of Chile, Benin, Mexico and - in this report - Thailand. The objective of this case study is to sketch out possible fields of institutional cooperation for introducing economic instruments in the protection of the environment in Thailand. Since emphasis is placed on finding entry-points for institutional cooperation by donor organisations, this report will analyse the implementation process abstractly, and then turn to Thailand and describe the scope for institutional assistance which can be given in the implementation of economic instruments.

As time for the field research was limited, and for the sake of a more detailed study, a narrowing of the appoach seemed to be necessary. Therefore, the focus of this report is on water resources of Thailand which includes the management of freshwater as well as wastewater.

In order to research Thailand's water resource management interviews were conducted with officials of Thailand's Ministry of Science, Technology and the Environment, Ministry of Industry, and other agencies and enterprises of the Royal Thai Government as well as with university researchers and private environmental counsultants.[1] Although this report is solely based on field research in Thailand, it will attempt to draw some general conclusions for the institutional cooperation offered by donor organisations in managing water resources.

With an ample supply of reports available from the World Bank, the United Nations, the Asian Development Bank and other institutions a general introduction to the economic conditions of Thailand and the natural resource basis can be omitted.[2] Instead, it will be sufficient to give information on the country as the issues come up.

At this point it should be mentioned, though, that Thailand is one of the fastest growing economies in the world. With real GDP growth rates of 8-10 % since

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1 The appendix contains a list of interview partners.

2 See for a brief introduction on Thailand's economic performance AKRASANEE (1991), more recent DEG (1993a), on natural resources TDRI (1987).

1986 fears of an overheating economy are greater than fears of a recession.[3] At the same time pollution of air and water was increasing, and in some areas it is reaching levels unaccepted by the population.[4] Consequently, Thailand has adopted various measures of environmental policy over the last years. Generally, this policy consisted of crisis-management rather than management of the resource basis, and of announcement rather than implementation. Among the more systematic attempts to formulate environmental policies is the adoption of the *Polluter-Pays Principle*[5] which is understood, broadly speaking, as pricing the emission of pollutants. Connecting prices to pollution is usually done by market-based instruments or economic instruments, two terms that will be used as synonyms in this report. One of the major advantages economic instruments have over *command-and-control*-policies is their cost-effectiveness. Cost-effectiveness is achieved, if a given goal is reached at minimal costs.

In order to offer some perspective on future cooperation given by donor organisations, this study outlines a staging approach on the implementation of economic instruments, specifically instruments for managing water resources (Chapter 2). Although references to a consecutive implementation of economic instruments are occasionally made in the literature[6], this study attempts a systematic approach. The staging approach for implementing economic instruments will be used to describe and categorize roughly Thailand's current water management (Chapter 3). In Chapter 3 most of the field research of Thailand will be presented. According to the classification of Thailand's water resource management, Chapter 4 will explore the scope for institutional cooperation by donor organisations in Thailand. And, finally, general conclusions about the scope for institutional cooperation will be drawn (Chapter 5). The hasty reader is provided with an executive summary in Chapter 6.

2 A Staging Approach on the Implementation of Economic Instruments for Managing Water Resources

The staging approach should be viewed as a tool for the understanding of requirements which must be fulfilled if economic instruments are supposed to work properly. Theoretically, the consecutive order of the instruments is not conclusive, but rather pragmatic.

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3 WORLD BANK (1993), p. 1.

4 See WORLD BANK (1993) for environmental quality standards, the data basis is insufficient for comparing economic growth with environmental degradation over time.

5 NESDB (1992), p. 17, see also PHANTUMVANIT/ PANAYOTOU (1990), p. 27.

6 See, for instance PEARCE (1991), p. 76 who offers a priority list of market-based instruments with some similiarity to the stages used in this approach. See also WONGBANDIT/ MEWONGUKOTE/ JAIHARN (1993) who implicitly follow the stages.

For the sake of clarity we will not include the entire range of economic instruments in the following stage model. Instead, in Section 2.1 the most relevant instruments will be selected; Section 2.2 presents the staging approach.

2.1 A Classification of Economic Instruments

Two fields of application for economic instruments can be distinguished.[7] One consists of pollution management and is largely drawn from the experience of the industrialized countries. The other relates to natural resource management and is primarily based on experiences of developing countries. Theoretically, these two fields are the two sides of the same coin: in the case of water resources, pollution affects freshwater resources as well as draining water bodies for irrigation water has an impact on wastewater concentration in the river. Following the objective to explore economic instruments in managing water, we will have to consider both fields of possible application. From the perspective of actually implementing economic instruments it appears reasonable to keep both issues distinct. In the following chapters both will be discussed.

In the discussion of economic instruments for water pollution management the following will be included:[8]

- fees for covering costs of infrastructure

- pollution charges

- pollution licenses or tradeable discharge permits.

Other sources also include subsidies for pollution control since they operate on the same basis as the instruments mentioned above: they also influence the price. Subsidies financially support activities which are considered as environmentally sound.[9] In theory, the effect of subsidies is more or less equivalent to the effect of charges: the former is lowering the price of acting in a certain way, the latter is raising the price. Fundamental differences appear,

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7 HARTJE (1993), p. 22.

8 See PEARCE/ TURNER (1990), p. 172; also HARTJE (1993), p. 22 from whose list deposit-refund-schemes are omitted. An application in water resources management seems unpractical.

9 PEARCE/ TURNER (1990) p. 172; PEARCE (1992), p. 51; OPSCHOOR/ VOSS (1989), p. 14; EFTEC (1993) p. 8.

however, once they are considered under the *Polluter-Pays Principle*.[10] Subsidies are usually granted at the expense of the general tax-payer. The society at large consequently pays in support of the activities by which pollution is supposedly reduced. Charges, in contrast, will be paid by the polluting agent who may shift the incidence of the charge to the purchasers of his products.[11] Since Thailand's environmental policy emphasizes the *Polluter-Pays Principle*, this report will concentrate on pollution charges and pollution licenses.[12] Included will be fees for using infrastructure.

Economic instruments for the management of freshwater include:[13]

- fees for cost-covering infrastructure

- resource user charges

- licenses or tradeable permits

Simply by comparing both lists of instruments it is apparent that the same mechanisms will be used regardless of whether freshwater management or wastewater management is concerned.

2.2 Stages of Implementing Economic Instruments

Even though economic instruments seem to operate rather independently of each other, this paper argues that there are various stages in the implementation of economic instruments which should be distinguished. The stages, however, should not be interpreted as the only path to introduce economic instruments.[14]

A staging approach naturally implies that some consecutive order *should* govern the implementation of economic instruments. As a matter of fact, various criteria must be fulfilled for successfully implementing economic

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10 But see PEARCE/ TURNER (1990), p. 175 for an exposition of the *Polluter-Pays Principle* as defined by the OECD. The OECD does not see subsidies as inconsistent with the *Polluter-Pays Principle.*

11 In the case of applying licenses, again polluters bear the cost of reducing emissions: even in the case of 'grandfathering' the licenses, a yearly devaluation of licenses requires a reduction of emissions by every polluter.

12 As UHLIG (1992), p. 343 points out, it is not reasonable to employ the *Polluter-Pays Principle* in every case. Despite this, an introduction of general principles brings clarity to all parties and lowers transaction costs.

13 Again subsidies could be included. See HARTJE (1993), p. 22.

14 This approach should therefore not be mistaken as what ROSTOW (1960), p. 3, thought of his evolutionary model of developing societies.

instruments. These criteria, or requirements, exist for each individual instrument. As the outlined stages of the implementing process suggest, some of the requirements for instruments at later stages are already met, if the implementation process follows the described path. The staging approach outlines a smoother path of implementation with the regard to political resistance by lobbying groups, less severe distributional effects by income groups as well as sectors of industry, and more administrative practicability.[15] Structuring the implementation process by stages, however, is primarily a matter of practical relevance, and not of theoretical necessity.

In the most simple form the process can be structured in three stages. Stage I establishes a system of property rights for emitting pollutants or using a resource. One way of establishing such property rights, though rarely noticed, is a *command-and-control*-policy. By setting mandatory standards, polluters receive a "right" to pollute to the level of the standard, and the right to pollute beyond this level is reserved by the state. Also in Stage I a control system must be introduced. In order to ensure compliance with standards adequate penalties must be imposed. Stage II introduces fees for covering the cost of infrastructure. Fees relate to private cost and are an instrument for covering operating, maintenance and investment costs of treatment plants etc. Infrastructure for treating wastewater, for instance, will be built only, if mandatory standards or enforced property rights require action on behalf of communities or private firms. Stage III, finally, gives rise to the implementation of tradeable permits or licenses as well as charges. At this stage, incentive giving instruments are used for reducing residual pollution.

2.2.1 Stage I: Implementing Property Rights and Permits

Many environmental resources are commonly understood as public goods, and public goods in turn are characterized as goods for which insufficient property rights are ascribed. Insufficient property rights lead to an over-exploitation of the resource. Property rights, if sufficient, must be clearly defined in terms of how and to what extent the resource may be used. They also must be exclusive, i. e. they reserve the resource to the one who holds the property right. In order to be exclusive, property rights must be enforceable. Enforcement can be achieved through licenses or permits issued by the state, and based on law. If such property rights in their institutional form of permits can be defended at the

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[15] GAWEL (1991), p. 21.

courts, they are also secure. In conclusion, property rights must be clearly defined, exclusive, enforceable and secure.[16]

Historically, the two classic environmental goods clean air and, in many areas, clean water were not only public goods, but also free goods: they were abundant. With growing populations and a more intense utilization of the resources they became scarce. Laws were introduced to protect the resource basis. The passing of environmental laws is, economically speaking, nothing but the definition of property rights.[17] Regarding environmental resources three systems can be applied:[18] (1) Property rights can be solely settled with the state (*state ownership*) which holds the property for the benefit of the society.[19] (2) Property rights can be established through a *public domain system*. Then, users of the resource must acquire permits or concessions for using the resource.[20] (3) Finally, the state can reserve the power to intervene with the use of a resource whereas the holders of property rights can be private (*private ownership with state intervention*). Any state intervention would then require a compensation of the holder of the property right.

All the three possibilities of establishing property rights impose restrictions on the resource in question: unrestricted common property is transferred into restricted property. And with either of these property rights regimes adopted, it is possible to introduce economic instruments. But it depends on the property rights regime how economic instruments should be implemented and to what extent incentives can be given.

For water resources property rights for various uses can be distinguished. We will not inspect property rights concerning navigation, fishing, swimming, etc. in greater detail. Instead, such property rights are looked upon as if protected by compliance with ambient standards. At the core of this report are two forms of utilizing water. On one hand, property rights can be created for using freshwater in consumption or production processes, on the other hand property rights can be established for discharging wastewater. Both property rights are rights for a

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16 See DALES (1968), p. 59. DALES mentions a fifth feature: property rights must be tradeable. We will come back to this later. See also PANAYOTOU (1990), p. 22.

17 See, for example, CLAPHAM (1993), p. 35.

18 WONGBANDIT/ MEWONGUKOTE/ JAIHARN (1993), p. 2.

19 An alternative would be to view the state as a semi-private owner of the resource. WONGBANDIT/ MEWONGUKOTE/ JAIHARN (1993), p. 2 oppose this view.

20 WONGBANDIT/ MEWONGUKOTE/ JAIHARN (1993), p. 2 see the *public domain regime* as generally inconsistent with tradeable permits.

special utilization. Although they are based on the same physical resource, they will be treated separately. We will turn to freshwater first, then we will cover wastewater.

Freshwater is used for irrigational purposes in agriculture, for tap water in urban and rural areas, and for industry. Freshwater can be drawn from surface water and groundwater at various depths. For either source it is possible to control the amounts of water drawn. Controlling this can only take place at certain costs.

With emerging shortages conflicts arise between different regions, various groups of the population or sectors of the economy. In the absence of yet established property rights, the event of actual shortages will produce some priority list for uses. Most likely those uses will enjoy priority which represent the greatest force in lobbying the government. Obviously, this does not need to be the group which is using the resource with the greatest benefit for the society. In order to create property rights which can be converted into tradeable property rights at a later stage, they must be defined clearly and exclusively. Despite some traditions to accept resource utilization by customary rights, permits or titles are an expression of property rights which offer an institutionalized form of adequately defining the property right.

Property rights are generally issued as either titles or permits. Titles signify private ownership but will be issued by the state which thereby guarantees validity of the property right. Permits will be granted by the state according to certain rules. Titles will be issued under a *private property regime*, permits will be given out under a *public domain* or *state ownership system*.

In order to enforce property rights, the issuing agency must have power to monitor freshwater consumption. Enforcement requires sufficient manpower, technical capability and legal measures to sanction non-compliance with the property right. Ideally, one agency is responsible for all these functions. As different sources of freshwater exist, e. g. surface water, groundwater, historically grown administrative structures might prevent to administer the entire resource by a single agency. If this is the case, it is even more important to unite the power to monitor, enforce and issue permits for one source of freshwater in the same agency to avoid inter-agency frictions.[21]

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[21] Frequently third-party monitoring is suggested to ease the administrative burden. See LIMVORAPITAK (1993), p. 85. For a critique see LÜBBE-WOLFF/ STEENKEN (1993). Third-party monitoring is not in conflict with an agency uniformly resonsible.

Permits for freshwater should be issued for a certain duration, in connection with a specific location and source, and with details about the extent to which freshwater can be extracted or drawn over time.

If permits contain the above information they can form the basis of an effective control system as well as long-term resource planning. As will be seen below, these are prerequisites for implementing economic instruments.

Wastewater comes from households, from the agro-industry or from manufacturing industry. In the context of this report wastewater is referred to as being effluent from point sources. Not included is run-off water polluted by pesticides, herbizides or fertilizers which can be a serious threat to water quality as well.[22] Historically, property rights for wastewater usually come into play when in the course of industrialization pollution occurs in such a concentrated dose that other uses of the water body are threatened. Most common are conflicts between effluent-intensive industries like pulp and paper mills or electroplating industry and fishing or drawing of drinking water. In order to curb such conflicts *command-and-control*-policies are introduced which set standards to either the amount of wastewater, the concentration of substances or both. As described above, such standards are already an expression of property rights concerning the discharge of wastewater.

Standard setting can be varied according to the management perspective of the water resource. It can either be focussing on emissions. Then it is limiting concentration and/or total volume of the discharge. Or it can be focussing on immissions, then standards for point sources relate to some ambient quality measure of the receiving stretch of water. Only if standard setting occurs under an ambient quality-related management strategy, standards will vary according to the location of industry. Ultimately, all emission standards should relate to ambient standards. By complying with ambient standards the various uses of watercourses are protected. Competing usages of a water body will always depend on the condition of the water body itself, and not on the emission of one point source. Therefore, ambient standards must be developed for stretches of streams according to the services they render. But usually long before ambient standards are developed and monitored, *hot spots* will occur which will force politicians to impose emission standards on polluters.

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[22] See LIMVORAPITAK (1993), p. 15 who lists this as one of the water polluting sources.

Ambient standards must be developed by an agency according to the different purposes the water body is serving. Since such services change over time, the agency will have to check occasionally on changes in demand for ambient standards.[23] According to ambient standards and industry located along the stretch of water, the agency will be setting emission standards. Obviously, a prerequisite for setting emission standards is detailed information on the type, size and exact location of plants. The agency will issue permits for the individual point sources for a specified duration. Permits for wastewater should contain, besides the duration and location of the point source, maximum concentration of pollutants for each point of time, and maximum loads of pollutants per time period.

Compliance with standards can be achieved by monitoring discharges of wastewater.[24] Again, monitoring is costly. But to guarantee the exclusiveness of property rights these costs must be born to some extent. As pointed out above, some portion of control costs for monitoring freshwater consumption as well as wastewater discharge is independent of the implementation of economic instruments, but occur whenever any kind of property right is introduced. On the other hand some control cost will depend on the instruments implemented.

For non-complying point-sources the agency should be given the power to impose a penalty. A penalty can give an incentive to users of resources to exploit the resource only within the prescribed limits.[25] Economically speaking, penalties curb the profit-seeking behaviour of polluters.[26] They should be severe enough to give sufficient incentives to adhere to standards or property rights, but, except for perhaps highly toxic and hazardous substances, they should not attempt to lead to an absolute adherence regardless of costs.

The definition of property rights, either for using freshwater or for discharging wastewater, necessarily has distributive effects. Emission standards will force polluters to spend money on abatement technology. The cost of investment and operation will be shifted to purchasers of the polluter's goods. If polluters are households, they will have little opportunity of shifting the burden to others. While the definition of property rights for pollution will not go by unnoticed by

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23 Ambient standards must also ensure that ecological functions are not perturbed.

24 See RICHARDSON/ OGUS/ BURROWS (1982), p. 78 for the British system of enforcement institutions.

25 RICHARDSON/ OGUS/ BURROWS (1982), p. 62.

26 PANAYOTOU (1991), p. 95.

the respective industries, the subsequent shifting of abatement costs, if possible, might very well go unnoticed. If industry is aware of the possibility to shift costs to consumers, the defining of property rights on using freshwater can be a rather hidden way of imposing costs on households. If property rights are allocated according to customary rights, current users will hardly resist the implementation while future users will not be represented in the lobbying process. Then, costs for demanders arise mostly from shortages of water which impose a uniform and proportional reduction of the property rights. At any rate, costs will emerge with shortages but not before.

In order to change behavior of resource users without causing great disruptions in the economy, the staging approach introduces costs consecutively. At this stage, costs occur in the form of abatement costs to polluters resulting from the definition and allocation of property rights and from penalties. Since penalties can be avoided by adhering to standards, only abatement costs remain.

2.2.2 Stage II: Implementing Fees

In this report, fees are meant to cover the private cost of infrastructure. So they are understood as a user-charge. But they are not an environmental user charge since they are not related directly to an environmental resource. By definition, fees will not include social or external cost by themselves.[27]

Infrastructure includes dams, irrigation canals, pre-treatment and freshwater pipes on the freshwater side; for wastewater it includes sewage systems and waste water treatment facilities. Freshwater fees will not include a price for the scarcity of the freshwater resource directly. Indirectly, however, there can be an element of scarcity pricing within the fee, if costs for producing freshwater are rising because groundwater must be extracted from greater depths, surface water must be pre-treated or transported through pipelines over long distances. This, however, should not be mistaken as including the social cost of using the resource as it will be through an environmental charge. Concerning wastewater fees, there is a similiar implication: rising fees usually reflect tighter effluent standards which in turn are based on some conflict over the use of water bodies. In this way, wastewater fees indirectly give some indication of the

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[27] Of course, once charges are introduced and a point source must pay a charge, this amount accrues as a private cost to the users of the infrastructure(KIBAT (1984), p. 708). Then, and only then, fees will include some social cost as well. See with a different approach: ZIMMERMANN (1981), p. 542.

resource scarcity as well. Again, this reflection is quite distinct from including social cost through charges.

In their implementation fees for either freshwater supply or wastewater treatment depend on the existence of property rights. Treatment facilities will be built only if other uses of water bodies compete with the discharges, and if these uses are protected by some enforceable property right. On the other hand, irrigation water or tap water can only be provided if the supplying agency holds some property right for using water. Property rights represent a necessary precondition before fees[28] can be implemented.

2.2.2.1 Fees for Freshwater

Fees for freshwater are ment to cover the private costs of infrastructure. In this sense, fees can be expected to provide means for operating and maintaining and modernizing existing facilities. But by definition, fees cannot be expected to give an incentive to utilize less water, if the no infrastructure is utilized. For example, plants frequently drill wells to extract groundwater. Naturally, they must bear their expenses for the well. But since they use no infrastructure, fees cannot give them an incentive to use less water. Such an incentive can be given through charges or tradeable permits which will be discussed in Stage III.

In order to implement freshwater fees certain requirements must be met referring to (1) the organizational structure (2) the legal situation (3) the monitoring and adequate penalties.

(1) The *organizational structure* of the freshwater supplier must include the entire generation and supply of freshwater. If the organization includes only part of the production process, some mechanism between the concerned agencies must provide for cost-covering prices for the demanders. Let us review two examples: Freshwater can be drawn from groundwater to feed drinking water systems of communities. The agency which operates the wells must be either included in the cost-calculation of the agency which distributes the water throughout a city, or it must charge the distributing agency at its own cost. Another example of an organizational disunity occurs in the case of dams. Dams usually are built for a variety of reasons: they provide drinking water and

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[28] The same is true for tradeable permits and charges.

irrigation water for dry seasons, and they can serve the generation of electricity. Therefore, the dam will be usually administered by a separate organization. This organization must give the appropriate signal for cost-covering prices to the agencies which distribute the water and charge the consumer with a fee. If the costs of other agencies than the finally distributing agency are neglected, fees will not cover private costs of generating freshwater, and the society at large will have to subsidize the price of freshwater supply.

The implementation of fees includes also the actual charging and collecting. In many developing countries, direct taxes as well as fees are not widely used as a source of revenue for the state. Consequently, fee collecting institutions will not exist yet. Fees should be collected by the agency which provides the irrigation or tap water. These agencies are in control of the physical infrastructure, they will install meters, and they will have an interest in shifting their costs on to consumers by collecting the fee. Funds raised by the fee will empower them to improve or extend their services. This provides an incentive for enforcement.

(2) The second issue concerned is the *legal situation*: The agency providing drinking water must be allowed to charge fees. If, as in many countries, this agency is an office of the local administration, the local level of government must be empowered to collect fees. If fees are collected at the local government level, the implementation process can have some decentralizing effects in centralized systems. The local government is gaining power by securing a service such as freshwater disribution and wastewater treatment for which it may charge cost-covering fees. In countries where decentralization is among the policy objectives this might constitute a small problem. Countries, which follow centralization tendencies will probably object to the independence local governments gain by fees.

However the general policy on centralization is, the calculation of fees should follow the same guidelines throughout the country. The guidelines must define what costs can be included, how the funds raised by fees should be administered in the local government’s budget, etc. Water supply fees for irrigation should follow a similiar guideline. In this case, a regional agency according to river basins might be a better choice. Whatever agency is responsible for the distribution of irrigation water, it should be empowered to introduce a cost-covering fee. As centralized irrigation systems have a tendency

to operate inefficiently, farmers might be welcoming a fee, if it causes irrigation to become more effective.

(3) The third issue mentioned above is *monitoring*. The water supply agency will have an interest in monitoring the amount of water drawn by every customer in order to charge him. A technical prerequisite are meters for tap water.[29] In the case of irrigation estimations can substitute exact metering. At the same time, the unauthorized drawing of drinking water or irrigation water should be penalized. Penalties should be severe enough to give a disincentive for illegal consumption of freshwater.[30]

The fact that water supply agencies will monitor their customers does not yet imply that they will use the freshwater drawn efficiently. One of the major losses of drinking water is caused by losses from underground pipelines. In some cities such losses account for up to 40 % of the water supplied. An incentive to water suppliers for efficiently distributing water can be a charge on every cubicmeter drawn. As such a charge cannot be connected to private costs at all, we will consider such a charge in Stage III. However, it should be mentioned that the financial constraint is the most common restriction water suppliers face on installing proper pipelines. This constraint could be eased by freshwater fees.

2.2.2.2 Fees for Wastewater

Wastewater fees face a set of requirements for the implementation as well: It consists again of (1) organizational requirements, (2) legal requirements and (3) monitoring problems. The requirements differ to a certain extent from freshwater fees.

(1) Wastewater must be collected from point sources and treated. In order to do so, an institution must be created on the municipal level which is authorized as well as technically capable of building and running facilities. In countries with scarce educated manpower this may be a serious constraint. Since fees will be collected as services are rendered, initial investments must be financed either by the general budget or loans on future revenues.

(2) Apart from creating a responsible institution, legal barriers to charging fees by communities must be removed. By shifting some "power to tax" to local

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[29] Metering is also possible for the extraction of ground water by industry. However, as we are concerned with fees as covering private costs, industry which extracts groundwater from their own wells are unaffected by these considerations.

[30] See TIETENBERG (1985), p. 171-175 for the economics of enforcement with penalties.

governments the internal balance of power is changed, even if only fees are concerned. In order to ensure that cost-covering fees are not used as a general source of income for communities, the funds must be ear-marked.

(3) Since the amount of wastewater in households largely depends on the amount of freshwater consumption, the latter should be used as a basis for calculating wastewater fees. Industrial or trade effluents discharged into the municipal sewage system must be treated differently. In industrial processes water can be incorporated into the product, for example in bread, or it can vaporize. For dischargers differing from households in their freshwater/wastewater relation individual or production oriented estimates must subsitute the assumption of identical volumes.

The same institution which collects freshwater fees should also collect wastewater fees in order to lower administrative costs.

By introducing cost-covering fees for infrastructure only allocative aspects were considered. The users of the infrastructure were supposed to receive incentives to use the infrastructure only to a level at which marginal gains equal marginal costs. In this perspective distributional aspects were completely neglected. Fees, however, have distributional effects severe enough to postpone their implementation. Assuming that the final incidence of fees will rest on households[31], the crucial question is, whether low income households are more affected than high income households. Various studies suggest that fees have a regressive effect, i. e. the burden of fees will be felt stronger by low-income groups.[32]

The regressiveness of fees carries some important implications for the implementation process. Political resistance as well as attempts to illegally bypass paying the fee can cause serious problems. Therefore it can be necessary to implement fees step by step. Since wastewater fees and freshwater fees will both be perceived by the public as a price increase of using water, they should not be introduced at the same time. In addition, fees can be split: if initial investment cost is financed by the general budget, and only operating and maintenance costs will be covered by the fee, the regressive

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[31] Industry as well as agriculture will at least try to shift the burden of fees on to the purchaser of the product. Of course, the burden can only be shifted, if price elasticities of demand allow to increase the price without an offsetting demand reduction.

[32] See ZIMMERMANN (1981), p. 384 and p. 542 with further references. Also O'CONNOR (1993), p. 35.

effect of the fee will be alleviated if the state's budget is financed more or less by a progressive income tax or duties. Even though an implementation of fees step by step should be considered under distributive aspects, it remains that the desired allocative effects can only be achieved once fees cover the full costs of infrastructure. It should be noted, that a fee system which is progressive with respect to the discharged volume does not give an appropriate allocative signal. It should rather be seen as a cross-subsidiy from greater wastewater dischargers to smaller ones. If these groups happen to be identical with high income and low income groups respectively distributional effects will be reduced.

Allocative distortions also ocurr if fees are offset by redistributing the funds raised to low-income groups. If these groups receive as much as they pay, the incentive to lower consumption according to their marginal benefit will be reduced. It should be emphasized that fees only serve the purpose of financing infrastructure.

It is quite a different issue, if the income tax is lowered in order to compensate low-income groups for the regressive effect of fees. But traditionally, the income tax serves a very different purpose and has very different dynamic characteristics from fees so that it might be possible to offset initial burden fees have on low income groups.[33] But it will be difficult to maintain the offsetting effect over the years. In developing countries, an additional difficulty is that income tax systems are not widely used since they require an effective finance administration and demand more bureaucratic efforts and costs than indirect taxes. It is far more difficult to construe offsetting distributional effects of fees through lowering direct taxes.

2.2.3 Stage III: Implementing Licenses and Charges

At Stage III licenses and charges are introduced to the management of natural resources. The objective of licenses and charges is to reduce demand according to environmental scarcity. They have the advantage of achieving their objective cost-effectively. The cost-effectiveness is the major advantage these instruments have over a *command-and-control* policy.[34] Licences and their derivative tradeable permits vary in their degree of constituting property rights. Although charges seem to have little connection with property rights they

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[33] See for different dynamic features as well as different functions the German debate on the ecological tax system, for example EWRINGMANN (1993).

[34] BAUMOL/ OATES (1988), Chapter 8, TIETENBERG (1985), p. 16-22, PEARCE/ TURNER (1990), Chapters 7 and 8.

depend on permits issued on the basis of property rights if they are not based on actual consumption or emissions. We will rely upon the discussion of property rights regimes of Stage I and fees of Stage II.

Another issue with regard to the implementing process of charges and licenses is the public acceptance. In connection with fees it was mentioned that acceptance depends strongly on the distributive effects of the instrument. We will take up this issue again as we discuss charges and licenses.

Again, we will discuss the freshwater side and the wastewater side separately. But there are some common features which should be mentioned first. Licenses or tradeable permits as well as tradeable discharge permits operate on the basis of a fixed amount of a resource. Only this amount may be utilized. State intervention concentrates on limiting the amount of the resource by giving out a restricted number of permits. Once permits are issued, they can be reallocated by trading in the market. The arising market price depends solely on supply and demand of permits. Charges, by contrast, work the other way around: the intervening state sets up a price at which freshwater can be utilized (or at which wastewater can be discharged). But the final decision of how much freshwater will be used (or how much wastewater will be discharged) rests with the individual.[35]

For a long time, economists proposed "pure" instrumental solutions to environmental problems. Meanwhile, awareness is widely spread that economic instruments in managing water resources are, first, never implemented into environments which are not already governed by a *command-and-control* policy, secondly, economic instruments need siding by other instruments to avoid undesirable environmental effects. We are reflecting this approach of mixed instruments by suggesting to view the implementation of economic instruments in stages.

2.2.3.1 Tradeable Permits and Charges for Freshwater

The problem of freshwater was already described above: various different users compete for the sources of freshwater which they either need for production or consumption. Competition will arise only, if the resource is scarce. Scarcity can be throughout the year or seasonal. Utilization of freshwater occurs in two ways. Water is either consumed as with irrigation or many industrial processes

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[35] Another common feature of tradeable permits and charges is that both fulfill the criteria of static and dynamic efficiency. But in the following discussion emphasis is not placed on the theoretical superiority of economic instruments over a *command-and-control* policy.

where it disappears from the water body, or it is used without diverting the course of the water as is the case with fishing, transporting, etc. Although frequently all uses compete in some ways with each other, we will focus on the consumptive utilization as the severest conflict.

Generally two possible base rights or permits could be designed.[36] The Prioritized Steady Use Right (PSUR) or the Fractional Flow Right (FFR). The PSUR acknowledges seniority in holding a right, i. e. during a water shortage the one who has seniority over the other holders of rights gets as much as the right holds while junior holders possibly receive nothing. But besides seniority, there can be other principles governing priority. It is possible, for instance, to give priority for household consumption and industry over irrigation. With FFRs each holder receives a proportion of the flow regardless of seniority in rights.[37] Either base right or base permit is compatible with any of the property right systems discussed below.

For creating markets the existing base rights must be made tradeable. Tradeability depends on the established property rights regime. Among the three possible regimes, *state ownership*, *public domain system* and *private ownership with state intervention*, different conditions for creating tradeable rights exist. Obviously, *private ownership*[38] offers the greatest scope for tradeability: state intervention will be restricted to preserve ecological functions of streams, the regeneration of groundwater reservoirs, and the protection of third parties. Since such intervention would have to come along with compensational measures for the holder of property rights, security will be great and tradeability high. Under a *public domain system*[39], permits are given out to use the resource according to certain requirements. If the requirements are met, the permit will be given. Such permits can be restricted to the location and the way of using the resource. According to the circumstances, the state can shape trading rules for permits. Actual trading can only occur with a consent by the state authority. The mere possiblity that the state may deny consent

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36 EHEART/ LYON (1983), p. 888.

37 Both of these base rights stem from the advanced discussion in the United States on the allocation of freshwater through tradeable rights. This is mostly due to the fact that the United States consist of different climatic regions, for example arid regions in the South-West and humid regions in the East. Both regions have their own property rights regime. In the East, under the riparian doctrine each property owner has the right to use the waterway for uses like fishing, swimming, boating, transporting or generating electricity as long as the flow of the water body is not diverted. In the South-West, the regime of appropriative water rights basically establishes property rights according to "first in time means first in right" principle (BURNESS/ QUIRK (1979), p. 25).

38 An example for a *private ownership with state intervention* are the property rights regimes of the United States.

39 A *public domain system* is enforced in Germany.

increases transaction costs considerably, and may prevent trading. In a *state ownership system* the situation is very similar if we assume the state to be bound to use the resource for the benefit of the society.[40] In either system of property rights the state should guarantee a certain duration of permits in order to induce holders of permits to trade. The biggest problem of trading permits is that uncertainty over the extent and duration of permits will prevent holders from trading. Instead they might choose to keep permits for securing their supply of freshwater.

On reviewing the three property rights regimes for creating markets we should distinguish, that in the *private property regime* property rights are traded, while in the *public domain system* and in the *state ownership regime* permits given by the state are exchanged on the market. Economically this difference is important, because a right is connected to a greater certainty than a permit.

For implementing tradeable permits, the state has to register all users of freshwater. Besides the agencies distributing freshwater to households, registration should include industrial and agricultural users. Registration will have to be according to river basins or groundwater reservoirs.[41] For each river basin, the amount of water for utilization must be specified. According to this amount permits can be granted. If a *private ownership regime* operates already, and if property rights exceed the amount of water available for utilization, the state has to compensate for the reduction of rights.[42] The reduction can take place as a proportional reduction of all property rights, or as an offer by the state to buy individual property rights which will not be sold again. In *public domain regimes* and *state ownership regimes* the state can reduce permits according to the environmental scarcity. If no property rights are granted to the users of freshwater, the state must decide on the mechanism by which permits should be given out.

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[40] But if the state is considered a semi-private owner of the resource the situation is more close to one of *private ownership*. Then, the state may freely sell rights to private owners. It remains unclear, though, how the state will protect the rights sold to others. WONGBANDIT/ MEWONGUKOTE/ JAIHARN (1993), pp. 2-3 conclude that a *state ownership system* is only reasonable if the state uses the resource for the social benefit.

[41] It depends on the hydogeological conditions of groundwater reservoirs whether drawing water from rivers should be viewed as the same as extracting water from groundwater reservoirs. See EHEART/ LYON (1983), p. 891.

[42] It might be possible to convert permits with fixed amount to the Fractional Flow Rights mentioned above. But this will require compensation as well.

Basically, there are two different ways for the initial allocation of rights or permits. The state can auction permits. Then all prospective users could bid for permits at the auction. The permits would be bought by the users with the highest returns on the water utilization. Assuming an overall scarcity, the users with the lowest returns on using water in their production process would drop out. The alternative mechanism frequently favoured for the initial distribution of permits is called 'grandfathering'.[43] This means that all current users receive permits according to the amount utilized in some base year. In a situation of scarcity the permits will have to be reduced proportinally. In the absence of strategic behavior by permit holders[44], the reduction will quickly lead to trading because users with high returns will offer increased prices in order to obtain more permits from users with lower returns. The latter, in turn, compare the returns of utilizing one unit of freshwater with the price per unit they can receive on the market.

It is obvious that the initial allocation will have some strong distributional effects. If permits are auctioned, all parties depending on freshwater for their production will be worse off. If permits are grandfathered, they will clearly gain since they receive permits which they can sell thereafter. Specifically those whose opportunity gains by producing are lower than the market price of permits, i. e. those who will actually sell their permits, will receive a compensation for reducing or stopping their utilization. We will come back later to these distributive effects of initially allocating permits.

With charges, by contrast, a problem concerning the initial allocation does not exist. Charges introduce a price for using freshwater. The price must be set to equal demand and supply. If shortages, *ceteris paribus*, still occur the charge is too low. The charge induces users of freshwater with marginal gains below the charge to quit production or consumption. If, for example, the price is set at x per cubic meter all users of freshwater who gain less than x by using one cubic meter will stop production or find ways without using as much water. Dropping out of production, however, will not be compensated.

Charges will raise public revenues.[45] This potential is frequently mentioned by critics[46] as well as proponents[47] of charges. In any case, the allocative effciency

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43 It is also possible to mix grandfathering and auctioning as is the case for permits for ozone depleting substances in Singapore. See O'CONNOR (1993), p. 38; for more details PANAYOTOU (1990), p. 106.

44 TIETENBERG (1985), p. 138.

45 Permits sold at auctions will also result in revenues. See O'CONNOR (1993), p. 38.

46 See for an early and polemic statement FERRAR/ WHINSTON (1972), p. 309.

brought about by the implementation of a charge does not depend on the way the revenue is used. Quite contrary, if the revenue is used to offset some of the effects of the charge inefficiencies might again arise. Redistribution of funds, if it is intended at all, must depend on other parameters than charging. If, as is often the case, the charge is set too low to induce behavioral changes it is reasonable to use the funds raised for an additional effect by subsidizing investments in abatement technology.[48] In practice, charges with rates sufficiently high to give incentives cause strong resistance so that charges are often used only for raising revenues.[49]

Regardless of whether charges or tradeable permits are introduced, an agency must be created which registers all freshwater consumers and their sources. In order to estimate the amount of water available adequately such an agency needs technical as well as administrative staff. For the collection of charges it is desirable to use already established agencies which demand payments according to the permits. In the case of freshwater, fees will be already collected by the irrigation agency or by the freshwater supplier in communities. In these cases the agencies can be charged for their overall consumption, and the agencies can shift the burden on to their customers. If, on the other hand, ground water is extracted by industry or farmers, their extraction must be metered. An additional agency must be created for the control of meters and charging. The same is true for surface water drawn by farmers or industry without using canals or pipelines of the irrigation agency.

2.2.3.2 Tradeable Discharge Permits and Charges for Wastewater

The situation with wastewater is somewhat different from freshwater. For emissions many countries apply the *Polluter-Pays Principle*.[50] Tradeable

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47 PEARCE (1991),p. 52 sees the potential "to offset tax-incidence on low-income groups."

48 PEZZEY (1992), O'CONNOR (1993), p. 37.

49 O'CONNOR (1993), p. 35.

50 Economists vividly discussed the very different implications of the *Polluter-Pays* Principle and the principle of reciprocity as stated by COASE (1960), and it was shown that the *Polluter-Pays* Principle can bring about inefficient results. Generally speaking, it is efficient, if the polluter can vary the level of emissions while the victim has no choice of changing the level or locality of his activity (SCHÄFER (1993), p. 51). In this study we can avoid the dispute over following either PIGOU or COASE since the

discharge permits and charges are both compatible with the *Polluter-Pays-Principle*. They also both achieve cost-effectiveness. Finally, both instruments demand siding by standards in order to avoid hot spots.

The basic requirement for both instruments is that various uses of the water bodies are registered and related to corresponding ambient standards. After assessing the overall carrying capacity of each stretch of water, the maximum load of pollutants can be set. According to this amount, tradeable discharge permits or charges must be designed. For all these informational demands on how and to what extent stretches of water are used, it is apparent that implementation of economic instruments implies more than simply collecting revenues from polluters.

We will turn back to the distinction of licenses and tradeable discharge permits to avoid a common fallacy[51]. As described in Stage I, traditionally *command-and-control* policies are introduced long before economic instruments are considered. The reason is that usually hot spots demand action on behalf of politicians and administrators before any necessity is seen to lower emissions on a large scale.[52] Once standards exist, the scope for licenses in their pure form is rather small. Licenses would include a right to emit as much as the license permits. In their pure academic form they implicitly assume that all polluters are emitting into the same part of the stream so that total emission could be split among the polluters without the possibility of hot spots. Unrestricted trading of licenses cannot achieve ambient standards of rivers if the point sources are unevenly distributed along the river. Tradeable discharge permits, on the other hand, are a practical derivative from licenses. They are subject to trading rules which allow emissions trading only if ambient standard are not violated. Consequently, the pure efficiency gain cannot be expected to be as great as it would be under unrestricted trading. On the other hand, ecological effectiveness is increased.

Charges basically face the same problem: if in the absence of standards a uniform charge would be levied on one pollutant, total emission might be reduced substantially but there is no mechanism to provide for an even reduction throughout the watershed. So it is possible that sources on the lower river cut on their emissions while sources on the upper river do not change

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focus on economic instruments implies to rely upon the tradition of Pigou. See PEARCE/ TURNER (1990), pp.174-175 for an exposition of the *Polluter-Pays* Principle as the OECD defines it.

51 See for instance PANAYOTOU (1991), p. 95, who complains that economic instruments never replaced regulation, but merely supplemented it.

52 O'CONNOR (1993), p. 36 who gives Japan as an example for applying a *command-and-control* policy for immediate relief in the case of the Minamata- and the Itai-Itai-desease (p. 34).

emissions. Then, ambient standards of most of the river would remain more or less unchanged.

In conclusion, the spatial dimension of pollutants is ecologically rather important. Economic instruments must be backed up by trading rules, standards or other regulative measures to achieve the desired ecological effects. Pure instruments fail to achieve ambient standards.

Depending on the property rights regime, a problem of incompatibility can arise with implementing tradeable discharge permits. Economically, tradeable discharge permits constitute a right to emit. Even if legally this right can only be called a permit, the permit must have a certain duration and a certain validity if it is supposed to have some market value. In other words, if tradeability for the permit is desired, the permit turns into a temporary right. Such a temporary right might be considered inconsistent with *public domain regimes* or *state ownership regimes*. Before substantial trading in tradeable discharge permits will take place, legal consistency with the property rights regime must be confirmed by the courts. Otherwise uncertainty over transactions will prevent holders of permits from exploring the gains of additional efforts in abatement and subsequent selling of permits. Such efforts are essential to bring about a sufficient number of transactions on the market for tradeable discharge permits so that a market price can develop. Such a market price, in turn, will give orientation for further polluters to weigh the gains of less pollution against the gains from the sale of permits. Only in such a process of continuous transactions, the efficiency gains of tradeable discharge permits can be achieved.

The problem of an insufficient number of transactions occurring in the market is called *thin markets*.[53] Unfortunately, the most prominent example of tradeable discharge permits for effluent suffered from thin markets.[54] Thin markets are the result of several circumstances. It is obvious that only emittents of the same pollutant can be trading with each other. Different pollutants have very different environmental impacts which cannot be substituted.[55] A second restriction stems from the necessity to avoid *hot spots* by giving out trading rules or setting maximum ambient standards. Under such a trading rule only certain sources

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[53] See, for example, PANAYOTOU (1990), p. 23.

[54] See VAN MARK/ GAWEL/ EWRINGMANN (1992), p. 31; JOERES/ DAVID (1983), p. 163; O'NEIL (1980).

[55] Even emissions measured by the same parameter, say biological oxygen demand, chemical-biological oxygen demand or, even more obvious, suspended solids, have different environmental impacts.

can trade with each other only to an extent which does not violate ambient standards. Toxic pollutants, such as mercury or other heavy metals, may be excluded from trading altogether.

Effluent charges work differently. By nature, they do not depend on trades but rather on the effect any kind of charge has on individuals. Beginning with the announcement effect, polluters will look for opportunities to bypass paying the charge. The most obvious way to bypass is to discharge less pollutants. Usually, reducing discharges will be in some connection with a change of inputs, cleaner technology or more abatement technology. In most cases higher costs must be weighted against the reduction of the charge, i. e. discharges will be reduced until the marginal cost of avoiding discharges will equal the marginal charge. If, as possible for individual polluters, the marginal cost of abatement exceeds the charge, the polluter will not reduce discharges at all but will pay the charge. If no polluter can be induced by the charge to reduce emissions, the charge is set too low to give the desired incentive.

Wastewater is generated by households, industry and the agro-industry. The number of sources is large. For the implementation of permits as well as charges only those sources can be included which use the carrying capacity of a body of water. As was explained above, charges and permits both give a price signal of the scarcity of an environmental good. It follows that the charge cannot be levied on dischargers who emit their effluent into the sewage system because they do not make use of the scarce carrying capacity of the river. However, since the municipal treatment plant at the end of the sewage system will discharge some proportion of the pollutants into the river, the treatment plant will be subject to the charge. The charge paid by the treatment facility will be part of the total cost accruing over the year. And, if the suggested implementation process is followed, the total cost will be covered by fees paid by the users of the municipal sewage system. Ideally, the scarcity price for ambient quality will be passed on to the wastewater sources which indirectly make use of the scarce resource.[56] For the implementation of a charge system one major point should be noticed: by including only the direct dischargers the number of sources is substantially reduced.

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[56] See KIBAT (1984) for an exposition of the problems connected with shifting the German effluent charge on to indirect dischargers.

Effluent charges can be either based on the amount of pollutants allowed in the permit, or they can be based on actual emissions. A charge on actual emissions would require either continuous monitoring, which is prohibitively expensive, or monitoring based on samples taken randomly. While the latter is still rather costly, if samples are taken only three or four times a year, it carries the additional disadvantage of founding the payment for an entire year on a few non-representative moments. Resistance to high payments will very likely be great, and many dischargers may decline to pay and rather go to court.

In order to keep resistance and monitoring costs low, the charge could be based on the permit. The permit would have to be issued with maximum loads per annum of all pollutants. The charge would be levied on this maximum load. If the discharger believes that he is emitting much less than actually permitted, he may apply for a reduced permit.[57] The state will monitor dischargers at random. Dischargers will be monitoring their effluents themselves: First, because they have some incentive to apply for reduced permits. Secondly, because they will have some interest in complying with the limits of the reduced permit, if penalties are high enough for emitting more than permitted. A charge based on permits is therefore easier to implement than a charge on actual emissions.[58]

2.3 Summary of the Staging Approach

At Stage I property rights and permits were introduced. Property rights play an important role in the implementation process of economic instruments. Before fees can be introduced at Stage II some property rights must be assumed, otherwise infrastructure would be superfluous. Once fees are in place, scarcity signals can be given by implementing tradeable permits or charges at Stage III. Both depend on property rights. With tradeable permits the connection is very obvious: the existing permits must be made transferable. With charges the connection is less direct: charges must be imposed on the basis of either actual utilization of the resource or on some permit issued. Charges on the basis of actual utilization are virtually impossible if the number of users is large. Therefore, charges are usually based on permits and are enforced by random checks. Tradeable permits as well as charges eventually impose costs on users. Agencies which provide tap water or irrigation water[59] for a large number of clients must shift their cost on to final consumers. An adequate mechanism

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[57] The first implemented form of the German effluent charge allowed dischargers to reduce their permit if their actual emissions was 25 % below the standards of their permit (§ 4 Abs. 5 AbwAG). Later this rate was reduced to 20 %.

[58] WORLD BANK (1993) labels such a charge "presumptive".

[59] The same is true for wastewater from households or industrial sources.

to do so is to add resource costs to the fee which pays for the utilization of infrastructure. For this reason charges and tradeable permits should be introduced after fees.

An additional reason is provided by the negative distributive effects of fees and charges. Both instruments have regressive effects. If political resistance is to be kept at bay they should be introduced one after the other or effects should be mitigated by other measures. Quite differently is the distributive effect of grandfathered permits. As mostly farmers as the historical users of irrigation water would receive permits, they could weigh income generated by selling permits against income generated by irrigating their fields. For any income loss due to reduced irrigation they receive a compensation in form of the price per permit.

Tab. 1: *The Staging Approach*

Stage	instrument	institution	objective/incentive
I	- property rights for utilizing the resource - permits - penalties	- administration capable of monitoring and enforcing permits	- registration of uses and users - precondition for long-term planning
II	- freshwater fees - wastewater fees should be identical with the institution operating the infrastructure	- the institution imposing the fee	- finance private cost of infrastructure - prevent overutilization of infrastructure
III	- tradeable permits	- "stock exchange" for permits, the volume utilized, the price is floating	- reducing resource utilization by fixing
	- charge	- administration with environmental and financial capability to impose the charge	- reducing resource utilization by fixing the price (charge), the volume utilized varies

3 Current Water Management in Thailand

This chapter is designed to provide all the essential information on Thailand's current water management in order to classify the water resources management according to the staging approach of Chapter 2. In Chapter 4 we will then be able to use the results of this chapter to analyse the scope for institutional cooperation through donor organizations. The

following section will serve as an introduction to the environment in which Thailand's water management is operating (Section 3.1). Then, in Section 3.2, we will discuss Thailand's freshwater management.[60] Section 3.3 deals with the management of wastewater.

3.1 General Conditions for Thailand's Water Management

Thailand's average rainfall is at 500-1,000 mm/a, some areas receive as much as 1,000-2,000 mm/a. The monsoonal climate brings heavy rain during the summer whereas the winter, in contrast, is extremely dry. The country can be divided into five regions: the Bangkok Metropolitan Region, the Central Plains, the North, the Northeast and the South. Three of the five regions depend on the same river basins: the North, where these rivers originate, the Central Plains which functions as Thailand's granary, and the Bangkok Metropolitan Region at the Gulf of Thailand, where most of Thailand's industry is concentrated.[61] The Northeast, separated from the Central Plains by a watershed, and also the South are depending on their own water resources. Conflicts of using water resources are most aggravated between the three regions mentioned first. In this core region most Thailand's industry and agriculture competes for resources. As water is one of the major inputs for the traditional rice farmer, competition is not only between different sectors of the economy but also between the rural and the urban, the poor and the rich, the traditional and the modern population of Thailand.

In view of average rainfalls it cannot surprise that the traditional attitude of Thais with water is relying on abundance of supply.[62] For centuries water was a free good. Agriculture, for a long time Thailand's driving force to an export-oriented economy, was based on rice crops in the Central Plains. Occasional shortages were seen in connection with poor administrative supply management or a lack of dams. Over the years, the major concern was on improving the supply management. Building dams was supposed to help seasonal shortages in the dry season and long channels were supposed to provide tap water for the most densely populated Bangkok Metropolitan Region. By now, it is widely acknowledged that the problem of spatial and seasonal shortages cannot be solved only by methods of supply management. In addition, policy instruments are suggested which give incentives to reduce water consumption to efficiency levels.

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60 Freshwater will include water used for irrigation and industry and water used for tap water.

61 PHANTUMVANIT/ PANAYOTOU (1990), p. 6 and 36.

62 See KAOSA-ARD/ KOSITRAT (1993), p. 2.

In connection with the supply of water resources one of the major issues in Thailand is deforestation. Apart from the Central Plains and the Bangkok Metropolitan Region, Thailand still has some tropical and subtropical forests though areas covered by forests in 1991 are approximately half of what was there in 1961.[63] Land ripped of forests quickly eroded and lost its capability to store water. Run-off water therefore increased considerably during the rainy season, and is frequently causing floods and landslides.[64] During the dry season the slow trickle of water from forest-covered areas is now missing as a continous contribution to the water stored in artificial lakes. Although deforestation is certainly a problem relevant to managing water resources the issues of reforestation, adequate land titles for slash-and burn-farmers, etc. cannot be addressed in this study.[65]

The growth of GDP over the last eight years was primarily based on a booming manufacturing sector. Apparently, environmental problems increased as output of industry grew. Since the majority of Thailand's industry is located in the most densely populated Bangkok Metropolitan Region, the increase of pollution was felt by a large part of Thailand's population.

3.2 Freshwater Management

Freshwater resources used in industry, agriculture and for household consumption are administered and distributed by various agencies. The Royal Irrigation Department is responsible for irrigation water. Tap water for households is provided by the Metropolitan Water Works Authority and the Provincial Water Works Authority. Water drawn from surface water for industry in designated Irrigation Areas must be permitted by the Royal Irrigation Department. Within Groundwater Areas another agency controls the exploitation of groundwater reservoirs.

3.2.1 Property Rights and Permits for Freshwater

Property rights for freshwater were not explicitly addressed by lawmakers in Thailand. Considering the historic abundance of water this cannot surprise. Currently, there is some academic as well as political debate in Thailand about the existing laws and how they can be interpreted with regard to property

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63 RFD (1993), p. 14.

64 See also LIMVORAPITAK (1993), p. 15 who mentions soil erosion as one of the sources of water pollution.

65 For more details on the sollution as approached by the Thai Government see RFD (1993).

rights.[66] As it is impossible to give a detailed picture of this debate, we will follow generally the interpretation of the Thammasat University.[67]

Water exists as water in watercourses,[68] run-off water, natural springs, groundwater, sea water and atmospheric water. For water in watercourses, etc. the Civil and Commercial Code, Section 1304 states that the public domain of the state includes "property for the common use of the people, e. g. foreshores, waterways, highways, lakes,..."[69]. While the issue of property rights of watercourses is fairly agreed upon by lawyers as a public domain regime, the ownership of run-off water and natural springs is more problematic. Section 1339 of the above quoted Code states:

"The owner of a piece of land is bound to take the water that flows naturally on to it from higher land. Water that flows naturally on to lower land and is necessary to such land may be retained by the owner of the higher land only to such an extent as is indispensable to his land."[70]

The authors suggest that this should be interpreted as a state ownership of run-off water, because land owners are only permitted to use run-off water to a certain extent. As mentioned already in Chapter 2, the legal phrase of "utilizing" can economically represent a property right. In the case of run-off water, the usufructuary right is to some extent reserved for the land owner, who must leave some to land owners below. Apparently there were few conflicts over run-off water between land owners yet; otherwise the legal situation would, perhaps, be a little clearer. In conclusion we note that usufructuary property rights on run-off water are split between upper and lower land owners while the state, as interpreted by the authors, reserves the ownership.[71] The same holds for natural springs to which the same legal provision is applied.

A different issue is groundwater: Section 16 of the Groundwater Act requires everybody to apply for a license if he desires to extract groundwater in the area subject to the Act. This area, called the Groundwater Area, is basically identical

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66 WONGBANDIT/ MEWONGUKOTE/ JAIHARN (1993) and interviews conducted at Thammasat University and Chualongkorn University.

67 See for the following WONGBANDIT/ MEWONGUKOTE/ JAIHARN (1993).

68 Including lakes, lagoons, etc.

69 Cited from WONGBANDIT/ MEWONGUKOTE/ JAIHARN (1993), p. 4.

70 Cited from WONGBANDIT/ MEWONGUKOTE/ JAIHARN (1993), p. 5.

71 Ownership in contrast to the usufructuary property right means the right to use it in any way which makes it impossible for others to use, for example, to dilute the run-off water for other purposes.

with the Bangkok Metropolitan Region. The Groundwater Act, originally designed to prevent further land subsidence[72], is again not explictly reserving ownership for the state. But, following the analysis of the Thammasat University, one may implicitly conclude that the state administers groundwater resources for the benefit of the general public.

Outside of the area[73] covered by the Groundwater Act, Section 1335 of the Civil and Commercial Code could apply. This section views everything beneath the surface as belonging to the land owner. Although it can be assumed that legislators intended the holders of land titles to own mineral deposits, it may be difficult to apply the concept of absolute ownership with regard to groundwater since groundwater does not flow according to the lines of private property. Despite this difficulty and by indicating that the doctrine of absolute ownership led to conflicts of uses in the United States the research team of the Thammasat Universtity suggests to view groundwater generally as being reserved by the state under a public domain regime. In economic terms, groundwater outside of the Groundwater Area is an unrestricted common property.

Regarding sea water, property rights are rather clear. Sea water is seen as a public domain property under Section 1304 of the Civil and Commercial Code because it is reserved for common use. The only case in which property rights remain unclear to the research team of the Thammasat University is atmospheric water. While the current situation is that technical difficulties prevent anyone from exclusively using atmospheric water for his own purposes, which could be possible by cloud seeding in the future, the suggestion is to pass a law reserving ownership for the state.

We can conclude[74] that all property rights of water resources are supposedly reserved for the state under a public domain regime, i. e. the state allows individuals as well as the general public to use the resource according to

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72 WORLD BANK (1993), p. 34 states that subsidence was 50 cm over the last 20-25 years.

73 And also 15 m below the surface since the Groundwater Act only applies to a depth of 15 m.

74 Albeit based entirely on the results of the report of the Thammasat University, the argument which led to the conclusion may be regarded as a little weak. In the absence of an alternative we will follow the results of WONGBANDIT/ MEWONGUKOTE/ JAIHARN (1993).

certain rules.[75] The usufructuary right of using run-off water to a certain extent rests with the land owners.

Following our conclusion we can turn our attention to permits. Currently permits are only required for extracting groundwater in the area of Bangkok,[76] for irrigating fields in specified irrigation areas with water from designated irrigation canals, or for industrial users in specified irrigation areas.[77] Other cases of regulated uses of water, but of minor importance for managing water resources, are in mining and hydropower generation.

Referring to Chapter 2, permits are an instrument to control individual uses of resources, and to plan the entire resource utilization over time. As shortages of the resource in question occur, permits are seen as one of the first instruments to implement in order to give appropriate incentives at later stages. With regard to Thailand's existing permit system, we can safely conclude that the potential of this basic controlling and planning instrument is not utilized yet. This is partly due to weak property rights, and partly due to a lack of appropriate legislation which enforces the application of permits to all uses of freshwater resources.[78]

Increasing demands and the lack of planning over the last years led to shortages of freshwater in the dry season. The arising conflicts were decided in favour of the Bangkok Metropolitan Region.[79] Farmers had to change to other crops than rice for their second harvest. In some areas famers did not even receive enough irrigation water for any cultivation. Subsequently, farmers move to industrialized areas in search for other jobs. As the manufacturing sector is still expanding, and the concentration process of the population in the Bangkok Metropolitan Region does not subside, shortages of fresh water will persist. Besides finding an allocative rule which brings freshwater in the most-beneficiary use, some measures must be found to ease the distributive impacts on the rural population.

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75 The distinction between a *public domain regime* and a *state ownership regime* turned rather diffuse by now. The emphasis is put on the reservation of ownership rights for the state in order to act for the public welfare. We will not enter into an academic hairsplitting whether the Thai system as interpreted by WONGBANDIT/ MEWONGUKOTE/ JAIHARN (1993) is a *public domain regime* or a *state ownership regime* after all.

76 WONGBANDIT/ MEWONGUKOTE/ JAIHARN (1993), p. 8.

77 WONGBANDIT/ MEWONGUKOTE/ JAIHARN (1993), p. 12. The legal basis is the Public Irrigation Act.

78 It seems reasonable to exclude freshwater used for households. WONGBANDIT/ MEWONGUKOTE/ JAIHARN (1993), p. 16.

79 Although WONGBANDIT/ MEWONGUKOTE/ JAIHARN (1993), p. 15 see an advantage of upstream water users.

3.2.2 Fees for Freshwater

Most of the freshwater goes into agriculture (70 %), much less into industry (20 %), and a minor portion is consumed by households (10 %). Apparently, most of the wasting of water also takes place within agriculture, when irrigation water seeps from secondary and tertiary canals.[80] Another problem is that due to an insufficient management water often is provided too irregular for optimal growth of plants. Then, farmers let the water simply run off elsewhere. Implementing fees for using irrigation infrastructure would provide an incentive for a more efficient utilization of irrigation water. But to impose fees on the volume of water drawn requires metering in irrigation canals which is costly. While it may be worthwhile to meter water in primary and secondary canals, the costs increase proportionally with the number of meters installed. Instead of metering water for each individual paddy field at prohibitive costs, water user associations should be formed which receive a certain volume of water and are responsible for providing their members with the adequate proportions of water.[81] Such water user associations would have to pay fees for the volume of water received from irrigation canals. In turn, they must find an appropriate measure to regain their payments for fees from their members based on the consumption of water.[82] Since water user associations will be formed on a very low level, say parts of valleys or villages, control and monitor problems will be diminished; pressure from the social environment will substitute strict policing by government agencies.

Currently there is no general fee system[83] with regard to the volume of irrigation water, but the Royal Irrigation Department registers all users of waters from irrigation canals. This registration could serve as a basis to implement a fee system. But one of the preconditions for implementing fees on irrigation water is the forming of water user associations to keep control costs at bay.[84] Another precondition is the installation of meters in primary and secondary irrigation canals. A third precondition is the establishing of a new branch within the Royal Irrigation Department which would check meters and collect the fee.

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80 Inofficial estimates claim losses of about 50 %.

81 STAMM-BERG (1993), PANAYOTOU (1991). The management of *local commons* is discussed extensively in OSTROM (1990), BARDHAN (1993), OSTROM/ GARDNER (1993) and SEABRIGHT (1993).

82 Possibly by square meter and ground conditions or by opening time of flood gates, etc.

83 A very low fee based on the volume of water drawn is imposed on a few industrial demanders. See KAOSA-ARD/ KOSITRAT (1993), p. 5.

84 Such a provision is also suggested by WONGBANDIT/ MEWONGUKOTE/ JAIHARN (1993), p. 97 in their draft for a Water Resources Act.

Fees, however, should not be paid only for irrigation, but for any public service in connection with fresh water, i. e. also for drinking water. Currently drinking water is provided by the Provincial Water Works Authority and the Metropolitan Water Works Authority. The latter provides drinking water for the Bangkok Metropolitan Region.[85] The main source for tap water is the Chao Praya from which raw water is drawn at approximately halfway upstream. The raw water is treated and then fed into pipelines which lead to Bangkok's tab system. It is apparent that such an extensive transportation of tap water and the treatment causes costs. These costs should be covered by fees.

Some time ago, Bangkok introduced a fee for tap water in order to reduce consumption. The progressive fee begins with 5 Baht per cubic meter at the approximate consumption level of an average household[86], and ends with 10 Baht per cubic meter for high consumption. Because of a stricter fee collection the public debate about the distributive effects grew more intense during the last year. Therefore, the progressive fee will more likely be extended than reduced to a uniform price. With reference to an efficient allocation, the fee should be uniform. Considering public resistance over the distributive effects, a progressive fee seems appropriate.[87] Such a cross-subsidizing of freshwater for low-income households by high-income households entails the potential danger of giving an inadequate incentive to a large number of households which might consume to much water to be cross-subsidized by the much smaller number of higher-income households. However, a progressive fee can certainly lessen the regressive distributional effect.

The funds raised by the fee are supposed to cover the costs of the system run by the Metropolitan or Provincial Water Works Authority.[88] The Water Works Authorities are technically capable of operating the system. They are also provided with the administrative power to impose the fee. They are responsible for reading the meters and collecting the fee. Fee collection is based on reading meters annually while payments are due monthly.

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85 Around 3.4 million cubic metres per day are taken from the tab system in Bangkok (Bangkok Post, Thursday, December 9, 1993, p. 8).

86 Which is estimated to be below 30 m^3/month.

87 WONGBANDIT/ MEWONGUKOTE/ JAIHARN (1993), p. 16 sees a special problem in the distributive effects of fees.

88 Fees are also used in places outside of the Bangkok Metropolitan Region, for example in Chiang Mai.

Fees function as a price signal for using public utilities. In the case of Thailand more is at stake than the over-utilization of the tap water system in Bangkok or the irrigation systems in the hinterland. By now, freshwater as a resource is scarce. We will look at tradeable permits and charges in the following subsection to introduce a measure for giving the appropriate price signal for the environmental scarcity of freshwater in Thailand.

3.2.3 Tradeable Permits and Charges

Currently no charges or tradeable permits are implemented in Thailand for freshwater. Both a charge and a permit system carry the potential to tag a scarcity price[89] to the environmental resource in question. In the case of freshwater, Thailand experiences a spatial and a seasonal scarcity. The resource scarcity is economically a sufficient reason for demanding economic instruments for the introduction of scarcity prices.

For the implementation of charges and tradeable permits certain requirements must be fulfilled. Among these is the property rights regime. With regard to freshwater in Thailand we have seen above that generally a *public domain regime* is in place.[90] Charges are compatible with a *public domain regime*, whereas, by definition, tradeable discharge permits may be considered incompatible if they are supposed to constitute a "right" to freely trade the permits.

As with fees, administrative costs for implementing economic instruments should be kept as low as possible. Again, it would not be reasonable to require all individual users of freshwater to buy tradeable permits or pay the charge. In the case of tap water generation, the Municipal and the Provincial Water Works Authorities, which actually draw the water, should be subjected to the scarcity signal. Costs imposed upon them, they could shift to final consumers by increasing the fee proportionally. Obviously, such a shift is only possible if fees are already in place. Also with irrigation water we face a large number of users who are difficult to monitor. As fees, charges or tradeable permits could be based on the level of water user associations which shift their expenses to their members according to their consumption. The incentive to use water according

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89 See WONGBANDIT/ MEWONGUKOTE/ JAIHARN (1993), p. 18 where the scarcity price is called "property value of water".

90 Only for run-off water property rights are ascribed to land owners.

to the scarcity price attached to it would be passed on. However, if fees take into consideration distributional aspects reductions in consumption can be substantially lower than expected.

Since scarcity prices must vary according to the regional supply and demand, they should vary with river basins. In Thailand, this is of special importance since competition for freshwater is tight between upstream users in the North and downstream users in the South. Basically three regions compete with each other for the same water: the North, the Central Plains and the Bangkok Metropolitan Region. Within these regions scarcity may vary somewhat depending on the river.

For initially allocating permits two basic approaches are proposed in the literature: auctioning permits and 'grandfathering'. Grandfathering the permits refers to issuing permits to current users by applying some base year for the amount of freshwater they are permitted to consume. Auctions, as is widely feared, may bring about an unwelcome effect: the rich will be able to drive up the price of permits at the auction while the poor will not be able to buy permits according to their needs. Therefore grandfathering is often favoured. Grandfathering puts all current users at an advantage over future demanders who then have to buy a permit from those who got it for free.

If a permit system would be introduced, trading rules would have to prevent that scarcities could still occur locally. For example, the right to extract groundwater from a reservoir which is connected to a river cannot be simply sold and be utilized as a right to draw water from the same river somewhere upstream because the spatial and temporal scarcity may be different. Since trading rules will have to regard hydrological conditions, the state will reserve vetoing the transaction if a non-equivalent usage of the resource is likely. Permits will govern a given volume of freshwater by issuing the equivalent amount of permits and then allowing permits to be traded. If shortages occur despite the limited amount of permits, permits can be porportionally reduced until the shortage is overcome. But we should be aware that 'grandfathering' tradeable permits would afford a change in the property rights regime of Thailand.

Charges, although they can be distinguished by region as well as by season, give a uniform incentive to use less water. The charge will set a price for each unit of freshwater, and shortages can only be avoided by increasing the charge.

If shortages can be predicted, as is usually the case in Thailand, the charge could theoretically be increased before reservoirs are depleted. With permits a percentage reduction of all permits would take place. The price of permits would rise if constant demand is assumed.

The distributional effects of charges are believed to be largely regressive, especially if low income groups, such as farmers, are depending on utilizing the resource. With an estimated consumption of 70 % of freshwater resources for irrigation, agriculture would be the most burdened sector. However, the regressiveness depends to a great extent on possible substitutes. In the case of the paddy field farmers direct substitutes for water are not available. But they can shift production to less water demanding crops during the dry season and thereby compensate income losses. With a charge variation according to seasonal scarcity, the regressive effect will be reduced, and only those farmers will be burdened who have no possibility to shift production to other crops in the dry season.[91]

A less direct regressive effect is placed on final consumers through product prices which include higher costs for water. First, the water intensive products (such as rice) must be bought by low income groups. Secondly, no substitutes are available, i. e. demand is predominantly inelastic. In Thailand, water intensive production takes place in the foodstuff industry, tanneries, electroplating industry and paper and pulp mills. Obviously, foodstuff production can cause severe distributive effects on low-income groups. This is especially true if a large part of the population depends on rice.

Tradeable permits are different from charges in their distributional effect if they are 'grandfathered'. As farmers are the major demand group of water at the moment, they would receive most of the water permits. Growing demand for tap water and industry primarily in the Bangkok Metropolitan Region would lead to a rise in the price per permit, and farmers would face growing incentives to sell water permits and shift their production to less water intensive crops. With tradeable permits, farmers would receive a compensation for shifting their

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[91] Obviously the regressive effect could be eased by introducing a differentiated tariff for farmers and industry with industry paying more than farmers. In terms of economic efficiency such a split tariff can not be supported since efficiency arises from the uniform incentive under which each economic agent can react freely. In the case of Thailand, a split tariff is especially problematic since a large volume of irrigation water is wasted.

production and regressive effects would be limited to low-income groups in the Bangkok Metropolitan Region which pay higher prices for tap water.[92]

In the current situation, farmers receive no systematic compensation but are simply cut off irrigation water which is reserved for the Bangkok Metropolitan Region. Consumers there do not pay an adequate scarcity price for their tap water, thereby consuming more than the optimal quantity. Farmers, facing poverty, drift into urban areas and increase the demand for tap water of the urban region.[93]

3.3 Wastewater Management

In the following section we will explore the current state of wastewater management in Thailand. With regard to water pollution, two acts are of special importance. The Factory Act, referring to industrial plants, and the National Environmental Quality Act concerned with ambient standards as well as emission standards are at the core of the subsequent sections.

The Factory Act was passed by Thailand's Congress in 1969. It introduced some measures of pollution control for industry and placed the control and monitoring duties with the Department of Industrial Works, Ministry of Industry, which is also responsible for the general licensing of plants. In 1975 the Enhancement and Conservation of National Environmental Quality Act (NEQA) was passed. The NEQA established a first agency which was solely concerned with environmental issues thereby reducing potential conflicts of interests. At the same time, the Factory Act was revised and amended. For the subsequent 17 years the Factory Act in conjunction with the NEQA formed the legal basis for any environmental action with regard to water pollution by industry. In 1992 both acts were amended again, and this time provisions were made to strengthen environmental agencies.[94] But besides the two there are various other acts which also address water pollution issues.[95]

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92 Again, also to the purchasers of water intensive goods for which no substitutes are available.

93 Bangkok Post, Dec. 6, 1993, p. 3; Bangkok Post, Dec. 7, 1993, p. 6.

94 LIMVORAPITAK (1993), p. 22 and p. 81.

95 For example, the Building Control Act, 1979, the Navigation in Thai Waters Act, the Public Health Act. Ironically, the Public Health Act currently provides the most stringent measures for water pollution by applying severe penalties. See LIMVORAPITAK (1993), p. 86.

The agencies concerned with water pollution are numerous.[96] As far as industry is concerned, the Department of Pollution Control (Ministry of Science, Technology and Environment), the Department of Industrial Works (Ministry of Industry) are directly involved. Besides other departments of the mentioned ministries, the Industrial Estate Authority of Thailand is responsible for factories on their estates. For domestic effluents the Ministry of Science, Technology and Environment and the Ministry of Interior share responsibilities. While the one is responsible for designing emission standards, the other one is concerned with technically designing and installing treatment and sewage systems through the Public Works Department.

This list, which is far from being complete, serves to highlight the "administrative cocktail" and should illustrate the problems of the agencies to locate responsibilities. The current confusion in Thailand partly stems from the recent amendments to the Factory Act and the National Environmental Quality Act and their reorganization of agencies. But the confusion causes delays where they should be avoided. In Pattaya, for example, one of the touristic centres of Thailand, treatment facilities were designed and construction began before 1992. With the new Environmental Quality Act it was possible for the Ministry of Science, Technology and Environment to declare certain regions as *pollution control areas*. Such areas receive higher priority for improving environmental quality in general, in this case priority for installing treatment facilities for waste water. Ironically, the bureaucratic upgrading of Pattaya's wastewater situation was followed by a construction stop of all treatment plants: responsibility, previously with the Department of Public Works which employs engineers, was shifted to the Department of Pollution Control. And the latter employs hardly any experienced engineer to continue construction.

Although the case of Pattaya can illuminate the current problems of environmental administration in Thailand, this is clearly connected to the necessary changes of the former structure to address environmental problems more effectively. However, expectations should be kept low for potential instruments which require frictionless cooperation across two or more agencies.

After illustrating some of the current problems of the environmental administration of Thailand, we will now turn to the established property rights and permits (Subsection 3.3.1), to fees imposed for wastewater treatment in domestic areas as well as for industry (Subsection 3.3.2), and finally we will

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[96] SACHASINH/ PHANTUMVANIT/ TRIDECH (1992), p. 16.

discuss the possibility of using tradeable discharge permits or charges for providing users with adequate scarcity signals (Subsection 3.3.3).

3.3.1 Property Rights and Permits for Discharging Wastewater

Property rights for discharging wastewater are not explicitely mentioned. In the absence of an equivalent to a Water Resources Management Act, which would provide guidelines for the utilization of all uses of water, property rights can be only based on the Factory Act or on the NEQA. Both acts prescribe emissions standards for plants.[97] The standards are applied uniformly throughout the country according to branches.[98] As described above, emission standards are an establishment of property rights; firms are allowed to emit effluent if they comply with standards. Pollution above the standard is prohibited. The state reserves these property rights for other uses.[99]

In Thailand, the property rights reserved by the state take a rather diffuse form. On one hand, the concentration of pollutants in discharges must be limited to certain levels. On the other hand, no limits are set for the total load emitted with the discharge. In order to specify the problem, we will look into the licensing process of factories.

Although the Factory Act applies to virtually all shops except craftsman[100], the Act distinguishes three groups of factories of which only two groups, depending on type and size of factory, must give notification to the Ministry of Industry or request a permit from it.[101]

Factories classified as members of Group 3 must apply for a license[102]. Responsible for issuing the license is an office within the Department of Industrial Works, called the One-Stop-Center.[103] In contrast to the license application of industrialized countries such as Germany, Thailand has a centralized application process in which all documents related to the application are handed in at the One-Stop-Service-Center. This Center is supported by two

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97 WONGBANDIT/ MEWONGUKOTE/ JAIHARN (1993), p. 28.

98 NEB (1989) with all relevant emission standards.

99 In a public domain regime for the benefit of the society.

100 A factory is defined as "a building, place, vehicle which uses a machine with five horsepowers... or more or which employs seven or more workers ... to produce, assemble, fill, repair,... anything in accordance with ... a ministerial rule." Section 5, Factory Act B.E. 2535. In what follows reference to the Factory Act always means Factory Act B.E. 2535.

101 Section 7, Factory Act.

102 In order to avoid misunderstanding we will call the *permit to establish a factory* of the Factory Act a *license*.

103 If the factory is established on an industrial estate, the Industrial Estate Authority of Thailand is solely responsible for granting the license. With them the licensing process from applying for a site to the permission of operating takes 93 days. See IEAT (1993).

more offices, the Central Office of Machinery Registration and the Office of Industrial Service and Waste Management. Applications are processed within eight to twelve weeks.[104]

Factories which are members of Group 3 must enclose blueprints of buildings and machineries including wastewater treatment and hazardous and solid waste disposal. However, details of the production process are not part of the application. Since the final license includes the entire operation of the plant, a violation of regulations or a violation of additional requirements after a preliminary violation of regulations will lead to revoking the entire license and closing of the factory.[105] Since such drastic measures will endanger jobs, they are rarely used.

As the license includes also the permit to discharge pretreated effluents into water bodies, it is the basis for calculating the utilization of water bodies by discharged wastewater. The license granted by the One-Stop-Service-Center classifies the factory as a member of a certain branch of industry. This classification connects point sources with the effluent standards according to the NEQA.[106] The Minister of Science, Technology and Environment is authorized by the NEQA to prescribe more stringent standards to point sources in order to meet ambient quality standards.[107]

The general problem with standard setting for industry according to these acts is that standards are ascribed for concentrations and not for total loads of pollutants. If the Minister of Science, Technology and Environment tightens standards for specific point sources to reach ambient standards, his intention might fail to achieve the objective, if the point sources react with lower concentrations but higher loads by increasing the volume of water discharged.[108] The connection between ambient standards which are a measure to protect alternative uses of the water body and emission standards is rather weak. This weakness is due to the diffuse property right established by the factory license. The license is limiting the emission of pollutants only to

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104 For more details on the application process for licenses see OECC (1993), p. 100-102.

105 See Section 39, Factory Act.

106 Emission standards can be applied on the basis of other bodies of law as well, for instance the Public Health Act.

107 Section 55, National Environmental Quality Act. See also WONGBANDIT/ MEWONGUKOTE/ JAIHARN (1993), p. 24.

108 Also the dynamics of Thailand's fast-growing economy is neglected. Where today several companies choose to locate their plants, an industrial center might arise tomorrow.

certain concentrations but since no restriction is placed on the total loads these do not sufficiently relate to ambient standards.

3.3.2 Fees for Wastewater

According to our definition of fees as an equivalent payment for using infrastructure, fees can only be expected where infrastructure exists or is under construction. In Thailand sewage systems and treatment facilities are provided on industrial estates. In addition, some areas of Bangkok and Pattaya have sewage systems which are connected to treatment facilities. In some rare cases, associations of certain industries are in charge of central treatment facilities.[109]

Industrial estates are run by the Industrial Estate Authority of Thailand (IEAT) and some private companies. Industrial estates are set up to provide infrastructure for industry in search of a new location. The IEAT, a government owned enterprise, develops industrial estates by building streets, providing electricity, freshwater, etc. After developing the estate, plots are sold to individual enterprises. The price includes the cost of land as well as the development costs including the building of wastewater treatment facilities.[110] As the operation of factories begins, wastewater dischargers must pay fees. The fee is based on freshwater consumption, biological oxygen demand and suspended solids.[111] While biological oxygen demand and suspended solids are measured by IEAT, the volume of wastewater is assumed to be 80 % of the metered freshwater consumption.[112] The fee includes operating and maintenance costs, initial investment costs are included in the developing costs which are covered by the price of the industrial site bought by the private industry.

As industrial estates are established prior to the establishing of factories at the spot, treatment facilities are frequently insufficient for the kind of wastewater they receive. After several complaints about the functioning of wastewater treatment plants of indutrial estates, suspicion grew that fees are taken as an additional income source for estates. Besides plans of IEAT to employ private companies to run treatment facilities to increase the quality of treatment, the major problem appears to be a lack of control of the treatment facilities by other

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[109] This is the case for sugar mills and tanneries. See LIMVORAPITAK (1993), pp. 38 and 39 for more details.

[110] Currently eighteen industrial estates have central treatment plants. See LIMVORAPITAK (1993), p. 35, also IEAT (1993).

[111] A surcharge is levied if other pollutants such as heavy metals exceed standards.

[112] This assumption is generally made and not varied according to the production. The reason is to give no incentive to discharge wastewater illegally for which the fee must be paid anyway.

government agencies. Besides an initial environmental impact assessment IEAT is neither controlled nor monitored by the Department of Industrial Works or the Department of Pollution Control.[113] Factories located on industrial estates are monitored only by IEAT itself.

Nevertheless industrial estates must be regarded as comparatively modern institutions because they provide infrastructure in a systematic way. Problems in densely populated and industrialized areas as the Bangkok Metropolitan Region are much more severe since basic infrastructure must be installed in the first place.

In Bangkok, four projects are undertaken currently to provide sewage systems and treatment facilities for the city. These projects aim to connect 98 % of all households and industry to treatment facilities. At the moment 2 % are connected. Investment costs of the facilities are covered by the Bangkok Metropolitan Authority (25 %) and the Central Government (75 %). The Bangkok Metropolitan Area[114] has the most independent government among the provincial governments of Thailand. For example, the gouvernor of Bangkok is an elected official while - with the exception of Pattaya - all the other gouvernors are appointed by the Minister of Interior. The Bangkok Metropolitan Authority is dependent on funds provided by the Central Government for bigger investments such as wastewater treatment facilities despite receiving higher local tax revenues than other provincial governments.[115] Once operation of the facilities is started fees will cover maintenance and operating costs. With an increasing number of requests for the construction of treatment facilities the Central Government faces immense financial demands by the Public Works Department.[116] During the last few years, funds of the Public Works Department have almost doubled every year. Wherever the Public Works Department built treatment facilities, operation and maintenance costs are supposed to be covered by fees.

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113 The only regulatory supervision of industrial estates is an environmental impact assessment by the Ministry of Science, Technology and Environment. See WORLD BANK (1993), p. 144.

114 The Bangkok Metropolitan Region consists six provinces amnong them the Bangkok Metropolitan Area.

115 BMA (1986), p. 13 shows that 71 % of total revenues come from local taxes, 17.6 % is given as grants from the Central Government, and the rest of 1.4 % is revenues from Enterprises, Fees, Fines, etc.

116 The Public Works Department, Ministry of Interior, is responsible for designing blueprints and contracting companies for the construction of treatment plants throughout the provinces outside the Bangkok Metropolitan Region. By now, 47 treatment facilities are built or planned.

In the Bangkok Metropolitan Area with its four ongoing projects, wastewater fees will raise the price of utilizing one cubic metre by a 100 %. In addition to freshwater fees the wastewater fee will accrue to 5 Baht/m^3. This fee covers only the operating and maintenance costs. If investment cost were included, the overall fee for freshwater and wastewater would be 15-20 Baht/m^3. This amount is deemed politically impossible since complaints about the mere fact that water should have a price are already voiced by the electorate.

Considering administrative practicability wastewater fees should be based on freshwater consumption. The Bangkok Metropolitan Authority endorses that the Metropolitan Water Works Authority should collect the wastewater fee together with freshwater fees and then pass the revenue on to them. The Metropolitan Water Works Authority resists this plan. In the eyes of the public they would rather be unconnected with the increase of fees. They also fear problems with the collection of their own fees if the additional wastewater fee must be explained to consumers as well.

3.3.3 Tradeable Discharge Permits and Charges

Neither tradeable discharge permits nor charges for wastewater are yet implemented in Thailand. Since market-based instruments are included in the frequent lip-services by the Central Government[117], one may expect that future considerations can include tradeable discharge permits and environmental charges.

In a *public domain* and a *state ownership system* of property rights discharge permits are a concession of the state to the fact that some pollution is supposed to be unavoidable in the course of econmic growth. In turning such permits into tradeable permits, polluters can sell and buy permits from other permit holders in order to increase their own discharges. Theoretically, locations of pollution changes but the total amount of pollution remains the same. Practically many problems are connected with turning discharge permits into tradeable discharge permits. First, the permits must exist as a permit separate from the operating license of the factory. As we have seen above, Thailand issues only one license which does not separate the permission to operate a factory from discharging wastewater.

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[117] See, for example, Bangkok Business Post, December 3, 1993, pp. 21 and 23; TCGE (1992), p. 37.

Secondly, the permit must include the loads of individual pollutants. Again, this is not the case in Thailand where neither the amount of discharged pollutants is limited directly nor the volume of wastewater is fixed so that loads of pollutants could be drawn from the wastewater volume and permitted maximum concentrations of pollutants. The discharge permits must also provide for a separation of different pollutants since different pollutants must be treated separatly.

Thirdly, the total load of pollutants permitted for discharge in relation to water quality must be known. This relation of emissions to ambient standards enables the administration to impose trading rules which prevent hot spots. In Thailand, the major rivers have ambient quality standards, but they still lack an explicit management of emissions. Since 1992, the Minister of Science, Technology and Environment has the power to impose stricter emission standards on certain sources of pollution if ambient quality standards are not met, but tradeable discharge permits require an *ex ante* management of total loads to create sufficient legal stability for trading.

Fourthly, tradeable discharge permits would be traded through a central agency which supervises the compliance to trading rules. Such an agency could be the Pollution Control Department since it is in charge of setting ambient standards. But in the current administrative set-up, the Pollution Control Department has no power in the issuing of factory licenses. With tradeable discharge permits, some of the power held by the Department of Industrial Works would be taken away, and the Department of Pollution Control would take over a part of the current licensing process. In the hands of the Department of Pollution Control, this part of licensing would undergo considerable changes. Besides issuing initial permits according to the data of the current factory licenses, ambient quality standards would provide for ceilings of total emitted pollution loads. Watercourses would be divided according to their potential to carry certain loads of pollutants. For each individual pollutant different maximum loads must be established. According to these maximum loads, permits would have to be reduced (proportionally) if current emissions would result in exceeding ambient standards. In Thailand river basin studies are currently conducted to gain information of competing uses of the water bodies and their ecological condition.

Generally, tradeability seems appropriate for non-toxic parameters such as biological oxygen demand, phosphates, and nitrates.[118] Tradeable permits for toxic pollutants should be prohibited since hot spots cannot be avoided.

For charges, basically the same requirements must be met as for tradeable discharge permits, except that discharge permits do not need to be separated from the general licensing process. Again, maximum loads for rivers must be identified to meet ambient quality standards. And again, permits for pollution sources must be given out according to ambient standards. If ambient standards are not met or such standards are tightened, the charge could be raised. As with tradeable discharge permits the process of reduction shows little immediate effect, but will result in cost-effective reductions over time.

The implementation process for charges requires an administration to impose the charge on polluters according to actual emissions or according to the permitted loads. In Thailand actual emissions are not regularly monitored yet. Responsible for enforcing emission standards is the Industrial Environment Division of the Department of Industrial Works. The Division employs 46 inspectors who attempt to monitor 3,000 firms per year. As monitoring often requires more than a single visit, an estimated 9,000 visits take place every year.[119] Thailand's industrial water-polluting plants were estimated to be above 20,000 in 1989.[120] It is apparent that a charge based on actual emissions would be impossible with the current manpower in enforcement.

A charge based on loads as permitted in the factory license would necessitate more detailed licenses which set limits to either wastewater volumes or to loads of pollutants.[121] The charge could be based on one or more pollutants. In the case of Thailand it might be useful to consider a charge based on the most critical parameter first, and to introduce other parameters later on. Monitoring a charge on permitted concentrations and loads rather than actual loads would require less manpower since samples could be taken randomly. Then polluters would comply with standards according to their estimates of probable penalties.

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118 BIZER (1991).
119 WORLD BANK (1993), p. 143.
120 LIMVORAPITAK (1993), p. 9; TCGE (1992), p. 35.
121 In any case maximum concentration must be set as well.

The collection of the charge requires an agency familiar with imposing charges or taxes on industry. Such an agency could possibly be found in the Ministry of Finance. In any case the charge collecting agency would depend on the data on existing and newly established water-polluting industries provided by the Department of Industrial Works and monitoring data by the same. For the ease of administering the charge, penalties should be imposed by the same agency which is collecting the fee.

3.4 Classification of Thailand's Current Water Management

In this chapter Thailand's current state of environmental policy with market-based instruments was described and classified within the staging approach of Chapter 2. Focusing on the "environmental good" freshwater and the "environmental bad" wastewater, we described Thailand's demand on the resource, the legal situation, the administration, and the possible paths for introducing further elements of market-based instruments.

Concerning freshwater, Thailand is somewhat between Stage I and Stage II: property rights are established to some extent, but they are neither clear and explicit nor do they establish enforcable rights. Poorly defined rights, which are neither enforced nor secure lead to the over-exploitation of freshwater. In the case of irrigation water "rights" for water can be withdrawn at any time and without any compensation if the water is needed elsewhere. As far as groundwater is concerned, only in some areas permits are required for extraction. In other areas groundwater can be freely drawn. A Water Resources Act as suggested by legal scholars[122] could solve the problem of insufficient property rights. The problem of enforcing permits and assuring exclusiveness of the permits can only be solved by creating environmental agencies with sufficient monitoring and enforcement power. Prohibitive monitoring costs could be avoided by introducing water user associations.

Fees for using infrastructure are not widely used. For irrigation water a fee is only collected from bigger industry using water from irrigation canals. Fees are collected also for tap water in the Bangkok Metroplitan Region. Fees should be considered for all water taken from irrigation systems and should be paid for by its beneficiaries. Currently, users of irrigation water are registered by the Royal Irrigation Department. As far as administration is concerned, the imposition of a fee should be largely unproblematic.

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[122] WONGBANDIT/ MEWONGUKOTE/ JAIHARN (1993), p. 76. Another draft was put forward by the National Resource Council of Thailand, see KAOSA-ARD/ KOSITRAT (1993), p. 8.

In the light of insufficiently defined property rights it cannot surprise that tradeable water rights or permits are not used at all yet. Both can be applied for limiting freshwater consumption. A permit system carries the advantage of limiting directly the amount of total consumption with a freely floating price. A charge system has the advantage of providing revenues and the disadvantage of requiring extensive monitoring to collect the appropriate amount. As this is unproblematic with households which can be metered it is difficult with industry sited at rivers with direct access to water there. For Thailand it is recommended by others that a permit system is implemented. According to those proposals water users would protect their own right and thereby provide sufficient control.[123]

As far as wastewater is concerned, Thailand' s current position is towards the end of Stage I. Property rights are indistinctly established by strict emission standards and a sluggish enforcement. Therefore the property right for polluting beyond the emission standard is only in theory reserved by the state which fails to enforce his property right. The Thai Government took a first step towards stricter enforcement by establishing the Pollution Control Department as an institution which is responsible for monitoring ambient standards as well as for the establishment of emission standards and occasional monitoring of factories.

Fees are collected at few industrial estates and central wastewater treatment facilities. Otherwise hardly any infrastructure is in place at the moment. But the two areas where sewage systems and treatment facilities will be in operation before too long are the Bangkok Metropolitan Region and Pattaya. In these areas fees will be collected for covering operating and maintenance costs. Investment costs are covered by general taxes.

Tradeable discharge permits and charges are not applied yet. Currently even the basic pre-requisites cannot be provided for an effective enforcement of either instrument. The greatest potential is probably with a charge based on permits. Such a charge could also be used to support the enforcement of existing standards. This enforcement-supportive element is especially attractive since Thailand's emission standards are as tight as enforcement is slacking.

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123 WONGBANDIT/ MEWONGUKOTE/ JAIHARN (1993), p. 17.

4 The Scope for Institutional Assistance on Market-Based Instruments

Contrary to widespread belief, developing countries, especially newly industrialized countries, already apply a variety of incentive-setting instruments.[124] In countries like Thailand, environmental problems are less a technical but more an institutional issue of giving scarcity signals to economic agents. Scarcity signals can be given through ambient and emission standards, where the latter relate to the former, or through "price-tags" placed on the utilization of the resource. Price-tags can be applied through charges directly or through tradeable permits by limiting the utilized amount of the resource.

As we laid out in the preceeding chapter, different institutional, informational and environmental conditions must be fulfilled in order to achieve the desired effects. The fulfillment of these conditions can be problematic depending on the political circumstances of the country. Thailand currently entertains a high profile on the introduction of economic instruments and appears to favour economic instruments.[125]

In furthering economic instruments donor organizations may engage in providing information on alternative instruments and experiences with their performances. In the case of Thailand, administrators as well as academic researchers and policy advisors are interested in obtaining a wide perspective on the potentials of economic instruments and their specific conditions. Institutional assistance can be provided in a variety of ways. First, joint research projects could be funded to bring together the experiences of already operating economic instruments in industrialized countries and the understanding of the country's characteristics which plans to implement market-based instruments. Such research projects should be interdisciplinary regarding economic, legal, environmental and social issues. Secondly, the success of economic instruments depends largely on the implementation, including the administrative functioning as well as appropriate enforcement. Again, the experiences of environmental administrators in industrialized countries could ease some of the implementation problems. Thirdly, the gained information must be brought into the political discussion to substaniate the informal as well as the public debate on economic instruments. Depending on the political circumstances, this can take various forms. Besides the political parties, industrial associations,

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124 See EFTEC (1993) and PANAYOTOU (1991) with a number of examples.

125 O'CONNOR (1993), p. 34.

farmer's associations, labor unions, non-government organizations and parts of the administration should be included in the building of a consensus. All of these groups have a significant influence on the design of economic instruments.

In the case of Thailand, one of the major players in the political arena is the Thai Federation of Industry with its branches. Although aware of environmental problems and the potential of market-based incentives to reduce them, the Federation is carefully avoiding open support for anything which could hurt its members. Although most of the members are big companies, the Federation feels responsible to protect also the interest of small companies. An even stronger opposition can be expected from farmer's associations or political parties who depend on a rural electorate. Farmers suffered increasing disadvantages compared to the urban population, and are therefore willing to defend their incomes against further demands. Since imposing fees or charges on freshwater will have relatively strong effects on farmers their opposition may be fierce. Within the administration, various offices would have to be included. A central role in forming the political agenda for the next few years is played by the National Board of Economic and Social Development (NESDB) who, as part of the Prime Minister's Office, develops five-year-plans. The NESDB suggested the introduction of the *Polluter-Pays Principle* a few years ago. The NESDB could be a possible partner for promoting economic instruments. Among the cabinet minsters the Minister of Science, Technology and Environment, the Minister of Industry and the Minister of Interior represent interests which are concerned when economic instruments are introduced. Since in Thailand the government frequently consists of numerous coalition parties these ministries are often held by different and sometimes conflicting party interests. As these interests are deeply rooted within the specific political parties it is difficult to estimate the possible influence of a consensus-building by outsiders.

Regardless of whether institutional assistance is given for research, the actual implementation, or for building a consensus among the parties concerned, it is important to note that rarely assistance is demanded beyond sharing experiences or providing local researchers and administrators with specific information. In order to provide such information when desired, it might be useful to offer assistance continually by locating an adviser at a central agency such as the NESDB in Thailand.

If a country's resource management is at the begining of Stage I, donor organizations may even try to initialize the debate on economic instruments by bringing together the interest groups.

4.1 The Scope for Institutional Assistance on Property Rights and Permits

In Thailand property rights are insufficiently defined for utilizing freshwater as well as for discharging wastewater. Generally, the clear definition of property rights, beginning with the establishment of a property rights regime, is a prerequisite for the implementation of instruments which give appropriate incentives. Currently, awareness of the economic implications of different property right regimes is very low in Thailand, and additional research should provide scenarios for different regimes. Institutional assistance could be granted for researching the legal implications of the existing laws and the potential for changes in the law. In Thailand, such a study was conducted already by the Thammasat University, and also the Environmental Law and Development Center of the Chualongkorn University emphasizes the importance of this issue. But, as the study conducted by Thammasat University was a purely legal one, the economic implications for different groups of economic agents were neglected. Interdisciplinary research should lay the grounds for weighing allocative efficiency gains against negative distributional effects.

Once impacts are evaluated, institutional assistance can be granted for bringing together the groups affected by the the design of property rights. In the case of freshwater this will be primarily industry and agriculture. But also the Provincial and Metropolitan Water Works Authorities will be affected.

As we have seen above, the establishment of property rights must be based on environmental conditions. Where resources become scarce, utilizations must be restricted in one way or another. A precondition for discussing different instruments giving scarcity signals is knowledge of the character of scarcities, the different uses of the resource and, in the case of freshwater, hydrogeological conditions. If wastewater is concerned, biological conditions of the water body must be known. In Thailand such studies are undertaken in the form of river basin studies.

Beyond laying a foundation for a public or informal discussion of different property rights regimes, and the provision of sufficient information for deciding about property rights, assistance can be given also in the actual implementation of property rights. The individual rights must be certified by permits, permits must be registered with an administration and some form of enforcement must

be found. If permits are supposed to become tradeable at a certain point of time, provisions should be made to cope with new holders of permits. As far as wastewater in Thailand is concerned, permits are included in the factory license. These licenses are not administered in a way which would allow an assessment of total emissions into watercourses. But this kind of information is needed by the Pollution Control Department in order to develop plans for reducing emissions in rivers where ambient standards are not met.

In conclusion, institutional assistance at Stage I provide research on environmental conditions. According to environmental conditions instrumental alternatives must be designed which can give the appropriate scarcity signals. The adequate instruments must be compatibel with the legal system. If incompatibilities are located changes of the law should be debated. Once instruments are found which address environmental scarcities in accordance with the law, the economic implications should be investigated to locate the final incidence of costs. The affected groups should be included in a consensus-building discourse on possible alternatives or measures to ease the burden without reducing the intended incentive. Finally the instruments should be checked for their administrative practicability, i. e. administrative costs, control and monitoring costs on behalf of the administration and enforcement.

4.2 The Scope for Institutional Assistance on Fees

Fees were defined as covering only the cost of infrastructure. Cost of infrastructure certainly covers operating and maintenance costs as well as investment cost. However, for an application of fees guidelines must be developed which ensure a similiar procedure for all public utilities. In the case of freshwater used in designated irrigation areas, fees should not be imposed only on a few industrial demanders but also on farmers to avoid wasting of water regardless of the utilization. Such a fee should cover not only operating and maintenance costs but also investment cost for the canals, etc. In Thailand, only the Royal Irrigation Department is responsible for administering the irrigation system. Therefore, it should be easy to introduce a fee which imposes the equivalent of costs on consumers. Whether and to what extent artificial dams should be included should depend on the other purposes the dams serve. If they function also as water reservoirs for hydropower generation some measure must be found to split costs.

In urban areas fees for freshwater are already used for covering costs at least for operation and maintenance. The implementation of fees appears to be unproblematic with regard to administrative issues. More difficult to cope with are distributive aspects. Institutional assistance could be funding research on the extent to which specific groups are burdened by fees and how this burden could be eased without foregoing allocative efficiency.[126]

In Thailand wastewater fees become necessary because the Central Government is not financially capable to cover investment costs for treatment facilities and sewage systems throughout the country. Currently, guidelines for calculating wastewater fees are developed by the Pollution Control Department with institutional assistance by USAID. These guidelines shall apply for all municipal wastewater fees, including domestic as well as industrial wastewater discharged into the sewage system.

Industrial estates already impose fees based on two or three parameters. These fees cover operating and maintenance costs. Initial investment costs are covered by the price of industrial sites. Since initial treatment will be hardly sufficient with tightening emission standards, eventually fees must be calculated including investment costs. The Industrial Estate Authority of Thailand appeared to be interested in the fee calculating procedures of other countries.

Some industries, for example tanneries and sugar mills, operate central treatment plants for their wastewater. Operating and maintenance costs are covered by the companies, investment cost is often covered by grants from the Central Government.[127]

As fees are introduced in close connection with infrastructure, the groups affected allocatively and distributionally are relatively small. But since fees will be introduced on a large scale throughout the country, the effects will be felt by many. Again, institutional assistance may considerably reduce resistance by providing the affected groups with a forum which also addresses the distributive issues.

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126 MACRO CONSULTANTS (1993), Chapter 8, especially p. 8-41 displays a justifiable concern with willingness-to-pay analysis but lacks a detailed answer to the distributive effects of the wastewater fee for the Bangkok Metropolitan Region.

127 TCGE (1992), p. 36; OECC (1993), p. 191.

4.3 The Scope for Institutional Assistance on Tradeable Discharge Permits and Charges

The ceasing abundance of freshwater in Thailand requires a reform of the current management approach which focuses mostly on supply. Institutional assistance should help to provide information on the various effects of pricing freshwater. Apparently, a price on freshwater supplied to industry appears feasible while farmers receive political protection. Since farmers utilize the biggest share of freshwater (and apparently waste the most), it would be crucial to know to what extent farmers would be burdened by introducing either charges or tradeable permits. As mentioned earlier, charges can be used for funding water-saving activities like shifting production to less water intensive crops. Tradeable permits sold by farmers provide revenues.

Currently, groundwater is rarely utilized for farming but more by industry as well as for households in some areas. Groundwater depletion in the Bangkok Metropolitan Region led to dramatic land subsidence.[128] Apparently problems are addressed by the Groundwater Act which regulates the extraction of groundwater. However, no prices are imposed. Economic instruments can avoid land subsidence and thereby increase total welfare. As groundwater is extracted primarily by industry, this field of application would provide quite a different potential conflict than the charging of irrigation water.

Institutional assistance for the introduction of wastewater charges or tradeable permits could be threefold again: Firstly, research could be funded for conducting estimates of marginal abatement cost and the environmental conditions of watercourses. Secondly, institutional assistance can bring together the affected groups to discuss the implications and find aceptable solutions. Thirdly, assistance could assist in the implementation and the development of enforcement strategies. In all of these cases, experiences made with the German effluent charge could provide helpful insights to the functioning of charges. But, as differences between the administrative systems of Germany and Thailand are enormous, the assistance would be necessarily limited to a forum for discussing economic instruments in the context of both countries' conditions.

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[128] World Bank (1993), p. 34.

5 Conclusion

The analysis departed from the question whether and how institutional assistance could be given by donor organisations in the protection of the environment. We limited our task to two types of water resources, freshwater and discharging wastewater. For these utilizations we developed a staging approach for the implementation of economic instruments.

Three stages were distinguished. Stage I defined property rights for the utilization and adequate permits. Property rights and their respective permits form the basis for any systematic approach to resource utilization as well as for any kind of economic instruments.

At Stage II fees are introduced to cover the costs of infrastructure. In the case of freshwater, such infrastructure can be irrigation canals or tap water systems including pre-treatment for drinking water. In the case of wastewater infrastructure includes sewage systems and treatment facilities. Fees should give scarcity signals for using such infrastructure and thus help to avoid over-utilization. The environmental problem addressed indirectly by fees is the wasting of freshwater in irrigation, households and the part of industry which receives water from the tab system. Wastewater fees present an additional incentive for reducing water consumption since wastewater fees will frequently be based on freshwater metering. Moreover, depending on the design wastewater fees can induce industry to check potentials to reduce the volume of pollutants. But even though fees have the potential to raise prices for utilizing a resource they should not be mistaken as pricing an environmental good. Fees, as we defined them, attach a scarcity price to using infrastructure. And infrastructure, for example tap water pipes, are not identical with the water which is provided by them. On the institutional side, Stage II requires administrations which collect the fees. In the case of Thailand, the Municipal and the Provincial Water Works Authority collect freshwater fees for tap water, and the Royal Irrigation Department collects fees from a few industrial demanders for irrigation water. Farmers, greater in number and in consumption, should be subject to fees as well. The Royal Irrigation Department would be the adequate institution for imposing fees on farmers. In order to reduce monitoring and control cost, water user associations could be established which serve as an intermediary between the Royal Irrigation Department and farmers. The associations would be metered and would have to pay the fee. They would have to recollect the fee from their members.

Stage III, finally, introduces charges and tradeable permits. Either of them can be applied to freshwater as well as to discharging wastewater. Tradeable permits rely upon the permits of Stage I which are now turned into transferable permits. With freshwater, the entire amount of freshwater in one river basin would be estimated and total permits would be limited accordingly. Since permits would have to be obtained by all agents also the agencies providing municipalities with tap water would need to hold freshwater permits. If permits are grandfathered according to historical uses, these agencies would only need to buy additional permits as consumption of tap water increases. In order to shift the costs for additional permits on to the final consumers, the fee system of Stage II must be in operation already. If charges are imposed on freshwater, the same holds true in order to shift the burden on to final consumers. Regarding wastewater we come to the same conclusion: in order to pass on the scarcity signal which is provided by either the price per permit or the charge a fee system should be in place. Neither charges nor tradeable permits are yet applied in Thailand.

According to the stages we classified Thailand's current water resource management. Referring to freshwater we concluded that Thailand is somewhat between Stage I and Stage II. Fees for tap water are implemented in urban areas. Some industrial users are paying fees for drawing irrigation water from irrigation canals. But these fees are far from cost-covering. At the same time property rights are not yet sufficientl defined. The ongoing debate over introducing a Water Resource Act reveals a lack of the current legal framework in this respect.

Concerning wastewater, Thailand is at Stage I, regarding industrial estates where fees are implemented at Stage II. Property rights are defined only by emission standards for industry which can be tightened if ambient standards are not met. Due to enforcement problems, these standards are of little value. However, at industrial estates and for some central treatment facilities of industrial associations fees exist. Usually these fees cover operation and maintenance costs. With an increasing number of treatment facilities in the Bangkok Metropolitan Region and Pattaya fees will also be introduced for domestic wastewater.

In this situation there is ample scope for institutional cooperation. Basically two forms of cooperation appear reasonable. First, joint research projects could provide administrators and academics with the necessary information on experiences with economic instruments in other countries. This information could be used in easing the distributional impacts on the groups seriously

affected by the suggested instruments. Secondly, donor organisations could provide administrative assistance in the implementing process of economic instruments. In addition, donor organizations may engage in the promotion of economic instruments as a management instrument and accompany the introduction by offering a forum for information and debate.

6 Executive Summary

(1) The aim of this study is to survey Thailand's water resource management to identify potential fields for institutional assistance in the introduction of economic instruments by donor organizations.

(2) In order to classify Thailand's current water resource management a staging approach is developed for the implementation of economic instruments. This staging approach is limited to managing freshwater demand and wastewater discharging.

The Staging Approach

(3) Three stages are distinguished: Stage I serves to implement property rights and permits, the latter being the former's institutional expression. Property rights must be defined by the state. A state agency must issue permits accordingly. Permits should institutionalize clearly defined, exclusive, enforcable and secure property rights for either utilizing freshwater or discharging wastewater. Administrative requirements include an agency which is informed about the different purposes the water bodies serve, corresponding ambient standards and actual emissions by industry. The agency must be sufficiently equipped to monitor compliance. It must be empowered to impose penalties.

(4) Stage II introduces fees for covering costs of infrastructure. Infrastructure may include irrigation canals, tap water systems, sewage systems and wastewater treatment facilities. Fees give the appropriate scarcity signal for using infrastructure and provide funds for improving services. In their implementation fees depend on existing property rights since, for example, no treatment would occur if no other uses would require protection.

(5) In their distributional effects freshwater and wastewater fees are both regressive which poses some difficulties for the implementation. Therefore it is suggested to implement fees step by step rather than imposing the entire burden of cost-covering fees upon households at once.

(6) Stage III brings scarcity signals for environmental goods into play. After being introduced at Stage I freshwater permits could be converted into tradeable permits at this stage. Regressive effects would be lower if tradeable permits are grandfathered, i. e. if they are given free of charge according to historical utilization, since farmers receive a compensation for giving up water intensive activities, for example growing less profitable crops. The regressive

effects for other low income groups in urban areas may well stay unaltered, but may also be augmented if farmers succeed in passing on their additional costs.

(7) Tradeable permits for discharging wastewater would be limited to individual pollutants. Toxic pollutants should not be included. Transactions would be restricted according to ambient standards. Markets for such permits are considerably smaller than for freshwater. Markets with few trades, *thin markets*, cannot realize predicted efficiency gains because uncertainty over permit prices prevents sufficient exploration of abatement technologies. For that reason tradeable discharge permits appear more problematic for implementation than tradeable permits for freshwater.

(8) The implementation of either instrument demands that certain institutional conditions are met. Tradeable permits must be traded according to trading rules which prevent *hot spots*. Charges must be complemented with standards to avoid local over-exploitation. Both must be administered on the basis of enforceable permits and require monitoring. In connection with penalties profit-seeking behavior can be limited.

Thailand's Current Water Management

(9) Thailand's current freshwater management is classified to be between Stage I and Stage II. Although freshwater fees are already employed for tap water and a small portion of irrigation water, the discussion over property rights is not yet finished for all sources of water. Accordingly, permits can not be issued appropriately to secure property rights. In order to avoid over-utilization of infrastructure fees should be imposed also on farmers. But to avoid excessive control costs water user associations should be established. Water user associations could be metered and fees paid by them. The expense should then be shifted on to their members.

(10) Tradeable permits as well as charges could be implemented in Thailand to provide users with a scarcity price for freshwater. In the Thai context, tradeable permits have some distributive effects which give them an advantage over charges. Institutional aspects seem favourable for a successful implementation. With regard to irrigation water only one agency is resonsible. Tap water is provided by either the Metropolitan or the Provinical Water Works Authority. Both are imposing fees already. Expenses for environmental scarcity could be added to fees to pass on the incentive to final consumers to reduce consumption.

(11) Environmental problems connected with wastewater occurred more recently. Consequently, awareness and institutional development is considerably less advanced. Thailand's wastewater management appears to be at the end of Stage I. Property rights for discharging are not clearly defined. Emission standards, as one expression of property rights, are rarely monitored and only occasionally enforced. Discharge permits, included in the general factory license, do not restrict loads of pollutants or the overall volume of wastewater in connection with concentration thresholds.

(12) However, on the few industrial estates of Thailand, fees are imposed for wastewater treatment. Also some central treatment facilities run by industrial associations operate with fees. In both cases fees cover only operating and maintenance costs. As treatment facilities and sewage systems are under construction in Pattaya and in the Bangkok Metropolitan Region, fees for covering maintenance and operating costs will be applied more widely before too long. Thailand's wastewater management can therefore be viewed as being on the verge of Stage II.

(13) As trading discharge permits could take place only for specific pollutants for which trading rules must be settled according to ambient standards, there is some danger of *thin markets*. Without further research on the location of industry discharging specific pollutants, no assessment can be made of the impact of this obstacle. A possible alternative to tradeable discharge permits is the introduction of charges. Charges, just like tradeable permits, require permits to specify loads of pollutants. Then, permits could be used as a basis for the charge. Occasional samples and appropriate penalties could prevent dischargers from claiming less polluted discharge for their permit than is actually true.

Scope for Institutional Assistance

(14) At any of the stages described abstractedly as well as for Thailand, scope exists for institutional assistance in various forms. Depending on the actual resource management, institutional assistance can include promoting economic instruments as a policy instrument, bringing together the groups concerned and developing a plan of implementation. Throughout the stages, institutional assistance can attempt to resolve the distributional conflicts which arise from implementing economic instruments. A prerequisite for solving such conflicts may be a forum for debate and providing the necessary information.

At Stage I the implications of different property rights and permits should be discussed extensively for freshwater and wastewater discharging since they influence the introduction of fees and charges or tradeable permits at later stages. At this stage, donor organizations could provide funds for researching environmental, legal and economic aspects of different property rights systems and forms of permits. Once property rights are defined legally, assistance will also be needed for implementation. Then, organizational and administrative issues are concerned. Adequate institutions must be created which are capable of monitoring and enforcing permits, and training of technical and administrative personnel will be necessary.

(15) If, as is the case in Thailand, property rights are expressed through a *command-and-control* policy, scope for institutional assistence lies within providing detailed information. The necessary relation between ambient standards and emission standards requires detailed knowledge of the environmental conditions of water bodies, their seasonal conditions and their carrying capacity with regard to different pollutants. Apparently these informational requirements are not easily obtained and institutional assistence could provide help in many ways.

(16) At Stage II, the core problem for institutions is to design cost-covering fees. This should be relatively easy for irrigation water. The Royal Irrigation Department is the only responsible agency for maintaining and administering irrigation systems. Basically, the costs of the Royal Irrigation Department must be covered by funds raised with the fee. Fees are already in place for tap water, and neither the Municipal nor the Provincial Water Works Authorities appear to face serious obstacles in the implementation. However, it is not clear whether they are able to cover costs by fees or whether they receive additional funds from the Central Government.

(17) In order to unify the cost-calculating procedure for municipal wastewater fees, the Department of Pollution Control is currently considering to issue guidelines with the help of donor organisations which provide knowledge of operating systems in industrialized countries. The implementation of fees will have some distributional effects. These should be surveyed, and measures should be developed to compensate for the imposed burden on low-income households. In Thailand, the fee collection appears to be largely unproblematic for the administration. However, because of distributional effects implementation is mostly a political matter. Apparently, unpredicted and

uncompensated effects could lead to a politically induced dismissal of fees in the short run.

(18) At Stage III institutional assistance for introducing and implementing tradeable permits and charges can rely upon information gained at the previous stages. Grandfathered tradeable permits for freshwater will give Thailand's farmers an advantage over industry or urban dwellers. But in order to allow trading in permits, an institution must be created which functions as an exchange agency. According to the prices at which permits are cleared, farmers or water user associations can estimate possible gains. Currently no central agency exists which could provide such services. Likewise, a central agency must be established if a charge on freshwater is imposed. However, a considerably smaller number of users will be directly concerned with the charge: the incentive can be passed on to final consumers by means of the fee systems. Besides the Royal Irrigation Department and the Municipal and Provincial Water Works Authorities mostly industrial users will be charged directly.

(19) In the case of wastewater, Thailand's current factory licensing system must be developed into a permit system which separates pollutants. In order to turn these into tradeable permits, trading rules must be established. Trading rules reflect the interdependence between ambient standards and emission standards and prevent *hot spots*. For the establishment of trading rules institutional assistance can help provide environmental information. If a charge shall be introduced, research must be conducted in order to define ambient quality standards and estimate abatement cost functions to levy the charge at a sufficiently high level.

(20) Also with wastewater a central agency must organise and supervise trading in permits. Contrary to freshwater management, Thailand already has a central agency for managing wastewater discharges: the Pollution Control Department is responsible for establishing ambient and emission standards. This institution should administer the market in tradeable permits. But the Pollution Control Department could also administer a charge. Since the department has no experience with collecting taxes or charges yet, institutional assistance could provide means for consultations.

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List of Tables

Abbreviations

BMA	Bangkok Metropolitan Area
BMR	Bangkok Metropolitan Region
BOD	Biochemical Oxygen Demand
BOI	Board of Investment
CCM	Computerized Color Matching
CNG	Compressed Natural Gas
CO	Cabon Monoxide
COD	Chemical Oxygen Demand
CTF	Central Treatment Facilities
cu.m.	cubic meter
CWTP	Central Wastewater Treatment Plant
DEQP	Department of Environmental Quality Promotion
DIE	Department of Industrial Environment
DIW	Department of Industrial Works
DO	Demand Oxygen
DOH	Department of Health
DPC	Department of Polution Control
DPW	Department of Public Works
EIA	Environmental Impact Assessment
EGAT	Electricity Generating Authority of Thailand
EQPD	Environmental Quality Promotion Department
ERTC	Environmental Research and Training Centre
f	Forecast
FAC	Factory Act

FTI	Federation of Thai Industries
GEMS	Global Environmental Monitoring System
GDP	Gross Domestic Product
GNP	Gross National Product
GTZ	Deutsche Gesellschaft Für Technische Zusammenarbeit
HC	Hydrocarbon
HSA	Hazardous Substances Act
IEAT	Industrial Estate Authority of Thailand
IEF	Industrial Environmental Fund
IEM	Industrial Environmental Management Program
IFCT	Industrial Finance Corporation of Thailand
IRR	Interest rate of return
ISC	Investment Service Center
kg/d	kilogram per day
LPG	Liguid Petroleum Gas
MANRES	Management of Natural Resources and Environment for Substainable Development
mg/l	milligram per liter
MOI	Ministry of Industry
MOPH	Ministry of Public Health
MOSTE	Ministry of Science, Technology and Environment
MPN	Most Probable Number
NAAQ	National Ambient Air Quality
NBSDB	National Economic and Social Development Board
NEB	National Environment Board
NESDB	National Economic and Social Development Board

NGO	Non-Governmental Organization
NHA	National Housing Authority
NIC	Newly Industrialised Country
NIE	Newly Industrialised Economics
NOx	Nitrogen Oxides
NSTDA	National Science and Technology Development Agency
O&M	Operation and Maintenance
ODS	Ozone-depleting Substances
OEPP	Office of Environmental Policy and Planning
OISWM	Office of Industrial Services and Waste Manangement
ONEB	Office of National Environment Board
Pb	Lead
PCC	Pollution Control Committee
PCD	Pollution Control Department
PCO	Pollution Control Officer
PHA	Public Health Act
PWD	Public Works Department
RTG	Royal Thai Government
SO_2	Sulfur dioxide
SPM	Suspended Particular Matter
TBCSD	Thailand Business Council for Sustainble Development
t/d	tons/day
TEI	Thailand Environment Institute
TIA	Tanneries Industry Association
TSA	Toxic Substances Act
TUTI	Thai United Tanning Industry Company, Ltd.

ULG	Unleaded Gasoline
USAID	United States Agency of International Development
WHO	World Health Oganization

1. REVIEW OF ECONOMIC, POLITICAL AND SOCIAL FRAMEWORK IN THAILAND

1.1 Current and Projected Population

Thailand's current population is 57 millions. Due to intensive family planning campaign, population growth rate has declined from 3 percent during 1960-1970 to only 1.5 percent in 1980s. In 1991, population rate dropped to 1.1 percent, the lowest rate of any of the South East Asian countries. According to the TDRI (1993), by the year 2006, total population is estimated to be 68 millions. Approximately 70 percent of its population still dwell in the rural areas, while the remaining live in urban areas. Bangkok alone hosts more than 11 percent of total population and is the most densely populated region of the kingdom (Statistics of Thailand, 1993).

Table 1.1 Current Population of Thailand and Projected Population

Unit: Million

Region	1990	1991	1996	2001	2006
North	10.8	10.8	11.5	11.9	12.3
Northeast	19.3	19.6	20.7	21.9	22.8
South	7.5	7.6	8.4	9.1	9.9
East	3.5	3.6	3.9	4.3	1.6
West	3.3	3.3	3.5	3.6	3.8
Central	2.7	2.8	2.9	3.1	3.2
BMA[1/]	9.0	9.2	10.1	11.0	11.9
Total	**56.1**	**56.9**	**61.0**	**64.9**	**68.5**

Source: TDRI (1993)

Note: Bangkok Metropolitan Area

1.2 Economic Development and Industrialisation

Over the past two decades, Thailand has achieved a very high Gross Domestic Product (GDP) growth rate, with an average real growth rate of GDP over 7 percent per annum. The growth rate of the industrial sector was more than 9

percent, that of the service sector was about 7 percent and that of the agricultural sector was less than 4 percent (Sussangkarn, 1992). Since 1986, the country GDP growth rate was more than 10 percent and continued at an average of 8 percent in early 1990s (TDRI, 1993). It is anticipated that GDP growth rate is continuing to grow at about 8 percent annually in early 1990s (TDRI,1993). As a result, per capita incomes have now been at the level of US$ 1,800 per head, almost twice as high in real terms compared to that of 1980 (Bank of Thailand, 1992).

Along with the high economic growth rate, the structure of Thai's economy has changed significantly. The most striking aspect of economic development is the rapid industrialization. The manufacturing sector has emerged as the most significant sector, replacing the primary sector in importance. In 1981, the manufacturing sector grew at a rate of more than 10 percent in real terms while growth in GDP over this period was 8 percent annually (World Bank, 1993). The double digit GDP growth rate in the late 1980s has been driven mainly by the sharp increase in manufacturing exports. These products included processed food, textiles, shoes, gems and jewelry, integrated circuits, toys and steel pipes. The share of the manufacturing sector in GDP has grown from 11.93 percent in 1960s to 24.8 percent in 1990 while its share in total export has significantly increased from 2.44 to 76.24 percent during the same period (Bank of Thailand, 1992).

A sharp decline in oil prices and interest rates as well as appropriate exchange rate policies and management were important factors that contributed to the high economic performance since 1986. Additionally, due to the relatively efficient and low-wages of the Thai labor force as well as strong pressures to shift and relocate manufacturing bases away from Japan and many Asian newly industrialized economies (NIEs), foreign investment increased substaintially (TDRI, 1990). This, in turn, contributed to rapid economic growth. Added to this was the incentive of political and social stability; Thailand had only one prime minister with a stable political system.

Table 1.2 Thailand's Key Economic Indicators

Year	**1988**	**1990**	**1992** *f*
GDP			
Real GDP at 1972 Price (percent change)	13.2	10.0	7.4
Per capita GNP (Baht)	27,179	36,637	45,619
Inflation (Consumer Price Index)	3.8	6.0	4.0
External Sector (billion Baht)			
Exports	399.2	583.2	816.5
percent change	*33.9*	*14.4*	*13.3*
Imports	*500.4*	*838.3*	*1,031.0*
percent change	*46.2*	*29.0*	*6.5*
Exchange Rate (annual average)	25.29	25.59	25.40

Source: Bank of Thailand (1993) **Note:** f = forecast

Equally important in economic transformation has been a substantial decline in the share of agriculture in GDP. As a percentage of overall economic activity, the agricultural sector in Thailand has gradually become less significant in recent decades. During the 1950s, the sector contributed nearly one-half of gross national product (GNP), but its share had declined to only 16 percent by the end of the 1980s. Nevertheless, actual agricultural output has increased over the same period. The percentage share of agricultural exports has dropped remarkably from more than 80 percent in early the 1960s to only 16 percent in the 1990s. However, Thailand still plays a crucial role in world agricultural exports. That is, Thailand still ranks among the top ten in export of rubber, sugarcane, maize and fisheries. The main agricultural products exported include rice, rubber, tapioca and sugarcane (Bank of Thailand, 1992). However, in recent years, the proportion of land and labour devoted to agriculture is declining in favour of the faster-growing manufacturing and construction industry. In recent years, land and labor in the agricultural sector are increasingly being completed away by the faster growing manufacturing and construction industry. High valued horticultural and tree crops as well as livestock are also replacing the major traditional crops.

Table 1.3 Agriculture Contribution to GDP at Current Prices

Plan	GDP of Agriculture as Percentage of Total GDP	Average Real Growth of Agricultural GDP 1/
Before plan 1950	45.22	
First plan 1961	39.19	7.6 (3.3)
Second plan 1967	32.47	4.2 (4.3)
Third plan 1972	25.36	4.2 (5.1)
Fourth plan 1977	24.77	4.0 (5.0)
Fifth plan 1982	19.13	3.9 (4.5)
Sixth plan 1987	16.41	3.4 (2.9)
Seventh plan 1992		(3.4)

Note: *1/ National Plan Targets in Parenthesis*

Source: Office of Agricultural Economics (1991)

Export earning has doubled from those of 1988, increasing from 400 billion baht to 800 billion baht in 1992 (Bank of Thailand, 1992). Table 1.4 illustrates that more than 70 percent of total exports is manufactured product. During 1986-1991, the growth of the manufacturing industry's exports averaged 33.76 percent (NESDB, 1993). Also shown in Table 1.4, the forestry and mining sector have become less important due, in part, to a decline in the country's resource base.

Table 1.4 Export Share Classified by Economic Sectors

Unit : Percent

Sector	1960	1970	1980	1990	1991
Agriculture	84.38	67.50	46.93	16.96	15.06
Fishery	0.41	2.49	4.16	5.51	6.02
Forestry	1.33	1.48	0.05	0.13	0.12
Mining	6.69	13.98	11.58	1.26	1.04
Manufacturing	2.44	6.10	32.33	74.67	76.24
Other	4.74	8.50	4.95	1.47	1.52
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Source: Bank of Thailand

Note: 1/ Including re-export

As Thailand's economy has undergone a massive structural transformation, the structure of the manufacturing sector has also experienced some changes. Table 1.5 shows that in the 1980s, food processing was the largest sector in terms of value-added. But this has been replaced by textile and wearing apparel. As illustrated in Table 1.5, the share of electirc machinery and supplies, non-metallic mineral products and leather products and footwear has grown since 1981. Manufacturing exports, including textiles and garments, sporting goods, toys, integrated circuits, rubber products, jewelry and furniture have expanded approximately 30 percent per year since 1986 (TDRI, 1992).

Table 1.5 Manufacturing Value Added Share (1988 price)

Sector	1981	1986	1991
Food	12.3	13.5	9.5
Beverages	8.4	7.1	6.0
Textile	10.8	11.3	10.9
Wearing Apparel Except Footwear	9.2	10.1	10.8
Leather, Leather Products and Footware	2.1	2.5	3.9
Paper and Paper Products	1.7	1.5	1.3
Printing, Publishing and Allied Industries	1.6	1.6	1.1
Chemicals and Chemical Products	3.0	3.2	2.6
Petroleum Refineries and Petroleum Products	9.2	8.7	5.6
Rubber and Plastic Products	2.1	2.5	2.3
Non-metallic Mineral Products	4.8	5.2	5.8
Basic Metal Industries	2.4	2.0	1.5
Fabricated Metal Products	2.3	2.7	2.8
Machinery	2.9	2.7	5.5
Electric Machinery and Supplies	3.0	4.2	6.8
Transport Equipment	8.9	5.6	8.8
Total Value Added (Million Baht)	224,94	294,21	606,63

Source: NESDB

However, high economic and industrial growth rates have been concentrated mainly in the Bangkok Metropolitan Region (BMR: Bangkok and 5 adjoining provinces) which accounted for 77.13 percent of value added in GDP in 1989 (NESDB, 1993). In 1981, the gross regional product of the Bangkok Metropolitan Region accounted for 42.3 percent of the GDP. The figure has increased to 48.2 percent of GDP in 1989 (NESDB, 1993). In 1990, the majority of industrial factories were located in the BMR, accounting for more than 50 percent of the total number of factories in the kingdom (Department of Industrial Works, 1992).

1.3 Employment, Education and Income Distribution

As double digit growth is mainly driven by the industrial and tourist sector, industry and services have been a major source of employment and income growth. However, despite the significance of the industrial and service sectors, agriculture has been, and still is, the main employer of the total labor force; more than 65.9 percent of labor force makes their living from the primary sector.

According to Hutaserani and Jitsuchon, (1988), income inequality in Thailand has been increasing over the last decade. As discussed earlier, the large differential between the share of employment in the agricultural sector and the share of agriculture in GDP indicates that income inequalities between agricultural household and non-agricultural household has been widening since the mid-1970s.

While approximately 95 percent of children in Thailand have access to primary education; less than half go beyond primary school (Myers and Susankran, 1992) Gross enrollment ratios from a farming background entering secondary school is 14.5 percent, half the total kingdom average of 29 percent. The figure drops to only 1.7 for tertiary education. As noted by Myers and Susangkran (1992) in 1990, more than 80 percent of the workforce has been educated to primary education standards or less. This low rate of secondary enrollment and a high proportion of the labor force having received only education to primary level or lower will be a principal obstacle to maintain long term economic growth and become a Newly Industrialised Country (NIC).

According to Myers and Susangkran (1992) inequalities in income distribution and poverty will intensify since there is a close relationship between the level of education and income distribution. To be able to maintain sustained growth and eradicate poverty and the income distribution problem, improving educational opportunities for lower income population groups is a must.

1.4 Political Framework

Thailand has been governed by a constitutional monarchy since 1932 when a bloodless coup abolished the absolute monarchy in favor of a constitutional democracy. The reigning King, His Majesty King Bhumibol Adulyadej, is the ninth king of the Chakri Dynasty and has been on the throne since 1946. On July 2, 1988, he became Thailand's longest-serving monarch. The king's authority is based less in the constitution than in the respect and affection in which he is held by Thai people. He has been playing an active role in environmental protection in both rural and urban areas. One part of his speech on New Year for 1990 concerned about environmental issues which enforced to strengthening the political will to implement projects with obvious environmental implications.

Although technically a democracy Thailand's political history had been up until 1980, one of a cycle of coups with periods of military role for exceeding the periods when civilian governments were in power. Between 1932 and 1993 Thailand had ten successful coups, a large number of unsuccessful ones, and 15 constitutions. Since 1980 Thailand's relative political stability has instilled confidence in investors and traders. Political stability has been one of the most important factors in the country's economic progress and indirectly has also continued to the growing concern about environmental protection.

With each new constitution there has been a change in the structure and function of the House of Parliament. hailand's 15th constitution which was enacted on December, 1991 consists of 360 members lower house from public election, 270 senators of the upper house appointed by the prime minister, and prime minister.

Although the details of budgeting etc. are determined by the government in power, there has been remarkable continuity in the direction of development plans owing to the role of National Economic and Social Development Board (NESDB)[129]. This Board has produced the seven five-year development plans which have guided Thailand in its efforts to industrialize. To current Seventh

[129] See responsibilities of NESDB in Appendix 1

National Economic and Social Development Plan focuses on sustainable development, natural resources management and environmental conservation.

2. REVIEW OF ENVIRONMENTAL PROBLEMS IN THAILAND

Since the rapid economic growth in the past decade Thailand's GDP grew at almost 10 percent annually (World Bank, 1993), resulting in the expansion of natural resources consumption particularly for the manufacturing, agriculturing, and fishing sectors. Due to the lack of long-term environmental management policies during that period, today, the environment shows signs of intense deterioration. Environmental problems which occur can be classified into two major categories: the first is *rural environmental problems*, namely deforestation, forest encroachment, cultivation of marginal and fragile lands, soil erosion, flooding and water shortages; the second category is *urban environmental problems*, nominally crowding, slum, traffic congestion, solid/hazardous waste, and water and air pollution from households and industries. As time passed, industrialization together with structural change and migration followed by urbanization, rural environmental problems transformed into urban environmental problems. Depending on the geographic location of urban cities and industries relative to the areas, there may also be physical environmental interactions such as downstream pollution from agricultural chemicals or damage to crops from industrial pollution and acid rain (Panayotou et al,1991).

Industrialization, urbanization, and energy consumption are closely related. Industries are attracted to urban centers, especially Bangkok and its satellites provinces because of the availability of the infrastructure and services, and the proximity to markets and ports. In addition, industrialization and urbanization utilize a lot of energy, resulting in the increase in pollution (Panayotou et al,1992). This chapter put emphasizes on urban and industrial environmental problems which connect to the deterioration of ambient environment and public infrastructure deficiency relative to demand. Since Bangkok is an urban and industrial center, this chapter will specifically focuses on the city's environmental problems. Table 2.1 shows the number of polluting industries in Thailand (OECC and TDRI, 1993).

Table 2.1 Number of Polluting Industries in Thailand

Year	Water-polluting	Air-polluting	Total air and water-polluting (1)	Hazardous Waste (2)
1969	159	68	211	248
1979	5,393	2,241	7.030	7,183
1989	20,221	8,120	26,235	17,056

Note: (1)The total air and water polluting industries excludes those which come into both categories, to avoid double-counting.

(2)Only factories producing large and moderate quantities of hazardous waste are reported.

Source: DIW (1989), (cited in Thailand Country Report for UNCED)

2.1 Air Pollution Problems

Air pollution in Bangkok has become a serious problem observing from toxic compounds distributed into the air caused by transportation (30 percent), industrialization (20 percent), generation (29 percent), and other sectors (21 percent) (UNCED, 1992). Sadly, air pollution problems are now developing in other major cities in Thailand as well, such as Chiang Mai, Hat Yai and Nakorn Ratchasima (Fahn, et al 1992). Table 2.2 shows emissions by sector.

Air quality in cities and industrial areas has deteriorated as a result of a combination of factors through vehicular exhaust gases, poor quality fuel and poor industrial combustion technology, inadequate use of air pollution control equipment in industries and poor enforcement of legislation for vehicular and industrial emission control (Fahn, et al 1992). Since 1978, under the WHO's Global Environmental Monitoring System (GEMS) program, the Ministry of Public Health (MOPH) is responsible for the monitoring of ambient air quality in Bangkok. In 1981, the National Ambient Air Quality (NAAQ) standards were established. Recently, the Department of Pollution Control (DPC) has set up its own monitoring activities at 7 permanent stations throughout the city. Today, air pollution is considered to be the most pressing environmental problem in the BMR (WHO,1993). Air pollution from any sources can be described as follow:

Table 2.2 Emissions by Sectors (tons/year)

Emssions	Total Emissions (1988)	Share by Sector (%)		
		Industry	Transport	Power
SO_2	203,634	42.6	38.7	16.0
NO_2	217,265	9.4	76.0	5.0
SPM	255,265	35.9	22.3	1.0
Lead	519	-	100	-

Source: World Bangkok, 1993

2.1.1 Air Pollution from Transport

Transportation is the largest energy consumer compared to other sectors. In 1990, 51 percent of the total energy consumed by transportation was used in the BMA. 75 percent of that was attributed to land transport while the rest were for water and air transport. Road transport is the main energy consumer while less than 1 percent goes to rail transport. In 1991, there are about 2.3 million vehicles in Bangkok or about four times the number of vehicles in the last decade (UNCED, 1992). Fuel used in transport are diesel (54.4 percent), gasoline (23.5 percent), aviation and jet fuel (17.0 percent), fuel oil (4.0 percent), and liquid petroleum gas (LPG) (1.1 percent). The main pollutants in the transporting sector are lead (Pb), carbon monoxide (CO), nitrogen oxides (NOx), hydrocarbons (HC), and smoke resulting from incomplete combustion in diesel and two-stroke motorcycle engines. It was found that this sector produced the highest level of NOx (64 percent), CO (87 percent) and HC (41 percent) emission of each total emission. Lead emission depends on the use of lead fuel more than sulfur dioxide (SO2) and suspended particular matters (SPM) (Fahn, et al, 1992). Table 2.3 shows air quality in Bangkok in 1993 (WHO, 1993). Table 2.4 presents emission by transport sector.

Table 2.3 Air Quality near Streets in Bangkok

Compounds	Concentration	Ambient Standard
NO_2 (mg/m^3)	0.002	50 (hr)
CO (mg/m^3)	1.15	20 (hr)
SPM (mg/m^3)	0.05-0.07	0.33 (24 hr)
Lead ($\mu g/m^3$)	0.01-3.0	10.0

Source: ONEB; Air and Noise Pollution, 1990

Table 2.4 Emissions from the Transport Sector (BMR) (Thousand Tons/Year)

	1986	1991	Aver.Annual % Growth Rate (1986-91)
SPM	42.51	76.15	12.4
NO_2	121.97	218.20	12.3
SO_2	58.77	106.82	12.1
CO	595.67	1,065.79	12.3
HC	83.85	149.94	12.3
Lead	0.396	0.618	9.3

Source: World Bank, 1993

Key factors relating to air pollution problems in the transport sector in Bangkok are described as follows (Fahn, et al, 1992, UNCED, 1992) :

(1) *Demand* for motorization increases as urban area expands, and the number of vehicles in urban areas increases as urban population grows.

(2) *Levels of traffic* exceed Bangkok roads' capacity resulting in greater incomplete combustion due to deceleration and traffic congestion.

(3) T*he quality of fuel* or lead content in fuel is the important factor which causes air pollution. Thus, in May 1992, unlead gasoline was introduced into the market. The government has also introduced regulations on distillation temperature (357°C) and sulfur content (0.5 percent) in order to reduce black smoke and sulfur dioxide emission.

(4) *Annual vehicles' inspections* are performed regularly only on trucks and buses. However, the Thai government is currently considering implementing such a scheme by allowing private inspection centers to perform this kind of service to privatly owned automobiles.

It was estimated that 415 news cars are being released into the streets every day, leading to the never ending traffic congestion and deterioration of air quality. As a result, the average blood lead level in those living in Bangkok is 22.68 μg/dl. Babies are born with blood lead level of 16 μg/ml which is above the level recommended for treatment. It is infants and children who are most vulnerable to the neurological effects of this heavy metal (Fahn, et al, 1992).

2.1.2 Air Pollution from Industry

Biomass fuels and petroleum products are the principal sources or energy consumption and air pollution in the industry sector (33.6 percent and 30.4 percent, respectively). The others are natural gas, electricity, coal and lignite. Three major toxic compounds emission by manufacturing industries are SO_2 (21 percent), NOx (12 percent), and SPM (56 percent) comparing to the total emission (UNCED, 1992). Non-metallic mineral industries (e.g. cement manufacture, glass and ceramics) and food processing industries significantly generate contaminants into ambient air. Non-metal alone produces over 40 percent of SO_2 and more than half of SPM emissions (OECC and TDRI, 1993). Table 2.5 shows estimated emissions by different sources in 1991.

Table 2.5 Estimated Emissions by each Source, 1991

Units: Percentage share of total industrial emissions

	CO_2	SO_2	NOx	SPM
Non-Metal	25.11	40.77	47.16	51.62
Food	50.32	16.66	21.36	36.24
Pulp and Paper	3.94	8.21	7.73	8.05
Textile	6.14	14.51	5.42	1.08

Note: The non-metal industry includes cement manufacturing, glass ceramics, etc.

Source: OECC and TDRI, 1993

A major factor of industrial air pollution is fuel type. Due to fuel price, lignite is the most attractive source. However, it is one of the most polluting fuel types, producing 4-5 times more SO2, 1.5 times more NOx and twice as much SPM as coal per unit of energy generated. The DIW is responsible for issuing

emission standards to industries which are designed to ensure that NAAQs are achieved (Fahn, et al, 1992).

2.1.3 Air Pollution from Electricity Generation

Presently, the principal fuels being used in electricity generating are natural gas (43 percent), fuel oil (29 percent), and lignite (22 percent). On the other hand, it generates less air emission in quantity compare to other sources. The major toxic compounds emited from electricity are SO_2 (56 percent) and NOx (16 percent) (UNCED, 1993). Due to the policy of domestic fuel use, coal and lignite are expected to become the significant energy sources in electricity generating leading to the increase of air pollutants in the future years (Fahn, et al, 1992).

Mae Moh is one of the serious case where sulfur was emitted into the surrounding area caused by the poor grade of Thai lignite which has a 2-6 percent sulfur content. It is estimated that 1.36 million tons of sulfur dioxide are being produced by the power plant at Mae Moh each year (Fahn, et al, 1992).

2.2 Water Pollution

Water pollution is another severe environmental problem in Thailand caused by the urban and the industrial sectors. Due to the lack of wastewater treatment facilities and sewerage systems, all pollutants from households and industries are directly discharged into klongs, river and other water bodies. To make matters worse, run-offs of chemicals from agriculturing deteriorate rivers, one of the most important source for fish and water. However, in Bangkok, the major source of water pollution is domestic wastewater. In 1988, 75 percent of total Biochemical Oxygen Demand (BOD) loads to lower Chao Phraya River in 1988. It is estimated that approximate 183,600 kg BOD has been loaded into the Chao Phaya per day (TDRI, 1992). In some rural areas such as the Mae Klong River, similar to Bangkok city, domestic wastewater is also a major cause of water pollution (93 percent of the total BOD load is from domestic wastewater) (UNCED, 1992). Table 2.6 demonstrates water quality of major rivers in Thailand.

Today, the BMA is in the process of constructing six central sewerage treatment systems as an urgent solution for controlling wastewater pollution problems. The construction covers six priority areas of Bangkok. The locations, types and treatment capacity are shown in Table 2.7. In the future, there will be

eleven master projects which the BMA plans to undertake. Between 1994-2001, the BMA poses to have private sectors invest in treatment systems for the remaining areas of Bangkok.

Table 2.6 Major Rivers' Water Quality in Thailand ,1989

	DO (mg/l)	BOD (mg/l)	Total coliform (MPN/100 ml)
Chao Phaya			
Upper	5.8	1.0	18,666
Middle	2.4	2.4	35,000
Lower	0.2	2.8	705,000
Tachin			
Upper	5.0	2.9	24,000
Middle	1.6	2.6	240,000
Lower	0.8	2.7	161,000
Mae Klong	5.3	2.0	25,800
Bang Pakong	4.1	1.2	9,800

Source: ONEB (1990)

Table 2.7 BMA's Projects on Sewerage Treatment Systems

Project	Location	Type of CWTP	Treatment Capacity (cum/d)	Budget (Baht)	Finished Year	Present Status
1. Sripraya CWTP	Sripraya Road, Klong Pradung Krongkasam	Activated Sludge Process with Contact Stabilization	30,000	464.4	1993	Being Constructed
2.Rattanakosin CWTP	Banpom Market, Klong Padung-kongkasam	Two-Stage Activated Sludge Process	40,000	883	1996	Bids being invitated
3. Yannawa CWTP	Klong Chong Nonsee	Activated Sludge Process	195,000	4,712	1996	Design finished in 1992
4. Nongkham CWTP	Near Nongkham Solid Waste Treatment Plant	Activated Sludge Process	157,000	3,621	1996	Design finished in 1993
5. Radburana CWTP	Thung Ku	Activated Sludge Process	65,000	2,827	1996	Design finished in 1993
6. Central Wastewater Treatment Phase 1	Near BMA Office 2	In Approving Process	350,000	6,382	1996	Bids being invitated

Source: Wastewater Treatment Division , Department of Drainage and Sewerage, BMA September 1993

Note: CWTP = Central Wastewater Treatment Plant

In addition, recently the BMA has held development plans for the expansion of sewerage treatment capacity in small scale communities previously undertaken by the National Housing Authority (NHA) (BMA, 1993). Furthermore, Department of Public Works (DPW) is now being responsible for the construction of sewerage treatment systems in municipalities throughout the country. At present, 10 domestic wastwater treatment plants are functioning in major municipalities. Beside this, about 49 areas are now being investigated for future construction of wastewater treatment plants at a feasible study stage.

Sources of water pollution are summarized as follows:

(1) Untreated domestic and municipal wastewater from municipalities and tourist resorts;

(2) Untreated industrial wastewater;

(3) Solid waste dumping in rivers due to inadequate collection system;

(4) Leachate from inadequate designed and managed solid waste landfill sites;

(5) Run-offs from agricultural land composed of pesticides, herbicides and fertilizers;

(6) Dumping of agricultural waste;

(7) Soil erosion due to extensive deforestation;

(8) Oil and chemical spills from marine traffic.

Water Pollution Caused by Industry

Although only 25 percent of pollution in water bodies is caused by industries, these pollutants contain non degradable compounds such as heavy metal, a solvent which can accumulate in the bottom sediment and in aquatic animals, which can consequently affect the ecosystem. Roughly 20,000 factories registered with the Department of Industrial Works (DIW) are classified as water polluting industries. The food and brewing, pulp and paper, rubber manufacturing and tanneries are the major pollutants. It was reported that many factories have their own on-site treatment systems, but theese systems are not being operated the reason that factory owners wanted to save treatment costs. Table 2.8 shows type of industries and its BOD load, 1986.

Although small- and medium-size industries are not required to install on-site treatment facilities considering that they have inadequate funds, large industries, on the other hand are being regulated by the DIW to install such facilities. It is more encouraging to know, however, that 70 percent of industrial wastewater are now being treated. Samut Prakan, the most important industrial city has approximately 1,600 water-polluting factories, only 165 factories (10 percent) have constructed their own on-site treatment system.

Table 2.8 Type of Industries and their BOD Load, 1986

Industry	BOD (tons)
Food	288,786
Berverages	203,468
Tobacco	0
Textiles	8,408
Wearing Apparel	3
Leather products and footwear	0
Wood and cork	1,409
Paper and paper products	11,463
Printing, publishing and allied	0
Chemical products	2,138
Petrolium products	0
Rubber and rubber products	548
Non-metalic mineral products	11
Basic metal industries	0
Fabricated products	0
Machinery	0
Electric machinery	0
Transport equipment	38
Miscellaneous	109
Total	516,381

Source: DIW

2.3 Hazardous Waste Pollution

The lack of proper hazardous waste disposal facilities in Thailand resulted in the creation of numerous environmental problems. These problems are usually associated with leachate and spillage of toxic compounds. In 1991, the explosion of a Port Klong Toey warehouse containing unknown quantities and varieties of toxic chemicals affected many local residents, causing sickness and possibly miscarriage.

The number of industries producing hazardous waste increased from 6,600 in 1979 to 16,000 in 1989. It is estimated that approximately two million tons of solid hazardous waste is being generated every year. Basic metal industry is the major generator of hazardous waste. It produces 72 percent of heavy metal sludge and solids of total solid hazardous waste.

Other generators of hazardous waste are manufacturing (90 percent), hospital and laboratory (4 percent), and municipalities (1 percent). The volume of hazardous waste in Thailand is growing rapidly, now exceeding the country's disposal capacity. Industries which are suspected to produce hazardous waste are metal's industry, transport equipment industry, machinery manufacture, chemicals, textiles, electronic, rubber and pulp and paper industries. Table 2.9 shows type and amount of hazardous waste produced in Thailand.

Table 2.9 Type and amount of Hazardous Waste Produced in Thailand

Unit: Tons

Waste	**1986**	**1991[f]**
Oil residues	124,194	219,467
Liquid organic waste	187	311
Organic sludge	3,737	6,674
Inorganic sludge	11,698	19,254
Heavy metal sludge	823,869	1,447,590
Solvent	19,783	36,163
Acid waste	81,054	125,428
Alkaline waste	21,952	34,235
Aqueous organic waste	12	25
Off-spec products	116	242
Aqueous organic waste	8,820	16,348
Photograph waste	7,231	11,787
Infectious waste	46,674	76,078
Total	1,151,729	1,993,602

Source: Engineering Science Inc., et al, 1989.

Note: f = forecast

2.4 Solid Waste Pollution

During the past decade, economic growth coupled with urbanization have lead to the increase of solid waste which will soon exceed the city's landfill capacity. This problem is further complicated by the BMA's restriction in solid waste management and by the inadequacy of treatment sites/plants despite the sub-contraction of disposal services by private agencies.

Solid waste generation in Bangkok city is about 5,000 metric tons per day, or 1.75 million metric tons per year. Solid waste product per capita varies due to areas. In central urban areas, about 1.77 kg per capita of solid waste is being produced a day, while in rural districts, only 0.45 kg per capita is being produced a day. The average solid waste production is estimated to be 0.88 kg per capita per day. The amount of solid waste generated also varies by season. May and August (rainy season) are the high season in which solid waste is produced. March and April (summer) are considered to be the low season. Table 2.10 shows the characteristic of solid waste in Thailand.

Table 2.10 Characteristic of Solid Waste in Thailand

Description	Unit	Bangkok	Regional Cities
Moisture content	% by weight	57.2	52.9
Volatile solid	"	-	65.40
Ash	"	21.80	34.60
Carbon	"	43.00	36.30
Nitrogen	"	0.97	0.25
Hydrogen	"	6.4	4.36
pH	"	6.36	7.21
Calorific value	cal/g	1,040 (wet)	3,824 (dry)
BOD of the leachate	mg/L	150-1,230	N.A

Source: Department of Health (DOH), 1989

2.4.1 Waste Collection Services

Waste collection services in the Bangkok region vary by areas. In central BMA there is 100 percent collection services. In contracy outer areas have only about 5 percent collection services. This is because of land availability, on-site burial and burning in the outer areas. At present, about 84 percent average of collection service is functioned by the BMA throughout the city.

The BMA has three solid waste opened dump sites: Nong Khame, Onnuj and Ram Indra which receives approximately 39 percent, 35 percent, and 26 percent of BMA's solid wastes respectively. There are small incinerators and composting facilities which are not effectively functioning--10 percent of waste can be treated-- in Nong Khame and Onnuj sites. Thus, most solid waste is discharged directly into opened dumping areas, resulting in the overload of solid waste relevant to site capacity. Table 2.11 shows solid waste disposal methods in Bangkok.

Table 2.11 Solid Waste Disposal Methods in Bangkok (1990)

Treatment Plant Site	Quantity (t/d)	Open Dumping (t/d)	Composting (t/d)	Landfill (t/d)
Nongkam	1,915	1,052	63	800*
Onnuj	1,139	1,066	73	-
Ram Indra	1,482	1,482	-	-
Total	4,536	3,600	136	800

Note: Operated by private enterprise
Source: Sujarittanon

2.4.2 Solid Waste Recycling

Recycling of solid waste in Bangkok depends on scavengers or those who buy materials directly from residents and shops and sell them to the recycling plants. The BMA's collecting crews are also recovering about 2.5 percent of these wastes by weight for selling. Nonetheless these kinds of collections are not very practical, although they do result in the reduction of solid waste being taken to the sanitary landfill. Presently, paper, plastic and glass factories implement some production based on second-hand materials.

3. ENVIRONMENTAL POLICY IN THAILAND

3.1 Environmental Policy in 1976-1991

Environmental policy and the rehabilitation of natural resources has been introduced in the Fourth Plan (1976-1981) to abate water pollution problem, deterioration of soil quality, shortage of water supply and depletion of forest resources (OECC and TDRI, 1993). In 1975, the Office of National Environment Board (ONEB) has been set-up under the National Environmental Quality Act, 1976 (NEQA). This act was the main instrument used to control environmental quality and determine environmental quality standard.

The Fifth Plan (1981-1986) succeeded in increasing environmental awareness, introducing a more integrated approach to natural resources development leading to the increase in the efficiency of natural resources utilization and restoration. In addition, it promoted cooperation between government and private sector in industrial pollution prevention. In 1981, ONEB began to focus on environmental quality standards in specific areas and decreed a notification on the types and sizes of projects that required an Environmental Impact Assessment (EIA) report. Meanwhile, the Department of Industrial Works (DIW) had set a system to monitor the wastewater quality discharged from factories.

The Sixth Plan (1986-1991) marked a turning point in the government's environmental strategies. This plan viewed the country's natural resources as a limited natural stock, meaning that the resource base might act as a constraint to economic development. Environmental guidelines of this plan included pollution clean-up plans, improving fuel quality and monitoring air quality emissions at an acceptable level, and encouraging private sector investment in pollution control and hazardous waste clean-up.

Since the development of environmental policy during 1976-1991 and the development of environmental management and regulation during 1969-1991 (Table 3.1), natural resources and environmental degradation continued to increase. Major problems and constraints in environmental management planning were:

1. Limitations of organizational structure, law/acts.

   - A lack of appropriate enforcable laws and measures such as in the control of effluent discharges from household and agriculture sources.
   - A lack of coordination of policy among different ministries and developments leading to duplication of works and conflicts.

2. Budget allocation and environment fund. Budget allocated from the central government is inadequate to solve environmental problems. Its requires large inputs of qualified manpower, technical knowledge and financial resources.

3. Lack of integration among socio-economics, natural resource and environmental protection.

4. Public awareness and coordination in environmental protection and control. Due to lack of awareness and lack of provision in laws and regulations, participation does not spread to communities, the private sector, or even government ffices. There is a widespread belief that environmental protection is not a part of their responsibilities.

5. Centralized decision making. Decentralization and delegation of environmental authority to provincial and local government, including personnel administration, fund raising, planning and decision-making, will facilitate participation from those who are directly affected by changes in their environmental condition.

Table 3.1 Development of Environmental Management and Regulation

Year	Activity
1969	Created Factory Act of 1969. Some basic guidelines for industrial operations and pollution control and a number of notifications for regulating industrial pollutant had been established.
1972	Environmental concern added to the National Economic and Social Development Plan (NESDP). Establish the Industrial Estate Authority of Thailand (IEAT) to promote industrial investment and to handle environmental management.
1975	Created The Improvement and Conservation of National Environmental Quality Act (NEQA/75). Established the Office of the National Environmental Board (ONEB). Amended the Factory Act (FAC/69) to strengthen environmental dimension. FAC/75 strengthened industrial pollution control and occupational health measures
1978	Amended NEQA/78, inaugurated an environmental impact assessment program to be implemented by ONEB.
1981	ONEB issued the precise guidelines required in preparing EIA report, establishment of standards for environmental quality and stringent enforcement of existing legislation DIW setting.
1992	Amended NEQA/1992, FAC/1992, HSA/1992, and PHA/1992.

Note: HSA/1992 = Hazardous Sustances Act, 1992.

PHA/1992 = Public Health Act, 1992.

3.2 The Seventh National Economic and Social Development Plan (1991-1996)

From past experiences, the Thai government recognized the limits of natural resources and the need for environmental conservation. Environmental policies in the Seven Plan (1991-1996), focus on five major areas: natural resources management, environmental quality, energy and environment, industry and environment, and urbanization and environment. The Seventh Plan directs the country to sustainable growth that accommodates both environmental management and economic development. The targets of this plan are set to improve environmental quality throughout the country including the rehabilitation of water quality of the lower reaches of the Chao Phraya and Tha Chin Rivers, the controlling of the pollutant from air pollution sources, the treatment of hazardous wastes generated from industries, the conservation of forest and the protection of coral reefs. Environment and Conservation of National Environmental Quality Act, 1992 (NEQA/1992) was established to

conserve natural resources and protect the environment. Environmental Fund was launched in October 1991 together with restructuring of the Ministry of Science, Technology and Energy. The costs of pollution control must be built into the capital and operating costs of manufacturing products and providing services, rather than be subsidized through the use of national tax revenues for pollution control and waste treatment projects. Besides the improvement of legal (see details in Appendix 2), fund provision and the reorganization of institutional structure (see details in Appendix 1), the Thai government started to acknowledge participation for every sector, namely governmental agencies, state enterprises, universities, business, and non-governmental organizations.

The NEQA/1992 revoked the policy and measurement for national environmental development (1981) and determined a new one (in section 35) called "Environmental quality management plan" in order to implement the national policy and plan for enhancement and conservation of environmental quality. Moreover, the local government must later formulate an action plan for environmental quality management at the provincial level.

Developing management mechanisms to deal with pollution problems:

1. Enforce the "Polluter-Pay-Principle[130]" during the Seventh Plan Period.

2. Improve organizational structure, particularly its role and legal framework to increase efficiency in environmental management, such as strengthening the role of local authorities in management and pollution treatment system in local areas. Local authorities should have flexibility in managing the treatment services, in both cases where public agencies offer the services themselves, and where they subcontract the services to the private sector. Local authorities should be empowered to collect service charges as appropriate.

3. Mobilize investment for the reduction and the controlling of pollution in various forms. For example, government may offer subsidies for the construction of central sewage treatment plants for communities and provide a partial of the total subsidy for garbage collection in local communities.

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[130] Polluter-Pays-Principle means the one polluting the environment is responsible for the costs associated with the effects. The principle reflects the acceptance of the right for good environment of society.

Similarly, government may invest or carry out joint investment, or grant a concession to the private sector for the provision of a central hazardous wastes disposal system for industrial plant etc.

4. The government should join forces with private sector communities, and the general public in protecting, preventing and solving environmental problems. For instance, a third-party representing communities, private enterprises and the government may be formed to supervise, protect and take care of environmental quality and maintain it at an acceptable level, particularly in urban areas, industrial zones, tourist destinations, etc.

3.3 Environmental Organizations

See Appendix 1.

3.4 Environmental Legislation

See Appendix 2

3.5 Guideline for Environmental Development for Quality of Life

See Appendix 3

3.6 Role of Non-Governmental Organizations (NGOs) and the Private Sector

Presently, there are 395 NGOs in Thailand. Most of them are involved in promoting and conserving natural resources. Approximately 36 of them are concerned in environmental problems and issues. Some NGOs, such as the Siam environment Club, the Conservation of Fine Arts and Environment Association, and the Thai Environmental Engineers Club play important catalysis role. The most well known NGO’s campaign belongs to the "Magic Eyes", a form of environmental education for children initiated by the Creative Thai Club. Policy oriented NGOs, namely Thailand Environment Institute (TEI) and Thailand Development Research Institute (TDRI), are influential to decision makers.

Active environmental conservationists could be grouped into four following categories: (IDCJ, 1992)

- True nature lovers who are interested only in conservation but never participate in political activities;
- Conservationists whose ideal is to participate and collaborate with villagers in fighting for environmental protection. They advise and join the villagers in various activities. Similar to the first group, they are not interested in politics but will organize as well as participate in a rally for environmental protection;
- Environmentalists who are interested in political power, and believe in fighting for the decentralization of governmental power in both administration and politics, as a pre-requisite to success in environmental conservation.
- The groups that have linkages with foreign sources in activities and financial resources. They see environmental problems as a global and an international issues.

In the past, environmental pollution has been taken as externalities (consideration of planning was made based on cost effectiveness and benefits in economic terms, by using the GNP per capita ratio as an indicator of the state of the country's development. Recently, the concept of "sustainable development" has been introduced in order to involve environmental costs into planning consideration.

Thailand Business Council for Sustainable Development (TBCSD)

Thailand Business Council for Sustainable Development (TBCSD) has been recently established to encourage business to take a leading role in preventing and solving national environmental problems; to foster the business role in environmental policy formulation; to promote the spirit of corporate citizenship, with business supporting initiatives in enhancing the quality of the degrading environment; and to promote the concept of "sustainable development" amongst business leaders.

Currently, TBCSD composed of fifty leading businessperson or Chief Executive Officers from various business sectors. Members are invited to join because of

their leadership qualities, their support for the environment and their willingness to implement change.

With Thailand Environment Institute (TEI) serving as the secretariat, the activities of TBCSD range from the national to the international level. *At the international level*, TBCSD will cooperate with the Business Council for Sustainable Development (BCSD) located in Geneva, in addressing gobal environmental issues. *At the regional level*, TBCSD will cooperate with ASEAN Chambers of Commerce and Industry in promoting cooperation among businessmen in ASEAN countries in fostering sustainable economic growth in combination with sound environmental management. As for *the national level*, emphasis will be put on field actions demonstrating what can be achieved through business initiatives and policy analysis on environmental issues whose solution depend on the vitality and the role of the private sector.

4. EVALUATION OF PRESENT ENVIRONMENTAL POLICY

Rapid economic growth in Thailand during 1986-90 resulted in abundant utilization of the country's natural resources and great expansion in industrialization inspite of the lack of any long-term environmental management policies. The National Development Plans in the past were clearly directed toward the development of infrastructures and basic services such as the construction of roads, dams and reservoirs, and other transportation and communication systems. Unfortunately these plans consequently increased deforestation, resulting in the acceleration of environmental pollution.

Government lacks the political mandate, budgetary resources, and enforcement capability. Commands and controls have been generally ineffective in controlling environmental degradation.

Considering the environmental problems require large inputs of qualified manpower, technical know-how and financial resources, the country's local governments get inadequate budget from the central government. At the provincial level, shortage of qualified personnel is an obstacle to the decentralization of policy and planning activities.

4.1 Polluter-Pays-Principle

Since 1969, Thailand has adopted command and control regulations from developed countries to solve environmental problems, under the conditions of unfavorable structural changes and without the benefits of strict enforcement or appropriate adaptations. Due to the ineffectiveness of the command and control regulations, environmental pollution increased continuously. The scarcity of tax revenues and the fear of becoming incompletant, the government has been interested in applying a market-based instrument. Effluent charges, self regulation and self-enforcement[131], differential tax of some others form of market-based instrument (see details in Chapter 5) have

[131]Self regulation and self-enforcement means that industrial association can be given to attain a certain ambient level of water or air quality on their own because they know best how to control their own waste.

been used to internalize environmental costs under the concept of the Polluter-Pays-Principle. However, although the Polluter-Pays-Principle has in principle been accepted as one of the government policies, there are no incentives for polluters to improve on official standard.

Experience from the Bangkhuntien Industrial Waste Treatment Center (see details in Section 5.1.2) indicated that the collection of fees by central waste treatment facilities has been difficult, although the environmental law allows managers of treatment facilities to charge fees, consumers were not willing to pay for them.

Urban environmental problems in Thailand occur from infrastructure constraints and are also related to the failure to establish and enforce full-cost pricing. The increasing of water pollution trend (particularly from wastewater and hazardous waste) enforces the government to develop waste treatment management systems. Still the existing wastewater and hazardous waste treatment facilities are inefficient and are short on availability. Today the government has a plan to build a number of central wastewater treatment facilities in Bangkok, in urban areas of cities and in industrial areas. The process of improving the environment involves large investments and operational costs but without short-run benefits, nor tangible returns to industries or the public. The failure to fully price water and to charge for waste disposal/treatment result in the excessive discharge of wastewater and inadequate funds to initiate sewage and waste collection/treatment systems. Revenues collected from water fees could be used to maintain the system, expand its distribution network and protect its watershed areas.

4.2 Legislation

Legislation seems to represent a continuation of past philosophies rather than a new departure. First, it is essentially an act that focuses on environmental issues and pollution control. It is not an act that recognizes the basic principle of sustainable development dispite the fact that economy and environment are inseparable. The legislation provides for the reorganization of environmental management within the executive branch, through the creation of a National Environment Board and an Environmental Fund, but it does not seek to integrate the environment with the work of other agencies of the central government (except in the financial administration of the Fund). Secondly, the legislation appears to maintain a top-down approach to priority setting. This is a

Thai characteristic. The sections which make specific reference to the role of provinces (primarily sections 37, 43, and 59, in relation to "environmentally protected areas" and "pollution control areas") appear to place provincial and local governments essentially in a responsive role. The central government designates these areas. The provincial authority is only responsible for the development of an appropriate action plan.

4.3 Enforcement

Many industries have installed their own wastewater treatment facilities in response to the DIW and Office of Environmental Policy and Planning (OEPP) requirements. Nonetheless, the country's environment continues to pollute because while industrial pollution increases, the existing on-site treatment facilities have been performing ineffectively. Addition costs for the implementation and operation of any waste treatment facilities caused industries to by-pass environmental regulations. The underlying motive is that Thai business relies on cheap labor and low production costs in being competitive.

Although the MOI and PCD have been increasingly active in setting standards and in developing environmental regulations, the actual implementation and enforcement of these regulations have be ineffective due to insufficient budget and staff, the lack of "political will" on the part of the politicians, the lack of knowledge on treatment technology and the lack of environmental awareness on the part of the public and people participation. Inadequate enforcement of environmental regulations and standards often increase the propensity for violators to continuously pollute, thereby accelerating the rate of environmental degradation.

In spite of the existing regulation framework, the DIW and MOSTE monitor emission from industries mainly on the quality of air emission, and the quality of wastewater discharges, but not on hazardous waste generation.

In the Kingdom of Thailand, any formal enforcements have to be initiated by the police (Ministry of Interior). Fines are small and the closure of facilities in response to non-compliance is viewed as a diastic measure and consequently rarely undertaken. While the revised NEQA/1992 allows for higher fines, its

implementation remains in doubt because even the lower fines were usually not levied (World Bank, 1993).

4.4 Standard

Ambient emission standards cannot successfully control environmental problems. The DIW has proposed a set of industrial air and wastewater emission standards for each category of factories which are expected to receive formal ministerial endorsement in the near future. This follows the Seventh plan policy in increasing control over industrial operations. However, the standards should also be set for each area with the cooperation of the central government and the local government through comprehensive, effective and appropriate measures in pollution prevention. This is because it is possible for a factory located in a highly populated area to cause environmental problems eventhough it meets the standards.

The regulations specify effluent standards for all pollutants in terms of concentrations (mg/l) rather than in limitation of total loadings (kg/d) (World Bank, 1993). The disadvantage of using concentration-based targets is that even if strictly enforced, these standards encourage dilution of wastes in order to meet standards. In this sense, not only is water conservation discouraged but effluent standards become irrelevant when water is under priced, as is the case of ground water in Bangkok city. The reason that concentration-based standards are preferred is that they are easier to enforce because they do not require data on effluent flow rates.

Effluent standards also require most firms to treat their wastewater in a uniform standard, which is 20 mg/l (World Bank, 1993). While this target is sensible for municipal sewage where untreated BOD concentrations vary between 100 and 300 mg/l depending on water use, it is an extremely stringent requirement for many industrial sectors where the raw BOD concentrations vary between 1,000 and 5,000 mg/l. For most industrial firms to attain the prescribed standards would require treatment efficiencies over 95 percent and in same cases, even exceeding 99 percent. The cost of meeting these standards is likely to be extremely high, but they generate moderate benefits. Typically, the costs (per ton of BOD) of going from 80 to 90 percent rise about three- to five-fold. Such an onerous standard encourages firms to falsify monitoring data in order to demonstrate their compliance.

4.5 Environmental Impact Assessment (EIA)

The Ministry of Science, Technology and Environment has issued a Notification on the Requirements of Environmental Impact for certain types and sizes of projects or activities in 1992 (an update of the 1981 notification). This notification covers the construction and operation of all petroleum refineries, natural gas facilities, airports, dams, reservoirs, irrigation, hotels, mass transit and express ways, mining, thermal power plants and various types and sizes of industries (see Appendix 3 for details).

EIA is being used as a planning and decision-making tool that can assist investors in mitigating environmental impacts.

The approval procedure of EIA is time-bound. OEPP has 15 days to ask the proponent about deficiencies or gaps, and a further 30 days to review and comment on the EIA submission, which may include the referring of that particular submission to a committee of experts chosen by OEPP. This committee has another 45 days to make its decision and recommendations. Failure to meet this deadline means automatic approval of the EIA (World Bank, 1993).

The advantage of these procedures is that it prevents large industrial projects from being held hostage by bureaucratic procedures or the injection of non-environemtnal concerns into EIA process (World Bank, 1993).

4.6 Industrial Promotion Zones

The Board of Investment (BOI) investment promotion zones concept is useful in limiting the sprout out of firms. Moreover, the incentives granted for locating a firm in Zone 1, the most congested and polluted zone, remain rather generous, and indirectly weakens the incentives grants for Zone 2 and 3.

The BOI promotes decentralization of industries from the BMR to outskirt areas despite that some areas are without any infrastructure systems, particularly the waste treatment facilities and drainage systems. The decentralization process

may lead to a spreading of industrial pollution from the BMR to outlying provinces. Although monitoring programmes should be organized by BOI, DIW, MOSTE and local government the BOI did not regulate any them. NGOs should play the role of the "watchdog" of environmental protection and enforcement in order to monitoring activities and put increasing pressures on factories to (re-) locate to Industrial Estate Authority of Thailand (IEAT) and BOI estates.

4.7 Incentive

MOSTE and BOI do provide incentives to industries using clean technology. Unfortunately, the actual quality of advice given by governmental agencies in terms of technologies selections tended to be rather poor as they lack update detailed technological information and unsystematic information about environmental issues.

A shortage of experienced administrators in OEPP and environmental facility of Industrial Finance Corporation of Thailand (IFCT) who can properly evaluate the feasibility of proposed investments in pollution prevention and clean technologies resulted in the private sector and local government investment lending to the delay in issuing the requirements of *Environmental Fund.*

4.8 Coordination

Due to the different nature and characteristics of the ministries and departments, there is still a strong lack of coordination in terms of policy palnning and implementation. This often leads to the duplication of works and conflicts which tend to further generate compartmentalization of works and aggravate the lack of coordination.

Because there is a lack of activities coordination among monitoring agencies, standardized analytical procedures and harmonized monitoring policies and objectives should be introduced in order to create complementary results and to save time, costs and efforts while making the monitoring of the industrial sector more effective.

4.9 Centralization

Although local governments have plans to employ the private sector to construct and manage wastewater treatment and drainage systems, unfortunately, they still remain dependent on limited capital transfers from the central government and environmental funds. Decentralized decision-making system should be induced especially in terms of financial aspect, e.g. reform and rearrangement of taxation involving rate and structure adjustment and improvement of tax administration, and the introduction of new taxes, charges and fees.

4.10 Public Participation

The revised law from NEQA/1992 gives NGOs a greater role in environmental protection by recognizing the need for greater public participation. However, public participation has been growing slowly considering that, first there is still some confusion when it comes to policy implementation. For example, how to allow people to participate in the decision-making in which they can monitor and make an inquiring into the unyielding actions, Second, the lack of public participation has spread among communities, private sector, and even government. People seem to think that environmental problems are not any of their business and believe them to be the responsibility of governmental officers. The underlying reason of this belief is the lack of awareness on the part of the public themselves.

DIW has a plan to build four new industrial waste treatment facilities in Ratchaburi, Chonburi, Saraburi, and Rayong Provinces. However, projects implementation is rather slow and is being resisted from local communities and NGOs.

5. VALUATION OF PAST AND PRESENT EXPERIENCES WITH MARKET-BASED INSTRUMENTS OF ENVIRONMENTAL MANAGEMENT

Command and control regulation (that is, direct regulation along with monitoring and enforcement systems) is the most commonly used environmental policy instrument in pollution control and waste management in Thailand. This approach relies primarily on regulatory instruments (for example permitting and enforcement procedures, and penalties for non-compliance). This approach is economically inefficient and difficult to enforce.

Market-based instruments are a tool with wide application in the field of environment policy. These methods were utilized by many countries such as France, Germany, Italy, the Netherlands, Sweden, and United States, etc.(OECD,1991). In Thailand market-based instruments are now begining to be implemented to prevent problems of environment deterioration. However, experiences with implementation of these instruments suggests that, market-based instruments have not eliminated the need for standards, environmental monitoring, enforcement, and other forms of government participation. It is therefore proposed that the best way to solve environmental problems in Thailand is to use a combination of both command and control regulations and market-based instruments. This chapter presents and evaluates past and present experiences of implementation of market-based instruments for environmental management in Thailand.

5.1. Effluent Charge

5.1.1 Application for industrial wastewater management in the Industrial Estate Authority of Thailand

The most effective effluent charge of industrial wastewater treatment is on the industrial estates managed by IEAT. Eigthteen industrial estates installed central wastewater treatment facilities. Factories are required to have pretreatment before discharge and must pay a charge for treatment. Effluent charge are based on the volume, BOD (Biochemical Oxygen Demand) and SS (Suspended Solid) concentrations of waste flows. The quantity of BOD and SS in wastewater is monitored by IEAT, and the volume of wastewater is estimated

to about 80% of water consumption. Examples of service cost equations of IEAT are as follows (IEAT, 1992):

For Leam Chabang Industrial Estate

$$C = 100 + 6.10\ Vi + \frac{Vi\ Si}{1{,}000} \times 10.47 + Cp \qquad (1)$$

where

C	=	Service cost for wastewater treatment, Baht/month
Vi	=	Wastewater quantity from industry, cu.m./month
Si	=	Organic concentration (BOD) from industry, mg/liter
Cp	=	Vi x K_3 when Suspended Solid (SS) > 200, Baht/month or
Cp	=	3(Cg+Cf+Cv) when other parameters do not meet standard e.g. heavy metal
K_3	=	2 for 200<SS<400, Baht/m^3/month
K_3	=	4 for 400<SS<600, Baht/m^3/month
K_3	=	8 for 600<SS<1,000, Baht/m^3/month
Cg	=	100 Baht/month
Cf	=	6.10 Vi
Cv	=	10.47 (ViSi/1,000)

However, this service fee is for wastewater treatment only and does not extend to other wastes, e.g. hazardous waste and air pollution. In addition, many factories did not understand clearly about pretreatment method, they discharged high polluted wastewater. There are still many complaints that industrial estates discharge wastewater to the environment.

The IEAT currently has plans to hire a private sector to operate waste management service for the next five years in recognition of the importance of public and private sector cooperation in environmental management.

5.1.2 Application for hazardous waste management in the Bangkhuntien Industrial Waste Treatment Center

The Bangkhuntien Industrial Waste Treatment Center which began operations in 1988, is the first center to be established in Thailand for treating hazardous waste. This center belongs to the Royal Thai Government (RTG), and the Office of Industrial Services and Waste Management (OISWM) under assignment of the Department of Industrial Work (DIW), is substantially responsible for controlling the leasing company's operations and collection of service fees. At present the leasing company is S.G.S. Co., Ltd. which rents this center from DIW and operates all activities of the center such as waste transportation, waste treatment, final landfill, personnel provision and administration and all other operations.

In 1993, wastewater from 187 fabricated metal products manufactures about 5,600 cu.m./month and 68 tannery industries about 4,500 cu.m./month and solid waste or sludge disposal from 156 factories about 900 tons/month were sent to disposal at this center.

The DIW arranges private sector as tenant to manage the center for serving the customers in the lowest cost as possible. The tenant's conditions specified by DIW are as follows:

(1) The tenant must pay rent of 50,000 baht/month to DIW

(2) The tenant must pay a treatment usufruct to DIW as: (a) for tannery industry wastewater treatment 5 baht/cu.m., (b) for tannery wastewater 3 baht/cu.m., (c) for neutralization of heavy metal sediment 100 baht/ton.

(3) The tenant must treat the wastes according to the treatment standards of government.

(4) The tenant must be responsible for marketing, financing, personnel management and all expenses.

(5) DIW will provide areas in Ratchaburi and the tenant must develop area for sludge collecting in secure landfills.

Service fees are classified into 4 types by service types as followings (Table 5.1) :

(1) Transportation of sludge from factory to Bangkhuntien center. Service fee is Baht/ton-km unit.

(2) Sludge treatment at Bangkhuntien center. Service fee (Baht/ton) is based on waste type, treatment method, chemicals and energy used.

(3) Transportation of treated waste from Bangkhuntien center to Ratchaburi province for the landfill, which is charged as Baht/ton-km.

(4) Landfill at Ratchaburi province which is charged as Baht/ton.

Table 5.1 Maximum Service Fees Proposed to Collect from Factories

Waste Type	**Service (1) (Baht/ton-km)**	**Service (2) (Baht/ton)**	**Service (3) (Baht/ton-km)**	**Service (4) (Baht/ton)**
Wastewater from fabricated metal products manufacturing	1	45	2	100
Wastewater from tannery industry	1	45	-	-
Lead sludge	2	450	2	100
Sediment sludge	1	450	1	100
Other sludge	2	450	2	100

The hazardous waste treatment center at Bangkhuntien is the first and current system that operates. Problems and limitation occurred in this center are:

- most industries often report the waste volume as lower than the real waste production, and also send waste for treatment less to minimize expenditure. In this case, minimum charge is proposed the customers doing in this way. In addition, it should have an examination system on waste volume before accepting any factories to be customers.

- this center has no real incentive for factories to reduce their wastes because the contract amount is specified in advance and no rebates are granted for reduced deliveries.

5.2 Self Regulation and Self-enforcement

Induced self-regulation is more efficient and cost effective than direct government regulation because industries know best how to control their own waste, because self-enforcement is induced by the desire to be accepted by other members in the association and by the community, and because the cost of policing and monitoring are significantly reduced. Funds needed for environmental clean up, enforcement of environmental regulations and monitoring are reduced and generated from among the members of the industrial association in a manner that alters behavior and the way of doing business, the only sustainable approach to higher growth with less destruction. The government needs only monitor ambient quality. Good experiences with the establishment of central wastewater treatment facilities for groups of sugar mills in Kanchanaburi Province and tannery industries in Samut Prakan Province suggest that a well-identified community of industries will choose self-regulation and self-enforcement.

5.2.1 Application for Wastewater Management in Sugar Mills

To decrease the pollution of the Mae Klong River by wastewater from sugar mill industries, the Royal Thai Government and Ministry of Industry financed construction of a central wastewater treatment facility and provided finance to cover the operation and maintenance costs (O&M) for ten years, 1973-1983 (Naphavaanonth, 1992). By 1983, the sugar mill industry had repaid the original investment costs and taken over responsibility for operating and financing the facility. Each sugar mill contributes to the yearly O&M costs based on sugar production (40%), COD (Chemical Oxygen Demand) of the wastewater (30%), and the volume of wastewater (30%). This payment plan encourages waste minimization and waste recycling thus increasing the environmental benefits of the central treatment facility. The final treatment pond of the facility is stocked for fish culture and fishing is permitted free of charge.

In 1983, the sugar industries developed a five level management system.

1) Monitoring level ⇒ managed by sugar mill general managers and DIW
2) Operational level ⇒ sugar mill managers
3) Sub-committee ⇒ technicians such as engineers and chemists
4) Consulting engineers ⇒ including water quality inspection and administrative/finance operations
5) Daily operations ⇒ carried out by another company on a one year contract.

A staff of eleven was hired to operate this facility. The MOI trained the staff who later became employees of private companies. The management committee establishes the rates, hires the personnel and determines which companies can participate.

5.2.2 Application for Wastewater Management in Tannery Industries

The Thai United Tanning Industry Company, Ltd. (TUTI), more commonly known as the Tanneries Industry Association (TIA) in 1976 has responsibility to control and monitor the activities of their members. TIA recognised industrial pollution. Two central waste treatment facilities (CTF) were built cooperatively by the TIA some years ago. Two CTF were set up to serve 80 tanning factories located at Km 30 and 53 at Km 34 of Sukhumvit road. It is estimated that if each industries had to construct their on-site wastewater treatment facilities, it would have cost five times as much as construction of a central wastewater facility.

5.3 Differential Tax

5.3.1 Application for Gasoline Price

In 1992, the government has promoted the use of lead-free gasoline by restructuring the tax regime as shown in Table 5.2. This results in a price differential between unleaded gasoline (ULG) and premium gasoline of 0.3 baht/liter.

Table 5.2 Restructuring the Tax Regime

Excise Tax	Before January, 1992	After January, 1992
Gasoline (0.4 g/l)	3.9	3.35
Gasoline (0.15 g/l)	3.6	3.05
Unleaded Gasoline	2.9	2.35

Source: NEPO, 1991

5.3.2 Application for Low Smoke Motor Oil

To control white smoke emission from motorcycles, the government has promulgated new mandatory standards for low smoke motor oil. Import taxes on any substances used to produce this oil have been reduced from 40% to 5% (NEPO, 1991).

The Fuel Oil Fund contribution rate is currently 0.1 Baht/liter for all fuels except LPG (Liquid Petroleum Gas). Of this, 0.3 Baht goes to the Energy Conservation Fund while the remainder (0.07 Baht) subsidizes LPG. The LPG subsidy is currently 0.1283 Baht/kg. It is expected that the Oil Fund tax will be abolished in the event that the LPG subsidy is removed.

5.4 Proposed Market-based Instruments

5.4.1 Application for Land Use and Slope Tax

Panayotou (1993) proposed a solution to protect catastrophic landslides and floods in Southern Thailand by *land use* and *slope tax* applications to high slopes rubber plantation areas. It noted that a more targeted land tax that varies with slope and land use would be efficient . Beside this, the tax should be combined with rebates (and perhaps subsidies) for land conservation practices and socially beneficial land uses such as forestry. It concluded that it might be preferable to have a tax that varies with slope and rebates that vary with land use; in this way the burden of proof of sustainable land use falls on the land owners.

In addition, the utilization of economic instruments to protect deforestation can be also applied in Thailand. Because of the natural disaster from floods in the South in 1988, Thailand government banned all commercial logging. However, *the ban did not reduce deforestation*, which still continues. This might be caused by the underlying incentives to clear land for agriculture. In the past, the Thai government encouraged landless peasants to squat on forest lands or deteriorated forest lands, and provided them 25 year usufruct rights. But in this way farmers have little security of tenure. This consequently stimulates further forest encroachment. Thus, alternative *policy instrument* would be: *the granting of secure* and *transferable property rights to occupied farmland*. The lack of security of ownership over land constitutes a serious obstacle to farm investments necessary for diversification, intensification, and increaseed productivity. For this reason, the Thai government in assistance with World Bank has carried out a major titling program to improve farmers' security of land ownership. It was found that full, secure, exclusive, transferable, and indefinite titles to land could result in increased investment and higher productivity. Phantumvanit and Panayotou (1990) also noted the importance of land tiling in raising farm incomes, in investing in soil conservation, and reducing encroachment. The study proposed a land tax as well as a more effective system of forest protection.

5.4.2 Application of Market-Based Instruments to Hazardous Waste Management

The Thailand Development Research Institute (TDRI) has put forward a proposal for hazardous waste management that is based on economic incentives (Kritiporn, Panayotou, and Charnprateep, 1990). The Industrial Environmental Fund (IEF) is established to provide a vehicle for managing industrial pollution and its future growth at a minimum cost (less than 0.5 percent of corresponding GDP), and with maximum freedom of choice and participation by industry. The IEF would be established with environmental charges. A charge of 1,000 Baht/ton in 1990 for hazardous-waste-producing industries was estimated including the cost of transport, treatment, and disposal of hazardous waste, plus a 35 percent profit margin. At the 1991 projected level of industrial hazardous waste (600,000 tons), a 1,000 Baht/ton charge would raise 600 million Baht, which is only 0.3 percent of the GDP originating in the 17,000 hazardous-waste-generating industrial plants. The objective of the proposed IEF is not only to fund treatment and proper disposal for waste but also to encourage waste minimization. The environmental fund would be financed from charges to hazardous waste generators in proportion to their type

and quantity of waste and its transport distance from the treatment facility. The charge should be set at the clean-up cost, which is about two times the treatment and disposal costs. The latter cost was estimated at an average of 1,000 Baht/ton, including transport, treatment, and disposal costs. Therefore, the total charge of the clean-up cost is 2,000 Baht/ton.

5.5 Evaluations

The market-based instrument which succeeded in Thailand is self regulation and self-enforcement found in the sugar mill and tannery industries. Factory owners acknowledged environmental problems and were willing to invest in wastewater treatment systems including their operation and maintenance costs. MOI officers monitor only in central waste treatment systems—this saves MOI time and budget, rather than monitoring every factory. In case of tannery industries, their wastewater consists of chromium substances which can not be removed by conventional wastewater treatment system. It is therefore recommended that the tannery association should install advanced treatment system to treat chromium from sludge and effluent or introducing clean technology for pre-treatment in each factory before discharge to the central treatment system.

The effluent charges of IEAT was considered only operating and maintenance costs, not covering capital cost for wastewater treatment facility, investment cost for transportation/collection system and monitoring cost. In the same manner, Bangkhuntien Industrial Waste Treatment Center did not consider capital cost for wastewater treatment facility, land cost and monitoring cost. The failure to fully charge for waste disposal/treatment results in excessive wastewater and inadequate funds for sewage and waste collection/treatment systems. Full charges collected from waste fees could be used to maintain the system, expand its distribution network and for building the new facility for other areas.

Aside this, effluent charges of IEAT were considered based on BOD and SS. In the fact that the range of water pollutants of concern from different industries is quite wide, which may make it necessary to charge additional pollutants for specific industries.

Lower ULG retail price, resulting from lower tax rate, is too little to encourage the majority of gasoline consumers to convert to use unleaded gasoline. Total ULG consumption during January-August, 1992 was only 18.2 percent of total gasoline consumed (World Bank, 1993). The reduction of leaded gasoline consumption will certainly improve the urban air quality as lead levels have

often exceeded both international and local safety standards. Since emissions from mobile sources are emitted at ground level, it is evident that Bangkok streets would have high lead levels abd might thusl have adverse effect on Bangkok’s residents. To be able to phase out the use of leaded gasoline quickly, the government should lower the tax rate so as to make the ULG price much lower than that of premium gasoline. Furthermore, this policy would be more effective if the government would apply both enforcement by mandatory fuel standards and use market-based instrument.

6. REVIEW OF RECENT DEVELOPMENTS TOWARDS INCREASED USE OF MARKET-BASED INSTRUMENTS AND POLLUTION PREVENTION

In the past, the solutions which have been adopted in pollution control and environmental management are centered around the enactment of laws, regulations, rules and criteria to be enforced by government agencies. However, the success is dependent on the efficiency of monitoring and enforcement. Nowadays, government policies are shifting toward the application of the Polluter-Pays-Principle and the use of co-operation among government agencies, private businesses and the people to enhance the process of environmental management.

6.1 Recent Developments towards Increased Use of Market-based Instruments

6.1.1 Establishment the Industrial Waste Treatment Centers

After the success of a DIW initiative to use public and private participation and the application of effluent charges in the Bangkhuntien Industrial Waste Treatment Center, the DIW plans to establish new industrial waste treatment centers in the priority areas emphasizing on treatment of hazardous waste and considering waste's severity level. Four centers are located in different places as follows:

(1) Ratchaburi center locates at Tumbon Hhin Krong, Maung district, Ratchaburi

(2) Chonburi center locates at Tumbon Nong Khangkog, Maung district,Chonburi

(3) Saraburi center locates at Wang Moung district,Saraburi

(4) Rayong center locates at Rayong

6.1.2 Strictly Punishment

This year, the Harbour Department brought actions against about 40 factories in Samut Prakan Province with discharging wastewater. Three of them were ordered to pay between 500,000 and 1,000,000 Baht. If these three factories discharge wastewater with pollutant level above emission standards again, they will be subject to imprisonment not exceeding three years. In this respect, the

Navigation in Thai Waters Act is stronger than the Factory Act (see details in Appendix 2). Thus it is one instrument which can stimulate the factory's owners to recognise their responsibility in addressing environmental problems.

6.1.3 Incentive for Factory Relocation

Industrial zoning has long been incorporated into the law governing the issue of factories licenses, with permits to be issued in line with officially adopted land use plans. However, the adoption of such land use plans has been slow, thus inducing the inadequacy supply of infrastructure for urban and industrial growth which relates directly to many urban environmental problems.

In order to reduce pollution problems in urban areas, relocation policies have been introduced. Approximately 28 factories in Samutprakarn have been identified as urgent cases for relocation because there is no satisfactory technology available to ameliorate pollution and they are producing severe pollution problems. In the BMR, at least an equal number of factories elsewhere will need to be moved.

Government policy calls for *the relocation of industries* from sites where adequate pollution control is not possible. The Ministry of Industry (MOI) and subcommitees (IEAT, BOI, IFTC, Krungthai Bank, and Federation of Thai Industries) formulated a strategy for implementing the policy on factory relocation in January 1993. They recommended *a package of financial benefits* via possible tax breaks, concessional financing, lower utility charges, and also examination of *the alternatives for particular factories considered candidates for relocation.*

In order to encourage industrial development in regional areas, the BOI provides grant promotion status to existing factories which want to relocate from the central to regional areas. Relocated factories receive the standard non-tax privileges, and tax privileges as follows:

(1) For factories which relocate to Zone 2:

1.1 Corporate income tax exemption for a period of 3 years.

1.2 Corporate income tax exemption for a period of 7 years if they relocate to industrial estates or promoted industrial zone.

(2) For factories which relocate to Zone 3

2.1 Corporate income tax exemption for 8 years.

2.2 Reduction of corporate income tax by 50% for 5 years after the initial exemption period.

2.3 Double deduction from taxable income of water, electricity and transport costs for 10 years.

2.4 Deduction from net profit of 25% of the costs of installation or construction of the project's infrastructure facilities.

(3) The income tax holiday period will start from the day for the first revenue is received from the relocated activities.

6.1.4 Environment Fund

Due to lack of investment financing, an Environment Fund was set up by NEQA/1992 to relax this constraint. The fund is designed to be an instrument for promoting investment in pollution control by industry and local municipalities, and for encouraging waste minimization. Initially, 500 million Baht was allocated by the government, this fund was to be used in support of environmental protection and included support functions, such as providing soft loans to small companies or funding wastewater treatment system. As of July, 1992, the Cabinet has been in the process of transferring an additional 4.5 billion Baht from the existing Oil Fund. Thus, a total of 5 billion Baht is earmarked for the Environment Fund. In addition, the Fund will receive (a) Money from the Fuel Oil Fund in amounts determined from year to year by the Prime Minister; (b) Service fees and penalties collected under provisions of the NEQA, 1992; (c) Moneys and properties received from other sources, both domestic and foreign, be they private parties, foreign governments or international organizations; (d) Interest and benefits accrued from this Fund; (e) Other grants from RTG; and (f) Other moneys received for the operation of this Fund.

The Directives of the Fund are still under preparation. Allocation of monies from the Fund is administered by the Fund Committee which is established by the Office of Environmental Policy and Planning. The Fund Committee consists of the MOSTE Permanent Secretary as Chairman and the Secretary-General of the OEPP as Member-Secretary. The Secretary-General of NESDB, the Director of the Bureau of the Budget, the Comptroller-General of the Comptroller-General's Department, the Director-General of the Public Works Department, the Director-Gerneral of DIW, the Director-General of the Mineral Resources Department, the Director-General of PCD, the Director-General of the EQPD and not more than five qualified persons appointed by the NEB serve as members.

This Fund gives first priority to request that contribute to the implementation of provincial action plans, especially for central wastewater or waste disposal facilities. Payments from the Fund are to be made for several activities and purposes: (Panat, 1993)

1. Grants will be made to government agencies or local administrative bodies for investment in and operation of central wastewater treatment plants or waste disposal facilities.
2. The Fund will provide loans to local administration or state enterprises for making available pollution control equipment and treatment and disposal facilities.
3. Fund loans are also available to the private sector if they have a legal duty to install and operate on-site pollution treatment or control equipment.
4. The Fund also provides financial support to any activity concerning the promotion and conservation of environmental quality.
5. The administrative expenses of the Fund.

Fund Managers are specified as (a) the Comptroller-General, Ministry of Finance for grants to the government agencies and local admiistrations and (b) the State of the Industrial Financing Corporation of Thailand (IFCT) for loans to the local administration, state enterprise or private sector.

6.2 Recent Development towards Increased Use of Pollution Prevention

In the Seventh Plan environmental management policies focus on environmental quality, energy and environment, industry and environment, urbanization and environment and natural resources management. Present Development plans have directives to improve environmental quality and control pollution at source and end-of-pipe in the areas of air pollution, water pollution, hazardous waste and solid waste. The government measures in each environmental issue are:

6.2.1 Air pollution

1. Introduction of catalytic converters. The new gasoline fueled cars must be equipped with catalytic converters, effective January 1993 for engine sized greater than 1,600 c.c. and September 1993 for engine sizes less than 1,600 c.c., requiring the use of unleaded gasoline Amranand, 1992).

2. Elimination of leaded gasoline. The government has encouraged the use of premium unleaded gasoline (ULG) by restructuring the gasoline tax, reduction of maximum allowable lead in gasoline from 0.4 to 0.15 grams per liter, and has a tentative plan to phase out premium leaded gasoline by 1996 (Amranand, 1992).

3. Control of diesel fuel quality. Since March, 1991, all buses owned and operated by state enterprises were required to use low-sulfur content diesel fuel (sulfur content reduction from 1 to 0.5 percent). A reduction in the sulfur level of automotive diesel fuel became effective on April, 1992 and September, 1995 for the whole country (Amranand, 1992).

4. Introduction of low-smoke motor oil. The government has introduced a new mandatory low-smoke motor oil standard (UNCED, 1992).

5. Introduction of compressed natural gas (CNG) buses. The conventional diesel-burning buses in Bangkok emit high levels of black smoke. Purchase of 200 CNG is espected to reduce the emissions levels by public transport in

Bangkok (UNCED, 1992).

6. Vehicle Inspection. The government provided training programs for NGOs and student volunteers to participate in vehicle inspection and implement an annual inspection program for vehicle emissions, beginning with the inspection of 100,000 government vehicles in Bangkok (UNCED, 1992).

For *air pollution policies from the industrial sector*, the DIW has proposed a set of industrial air emission standard that are expected to receive formal ministerial notification in the near future.

6.2.2 Water Pollution

1. Construction of central wastewater treatment facilitates in many provinces to treat wastewater from urban and industrial areas by promoting and supporting private sector cooperation in both investment and operation

2. Moving of severe pollution problem-producing industries. The industries considered in this case can be classified in four groups such as the metal industries, products of leather and leather substitutes, textile industries and chemical industries.

6.2.3 Hazardous Waste

1. Improvement the standards and regulations for industrial hazardous waste control and monitoring (Thangtongtawi, and Elliolt, 1991).
2. Advocating the relocation of hazardous waste-producing industries from the Bangkok Metropolitan Region (BMR) to designated industrial development areas.
3. Establishing additional treatment and disposal facilities in Rachaburi, Chonburi, Saraburi, and Rayong Provinces

6.2.4 Solid Waste

1. Promotion of contracts between government and private sector including collection and transportation of solid waste, and design, operation, and construction of solid waste disposal facilities.
2. Encouragement of the utilization of clean technology for reducing solid waste quantity and solid waste recycling (Somchevita, 1991).

3. Construction of solid waste treatment and disposal facilities for high density industrial areas, especially in industrial estates.

4.

6.2.5 Technical Assistance from International Institutes

With the rapid growth of the Thai economy, the number of small- and medium-scale industries has increased rapidly, e.g. textiles, tanning, agro-industries, etc. These factories generated more pollution per unit of output than do large-scale industries. Due to inadequate funds and technology, most of them can not treat and control their waste, while large-scale industries have often had their own wastewater treatment facilities, and are regulated principally by the DIW. Nowadays, two international institutes supporting technical assistance for small- and medium-scale industries in Thailand are the United States Agency for International Development (USAID) and Deutsche Gesellschaft Für Technische Zusammenarbeit (GTZ).

a) United States Agency for International Development (USAID)

Industrial Environmental Management Program (IEM) was established in 1990 through a cooperative agreement between USAID and FTI. It is one of the subprojects of the program on Management of Natural Resources and Environment for Sustainable Development (MANRES) which has been developed with the aim of development of the capacities of Thai government and non-governmental institutions to define, analyze and respond effectively to current and emerging natural resource and environmental problems, and to build consensus and capacity for advancing policy options that will lead to sustainable development. Its primary aim is to support technical assistance to the Thai industrial sector in the areas of industrial pollution control, toxic and hazardous waste management, and work health and safety, especially small- and medium-scale industries. Industrial groups from USAID are supporting this work in textile dyeing, printing and finishing, pulp and paper, and food industries. Technologies were transfered from USA, e.g. Computerized Color Matching (CCM) for small- and medium-scale textile mills and Vacuum Technology for dyeing and finishing mill.

b) Deutsche Gesellschaft Für Technische Zusammenarbeit (GTZ)

GTZ supports the project "Environmental Advisory Assistance to Agro-Industry" in the field of introduced waste minimization technologies. The project is being implemented by the DIW. The objectives of project are:

(1) to increase the capability of Thai agro-industries to apply suitable technology for waste management. Waste management technologies in this project are not necessarily high. Pilot projects are initiated in Thailand and studied by Thai universities. Branches of agro-industry chosen for assessment and demonstration of new technologies are:

Tannery industries	⇒	chromium recycling by chemical precipitation (MgO and Na_2CO_3)
Palm Oil Mill	⇒	oil recovery by dissolved air flotation
Tuna Canneries	⇒	protein recovery by dissolved air flotation
Chicken Slaughterhouses	⇒	protein recovery by dissolved air flotation

(2) to increase the capacity of counterpart institutions to apply project and environment management methods

(3) to prepare of technical guideline for each branch of agro-industry.

6.3 Conclusion

Thailand has adopted command and control regulations from the developed countries under conditions of unfavorable structural change and without the benefit of strict enforcement or appropriate adaptations. Due to ineffectiveness of command and control, the scarcity of tax revenues, and the fear of losing competitiveness, RTG has interested to apply market-based instrument and Polluter-Pays-Principle has in principle been accepted in government policies. Effluent charges, pollution permits, differential tax of some other form of market-based instrument have been used to internalize environmental costs in the concept of Polluter-Pays-Principle. From the policy in economic

environment, it induces the fast adaptation of clean technologies in Thailand including low-waste and non-waste technologies and recycling technologies.

7. THE FEASIBILITY OF APPLYING MARKET-BASED INSTRUMENTS IN THAILAND

Since 1969, command and control regulations have been used as instruments to solve environmental problems in Thailand. Yet, the country's natural resources and environment degrade continuously. In 1992, the government decided to introduce the economic environment as a Polluter-Pays-Principle to solve environmental problems. As a consequence, environmental law and management framework were improved. The channel for applying a market-based instrument is thus opened. However, the improvement of environmental management is still slow. The many barriers to market-based instrument application will be discussed in this chapter.

New laws provide new dimensions of environmental management task in Thailand (see Appendix 2). The restructured organization can now carry out policy planning and advisory tasks as well as act as the implementators of these activities (see Appendix 1). The NEQA/1992 allows for the application of user charges in improving the environment, compensate damage to the public and establish environmental fund. The government has allowed room for flexibility in terms of the Polluter-Pays-Principle, at least where small-and medium-scale industries were concerned, by offering to subsidize pollution control through the dispersal of soft loans. Policy in economic environment induces the fast adaptation of clean technologies in Thailand, including low-waste and non-waste technologies and recycling technologies.

In 1992, the Royal Thai Government began to take a different approach to environmental legislation enforcement. Six factories in Songkhla were closed down by the DIW. Factories licenses were withdrawn from other two factories because they failed to obey wastewater treatment regulation standards.

Government authorities are still centralized in Bangkok. As a consequence, the collection of taxes, exemption of taxes, the spending of tax revenue, the formulation of economic policies, the approval of project applications, etc. are authorized from the capital city. Considering that each province has its own unique strengths and weaknesses, and that the central government does not

have enough manpower to carry out site visitations, the situations in each particular province would be difficult to comprehend. The Seventh plan tries to solve this problem with a legislation that decentralize and delegate environmental authority to provincial and local governments. Eventually, this will facilitate participation by people who are directly affected by the changes in their environmental conditions. The most practical way is to utilize local government manpower and branch offices of the central government. There are two aspects concerning this issue; the budget and the human resource aspects, where in the later case, under-staff is still a problem for the central government.

In the past, government enforced factory owners to install their own wastewater treatment facility. However, due to high implementation and operation costs, it motivated industries to by-pass the environmental regulation. Similarly, the benefits of preventing pollution in the form of increased efficiency are largely ignored because Thai business generally relies on cheap labor and low production costs to achieve their competitive advantage. The application of Market-Based Instruments is based on the equity of the polluters to pay for their waste management. The competition among firms to reduce their production costs by reducing their waste or improving the production processes will occur in the near future.

Several kinds of market-based instrument have been applied in Thailand: the hazardous waste management in Bangkhuntien industrial waste treatment center, the wastewater management in IEAT, sugar mills and tannery industries, and oil tax etc. (see details in Chapter 5). Today, the government has plans to build central waste treatment facilities for hazardous waste in Rachaburi, Chonburi, Saraburi and Rayong Provinces together with central wastewater treatment plants in many other places to reduce water pollution problem in urban area. Based on the Bangkhuntien experience, the user charge is now proposed as an instrument to collect fee from polluters, such as, in the BMA where the governor proposes to collect user charges from every activity within the next three years.

Although government policy promotes the application of Market-Based Instruments in solving Thailand’s environmental problems, these instruments face many barriers which obstruct their performances. These barriers include institutional framework, governmental capacities, legal framework, lack of public

awareness, etc. The solution in overcoming these barriers will be discussed in Chapter 8.

7.1 Institution Capacity in Administrating and Monitoring

Presently, there is a strong lack of coordinated policies originating from different ministries and departments. Implementation agencies are also scattered among several organizations. This often lead to duplication of effort and conflict and further affects the budget and human resources. The implementation of Polluter-Pays-Principle requires cooperation from several ministries and departments as well as local governments to monitor and enforce.

Enforcement problems are compounded by the overlap and redundancy that exists in environmental responsibilities. For example: (1) the PCD, DIW and provincial governors can all set emission standards. If the standards differ, adjudication is required but it is unclear who would provide it. (2) The responsibilities of the MOSTE have grown increasingly since the passage of the NEQA/1992. As a result, this agency's responsibilities frequently overlap with those of the DIW's.

Despite the extensive amount of legislation passed to control pollution and enhance environmental quality in Thailand, the agencies involved still lack the proper and effective mechanisms to enforce those provisions. Some agencies are drastically under-staffed and under-funded given their respective responsibilities and the growth of the industrial sector in Thailand.

The lack of a sufficient number of qualified human resources witjin the central government seriously affects policy and planning considering that they require not only academic experience but also the understanding of related problems at the grass root level. Similarly shortages of qualified personnel at the local government level is also an obstacle to the decentralization of policy and planning activities, environmental management, and environmental monitoring. To make matters worse due to the rapid expansion of the private sector in recent years, there is the strong competition for skilled labour. This has draw many qualified personnel away from government offices. This is difficult to remedy via a realignment of public/private sector pay scales since the necessary adjustments would place unacceptable strains on public finances.

The manufacturing sector in Thailand has undergone tremendous growth and restructuring since the iniation of the government's policy to promote industrialization in the late 1950's. From then on, the number of factories in Thailand has increased to over 100,000. Despite its extensive responsibilities, the DIW remains far too sparsely equipped in terms of personnel and resources to deal with this tremendous growth. DIW currently has about 500 inspectors for all 100,000 factories in Thailand (Table 7.1), and operates only one laboratory to check the quality of effluents and emissions. Only BMR has over 25,000 registered factories but DIW can inspect only about 3,000 factories per year or 12 percent of total. Similarly, OEPP has only 224 staffs to plan environment policy, PCD has only 115 technical staffs to monitor the levels of pollution in Thailand, and ERTC has 103 staffs for laboratory analysis and environmental training (Table 7.2 and 7.3). Therefore, it is nearly impossible for the agency to fulfill its monitoring compliance and enforcement duties under the law.

At the local level, local government has limitations in terms of financial strength and human resource needed in environmental management. This is due to the inadequacy of the budget allocated from the central government. To implement some kinds of market-based instruments especially the Polluter-Pays-Principle, local government or new organization should take on the responsibilities of collecting and managing the fee together with monitoring processes. It should then report the findings back to the central government. Even this requirement, the local government would need substantial qualified manpower, technical know-how, and financial resources.

A good example illustrating the capacity of the local government in environmental management is Samut Prakan Provincial Department of Industrial Works (SP-DIW). SP-DIW has the responsibilities to regist factories, take pollution complaint, monitor, etc. The main problem of this office is the lack of manpower to carry out all of its responsibilities. While there are approximately 4,000 factories in Samut Prakan Province, SP-DIW has very few professionals namely:

- Director of SP-DIW 1 person
- Assistant Director of SP-DIW 1 person
- Engineer 3 persons
- Industrial Inspectors 3 persons
- Clerks 2 persons
- Typist 1 person
- Junitor 1 person
- Drivers 2 persons

Obviously this implies that Samut Prakan Province has only 6 technical staffs to take care of 4,000 factories (about 670 factories per person). The other problem which SP-DIW has to face the lack of practical overall pollution management plan for the execution of their responsibilities. These conditions are the obstructions to the implementation of the market-based instruments.

7.2 Environmental Legislation and Policy

The Seventh Plan has set environmental development targets and guidelines to reduce air, noise and water pollution level, solid wastes and toxic chemicals. The Polluter-Pays-Principle has also been enforced in this plan for environmental pollution control. However, implementing methodologies to environmental development has not been refered in this principle.

Although all the provisions of NEQA/1992 and FAC/1992 could to a certain extent solve pollution problem, in order to implement the Polluter-Pays-Principle following the Seventh Plan and to prevent environmental pollution, a law should be enacted to contact point-source pollution as a protective measure before it discharges into the environment, as well as add in other legal measures. This issuance of licenses would inevitable involve fees as supported by the Polluter-Pays-Principle. Despite the proposed requirement of licenses for all pollution discharges, the fees could vary, depending on types of activities and quality of wastes.

In addition, there is also a lack of appropriate laws and measures to enforce effluent discharge from non-industrial sources such as housing and agriculture.

7.3 Technology Transfer

Beside the shortages of human resource in academic institutions, government offices, and the private sector, there is also shortages in terms of equipment. Today Thailand urgently needs to acquire clean technology and the know-how transferred in environmental control and protection and automatic monitoring equipment.

The financing management schemes to collect fees or charges, environmental investment, management, and monitoring suffer from a lack of experienced administrators. There is a need to provide basic training to officers both at the central and the local government levels.

7.4 Public Awareness

Due to the lack of awareness, public participation is rare. This creates to a greater burden for governmental agencies entrusted to enforce environmental laws. As a result, people come to believe that environmental protection is not their business. Factories become afraid of losing profits and competitiveness.

Table 7.1 Number of Staffs of DIW in 1992

Division	**In 1992**
Industrial Safety	80
Factory Inspector	107
Planning	42
Industrial Environment	141
Factory Control	178
Hazardous Substances and Chemicals Control	54
One Stop Science Center	34
Control Office for Machinery Registration	85
Office of Industrial Services and Waste Management	66
Finance	47
Office of the Secretary	56
Total	890

Source: DIW

Table 7.2 Number of Staffs of Office of Environmental Policy and Planning (OEPP) and Environmental Research and Training Centre (ERTC).

Office	Number of Staffs		
	1991	Required in 1992	Required in 1993
OEPP	149	224	-
PCD	88	141	165
ERTC	78	103	35
Total	**315**	**468**	**200**

Source: Pollution Control Department, May 1993.

Table 7.3 Number of Staffs of Pollution Control Department

Division	Number of Staffs		
	Existing	To Be Added	Total
Director, Inspector and Deputies	4	0	4
Office of the Secretary	22	8	30
Air Quality and Noise	26	49	75
Hazardous Substances and Solid Waste Management	26	20	46
Legal and Petition	12	4	16
Pollution Management and Coordination	22	30	52
Water quality Management	29	54	83
Total	**141**	**165**	**306**

Source: Pollution Control Department, May 1993.

8. RECOMMENDATIONS OF METHODS TO PROMOTE THE USE OF MARKET-BASED INSTRUMENTS IN THE CASE OF WASTEWATER MANAGEMENT

In the past, environmental management and pollution control were centered around the enactment of laws, regulations, rules and the criteria to be enforced by governmental agencies. Environmental problems occurred due to the inefficiency in monitoring and enforcement. To solve these problems, (1) the concept of "sustainable development" has to be introduced in order to involve environmental costs into planning consideration, (2) market-based instruments should be applied, and (3) environmental management has to be shifted toward the use of co-operation among governmental agencies, private businesses and the public.

Appropriate market-based instruments combined with improved regulations could be employed to encourage or force polluters to incorporate environmental management into development planning. For examples: taxes on environmentally damaging or energy-inefficient products; reduction or elimination of subsidies that support environmentally destructive or resource-inefficient practices; and pollution charge.

The promotion for the use of market-based instruments in the case of wastewater management involves three parties: the public[132], local government and central government.

8.1 Public Participation

The involvement of public in wastewater management should be introduced particularly in the planning and decision making processes, full price of charges, cooperative investment and operation for waste treatment facilities and environmental monitoring. Methods to promote public participation include information sharing, opinion survey and public hearing. NGOs have a role in

[132] including local people, NGOs, and businesses

supporting the local people on a continuous basis with systematic, scientific and technological backing. In the future, NGOs should play a more significant role in environmental monitoring and protection, such as the reporting of non-compliance incidents with responsible governmental agencies.

The private sector could play a significant role in the collection, transportation, treatment, or disposal of waste at a privately managed final secured landfill. This could be achieved through a law regulating the performances of private companies in hauling, treating, and land filling of industrial wastes. The government could then restrict itself only to setting up the rules and standards and leave the development of methods or technologies to private parties who could carry out those processes more efficiently.

Information should be shared and disseminated to all concerned parties to avoid misunderstanding and mistrust which can lead to environmental conflicts.

8.2 The Role of the Central Government

8.2.1 A way to eliminate the inefficiencies and the overlapping of responsibilities among agencies is to hold joint seminars between the agencies responsible for *environmental management*, namely the DIW, MOSTE, BOI and others. The purpose of these seminars would be to investigate agency overlap and work out possible cooperation schemes for the exchange of information. Also, such seminars might be a good way to initiate the process of standardizing analytical procedures, harmonizing monitoring policies and objectives, and fostering a stronger working relationship among official personnel. Consequently, this would make monitoring and enforcement more effective as well as save costs, time and effort in the long run.

8.2.2 MOPH, PCD, and DIW are responsible for source and ambient monitoring. However, the resources needed in terms of the number of personnel, salaries and monitoring equipment are insufficient. It would be more effective to pool these resources into a single agency and leave the three agencies with the responsibilities of setting standards, source monitoring or enforcement, etc.

8.2.3 One possible solution to the funding and staffing problems of the *environmental management* system in Thailand is to promote a more extensive program which involves the private sector in pollution control efforts. For example, consultants can help governmental agencies and companies operate their wastewater treatment facilities and monitor environmental quality to meet the legal standard.

The problem of the lack of qualified staffs can be solved by

1. accelerate the production of environmental engineers, scientists and economists, and professionals in some related areas by:

   - encouraging public and private education institutions to speed up manpower production in shortage fields; and

   - acquiring experts in environmental economic, finance, environmental engineer, from abroad to teach and train government officials;

2. accelerate the production of technicians and skilled workers in areas of need;

3. accelerate the production of university professors and researchers in necessary fields.

8.2.4 Foreign aid plays an important role in strengthening the government's environmental management capabilities by promoting a decentralization of the environmental management process. In accordance with these efforts to decentralize the monitoring and enforcement responsibilities, it will also be necessary to decentralize the training effort. Thus, in order to promote a pool of effectual personnel, it may be useful to consider a series of training workshops located in the major areas concentrated with polluting factories.

8.2.5 The government should set up emission standards for each polluting activity. Emission standards should be the key to environmental protection considering that the level of charge will depend on the level of emission standard.

8.2.6 Government must provide the people, factory's owners and businesses with the knowledge and understanding concerning water pollution problem and its impacts on the environment, together with effective soluble methods before

applying any market-based instruments for wastewater management, for at least one year. The steps used in implementing this method should be taken gradually.

Methodologies to promote public participation about market-based instrument and its effect in environmental protection are:

1. **For people in general**: the dissemination of formation and knowledge about environmental problems, how to protect the environment, details of applied instrument, the effects of these instruments to product pricing, how to manage the fee, and how the fee can solve environmental problems. The information should be given to the level that they are willing to respond.

2. **For factories and the private sector**: the dissemination of knowledge about the level of fee, how to calculate their fee, methods to reduce their wastes, monitoring methods, as well as clean technology or waste recycling and environmental auditing.

3. **For consultant companies**: the provision of methods to monitor environmental quality, environmental auditing or environmental management system used in evaluating factory wastes reduction processes. THese methods could be provided and trained by experts from abroad.

8.2.7 Long term policies should promote recycling, such as government subsidies for recycling technologies or taxes on non-recyclable materials.

8.3 The Role of the Local Government

8.3.1 Local government could not ignore social pressures.

8.3.2 Each province should have an environmental policy supervision center or an office serving as secretariats of the provincial environmental council, providing advice to the governor in overseeing the implementation of national and provincial environmental policies.

8.3.3 To improve the capabilities of local government staffs, training on wastewater management, wastewater charge, water pollution control and environmental monitoring, etc., should be provided on a continuous basis.

8.3.4 Decision-making needs to become less centralized. Delegation of environmental responsibilities and the spreading of enforcing responsibility to a broader circle to provisional and local governments can greatly reduce the burden on the national government. When people feel that they are directly responsible for their actions and for the preservation of the environment, they will take certain steps to protect it.

8.3.5 Plan to prepare qualified staffs for implementating theMarket-Based Instruments by enlarging the number of staffs and increasing training course for the old and new staffs in environmental management in the areas of financial administration, technical know-how, environmental monitoring, etc.

8.4 Market-Based Instrument for Wastewater

In Thailand where insufficient law enforcement is one of the main factor affecting pollution control capability, sufficient budget is one of the key elements in the development of pollution control. The industrial sector and urban areas continue to expand far greater than the public sector ability to solely handle and control them. It is more viable to adopt a third party approach in couple with a pollution charge system. Through a third party approach, the monitoring responsibility can be released from the public sector. Through the pollution charge system, a large sum of financial resources can be generated to support public administration. The trade-offs for the pollution charge system and the application of a third party, however, is that the consumers have to bear the costs generated by the system. On the other hand, since the ultimate sources of pollution are consumers who demand for the pollution generating products, the prices consumers pay for pollution well fit the Polluter Pays Principle! Keep in mind that the standard and control approaches also impose the costs to consumers. To be effective, it is likely that inspection and control must be equally sufficient as in the economic approach.

Level of Fee

The level of the fee should be set to reflect the cost of pollution treatment, including investment, operation, maintenance, drainage system and land costs. It must also be at least as high as the charge per unit of BOD imposed on factories located within the industrial estates. The rate of the fee should be high for industries[133] which pollute extensively. Low polluting industries and domestic wastewater should be charged a flat rate.

The level of cost should be calculated based on wastewater load information obtained through monthly reporting by independent certified consultants, and government estimates and inspections.

Monitoring

Large polluters with and without their own wastewater treatment facilities should send monthly reports to the government. Monthly reports should be prepared by an independent certified consulting firm. The report has to provide the quantity of water used, the amount of pollutants discharged such as BOD, SS, heavy metal, etc. For factories which have installed their own wastewater treatment facility, their report must describe any malfunctions occurred during the one month period and the necessary steps taken to correct them. It is important to understand that malfunction of any equipment should not be considered a legitimate excuse for the failure to pay the fee. For medium polluters, monitoring should be random by sizes and types of industries at least two times a year per factory. For small dischargers, monitoring should be minimal and applied when there is specific notion of doubt about the existing estimations.

Government estimates and inspections

The government makes presumptive estimates of BOD discharge based on industrial averages. Factories will thus be informed that they will be charged a fee based on these presumptive estimates to be effective within 6 months. Until such time as they prove that their own waste discharges are less than the government estimate, they will be relieve from those fees. All proofs would need to be authenticated with an independent environmental audit.

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[133] High polluting industries are categorized in terms of the amount of waste generated per day (eg. kg/day)

Government inspectors would also have the right to make their own inspections to evaluate the performance of the independent auditors. Those factories failing to cooperate with the required audits, fees, and inspections would have their permits revoked.

Organization

All in all, the implementation of any market-based instrument projects in Thailand will not succeed completely if the government is still centralized and manages unsystematically. From the policy of government, Polluter-Pays Principle has been endorsed, and from our experiences, user fee is the most suitable instrument for wastewater management in Thailand. The government should set up a center or an organization under the local government or a state enterprise (the same as the Electricity Generating Authority of Thailand, EGAT), with the aim of collecting the fee, monitoring, and constructing, operating, maintaining a central wastewater treatment facility, etc. This center should consist of committees from the central government such as OEPP, PCD, DIW, NESDB, IEAT, BOI, Ministry of Interior, NGO, etc.

To ensure effective implementation of such a system, however, a number of institutional, political and technical conditions must be existed or be created. The responsible institution should have the legal authority to impose and enforce charges on polluters. This authority would require:

- analytical methods and data to establish the monetary value of damages caused by various pollutants or a method for estimating the level of the fee necessary to meet environmental quality standards,
- adequate resources to monitor emissions for each source of pollution,
- self-monitoring with periodic verification and enforcement, and
- legal power over the disposition of revenues.

The concept to set an institute or a center to implement market-based instrument in Thailand is new and strongly required experts from the experiment countries for

- setting the organization management system which can be used for all provinces,
- setting the level of fee based on equity and possibility of domestic and industrial wastewater,
- monitoring the system and enforcement mechanism,
- financial administration,
- providing education and inquiring public relation for people to clearly understand market based instrument,
- providing experts and technicians to educate the private sector on waste recycling, waste minimization, and clean technology whereas the private sector will be motivated to reduce wases after the effect of the fee,
- being responsible for using effluent fees in pollution control and waste management.

Nonetheless, the feasibility of applying Market-Based Instruments for wastewater management in Thailand should be studied and looked at in detail before implementing them on a national level.

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APPENDIX 1

ENVIRONMENTAL ORGANIZATIONS

I. Ministry of Science, Technology and Environment (MOSTE)

Since the promulgation of the National Environmental Quality Act (NEQA) in 1975 which provide an establishment of the National Environment Board (NEB) and the Office of National Environment Board (ONEB) as its secretariat, ONEB has been the responsible agency for planning policies on environmental protection and setting the ambient quality standards. However, its provisions were in adequate to address Thailand's increasingly complex environmental problems.

In 1992, a new act on an environmental protection, namely the National Environmental Quality Conservation and Promotion Act 1992 was promulgated. With the enforcement of the new act, the Ministry of Science, Technology and Energy was renamed to the Ministry of Science, Technology and Environment. Three new departments (see organization chart in Figure A1) were established to replace the former Office of the National Environment Board (ONEB), as follow:

- the Office of Environmental Policy and Planning (OEPP);
- the Department of Environmental Quality Promotion (DEQP)
- the Pollution Control Department (PCD).

Some issues of environmental act prescribe about transfer authority, administration, enterprise, state property, legal right, debts, and monetary budget to new environmental departments as mentioned. The staff resources of the former ONEB were also distributed among the three newly formed departments. This has created severe shortage of experienced and properly trained human resources within the departments.

A revision of NEQA in 1992 departs from previous practice in three other ways.

1. Greater authority in environmental protection is delegated to local government officials including provincial governors and mayors.
2. The revised law gives non-governmental organizations (NGOs) a greater role in environmental protection by explicitly recognizing the need for greater public participation.

3. The role of MOSTE in implementing measures to control pollution from energy, transport and industrial sources in expended by the revised law.

1.1 Office of Environmental Policy and Planning, OEPP

1. To prepare the national policy and plan for enhancement and conservation of environmental quality in accordance with other national policies as well as to follow-up and evaluate the policies.
2. To coordinate the preparation of environmental quality management plan according to the enhancement and conservation of national environmental quality act.
3. To monitor and prepare the report on a natural resources profile of problem or situation.
4. To coordinate the natural resources management according to the national policy and plan for enhancement and conservation of environmental quality, the national policies on socio-economic development plan and the environmental quality management plan.
5. To provide guidelines, terms of references and review any governmental and non-governmental program/project, which may cause a deteriorate to the environmental quality.
6. To initiate and provide guideline, role also to cooperate among various countries in the international environmental obligation.
7. To make recommendations on policy and guidelines as well as to coordinate in the administration and management of the environmental fund, including raising-fund campaign for environmental fund in accordance with the enhancement and conservation of national environmental quality act.
8. To coordinate the management of regional environmental issues/program and project.
9. To perform other functions as may be provided by authority of the Office of Environmental Policy and Planning, the Ministry and/or the Cabinet.

1.2 Pollution Control Department, PCD

1. To submit opinion for a preparation of the national policy and plan on enhancement and conservation of environmental quality relating to pollution control.

2. To recommend on establishment both ambient and effluent environmental quality standards.
3. To prepare the Environmental Quality Management Plan and to initiate appropriate pollution control measures.
4. To monitor and prepare the report on a pollution profile of problem/situation.
5. To develop appropriate system, pattern and/or applicable to strategy the management of water quality, air, noise, toxic substance and solid waste.
6. To carry out the law on enhancement and conservation of national environmental quality relating to pollution control purpose.
7. To receive for consideration and remedy petition from any person who has been aggrieved or damaged by an act which has adverse effects on the environmental quality.
8. To perform other functions as may be provided by the authority of the Department of Pollution Control, the Ministry and/or the Cabinet.

1.3 Department of Environmental Quality Promotion, DEQP

1. To promote environmental awareness through campaign activities including environmental exhibitions.
2. To prepare publications, distribute all environmental information, and also serve as the center for coordination and public relations on matters of environmental quality promotion.
3. To encourage the incorporation education into non-formal and formal education process.
4. To perform other functions as may be provided by the authority of the Department of Pollution Control, the Ministry and/or the Cabinet.

1.4 Environmental Research and Training Centre (ERTC)

The Environmental Research and Training Centre (ERTC) is operated by DEQP under the overall Jurisdiction of the Ministry of Science, Technology and Environment. Its fundamental purpose is to carry out research and provide technical support in the implementation of environmental policy and environmental management initiatives. The Centre provides professional training to staff in national and local governments, and in non-governmental organizations, focusing on training professionals and technical staff in the necessary techniques for successful environmental management.

The objectives of the ERCT can be summarized as follows:

- To undertake practical research programmes on environmental management, particularly in the fields of water pollution, air pollution, noise, solid waste and toxic substances.
- To promote and encourage research activities on environmental quality in cooperation with educational establishments and other agencies.
- To strengthen environmental monitoring programmes for use in the planning and determination of national environmental quality standards and formulate guidelines for the improvement of environmental quality.
- To provide training programmes in environmental management for governmental organizations, local government and other organizations.
- To provide environmental education programmes for staff at all levels and to train people with the appropriate expertise to be qualified instructors.

1.5 National Science and Technology Development Agency (NSTDA)

NSTDA is a non-governmental organization under the Ministry of Science, Technology and Environment (MOSTE). It is an autonomous funding and research organization, established in 1991, outside the normal framework of state-enterprise and civil service. It undertakes a broad-based, systematic approach towards enhancing the entire science and technology system of Thailand in support of national economic and social development.

NSTDA's target is to improve production and services, as well as backing research aimed at commercial application. Three specialized centres - Genetic Engineering and Biotechnology, Metal and Materials Technology and Electronics and Computer Technology - come under the NSTDA umbrella. NSTDA industrial consultancy and Quality management program involve with a number of industrial enterprises, especially the small and medium ones.

II. Ministry of Industry, MOI

Ministry of Industry (MOI), through its Department of Industrial Works (DIW) and the Department of Industrial Environment (DIE) has been engaged in activities for the control of industrial pollution for more than 20 years. The Office of Industrial Services and Wastes Management (OISWM), an internal division of the DIW, has recently been established in order to provide industrial environmental services and to promote joint treatment facilities.

The departments within the Ministry of Industry such as

- the Institute of Industrial Standards of Thailand who should pay attention upon the control of pollution from vehicles and industrial machineries, and
- the Industrial Estate Authority of Thailand who should try to separate industries from residential areas by introducing policies and measures which would attract industries, especially the small and polluting ones to be located in industrial estates so that pollution control could be effectively carried out.
- The Department of Mineral Resources has dual roles in the efficient use of mineral resources and the control of pollution from mining activities especially where sensitive coastal zone and forest resources are concerned.
- The Department of Industrial Works (DIW) has responsible for the registration of all factories, so newly proposed industry must submit complete information including plant layouts, detailed drawing and specifications on process equipment, etc. as well as control facilities for wastes (wastewater, air pollution or solid waste). If the establishing factory is a large-scale industry where environmental impact will be of major concern, the applicant will be required to submit an environmental impact assessment study.

2.1 Department of Industrial Works (DIW)

DIW of the Ministry of Industry carries responsibility for monitoring factories' compliance with pollution control standards and adherence to undertakings given in their operating licenses for more than 20 years. It is widely acknowledged to be too sparsely staffed to carry that function effectively. DIW has also been active in planning and construction of central waste management facilities, having built and leased the Bang Khuntien pilot plant for hazardous waste disposal several years ago and, more recently in collaboration with World Bank staff, supervised the design and engineering preparations for the proposed Suksawat wastewater collection and treatment system.

DIW of the Ministry of Industry is in charge of administering the Factory Act of 1969 (amended in 1992) and other acts relating to the operation of factories. In conjunction with its provincial offices, the DIW is responsible for all activities concerning industrial environmental services and controlling and enforcing the Factory Act throughout the country. The DIW consists of 11 divisions, among these divisions the Industrial Environment Department is in charge of the enforcement of industrial pollution regulation and licensing of private sector

consultants to conduct environmental audits. The DIW has instituted a number of programs to control industrial discharges through licensing system, to enforce effluent standards, to monitor works, to provide central treatment facilities for hazardous waste. The DIW also provides training programmes for waste treatment operators. The DIW licensing program covers all aspects of industrial activity such as boiler safety, building code requirements, worker sanitation and health, wastewater discharge, air emissions' odors, community health and safety, and industrial solid wastes.

Environmental divisions of the DIW are (see organization chart in Figure A2):

Office of Secretary - the office is responsible in issuing legislation, handling public relations and administration works.

Factory Control Division - main responsibility for the division is to issue permits for factory establishment, operation, including extension and renewal permit for factories.

Factory Inspection Division - the division main task is to carry out inspection work to ensure that these factories comply with regulation. The Division also responsible on regulating safety and accident prevention measures.

Technique and Planning Division - it plays a significant role in setting policies and standards on state-owned Factory under the auspices of IWD. Reset work on technology improvement for factories is one of the main task conducted by the division.

Industrial Environment Division - this division main duty is to monitor and control factories to assure that Environmental Pollution Standards notified by MOI are not violated.

Office of Hazardous Substances - the office of hazardous substance has been assigned to monitor and control import, transport and storage of toxic and hazardous chemical substances.

Office of Industrial Services and Waste Management (OISWM) **-** OISWM serves as principal agency in planning to introduce better monitoring program waste reduction technology, water conservation measures, promote private investment in the construction and management of joint industrial wastewater treatment facilities. The OISWM provides information in the form of technical papers, visual aids, and training courses covering various aspects of industrial pollution control. It also is promoting research and development programs on how to manage and enhance the recovery of by-products in industry.

The DIW's activities in industrial pollution control consist of the following:

1. Licensing System Prior to Construction. Review of treatment system design and/or measure in control pollution prior to construction.

2. Licensing System Prior to Operation. Inspection of treatment facilities according to the design previously submitted to the DIW.

3. Factory Monitoring. Pollution monitoring work is performed by the DIW at end of pipe for efficiency inspection. The DIW is empowered by the Factory Act to enforce the following orders.

4. License Renewal. Every three years, factory licenses must be renewed, and the DIW will inspect a factory when necessary, especially those with violation records.

5. Industrial Complaint. In case of a complaint related to industrial pollution, the DIW will inspect the treatment system and follow the procedure in (3).

6. Factory Expansion License. For every factory expansion, the DIW will review the existing treatment system in relation to the proposed expansion capacity for its viability.

7. Treatment Design Service. The DIW gives treatment design service free of charge to factories with a small production capacity.

8. Central Treatment Facility. The DIW has constructed central treatment systems to facilitate waste from sugar refineries in Ratchaburi Province and Kanchanaburi Province and from a hazardous water treatment factory at Bang Khuntien.

9. Training for Treatment Operation. The DIW conducts training courses for industry wastewater operators and for technical staff employed by industry.

New factories in nine industries — cement, chloro-akalyne production, steel manufacturing, ore melting, petrochemicals, oil refineries, pulp and paper mills, natural gas, and fertilizers — all must be subject to environmental impact assessments carried out by the OEPP before new plant is approved. Updated EIAs must be carried every three years in order for a factory to get its license renewed, or if a company wishes to expand production.

2.2 Industrial Estate Authority of Thailand (IEAT)

IEAT was established in 1972 to plan, develop and manage industrial estates throughout the country both separately and in cooperation with private enterprise (TDRI, 1993). The Authority's main objectives are decentralize industrial development, provide systematic industrial development including public facilities and services operate industry-related business and promote and supervise public and private industrial estate. IEAT has regulated standards to prevent and control the impacts from establishing industrial estate on the environment:

(1) Measures to Prevent Pollution

In preparation for the reduction of impacts on the environment, including preventive and soluble measures, before the start of the program, the IEAT will conduct studies on the construction of industrial estate to look into its possible effects on the environment. In addition, the IEAT will build a central waste water treatment system. The design, the construction, the inspection, the approval of the blueprints and the controlling of the industrial operations conforming to the standard set by the Ministry of Industry, will be the responsibilities of the IEAT. The IEAT will impose the bidding in relevance to the amount of water used in each industry.

(2) Laws and Regulations

The IEAT has regulated a standard for waste water discharged from each industry before it enters the treating system. If discharged waste water is over the allowable limit, the accountable industry will be forced to pre-treat its waste water with its own treating system, considering that the system has been approved by the IEAT based on the Factory and the Building Act.

(3) Inspection and Follow Through

The IEAT will monitor the peculiarity of waste water released from every industry in the estate in order to be able to determine the service fee in which will be based on the quality of the water. The IEAT will also examine the efficiency of the treatment system.

(4) Complaint Investigation

In cases where there are complaints against industries in the estate polluting the environment, the IEAT will examine and investigate the posed case and resolve the problem.

In 1991, the IEAT has established a unit to oversee safety and environmental issues ***Environmental and Safety Control Division.*** The objective of this unit is to amend the quality of the environment in industrial estate. The unit has four sections responsible for the followings:

(1) Environmental Impact Analysis Section

Conduct studies, supervise, provide advice, report on the impacts on the environment, set measures to reduce those impacts and set practical environmental quality standards in both established industries which are required to submit environmental report and in newly established industrial estate.

(2) Environmental Control Section

Develop and calibrate environmental standards in each industrial estate. Provide advice on possible measures used in tackling environmental problems (i.e. water, air, wastes). Assess the quality of the systems and provide guidelines on how to enhance the quality of pollution protection systems.

(3) Monitoring and Appraisal Section

Appraise and evaluate equipment quality. Examine and analyze pollution. Advice on how to improve the quality of the equipment. Plan and monitor on water and air quality in each industrial estate.

(4) Safety Section

Control and monitor safety together with the health status of the employees. Regulate emergency standards. Provide training on safety issues. Install an information system. Collect hazardous material. Collaborate with health centers

in examining, rectifying and medicating injuries which occurred at the work place.

In addition to this, the IEAT has a goal to advance environmental quality and to upgrade the standard of living of factory employees:

(1) Reduce the amount of waste in industrial estate through waste recycling program through:

1.1 Environment and Safety Information Center;

1.2 Exchange program for auxiliary material in the estate.

(2) Monitor the treating procedures of wastes from industries to modernize the treatment systems through:

2.1 Environmental Information Center

2.2 Central Laboratory Unit

2.3 Mobile Laboratory Unit

2.4 research studies and setting environmental quality standards.

(3) Upgrade workers' standard of working in industries by providing services and knowledge concerning industrial hygiene, hearing capability and vision quality in order to decrease accidents. Projects conducted to meet these objectives cover:

3.1 Research studies and set-up environmental quality standards (i.e. water, air) in each industrial estate to restore the eco-system;

3.2 Prevention of accidents from hazardous chemicals and hazardous material by establishing a center to organize a joint collaboration between the industrial estate and the local government offices.

III. Department of Health (DOH)

The DOH is under the Ministry of Public Health (MOPH) and is in charge of the Public Health Act (PHA). Besides implementing the government's health program, it is also responsible for environmental protection pertaining to waste disposal environmental monitoring, and environmental conditions in work place. The work is being undertaken by two units, namely the Occupational Health Division and the Environmental Health Division. The Occupational Health Division is concerned with environmental conditions in the work place. The Environmental Health Division is responsible for environmental protection

pertaining to the disposal of wastes from communities and hospitals and for environmental monitoring.

Division of Environmental Health

The Division of Environmental Health consists of 5 sections which involve in environmental issues:

Environmental Technology Promotion Section has duty to planning, evaluation, design the system, collecting data, training, producing the vision device and advertising including promotion, researching and joining in the special project.

Environmental Technology Promotion Section has duty to monitoring and controlling the quality of the water, consumable water including promote about improving of the water, support for the equipment, controlling water quality, noise quality, light quality, etc. In addition, setting the standard level and improving for the suitable form.

Environmental Quality Development Section has a duty to survey with survey, researching, proposing and solving the problem. In addition, improving the environmental health that cause annoyance or danger for the public health, urban and activity center including coordinating with the provincial authorities.

Environmental Quality Analysis Section has a duty to monitoring the quality of water, air, soil and wastes on physical, chemical and biological properties. Moreover, checking analytical standard and equipment including improving analytical method and suitable equipment and producing appropriate equipment for monitoring.

Environmental Engineering Section is responsible for design, controlling construction, evaluation and following the wastes treatment system including setting the treatment standard of the solid, liquid and gas wastes in the hospital, urban and some industry.

IV. Ministry of Interior

Several departments within the Ministry of Interior have direct jurisdiction over environmental projects. The Public Works Department is planning to build wastewater treatment systems in nine cities along the Chao Phraya River. The Department of Local Administration is looking into building similar facilities in dozens of other urban centers around the country.

4.1 Public Works Department, PWD

Public Works Department is under the Ministry of Interior, the responsibilities concerning the environmental protection are establishment a wastewater purification system, garbage collection system in densely-populated areas in order to promote public health, and flood prevention by providing a proper drainage system in cities and in other communities in order to promote a good environment.

According to the Seven National Economic and Social Development Plan, Ministry of Interior has set up project "***Municipal Wastewater Treatment System".*** PWD is an authorized agency to carry out such important facilities through feasibility studies, detailed designs, supervisions and implementation of projects. PWD has proposed projects on drainage and sewerage system in 67 communities. The priority for project implementation has been categorized as follows:

- Cities or communities under which the government has already endorsed in its national plans and policies,
- Coastal Cities and predominant resort cities which has specified in tourism development plan of Tourism Authority of Thailand,
- Cities situated nearly important rivers or natural water sources which its growth might adversely effect to such water sources in future.

Furthermore, the Ministry of Interior has also assigned PWD to implement sewerage system to protect the detriment of Chao Phraya River in respond to the Cabinet resolution on August 20, 1991. The active performances which are being undertaken including;

- With the technical assistance from JICA, the Master Plan of Sewerage Works Management along Chao Phraya River from Chainat down to Nondhaburi will start at the end of 1991,
- The fiscal budget of 1991 and 1992 have been allocated for the feasibility study of Pra Nakhon Sri Ayudhaya Municipality, Pathum Thani, Nondhaburi and Samut Prakan. The study will start at the end of 1991.
- The feasibility study of storm water drainage and sewerage system of Nakhon Sawan Municipality had already completed in 1990,

- The PWD has set up the criteria for procurement of land required for construction of wastewater treatment plant adequately for 20 years projection. This scheme has been approved by MOI and every municipalities have simultaneously been mandated to acquire lands as proposed.

- Previous sewerage projects that has satisfactorily been achieved in compatible with the national and ministerial plans and policies, comprising: Pattaya City-North and South Areas Stage I and II, Patong Beach-Phuket, Khon-Kaen Municipality, Nakhon Ratchasima Municipality and Hua Hin Municipality Stage I.

4.2 Bangkok Metropolitan Authority (BMA)

The BMA is a juristic entity having the status as a local administrator. The duties of BMA are stipulated in Section 89 of the BMA Act which explicitly includes the developing and conserving of the environment. The BMA is also authorized to undertake activities that lie outside its jurisdiction if such activities are in the interests of Bangkok residents.

The departments that have some bearing on the environment are:

1. Department of Policy and Planning
2. Department of Civil Works
3. Department of Drainage and Sewerage
4. Department of Public Cleansing
5. Department of Public Health

V Industrial Environmental Management (IEM)

IEM under the management of the Natural Resources and Environment for Sustainable Development Project (MANRES) funded by USAID, is operated by the Federation of Thai Industries (FTI) to promote greater awareness among Thai industrialists of fundamental environmental problems. The FTI is charged with maintaining an effective liaison with the MOI, the ONEB, and other relevant Royal Thai Government agencies using FTI channels and mechanisms with in the public sector. The activities of the FTI on IEM consist of the following:

Environmental Awareness - promoting consensus among key public and private sector leaders on how to the best address the critical environmental issues plan and implement a series of public and industrial awareness building activities such as conferences, seminars, training sessions, radio and television programs, etc.

International Exchange and Outreach - linking with other local and international bodies involved in environmental work to gain access to up-to-date information, knowledge, technology, international business philosophy, and policy developments related to environment matters and establishing constructive dialogue between various interest groups on specific policy issues.

Cooperatives Technical Assistance - cooperating with leading US private organizations and industries as well as with Thai research groups provides technical assistance, providing consulting services to the Thai participating industries in the areas of industrial pollution to enable the industries to comply with the government's regulations and standard, conducting special studies concerning the environmental impacts of rapid industrialization and other topics to be identified, and providing recommendations to both governmental organizations and industries toward the establishment of appropriate regulations and standards for pollution control.

Industrial Environmental Database - developing an Industrial Environmental Information System which will serve as a major source of information on various aspect of industrial environmental problems, pollution prevention, treatment and disposal of industrial wastes and related areas.

Staff Development - *providing* practical training and study tours to other countries to review industrial environmental issues for IEM Staff and FTI member companies.

IEM Activities (1993) are

1. Promotion of clean technology and effective environmental management in textile, pulp and paper, food and other industries and Chao Praya River

2. US-Thai environmental partnership activities

2.1 Technical assistance on specific problems of hazardous waste management and establishment of a waste exchange center

2.2 Technical assistance on environmental management and clean technology to industrial estate and other industrial areas in Thailand

3. Environmental awareness in industry and international cooperation

4. Information services by establishment of a computerized industrial environmental database and development of reference library.

VI. National Economic and Social Development Board (NESDB)

The NESDB is a planning agency directly under the Prime Minister's Office which overlooks both macro and sectorial plans. Under the National Economic and Social Development Act of 1978, the NESDB is chartered with carrying out the following functions:

1. To formulate policies and draw up master plans for the country's economic and social development.

2. To translate the policies and plans into consistent operational plans for the related ministries, bureaus, and departments in the government so that they can be implemented.

3. To monitor and follow up on various plans and projects of the implementing agencies.

4. To evaluate the actual implementation of the plans and projects of the various government agencies.

For environmental policies and plans, the Technology Planning and Environment Division is unit directly charged with these responsibilities in the NESDB. The Government-Private Cooperation Division is the unit directly in charge of industrial policies and plans.

In the planning and formulation of industrial and environment plan, it can be said that the NESDB is the core agency which provides the studies and analysis to back up such activities. It also screens developmental projects and offers advice in solving problems to various governmental agencies. The approach that the NESDB uses while carrying out its duties is to consult and coordinate with the various government agencies together with domestic and expatriate academics and experts in various fields. Also, the NESDB quotes through various working groups and subcommittees.

VII. The Board of Investment (BOI)

The BOI was set up in 1960 and is Thailand's central investment planning authority, with wide discretionary powers to promote both foreign and domestic investment, especially in the industrial sector. The activities of the BOI have been concentrated in the provision of investment incentives to target industries. In 1972 the BOI began to provide extra incentives to particular areas outside Bangkok. The main functions of the BOI include the following:

- To disseminate information regarding the investment climate together with attracting investment in target industries.
- To establish an investment center to provide services to investors including the obtaining of various permits, project preparation assistance, and identification of project partners.
- To analyze project applications for investment promotion and to verify, control, and evaluate projects which received promotion privileges.
- To identify investment opportunities and promote new industries.

Under the BOI, the Investment Service Center (ISC) was established to facilitate investors' obtaining all permits and registrations to operate a factory. There are two centers established to provide full service to investor: (1) The Center Office of the Board of Investment is responsible for issuing factory licenses for BOI-promoted activity, as well as managing to obtain further permits; and The Center in the Department of Industrial Works is responsible for issuing factory licenses for non promoted activity as well as managing to obtain further permits. The ISC is empowered to issue permits for the establishment or expansion of factories, of for factories operation, and will coordinate with the related agencies to obtain other permits with in 90 days of the date of application. In relation to environmental requirements, certain

industrial projects have to conform with all the requirements stipulated by the ONEB and the MOSTE prior to BOI promotion.

VIII. The Industrial Finance Corporation of Thailand (IFCT)

The IFCT was established by the government under the Industrial Finance Corporation of Thailand Act in 1958 during the same period when the BOI was set up. The principal purpose of the IFCT is to provide investment capital for the establishment, expansion, and modernization of industries in Thailand. The IFCT appraisal process includes marketing, financing, and engineering analyses. (The Industrial Management Co. Ltd., an affiliated company of The IFCT, was established in 1977 to provide consultancy services in the area of industrial management, and research services on economic and industrial issues to both the public and private sectors as well as international institutions. The consultancy services include feasibility studies, marketing research, accounting and production systems designs, and staff training). The key criteria are debt-equity ratio-- long-term debt should not exceed 60 percent of total equity-- cash flow adequacy, and an interest rate of return (IRR) at least equal to the opportunity cost of capital. The IFCT does provide investment capital needed by industries to implement in-plant waste treatment as part of the loan package.

IX. Local Government

Administration of environmental matters is under the direction of Provincial Governor. Local administration of FAC is handled by the Provincial Industry Office, which is responsible to the Deputy Governor, but has a direct link with DIW on technical matters such as the factory license system. The Provincial Industry Office is heavily involved with processing of factory licenses and has sufficient staff to carry out its pollution control enforcement duties satisfactorily.

APPENDIX 2

ENVIRONMENTAL LEGISLATION

The framework for managing the environment has been in place since 1970. Ministry of Industry (MOI) broadened its mandate under the Factory Act (1969) to include industrial pollution control. In the Third Plan (1972-1976), environmental concerns effectively entered the national plan. The Factory Act 1969 was amended in 1975 to strengthen its environmental dimension in the areas of industrial pollution control and occupational health. The Department of Industrial Works (DIW) is responsible for effluent and emission standards for industry, and control of all industrial activities in accordance with these standards.

The initiation of the Industrial Estate Authority of Thailand (IEAT) in 1972 aimed at promoting the establishment and management of industrial estates. The investment incentives for factories in the industrial estates are given through the Investment Promotion Act of 1977 under the BOI's jurisdiction.

The Improvement and Conservation of National Environmental Quality Act of 1975 was established. Under this Act, the National Environment Board (NEB) was established as the main policy planning, the Office of National Environmental Board (ONEB) was also established as secretariat of NEB. ONEB has been the responsible agency for planning policies on environmental protection and setting the ambient quality standards.

Major legislations for environmental pollution are shown below.

- Environment and Conservation of National Environmental Quality Act, 1992
- Factory Act, 1992
- Hazardous Substances Act, 1992
- Public Health Act, 1992 or 1941
- Energy Conservation Promotion Act, 1992
- Navigation in Thai Waters Act Building Control Act, 1979
- Building Control Act, 1979
- Investment Promotion Act, 1993

1. The Environment and Conservation of National Environmental Quality Act of 1992 (NEQA)

The NEQA/92 is a newly amended act (from NEQA/78) concerning environmental protection and pollution control. This act is an important over the NEQA/78, as it attempts to create legal mechanisms to correct institutional problems and fill regulatory voids. It stipulates the responsibility of the provincial government, the foundation of Environment Fund, promulgation of environmental quality standards, assignment of conservation and environmentally protected area, assignment of pollution control area, duties of pollution control officer, framework of environmental monitoring, inspection, etc. This act also provides some incentive or privileges for the enterprises to install an on-site pollution control facility as their duty.

The NEQA/92 updates the previous NEQA/78 laws and conveys the following objectives:

1. The law recognizes the urgency of environmental issues, which requires immediate collective action from all sectors of society. The legislation empowers both policy and planning agencies with other precautionary actions. In addition, environmental standards will be enforced according to the Polluter Pays Principle.

2. The law advocates the decentralization of implementation and enforcement authority to provincial and local governments. This will facilitate participation by the people who are directly affected by changes in their environmental conditions.

3. The law recognizes the public’s right to know and to participate in national environmental affairs and the constructive role of the private sector and NGOs in environmental rehabilitation.

Given these objectives, the NEQA/92 restructures existing environmental institutions and delineates specific measures that strengthen regulation of pollution control standards. The major changes introduced in the law are as follows:

1. NEQA/92 dissolves the ONEB. The functions of ONEB are divided among three new departments: Policy and Planning, Pollution Control and Environmental Quality Promotion. These departments will exist within the Ministry of Science, Technology and Environment (MOSTE). The three new departments are assigned the following tasks:

- The Office of Environmental Policy and Planning (OEPP) will be responsible for managing the Environmental Fund and regulating the EIA process. In addition, the OEPP will establish regional offices in order to coordinate regional activities.

- The Pollution Control Department (PCD) will follow trends in air, water and hazardous waste pollution. It is responsible for recommending standards and revisions concerning pollution control measures. In addition, the PCD is empowered to investigate complaints.

- The Environmental Quality Promotion Department is responsible for disseminating information, heightening public awareness, forging private sector and NGO alliances and conducting training courses.

2. The Environment Fund is legally established by NEQA/92. Environment Fund is the public fund which will be loaned with no interest for the governmental organizations or local governments to construct or operate the waste or sewage treatment facilities.

3. The Office of Environmental Policy and Planning and Pollution Control Department will designate Pollution Control Zones where incidence of air, water and hazardous waste are unusually high. Local officials must prepare a pollution reduction and eradication plan for each such zone, to be incorporated into the Provincial environmental quality management plan. These zones will receive priority in government plans to construct central waste treatment facilities. The special standards that are more stringent than environmental quality standards will be established if necessary to preserve pollution control zones.

4. In an attempt to decentralized enforcement and monitoring mechanisms, the law empowers to PCD to employ Pollution Control Officers (PCOs). PCOs will be assigned for different regions and pollution control zones nationwide. Private industry must provide PCOs with monthly reports of their emission levels and volumes of waste treated. The PCOs can demand factory operators to remedy any inappropriate treatment procedures. Noncompliance to standards and PCO regulations can result in the suspension of operating license.

5 Local administration will be allowed to license the private sector to undertake control waste treatment works for industrial and household waste. Medium and small-scale industries unable to install wastewater treatment can use central wastewater treatment to be built in major cities and provinces.

6. All polluting factories are required to install in-house treatment facilities or send their waste to government or private-operated central treatment facilities.

7. The Ministry of Science, Technology and Energy is changed to the Ministry of Science, Technology and Environment.

Important issues in NEQA/1992 are:

1) Pollution Control Committee

NEQA creates a Pollution Control Committee (PCC), chaired by the Permanent Secretary of MOSTE and including 12 senior officers (Director General level), up to 5 NEB-appointed expert members and the Director General of PCD as member-secretary. The PCC has several powers and duties including submitting action plans for the prevention or remediation of pollution hazards or contamination, proposing tax incentives and fees, advising the Minister on the setting of emission standards, coordinating government agencies, enterprises, and the private sector to control and prevent pollution and reporting to NEB on the pollution situation annually.

2) Environmental Audit

Pollution Control Officer (PCO) is empowered as follows:

1. to inspect and examine the notes, statistics or data on the functioning process of pollution control equipment in the factory or point source of pollution.

2. to issue an order in writing directing the owner, the Monitoring Control Operator, or the licensed Service Contractor to correct, change , improve or repair the pollution control equipment. If however, the point source is a factory, the official under the law on industrial plants fails to take action within his power and duty, the pollution control official shall have the power to take action in accordance with this act.

3. To issue a written order directing the owner of the point source of pollution. If the point source of pollution is a factory the official under the law on industrial plants shall be notified to order the owner to pay the penalties. If however, the point source is a factory, the official under the law on industrial plants fails to take action within his power and duty, the pollution control official shall have the power to take action in accordance with this act.

4. To issue a written order directing the Service contractor licensed to render the services of waste treatment to stop or shut down his service, or revoking his license in case such Service Contractor violates or not comply with this Act.

5. To issue a written order suspending the Monitoring Control Operator in case such Monitoring Control Operator violates or does not comply with this Act.

3) Service Fee and Penalty

From section 88, in any pollution area or locality where a central waste treatment plant has been constructed and brought into operation as a public utility service, NEB with the advice of the PCC shall fix the rates of service fee to applicable within the limits of each pollution control area or locality. The local authority or the competent official of the government agency responsible for operation of public waste treatment facility shall have the power and duty to collect service fees, penalties and claim for damages.

Any owner of point source of pollution who avoids to send wastes to the central waste treatment plant and discharges wastes into the environment beyond standard shall be liable to pay as a penalty four times as much the amount of service fee (section 90).

Any owner of point source of pollution, required to have on-site waste treatment facility, who illegally discharges waste into central treatment facility or into the environment beyond standard, shall be liable to pay as a daily penalty four time as much the amount of daily expenses and shall also be liable to pay damages if such illegal discharge has caused any damage or defection to central waste treatment facility (section 91-92).

4) Public Rights

To promote public participation in environmental conservation efforts, Section 6 of NEQA states that individuals have the following rights and duties: (Panat 1993)

- to be informed and obtain information and data from the government in matters concerning the enhancement and conservation of environmental quality. Exceptions are information classified as secret intelligence for national security, trade secrets, or secrets protected by the right to privacy or property rights;

- to be remedied or compensated by the State in case damage or injury is sustained due to pollutant contamination caused by activities undertaken by a government agency or state enterprise;
- to file a complaint, upon witnessing any act committed in violation of laws relating to pollution control or the conservation of natural resources;
- to cooperate and assist government officials in the performance of duties relating to the enhancement and conservation of environmental quality;
- to observe strictly the provisions of NEQA or other laws concerning environmental quality.

5) Environment Fund

See details in Section 6.1.4

2. The Factory Act of 1992 (FAC)

The FAC was first enacted in 1969 by Department of Industrial Works to regulate factory construction, operation, expansion, and safety requirements. FAC was amended in 1975 and amended again in 1992, the new act primarily consists of amendment to previous FAC of 1969. The FAC provides the legal basis for establishment and control industrial plants, and the MOI is vested with power to administer the FAC through issuing ministerial regulations and notifications.

FAC/92 introduces the following new measures:

1. Private sector environmental service firms will be solicited to conduct emission and waste level monitoring. Previously, factories were required to monitor their own pollution levels; however, many factories did not possess the proper technology and were not competent in monitoring procedures. The idea to involve the private consultants is based on the "third party" system where monitoring and evaluation by outside parties are reportedly more efficient and accurate.

2. Penalties for emitting high levels of atmospheric pollutants and/or untreated wastes will be raised. Violators can be fined up to 400,000 Baht or be imprisoned for up to four years. Past fines amounted to only several thousand Baht; Larger industries would pay the fine and continue operating in the same mode. With the passage of this act, polluting factories are required to pay both the fine and remedy polluting processes.

3. Hazardous Substances Act of 1992 (HSA)

The Toxic Substances Act (TSA) was introduced in 1967 as a measure to control the import, export, manufacture, marketing, storage, transport, and use in agriculture, industry and hospitals came under joint control of the Ministry of Agriculture, the Ministry of Industry, and the Ministry of Public Health. The respective Ministries were empowered to produce a list of poisonous substances considered dangerous, which would then be regulated by the joint-ministries.

In April 1992, TSA was repealed and replaced by the Hazardous Substances Act (HSA), HSA introduced a comprehensive control framework for the possession, use and handling of all substances considered mutation-inducing, infectious, explosive, flammable, and corrosive. The HSA covers all hazardous materials including ozone-depleting substances (ODS). HSA authorizes the Ministry of Industry to regulate and monitor the import, production, transportation and storage of hazardous and toxic waste. In addition, it requires the Ministry of Industry to establish an information center on hazardous waste materials.

Penalties for violating the new Hazardous Substances Act are now quite severe. Offenders can pay fines up to one-million baht and may receive jail terms up to 10 years.

4. The Public Health Act of 1992

The PHA was enacted for the prevention diseases and the provision of national health care. Some of its sections also provide legal authority for the prevention and abatement of water pollution. Environmental public nuisances, as defined by the PHA, are broad in concept, and embrace all sources of water, air and noise pollution which are potentially harmful to the safety or rights and liberty of the public. The enforcement mechanisms contained in the PHA are currently the most effective legal controls for general pollution, and include abatement orders, judicial injunction and criminal prosecution. Abatement orders, prohibition orders, or closing orders can be made by court injunction.

5. Energy Conservation Promotion Act of 1992

In February 1992, the Thai government approved the Energy Conservation Promotion Act. The Act included new regulations for energy conservation in factories and large buildings. Owners of controlled buildings and factories were

given three years from February 27, 1992, to meet conservation requirements. Examples are as follows:

- Follow general measures which factory and large building owners could take to reduce energy use.
- Conform to regulations set for a category of "controlled factories and buildings" which were expected to have a peak electric demand exceeding 2,000 kilowatts of annual energy use equivalent to more than four millions liters of fuel oil.
- Factory owners must conduct energy audits, appoint a government certified energy manager, keep records on energy production, consumption and conservation, and submit this data to the government.
- Set conservation goals and submit a conservation plan to the government for approval.

As well, the Department of Energy Affairs was authorized to issue regulations governing the minimum efficiency of machinery, equipment appliances, building materials, control systems and related items.

Under the Act an Energy Conservation Promotion Fund will be established. The National Energy Policy Committee has recommended that US$ 60 million, from a variety of sources, be allocated to set up the fund. Grants will be provided from the fund for energy efficiency and renewable energy projects and related environmental activities. Funds may be used for education, promotion, demonstration, monitoring, research and development, and policy and planning.

6. The Navigation in Thai Waters Act

Section 119, 119 bis and 204 of the Navigation in Thai Waters Act, B.E. 2456 prohibits the disposal of things, garbage, or discharge of oil into the water used for navigation in such a manner as to cause harm to environment.

7. The Building Control Act of 1979

Ministerial Regulation No. 33 requires wastewater from large buildings or buildings higher than 23 meters to be treated before being discharged to ambient and its quality must meet effluent standards set up by the National Environment Board.

8. The Investment Promotion Act of 1993

The Investment Promotion Act 1977 is administered by the Board of Investment (BOI) whose function is to promote domestic and foreign investment considered

important and useful to the social and economic development of Thailand. The Investment Promotion Act, 1977 was amended in 1993.

8.1 Policies and Criteria for Investment Promotion Concerning the Environmental Protection and/or Restoration (BOI Announcement No. 1/1993)

In order to support and follow the National Economic and Social Development Plan and the government policies concerning the environmental protection and/or restoration, the Board of Investment has updated the polices and criteria for granting investment promotion and providing tax incentives as follows:

Legal Aspect

Under the Investment Promotion Act of 1977, the Board of Investment may approve the promotion investment projects when it considers that the products, commodities or services are economically and technologically appropriate, and have adequate preventive measures against damage to the environment.

Policy Aspect

Under the Investment Promotion Act of 1977, the Board of Investment maintains a policy of giving special consideration to investment projects which

- develop public utilities and basic infrastructure;

- conserve natural resources and reduce environmental problems;

- conserve energy and replace imported energy supplies; and

- contribute to technological development.

Criteria for Project Approval

A project which involves conserving, restoring or developing natural resources and the environment and installs adequate environmental protection systems can request investment promotion.

Criteria for Joint Venture

During the Seventh Development Plan Project (1992-1996) the foreign investors (in a wholly foreign-owned project or a joint-venture project) which invest projects in the area of environmental conservation and restoration will be considered for investment promotion and the Board itself will not consider the foreign ownership issue. However, the requirements will be established by responsible ministries on a case-by-case basis.

Investment Promotion Zones

All provinces throughout the country, as well as Laem Chabang Industrial Estate, expect Bangkok, Samut Prakan, Samut Sakhon, Pathum Thani, Nonta Buri, Nakhon Pathom, Samut Songkhram, Rachaburi, Kanchanaburi, Suphanburi, Angthong, Ayutthaya, Saraburi, Nakhon Nayok, Chachoengsao and Chonburi, are designated as **Investment Promotion Zones**[134].

Project Activities

Environmental protection and/or restoration is one area in five priority activities which will receive the following privileges:

- Corporate income tax exemption for 8 years, regardless of location.
- import duty reduction on machinery which is not included in the tariff reduction notification of the Ministry of Finance (Notification No. C 13/2533) and which is subject to import duty greater than or equal to 10% for projects located in Zone 1 or 2.
- Import duty exemption on machinery for projects located in Zone 3.

Criteria for Factory Relocation

For projects facing environmental problems are required by the Ministry of Industry to relocate:

1. The factory must relocate to an industrial estate or promoted industrial zone.

2. The former factory must be closed down and all machinery moved to the new location. The new factory must be ready for operation within 2 years of receiving the promotion certificate.

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[134] Project location can be divided into 3 zones

Zone1: Bangkok, Samut Prakan, Samut Sakhon, Pathum Thani, Nonta Buri and Nakhon Pathom.

Zone2: Samut Songkhram, Rachaburi, Kanchanaburi, Suphanburi, Augthong, Ayutthaya, Saraburi, Nakhon Nayok, Chachoengsao and Chonburi.

Zone 3: The remaining Provinces plus Laem Chabung Industrial Estate.

8.2 List of Activities Eligible for Investment Promotion Concerning the Environmental Protection and/or Restoration (BOI Announcement No. 2/1993.

1. Water works or supply for industrial uses

   Must be approved by the concerned government agencies.

2. Refuse, industrial waste, or water disposal services.

   2.1 Must be approved by the concerned government agencies.

   2.2 For projects located in Zone 1 or 2. 50% import duty reduction on machinery which is not included in the tariff reduction notification of the Ministry of Finance (Notification No. C 13/2533) and which is subject to import duty greater than equal to 10%.

   2.3 For projects located in Zone 3. Exemption of import duty on machinery.

   2.4 Corporate income tax exemption will be granted for 8 years, regardless of location.

3. Transportation of hazardous chemicals

   3.1 Must be approved by the concerned government agencies.

   3.2 For projects located in Zone 1 or 2. 50% import duty reduction on machinery which is not included in the tariff reduction notification of the Ministry of Finance (Notification No. C 13/2533) and which is subject to import duty greater than equal to 10%.

   3.3 For projects located in Zone 3. Exemption of import duty on machinery.

   3.4 Corporate income tax exemption will be granted for 8 years, regardless of location.

4. Industrial zones

   Projects which request for establishment the industrial zones must be required about environmental protection and/or restoration as follows:

   - Sewage and wastewater disposal: A wastewater treatment plant must be set up as approved by the Board. Sewage and wastewater drainage systems must be separated.
   - Refuse disposal: Refuse storage and incineration areas must be sufficient with suitable refuse collection methods.
   - Environmental protection: To prevent factories which generate smoke and malodor from being located in the industrial zones, factories in the industrial zones must be approved by the Board.

8.3 Regulation Concerning Environmental Impact Assessment

To facilitate investors in obtaining all permits and registration to start business or operating factory, the One Stop Service Center was established in the way that investor can contact only this office for permitting process.

In environmental quality control, the Investment Promotion Act states in Section 19 that the investment project to which the Board may grant promotion shall be one which incorporates appropriate measures for the prevention and control of adverse effects on environmental quality in the interest of the common good of the general living of the public and for the perpetuation of mankind and nature, and Section 20 states that in the case where the Board deems it appropriate to grant promotion to any applicant, the Board may stipulate conditions for prevention and control of the damage of environmental quality.

For those applicants of the projects which are required to prepare Environmental Impact Assessment under the National Environmental Quality Act, as mentioned in section B(1) entitled "Types and Sizes of Projects or Activities Requiring Environmental Impact Assessment Reports", must submit EIA report to the One Stop Service Center for further review by Office of the National Environment Board.

Once an application has been submitted to the One Stop Service Center, it will be checked immediately for completeness, if it contains insufficient details or not correspond to the required conditions, the Center will return the application within five days from the date of receipt.

If it is required by the applicant, and if it is necessary, the Center may inform the application within 20 days from the date the application received, whether or not the application will be approved and under which conditions, so that the investor can proceed further with his project without having to wait for procedure of issuing the license.

In case that the application is incomplete from which contain sufficient details the Center will inform the application of the final decision, whether his application is approved or not within 90 days, this should not include the time that the application is returned for amending.

APPENDIX 3

GUIDELINES FOR ENVIRONMENTAL DEVELOPMENT

FOR QUALITY OF LIFE

Guidelines for Environmental Development for Quality of Life

In order to attain the set targets, the following operational guidelines and measures for control, prevention and solution of environmental problems during the Seventh Plan period have been formulated.

1.1 Water Pollution

1.1.1 reduce water pollution generated by communities, industrial, as well as agricultural activities, via the following:

(1) Support relocation of pollution-generating industries within Bangkok metropolis and vicinity towns to designated areas.

(2) Enforce domestic effluent standards for all buildings based on the Building Control Act, or other existing laws, as well as enforce effluent standards from livestock farms, and aquaculture farms to ensure strict adherence to the set standard.

(3) Collect water fees for agricultural and industrial activities, and levy effluent charges to encourage economical use of water and to stimulate application of appropriate technology.

(4) Encourage use of clean or pollution free technology in the production process or in business operations.

(5) Encourage waste recycling for productive use, and promote utilization of recycled water.

(6) Control and supervise reduction of pollution level, with emphasis on pollution generation sources, and particularly in locations outside the target zones serviced by the comprehensive waste treatment system, taking into account the absorptive capacity of the environment and water resources.

3.1.2 Enforce control measures and ensure that there are no additional discharges of effluents into water resources currently facing critical pollution problems, via the following:

(1) Control construction and expansion of industrial plants which generate water pollution problems, as well as control location and expansion of communities in the target water resources.

(2) Support establishment of industrial estates, industrial zones, flats and condominiums for industrial factories by encouraging private sector investment or joint investment.

(3) Designate land use zones for livestock and aquaculture farms, and support business and industrial operations in the form of estates, grouping or associations which have a system of basic facilities, such as salt water protection dam, waste water treatment system and drainage ditches in the case of aquatic farms, etc.

(4) Separate the sewage system from storm water drainage system in newly developed communities and industrial areas to increase efficiency of pollution control.

1.1.2 Encourage investment and make preparations for investment in construction of waste water treatment system as following:

(1) Construct comprehensive waste water treatment system for communities and industrial plants in target areas, such as Bangkok Metropolis, municipalities of vicinity towns, regional urban centers, tourist destinations, etc.

(2) Conduct feasibility studies for the construction of comprehensive waste water treatment system for communities and industries in other areas in order of priority.

1.2 Air and Noise Pollution

1.2.1 Reduce and control air pollution as caused by traffic via the following:

(1) Reduce lead content in benzene from 0.4 grams per liter to 0.15 grams per liter by January 1st, 1992, and speed up distribution of unleaded gasoline nation wide by the end of 1991 in order to facilitate installation of catalytic converter in new cars by January 1st, 1992.

(2) Improve quality of benzene by addition of oxygenates to reduce carbon monoxide in urban areas.

(3) Set standard of air pollution which may be emitted by motor vehicles and new motorcycles from 1992, and require new gasoline-driven motor vehicles from 1992 on ward to install a catalytic converters. In the event that it is not feasible to have an across- the-board enforcement for all new motor vehicles, fiscal incentives should be provided to encourage installation of catalytic

converters on a voluntary basis. Mandatory installation may subsequently be imposed after car producers have appropriate lead time for necessary adjustments.

(4) Set standard permissible level of exhaust fumes emitted by vehicles, and ensure strict enforcement in annual inspection of currently used motor vehicles and motorcycles..

(5) Set standard of energy efficiency for new cars.

(6) Improve quality of high-speed diesel to reduce problems of emission of black smoke and toxic fumes by (a) reducing level of sulfur from 1 percent to 0.5 percent by 1 September 1993, and consider possibility of further reduction of sulfur content to an appropriate level by the end of the Seventh Plan; (b) reduce oil refining temperature at the 90 percent refining point from 370 degrees Celsius to 357 degrees Celsius by September 1 st, 1992 at the latest by providing necessary incentives to stimulate oil users, traders and oil refineries to take urgent actions.

(7) Encourage wider use of fuels which emit lower volumes of pollution, such as liquefied petroleum gas in motor vehicles, and compressed natural gas in public buses. etc.

(8) Speed up provision of efficient public mass transit system, particularly the mass transit electric rail system to alleviate traffic problems, as well as to reduce pollution problems.

(9) Invest in solving air pollution problems to set socially constructive examples and to demonstrate government sincerity in this regard, especially investment in solving pollution problems of the public transport sector, such as the Bangkok Mass Transit Authority, the Express Transportation Organization of Thailand, and the Transport Company Limited, by improving conditions, careful maintenance of the buses, and replacing older fleets of buses with newer ones based on international standards.

(10) Reduce volumes of oil transport by trucks from Chong Nontsee oil depot and reduce the size of Chong Nontsee oil depot in order to relieve traffic congestion and environmental conditions of Bangkok Metropolis.

(11) Strictly enforce measures for controlling falling of debris, and other objects on road surface, and strictly enforce laws for controlling the operations of earth and other types of overweight trucks.

(12) Encourage regular monitoring of air quality and strictly enforce all the legal measures to maintain the set standard.

1.2.2 Reduce and control air pollution caused by industrial plants, via the following:

(1) Set standard, as well as enforce control measures for the maximum allowable level of toxic chemicals, particularly sulfur dioxide and dust particles, to be emitted from chimneys, or as generated by industrial plants, or groups of plants (such as in industrial estates) and electricity generators, while taking sue account of the local conditions and development stages.

(2) Encourage sales of fuel oil with low sulfur content, and control quality of lignite to enable industrial plants and electricity generators which have no sulfur dioxide treatment system to use lignite without exceeding standard limits for the emission of toxic chemicals. Fiscal incentives and pricing measures may be used to ensure effective implementation.

(3) Set standards of energy efficiency, and emission of toxic chemicals of boilers in new industrial plants.

(4) Require newly established lignite-fired electricity plants of the Electricity Generating Authority of Thailand to install a sulfur dioxide treatment unit.

(5) Reduce the impact from lignite mining and quarrying activities.

(6) Encourage air pollution generating industries to be relocated industrial estates or other designated zones.

(7) Conduct feasibility studies on the use of pollution free energy, such as import of natural gas, and international cooperation in hydro power development for electricity generation, etc.

(8) Set standards of air quality in industrial zones and other related areas, and encourage regular monitoring of air quality.

1.2.3 Reduce and control noise pollution

(1) Set standards of noise level for domestically produced and assembled motor vehicles and motorcycles, as well as ensure strict compliance with the regulations.

(2) Formulate measures for prevention of noise and vibrations in industrial and business establishments and in the transport sector, particularly form airports and construction as well as renovation activities.

1.3 Pollution from Solid Wastes

1.3.1 Support application of technology which helps reduce volumes of solid wastes, as well as encourage recycling of solid wastes, such as garbage, night soil, and discarded materials form various activities, for productive uses, which represent effective conservation of resources and reduction of expenses for collection and disposal of the solid wastes.

1.3.2 Set up a technically appropriate management systems of solid wastes, from the stages of wastes collection, transportation, utilization, to the stage of final disposal by encouraging joint investment and granting concessions to the private sector.

1.3.3 Support implementing agencies, particularly at the local level, such as Bangkok Metropolitan Administration, municipalities, and sanitary units, in formulating solid wastes disposal plans for the future to keep pace with the increasing volumes of solid wastes.

1.3.4 Educate the public on how to store, and reduce the daily supply of garbage, in line with collection and disposal methods of implementing agencies, and set appropriate level of service fees.

1.3.5 Procure land for garbage disposal using sanitary landfill method for a period of at least five years for communities of all sizes, and consider the feasibility of using incinerators in the future.

1.3.6 Impose controls and strictly enforce law and regulations covering both public and private institution concerning the use of correct methods of disposal of hazardous wastes from agricultural and industrial production, such as containers of toxic chemicals, used batteries, broken fluorescent lights, and infectious wastes from hospitals.

1.3.7 Encourage investment in the construction of central hazardous wastes treatment plants for industrial factories in locations with heavy factory concentrations via joint ventures with the private sector, or granting of concession to the private sector, or implementation of pilot projects by the public sector.

1.4 Pollution from Toxic and Hazardous Chemicals

1.4.1 Formulate measures for management of toxic and hazardous chemicals in an integrated manner from the stages of import of hazardous chemicals setting standard for storage of the products, standard for transportation, and

disposal of the hazardous wastes, as well as strictly enforce all control measures.

1.4.2 Encourage greater safety precautions for utilization, storage, and transportation of oil by strictly enforcing safety measures, as well as urge concerned public and private agencies to procure all the necessary equipment for the efficient prevention of oil leakage. These agencies should also be encouraged to prepare contingency plans in case of accidental leakages, as well as review and revise inappropriate safety precaution measures, particularly in the use of liquefied petroleum gas.

1.4.3 reduce use of toxic and hazardous chemicals in agricultural and industrial activities by encouraging use of other substitutes, such as use of organic fertilizers, prevention and control of pests and insects via natural methods, and production process improvement in industrial factories etc.

1.4.4 Encourage preparation of plan for the prevention of accidents caused by poisonous chemicals and other hazardous materials, particularly in industrial zones in the Eastern Seaboard area, and other depots for storing poisonous and toxic chemicals.

1.4.5 Encourage setting up of an information center for the exchange or information, public relations activities, and training services to educate concerned agencies and the public about proper storage, the use of hazardous chemicals, and instructions to follow in the event of an accident caused by these poisonous products.

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1.5 Global Warming Problem

1.5.1 Carry out studies quickly to help determine Thailand’s position for cooperating with the world community in tackling the global warming problem as well as emphasize reforestation efforts via development of plantations to help absorb carbon dioxide.

1.5.2 Prevent problems associated with global warming and the green-house effect, caused by increase i carbon dioxide from fuel combustion, by encouraging planting of trees and reforestations, and carry out public relations

campaigns to create understanding by the public abut the serious impacts and to seek cooperation in solving the problems.

1.6 Improvement of development mechanism and administration and management of the environment.

1.6.1 Enforce the "polluter-pays-principle" to ensure that polluters indeed are required to shoulder the burdens of treatment and disposal of pollution within the Seventh Plan period.

(1) Enforce collection of fees pollution treatment and disposal in the form of pollution taxes, fee or service charges, at rates which may be determined in accordance with types of activities and products causing damages to the environment. This money should then constitute a fund for investment in environmental management.

(2) Set up an environment fund with initial endowment from the government. In the beginning, existing public agencies may be assigned to administer the fund until appropriate legislation has been prepared. With a proper legal basis, an independent organization, which has status of a juristic person, may be set up to administer this fund.

(3) Encourage enterprises with proper environmental management to mobilize capital from the stock market, and encourage financial institutions to set up funds to mobilize resources from the public for investment in projects or activities concerning the environment.

1.6.2 Improve organization., administration and management, as well as amend laws, via the following:

(1) Encourage formulation of plans and systematic coordination of urban environmental development plan, together with clear definition of the respective roles of the central, regional and local authorities, and encouragement or private sector participation.

(2) Improve organizations responsible for policy formulation and coordination at the central and local levels, and set up national and local organizations for the supervision and coordination of rehabilitation and development policies concerning environmental conditions (for Bangkok Metropolis and vicinity towns, and each province).

(3) Require the construction of infrastructure facilities with impact on the environment to set up a system for the prevention of environmental problems, and include the costs of such systems as part of the original investment cost.

(4) Provide partial or total public subsidies for construction of waste water treatment and disposal systems , as well as garbage disposal to the local authorities, which may include procurement of land, equipment, and vehicles necessary for the management efforts.

(5) Improve and strengthen the role of local authorities to enable them to manage waste treatment systems in an independent manner. The local authorities should have the flexibility to manage the treatment services, as provided by the local authorities themselves, or by sub-contracting to the private sector, and may determine service charges as appropriate.

(6) Set up a tripartite organization including communities, enterprises and the government to supervise maintain environmental quality at an acceptable standard, particularly in urban areas, industrial zone, and tourist destinations.

(7) Develop manpower and technology for the reduction and treatment of pollution by speeding up development of manpower at the university level in the fields of sanitary and environmental engineering, and environmental science, emphasizing studies of pollution, as well as development of technicians at the levels of lower and higher diplomas in the fields of pollution control to supervise activities at treatment plants. Furthermore, speed up research and transfer of pollution control an pollution reduction technology which allows for possible design and construction of the system and production of pollution control equipment.

(8) Improve and amend the Improvement and Conservation of the National Environmental Quality Act, B.E. 2518 to cover prevention, control and management of the environment in all aspects, including establishment of an environment fund, which may be efficiently used for effective environmental control.

(9) Promote public relations service to educate the public, and to disseminate information on various kinds of pollutants to the public at all levels, as well as carry out campaigns to mobilize cooperation for the prevention and solution of environmental problems.

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