An Alternative Planning Process for Improving Energy Efficiency Programs in Developing Countries

by

BEULAH ANCHITA D'SOUZA
B.A., Economics
Wellesley College, 1990

Submitted to the Department of Urban Studies and Planning in Partial Fulfillment of the Requirements for the Degree of

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ABSTRACT

This thesis investigates the performance of energy efficiency programs and organizations in developing countries. A review of several case studies uncovered institutional, organizational and financial factors as the causes of the disappointing performances of these programs. In addition, my research shows that many of these shortcomings occurred as a result of an ill-defined program planning process. I conclude that shifting control of the planning process from bi-lateral donor organizations (the usual promoters of these programs) to local stakeholders (government and private groups) will help overcome some of the current shortcomings.

I propose a planning process in which bi-lateral donor organizations work as facilitators rather than directors of the planning process. This model builds upon an incipient approach undertaken by ESMAP, a group at the World Bank that provides technical assistance for energy efficiency programs. In this thesis, I conceptualize the ad-hoc method that this group has developed in practice. This is the starting point for the alternative model.

I extend ESMAP's approach to incorporate specific planning principles, stages, and methods. I argue that energy efficiency programs can be more successful if they address barriers associated with individual groups of stakeholders. The alternative approach recommended herein includes the stakeholders in the planning process. It specifically allows them to design energy efficiency programs and organizations that are based on their mutual interests and needs. Consequently, these new institutions are more likely to be effective in overcoming the barriers to long-term energy efficiency.

Thesis Supervisor: Dr. Richard Tabors
Title: Senior Research Engineer, Laboratory for Electromagnetic and Electrical Systems
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<td>Board of Directors</td>
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<td>BPP</td>
<td>Best Practice Program</td>
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<td>CEC</td>
<td>Commission for European Committee</td>
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<td>CEM</td>
<td>Contract Energy Management</td>
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<td>CIDA</td>
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<td>DSM</td>
<td>Demand-Side Management</td>
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<td>Energy Management Law</td>
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<td>Energy Sector Management Assistance Program</td>
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<td>Federation of Thai Industries</td>
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<td>KEMCO</td>
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<td>Acronym</td>
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<td>KONEBA</td>
<td>P. T. Konservasi Abadi</td>
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<td>MPD</td>
<td>Ministry of Planning and Development</td>
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<td>MTE</td>
<td>Ministry of Transport and Energy</td>
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<td>MWP</td>
<td>Ministry of Water and Power</td>
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<td>NEEIP</td>
<td>National Energy Efficiency Improvement Program</td>
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<td>NEES</td>
<td>National Energy Efficiency Strategy</td>
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<td>ODA</td>
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<td>UNDP</td>
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Introduction

Every year, developing countries waste ten to twenty percent of their commercial energy through inefficient usage (Levine, 1991). Besides increasing annual energy imports, inefficient energy use puts additional financial pressures on governments that are already struggling to meet the costs of expanding energy supplies to fuel their growing economies. In addition, low energy efficiency causes unnecessary emission of pollutants, greenhouse gas emissions and a depletion of natural resources. Because of their currently low efficiency, developing countries have the potential to achieve significant energy efficiency gains that cost less than increasing energy supply.

The goals of Energy Efficiency Programs (EEPs) are to disseminate information, to increase technical expertise in energy efficiency through training programs, encourage domestic production of efficient equipment or increase the availability of imported equipment, and make available financing packages for equipment substitution that decrease financial risks by minimizing high up-front costs. The Energy Efficiency Implementing Organizations (EEIOs) can reach their above-mentioned goals by working with the stakeholders in their interest and benefit to ensure the implementation of energy efficiency measures in the long-term.

The objective of this thesis is to understand why these programs and EEIOs were not able to raise the level of efficiency to projected levels. I propose the formulation of a National Energy Efficiency Strategy (NEES) that explicitly describes the institutional setup of the EEIO, and a priority listing of both the areas that require improved energy usage, and the types of programs to be implemented. In addition, an alternative planning process that includes the participation of the stakeholders is recommended to formulate the NEES. In order to do so, I review six types of programs, and four types of EEIOs to highlight how these programs and organizations differ, and why they have run into problems. This review led me to evaluate the conventional and current trends in formulating the NEES by separating the process into four distinct stages. These reviews and evaluations revealed the need for an alternative planning process.
Energy efficiency programs have the potential to save energy in developing countries. There are many reasons why they have not met projected goals. They can be related to the fact that they were subsidized or market-based, state-run or privately-run, and if these countries have or do not have policies to promote efficiency. In addition, I argue that the root of the problem is the lack of failed implementation. It is important to understand the economic and physical context in which energy efficiency programs are implemented. These programs are implemented by individuals and groups of people that can be referred to as stakeholders. They include: energy consumers (individuals, households, firms, farms, factories, etc.), manufacturers and providers of end-use equipment, producers and distributors of energy carriers, local/national financial institutions, government and bi-lateral donor organizations. Stakeholders' behaviors are closely related to barriers such as: low energy prices; lack of competitive markets; lack of awareness of efficiency, information on energy efficiency and technical expertise; absence of a management perspective that encourages energy efficiency; the difficulties in obtaining energy efficient equipment; and financial constraints. Stakeholders clearly understand these issues that are profoundly embedded in the political economic environment of their country, making their participation invaluable to the planning process. Their engagement in the planning is also important because it increases their commitment to the strategies that they help design.

It is widely perceived by many analyst that energy efficiency can be pursued only when the political and social institutions are already in place to address the problem. As a result, we see few examples in the literature or in practice of a given energy efficiency proposal being pursued simultaneously at the technical, economic, behavioral and institutional levels. Yet, it is exactly this lack of an integrated approach that has resulted in the poor record of energy efficiency implementation in developing countries. I argue that the planning process has failed to recognize the roles played by various stakeholder groups, such as: energy consumers, manufacturers and providers of end-use equipment, producers and distributors of energy, financial institutions, governments and international donor agencies. The conventional process does not take into account the stakeholders' differing goals and perspectives in the type of EEP, the setup of the EEIO and the policy options into account. Based on the findings of this review and other critiques presented in the available literature, I develop a
planning process that attempts to localize planning by incorporating the stakeholders. This planning process builds upon the participatory and integrative approach is currently being used by the Energy Sector Management Assistance Program (ESMAP) of the World Bank in its technical assistance projects to developing countries.

A shift is recommended from the traditional planning process that focuses only on the technical and economic analysis of EEPs to an integrated approach that results in the optimal mix of EEPs to include both market solutions and policy options. This begins with a comprehensive analysis that assembles available data on energy demand and supply, undertakes the institutional analysis, and incorporates current programs and projects to identify both areas where present and future energy bottlenecks exist and where there are opportunities to enhance development. I recommend that the alternative NEES options be formulated by the stakeholders using the analysis and that the stakeholders and decision makers work jointly to assess and select the appropriate NEES option.

Since the current energy policy decision making process is highly decentralized, and often not well-informed, this thesis argues that by focusing the decision-making process around the NEES options assessment (formulated by the stakeholders), a substantial improvement in the implementation of EEPs may be achieved. Unfortunately, the merits of the proposed process cannot be proven because experiences that use elements of the approach are still at a very early stage of implementation.

Chapter 1 provides background on energy efficiency in developing countries. It explains the current low level of energy efficiency and reviews its causes provided in current literature. Policy and instrument options to increase efficiency are summarized, focusing on the use of EEIOs to implement EEPs. Chapters 2 and 3 review EEPs and EEIOs respectively, to uncover lessons learned from existing programs and organizations. These lessons provide a background and rationale for the alternative planning process by showing: 1) what barriers these programs were trying to overcome, 2) why they were unsuccessful, 3) the importance of recognizing the context in which these programs were implemented, 4) the necessity of the stakeholders' participation, and 5) how these programs and organizations can be improved. In chapter 4, the
conventional planning process of EEPs and EEIOs is analyzed and linked to the efforts of international donor organizations. The aim of this chapter is to show the need to transfer the control of the planning process to the governments of the developing countries. Using this approach, an alternative planning process that integrates the participation of key actors is described in order to show its merits over the conventional planning process. Finally, the conclusions of the thesis are presented.
Chapter 1
Background

It is important to understand why energy is used so inefficiently in developing countries. By linking the circumstances of the economy, energy sector, stakeholders, and institutions involved in the supply and use of energy, it is possible to identify the barriers to energy efficiency. Governments in developing countries have tried a number of instruments to overcome some of these barriers to increase energy efficiency. Among them, the use of institutions to implement Energy Efficiency Programs (EEPs) have been less successful than anticipated (see chapter 2). In this chapter, an analysis of the stakeholders as they relate to existing barriers are discussed to recommend their participation in a more integrated planning process. This process will formulate the National Energy Efficiency Strategy (NEES) which contains among other things, the appropriate EEIO setup and the type of EEP. A brief description of the contents of the NEES and its operations show how lessons learned in chapters 2 and 3 can be incorporated into the planning process to design EEPs and setup the EEIO.

A case for energy efficiency is made in the beginning of this chapter. Then the reasons for the current state of inefficient usage in developing countries are described. These reasons are first listed as barriers, then they are incorporated into a stakeholder analysis to give an alternative perspective on the barriers. Following this, a number of current policy options and instruments to promote energy efficiency are described. Of the instruments, EEIOs and their programs are explored in the most detail since they form a central component of this thesis. This chapter concludes by defining the NEES to allow the reader to understand the relevance of chapters 2 and 3 for the NEES formulation and alternative planning process.
1.1. A Case for Energy Efficiency

During the oil price shocks of the 1970s, energy conservation as a means to reducing the total use of energy was the driving force to increasing energy efficiency. In the 1980s, these Energy Efficiency Programs (EEPs) were launched to increase the competitiveness of energy using industries. Since the late 1980s, the environmental movement has pushed energy efficiency onto the agenda with greater force.

Today, many developing countries are considering reforming the way energy is produced and consumed as they experience: (a) rapidly growing demand for energy; (b) major constraints on available energy financing; (c) increasing pressures to protect the environment; and (d) a reappraisal of the roles of government and private sectors in managing the energy sector. These factors are forcing developing countries to address long-neglected issues of energy wastage in production and end use.

1.1.1. Growing Energy Demand in Developing Countries

It is unavoidable that developing countries will have to increase the amount of commercial energy they consume in order to improve the welfare of their populations. Developing countries annually consume about 0.4 toe\textsuperscript{1} per capita of commercial fuels, or 0.6 toe including biofuels, compared to more than 3.2 toe in Western Europe and 7.4 toe in the United States (US). Over the past two decades, the rate of growth in commercial energy consumption in the developing countries has been more than seven times that of the Organization for the Economic Cooperation and Development (OECD) countries (5.3 percent per year compared with 0.7 percent per year). In the electric power sector alone, installed capacity and generation per capita grew at more than twice the real growth rate of Gross Domestic Product (GDP) of developing countries.

Given the trends in the growth of energy supply in the last decade, and the relatively low consumption base, it is expected that developing countries will account for almost all of the increase in future world energy consumption. This demand growth is driven by several related factors, including the growth of

\textsuperscript{1}Tons of oil equivalent.
populations and per capita incomes; the migration to urban areas in many instances, leads to substitution of commercial energy for fuelwood; the increasing penetration of energy-intensive products and technologies; and poor efficiency with which energy is utilized (World Bank, 1993, Levine et al., 1991).

### 1.1.2. Financing Constraints

Given this rapidly growing demand, developing countries are beginning to experience increased pressures to produce and consume energy more efficiently, partly because of financing constraints on new energy supplies. It is projected that for electric power supply alone developing countries need an investment of US $100 billion a year over the next decade (World Bank, 1993).

Today in some developing countries, 25% to 33% of public expenditure goes to investments for electric power, and these investments are still inadequate. The World Bank currently loans developing countries US $4 billion annually while loans from other multinational banks make up an additional US $6 billion (Phillips, 1991). This leaves the domestic and international capital markets as potential sources for the remainder of the new investment capital. Unfortunately, domestic capital markets in many developing countries are weak, which often makes the mobilization of the magnitude of funds required impossible.

The World Development Report, 1992 (World Bank, 1992), estimates that electricity prices in developing countries are only 50 percent of the total supply costs. When these revenues are compared with existing losses in capacity and energy usage from technical inefficiency, it doubles the investment requirements for power supplies. Raising energy prices and increasing technical efficiency would reduce the need for additional supplies, remove the competition for much-needed domestic and foreign development capital. Raising energy prices also has the potential to reduce foreign exchange and international debt burdens while reducing dependence on volatile energy markets.

### 1.1.3. Energy and the Environment

Environmental implications of growing energy demand in developing countries are receiving worldwide attention. Both energy production (e.g., inefficient combustion of household fuels and poor practices in coal-burning

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2In 1991.
power plants) and end-use (e.g., poor management of urban congestion and automobile use) contribute to environmental degradation. On a global scale, the production and use of energy accounts for between 50 and 60 percent of the greenhouse trace gas emissions into the atmosphere (World Bank, 1992). A number of studies have concluded that environmental degradation can be reduced by switching to cleaner fuels and reducing the energy intensity of economic activity by using best practices and technology in both energy production and consumption.

A recent World Bank review of the operational performance of the largest power utilities in fifty-one developing countries over a twenty-year period show a general trend of declining technical efficiency. It has been estimated that older power plants in many developing countries consume from 18 to 44 percent more fuel per kilowatt hour of electricity produced than do plants in OECD countries, and they suffer transmission and distribution (T&D) losses two to four times higher. In fact, technical and non-technical T&D system losses in the delivery are commonly greater than 20 percent and occasionally approach 40 percent: 31 percent in Bangladesh, 28 percent in Pakistan, and 22 percent in Thailand and the Philippines (In the United States only 8 percent of electricity is lost during transmission; in Japan, 7 percent.). These losses\(^3\), the equivalent of about 75,000 megawatts of capacity and 300 terawatt hours a year, represent a loss to developing countries of approximately $30 billion a year through increased supply costs. By the end of the century, based on present trends, aggregate losses would double (Munasinghe, 1993).

Developing countries have the potential to achieve significant energy efficiency gains because of their current low efficiency base. The economic impacts of policies and investments that improve energy efficiency in developing countries can be substantial, first, because of the possibilities of delaying capital-intensive investments in energy supply, and second, because of the potential savings in fuels. On average, energy supply and end-use

\(^3\) While some losses represent theft and shortcomings in billing and collection, it is clear that technical losses in networks are very high.
efficiencies and industrial energy efficiency rates are 66% to 50% compared to best practices in industrialized countries⁴.

1.2. Why Energy Efficiency Is So Low in Developing Countries

The reasons for the inefficient usage of energy can be linked to two types of barriers. Examples of market-related barriers that must be addressed by the government, include: low energy prices, lack of competitive markets, existence of protected industries, and government ownership of energy supply enterprises. Examples of non-optimal or irrational behavior of economic agents related barriers, include: the lack of awareness and information on energy efficiency, technical expertise, availability of efficient equipment and viable financing packages. It is the latter type of barriers that EEPs try to overcome.

Most industrialized countries had experienced decades of low energy prices and plentiful fuel supplies by the early 1970s. High energy usage was of little concern until the first oil shock, when rapidly rising energy prices and interruptions in supplies forced the reexamination of existing policies. Conservation and end-use efficiency improvements became an important component of energy policy, and by the mid-1980s, a large part of the capital stock reflected newer, more efficient technologies resulting in decreasing levels of energy consumption. Consequently, economic growth continued to increase.

Unfortunately, this was not the case with developing countries. During this period many developing countries were focusing on increasing energy supply to fuel their growing economies. The oil price shocks coincided with low commodity prices for major exports (raw materials) from developing countries. They reacted to the compounded effects with minor increases in energy prices (especially petroleum) and some measures to ration energy supplies temporarily. Nevertheless, these countries continued to rely on external borrowing to pay for the rapidly rising energy import bills while continuing to focus on increasing energy supply (World Development Report, 1981). They were no better prepared when the second oil crisis occurred in the late 1970s,

⁴ Over the longer term, as investments are made in new capital equipment, it is likely that larger energy savings will be achieved on the order of 30 to 60 percent above what is now possible with current equipment.
leaving them with no choice but to move from planning for future development to struggling for survival. In contrast, the long-term coordinated approaches by OECD countries to diversify their energy resource bases, restructure their industrial sectors as a result of technological change and industrial policy, and emphasize energy efficiency through demand management and energy efficiency technologies, were effective in de-linking energy consumption from economic growth.

The current environment of low energy prices gives developing countries the time needed to take stock of existing policies and to grasp the opportunity to improve energy efficiency in current and future energy use. Unfortunately, increasing debt burdens, continually declining prices of raw materials coupled with the increasing cost of manufactured imports, increasing populations and declining performance of conventional energy utilities are pulling governments into different and often opposing directions. Governments continue to operate with no clear strategy for managing demand or obtaining future energy supplies. It comes as no surprise that a similar improvement in energy efficiency has not occurred in most of the developing world. To the contrary, in many instances, energy intensity\(^5\) has continued to increase (World Bank, 1993).

The energy sectors in many developing countries are structured with a single national electric, gas utility, or oil company operating as a public monopoly. This model is based on the principle that energy is a strategic and publicly-provided good. During the formative stages of these industries, this model was suited to the energy sector because it facilitated expansion of energy supplies, captured technical economies of scale, and, at least in the early years, made effective use of scarce managerial and technical skills. But according to Munasinghe (1993), government interference is currently the biggest problem in the energy sector. It is responsible for the lack of competitive markets, low energy prices, protected industries and government ownership of energy suppliers, all of which contribute to creating an environment that does not facilitate the efficient usage of energy in developing countries.

\(^5\) Energy consumed per unit of output
1.2.1. Low Energy Prices

Prices in most industrialized countries are set with the objective of covering at least the financial costs of supply but, in many developing countries, energy prices tend to be much lower than the cost of supplying energy. Governments of developing countries tend to use energy pricing for multiple implicit and explicit objectives, such as increasing the competitiveness of exports; securing government revenues; achieving equity in income distribution; facilitating demand management; utilizing domestic energy resource supply; stemming inflation; and winning popular support (deLucia, 1985).

These governments' pricing policies includes taxes and subsidies which lead to price distortions. It is also not uncommon for the governments in developing countries to cross subsidize low energy prices in the residential sector by higher energy prices in the industrial sector (Armar, 1993). Although subsidies can make products more competitive in both international and domestic markets, they can have negative financial implications for national budgets because they must be financed from other non-energy revenue or recovered through cross subsidies. Low energy prices give improper investment signals and encourage the misapplication of resources such as fuel mixing and inappropriate selection of industrial processes and equipment purchases (Hill, 1988); government-owned energy institutions face severe financial problems; and there is a tendency towards poorly designed policies that are economically inefficient and socially regressive.

1.2.2. Lack of Competitive Markets and Protected Public Enterprises

Monopolies and government regulations that protect public enterprises discourage the development of a competitive energy supply market. Commercial energy in most developing countries is concentrated in the industrial sector often in highly protected state-owned industries, whose processes require far more energy per unit of output than do similar processes in the industrialized world. For example, steel and ammonia fertilizer production often require twice as much energy per unit of output; and pulp and paper production often requires three times as much (World Bank, 1993). But in the absence of competitive
markets, raising the energy prices paid by these protected industries will do little to encourage them to curb energy wastage.

1.2.3. Supply Side Institutions

The energy sectors in many developing countries are characterized as public monopolies, where the government assumes multiple roles: regulator, operator, and owner of energy enterprises. Energy suppliers and electrical utilities in United States (US) and Western Europe operate on commercial principles: they pay interest and taxes; earn commercially competitive rates of return on equity; and have responsibility for their own budgets, borrowing, procurement, salaries, and conditions pertaining to staff.

The unreliability, insufficiency, inefficiency and low quality of energy supply is frequently attributed to weak institutions, government interventions, uncertain and variable policy frameworks, and a command-and-control decision-making process that increases the likelihood of corruption and waste.

In many government-owned energy supply institutions, laws are not enforced, budgetary policies are not monitored and accounting systems tend to be weak because there is no clear distinction between the government, the energy supplier and in many cases, the energy user (publicly owned enterprises). The absence of clear roles influences procurement decisions, discourages least-cost fuel choice, restricts the ability to raise power tariffs to meet revenue requirements, restricts the enterprise’s access to foreign exchange, ties salaries to low civil service levels, and promotes excess staffing and political patronage (World Bank, 1993).

1.2.4. Barriers to Energy Efficiency

Experience in both developed and developing countries has shown that enabling better institutional and regulatory frameworks to be put in place, allowing energy prices to reflect real costs, and ensuring that competitive end-use markets function through the removal of market-related behavior type barriers does not eliminate the obstacles of raising energy efficiency. Other market and non-market imperfections could still create significant barriers to

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6 It is possible that a much less energy-intensive mix of industries would evolve if the market were competitive.
efficient energy production and end-use. They are categorized below as technical, economic and financial, and institutional barriers (although some barriers fall in more than one category since they tend to be related to a number of issues). In the next section, these barriers are analyzed from a political economic perspective by linking it to individual stakeholders.

**Technical Barriers**

- Most industries work with outdated technologies and aging equipment which often make it impossible to achieve significant energy savings unless the whole process or equipment is replaced by modern technology.

- A chronic shortage of energy efficiency equipment, spare parts and measuring equipment as a result of the lack of indigenous industries and/or imported equipment often prevents achievement of simple savings by replacement of equipment, spare parts and standard maintenance procedures.

- The lack of ability to diagnose, design and improve engineering solutions to energy problems.

- Lack of "energy efficiency" training for technical staff, for example, in the case of transportation, a lack of training in efficient driving techniques and proper vehicle maintenance.

**Economic and Financial Barriers**

- In the trade sector, significant impediments to efficient production and end-use of energy include: trade restrictions or import duties on energy-efficient technology, equipment and appliances, and restricted access to foreign exchange.

- Local banks are unwilling to provide loans to finance energy saving investments, partly because these banks do not have experience in providing money for this type of program. They are also concerned about the financial stability of the companies interested in implementing energy savings programs.

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7The term "institutional" is defined as: A set of rules actually used by a set of individuals to organize repetitive activities that produce outcomes affecting those individuals and potentially affecting others.
Furthermore, local banks are not interested in financing non-proven technologies.

- Weak domestic capital markets limit foreign private investment to a selected number of foreign-owned companies making it difficult for most of the industries, local-based industries to acquire the necessary financing to increase energy efficiency.

- The complexity of energy conservation investments and the risks involved in adopting unfamiliar innovation and in interrupting production flows does not promote the uptake of energy efficiency measures.

- For a variety of reasons, end-use energy consumers tend to have higher implied discount rates than do energy suppliers. This causes different levels on interest and abilities to invest in energy efficiency. For example, an electric or gas utility may be able to borrow at a below-market rate (6-10 percent) to increase its energy supplies. This utility will have an advantage over a competing energy service company, private power project, alternative fuels project, or firm that must pay the market rate (15-20 percent) to install more efficient equipment, yet both the above groups have lower discount rates than the individual household consumer.

**Institutional Barriers**

- The lack of market intermediation has resulted in high transaction costs for information that assesses energy losses; the inaccessibility of loss reduction techniques, technology and process options; innovative financing options; and the potential for joint venture opportunities. In the household sector in particular, energy users do not usually have easy, low-cost access to the necessary technical information and capital, and first-time appliance buyers do not generally have the sophistication to understand the potential differences in the costs of ongoing energy consumption.

- Household end-use energy consumers usually do not face real costs of energy use because households are often not adequately metered and because investment decisions are often split among tenants, owners, and contractors.
• Low energy prices entice industries to substitute capital for labor and install processes and equipment based on cheap available energy.

• Energy efficiency investment, which normally consists of a large number of small, separate items and facilities tend to go unnoticed.

• In public enterprises and in government circles, there is a preference for production increases and new projects. Energy efficiency problems are frequently given low priority, or ignored, especially when the government covers financial losses.

• Countries lack specific incentives for increasing efficiency, such as mandated energy performance codes and standards for industry, transport and buildings.

1.3. Stakeholders

Barriers can be related to the economic and physical context in which energy efficiency programs are implemented. Since the implementation of these programs requires the support of individuals and groups of people, it is important to understand their perspective on energy efficiency. Stakeholders clearly understand the issues that are profoundly embedded in the political-economic context. One of the major tenets of this thesis is to educate the stakeholders as well as to learn of the stakeholders’ needs. I have taken Reddy’s (1991) approach where he associates specific barriers with individual stakeholders in energy efficiency. He argues that the patterns of energy consumption are shaped by the behaviors of a large number of actors, each of whom has to make decisions relating to energy using activities. He considers the following stakeholders in his analysis: energy consumers (individuals, households, firms, farms, factories, etc.), manufacturers and providers of end-use equipment, producers and distributors of energy carriers, local/national financial institutions, government and bi-lateral donor organizations.

It is assumed in this section that the stakeholders should be included into the planning process to better define the NEES for reasons that will be described in this section and in chapter 2, 3, and 4. In this section, I summarize Reddy’s main points for each stakeholder, then, I use specific characteristics of a type of program, mix of programs or the alternative planning process that can be used
to overcome each barrier associated with a stakeholder group (see chapters 2 and 4). Throughout chapters 2 and 3, it will become increasingly clear that the downfall of the programs are directly related to the previous exclusion of the stakeholders from the planning process. In chapter 4, this stakeholder analysis is used to operationalize an alternative planning process.

1.3.1. Energy Consumers

Reddy (1991) identifies energy consumers as: the ignorant consumers, who are unaware of the possibilities for efficiency improvement and the cost-effectiveness of conservation measures; the poor, who are sensitive to the first cost of efficient equipment; the indifferent consumers, who although fully knowledgeable about the net benefits of efficiency improvement, and in a position to afford the products, do not do so because their energy costs are not significant; the helpless, who are knowledgeable about energy efficiency and able to afford the efficiency improvements but are completely helpless in the face of all the problems that must be tackled in identifying, procuring, installing, operating and maintaining the associated devices and equipment; and the inheritors of inefficiency who are victims of indirect purchase decisions, for example, a tenant who rents a house that is energy inefficient.

These barriers can be overcome by targeting programs to specific groups of people, for the ignorant, the most obvious solution is to provide information; for the poor, financing packages that convert the initial down payment into a payment plan that coincides in time with the savings achieved could be used; for the indifferent; DSM type programs and/or standards can be used to govern the efficiency of appliances; for the helpless, a mix of programs that inform, label and make available equipment and technical services for installation and maintenance are helpful; and for the inheritors of inefficiency, standards and codes can be used.

1.3.2. Manufacturers and Providers of End-Use Equipment

Reddy (1991) distinguishes manufacturers as efficiency-blind and operating-cost-blind. For the efficiency-blind, sales depend far more on the first cost of the equipment than on its efficiency. Since quite often lower first cost means lower efficiency, sales may actually decrease with efficiency improvement. This barrier
can be overcome partly by government enforced efficiency standards and the labeling of end-use devices. The establishment of financing programs for purchasing this equipment will also assure manufacturers that the demand for their goods will not be diminished by cheaper non-efficient alternative equipment.

The operating-cost-blind providers of end-use equipment are those who minimize the capital cost of the equipment irrespective of the consequences of the decision of the energy consumer. Buildings are an example of this situation. Building codes that stress energy efficiency can contribute to surmounting this barrier.

1.3.3. Producers and Distributors of Energy

Reddy (1991) believes that producers and distributors of energy are obsessed with increasing supply. They are also biased towards centralized production with little interest in decentralizing energy efficiency improvements or in cogeneration type programs that can supply energy. In addition, there are laws in many developing countries that prevent the production of energy by private producers. It is not surprising that little attention is devoted to marketing energy efficiency improvements. Energy producers do not believe that conservation is part of their business, because it involves equipment that they do not produce, installed in properties that they do not own. The problem is aggravated by the fact that the marketing of efficiency improvements is inherently more complicated than the marketing of energy supplies.

A change in the charter of the producer, from suppliers of carriers to vendors of energy services, and/or the use of an EEIO to assist in certain aspects of marketing these programs can contribute to overcoming this barrier. The barrier of the centralization bias can be tackled by insisting on least-cost planning that evaluates energy efficiency and supply alternatives on a level playing field. Laws in the US that encourage and reward independent producers can be adopted appropriately to overcome the centralization bias.

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8 For example, electricity profits increase with every kWh sold.
1.3.4. Local/National Financial Institutions

The financial institutions that provide capital are also supply-biased. They also avoid supporting anything that is non-proven. This affects the uptake of energy efficiency technology since the technologies for energy efficiency improvements are evolving rapidly, incorporating the use of non-proven technologies.

Propagating the paradigm that the level of energy services required to improve efficiency is also a means to increasing energy supply, it is possible to broaden the financial institutions' view of increasing energy supply. Packaging a portfolio of technologies, rather than basing financing on each individual technology (with the rational that one of the many technologies would be successful in the market place) is one way to overcome their bias.

1.3.5. Government

As shown earlier in this chapter, the government’s involvement in the energy sector makes it an important stakeholder. It is important to convince the government of the benefits of energy efficiency, since they are in a position to modify regulations and current practices, thereby creating an environment that facilitates efficiency improvements.

Reddy (1991) believes that most governments in developing countries believe that conservation/energy efficiency9 is a rich country’s game, because the term has been understood to mean making do with fewer energy services. As a result, decision makers have shown a tendency to be uninterested in energy efficiency measures. If energy efficiency is understood as increasing energy services with less energy consumption, then it can become the core of the national development strategies.

In addition, the formulation and implementation of energy efficiency programs require technical and managerial skills of a higher order, which are precisely the types of skills that are usually in extremely short supply in developing countries. Since the field is changing rapidly, most governments have a difficult time keeping up-to-date with the latest information and

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9These two terms have been interchangeably, however; the term energy efficiency is more commonly used.
equipment. However, extensive and intensive training programs and collaboration with organizations in Europe and the US, such as ETSU in the UK and Commission of European Communities (CEC) in Europe, can facilitate the transfer and understanding of updated information on innovative technologies and programs.

In most developing countries, energy suppliers tend to be public enterprises. The rate-setting formulas are biased towards increasing energy supply. Energy suppliers who undertake energy efficiency programs experience losses in revenue due to reduced sales and lose returns on investments in demand reduction. In this respect, regulators can play a central role in modifying the reward structure to separate profits from sales and allow utilities to recover costs (and make a profit) from successful programs by removing the disincentives to least-cost planning.

Decisions regarding energy supply and energy efficiency are often handled by separate offices and by separate department or ministries with separate budgets. Centralized supplies get the biggest budgets, while energy efficiency programs must be content with the leftovers. One way to tackle the fragmented decision making barrier is to ensure that energy efficiency improvements are incorporated into the same investment decisions as those involving energy supply. Furthermore, it should be handled by the same office and decision maker.

Government decision makers are very much concerned with the political "pay-off" and "mileage" they can get out of their decisions. They therefore estimate the comparative "political returns" from technological choices and invariably view large plants as impressive and grand exhibits that stand as permanent testimonies to their concern for populace. This barrier can only be removed by educating decision makers of the inherent benefits of EEPs.

Even when governments are interested in energy efficiency, they tend to create a separate unit for it. Unfortunately, such a separate entity cannot wield enough power to enforce energy efficiency decisions on other department and ministries, much less have the flexibility and resources to implement energy efficiency programs outside of the government. By and large, these agencies end
up confining themselves to publicity and information. A major step towards surmounting this barrier is discussed at the end of this chapter and in chapter 4.

1.3.6. Bi-Lateral Donor Organizations

Reddy (1991) described bi-lateral donor organizations as supply biased, anti-innovation and biased towards large projects. Although bi-lateral donor organizations realize that developing countries may not have the technological and management institutions, or expertise to strategy and administer EEPs, they are still more concerned with projects than programs, especially narrowly defined projects that do not rely too much on local institutions and capabilities. Reddy argues that this leads to the exportation of energy inefficient technologies and equipment. In addition, it gives these organizations more control over projects, allowing them to use foreign consultants and First World solutions, creating a dependency that will maintain their services in the long-term.

Many of the solutions described above such as incorporating a least-cost approach, strengthening indigenous capability to keep up with energy technologies, undertaking energy planning, and assessing the viability of these projects, can be used to overcome these barriers. In chapter 4, I show how an alternative planning process that shifts the responsibility to the host governments can overcome these barriers.

1.4. Energy Efficiency Policy and Instruments

Gamba (1989) argues that the most successful strategies to promote energy efficiency are the ones that are integrated into the overall economic policy environment and system of the country concerned. He also states that the highest priorities for improving the efficiency of energy supply and end use in many developing countries is to increase the institutional capacity of the energy supply enterprises and users, and to raise prices.

It is the government's role to make policy decisions to overcome the market-related barriers to improving energy efficiency. However, these changes take time, and the outcome is often unclear. Meanwhile, governments have been using several instruments to overcome these barriers in the short-term with varying degrees of success.
1.4.1. Policy

In a developing-country context, the highest priority is to let energy prices reflect the long-run marginal cost of supply. This not only allows many developing-country power utilities to be economically and financially viable by reducing financial transfers from the national budgets, but it also ensures that energy users are paying the true cost of energy, making them responsible for their inefficient energy usage.

To stimulate the supply and end-use efficiency of energy, governments of developing countries should consider eliminating protective industrial and commercial barriers, and phase out trade restrictions and foreign exchange controls. Countries in which the private sector is allowed to operate freely are usually the first to adopt new technologies effectively.

1.4.2. Operational Tools

There are three main types of instruments that have been used to overcome the barriers related to irrational behavior of economic agents: demand-side management (DSM), minimum standard codes, and energy efficiency institutions. DSM and minimum standard codes are also a type of EEP. They are described in chapter 2 along with four other programs. The next section gives an introduction to energy efficiency institutions, which will be further analyzed in chapter 3.

1.5. Energy Efficiency Institutions

Energy Efficiency Programs (EEPs), such as informational, equipment replacement, and process-modification programs can help narrow the gap between the technical potential of energy efficiency and current efficiency levels by providing consumers with the appropriate technical, economic and financial information they need to make decisions on energy consumption that are in their own economic self-interest. These programs are described and analyzed in chapter 2.

Experience in several developing (Korea, Thailand, Pakistan) and developed (Japan, the UK, and Netherlands) countries has shown that using an independent, high-level energy efficiency institute as the institutional focal point
for energy efficiency is one way to address some of the information intermediation and policy barriers to efficiency. In chapter 3, EEIOs in Pakistan, Thailand, Indonesia and the United Kingdom are further described in order to extract important lessons that point towards a need for a participatory planning process to include the interests of the stakeholders in the design of EEPs and the setup of the EEIO.

The combination of the design of the EEPs and the setup of the EEIO was a major impediment to the effectiveness of EEPs. In 1987, the Beijir Institute advocated a comprehensive energy planning process that assembles available data on energy demand and supply, that collaborates with key actors, and incorporates current programs and projects to identify areas where present and future energy bottlenecks exists, as well as to identify opportunities to enhance development. This type of a participatory and integrative approach is currently being used by the Energy Sector Management Assistance Program (ESMAP) of the World Bank in its technical assistance projects to developing countries. This thesis will build upon this type of approach in chapter 4 to define the planning principles, stages and methods that can be used to fully develop an alternative planning process for designing energy efficiency programs and organizations.

### 1.6. National Energy Efficiency Strategy (NEES)

I propose the formulation of a National Energy Efficiency Strategy (NEES) that has a long-term objective to facilitate a 'learning by doing' process. This process avoids the 'hit-and-run' type programs typically undertaken by bi-lateral donor organizations such as the Canadian International Development Agency (CIDA), Swedish International Development Agency (SIDA), Overseas Development Agency (ODA), United Stated Agency for International

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10ESMAP is partially funded by the World Bank, most of it funds come from OECD countries. They do not provide loans to developing countries but provide technical assistance. For instance, in energy efficiency, they would assist in developing a NEES for increasing energy efficiency. Then, it is up to the host governments to follow up on their recommendations and undertake the programs. In this regard, it is not considered an international donor organization.
Development (USAID), etc. In addition, it allows for the creation of local solutions.

The contents of the proposed NEES and the implementation process are described to assist the reader in understanding the relevance of chapters 2 and 3 to the planning process that will eventually formulate the NEES. Going through the steps of implementing the NEES will also assist the reader to understand some of the functions of the EEIO that incorporates existing programs with new programs, and executes and manages EEPs.

A typical NEES contains provisions that cover the:

- goals and objectives of the NEES;
- priority listing of the scope of EEPs - sector and fuel type;
- type and mix of EEPs;
- EEIO set up and functions;
- mechanisms to monitor and evaluate EEPs and EEIO;
- funding mechanisms for EEPs and EEIO; and
- criteria for reformulating the NEES.

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Bi-lateral donor organizations plan, fund and undertake energy efficiency programs in developing countries.
Figure 1. Integrating Additional EEPs with Existing EEPs into the Scope of the NEES
Figure 1 is a schematic representation in which existing EEPs are evolved into the NEES. This is a dynamic process that occurs on two levels. On one level, the EEIO designs and implements programs which are evaluated by an independent body against the NEES priority areas, and its goals and objectives. This allows the EEIO to identify additional programs or modify existing programs that may be needed. On a broader level, the government will reformulate the NEES after a period of five years or so, to dynamically evolve the NEES according to changes that have occurred within the country (as described in the analysis stage in chapter 4).

The process in figure 1 can be described in the following manner:

1) the existing programs that target specific areas of energy usage are mapped against the priority areas identified during the analysis stage;

2) the NEES is defined, the overlap between the existing EEPs are eliminated and they are evolved into the NEES;

3) the EEIO coordinates the existing EEPs, and identifies new EEPs to address the rest of the priority areas;

4) the EEIO will evaluate the EEPs against the priority areas of the NEES. This evolving process redefines the scope of EEPs and/or creates additional EEPs. This process continues until some point in time when a reformulation of the NEES is required;

When a reformulation of the NEES is required, the process 1), 2), 3) and 4 are taken:

Process 4, 1, 2 and 3 forms a dynamic loop that continually redefines the NEES and identifies new EEPs in response to changes in the energy sector and national priorities. This is the major loop that would occur approximately once every five years or so. The minor loop occurs more frequently in process 4, 2 and 3 to evaluate existing EEPs with the priority areas identified in the NEES.

The NEES option selected depends very much on the context of the country. Chapters 2 and 3 offer six types of programs and four ways to setup the EEIO. Different combinations or variations of programs and institutional setup of the
EEIO can be used to set up the NEES. The alternative planning process described in chapter 4 shows how these options can be selected. In the next chapter, several generic types of programs are described and evaluated using previous experiences.
Chapter 2
Energy Efficiency Programs (EEPs)

This chapter describes several typical Energy Efficiency Programs (EEPs) that have been used around the world, particularly in North America and Western Europe. I compare and contrast the programs using specific criteria to highlight program characteristics that contribute to the implementability and long-term sustainability of energy-saving behavior. This information is incorporated into the guidelines for EEPs. Researchers have argued that 1) subsidized programs tend to be 'one-time' programs; 2) 'full cost recovery' programs had lower participation rates; 3) active informational programs and Energy Service Company (ESCo) type programs are appropriate for large energy users; and 4) informational programs to be the most important programs although it is difficult to evaluate their effectiveness and their costs cannot be recovered.

The first section of this chapter focuses on the different types of energy efficiency programs. Lessons learned from the programs are linked to the alternative planning process and the NEES. Then, these lessons are incorporated into the program design guidelines following a summary of the programs.

2.1. Types and Characteristics of EEPs

The current programs can be broadly classified as: 1) passive information programs that distribute informational booklets, organize seminars and workshops, etc.; 2) active information programs that undertake energy audits, and training programs; 3) programs that assist in developing and implementing regulation, standards and codes using available technology as benchmarks for a command and control type mechanism for imposing standards on equipment; 4) programs that stimulate the supply of energy efficient equipment through research and development grants; 5) programs that expand of the use of efficient equipment through grants and DSM Programs; and finally, 6) packaged programs that provide energy efficiency services through a contractual agreement with an energy service company (ESCo).
In general, Energy Efficiency Programs are used to increase the level of information and technical expertise, the availability of equipment, and financing mechanisms to improve the efficiency of energy use. Most of the programs described in this chapter are not able to do this independently. Many practitioners in this field advocate for an integrated program combining elements from each of the six programs since such a program could be carefully designed to overcome the barriers related to irrational behavior of economic agents that exist in the host country (Reddy, 1991 and Robinson, 1991). This kind of approach is commonly used in most countries as described in chapter 3. My interest in reviewing these programs goes beyond uncovering their merits and failings. I am more interested in showing how each program is related to stakeholder groups, and in turn how these programs try to overcome the previously identified barriers.

The descriptions of the programs are designed to uncover five characteristics: sectors targeted and actors involved; implementability; financing; monitoring; effectiveness; and the long-term sustainability of each program. It is difficult to isolate these specific characteristics since the synergy of an overall packaged EEP combined with the specific context within which it is implemented would override any one individual element. However, the analysis must be performed at this level in order to distinguish the importance of specific characteristics that contribute to the success of a program.

2.1.1. Passive Information Programs

In general, information programs are designed to overcome the lack of information and misinformation that are significant barriers in implementing energy efficiency measures. This type of program is designed to move end users along a chain of understanding: from unawareness, through awareness, on to comprehension and understanding, leading to a conviction to act. What information programs cannot do is to turn conviction to act into action (ETSU, 1993).

Information programs aim to encourage end-users to act in their own economic self-interest and use existing market mechanisms to stimulate the uptake of energy efficient technologies and techniques. To achieve this aim,
programs target end users with information that clearly states the economic benefits of taking up a technology or technique.

An organization will provide material to enable end users to both handle and process information. A central organization (for example, the Energy Conservation Center of Thailand (ECCT)) is used as a focus point of information collection, production and dissemination.

These programs are used to promote energy efficiency and to promote services of the Energy Efficiency Implementing Organization (EEIO), for instance, ECCT is now closely associated with increasing energy efficiency in Thailand. Passive programs can also be part of a larger program, such as a motor replacement or a co-generation program, by conveying information on the overall program and/or providing specific technical information. This type of program tends to be a part of a larger program like the five programs that will be discussed later.

In general, passive information programs target the domestic and commercial sectors with information on specific measures, for e.g.: improved lighting, refrigeration, space heating, building design, and building energy management techniques that have short payback time frames (under two or three years).

Information dissemination can take the form of: a) information programs using the mass media1 such as advertisements, commercials, booklets, and leaflets; b) audio tapes, videos, and software; c) training programs2 for managers, technical staff and operators of technical equipment; d) seminars, and conferences; e) advice centers and hot-line telephone services; and the e) educational system. At the tertiary education level, classes in engineering departments can be used to train engineers and technicians to identify, locate

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1 In Pakistan and Thailand, the mass media were successful in informing energy consumers of the types of ongoing programs; the support available and the successes of these programs in achieving energy savings for its clients. The credibility of these organizations was also recognized throughout the country resulting in increasing numbers of requests for surveys.

2 Training programs were well received. Training in many cases created "energy champions" who played an important role in communicating with management on the potential savings in energy that were often regarded as a fixed overhead cost.
and install energy efficiency measures. Robinson (1991) stipulates that it is important for information to be vivid, personalized, concrete, and targeted to specific end users and energy end-use. There is evidence that casting the efficiency message in terms of avoided losses is likely to be more effective than describing it in terms of expected savings. With respect to program delivery, it has been found that word of mouth, informal contacts and local media are more important vehicles of information dissemination than are more traditional means such as pamphlets, fliers and network TV or ratio advertising. It is also clear that the credibility and degree of public trust in the program and delivery agents are critical.

Information programs are important because they represent the first mode of outreach communication. They usually form the basic level of any program. They are intended to operate over the long term because: new information is constantly becoming available; energy users need ongoing stimulus to maintain savings (Katzev, 1987, Baum, 1982) and expansion to new areas; and it is common for companies to lose their energy managers making it necessary to update new managers to maintain the momentum. For example, the National Energy Conservation Center's (ENERCON's) work in Pakistan in the late 1980's and early 1990's convinced its clients to take actions and to build up the enthusiasm for energy efficiency. But after only a few months of inaction during its period of uncertain status (1992-1993), all the goodwill and enthusiasm evaporated (ETSU, 1993).

The implementability of these programs is relatively straightforward but it is impossible to accurately assess the effectiveness of the programs based on energy savings achieved. Instead, the assessment is limited to participation levels. Therefore, the government usually takes the lead in financing and maintaining these programs because they are important and not cost effective (only in some cases, can full or partial fees be charged for literature, and attendance at seminars and workshops). In the United Kingdom (UK), the effect of public campaigns aimed at domestic households were successful with regard to heightening awareness, but many householders still remained reluctant to

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3 In the United Kingdom, Energy Technology Support Unit (ETSU) has developed a module on energy efficiency that is now a part of technical programs in many universities in the United Kingdom (UK). In the UK and Thailand, ETSU and ECCT use engineering students to work on energy audits.
implement measures (ETSU, 1993). This raises the importance of complementing or tailoring informational programs with targeted programs such as the following five types of programs.

2.1.2. Active Information Programs

Active information programs such as energy audits and training programs, go one step further than passive informational programs to personally communicate with interested energy users. An energy audit examines the use of energy to identify potential areas for savings, either through equipment/process replacement or retrofit. The EEIO typically uses process or equipment specific information from previous experiences with other clients to convince a client to undertake the efficiency measures.

Individuals who attend training programs that are tailored for energy managers, head operations engineers or management are usually genuinely interested in obtaining skills to increase energy efficiency. These programs better equip them to make recommendations to their facility on specific energy efficiency measures.

Energy audits are targeted towards medium- and high-energy users such as large commercial buildings and the industrial sector. They are usually subsidized by the government as in Pakistan, Thailand and India. Only in rare cases are facilities required to pay for audits. Unfortunately, support for these audits do not necessarily lead to energy savings actions being taken. In the UK, audits carried out in the 1980s identified cost effective savings opportunities averaging over 10% in the surveyed sites. The rate of implementation of these measures is less clear, primarily because of the lack capital and manpower.

When subsidies were gradually eliminated in Pakistan, there was a noticeable decline in requests for audits (UNDP, 1993). However, in a recent audit scheme in the UK, a grant was phased in to subsidize the general audit, specific project design and project management of the implementation to increase the rates of implementation of the recommended measures.

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4These subsidies are usually financed by grants from international donor organizations.

5Audit schemes is another way to refer to energy audits.
Unfortunately, it is too early to judge the effectiveness of this scheme (ETSU, 1993).

In the UK, the government has established a unique performance based contractual relationship with the Energy Technology Support Unit (ETSU). ETSU’s Best Practice Program promotes information on proven technologies and techniques by combining energy audits with targeted information and technical assistance to specific energy efficiency measures. The contract stipulates that the ratio of long-term annual energy savings generated to one-time government expenditure will be in excess of 20:1 for each project. This arrangement has been successful and the contract has been maintained since 1989 (ETSU, 1993).

The UK government monitors and evaluates the results of energy savings to determine the cost-effectiveness of ETSU’s Best Practice Program. In most cases, facilities that invest in energy efficiency measures conduct internal monitoring to justify the cost of their expenditure. In Thailand, legislation requires large energy users to carry out energy audits, and document and monitor energy savings. However, in Pakistan, monitoring was not an integral part of ENERCON’s programs, which makes it difficult for the government and for the facilities to assess the performance of implemented measures.

Many facilities in developing countries such as India (Limaye, 1992) and Zimbabwe (D’Souza, 1993) are concerned about disclosing confidential information regarding energy usage, since these facts reveal their comparative advantage over other firms, production rate and technology. This raises the issue of the type of organization that should undertake energy audits. Another related issue is the expertise of the institution that undertakes these audits. In Thailand, where audits are mandatory, a number of under-rated consulting firms are entering the business. Less than successful audits give wrong signals to energy users that can jeopardize the intentions of these audits and the overall concept of energy efficiency.

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6 This contractual arrangement is described in chapter 3.
7 The government will only subsidize the facility for the time and effort spent on retrieving data and assisting ETSU during the facility survey. All costs related to expenditures on energy efficiency measures are fully borne by the facility.
8 Only for large energy users.
The long-term sustainability and implementability of energy audits depend on the availability of grants (where energy audits are subsidized). Evidence has shown that integrating energy audits with training programs, specific technical information, availability of viable financing packages and equipment increases the implementability of the recommended measures.

2.1.3. Legislation, Regulation and Codes

Legislation can have the full authority of the civil and criminal systems. It usually sets out the framework for a particular policy objective, for example, requiring mandatory efficiency standards. The law itself does not usually specify technical or organizational details for the regulation, but will ensure that a regulation is put in place.

A regulation is defined as "a requirement to achieve certain standards for a product or service". Inspections will normally be required and reported non-compliance must be rectified. The content of regulations will generally have been agreed in advance through consultation with the parties whose actions are to be regulated.

A code is a set of working practices to which a number of parties have agreed to conform. This code serves as a benchmark on proven technology for a variety of end-use products. The suppliers are required to meet the codes so that all new products, excluding industrial processes, will be energy efficient. The government enacts legislation, regulation and codes. The implementing organization can act as a consultative body to the government to recommend appropriate legislation. Once the legislation is enacted, a demand will be created for the EEIO's services. The organization is then entrusted with the responsibility of coordinating programs to ensure the transition to increased efficiency.

If appropriately set and enforced, standards and regulations can ensure a continual improvement of efficiency over the long-term. However, the process of gaining agreement on minimum standard levels can be a long, drawn-out process. Even when accepted, enforcement them can be difficult as a result of resistance not only from the manufacturers, but also from the customers who are fearful of increased prices. Therefore, these requirements are generally limited to
transportation, domestic appliances and buildings, because these areas have well-defined operational procedures that can be easily monitored.

Agreement to and policing of standards can also be difficult, especially where international trade is concerned. In a country like Zimbabwe, where an open market economy is being pursued, enforcing standards and regulations will impose heavy burdens on the domestic manufacturing industry.

It is difficult to determine the cost effectiveness of this program because it is a long process that requires data compilation, consensus-seeking, technology transfer, and redesigning products to meet specifications. However, it is a long-term effort that is sustainable if strictly enforced.

Thailand is currently drafting legislation requiring the sale of efficient fluorescent lamps and motors. The list of products is expected to increase in the future, and equipment suppliers are currently studying the possibility of engaging in joint ventures with foreign companies and/or redesigning their specifications to meet these requirements (Chantanakome, 1993).

2.1.4. Availability of Efficient Equipment

Increasing the availability of efficient equipment is done through direct financial support to the equipment supply industry to reduce the financial risk of undertaking research. Many governments support research and development by using financial measures such as grants, low-interest loans and tax reductions since most financial institutions are not interested in financing unproven technologies. Alternately, equipment supply can also be increased by reducing import barriers such as equipment bans and quotas.

Programs can be financed by the government, electric utilities or through levies on gas and electric bills. Research and development organizations and equipment suppliers use these grants to develop efficient equipment in all sectors. The danger with a grant program is that it provides an incentive to the industrial sector instead of relying on the market. In doing so, it distorts the market.

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9This also refers to the development of energy efficient technology that is usually incorporated in equipment. However, in many cases, technology is used to modify or replace existing industrial processes.
The government of the UK directly supported the development of monitoring equipment through alternative capital financing techniques for a small-scale Combined Heat and Power program. These developments solved previous technical problems and has resulted in a thriving competitive market (ETSU, 1993). In this example, the UK government assisted the development of the program and then allowed the market to determine its potential.

At best, the ratio of annual energy cost savings to government cost has been 1:1 (ETSU, 1993). The effectiveness of these programs depends very much on the size of the grants, the demand for the goods, and the willingness of companies to undertake the venture. There is also no guarantee of technical and commercial success. Although the grants stimulate the programs, they are only sustainable when there is a high potential for the demand for these products. This can only occur when the customers know about products, value their energy saving features, and are willing to pay for them. When this occurs, support for research and product development will enable energy savings in the longer term.

In the case of removing import barriers, demand will increase only when the cost of the equipment is competitive with local equipment, provided the equipment is suitable for domestic consumption.

2.1.5. Equipment Substitution

Equipment substitution can be accelerated through grants and a utility-based Demand-Side Management (DSM) program that reduces the risk of an investment while increasing the financial attractiveness of the equipment. In addition, reducing import tariffs on foreign energy efficient equipment can also stimulate demand. Many governments use similar financial measures (as described in the previous section) to encourage the use of energy efficient equipment. Most utilities are able to undertake DSM programs since they can obtain financing at a lower interest rates. Programs aimed at the residential sector clearly indicate that financial support has promoted the uptake of energy-efficient technology and accelerated the process of innovation.

The term utility-based DSM (see description in chapter 1) connotes the activities undertaken by the utility to affect demand. DSM strives to increase the utilization of plant capacity by managing the peak load. It does this by reducing
or slowing the growth of the peak load on the system, and thereby deferring the need for additional capacity to meet peak load. Utilities can use aggressive electricity pricing mechanisms (time of day, maximum demand and power factor) to discourage electricity usage at times of system peak or they can undertake DSM programs.

DSM programs work directly with energy consumers and energy-using manufacturers to adopt processes, and adopt or produce equipment that will result in more efficient consumption. DSM programs are undertaken because they cost less than a new generating plant or increasing electricity purchases. The costs of this type of DSM program, and their consequent reduced sales and profits for the utility, are usually recovered through specially modified regulatory regimes, and/or through a very small increase in unit electricity costs. The cost of the equipment is offset by energy savings, resulting in a net decrease or stable monthly bills until the full amount of the equipment is recovered by the utility. Since the utility has a lower discount rate than most energy users, the cost is recovered in a shorter period of time. In addition, the utility provides all the services such as purchasing, installing the measures, and recording the energy savings and payments for the measures.

DSM programs are complicated and sophisticated programs that try to influence their customers to use efficient equipment by offering incentives through attractive financing methods. In order to undertake such a program, a utility needs to have a good familiarity with the market, to be able to evaluate the supply and demand of goods, and predict how much energy savings it will obtain for inclusion into future plans for energy supply. The utility's permanence, cash flow, low cost of capital, credibility, market knowledge of application areas, close ties with customers, and application-specific technical knowledge are all important factors that must be considered prior to launching a DSM program. However, combining DSM technologies into economically attractive program packages has proven to be a difficult task, and it is an ongoing process that is still developing. Many of the issues faced by DSM programs are also experienced by other equipment substitution programs.

Most programs offer financial rebates to end-users to invest in high efficiency thus creating a market pull; some programs also, or alternatively, pay manufacturers or retailers to create a market push. However, only those
participating in the programs see an overall reduction in their total electricity bill.

Usually, participation is a long way below expectations because it is difficult to anticipate customers' behavior. Customers shun efficiency even when it is accompanied by attractive economic incentives for a variety of behavioral reasons. Industry and commerce are concerned about product quality, production reliability, and financial and technical risk. Meanwhile, increasing participation levels thorough increasing the rebate or subsidy can worsen the cost-effectiveness of the program.

Realized saving rates of 50-60% below original projection are not uncommon. This implies broad engineering estimates of savings should be treated with caution, and more focus should be placed on interacting with customers. In a DSM program, the cost per kWh saved by a program is often higher than original predictions because savings do not meet expectations. The true cost of programs are often underestimated because neither the administration costs nor the difference in accounting for "free riders" 1 is taken into account.

Grants are able to target a specific group, i.e., low income groups. However, in most cases, grants and rebates are used by users who need to replace their equipment anyway (free riders); they do not target the people whose behavior need to be changed. The cost effectiveness of these types of programs is low because the rate of implementation is unclear. If the costs cannot be easily predicted and there is no guarantee of action, it becomes difficult to justify maintaining a grant program. In the United States, regulations require utilities to pursue DSM programs because it is the least-cost option to supplying energy.

Reducing import tariffs increases the financial burdens of many governments who depend on the tariffs for revenue, for example, the government of Pakistan receives 50% of its revenue from import tariffs (Phillips, 1990). In addition, tariff reduction or elimination forces domestic manufacturing industries to compete with foreign goods that are of higher quality.


11 "Free riders" are customers who would have invested in an efficient technology without the program but choose to participate in order to receive the subsidy (they are often a significant proportion of the program participation) (Joskow, 1992).
Grant-induced demand stimulates action that is not always in the users' commercial interest. It also does not always guarantee optimum use. For example, light bulbs in residential homes are replaced when replacements in commercial establishments yield greater savings due to optimum usage. The coverage is also limited to a number of appliances. In the case of DSM, it is limited to electrical products.

If successful, equipment substitution programs have the potential to increase energy efficiency in the long-term, but their coverage is patchy and they are also expensive ventures.

2.1.6. CEM/ESCos Type Program

A Contract Energy Management (CEM), or an Energy Service Company's (ESCo) program is a packaged service that attempts to tackle three barriers to increase the uptake of energy efficiency measures by: 1) bringing additional staff resources and knowledge to energy efficiency measures; 2) bringing additional capital resources to a project; and 3) lowering the risk to the host of any investment by taking over the responsibility for the operation and managing of all or part of the host’s energy services.

The contract is made between the ESCo and client. The basis of the CEM contract is usually a shared-savings energy performance contract, although variations of this contract and a fixed fee contract are possible alternatives. The CEM companies' costs are recovered from the energy cost savings over a contract period of typically five to seven years.

There are variations to the shared-saving arrangements such as the joint-venture arrangement, energy service agreement, variable payment loan and the limited-term, guaranteed-payback loans program. In each arrangement, there are variation in the risk, role of the ESCo, term of the contract (set or based on monthly energy savings), the value of the savings (fixed or variable, based on monthly operations) and the up-front costs. Generally, the ESCo receives a share of the value of energy savings and also the tax-related benefits associated with ownership of the investment. In return, the energy user obtains the potential economic benefits through the installation of capital improvements for which the user has no financial obligation or liability. The energy user is not required to
make any up-front cash outlays, or the downstream payments to the shared-
savings external investor. Potential savings are contingent upon the technical
and economic performance of the conservation improvement and the risks of
these performances are shared by the ESCo and client (Fisher, 1985).

The most significant barrier to an ESCo type program is that it is a new
concept with limited experience in developing countries. Another significant
barrier is the reluctance of certain industrial firms to allow monitoring and
metering of their facilities. For example, in India, many industries maintain a
number of accounting systems for tax purposes. Documenting their energy
usage would reveal their actual production rates and subject them to additional
taxes. There is also the issue of theft and misuse of actual energy usage and
tariff-class related issues which energy audits will uncover. Finally, an ESCos
type arrangement is possible only if the ESCo is able to obtain large amounts of
funds at competitive rates. In most developing countries, this is impossible. A
multinational ESCo would be in a better position to obtain funds from abroad to
finance projects in developing countries. However, in some developing countries
such as India, there are restrictions on the amount of foreign capital that can be
brought into the country.

These financing arrangements require institutions that are willing to assume
certain risks associated with innovative financing arrangements in return for
higher returns. Governments can assist by forming a publicly-chartered finance
corporation through start-up capital from public funds. After the start-up period,
the corporation would be able to gain access to private capital and perhaps
become completely independent of government support. Another government
role would be to sponsor demonstrations of the financing arrangement. Such
demonstrations can be conducted jointly by a public agency and a private
organization (e.g. a commercial bank, investment bank, or utility firm).

ESCos' services are only relevant to large energy users such as the industrial,
commercial and public sectors. They have been successful in the US and Western
Europe in: 1) achieving rapid market penetration and mobilization in the field;
2) development of financial, legal and contract technology for shared savings or
other financing of energy-efficiency measures; 3) achieving successful
technology integration for a number of energy-efficiency products and services;
4) effective project management and quality control; 5) ability to target long
payback measures that are typically neglected; and 6) success in maintaining energy savings over time. The ESCo program is still in its infancy but, it has much potential to develop in the future (Limaye, 1993).

The ESCo-type program is limited to its clients. They do not disseminate information, design training programs or make equipment available for the general energy user. The contracts are stipulated for a period of time, and there is no assurance of long-term savings. In addition, these contracts require the facility to maintain the technology and fuel type for the period of the contract. However, in most developing countries, rapid technological development and fluctuating energy prices have prevented facilities from committing to a seven year contract. On the other hand, if these programs are successful in making a positive financial impact, there is the potential that their services can be expanded to other areas within the facility. Moreover, it is found that word of mouth, and informal contacts are important vehicles for information dissemination (Robinson, 1991). Indirectly, the success stories of these programs can raise awareness and lead to energy saving activities at other facilities.

2.2. Summary

In most countries the government has taken an active role in implementing and financing energy efficiency programs. Private companies are reluctant to enter this field since the returns are not certain, and the barriers are complex—market failures and little understanding of the behavioral-related issues. As shown in the each of the six programs, government assistance plays an integral role in starting these programs. In time, with appropriate control and planning, most of these programs can have the potential to operate on a 'full cost recovery' basis.

Each of the six types of program described originates from a separate direction moving towards the same goal. Depending on the context, one program can be more successful than the other, usually an integrated program that consists of a mix of the six types of programs is undertaken. Unfortunately, most programs are designed and implemented without understanding inherent barriers and the importance of collaborating with stakeholders. In most instances, there were also no long-term plans to monitor and evaluate the energy savings of these programs to understand the issues that affect their long-term
sustainability in developing countries. In addition, innovative financing mechanisms that involve local financial institutions were not explored when existing grants ran out, training programs were not aggressively pursued to raise local technical expertise, and finally, local production of energy efficient equipment was not considered (except in Thailand). This becomes an issue when donor funding diminishes and it is apparent that the adoption of energy efficiency measures is relatively low compared to the high costs of implementing EEPs.

Energy users are also not completely assured that these programs would continue and preferred to treat them as the exception rather than the norm while energy suppliers are not willing to incur additional costs and risks to produce efficient equipment.

In the alternative planning process, the stakeholders' participation enables the NEES to identify the types of programs that are most appropriate for the country. The stakeholders are in a better position to advocate for the correct mix of programs because they are directly involved in the programs. In the next section, guidelines for EEPs incorporate this summary to described attributes of an EEP into two parts: market oriented and self-contained.

2.3. Attributes of an EEP

An EEP is a comprehensive program that can be based on a type of program or on a mixture of programs. A market oriented program makes commercial sense to a customer while a self-contained EEP reassures the client that there is adequate information, efficient equipment and spare parts, technical expertise and available financing mechanisms to maintain efficiency measures in the long-term. Input from stakeholders in program design is especially important in designing these programs since they will be not only be implementing the programs but they will also be providing the assistance that ensures their implementability.

2.3.1. Market-Oriented

A market-oriented programs ensures that energy efficiency measures are implemented by energy users because it makes commercial sense to them. For
the EEIO, it ensures that these programs are cost-effective, therefore, they can be maintained in the long-run. In order to avoid 'one-time' programs, potential EEPs must be closely studied from a business point-of-view, i.e., market acceptance and penetration, investment and cost, cash flow, and profitability taking into account the financial, technical and institutional barriers. The preparation of such a business plan would require strategic planning, market research and surveys, and accurate financial analysis of the costs and revenues of each program. Although it is impossible to recover the cost of a passive informational program, funds can be appropriated from a general fund for informational programs while targeted programs can be financed via a revolving fund.

Subsidized programs by themselves have a tendency to end up as one-time programs with no continuity while full cost recovery programs have a lower rate of implementation. Subsidized programs implemented in Pakistan and Thailand generally do not have financing packages or an adequate supply of equipment and spare parts. In some cases, participants of the programs are not genuinely interested in increasing efficiency and are attracted to the grants, in other cases, the participants are 'free-riders' who would in any case replace their equipment. It is not uncommon for EEIOs to calculate the net present value of the costs against the savings as proof of the potential savings of the energy savings measures. Unfortunately, the absence of a financing package causes full-cost recovery programs to be a deterrent to customers since the up-front costs of the measures are usually too high to warrant an uncertain outcome (especially when the payback of the savings are over three years).

Evidence from case studies in Pakistan and the UK, show a greater implementation rate of identified projects when the client requests for the services and were willing to pay for the survey. This also shows the importance of effective information dissemination, training programs and seminars. Nevertheless, the major obstacle to energy efficiency is the lack of viable financing mechanisms. Packaging the program with a financing mechanism and incentives to spread the high up-front cost over a longer period of time such as the shared-savings mechanisms can be used. Alternately, the government can provide loans at a competitive rate.
A monitoring program can evaluate the cost effectiveness of an EEP to the EEIO and customer, justifying further expenditure on raising energy efficiency if deemed appropriate. Simultaneously, feedback from a monitoring program can be evaluated and incorporated into future program design and implementation.

2.3.2. Self-Contained

From a client's point of view, a self-contained program refers to an environment where an industrial, commercial or household consumer is assured that he/she can locate technical assistance to perform an energy audit, to install equipment and to provide maintenance and service in the event of a breakdown. This assurance can translate interest into action and maintain energy efficient practices. The client must be able to purchase equipment and spare parts with minimal effort and be able to obtain credible external information, for example, a DSM program. The general objective of an EEIO is to create the above mentioned environment that facilitates the uptake of energy efficiency measures and an EEIO can do so incrementally through specific programs.

In the next chapter, a study of several EEIOs in developing countries will show how these agencies are setup to undertake these programs. It will also reveal the influence of their setup to their ability to undertake a market oriented and self-contained program.
Chapter 3
Energy Efficiency Implementing Organizations (EEIO)

This chapter reviews the Energy Efficiency Implementing Organizations (EEIOs) in Pakistan, Indonesia, Thailand and in one industrialized country, the United Kingdom (UK). The Energy Technical Support Unit (ETSU) in UK is included because it is important to show how a government agency can operate effectively to increase efficiency. This review is useful for understanding the intentions of governments and the translation of these intentions into action, many of which were not intended. The purpose of this review is to understand 1) the institutional setup of the organizations and how it facilitated the EEIO in reaching its objectives; 2) what types of programs were implemented, and 3) how successful the EEIOs were in implementing Energy Efficiency Programs (EPPs). The lessons learned from this review show how important it is to collaborate with the stakeholders and to cater directly to the needs of the consumers. More importantly, these reviews show that some of these organizations failed to collaborate with stakeholders, and how as a result, some of their programs could not be maintained. These reviews incorporate stakeholders in creating guidelines for the institutional setup, functions and funding for an organization.

This chapter begins by reviewing the EEIOs that are categorized into two areas—public and private (parastatal) sector. It is important to recognize that the governments in developing and industrialized countries are very different. In the UK, the government is committed to privatization and the use of the market economy, while in most developing countries, the governments tend to assume many roles that are managed by the private sector in industrialized countries. Finally, lessons learned from these reviews are used to articulate the attributes of the EEIO's institutional structure.

1 The institutional setup of these organizations are evaluated on the performance of their programs although in some instances the programs were meant to be demonstration programs.
3.1. EEIO Models

The EEIOs are categorized into four separate models that can be referred to as public or private sector organizations. The Energy Conservation Center of Thailand (ECCT) and the National Energy Conservation Center (ENERCON) are categorized as civil service based organizations although they were set up as autonomous governmental agencies. In contrast, the Energy Technology Support Unit (ETSU) is referred to as a governmental agency although it operates more like a private consulting company. P. T. Konservasi Abadi (KONEBA) in Indonesia began as a private corporation reporting to stockholders and relying on borrowed funds from the World Bank. In 1992, the government of Indonesia issued a decree to reform KONEBA into a parastatal company. In some countries such as India and Thailand, there are more than one organization involved in improving energy efficiency. However, in this review only one organization's activities are addressed.

3.1.1. Civil Service Based

Pakistan: The National Energy Conservation Center (ENERCON)

In the mid 1980s, the United States Association for International Development (USAID), aware of the potential for energy savings in Pakistan, provided US $10 million towards setting up an energy efficiency implementing organization.² The Government of Pakistan (GOP) gave financial and legislative support through an Executive Resolution in 1986 to create the Pakistan Energy Conservation Committee (PECC) and ENERCON as its operating agent. Organizationally, it is located in the Ministry of Planning and Development (MPD) and it reports to the PECC that is headed by the Minister of MPD (Phillips, 1990).

The resolution established the PECC as an inter-ministerial body with oversight and direct management responsibility for ENERCON, although the Executive Resolution which created it envisaged it as an "autonomous organization" under the PECC. After five years, it was envisioned that ENERCON would evolve to become a private organization. The PECC was empowered to develop legislation and national plans; implement demonstration

²This amount constituted 95% of ENERCON's budget (Phillips, 1990).
programs and enforce regulations for energy conservation; and impose sanctions and levy fines against violators of the regulations issued. The PECC's membership was composed of the secretaries from 11 ministries and provincial governments. Despite its responsibility for both public and private sector energy conservation activities, the PECC did not have any private sector representatives. The PECC had the power to raise and invest funds, hire and dismiss all officers and consultants (except the Managing Director who is appointed by the GOP), and to oversee ENERCON in the discharge of its functions.

ENERCON was to prepare a comprehensive national energy conservation plan; undertake training, demonstration and information dissemination programs; recommend energy efficiency standards, establish standard laboratories, draft legislation; and procure funds to support its activities in addition to undertaking duties assigned by the PECC. Unfortunately, ENERCON is governed by civil service procedures, its management and control system (including accounting and finance, contract administration, procurement, personnel administration and administrative services) were conducted by the GOP's Auditor General. According to ETSU (1993), this made decision making slow, leading to a loss of credibility with its clients, especially the industrial sector. In addition, its large range of activities, from national plan preparation and standards enforcement to EEP implementation, created some distrust among those outside government regarding ENERCON's exact role (ETSU, 1993).

Since the budget came from USAID, foreign consultants (RCG/Haigler, Bailly, Inc.) were hired to undertake the bulk of professional work instead of allowing local consultants to develop their expertise through job experience and training programs. There was also no mechanism to differentiate between operations and projects expenses. It was not only impossible to determine the exact amount spent on each program but funds were often misappropriated, allocated for unrelated seminars, training programs and scholarship funds for the MPD. In addition, there were no efforts made to explore long-term funding for ENERCON and its programs (ETSU, 1993, UNDP, 1993).

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3The private sector in Pakistan is aware of the government's procedure laden operations and its instability as a result of past and recent political upheavals. If possible, they would prefer to keep limit their dealing with the government.
The staff operating within ENERCON contained a mixture of career civil servants energy professionals and contracted foreign consultants from the US.\textsuperscript{4} Between 1986 and 1992, in conjunction with US consulting companies, ENERCON undertook a wide range of activities, many of which were highly successful. This success is attributed to its high participation rates as a result of the subsidies and grants that were made available for training programs and energy surveys.\textsuperscript{5} Activities undertaken with the industry and power sector program included energy surveys, boiler/furnace tune-ups, steam system surveys, electrical systems surveys, technical advisory service, training programs education courses, and the development of several conservation manuals and newsletters.

A decision to terminate the USAID project by the end of June 1992 as a result of US foreign policy\textsuperscript{6} raised several problems concerning ENERCON's status: the technical expertise of its staff, the future of its programs, and funding. Once the expatriate staff departed from ENERCON, it quickly became apparent that sufficient indigenous administrative skills and procedures were not available. Many of the personnel within ENERCON appeared not to be capable of operating effectively in its risky, action oriented environment because they were used to a traditional civil service type jobs (ETSU, 1993).

The majority of its programs were information type programs and generic energy conservation measures such as combustion system improvements, steam system retrofits, and electric system improvements. Since there was no follow-up, monitoring or evaluation of these measures, it was impossible to gauge the effectiveness of those programs (Phillips, 1990).

Between 1992 and 1993, the level of ENERCON's service deteriorated markedly as a result of the unresolved status of ENERCON. This in turn brought a standstill to all its programs. Previous clients reverted to their old practices since they were not able to rely on ENERCON for information, spare parts or

\textsuperscript{4}Until July 31, 1990, the ENERCON staff consisted of 11 local professionals hired by ENERCON plus 29 foreign professionals hired by Haigler-Bailly, Inc., the ENERCON consultant hired by USAID. Most of the 29 professionals left ENERCON with the expiration of USAID's contract (Phillips, 1990).

\textsuperscript{5}Energy surveys is another way to refer to energy audits.

\textsuperscript{6}USAID works according to US foreign policy. In 1992, the US decided to terminate its activities in Pakistan.
technical advice. Although ENERCON's informational and training programs raised awareness, convincing energy users to implement energy efficiency programs was still difficult. The financing mechanisms were innovative but they required ENERCON to act as a financing agency. ENERCON would pay one-third the cost of a combustion analyzer or a capacitor, while the recipient paid one-third up front, keeping it for 12 months. At the end of the 12 month period, the recipient either paid the remaining one-third or returned the equipment for a refund (Phillips, 1990). In addition, ENERCON also acted as an equipment supplier instead of encouraging the local equipment supply industry to produce energy efficient equipment. Finally, ENERCON provided the bulk of the technical expertise instead of developing and or using local consulting services to undertake the bulk of the technical. This would have allowed ENERCON consultants to concentrate on program management and policy related work.

Although the GOP was unsure of the effectiveness of ENERCON's activities, the Chairman of the Planning Commission recognized its potential and took the initiative to remove ENERCON from the MPD and position it within the Ministry of Water and Power (MWP). The rationale being that the MWP's involvement in implementation and its considerable field experience put them in a better position to understand ENERCON's operation than the MPD, which emphasizes energy planning and data collection, not service to consumers (Armar, 1993).7

The GOP did not fully understand how ENERCON was going to increase energy efficiency. The PECC was created to command and control ENERCON's activities although ENERCON was neither set up nor equipped to undertake its activities because it was not designed to develop policy, a national plan nor to undertake technical, management and financial aspects of a program. USAID took the liberty of managing ENERCON's activities as it saw fit from its perspective: foreign consultants were hired, PECC and ENERCON was set up accordingly, and ENERCON was required to purchase equipment from the US, a situation that is commonly referred to as "tied-aid". Bad hiring and spending practices and poor management methods that limited stakeholder participation

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7 At this point in time (January 1994), the exact funding and reporting lines of ENERCON are still unclear.
can be attributed to ENERCON's inability to successfully develop local solutions to increase the uptake of energy efficiency measures.

Thailand: Energy Conservation Center of Thailand (ECCT)

In 1985, the Federation of Thai Industries (FTI) received US $1.6 million8 from the United Nations Development Program (UNDP)9. Simultaneously, the Royal Thai Government (RTG) was seriously considering creating an implementing organization. The FTI and RTG decided to use the money to set up the Energy Conservation Center of Thailand (ECCT). In 1987, the Energy Management Law (EML) was passed and ECCT was established as the national energy conservation organization for implementing energy efficiency programs in the public and private sectors. The center, similar to ENERCON, was set up to be an autonomous organization in order to gain increased public visibility, to be unencumbered with governmental procedures and to be able to exercise independent judgment in the area of energy efficiency (RCG/Haigler, Bailly, 1988).10 It was to operate in a consulting mode, charging fees to recover the costs of its services. It was envisioned that ECCT would utilize its funding for 5 years, at which point it would be financially self-reliant (Chantanakome, 1993a). The center's goal was to save at least 10% of annual national energy consumption amounting in value of about US $200 million in oil equivalent (Vedavalli, 1994).

The EML specified that the ECCT was to operate under the policy guidance of the Board of Directors (BOD), that consisted of 5 representatives from the government agencies and 4 representatives from the private sectors concerned, although the ECCT was to be "run totally by the private sector." The board was given the authority to formulate or specify administrative responsibilities of the center (RCG/Haigler, Bailly, 1988). Its major role was to approve all ECCT's missions and activities, though in reality, the board did not have much power, it referred to the National Energy Planning Office (NEPO) and the National Energy Planning Commission (NEPC) for approval. It was the Department of Energy Development and Promotion (DEDP) that implemented NEPO and

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8 Conversion of funds based on exchange rate of US $1=25 Baht.
9 This constitutes close to 100% of ECCT's funding (Phillips, 1990).
10 This setup was based on previous experience, when the Department of Energy Development and Promotion (DEDP) failed to successfully implement EEPs due to the rigidity of the government's bureaucracy.
NEPC’s policies by using ECCT as its implementing agency (Chantanakome, 1993d).

The ECCT was actually a subcomponent of DEDP. Neither ECCT nor DEDP formulates the national energy conservation plan for Thailand. NEPO formulated the plan, but it was the responsibility of DEDP to implement it, and it does so via ECCT. Therefore, it was DEDP and not the board that assumed responsibilities for ECCT’s programmatic and organizational decisions.

When the board was faced with operations issues, bureaucratic procedures were assumed. When policy-laden operating issues arose, the public-sector representatives on the BOD and the day-to-day controlling officials in the Ministry of Finance reverted to the familiar procedures and applied the regulations developed for state-owned enterprises (Richey, 1993). ECCT became a part of the complicated, procedure laden, and time consuming political process of the government. Over time, the flexibility intended by the designers of ECCT gradually eroded causing operational difficulties for ECCT’s staff and frustration among private sector board members. Consequently, many of the center’s professionals left the center for more lucrative salaries and benefits in the private sector (Chantanakome, 1993c).

Since its first operation in 1988, ECCT focused on the development and implementation of awareness campaigns, energy audits (100 per year), seminars and training programs, and engineering services. In particular, ECCT offered comprehensive engineering consulting service in advisory, engineering design, equipment supply, installation and start-up, and maintenance. Recently, ECCT performed a technical and financial analysis of the feasibility of installing cogeneration technology in five different industries with technical assistance from SwedPower, a private Swedish firm. This venture is a solid example of an integrated technology transfer project that exemplifies the level of expertise within ECCT (Richey, 1993).

The government was still committed to increasing efficiency. It passed the Energy Conservation Promotion Act of 1992 (ECPA) that required large energy users to perform periodic energy audits, implement energy efficiency measures, and monitor energy savings. Energy managers were also required to obtain

\[11\] This effort was funded by the Swedish International Development Agency (SIDA).
certification through training programs provided by ECCT. It is now in the process of preparing legislation requiring the sale of only efficient fluorescent lamps and motors, and hopes to expand this list to include other end-use products (Chantanakome, 1993).

DEDP and NEPO constrain ECCT's ability to expand to other areas by confining its focus to energy audits even though the rate of implementation of audit recommendations is low. In addition, ECCT's charges are only 20-30% of market rate despite the fact that it provides the most comprehensive energy audits in the country. ECCT would like to do much more than training programs and energy audits which the private sector consulting firms are more than capable of handling. Instead, it would like to use its trained staff and accumulated experience to implement proven technologies and engineering designs to target larger areas for energy savings such as co-generation, where the potential savings for energy is enormous, not to mention the potential revenues for ECCT (Richey, 1993).

Similar to ENERCON, ECCT was fortunate in that the Secretary of the Mining and Industrial Ministry, who was also a member of the board took the initiative to add a clause within the ECPA to allow a new organization, known as the Thailand Energy Efficiency Institute (TEEI) to be established as a foundation under the foundation act of Thailand. As of October, 1993, TEEI is in the process of adopting this clause and is securing foundation money from the Thai Oil Refinery (Armar, 1993).

Unlike ENERCON, ECCT has the capability to increase energy efficiency because the Executive Director has the training and background to understand what needs to be done in Thailand. He also knows that ECCT is constrained by DEDP, yet he still tries to involve ECCT in areas in which greater energy savings can be realized. It is anticipated that TEEI will be in an excellent position to systematically design, implement and maintain programs that yield even greater energy savings for Thailand.
3.1.2. Government Agency

*United Kingdom: Energy Technology Support Unit (ETSU)*

The Department of Energy was set up in 1974, following the first oil shock. Subsequently, the Energy Technology Support Unit (ETSU) was created in the same year to support its activities in renewable energy and energy conservation. The role of ETSU was to manage the Energy Efficiency Demonstration Scheme on behalf of the Energy Efficiency Office (EEO) under a performance-based contract (ETSU, 1993).

The Best Practice Program (BPP) was developed between EEO and ETSU to meet a number of needs in the research, development, demonstration and dissemination areas. The key feature of the BPP is that it addresses market failures and relies on individual organizations making decisions on energy efficiency out of economic self-interest.

The relationship between ETSU and the EEO is set up in an annual Program Letter. ETSU and EEO set up and agree upon a series of targets prior to each financial year. These targets can be broadly divided into two types: performance targets and operational efficiency targets. The performance targets are related to the number of projects which will be developed, publications that will be issued and promotional activities that will be carried out. These ultimately lead to the single most important performance target, which is a target for the energy savings generated as a result of the program activities. The targets concerned with operational efficiency relate to the amount of effort required to meet the agreed performance targets (ETSU, 1993).

It is not possible to judge the performance of an energy efficiency organization over the whole range of its targets on one year alone. Energy savings, for example, lag behind the promotional activities because of the need for individual firms to make investment decisions and implement them. The arrangement is therefore based on a 3-year rolling contract.

The arrangement benefits the EEO in a number of ways: 1) it frees the government department to concentrate on policy issues, while leaving ETSU, the Executive Organization, to manage the program. This clearly defined split ensures that an effort by an individual is directed at one type of task only,
leading to the optimum use of resources; 2) the organization is free to recruit appropriately skilled staff and to develop optimum working practices for the running of a program; 3) clear targets can be set for the organization, which form the basis of a contract. This performance contract acts as a stimulus to ensure an efficient and effective organization; 4) it allows a comparatively small policy unit of civil servants, whose skills are in the area of policy formulation, to control a large program.

There are also disadvantages to this setup: the government could become insulated from direct contact with end users and thus it could attempt to form policy in a vacuum; and over time, a heavy reliance on ETSU. If and when performance falls off, it could cause a dilemma for the central policy unit (ETSU, 1993).

3.1.3. Parastatal Corporation

_Indonesia: P.T. Konservasi Abadi (KONEBA)_

The idea for KONEBA, the Indonesian industrial energy conservation company, first emerged in 1984. As originally envisioned, such a corporation would conduct training, audits, and studies of energy demand in different sectors. Although the Indonesian government was keen to see the increase in the uptake of energy efficiency measures, it was not interested in undertaking such work since it was developing austerity measures in response to the decrease in oil prices and the resulting drop in oil export revenues. The Indonesian government was looking towards the Korean model at that time, where the Korean Energy Management Company (KEMCO) was setup as a parastatal corporation working directly for the Korean government. Unfortunately, the design of KONEBA was flawed. It was not set up to be the national EEIO, instead it was seen as an implementing organization for a fertilizer company.

The largest fertilizer company in the country proposed that this function be handled by a new private sector entity. It was already in discussion with the World Bank over the next series of fertilizer industry loans and decided to add the KONEBA idea on as a small portion (US $4.5 million) of the loan. KONEBA

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12This entire section is abstracted from Phillips, 1990 with additional comments and rectifications by Armar (1993).
brought in four other fertilizer companies and formed a five-person board of directors. The companies put up US $4.5 million of their own, thus establishing an initial operating budget of US $9 million. The World Bank funds supported KONEBA's foreign exchange requirements, while the shareholders and proceeds from contracts provided local funding. The fertilizer company supplied 23 of the 25 KONEBA staff members.\(^1\)

KONEBA's mission has changed since its inception. Since the corporation must repay its US $4.5 million loan from the World Bank beginning in 1992, its orientation has evolved towards activities which will generate income, such as fee-for-service audits and engineering studies. Since KONEBA was setup within the fertilizer company, with a focus towards increasing efficiency in the fertilizer industry and creating additional work for the government, the other sectors were convinced that KONEBA did not have the expertise or orientation to handle efficiency work in other sectors. Since the market did not recognize KONEBA, it was unable to expand and replicate its services to other sectors. In contrast, KEMCO had a national mandate to perform audits and district heating projects that were commissioned by the government and supported through a trust fund financed by the national oil company.

In 1992, the ownership of KONEBA transferred from the fertilizer company to the government. Now it is a parastatal company that had to focus on income generating projects to repay its loan to the bank. As a result, the education, promotion, and training activities have fallen by the wayside, as have policy analysis and plans for working outside the industrial sector. Even in the industrial sector, the focus is on large facilities because there is more potential for income generation there. As of June, 1989, KONEBA had conducted preliminary energy audits in 35 industrial plants.

KONEBA's approach is to address one industrial subsector at a time. It started with the fertilizer industry and is now working on the cement industry. The problem, according to one KONEBA consultant, is that anything related to cost reduction, such as energy conservation, does not get as much attention from clients as does increasing production. KONEBA's response to this attitudinal

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\(^1\)According to one observer; however, the management of the fertilizer company chose their less capable staff to be transferred to KONEBA, thus adding the difficulties associated with starting an innovative company.
problem has been to try marketing energy conservation as a form of productivity improvement.

KONEBA has also entered into shared savings arrangements similar to the ESCo type program. But KONEBA is having problems with this arrangement since the characteristics of their clients do not remain static—they frequently change fuels, processes, and even plant managers. In such an environment, there is often an unwillingness to commit to a contract for six years.

Both KONEBA and the World Bank are concerned about KONEBA’s ability to repay its loan obligations, let alone make a profit for its shareholders. KONEBA would be assisted in its marketing efforts if the Indonesian government more actively promoted energy conservation. This would allow KONEBA to develop a National Energy Efficiency Strategy (NEES) to target households and small energy users. Most importantly, it could focus on increasing the level of awareness, efficient equipment, technical expertise and the availability of financing packages.

3.1.4. Not for Profit Organization

A not for profit organization connotes that an organization is providing a public good but operates on a commercial basis. Such an organization can receive funds from the government and outside organizations but it can have greater flexibility and authority to undertake its programs than a government-run organization.

Thailand: Thailand Energy Efficiency Institute (TEEI)

The details of TEEI’s setup and ECCT’s future is not firm at this point in time. It is anticipated that TEEI will operate as a sister organization to ECCT. TEEI will be financed by a trust fund from the Thai oil refinery corporation and would operate more like a private corporation, reporting to a BOD that is more representative of the public and private sector. The government may continue to support its informational programs, but TEEI plans to expand its services to other more profitable areas. These programs could be market-oriented, depending on the availability of innovative financing programs.
Similar to KONEBA, TEEI can focus on developing a business strategy to target areas that are profitable. Unlike KONEBA, TEEI should ensure that its informational programs do not fall to the wayside, pre-empted by more lucrative programs. TEEI should also consider using ECCT's clout as the national EEIO to give it the necessary leverage to work with both the public and private sectors.

3.2. Lessons Learned

The institutional and organizational setup of the EEIO depends very much on the context in which it operates. It is still too early to fully evaluate the organizations that have only been in existence for the last five to ten years, however; it is still possible to incorporate lessons learned from their experiences into guidelines that are described at the end of this chapter.

Bi-lateral donor organizations were instrumental in recommending that ENERCON and ECCT be setup as autonomous agencies under a governmental organization, a concept familiar to industrialized countries. Unfortunately, the governments of developing countries had no clear idea on how to set up these agencies. Since policies are generally easier to implement if they fit with the ministries' existing knowledge and understanding (Weiss and Cohen, 1992), it was natural for these EEIOs to be absorbed into the governments' bureaucracies and to operate as public agencies. On the other hand, KONEBA was set up as a private corporation reporting to its shareholders. ETSU was also set up to be an autonomous agency, but in fact it operated very much like a private organization.

The review showed that ENERCON and ECCT did not formulate a national strategy to raise efficiency levels. They could have done so but they were not given the authority and power to do so. In Thailand, Pakistan and Indonesia, bi-lateral donor organizations relied on foreign consultants (in all three countries it was RCG/Haigler, Bailly, Inc. from the US) to assist in setting up the EEIO and the programs. The bi-lateral donors did not concentrate on using local solutions and expertise--funding was tied, that is, foreign consultants and equipment had to be used as part of the funding package.
In these three countries the methodology was based on a western concept. They did not focus on transferring expertise to the local counterparts, nor look for local solutions to sustain the energy efficiency practices. Instead efforts were concentrated on the short-term, with an interest in maintaining the demand for its services.

For an example, a majority of the programs undertaken did not directly attempt to address the operational barriers, the EEIOs did not collaborate with the other stakeholders or rely on existing institutions, and a market was not created to sustain the services of the EEIOs. Instead, the EEIOs attempted to undertake all aspects of the program. In most cases, they were unable to do so, creating bottlenecks in the supply of the equipment, services and financing of the programs.

ECCT, and especially ENERCON, were not accountable for saving a specific amount of energy. They were accountable for performing a specific number of audits, undertaking a set number of seminars and training programs, etc. Since their programs were not monitored for energy savings, it is impossible to determine the effectiveness of these programs. In a related issue, permanent funding for operations and programs were not explored early on, putting ENERCON and ECCT in a vulnerable position organizationally and programmatically when their funding ran out. ETSU on the other hand, operates as the executing organization for EEO which is not interested in managing ETSU. ETSU is successful because specific energy targets are incorporated into each program. This requires ETSU to ensure its programs are cost effective for the government and its clients. Unlike the other agencies, KONEBA is a private organization that does not have the benefit of government resources and support. Its activities are limited to large industries since its major concern is securing adequate revenues.

The best projects are those that reduce the amount of effort for the implementing agency, both in creating the project and in maintaining it (Ostrom, 1992). The fewer the agencies involved in a program, the easier it is to implement, because agencies have different agendas that they bring to bear on a program. When these agendas conflict as it did in Thailand and Pakistan, the relative power positions of the agencies involved tend to determine program’s outcomes (Grindle, 1980; Tendler 1991).
Plans that are impossible to implement for whatever reasons tend to gather dust on bureaucrats' shelves (Caiden and Wildavsky, 1971). An EEIO must have adequate expertise in order to understand its mission, develop the NEES and implement it. ENERCON was unsuccessful in part because it was mandated to carry out too large a range of activities. ENERCON’s problems were primarily a result of its undertaking too many activities given the size of its organization. Secondly, it put the stakeholders in a defensive position. For example, it secured imported equipment in bulk because aid was tied, instead of collaborating with local equipment suppliers to ensure a long-term supply of domestically-produced energy efficient equipment. I believe ENERCON could have been more successful if it had collaborated with the stakeholders.

Governments with their resources and authority in the energy sector, play an important role in developing the operations of these organizations. In addition, EEIOs in developing countries need to closely collaborate with specific groups of people in order to overcome existing barriers. The next section incorporates these groups of people into the attributes of the EEIO’s institutional setup.

### 3.2.1. EEIO Institutional Setup

Based on the reviews above, I recommend the following setup for EEIOs in developing countries. An EEIO that is truly autonomous, that reports to a management board that is more reflective of the stakeholders and that equally represents the public and private sectors as is shown in figure 2 gives the EEIO greater flexibility to collaborate with stakeholders as well as greater authority to formulate its own policies and strategies to undertake EEPs. The EEIO can be set up as an autonomous organization within the government, as an independent organization, or as part of a credible organization such as a trade group, or a research and development institution.

The implementing organization can take a progressive corporate approach by setting up the organizational structure in which the EEIO reports to a management board comprised of the stakeholders. This type of setup is suitable for the organization because it clearly defines the reporting lines and allows the stakeholders to maintain their role in the implementation process. The role of the board can include: 1) setting overall policy and direction for the EEIO; 2) regulating responsibility; 3) establishing performance objectives for the EEIO;
and 4) evaluating the performance of the Director based on her/his ability to meet objectives. This allows the organization to limit its responsibilities to collaboration with stakeholders, program design, and execution and management of programs.

In this setup, the management board can ensure that the EEIO develops and executes independent policies, procedures, and systems for personnel, accounting and financial management, contracting and procurement and the management of its assets (e.g., buildings, vehicles, equipment, intellectual property, etc.) This can allow the organization to operate as a corporation with clear objectives and a strategy to adequately use its resources to optimize energy savings. Unlike a governmental agency, this would not require the organization to focus on the process. Rather, it can be concerned with the outcome of its efforts, on setting and reaching realistic targets for its programs.

An autonomous EEIO can be more concerned about justifying its existence through regular monitoring programs and evaluations of its programs. An independent organization does not risk losing the support of its host organization in the event that its host organization loses interest in the EEIO's purpose.

An EEIO must be given a high profile to have the power and prestige to implement projects both in the private and public sector (Tendler, 1991). In addition, an EEIO that is the only implementing organization for a program in a given sector or for a fuel type eliminates overlap and questions pertaining to authority, budgets, etc. For example, in Thailand, ECCT is meant to be the national EEIO, however; the Electricity Generating Authority of Thailand (EGAT) received an US $80 million dollar grant from the Global Environmental Fund to undertake a Demand-Side Management Program. As mentioned in chapter 2, DSM is a western based concept that focuses only on a limited number of equipment and on electrical products. This project's budget not only overshadows that of ECCT, but in addition, the project falls into ECCT's jurisdiction. Instead of managing this program, ECCT is a major consultant for this project managed by EGAT. In addition, EGAT does not possess the necessary expertise and training to undertake a large scale DSM project, subsequently, foreign consultants have been hired to assist in the development and implementation of the project.
Leadership and Management

Leadership and management of an EEIO are important in defining the organization's goals and strategies, in motivating its staff and in managing its operations. Nothing serves an organization better than leadership that knows what it wants, communicates those intentions, positions itself correctly, and empowers its workforce (Bennis & Nanus, 1985). A leader that has a vision for her/his organization brings meaning to the organization by articulating and communicating the purposes and goals of the organization to the staff and clients. The leader invokes trust within the organization to maintain organizational integrity while constantly developing and improving herself/himself to distinguish himself as a leader for the organization.

It is important for the Director to devise an appropriate corporate and business strategy to evaluate the environment for action and the capability for action to ground the context within which the organization must operate. A corporate strategy produces principal policies and plans for achieving goals; it defines the range of business that the EEIO can pursue, preferably in a way that focuses resources to reach its goals. The business strategy, although less comprehensive, defines the EEPs (Andrews, 1987).

Of all the components of strategic choice, an organization's competence in optimizing its internal resources is most crucial to success (Andrews, 1987). The staff of the EEIO are the most valuable resources of the organization. An EEIO is a knowledge based organization. Besides being qualified and trained, staff that is able to communicate, build rapport and initiate action is important towards undertaking the multidisciplinary functions of the organization. The broad functions of the EEIO require capabilities in interfacing with government and industry, while being able to think strategically. Specifically, staff with strong marketing skills and a sound understanding of technical issues, and support staff capable of facilitating day-to-day operations effectively are needed (ETSU, 1993). In ETSU, each staff member is a specialist in either an industrial operation or in an end-use product, for example, in the textile industry or in the boiler

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14This includes: Market Research, Market Intelligence, Promotion, Event Management, Technical Writing/Publications, and Press Communications.

15Technical issues on selected technologies and industries, project management and financial control, negotiation, commercial awareness, communications, and industrial/commercial experience.
system. For any given project, specialists in both areas can interact to design specific programs that can be replicated throughout the industry.

It is important that the services of the EEIO's staff be compensated by material and non-material incentives in the form of competitive wages, good working conditions, retirement compensation plans and training programs. Competitive incentives can be used to attract and maintain competent staff to ensure that the learning process is undertaken and retained by the staff within the organization.

3.2.2. Functions of EEIO

The EEIO has a wide range of functions that can be broadly described to cover four major areas: NEES planning, communication, management of EEPs and execution of programs (see figure 2). Its functions center around the design and the development, implementation, and maintenance of programs. These functions entail performing a range tasks from maintaining a database, keeping abreast of new technology and innovative management techniques to more macro issues such as monitoring the long-term price and supply of energy.

**NEES Planning**

The EEIO implements EEPs, monitors and evaluates their performance against the goals of the NEES. The organization constantly reformulate and/or design additional EEPs while coordinating existing programs to eliminate overlapping based on the NEES's priority EEP listing.
The EEIO also acts as a bridge between government, energy suppliers, manufacturers, financial institutions, international donor organizations and users of energy to extract their interest, support and consensus in formulating the strategy, and designing implementable EEPs. The organization can also communicate policy recommendations to the government via the management board.

**Management**

The EEIO can undertake their functions or chose to contract external expertise in program implementation. This is likely to allow it to focus its activities towards planning and coordinating programs. The implementing organization can also manage contractual agreements with training centers to provide specialized training courses for energy efficiency, with equipment suppliers providing equipment, and/or with consulting companies to undertake
technical assessments such as energy audits. For monitoring purposes, the EEIO can also contract external consultants to evaluate the programs, informational and training activities.

**Execution**

The responsibility of the EEIO is to increase the general level of information and technical expertise, and increasing availability of efficient equipment and financing packages through the execution of programs that translate conviction into action. These actions as described in chapter 2, make it easier for an energy user to implement and sustain energy efficiency measures.

Simultaneously, the setting of targets for individual EEPs as done by ETSU can be used as a means of focusing and evaluating its efforts through its programs, i.e., the amount of energy savings. Besides justifying the results of EEPs, they also enable the organization learn from previous experiences, to identify bottlenecks and impediments to successful implementation of a program. Finally, it allows an organization to use the feedback to modify energy saving strategies.

**3.2.3. Funding**

It takes time for an organization to organize its resources and develop its expertise to be able to operate along commercial lines. The market will eventually determine the effectiveness of the EEIO's operations. International and bi-lateral donor funding can be used to setup an organization with competent consultants. This funding can be funneled through the government as was done in Korea. Instead of the EEIO being accountable to a bi-lateral donor organization, the EEIO can be accountable to both its customers and to the government. The government can contract the EEIO for specific energy savings. Simultaneously, a shared savings mechanism can be arranged between the EEIO and its customers for a contracted period of time. At the end of the contract, the EEIO will receive its service fees from both the government and its clients based on actual energy savings.

This arrangement gives the government the authority to evaluate the EEIO and the prerogative to support or terminate its operations. The EEIO's client's risk is minimized and it is guaranteed to receive a specific amount of energy
savings. This arrangement also ensures that the EEIO develops and implements a program that is commercially viable for its clients and sustainable in the long-term for the government. At any point, the government can also make available funding for the EEIO in the long-term, by retrieving a portion of energy savings, adding a surcharge tax on energy or adding a service charge on energy usage.

The long-term sustainability of energy efficiency requires a strong focus towards targeted market assessments, and activities which support the dissemination of new energy conservation technology. By developing energy efficiency improvement programs for specific end-users, the EEIO demonstrates the commercial viability of energy-efficient technology and targeted technical services. This can lead to the creation of an energy efficiency industry by successively developing segments of the industry, for example, technical information, efficient equipment, technical consulting expertise, financing mechanisms and training programs (UNDP, 1992).
Chapter 4
National Energy Efficiency Strategy (NEES)

The appropriateness of one type of Energy Efficiency Program (EEP) over another, the mix of programs, and the suitable setup for the Energy Efficiency Implement Organization (EEIO) are all important considerations for formulating the National Energy Efficiency Strategy (NEES). The purpose of the planning process is to be able to make correct decisions. For reasons that will be explored in this chapter, the conventional planning process for EEPs has failed to: undertake a comprehensive analysis of local institutions and existing programs with energy balances; incorporate previous experiences from other countries; and include local participation in the decisions concerning the organization's setup and types of programs. In this chapter, I propose an alternative model for the planning process. This process formulates the proposed NEES by incorporating the lessons learned from programs and organizations throughout the world (chapters 2 and 3) and the traditional and current trends of the planning processes.

First, I describe a generic planning process, followed by the conventional planning process. Lessons learned from this approach are incorporated with a review of existing planning theories and the current trends in the planning process to conceptualize an alternative model to design a different planning process. This alternative planning process is described through the four distinct stages. They illustrate the shift from the conventional planning process to a more comprehensive and interactive process that is based on a broad analysis and recognition of stakeholder needs.

4.1. Planning and Implementation Process

The planning and implementation process can be conceptualized into a number of stages (see figure 3). In the planning process, analysis is performed to
Figure 3: NEES Formulation and Implementation
formulate alternative NEES options that will be assessed for decision making. Once the strategy is formulated, the implementation phase begins. The enacted organization will implement programs. The EEIO will evaluate the programs against the scope defined in the strategy. Modifications or additional programs may be implemented until there is a need to reformulate the strategy. At this point in time, the entire process of reformulating the NEES is repeated.

This figure consists of clearly defined stages that are inherent in all types of planning processes. However, the borders are blurred between each stage and there a certain degree of overlap between the stages. Nevertheless, these four stages will be used to describe the conventional and alternative planning process.

4.1.1. Conventional Approach

Bi-lateral donor organizations have been the main promoters of initiating the concept of energy efficiency in developing countries. They approach host governments of developing countries with proposals, that among other things, will study energy usage, undertake energy audits, and establish training programs with the aim of increasing energy efficiency. The creation of an EEIO is usually recommended to undertake these activities.

Host governments are eager to accept these offerings although they may not be committed to or involved in the process since they are usually biased towards energy supply expansion or programs that have more 'public' appeal.

Bi-lateral donor organizations also tend to hire First World consultants for developing programs. Their methods of analysis are based on data collection, analysis and prediction of energy balances using complex models. The alternatives that they propose consist mainly of First World solutions, for example, Demand-Side Management (DSM) programs that involve the use of sophisticated equipment that is usually not available in developing countries. Little consideration is paid to institutional issues of the host country. The EEIO setup is usually based on the western concept of an autonomous agency that many governments of developing countries are not familiar with. This lack of local involvement can describe host governments as "reactive" and "minimalist", characterizing them as outsiders in their own country.
A "top-down" approach is used to determine the organizational setup and type of programs implemented. Bi-lateral donor organizations instruct host governments on what should be done. Since host governments do not have the expertise or experience in energy efficiency to understand the implications of these decisions, they adopt these recommendations and enact legislation that often does not fit into the local setting and in many cases also contradicts other government policies (see chapter 3, Thailand and Pakistan).

The programs that result from this type of planning process have had little success. This narrowly focused process raises the issue of the appropriateness of the conventional planning methods since it directly affects implementation.

4.1.2. Lessons Learned

One of the most important lessons learned is that the control of the planning process must be shifted from bi-lateral donor organizations to the host government. The analysis must be broadened; the planning process must be interactive to include local participation in order to discover local solutions.

Private industry has not been interested in addressing the inefficient use of energy because of the complex barriers to change. Fortunately, governments are accountable to the public and have the responsibility and authority to undertake such processes. As explained in chapter 1, governments play a key role in the energy sector. Governments also tend to have trained staff, the clout and the necessary resources to undertake the type of analysis required, which private sector organizations and other non-governmental organizations lack.

There are vast differences in the energy sector, configuration of the economy and the operating environment between industrialized and developing countries not to mention the differences among developing countries. Most developing countries do not have an established national energy agency, nor do they have the technical expertise to use complex models (Phillips, 1991). Therefore, the replication of programs used in industrialized nations is not appropriate for a developing country if it is not appropriate for the operating environment. Moreover, decision-makers do not operate according to pre-determined or "scientific" models, but rather choose between policies that are only
incrementally different from what already exists, and that are relatively easy to implement (Lindblom, 1959) (see chapter 3, Thailand and Pakistan).

In general, bi-lateral donor organizations have authority to dictate the planning process since they have the resources. The focus of energy efficiency has been on the technical potential of improved equipment and manufacturing processes, and the environmental improvement associated with energy efficiency. The necessary up-front effort to analyze the local context for creating an EEIO, and designing and implementing an EEP is seldom performed. As a result, many of these type of initiatives have resulted in 'one-time' programs that can be characterized as 'hit and run' attempts.

Since the analysis is narrowly performed, it is not possible to have a comprehensive selection of alternatives. Foreign consultants are hired to gather relevant material to operate sophisticated models to categorize and predict future energy usage, and to use foreign equipment and technology in EEPs. This approach does not facilitate the 'learning by doing' process, and it does not consider local solutions such as promoting the local production of equipment through joint ventures. Instead, quick solutions that are often short-term are implemented.

The Energy Support Management Assistance Program (ESMAP), a group within the World Bank has taken a leading role in moving towards a more integrated planning process that involves local participation as a means to shifting responsibility towards the host country. ESMAP first opted for this type of approach in 1992 in Pakistan and is currently involved in a similar project in Zimbabwe.

4.1.3. Current Trends

The current trend is to shift control from bi-lateral donor organizations to the governments of developing countries, but the mechanism is still in the embryonic stage\(^1\). For example, ESMAP has initiated this approach in Zimbabwe where a National Energy Efficiency Improvement Program (NEEIP) is being developed. Instead of focusing exclusively on energy balances, local actors and existing programs are incorporated into the planning process. Workshops and

\(^1\)This interactive process was first initiated in Pakistan in 1992.
consensus building strategies are being promoted in order to involve key actors from the government, trade groups and bi-lateral donor organizations.

Interactive planning processes that is based on comprehensive analysis are time consuming. And, the applicability of this type of process in a larger economy must be carefully considered, since it increases the magnitude of the analysis, number of participants, etc., making it difficult to control this process. In a participatory process, there is also the danger of balancing the numbers of the groups so that one organization is not over represented. Moreover, when a number of officials from several institutions are involved in a process, important issues run the risk of being ignored as the team members pursue their interests, irrespective of the wishes of the coordinator (Chisolm, 1989).

These are the downfalls of the process, but there are a selection of available methods and innovative instruments that can be used to minimize these difficulties in order to maximize the benefits of the process. They include the use of computer-aided analytical tools, facilitators, and prepared handouts for scheduled meetings. Computers can be used to centralize information by analyzing information using popular software that is available in most countries. Facilitators can manage and focus the discussions during a workshop or meeting to minimize the dominance of a group or individual over the other participants while ensuring that the view of each stakeholder is presented. Clear and concise information, in lay person's language, regarding the issues to be discussed at the upcoming meeting can be distributed well in advance to enable all the participants to prepare for the meeting. This will also allow participants to actively participate in the meetings.

ESMAP's work in Zimbabwe is moving towards this type of planning model, but the process still needs improvement. ESMAP undertook most of the analysis and planned to develop a strategic framework for the NEEIP, the institutional guidelines, and an appropriate mechanism for ensuring the effective implementation of energy efficiency activities established within the framework during a workshop held in December, 1993 in Zimbabwe (Schenk, 1993). The results of the analysis stage and the contents of the informational package for the participants for the workshop were not undertaken by the host government, instead it was completed by foreign consultants.
At this workshop, ESMAP acted as a facilitator to bring consensus on the issues to be discussed. The objectives of the workshop were ambitious, since most of the participants had not have had the opportunity to discuss, evaluate or learn about energy efficiency and its implications for Zimbabwe prior to the workshop. Although the workshop was unable to reach all of its objectives, the Department of Energy Resources and Development of the Ministry of Transport and Energy was given the responsibility of developing the NEEIP strategy and the investigation of the appropriate institutional setup for the EEIO. In this regard, the process differs from the proposed alternative planning process. Specific attributes of the EEIO's institutional setup that were discussed also differed from the recommended attributes outlined in chapter 3. Nevertheless, the workshop was successful in: 1) bringing together 62 officials representing a diverse selection of institutions; 2) educating its participants on the importance of energy efficiency and the numerous issues that need to be resolved when formulating the NEEIP; and 3) reaching consensus on the prioritization of sectors to target for EEPs.

As I see it, bi-lateral donor organizations have a role in initiating and emphasizing the importance of energy conservation, and as facilitators to strategically direct the process towards formulating local solutions through the participation of local actors.

4.2. An Alternative Model for NEES Planning

Redefining the roles of the bi-lateral donor organizations requires them to operationalize an alternative form of NEES planning. In this section, I conceptualize a model that can be useful for such purposes. This task requires a strategy to define how the planning methods can be integrated with the process.

There are a number of planning, problem solving or decision making models available today. They can be categorized into two groups as clearly described Lindblom's classic 1959 article "The Science of Muddling Through": the Rational-Comprehensive Model (RCM) and the Successive Limited Comparison Model (SLCM).

The rational-comprehensive approach sees the phenomenon to be planned or managed, as more static, end-state, knowable and predictable. The process is
seen as capable of careful design and control where specific increments will be added in scheduled steps to achieve a desired future end-state. It does not focus on the actors, instead it is based on selected aspects of external forces and trends. Participation is generally provided following strategy completion. Although it may also include participation in goal setting, it rarely includes participation in the design of policy options. The analogy is to building a wall, brick by brick, knowing in advance what it will look like with each addition (Einsweiler, 1992).

Alternately, the SLCM envisions a more open-ended, interacting, feedback loop-type process that is oriented towards managing the process rather than a strategy of specific steps. The issue agenda is essentially set by external forces, where organizations take incremental action and await "messages" from others in the environment in terms of counter moves, or vocal objections to actions taken. A step-by-step analysis using past experience is favored since it allows the test of previous predictions, and most importantly, it allows the quick incorporation of remedies to past errors.

In the rational-comprehensive model, planning is completed and followed by implementation. In the SLCM (and in many strategic planning models) the process of developing courses of action and making decisions on them proceed in parallel, interactively. Planning in this model is the preparation of advice for decision making on the parallel, real-time basis.

One common thread that runs through all theories is that of uncertainty and how to cope with it. In the RCM, the end-state is predicted, while the SLCM sees uncertainty as unknowable and unpredictable. It is not static, causally linked, and linear in its change. Rather it is dynamic and interacting. Since SLCM is derived from this description of uncertainty, it is a planning model that reacts and interacts with the unknown in an effort to comprehend economic development, technological development and policy making as the processes unfold.

4.2.1. The Planning Process

The alternative model that I propose uses elements of the RCM and SLCM and lessons learnt from previous experience to advocate for a centralized and participatory planning process that is controlled by the government. Although
There are many actors in the energy sector, it is typical for a small committee of public officials to stage 'ad hoc' meetings for decision-making purposes. This model proposes the use of a centralized process to collect and analyze dispersed information that is relevant to the planning process. The process incorporates the knowledge, influence and reactions of the stakeholders (especially those who must produce action), existing EEPs and previous experiences from other countries.

**Figure 4: Planning Process**

The four distinct stages depicted in figure 4 (which is the upper half of figure 3) are used to describe the alternative process. This process constantly evolves based on rapid feedback from the participants, since most of the stakeholders represent institutions that will be analyzed for collecting information on energy balances, institutions, and existing EEPs. In the analysis stage, the government undertakes the analysis, but in the formulation of alternatives, the analysis can be easily reinterpreted and redefined by the stakeholders who will be closely involved in the process of formulating alternative NEES options. In the alternative assessment stage, the formulations are assessed by the stakeholders and the decision makers to formulate the NEES. The decision makers will be given the authority to make the ultimate decision, but if needed, they can reactivate the analysis stage to gather additional information or to reanalyze information. The process continues until the NEES is formulated.
4.3. Analysis

The analysis is meant to be comprehensive. It does not focus entirely on energy balances, rather it goes further to incorporate institutional analysis and existing programs. This form of analysis demands the participation of local actors who know how local institutions operate.

The analysis as shown in Figure 4 can be used to centralize the information that will be used for the alternative formulations of the NEES. Although the elements to be analyzed are comprehensive, this analysis is meant to provide a rough\(^2\) approximation of the relevant elements.

**ANALYSIS STAGE**

**Figure 5: Analysis and Alternative NEES Option stage**

Figure 5 is divided into two stages: analysis of the existing stages that will study: a) energy balances; b) institutions and policy analysis; and c) existing EEPs; and the formulation of the NEES options that will occur in the next stage. The information gathered and the categorization of organizations and programs

\(^2\)The majority of the resources should be allocated for a profound analysis in the later stage once the EEPs are implemented.
from chapter 2 and 3 will enable the incorporation of previous experiences from other countries in the construction of the NEES options.

The analysis provides baseline information for the energy sector, institutions and existing EEPs. Analysis of the energy sector will identify the areas and types of fuel for potential programs. Institutional mapping and analysis of existing programs will reveal the existing institutional structures for programs and potential options for setting up the EEIO. It also identifies the relevant stakeholders and institutions that should be involved in the planning process. Finally, the analysis of existing EEPs will identify the gaps in the strategy that need to be addressed. Alternately, the EEIO may consider modifying existing programs so that they better address the NEES’s scope.

4.3.1. Energy Balances

The analysis\(^3\) of the energy sector will be confined to energy supply and energy usage, trends in energy demand and energy intensities. On the demand side, energy consumption will first be divided into the different sectors: industrial, agriculture, commercial, transportation, residential, etc. Then energy consumption will further be categorized by fuel type to show how much energy each sector consumes by fuel type. A compilation of energy intensities of industrial processes, transportation vehicles, household and industrial end-use equipment can be compared to similar intensities collected from countries where it is known that energy is used more efficiently for the similar activities. This analysis will provide the benchmark for potential energy savings.

On the supply side, energy supply is divided into two categories energy produced domestically and imported energy inputs. The aim of this analysis is twofold: to identify the efficiency of supplying energy and the imported fuels, and the potential for increasing energy efficiency. For example, the government may decide to reduce foreign exchange expenditure on procuring imported oil. The analysis identifies the areas of the economy that are utilizing oil and their level of efficiency, to identify potential areas for implementing EEPs.

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\(^3\)In most countries, this analysis has already been performed by international donor organizations such as the World Bank.
By extending the analysis to look at future trends, it is possible to see the
trends in energy usage over time by sector and fuel type. The rapid growth of
economies in developing countries are resulting in massive building of
infrastructure, installation of capital equipment and large demands for electrical
products. EEPs that incorporate new and efficient modern energy-saving
technologies may well allow developing countries to leapfrog older
technologies.

4.3.2. Institutional\textsuperscript{4} Mapping

The study of institutions is crucial in mapping out all the stakeholders in
order to define their interest and roles in energy efficiency. Understanding how
the government makes decision on energy policy allows the EEIO to incorporate
these issues into their analysis while enabling the identification of the
governmental organizations that are responsible for decision making.

The government wants to decrease expenditures on imported energy imports
and to postpone the need for additional power stations. However, there are
millions of energy users who make decisions that do not always promote energy
efficiency. Non-governmental organizations, such as trade groups that are
represent the large, medium and small energy consumers also have specific
needs that usually revolve around energy prices and reliable energy supply.
They are interested in energy efficiency but are concerned about the costs. They
are a reliable source of information on the barriers they face in implementing
energy efficiency measures and in the solutions that they perceive to be practical
from their viewpoint. Therefore, their cooperation is essential for designing and
implementing an EEP that is viable in the long-term.

There are also a number of local and international non-governmental
organizations that work on specific locally-based projects to increase energy
efficiency such as the improved stoves and the tree planting program. Concerted
efforts can increase the implementability of the programs.

\textsuperscript{4}In the development literature the term "institutional" can refer to a specific organization in
a particular country, such as the Department of Energy; it can describe established
human relationships in a society, such as family structure (the institution of the family);
or it can denote the rules that individuals use to order specific relationships with one
another. This section uses the term "institution" in the first sense; it refers to a specific
organization (Ostrom, 1992).
Institutional mapping will describe:

- the governmental institutions, international agencies, bi-lateral donor organizations and trade groups;
- their objectives and functions;
- their activities to date, as well as present and future activities;
- how projects are funded and implemented; which institutional structures are used to implement projects, and/or which new institutions were created to carry out projects;
- how governmental ministries (individually and in coordination with other ministries) shape policies concerning energy use and coordinate it with the economic and national policy to create an energy policy and strategy;
- what mechanisms are used by individual ministries and the government to reach the goals of the energy policy;
- the role of the executive agencies or autonomous agencies; how the ministries use executive agencies to reach their goals; and
- the governmental and non-governmental organizations that are involved in energy efficiency, such as the existing EEPs.

This exercise also identifies the stakeholders for future collaboration, discloses the inside view of each organization of each other's activities, their perceived capability, their effectiveness as an organization, etc. This analysis assists in avoiding deadlock when it comes to creating the organization. Whether the EEIO is setup within government, outside government, as part of another organization or as a stand alone organization, it is important to know prior to setting up the organization which structure would work best within the country in question.

4.3.3. Existing EEPs

This study will identify the types of programs that are currently being implemented. The NEES will bring these programs into its umbrella for
redefinition and incorporation into the strategy. Besides having the opportunity to learn from their experience and to foster close collaboration with the implementing agency, the strategy will also be able to identify existing gaps and strategy for additional programs.

4.4. Alternative NEES Formulation

The six different types of EEPs that were reviewed in chapter 2 and the four options for setting up an EEIO that were presented in chapter 3 will be the starting point for formulating the NEES options. Once this analysis is completed, the reviews can be used to assist in formulating the NEES options. The analysis can be used to construct individual Energy Impact Statements that clearly describe the results of the analysis in such as way as to identify the pros and cons of each option within the context of the host country.

Since the stakeholders will be involved closely in this process, their interest will clearly be reflected in the NEES options. In this stage, the differences of the participants will raise the level of awareness of all concerned on the distinctive views held by each stakeholder in the hope that some form of consensus can be reached. Once these options are selected, they will be presented to the decision-makers.

4.5. Alternative NEES Assessment

This stage uses a delivery method such as a series of presentations, panel discussions, meetings or workshops by which the NEES options are presented to the decision makers. During these presentations, the decision makers will be in direct contact with the stakeholders who put together the NEES options. Open discussions and immediate response to the rational of each NEES option is the key element for eliminating potential misunderstandings. Consensus building techniques are used to air out differences and to reach a viable decision on an implementable NEES option. The use of an impartial facilitator is particularly important in bringing out the concerns and views of all present at these meetings. It is especially important that all the participants agree and support the decisions made since it is their involvement and assistance that will enable the process of improving energy efficiency.
4.6. Decision Making

The host governments should be given the authority to make the final decision on the NEES option based on the information presented in stage three because: they are intimately involved in the energy sector; they are accountable to their citizens; and they have the financial resources since most international loans and grants come through the government. In addition, most programs reviewed need the government's initial support, likewise the EEIO needs the government's backing and financial support.

Many analysts have pointed out the inadequacies of the governments in developing countries, their lack of commitment and their personal interest in the material benefits of the programs (Reddy, 1991). It can also be argued that developing countries do not have the experience or technical expertise to undertake the planning process. However, the host government knows best how its country operates and its limitations. The host governments of most developing countries are in the process of reforming the way energy is produced and consumed. They have the authority and power to make a difference. Since they must live with their decisions, it is rational to assume that the best decisions are the ones that are made by the host government and not by bi-lateral donor organizations. But it also true that the host governments need a clear direction on how to optimize its resources appropriately to formulate an NEES that is capable of increasing energy efficiency in the long-run.

The control of the decision-making process must be transferred from the bi-lateral donor organizations to the host government. It may be difficult to change the way a bi-lateral donor organization operates, however; it is important that they assume roles as facilitators. Bi-lateral donor organizations can assist host governments by strengthening the institutions in developing countries, equipping them with the expertise they need to undertake a comprehensive planning processes, and by showing them how they can make decisions based on sound information.

There is no available data to evaluate this type of approach; however, there is evidence from Korea and Japan to show that energy efficiency programs initiated and undertaken by the government have been successful in implementing programs in the long-term. In both countries, the government
formulated the NEEP and then contracted their respective EEIOs to undertake EEPs. Based on the energy savings achieved, these EEIOs were compensated for their efforts. In Korea, the funds from bi-lateral donor organizations were funneled through the government limiting the involvement of these international organizations.
Conclusions

Energy Efficiency Programs (EEPs) have faced many problems in developing countries. But, they have the potential to be successful if designed differently. In this thesis, I focus on the planning process to recommend that bi-lateral donor organizations allow governments of developing countries to assume authority over the planning process, while the donor organizations take on the role of facilitators.

There are merits in setting up an Energy Efficiency Implementing Organization (EEIO) to implement EEPs. In this thesis, I evaluate six types of EEPs and four types of EEIOs to determine the reasons for the shortcomings of past programs. This evaluation prompted me to study both the conventional and current planning process which in combination with the above evaluations supported the need for an alternative planning process.

Current programs have been successful in elevating the level of awareness on energy efficiency. However, they have not been able to translate awareness into action because they tend to be limited to subsidized informational programs that do not necessarily lead to the implementation of energy efficiency measures. In general, these programs: 1) did not go beyond simple energy audits to target larger energy saving areas because of the design of EEPs and EEIO institutional setup; and 2) are unsustainable because they relied on grants from bi-lateral donor organizations. The EEIOs: 1) were not institutionally set up for the local operating environment; 2) did not collaborate with the stakeholders; and 3) did not undertake the necessary analysis to formulate the NEES.

This thesis recommends a participatory process that includes the stakeholders in the planning and decision-making processes. Although this planning process has not been tested, EEPs have a better chance of surviving if they are designed and supported by stakeholders from the public and private sectors, since many of the barriers that EEPs face can be linked to stakeholder non-participation or exclusion.
It is true that shifting the planning and decision-making authority to the governments of developing countries is a difficult thing, since it requires bilateral donor organizations to change their approach to undertaking projects in developing countries. Moreover, it gives additional responsibility to host governments who do not have the expertise and skills to undertake this type of planning process. However, these skills must be acquired, and donor organizations can assist in building an institutional structure and strengthening indigenous capability.

The alternative planning process can be strengthened by further research in areas that center around involving the stakeholders in the process. Firstly, the stakeholders must be convinced that energy efficiency can work towards their benefit. Secondly, stakeholders groups that have the potential for greater benefits should be prevented from influencing the EEIOs and their programs. Finally, the commitment of the stakeholders must be retained over the long-term. The results of this research will assist in making this process implementable.

The apparent short-comings of the EEIOs and EEPs provide lessons that are useful to assisting these countries to make better decisions in the future. In addition, the recommendations of this thesis may allow developing countries to attain some of the many benefits associated with increased energy efficiency.
Bibliography


