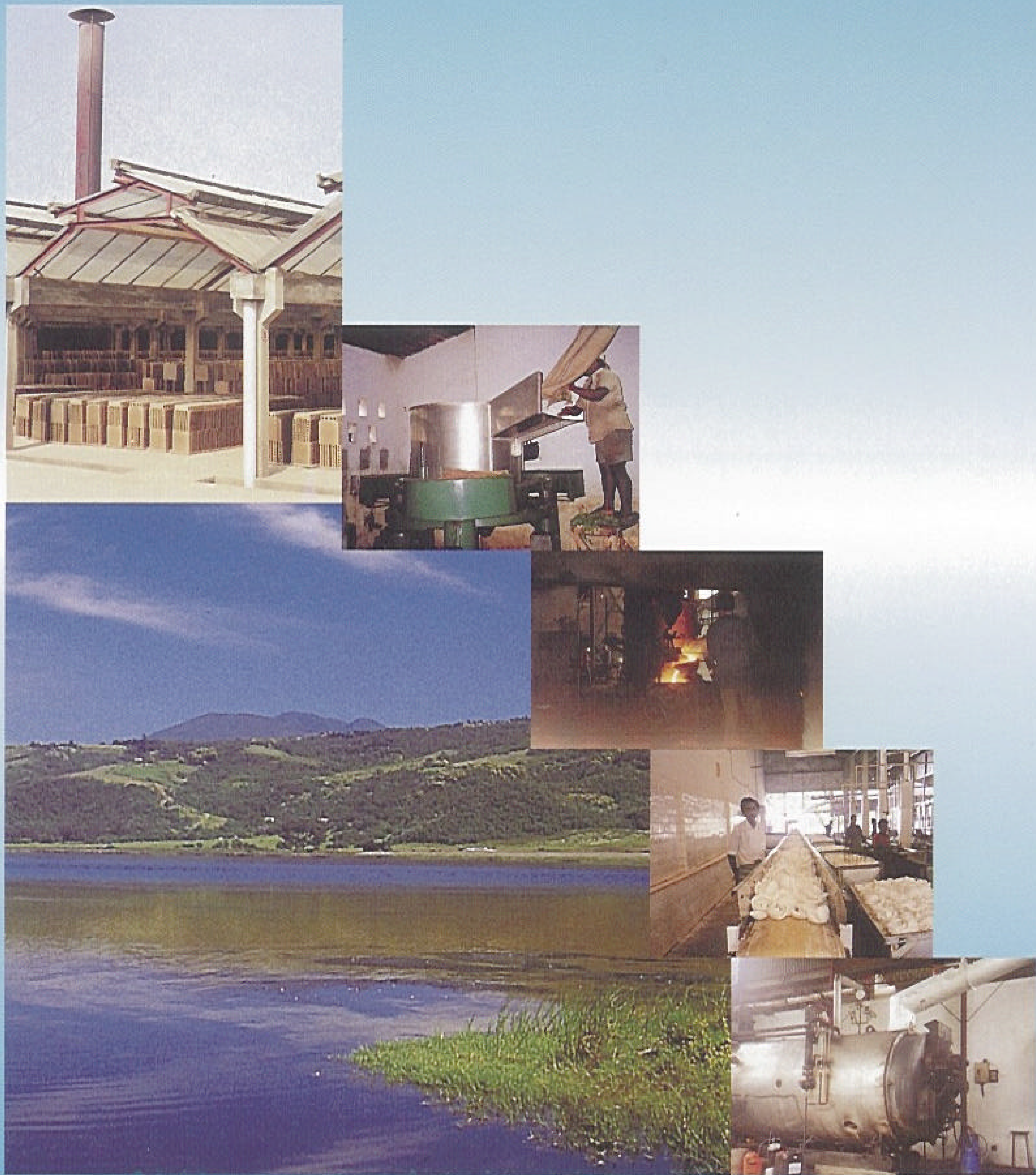
Small and Medium scale Industries in Asia:
Energy and Environment

Policy Interventions to Promote Energy Efficient and Environmentally Sound Technologies in SMI



Asian Institute of Technology

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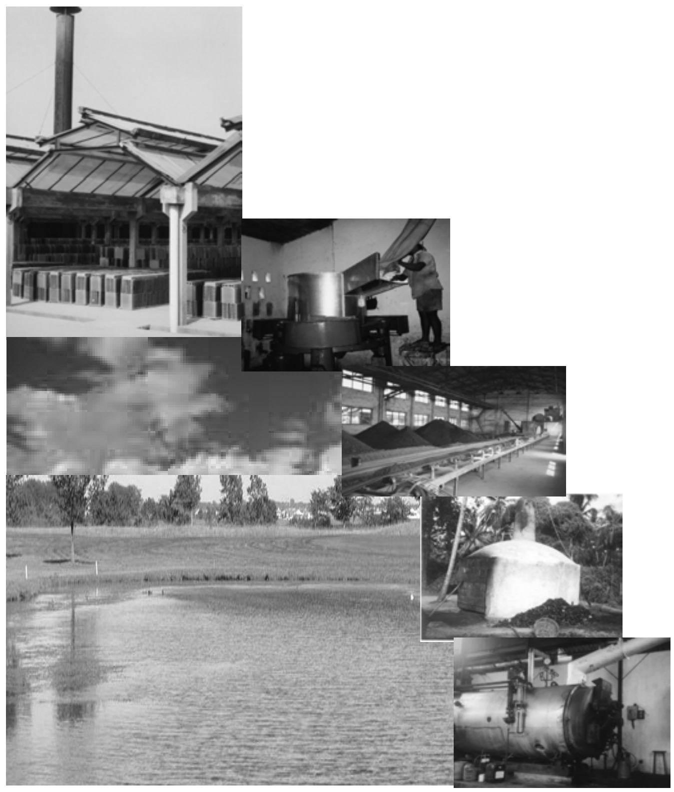
Energy, Environment, and Climate Interrelation



Small and Medium scale Industries in Asia:
Energy and Environment

Policy Interventions to Promote Energy Efficient and Environmentally Sound Technologies in SMI

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The *Asian Institute of Technology* (AIT) is an autonomous international academic institution in Bangkok, Thailand. Its main mission is the promotion of technological changes and their management for sustainable development in the Asia Pacific region through high-level education, research and outreach activities which integrate technology, planning and management.

AIT carried out the *Asian Regional Research Programme in Energy, Environment and Climate* (ARRPEEC) Phase-II, with the support of the *Swedish International Development Cooperation Agency* (Sida). One of the projects under this programme is **Small and Medium scale Industries in Asia: Energy, Environment and Climate Interrelations**.

The SMI project was aimed at promoting activities to mitigate greenhouse gas (GHG) emissions and other pollutants in *brick and ceramic, desiccated coconut, foundry, tea and textile* sectors in **China, India, the Philippines, Sri Lanka and Viet Nam**. The specific project objectives were to:

i) Review the operational practices and technological status of the selected sector;
ii) Identify and study the factors for effective promotion of energy efficient and environmentally sound technologies (E3ST);
iii) Enhance capacity mobilization to promote E3ST; and
iv) Review existing policies and develop a scenario for sustainable promotion of E3ST.

Other related publications based on this research include:

- SMI in Asia: Energy and Environment - *Desiccated Coconut* Sector
- SMI in Asia: Energy and Environment - *Tea* Sector
- SMI in Asia: Energy and Environment - *Brick* Sector
- SMI in Asia: Energy and Environment - *Foundry* Sector
- Quarterly SMI Newsletter since March 1999
- A Road Map on CD which contains details and videos of production processes of the sectors considered in the study, all publications (newsletter, reports, articles) and other outputs from the project.

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Foreword

After the industrial revolution, anthropogenic greenhouse gas (GHG) emissions have been increasing and a broad consensus has emerged that human life will be affected by earth's climate change. The GHG emissions result from many of the industrial, transportation, agricultural, and other activities through population growth, fossil fuel burning, and deforestation. The economic and social consequences of GHG emission imply that they should be addressed on a global scale. In a joint action under the United Nations Framework Convention on Climate Change (UNFCCC), developed countries committed themselves to reduce their anthropogenic emissions of GHG. They are implementing many partnership programs with industry to reduce emissions of carbon dioxide (CO_2) and other greenhouse gases. To address these issues in developing countries, UNFCCC established funds for their benefits in terms of capacity building and transfer of energy efficient and environmentally sound technological measures.

To enhance this global effort on protection of the environment, Sida initiated the Asian Regional Research Programme on Energy, Environment and Climate (ARRPEEC), a research programme aimed at producing policy-oriented research for mitigation of greenhouse gases and other hazardous emissions resulting from fossil fuel use. In Phase-I of ARRPEEC, studies were carried out in the industrial sector for the promotion of energy efficient and environmentally sound technologies. This knowledge led to the study of Small and Medium scale Industries (SMIs) in Asia.

In Asian manufacturing establishments, SMIs play a vital role by contributing substantially to its economic and industrial development. Many SMIs do not perceive their own environmental impacts as significant when set against those of large numbers. But collectively they could make a great impact. Therefore it is important that they encourage improving their efforts towards environmental protection for sustainable development. With this motivation, Sida supported the SMI project to mobilize and strengthen competence and capacity in national research institutions participating in the programme.

Dr. Gity Behravan
Senior Research Adviser
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Swedish International Development Cooperation Agency

Preface

The *Asian Regional Research Programme on Energy, Environment and Climate* (ARRPEEC) funded by the Swedish International Development Cooperation Agency (Sida) was broadly aimed at studies to promote activities to mitigate greenhouse gas (GHG) emission and other pollutants in various sectors. One of the projects undertaken for study in Phase-II of ARRPEEC was the Small and Medium scale Industries (SMI) sector considering its possible impacts to the environment. Five SMI sectors were identified for this study: brick and ceramic, desiccated coconut, foundry, tea and textile. The study was conducted in China, India, Philippines, Sri Lanka and Vietnam.

This report is based on the research done in view of growing significance of SMI in energy and environmental issues. Study was conducted to develop a framework of policy instruments and strategies needed to promote energy efficient and environmentally sound technologies (E3ST) in China, India, Philippines, Sri Lanka and Vietnam for the desiccated coconut, foundry, tea, textile, and brick and ceramic sectors.

It is believed that this report will be useful to policy personnel and government agencies involved in SMI, energy or environment, industrial organizations and researchers. This report consists of chapters on overview of SMI sector in studied countries, national policies on economy, energy and environment, trends in energy consumption and its environmental impacts in study countries and policy instruments to promote E3ST in the SMI sector.

We would like to thank the following experts for critically reviewing this document and providing inputs:

? Ms. Lisa C. Antonio, Director, Philippine Business for Environment, Philippines;
? Ms. Jocelyn S. Esguerra, Project Manager, PRIME Project, Module 4 - Environmental Entrepreneurship, Philippines;
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? Mr. Le Nguyen Tuong, Chief of Planning and Finance Division, Institute of Meteorology and Hydrology (IMH), Vietnam; and
? Prof. Meng Zhaoli, Tsinghua University, Beijing, China.

On behalf of the national research institutes (NRIs) and on our behalf, we take this opportunity to thank Sida for sponsoring this timely and important study and to AIT for providing an excellent atmosphere for carrying out this research.

S. Kumar
C. Visvanathan

Executive Summary

In most developing countries in Asia, the Small and Medium scale Industries (SMIs) play an important role in both income and employment generation. SMIs constitute a major portion of the industrial sector and generally use excessive energy and generate pollution, causing environmental degradation. In view of the growing significance of SMI in energy and environmental issues, a study was conducted to develop a framework of policy instruments and strategies needed to promote energy efficient and environmentally sound technologies (E3ST) in China, India, Philippines, Sri Lanka and Vietnam for the desiccated coconut, foundry, tea, textile, and brick and ceramic sectors.

This report discusses the role of SMI in the economy, its employment potential, and the support given to the SMI sector by governments through their economic and industrial policies. A cross-country comparison of the existing national policies on economy, energy and environment is highlighted. It was revealed that as far as the industrial sector is concerned, the study countries advocate foreign direct investment for industrial and infrastructure development, and provide incentives for modernisation of technologies. The study countries have also identified energy conservation and environment friendly technologies as a means to reduce energy consumption and pollution of the industrial sector. Energy conservation policies and environment protection laws are already in-place in some countries and others are in the process of formulating one. However, most policies are merely focused towards high energy consuming industries and there is little or no consideration given in energy conservation, pollution control policies and programs specifically for the SMI sector.

The major environmental problems related to fuel use by the industrial sector, particularly the SMI in the study countries were analysed using published data on energy and environment. Based on information on the types of fuel used, the fuel mix adopted and the change in fuel mix ratio over a ten-year period, the potential contribution to the global and local pollution was estimated. Although SMIs are not the major polluters in most sub-sectors, they often pollute more per unit compared to large-scale industries. Analysing the composition of criteria pollutants and its change over time showed the impacts on the environment by increased fuel consumption in the study countries. With the revealed evidence of increasing energy consumption and consequent pollution, there is a need for governments to address environment protection and energy conservation as two important and integrated areas. Hence, E3ST is identified as one of the suitable options, where both savings in energy input and reduction in emissions to the atmosphere are simultaneously achieved.

Though E3ST is considered as a means of future energy conservation and industrial pollution management, SMIs in the developing countries have not adopted E3ST readily due to some barriers. In fact, many E3ST methods can be readily adopted by SMIs with little or no financial investments. However, lack of awareness, education, and training on E3ST, lack of financing, lack of coordination among various government departments, lack of enforcement of regulations, lack of integration of energy and environment issues during policy formulation, unfavorable energy pricing, lack of research and development, and lack of infrastructures are the various factors that have slowed the implementation of E3ST. Information and capacity building are likewise important issues that most countries have to address at the beginning of these conservation programs.

The existing policies do not target any particular sub-sector, location, pollutant or any particular energy segment for conservation and are not time bound. Little is mentioned about direct interaction between energy conservation and environmental regulations. In this light, strategies that governments can adopt in promoting E3ST were analysed to be able to recommend policy options and instruments that could be used for the promotion of E3ST in the study countries. This report does not intend to provide specific solutions to each country or a sub-sector but cites examples, experiences and success stories that could be adapted in a particular situation or country.

Primarily, governments and national bodies of the study countries should actively promote guidelines and formulate laws on preventive strategies as a measure to maximize energy efficiency and thereby minimize emissions pertaining to SMIs. There is a need to improve enforcement of the existing environmental and energy conservations laws. In many countries insufficient administrative capacity is a limiting factor in policy enforcement. Other options to promote E3ST include the encouragement of the use of cleaner production technologies, creation of incentives for economically efficient and environmentally sound fuel switching, intervention through pollution or fuel source-based policies, enforcement of regulations through sanctions or incentives-based strategies, application of the polluters pay principle, provision of financial incentives, subsidies, taxes and favorable fuel pricing, and establishment of standards and labeling of products and services to motivate energy conservation and pollution reduction.

Integration of environment and energy policies is also highly recommended at policy level to minimize the cost of policy intervention on environmental conservation and energy efficiency if implemented separately. Industry location policies should be encouraged to provide infrastructures much needed by SMIs. Future SMIs should be located and linked to the large-scale industries to facilitate industrial symbiosis and technology transfer. Local collaborative research and development with SMIs should also be promoted.

There is a need to develop well-defined and time-bound action plans with clear and simple structures for planning, coordination and implementation and with adequate budget allocation for the promotion of E3ST targeting specific industrial sub-sectors and locations while assigning specific responsibilities to stakeholders. The action plans should allow updating based on the lessons learnt. It should also be ensured that the private sector and end users be involved and committed to the action plans and policies and support from key decision makers are obtained. Plans and policies need to be communicated to the end users clearly. In this way, the promotion of E3ST through policy interventions will successfully result in energy conservation and environmental protection for the sustainable development of the SMI sector.

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Units and Abbreviations

ADB	Asian Development Bank
BEE	Bureau of Energy Efficiency
CO_2	Carbon Dioxide
CP	Cleaner Production
DSM	Demand-Side Management
EESCO	Energy and Environmental Services Company
EIA	Environmental Impact Assessment
EPL	Environmental Protection Licensing
ESCO	Energy Service Company
E3ST	Energy Efficient and Environmentally Sound Technologies
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GHG	Greenhouse Gases
GNP	Gross National Product
GWh	GigaWatt Hour
IPCC	Intergovernmental Panel of Climate Change
kg	kilograms
kWh	kilowatt hour
MJ	Mega Joule
MOI	Ministry of Industries
Mt	Million Tons
MWh	MegaWatt hour
NA	Not Available
NEAP	National Environmental Action Plan
NO_x	Oxides of Nitrogen

PCAF	Pollution Control and Abatement Fund
PCB	Pollution Control Board
PM	Particulate Matter
PPP	Polluter Pays Principle
PRC	People's Republic of China
R&D	Research and Development
SMI	Small and Medium scale Industries
SO_2	Sulfur Dioxide
SOE	State-Owned Enterprises
TFS	Technology Fact Sheets
TJ	Terra Joules
UN	United Nations
UNEP	United Nations Environment Programme
WB	World Bank
WTO	World Trade Organization

CHAPTER 1: OVERVIEW OF THE SMI SECTOR

This chapter outlines the background of this study and describes the characteristics of Small and Medium scale Industries (SMI) in selected countries in Asia in terms of their impact on the environment and importance to the national economy.

Background of the Study

Over the past three decades the environmental impacts of human activities have grown considerably due to increasing economic activity, spiraling population growth and greater exploitation of resources. The state of the environment has now become a primary issue worldwide.

Among these activities, those associated with energy production and utilization have caused major changes in the environment. Consequently, this has led to significant undesirable environmental impacts such as, groundwater and air contamination; land degradation; marine and coastal pollution; ecosystem destruction and loss of biodiversity; damage to health and natural ecosystems from air pollutants; and increased levels of greenhouse gas emissions (GHG) known to cause long term global climate changes. However, energy services such as heating, refrigeration, cooking, lighting communication, motive power and electricity remain essential for economic growth and human well-being.

In the mature economies of industrialized countries, it has been observed that they were able to reduce energy wastage through better energy management by restructuring and using energy efficient technologies. Unfortunately, such observations have not been noted in developing countries although they are seen as the largest energy consumers of the future due to their anticipated direction towards rapid economic growth.

In most of the developing countries in Asia, the SMI play an important role in both income and employment generation. SMI constitute a major portion of the industrial sector and generally use excessive energy and generate pollution, causing environmental degradation. However, these industries often lack capital, skilled personnel and awareness about existing energy efficient and environmentally sound technologies (E3ST).

In view of the growing importance of energy and environmental issues associated with SMI in developing countries in Asia, it was deemed important to conduct a cross-country study involving China, India, The Philippines, Sri Lanka and Vietnam to develop a framework of policy instruments that could be used to encourage SMI to adapt E3ST as a means of energy conservation and pollution prevention. This report does not intend to provide specific solutions to each study country or SMI sub-sector but cites examples and experiences of successful implementation of particular E3ST options. However, this policy report is complemented by in-depth studies conducted in some SMI sub-sectors including tea, desiccated coconut, foundry, and brick that discusses sector-specific production processes, energy and environment issues, and identify the barriers to adopting E3ST by the sector.

Characteristics of SMI

There is no universal definition for the SMI sector and countries use different sets of criteria in categorizing their industries accordingly. Among the study countries, the SMI sector is mainly defined based on capital investment and number of employees; their common distinguishing feature being their importance and dynamism in the whole industrial sector.

The SMI in developing countries mostly cater towards the domestic market and use local resources. They are usually located in the sub-urban areas of the cities or close to the main input needed. These enterprises are mostly labor intensive and use unskilled labor. Therefore, they have become a significant employment provider to local men and women, offering rare opportunities for the poor to secure some form of livelihood. The technology used is

Country	Capital I vestment	Number of Workers	Ot er Criteria
China	Medium: 50 million - 5 billion RMB Small: < 50 million RMB	Not Accounted	N/A
India	Small: < 30 million Rupees Tiny: < 2.5 million Rupees	Not Accounted	N/A
Indonesia	Small: Maximum 200 million Rupiah	Not Accounted	Annual turn over: 1 billion Rupiah (maximum)
Philippines	Small: 1.5-15 million Peso Medium: > 15 million Peso	Small: 10-99 Medium: 100–199	N/A
Sri Lanka	Small & Medium: < 16 million Rupees	Small: < 49 Medium: 50-99	N/A
Thailand	Less than 10 million Baht	< 50	Peak power demand less than 1 MW
Vietnam[1]	Less than 5 billion Dong	< 200	N/A

Source: (Hillary, 2000; UNESCAP, 1999; Williams, 1999;Priambdo, 1998); Note: For monetary conversions refer to Annex 1;
[1] Vietnam: Ministry of Planning and Investment – Draft of Decree on Development of SMEs

Different countries have their own definitions of SMI mainly in terms of capital investment and number of workers.

traditional, with very minimal modernization over the years leading to wasted resources, high pollution levels, and high occupational health and safety risks. They are individually owned or with two to three partners. There have limited financial sources coming from development or commercial banks for investments. Decision-making usually relies on an individual, generally by the owner. Managerial and entrepreneurial skills and employee skills are less with the limited access to information and financial resources. These limitations make it difficult for SMI to upgrade their technologies and allocate their resources efficiently.

The 90's have brought globalization of economies, and many countries have removed the protective tariff walls that usually prevent the international players from entering the domestic market. Those SMI that are pragmatic would view this as an opportunity to upgrade their technology, innovate their products, and explore foreign markets. On the other hand, SMI that will continue to use traditional technologies would face high competition to their great disadvantage.

Sectoral Distribution of SMI

Generally SMI are found in all major manufacturing sub-sectors. However, for each country, there are characteristic sub-sectors that constitute the major part of the SMI sector. For example, in the Philippines nearly 45% of the SMI sector is from the food processing and desiccated coconut sub-sectors and in China 95% of foundry industries and 80% of textile industries belong to the SMI. In India, textiles and foundry are some of the important SMI

Industry	China	India	Philippines	Sri Lanka	Vietnam
Food Processing	More than 80%	More than 80%	More than 80%	More than 80%	More than 80%
Textile and Apparel	More than 80%	More than 80%	More than 80%	More than 80%	More than 80%
Wood and Wood Products	More than 80%	More than 80%	More than 80%	More than 80%	More than 80%
Paper, printing & publishing					
Chemicals					
Basic Metals	More than 50% less than 80%	More than 50% less than 80%	More than 50% less than 80%		Less than 50%
Leather and Leather Products	More than 50% less than 80%	More than 50% less than 80%	More than 50% less than 80%	More than 80%	More than 50% less than 80%
Machinery	More than 80%	More than 80%			
Pottery, China & Earthenware	More than 80%	More than 80%	More than 80%	More than 80%	More than 80%
Tea	More than 80%	More than 80%		More than 80%	More than 80%
Rubber Based Products	More than 50% less than 80%	More than 50% less than 80%	More than 50% less than 80%	More than 50% less than 80%	More than 50% less than 80%
Plastic Products	More than 50% less than 80%	More than 50% less than 80%	More than 50% less than 80%	More than 50% less than 80%	More than 50% less than 80%
Desiccated Coconut		More than 80%	More than 80%	More than 80%	More than 80%
Brick	More than 80%	More than 80%	More than 80%	More than 80%	More than 80%

Key: More than 80% | More than 50% less than 80% | Less than 50% | Mostly Large Scale or not applicable (blank)

Sectoral distribution show that SMI forms a significant portion of the overall manufacturing industry in all the study countries.

sectors while in Sri Lanka textiles, brick and tea. Data show that textile and apparel, tea, desiccated coconut, brick, wood and wood products constitute more than 80% of SMI in each of the study countries

Importance of SMI Sector in the Economy

Irrespective of the definition, both developing and developed counties consider the SMI sector as an engine for their economic growth and development. They account for 60–70% of the domestic industrial production. Their contribution to export earnings is about 75–80%. Of this, about 30–40% is from direct exports and the rest from subcontracts and ancillary supplies. But only 5–10% of SMI in all developing countries are engaged in export related activities. SMI in developing countries cater the domestic markets but a vast export potential exists for those not yet engaged in it (Vepa, 1997).

Statistics show the importance of SMI in the industrial sector in Asia. They account for more than 50% of the total industrial sector output in China and India, and for 10–25% in most other Asian countries. Unfortunately, sufficient data to analyse the SMI contribution over the years do not readily exist.

SMI as an Employer

In developing countries, the economic and social significance of small-scale enterprises is well recognized. Enterprises of up to 50 workers are categorized in developing countries as SMI. According to some estimates, 17–27% of the labor force is employed by SMI. In Asia, the majority of population lives in rural areas where SMI provide 20–45% of full time employment and 30–50% of household income. In developing countries, a larger proportion of SMI is employed in the manufacturing sector. For example, in India 27% of the 12.6 million micro and small-scale enterprises are in the manufacturing sector (Hillary, 2000).

Country	Medium-scale (%)	Small, Cottage or Household (%)
China (1989)	19	49.4
Korea (1988)	17.2 (20-99 employees)	4.9 (5-19 employees)
Indonesia (1986)	6.9 (20-150 employees)	11.1(<19 employees)
Philippines (1983)	10.4 (10-99 employees)	2.4 (10 employees)
Thailand (1986)	no data	1.7 (10-19 employees)
India (1988/89)	57.8 (<2 million Rs. Investment)	no data
Pakistan (1985/86)	12.3 (10-99 employees)	0.9 (,10 employees)

Source: World Bank discussion papers, Towards an Environmental Strategy, 1993.

Some statistics on the SMI sector in different Asian countries regarding distribution of small or medium- scale industries and number of employees.

The maximum number of employees per SMI does not in general exceed 250 workers. However, the mere number of enterprises makes the total volume of workers considerably large within the overall manufacturing sector. For example in 1998, China had 991 (0.21%) large, 9,186 (1.96%) medium and 458,329 (97.83%) small scale industries (CEST, 1999). Based on available literature, a conservative estimate of the total labor force in the manufacturing sector employed by the SMI in the study countries would be nearly 60-70%.

CHAPTER 2: NATIONAL POLICIES ON ECONOMY, ENERGY AND ENVIRONMENT

Given the significant contribution of SMI to the national economy, this chapter presents the economic performance of the study countries and their respective economic and industrial policies in order to examine the importance they give to the SMI. It also discusses the policies of the study countries on energy and environment. The salient features of the policies **(see Appendix C for the outline of existing policies)** are described and analyzed through cross-country compa-risons.

Economic and Industrialization Policies of Study Countries

Economic Performance

The economy of the People's Republic of China (PRC) grew at the rate of 10.1% during the period of 1980–90 and at 11.2% during 1990–98. The economy rebounded in 1999 and 2000 after a deep recession in 1998 in the wake of the Asian financial crisis, with real GDP growth reaching 10.9% in 1999 and 8.8% in 2000 (ADB, 2000). The manufacturing sector contributes 40% of the GDP and employs more than 15% of the total industrial labor force (UN, 1999).

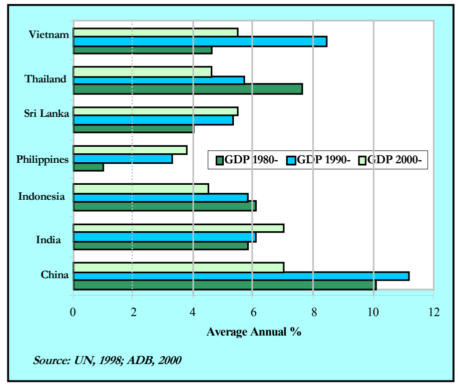
The Indian economy has been growing at the rate of 5.8% per annum during 1980–90 and at 6.1% during 1990–98. The manufacturing sector contributes 16% of the GDP and employs more than 24% of the total industrial labor force (UN, 1999). During the past decade, the manufacturing sector has shown a growth of 8% compared to the 7.4% during 1980–90.

The Philippine economy has grown at the rate of 1% per annum over 1980–90 and 3.3% over 1990–98. The manufacturing sector contributes 23% of GDP and employs 10% of the total industrial labour force (UN, 1999). During the past decade, the manufacturing sector has shown an average growth of 3.1% compared to 0.1% during 1980–90, indicating the increasing importance of the sector within the economy. The economy registered a GDP growth of 3.9% in 2000, continuing the recovery stage in 1999. The agriculture sector grew by 3.4%, the service sector by 4.4% and the industry sector by 3.6% (ADB, 2000).

An economic growth rate of 4% per annum over 1980–90 and 5.3% over 1990–98 in Sri Lanka has been reported. The manufacturing sector contributes 17% of the GDP and employs 15% of the total industrial labour force (UN, 1999). During the past decade the manufacturing sector has shown a growth rate of 8.5% compared to the 6.3% during 1980–90, indicating the increased importance of the sector within the economy. Sri Lanka recorded an annual growth rate of 6.0% in 2000 compared with 4.3% in1999. The industry sector has out performed other sectors during 1999 (ADB 2000).

Vietnam's economy has been growing at the rate of 4.6% per annum over the period 1980–90 and at 8.4% over the period 1990–98. The manufacturing sector contributes 22% of the GDP and employs 10% of the total industrial labor force (UN, 1999). During the past decade the manufacturing sector has shown an average growth of 5% compared to 4% during 1980–90. Vietnam's real GDP growth was estimated at 6.8%, an increase from 4.8% in 1999. The main source of this growth has been the strong performance in export and industry and the reported growth rate of 9.7% in the industrial sector (ADB, 2000)

These data show that the Asian economy has changed considerably during 1999 experiencing a recession. In early 1999, an average annual growth of 4.4% was expected for the region (ADB, 2000). However, the recovery has been uneven across developing Asia. It was forecasted that growth would be particularly strong both in PRC and India. The fast recovery in the first half of 1999 in most of the economies affected by recession, viz. Korea, Malaysia, Philippines, and Thailand, is due to simulative monetary and fiscal policy. This turn-around was brought about by increased exports, especially in the high-tech industries. The up-turn in the economy resulted in inflow of foreign and private capital to Asia. The dip in economic growth stimulated some of the countries to rethink about changes in economic policy resulting in liberalisation for foreign capital and investments in infrastructure development.



Real GDP Growth Rates varied among the Study Countries in the last three decades.

Domestic Economic Policy Initiatives

In China, building on a constitutional amendment giving greater constitutional status to the private sector, several economic laws have been enacted to develop a better legal and regulatory framework for the market economy to function efficiently. The government also sought to improve private firms access to credit by setting up credit guarantee scheme for SMI in 70 cities. PRC's accession to WTO and the commitments to cut tariff, liberalized trade and investment, and open up domestic sectors for foreign participation are expected to bring sufficient efficiency gains.

In recent years India has maintained low interest rates to support industry sector recovery. In Sri Lanka, the policy dialogues focus on improving public sector governance and efficiency, promoting private sector growth and reducing poverty. Industrial policy focuses on export oriented industry promotion with special consideration of SMI as an important segment in providing employment and domestic producer.

The domestic policies of the Philippines focus mainly on improving macro economic stability, privatisation process, accelerating structural reforms and rural development, enhancing competition and private sector participation. The Vietnam government continued with reforms in 2000 in private sector development, state owned enterprises (SOE) and banking. The government has formulated an SOE reform plan (ADB, 2000).

A Cross-Country Comparison

There are two distinct pathways for economic development observed around the world, namely through open economic policies or inward-looking, centrally- planned economic policies. In centrally-planned economies, a central body makes the decisions. In open economies, the individual decisions are considered in the economy-wide policy decisions. In all the study countries, governments have accepted in general an open economic policy as a means of achieving their economic growth. Under this framework, the economies are opened for global markets through the removal of tariff barriers and capital inflows from foreign investments. All these countries have gradually deregulated most of their activities with the commencement of the liberalization process. Competitiveness and efficient economic management have become important considerations. In this economic environment, the private sector is regarded as the engine of growth.

As far as the industrial sector is concerned, these countries advocate foreign direct investment for industrial and infrastructure development considering it a means for attracting much needed capital. Privatisation of state run industries is one of the industrial reforms except in India where some sectors are listed only for the state. Countries provide incentives for modernisation of technologies.

The economic indicators of these countries during the past two decades reveal that:

- ❖ The economic growth was highest in China (11.2%) during 1990–1998 followed by India (6.1%) Vietnam (8.4%), Sri Lanka (5.3%), and Philippines (3.3%).
- ❖ The manufacturing sector contribution to GDP is highly significant in China (40%), followed by Philippines (23%), Vietnam (22%), Sri Lanka (17%), and India (16%).
- ❖ Manufacturing sector employment generation is significantly high in India (24% of total labor force). Manufacturing sector contribution to total labor employment is more than 10% in all other countries.

THRUST AREAS

- Open economic policy
- Foreign Direct Investment (FDI)
- Industrial modernization & use of advanced technology
- Industrial pollution
- Importance of SMI sector

China

- Open economic policy with government control
- FDI is permitted
- Focused towards high tech and agricultural based industries with incentives for modernization and privatization of state run industries.
- Follows an industrial location policy (western region) and closure of all old and polluting industries
- Employment generation is considered to be from SMI sector

Source: CEST,1999

Vietnam

- Open Economic Policy with Government control
- Industrial policy aims at FDI
- Focused towards modernisation in multi-sector industries and encourages improvement, modernisation and use of advanced technologies
- SMIs are important due to employment generation
- Equity in state-run institutions

Source: Communiqué from the NRI

Sri Lanka

- Open economic policy is accepted
- FDI is permitted
- Encouraging private sector participation with incentives for modernization and use of advanced technologies, privatisation of state run institutions
- Environmental Clearance for medium and large scale industries is needed before start-up
- SMI sector is recognized by the policy and employment generation is considered from SMI

Source: Central Bank of Sri Lanka, 1999

Philippines

- Open economic policy is accepted
- FDI is permitted
- Focused towards high tech and agricultural based industries with incentives for modernization and privatisation of state run industries
- Environmental Clearance required for industries
- SMI sector is recognized by the policy due to potential for employment generation

Source: NEDA, 2000

India

- Open economic policy accepted
- FDI is permitted
- Privatisation of state run institutions with incentives for modernization, focused towards all industries except industries reserved for State
- Environmental Clearance required for medium and large scale industries before start-up and follows a locational policy for all medium and large scale industries (25kms away from the Standard Urban Area)
- SMI sector is recognized by the policy (there is a reserved list for small industries) due to its employment generation potential

Source: Secretariat for Industrial Assistance, 1999

Salient features of economic and industrial policies of the study countries

The manufacturing sector's contribution to the added economic value is still very high in the phase of their economic development. Furthermore, the manufacturing sector has become important as an employment provider. Considering the fact that SMI account for a larger proportion of the manufacturing sector, domestic policies have focused on SMI considering their importance in the economy. Domestic policies have given priority for the location of medium and large-scale industries, and are also providing some protectionism and incentives for SMI.

Issue	China	India	Indonesia	Philippines	Sri Lanka	Thailand	Vietnam
1. Economic Policy	Open (with control)	Open	Open	Open	Open	Open	Open (with control)
2. Foreign Direct Investment	✓	✓	✓	✓	✓	✓	✓
3. High Tech Industries	✓	✓	✓	✓	Not Mentioned	✓	✓
4. Creation of Employment	✓ (SMI)	✓ (SMI)	✓ (SMI)	✓ (SMI)	✓ (SMI)	✓ (SMI)	✓ (SMI)
5. Locational Policy	✓	✓ (except SMI)	✓	Not mentioned	✓	✓	✓
6. Incentives for modernization	✓	✓	✓	✓	✓	✓	✓
7. Private sector participation	✓	✓ (except the reserved list)	✓	✓	✓	✓	✓
8. Privatisation of Sate run industries	✓	✓	✓	✓	✓	✓	✓
9. Environmental Clearance	✓	✓	✓	✓	✓	✓	Partly

Key: (✓) implies,
1 - Open economic policy is accepted; **2** - Foreign direct Investment accepted; **3** - High tech industries promoted
4 - SMI are important as source of employment; **5** - Advocate industry location policies;
6 - Incentives available for industry modernization; **7** - Private sector participation considered in economic development;
8 - Have started to privatise state run industries; **9** - Environmental clearance is required for new industries

Cross-country comparision of economic and industrialisation policies

Energy and Environmental Policies of Study Countries

An Overview

With the creation of the World Trade Organization (WTO) and ongoing multi-national trade negotiations, the world has entered into a new trading environment. Most of the countries opened their economies, eliminating tariff barriers and placing emphasis on more outward-looking and liberal economic policies instead of the control-oriented economic policies.

As pointed out, all the countries under study advocate open economic policy, but have differences with regard to the manner, sequencing and the speed of implementing the necessary policy reforms. For example, Sri Lanka had come to accept the virtues of market-oriented policies in 1997. India opened their economy in the 1990's and China and India had a slow movement towards open economic regimes. However, all these countries have identified open economic policy as a means of achieving economic growth.

Due to anticipated consequences of higher energy requirement to cater the expected economic growth, and the adverse environmental effects, energy and environment conservation policies and other domestic policies are important to create a "level paying ground" in achieving not only material development, but the social welfare of the countries.

Salient Features of Policies

Legislative approaches such as Acts and Laws, national policies and regulations are considered as broader policies in addressing the energy and environmental issues. These issues are dealt with in official endorsements such as departmental or sectoral strategies, action plans and programs. Therefore in these countries, provisions are given for energy and environmental issues either in legislations or any of the other governmental documents, which have wider national acceptance.

Energy conservation has already been declared in China in 1997, and has provisions for both regulatory and incentive measures in achieving industry energy efficiency. China has focused on larger higher-energy consuming industries while small industries are relatively neglected. China is particularly aware of the pollution potential of stewardship and village industrial enterprises (mainly consists of SMI). Their serious contribution to environmental problems has prompted the municipal and provincial governments to pursue detailed specialized strategies for relocation or closing of industries, encouraging changes in the production line or raw materials, establishing pre-treatment and common treatment facilities for waste and giving different kinds of incentives to industries. China has succeeded in its development of regulatory measures where comprehensive administration system prevails compared to other countries. Market based approaches have not been widely incorporated in promoting E3ST in China.

At present, China has recognized the open economic policy as a means of their economic growth, has recognized need to improve the industry efficiency. China's approach to day is to promote SMIs with incentives for technological improvements enabling them to achieve production efficiency. This kind of environment is very much favorable for addressing energy efficiency issues through technology improvements.

Policy Interventions for Energy Efficiency Improvement – The China Experience

China has notable progress in reducing unit energy consumption levels over the decade. Progress has been made through widespread promotion of rudimentary energy management practices, energy housekeeping measures, and a variety of retrofitting projects. Government units in all provinces have been established to enforce energy consumption standards.

The institutional system which China has developed has succeeded in prodding a wide array of enterprises to undertake technical and managerial measures to improve energy efficiency. Unlike the U.S. approach, in which utility companies are instrumental, in China (as in Japan and Korea), the government works directly with industrial enterprises. China's program is now strong in its broad coverage of enterprises, monitoring of consumption practices, promotion of energy efficiency goals, and information dissemination. Efforts to improve energy efficiency have become a more integral aspect of the energy planning process than in most developing countries. The system seems to work well for disseminating information on consumption norms between provinces, and promoting generic energy conservation investments.

On a technical level, China's energy conservation strategies revolve around two basic themes: (a) linking energy efficiency with the broader process of industrial growth, and (b) upgrading the efficiency of existing equipment. The first theme was based on the opportunity presented by new investments taking place in the industrial sector. Much industrial capacity installed in 1980 were below international standards, but the focus then was long-term penalties in terms of high recurring costs and energy consumption rates.

The second theme – upgrading the efficiency of existing equipment –had many components. This includes promotion of industrial co-generation facilities, reduction of power transmission and distribution losses, improvements in coal quality, and aggressive replacement of inefficient boilers and motors.

(Source: World Bank Discussion Papers, 1994)

Policy Features	China	India			Vietnam
Energy Policy formulated by the Government	Yes (Energy Conservation Law)	Yes (Mega Power Policy); Energy Source-specific policies also declared.	Yes (Energy Development Plan 2001-2004)	No	No
Implementation of Demand Side Management	Only for high energy consuming industries.	Not Mentioned (Proposed under Energy Conservation Bill 2000)	Yes	Carried out as an independent Program	Yes (Master Plan for Energy Conservation and Efficiency, 1998)
Conduction of Energy Audit	Yes, but compulsory only for high energy consuming industries	Not Mentioned (Proposed under Energy Conservation Bill 2000)	Yes	Not mentioned	Yes
Promotion of Renewable Energy Sources	Yes	Yes	Yes	Not mentioned	No
Financial instruments for Energy Conservation	Yes, for conservation under Energy Conservation Fund	Yes but only on power generation side	Yes but only on power generation side	Yes	No
Financial incentives to industries for use/generation of Renewable Energy	Yes	Yes (Provided by the Ministry of Non-conventional Energy Sources and Indian Renewable Energy Development Agency)	Not mentioned	Not mentioned	No
Standards and Labels for Energy Conservation devices	Formulation of National Standards and Introduction of Certification and Labeling	Voluntary Labeling applicable only to a few consumer products	Yes	No	No
Information dissemination on Energy Conservation & efficiency	Yes	Yes	Yes	Yes	Yes
Promotion of R&D on development of indigenous technologies	Yes	Not mentioned	Yes	Yes, under the Energy Conservation Act Fund 1985	No
Target industry of the Policy	Large	Not mentioned	Large	Not mentioned	Not mentioned
Private sector participation in power generation (including renewable power)	Not mentioned	Yes	Yes	Yes	No
Provision of Penalties/prosecution for non-compliance of rules	Yes	Not Mentioned (Proposed under Energy Conservation Bill 2000)	Yes but targeted to Large Scale industries	Not mentioned	No
Policy on Energy use and Efficiency for SMI	No. More focused on large industries.	No. More focused on large industries.	No. More focused on large industries.	No. More focused on large industries.	No

Comparison of energy policies of the study countries

Despite the absence of an energy policy in Sri Lanka, energy issues are addressed in departmental strategies and plans, but the recognition of energy conservation and environmental issues is inadequate. However, the state owned authority for electricity supply in Sri Lanka, Ceylon Electricity Board (CEB) conducts demand side management programs providing energy audit services for industries, pre-construction consultancy services for construction industries (technical drawings and recommendations based on energy efficiency), power quality analysis and lighting design for buildings for a fee. In addition, programs for energy efficient lighting and customer education are carried out for the domestic and small commercial sector. There are many other organizations with diverse authorities and functions involved in energy conservation programs however a cohesive attempt is non-prevalent in policy formulation.

National standards for air emissions, noise pollution and industrial effluents have been set under the National Environmental Act of Sri Lanka (NEAP, 1998-2001). Under this policy, Environmental Impact Assessment (EIA) and Environmental Protection Licensing (EPL) are the administrative procedures that industries should undergo for environmental clearance. EPL is mainly applicable for new SMI. The SMI sector is dealt with extensively in the industrial policies of Sri Lanka and is encouraged to participate in technology transfers with the larger industries. Cleaner production is another initiative that incorporates programs to improve energy efficiency and minimize environmental pollution for new industries. A Pollution Control and Abatement Fund has been set up to provide interest free loans for industries (National Industrial Pollution Management Policy, 1996).

A Cross-country Comparison

Generally the existing energy conservation and environmental laws, plans and regulations aim at reducing energy consumption and pollution prevention in industries. Most of the existing energy policies focus on supply side management. So far the laws and plans do not especially target SMI but also cover them under the general category of industries. The plans also include conservation of energy resources and encourage the use of renewable energy sources. However, provision is made for continued renewal of the plans in order for it to be more responsive to the changing needs of society. Research and development to introduce devices for energy conservation and pollution mitigation is included in most policies. In most countries, different ministries or departments handle the energy and environment areas and also implement the laws independently. The only point of integration of both issues is in the development plans or project level.

There are three main approaches for policy intervention namely, regulatory, market, and integrated approach where both regulatory and market instruments are used in a complementary manner. In the regulatory approach, monitoring and enforcement cost is high and it needs higher administrative capacity and is a high cost to the country. But the market approach brings about a voluntary behavioral change, which is less of a burden to the government. The integrated approach is common in transition economies including the study countries and countries use each of the instruments according to their capacities and objectives.

The various examples illustrated earlier shows that, regulatory approach has been successful where considerable control and closer contacts with grassroots industries have been made.

Policy Features	China	India	Philippines	Sri Lanka	Vietnam
Formulation of Environmental Policy	No (Decision of the State Council on Environmental Protection 1996/31)	Yes, (Abatement of Pollution Policy, National Conservation Strategy Statement of Conservation and Development; Ecomark Policy); National Environment Policy under preparation	Yes, (PD 1151: Philippine Environmental Policy)	Yes, (National Policy on Industrial Pollution Management, 1996)	Yes (Environment Protection Law)
Adoption of PPP	No	Yes	Yes	Yes	Yes
Encouragement of CP	Yes	Yes (CP Technology Policy)	Yes	Yes	No
Creation of Industrial Estates	Yes	Yes	Yes	Yes	Yes
Financial incentives for pollution prevention	Yes	Yes	Yes	Yes	No
Formulation of Environ-mental Protection Laws	Yes (Environment Protection Law 1979, Revision 1989)	Yes (Environment (Protection) Act, 1986)	Yes (Philippine Environmental Code)	Yes (National Environmental Act No.47, 1980)	Yes (Vietnamese Environmental Pollution Standards)
Declaration of Air Emission Standards	Yes (Environment Protection Law)	Yes (Environment (Protection) Act, 1986)	Yes (Philippine Environmental Code)	Yes (National Environmental Act)	Yes (Vietnamese Environmental Pollution Standards)
Declaration of Wastewater discharge Standards	Yes (Environment Protection Law)	Yes (Environment (Protection) Act, 1986)	Yes (Philippine Environmental Code	Yes (National Environmental Act)	Yes, under Vietnamese Environmental Pollution Standards
Requirement of EPL for Industries	Yes	Yes	Yes	Yes	Yes
Requirement of EIA for new industries	Yes	Yes	Yes	Yes	Yes
Policy coverage for Pollution mitigation in SMI	No	No	No	No	No

LEGEND: **CP** – Cleaner Production; **EIA** – Environmental Impact Assessment; **EPL** – Environmental Protection Licensing;
PPP – Polluter Pays Principle; **SMI** – Small and Medium scale Industries

Comparison of environmental policies of the study countries

CHAPTER 3: TRENDS IN INDUSTRIAL ENERGY CONSUMPTION AND ITS ENVIRONMENTAL IMPACTS IN STUDY COUNTRIES

This chapter describes the general trends of energy consumption and consequent environmental implications of the industrial sector (giving emphasis on SMI) in relation to the economic growth of each study country. The potential factors that could enable SMI to adopt E3ST are identified. An analysis is further made on selected SMI sub-sectors to determine its role within the whole industrial sector.

An Overview

The economic development of nations results in increased demand for energy resources. Shifts in the structure of consumption and production, however alter the impact that changes in output have on changes in energy consumption. At present developing countries comprise more than 75% of the world population but utilize only a quarter of the world's energy. Their per capita energy consumption a mere one-tenth of what it is in the rich countries. However it is doubling every 15 years and is expected to increase fivefold over the next three decades or so in the course of economic growth (Anderson, 1996).

The state of the environment is a major worldwide concern today. Pollution in particular is perceived as a serious threat both in the developed and developing countries, where quality of life has hitherto been measured in terms of material output. Meanwhile, environmental degradation has become a serious impediment to economic development especially in developing countries today, and environmental conservation is of a considerable cost to them.

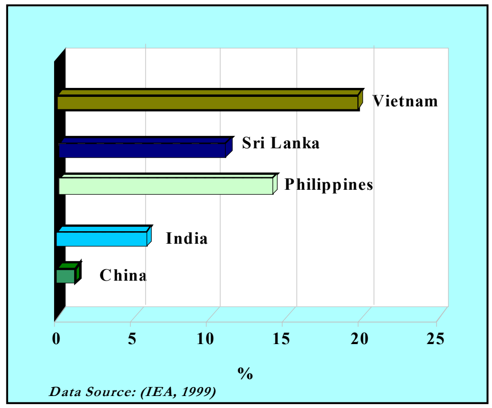
The growing evidence of environmental problems is due to a combination of factors. Energy production, conversion, transportation and utilization have been and continue to be a primary source of local, transnational, and global pollution. Energy efficiency is one of the widely advocated methods of reducing pollution in both developed and developing countries. During the past two centuries, the efficiency of energy use, as measured by the amount of energy needed to provide a given output or service, has improved by factors ranging between 50 and 100 times more (Anderson, 1993). Finding energy efficient and environmentally sound technologies (E3ST) is one of the more important quests of today because the adoption of such provides many opportunities for developing nations to achieve considerable economic and environmental gains.

Industrial Sector Energy Consumption and Energy Mix

Trends in Total Industrial Energy Consumption

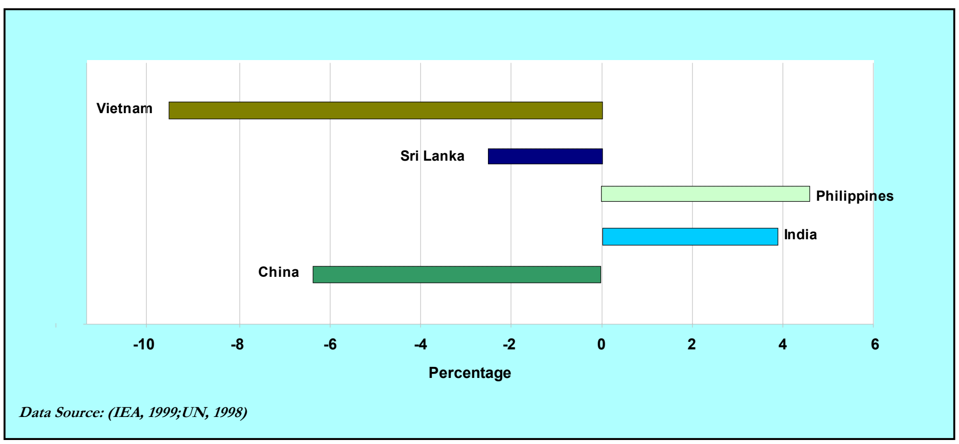
The average annual increase in total energy consumption by the manufacturing sector is increasing based on the figures from 1987–1997. Except China (1.3%), countries like India (5.8%), Indonesia (17.2%), Philippines (14%), Sri Lanka (11.0%), Vietnam (19.9%), and Thailand (20%) have recorded a significant growth.

Taking into account how each country's industrial sector performed in relation to their energy consumption reveals a notable trend. In spite of the rise in total manufacturing sector energy consumption over the years, China, Vietnam and



Annual Industrial Energy Consumption Growth Rate 1987 – 1997 (Base Year 1987)

Sri Lanka showed a downward trend in yearly energy consumption by the manufacturing sector during 1987-1997 based on the sector's contribution to GDP. This resulting indicative trend may be a reflection of energy efficiency measures adopted by each country in the past.



Annual Change in the manufacturing sector Energy Consumption based on GDP Contribution by manufacturing Sector in Billion $ shows a downward trend for Vietnam, Sri Lanka and China.

Primary Energy Share in Industrial Energy Consumption

When considering the following data on the rate of industrial energy consumption, it should be noted that these figures already include the consumption of the SMI sector, which as mentioned earlier, forms a significant portion of the whole industrial sector in the respective study countries.

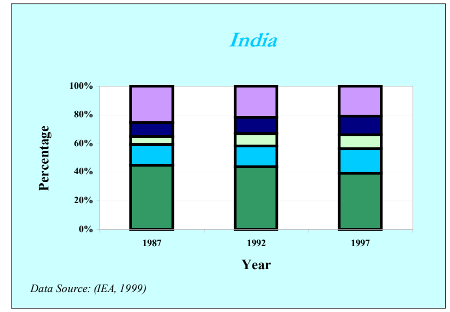
In China, composition of energy sources for industrial production had changed only marginally over the last decade. In 1987, coal accounted for nearly 80% of the total energy consumption followed by oil (9%), electricity (9%), natural gas (2%) and biomass (negligible). In 1997, coal consumption had reduced to 71%, and there was an increase in oil (12%), electricity (9%), and natural gas (3%) consumption.

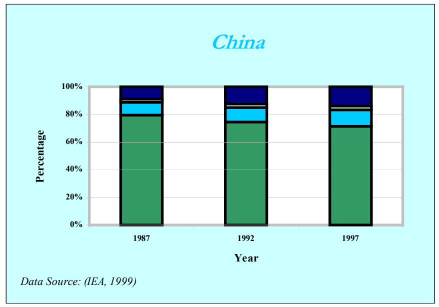
In India, composition of energy mix in industrial production has changed towards use of more electricity and natural gas during the last decade. In 1987, coal accounted for nearly 45% of the total energy consumption followed by biomass (25%), oil (15%), electricity (10%), and natural gas (5%). In 1997, coal and biomass share had reduced to 39% and 21% respectively but consumption of oil (17%), electricity (13%), and natural gas (10%) had increased. Figure 4.4 shows the composition of energy mix during 1987-97. It is interesting to find that in China and India, being two of the largest world coal producers, the consumption of coal in their industrial sector had a decreasing trend.

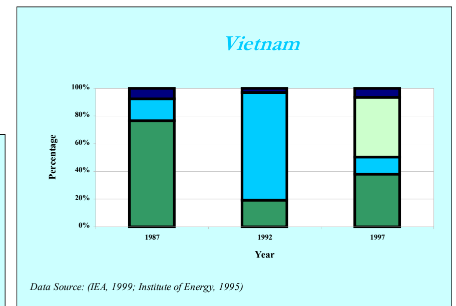
The primary sources of energy for industries in the Philippines are electricity and biomass. There was an increase in the use of natural gas during 1992-97, a positive trend towards the use of cleaner fuels. In 1987, biomass accounted for nearly 44% of the total energy consumption followed by oil (32%), electricity (12%), and coal (11%). In 1997, the share of oil (22%), electricity (8%), coal (11%) and biomass 27% had reduced and natural gas accounted for 26% of total energy consumption.

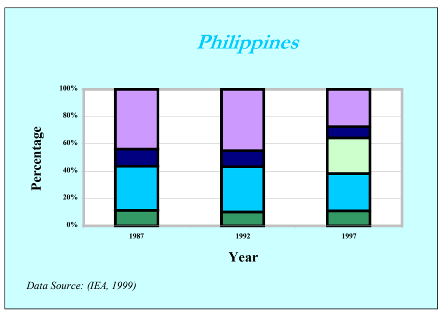
Sri Lanka's primary energy sources for industry are biomass, oil and electricity. In 1987, biomass accounted for 73% of the total energy consumption followed by oil (14%) and electricity (12%). Biomass and electricity consumption have reduced to 57% and 11% respectively, while share in 1997 of oil had increased to 32%. The reduction in biomass use is due to its non-availability and consequent increase in price. Hence, large biomass consumers like SMI have shifted to fossil fuels, which are easy to use and have higher heating value.

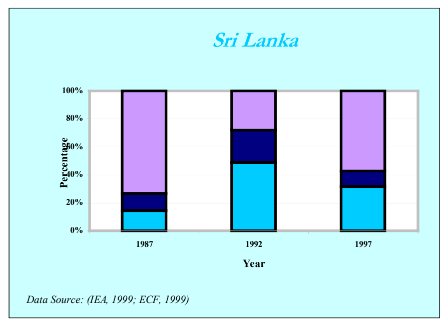
Vietnam's primary energy sources of industry are coal, electricity and oil. Use of biomass in industry is less. In 1987, coal accounted for nearly 77% of the total energy consumption followed by oil (16%), and electricity (8%). In 1997, the use of coal (38%), oil (12%), and electricity (7%) had reduced but natural gas (43%) consumption has increased. Hence, the industrial sector coal consumption has reduced in Vietnam. The trend for cleaner fuel such as natural gas is an encouraging signal in the environmental perspective.

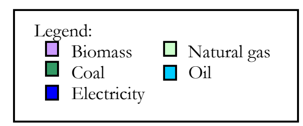












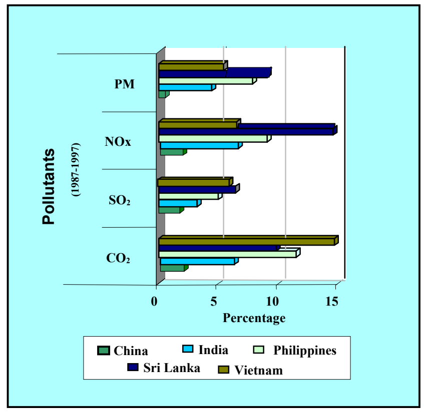
Composition of Industrial Energy Consumption (TJ) in 1987, 1992 and 1997 varied in each Study Country.

Effects of Energy Consumption on Environment

The major environmental problems related to fuels are local air pollution, acid rain, and global climate change, which is of major concern today. Isolated responses to one environmental problem may in fact worsen another. For example, catalytic converters on cars decrease nitric oxide emissions and help to reduce acid rain and urban smog but they release higher levels of nitrous oxide, which is a potent greenhouse gas and contributor to stratospheric ozone depletion. Therefore the environmental issues relating to fuel use need to be addressed comprehensively.

Comparing data obtained between 1987 and 1997, it was observed that the average air pollution output in terms of particulate matter (PM), nitrogen oxides (NO_x), sulfur dioxide (SO_2), and carbon dioxide (CO_2) has generally increased in the study countries. Over this period, increase in PM NO_x and SO_2 emissions were highest in Sri Lanka at about 8%, 14% and 6% respectively while increase in CO_2 emissions was highest in Vietnam at about 11%. These are the criteria pollutants used for analysis because of their serious implications to the environment: CO_2 is an indicator for greenhouse gases, SO_2 is a source for acid rain, NO_x is a source for creating "smog", and PM (<10 micron) is a source of carriers of absorbed chemicals. All these are pollutants directly generated from energy consumption.

The Asia Pacific region has experienced significant atmospheric pollution, resulting from the heavy use of coal and high sulfur



Average annual pollution growth rates during 1987 - 1997 (base year 1987) of study countries.

fuels, biomass consumption and forest fires. In Asia, emissions of criteria pollutants are a major growing problem. For example, if current trends continue, emissions of sulfur dioxide from coal burning in Asia will surpass emissions from North America and Europe. Some impacts have already been identified. According to World Bank, China's overall annual forest and crop losses due to acid rain is estimated at US$500 million. Many monitoring sites have recorded high annual sulfur dioxide depositions and winter rain acidity in Japan and Republic of Korea (UNEP, Global Environmental Out look, 1999). Despite the global and regional effects, local air pollution is an important issue where local heath will be seriously affected.

Therefore the global, regional and local effects of fuels have to be realized for these countries to respond to the national future energy demand and the global and local environmental pressures. Prioritising the objectives and streamlining the sectors, sub-sectors and grassroots level should be a major concern of policy formulation in these individual countries.

Different fuels pollute at different levels. Hence any change in energy mix has a direct impact on the pollution levels. Projection of emission scenarios for criteria pollutants used in this report is based on emission factors developed by IPCC and USEPA using the energy consumption patterns and compositional changes discussed earlier. Indirect emissions from electricity generation are also included in the inventory.

Based on the consumption data and projected emissions from each energy source, compositional changes in 1987 and 1997 for criteria pollutants were quantified for each study country. In China and Vietnam, highest contribution to all criteria pollutant comes from coal although there was a decreasing trend over the decade. In India, biomass and coal both account for a major portion of all pollutants. In Sri Lanka, industrial sector pollution is mainly due to biomass and oil consumption. In the Philippines, most of the criteria pollutants were contributed from biomass.

Data shows that a larger portion of the energy requirement of these countries still comes from coal and that has a potential for causing acid rains. Biomass also accounts for a large portion of particulate matter and sulfur dioxide. Considering the non-commercial use of biomass in other sectors, the effect could be much higher. High particulate matter and NO_x can cause detrimental health effects locally. Renewable energy use is less in all countries. Therefore, promotion of renewable energy should be a major focus in formulating national policies.

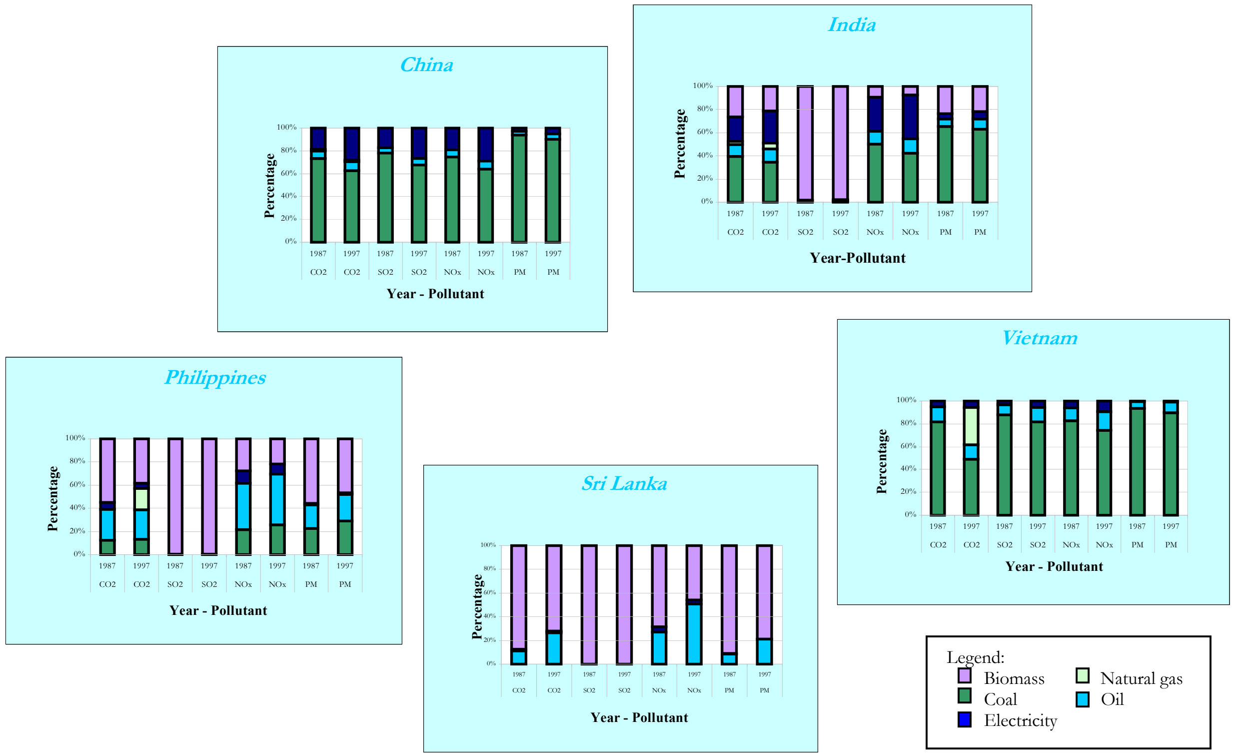
A Cross-Country Comparison

Economic Growth, Industrial Growth and Energy Use

The relationship between economic growth and commercial energy demand is quite complex and is beyond the scope of this report. However, this section attempts to relate the three components, GDP growth, manufacturing sector growth and manufacturing sector energy demand based on available data.

The study countries are at varying degrees and stages in the development process. Industrial sector dominance in the economy compared to other sectors is what is common to all. The per capita GDP is highest in China at US$ 780 then India at US$ 450. Sri Lanka and Vietnam has US$ 820 and US$ 370 per capita GNP respectively (ADB, 2000). In accordance with the per capita GNP, all these countries are in the category of low to lower middle-income countries.

Economic growth and energy consumption have direct and indirect relationships but that cannot be deduced easily. However some empirical estimates permit further analysis of the issue relating economic development, energy consumption and environment. Several studies have attempted to determine the changes in the structure of



Compositional Change for Criteria Pollutants from Industrial Energy Consumption by Source in Study Countries

production and consumption that occur as economic development progresses in determining growth of energy demand. It was found that at the early stages of a country's development, there is a high importance given to industry and there is high energy consumption by the industrial sector. Therefore developing country energy consumption is expected to increase at a higher rate with increase of per capita income irrespective of technological improvements (Kuznets, 1971; Chnery and Syrqin, 1975; Kenneth et al, 2001). This implies that China and India will become increasingly important in world energy markets since they are expected to be higher energy consumers. Nevertheless, in all the study countries there will be an increasing domestic need for energy resources.

China and India are large coal producers in the world. Since coal is considered an environmentally undesirable fuel, it is foreseen that international pressure will be exerted on these countries as they use coal to meet increasing domestic energy demand. Substitution of coal by oil will also be a crucial issue because even oil is considered environmentally undesirable and subjected to price instabilities. Therefore domestic policies will become increasingly important in determining future energy demand from conventional sources. Accordingly, in most countries there may be increasing pressure to institute policies to secure stable flow of 'cleaner' energy resources, such as natural gas (Kenneth et al, 2001).

In this context, the trends and achievements of each study country may be assessed. Comparison of manufacturing sector contribution to economic growth, and energy consumption with respect to sector contribution to economy shows that:

❖ China has the highest annual GDP growth compared to other study countries and the contribution by the manufacturing sector is significantly high (14.7%). The manufacturing sector annual energy consumption growth rate (1.3%) is very much less as compared to the contribution to economic growth.

❖ In India, the manufacturing sector contribution is significantly high where manufacturing sector contributes by 8%,

Study Country	Economic growth rate	Manufacturing sector growth rate	Manufacturing sector energy consumption
China	11.2%	14.7%	1.3%
India	6.1%	8%	5.8%
Philippines	3.3%	3.1%	14%
Sri Lanka	5.3%	8.5%	11%
Vietnam	8.4%	5%	19.9%

Annual economic growth rate, manufacturing sector growth rate, and manufacturing sector energy consumption of study countries may be related to indicate level of efficiency in industrial energy use.

while economy is growing at 6.1% annually. There has been a high annual increase in energy consumption (5.8%) in the manufacturing sector, almost equal to the annual economic growth (6%).

❖ In Vietnam, Philippines, and Sri Lanka the manufacturing sector annual energy consumption is almost double the annual economic growth. In Sri Lanka, the manufacturing sector contribution is significantly high (8.5%) compared to the annual growth of the economy (5.3%) and, the energy consumption by the manufacturing sector has also grown annually by 11%.

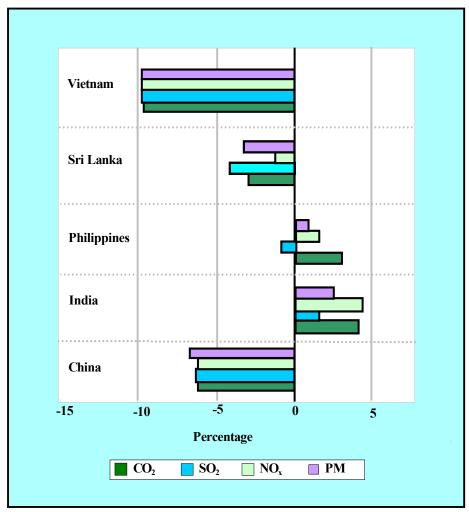
Considering the manufacturing sector performance compared to the economic growth, China seems to have made significant improvements in manufacturing sector energy efficiency. This could be a reflection of the nature of related policies and effective implementation of such.

As observed in the previous section China, India and Vietnam have reduced their coal use during 1987-1997, a trend which is more desirable in the environmental perspective. Yet substitution of coal by renewable sources has not been dealt with adequately. The adoption of conservation policies and encouragement of technological innovations for energy efficiency has considerable gains to all these countries in fulfilling future energy demand. The SMI sector should especially be encouraged to use renewable sources of energy.

Specific Impacts of the SMI Sector on Energy and Environment

As far as the SMI sector is concerned, its environmental impact on the local level is much higher, held responsible for significant levels of air, water and toxic pollutants, solid waste generation and damage to local ecosystems. Although they are not the major polluters in most sub-sectors, the specific pollution loads are often higher than large firms operating in the same sub-sector.

Both resource use efficiency (including energy) and local pollution have to be simultaneously factored in when formulating policies for the SMI sector. The percentage change of criteria pollutants compared to the industry



Annual change in total emissions per billion US$ GDP contribution by industrial sector (1987-1997)

sector GDP contribution during 1987–1997 shows that among the study countries, Vietnam, Sri Lanka and China had negative values, implying that emissions per GDP contribution by the industrial sector have decreased over this decade. Such improvements could again be indicative of the nature of the policies adopted by these countries.

Energy use pattern and potential environmental impacts due to various pollutants in selected SMI sub-sectors have been studied and cross-country comparisons were made on them. Sub-sectors like textile, tea, foundry and brick industries have been targeted here since they generally dominate the whole SMI sector.

From the following tables, it can be concluded that the emission from the SMI sector cannot be neglected at all. Though emissions from individual SMI are small, the fact that collective contribution is significant only means that the SMI sector could have a predominant effect in modifying the local environment and its micro-climatic condition. Hence any energy and environment policy or plan should also address SMI specifically and SMI sub-sectors should be addressed according to their importance in the economy, energy consumption, and contribution to local pollution.

Country	**Total Energy Consumption**	**Energy Source**	**Emissions**	**Specific Energy Consumption***
China	$2.1\ 10^6$ TJ (14% of total industrial consumption)	Coal 36% Fuel Oil 4% Electricity 60%	332 Mt of CO_2 (22% of industrial emissions) 4.4 Mt of SO_X (<21% of industrial emissions)	81.4 MJ/m^2
India	$3.72\ 10^5$ TJ (8% of total industrial consumption)	Coal 14% Fuel Oil 7% Electricity 79%	69Mt of CO_2 (14% of industrial emissions) 1 Mt of SO_X (<1% of industrial emissions)	12.17 MJ/m^2
Vietnam	27,169 TJ (8% of total industrial consumption)	Coal 22% Fuel Oil 21% Electricity 57%	1386 kt of CO_2 (6% of industrial emissions) 17kt of SO_X (8% of industrial emissions)	NA

Source: *(Murugan, 2000)*
*Basis: Fabric produced (UN, 1999) per year divided by the total energy consumption by the sector; NA – no available data

Cross Country Comparison of Energy Consumption and Emissions in the Textile Industry

Country	**Total Energy Consumption**	**Energy Source**	**Emissions**	**Specific Energy Consumption**
India	5.6TWh (6% of agricultural sector; <1% of total industrial consumption)	Coal 20% Fuel Oil 19% Biomass 61% (Natural Gas is used only in the northeast areas)	1.8 Mt of CO_2 (0.75% of industrial emissions) 14.17 kt of SO_X (0.41% of industrial emissions)	Electrical: 0.58 kWh/kg of tea made Thermal: 4.38 kWh/kg of tea made
Sri Lanka	2 TWh (28% of agricultural sector; <10% of total industrial consumption)	Firewood 80% Fuel oil 12% Electricity 15-20%	527 kt of CO_2 (22% of industrial emissions) 3.64 kt of SO_X (<1% of industrial emissions)	Electrical: 0.48 kWh/kg of tea made Thermal: 5.28 kWh/kg of tea made
Vietnam	0.3 TWh (6% of agricultural sector; <1.5% of total industrial consumption)	Coal 80% Electricity 20%	203 kt of CO_2 (2% of industrial emissions) 0.69 kt of SO_X (0.5% of industrial emissions)	Electrical: 0.50 kWh/kg of tea made Thermal: 12.2 kWh/kg of tea made

Source: (Ratnakumara, 2000)

Cross Country Comparison of Energy Consumption and Emissions in the Tea Industry

Country	Total Energy Consumption	Energy Source	Emissions	Specific Energy Consumption
China	20.5 10^6 TJ (44% of total industrial consumption)	NA	Dust: 0.55 Mt Waste gases: 11 billion m^3 CO_2 : 19.8 Mt (1% of total industrial emissions)	Backward : 0.76 tce/t of casting General: 0.56 tce/t of casting Advanced: 0.49 tce/t of casting
India	88.1 10^4 TJ (20% of total industrial consumption)		Dust: 0.06 Mt Waste gases: 11 billion m^3 CO_2 : 1 Mt (<0.5% of total industrial emissions)	0.862 tce/t of casting
Philippines	NA	NA	NA	0.1352 tce/t of casting

Source: (Sizen, 2000)
NA : Data not available

Cross Country Comparison of Energy Consumption and Emissions in the Foundry Industry

Country	Energy Source	Emissions (t/million bricks)	Specific Energy Consumption (MJ/million bricks)
China	Coal 80% Electricity 20%	Traditional: CO_2 110 – 115 SO_2 5 – 6 Semi Mechanized: CO_2 37 – 63 SO_2 1.6 – 2.7 Fully Mechanized: CO_2 80 SO_2 3.5	Traditional 4.5 – 5.6 Semi Mechanized 2.7 – 3.6 Fully Mechanized 2.9 – 3.6
India	Firewood 1% Coal 99%	CO_2 165 – 825	Traditional 6.5 – 24.5 Semi Mechanised 3.3 – 9 Fully Mechanised 3.3 – 4.5
Sri Lanka	Biomass 100%	Traditional: CO_2 400 SO_2 0.5	Traditional 12 – 13.5
Vietnam	Coal 90% Electricity 10%	Mechanized: CO_2 90 SO_2 3	Traditional 13.5 – 21.5 Semi Mechanised: 9 – 14.5 Fully Mechanised: 4.5 – 5.6

Cross Country Comparison of Energy Consumption and Emissions in the Brick Industry

Chapter 4: POLICY INSTRUMENTS TO PROMOTE E3ST IN THE SMI SECTOR

This chapter identifies the barriers that industries face in adopting E3ST, suggests strategies and policy instruments governments can implement to promote such technologies especially in the SMI sector, and describes some success stories of E3ST adoption in the study countries.

Rationale for Policy Intervention

Management of energy and environment by the governments are carried out through policies or regulations. But in most countries, the issues of energy and environment are dealt with separately and by different departments of the government. Some national energy policies predominantly deal with the supply side management rather than conservation at the end-user level. For each country, the ultimate objective of an integrated energy and environmental planning is to arrive at a set of agreed feasible and consistent targets for policy intervention.

To support the growth of the SMI sector, governments need to provide reliable and cost effective energy. Opportunities exist for governments to link the economic policies with the energy and environmental policies among industries to reduce or minimize the burden of developing new infrastructure. One such emerging area for sustainable development is through the adoption of energy efficient and environmentally sound technological options. Though large industries have readily shifted to modern technologies for energy efficiency and pollution prevention, and have benefited financially from conserving energy and minimizing waste, the SMI for some reasons, is still reluctant to follow suit. Therefore, there is a need to address this gap at the policy level by formulating strategies and instruments to promote E3ST in the SMI sector.

Benefits of E3ST

There are many ways by which energy can be conserved and adopting E3ST is one strategic way of achieving the dual goal of energy conservation and emission prevention. While obtaining the desired output, the use of E3ST facilitates more efficient use of energy resources, improves eco-efficiency, and preserves the environment as a whole. In other words, by opting to implement E3ST over traditional technologies, industries achieve a net saving in the energy input, and also a reduction of greenhouse gas emissions. It is not only beneficial to individual end users but the positive impacts could be translated to a bigger scale as savings in the production of energy and reduction in emissions on the national and even the global level.

E3ST SUCCESS STORY IN AN INDIAN TEA FACTORY

Drying is the most energy intensive operation in black tea production. In many factories, three-stage conventional dryers are used for drying. Fluidized bed driers are more energy efficient than conventional dryers. This new dryer provides a lower drying temperature that ensures gradual removal of moisture and uniform drying of tea – from the surface as well as from the core. Due to savings in fuel and waste reduction, industries benefit economically. Due to higher efficiency than conventional driers, fuel is saved and hence emissions are also reduced.

Background

Specific Product:	Black tea
E3ST Adopted:	Replacement of conventional tray dryer with fluidized bed dryer
Implementing Industry:	Karodaiya Tea Industry, Batalada, Konavakorai P.O.Nilgiris, Tamil Nadu, India.
Rate of Production:	3,000 kg of made tea per day

Technical data

Rated capacity of dryer: 300 kg of made tea per hour

	Before	**After**
Electricity consumption (kWh per year)	138,528	52,416
Coal consumption (tons per year)	786	674
Processing time (minutes)	23	15
Solid wastes (in % of made tea)	3 to 4	<2

Category of E3ST

- Process Automation
- Process equipment improvement
- Improved energy efficiency
- Waste reduction and pollution control

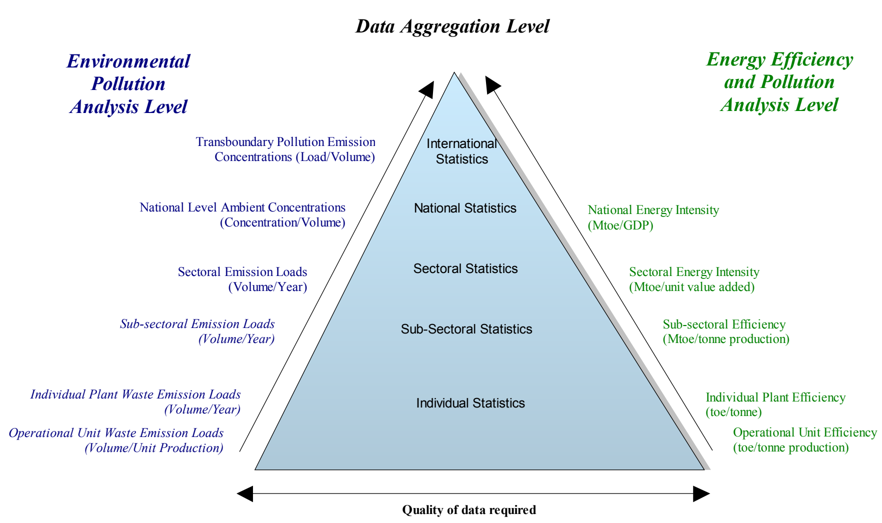
Energy, Environment and Economic Benefits

Reduction in Electricity consumption:	86,112 kWh per year
Reduction in coal use:	112 tons per year
Simple payback period	3 years
Reduction in CO_2 emission	373 t of CO_2 per year

(Source: SMI Newsletter, 2001)

Energy and Environmental Efficiency Indicators

Energy and environmental efficiency indicators measure 'how well' the energy is used or 'how bad' the sector has performed. These indicators are important elements in developing correct policy interventions and to measure the impact of implementation. At the industry level, it allows to determine the position of the industry with reference to the energy consumption and pollution status and helps to appraise new technologies. Indicators could be generated at many different levels, each of which can be used to answer specific or general questions related to energy efficiency and environmental pollution issues. The broad variety of energy and environmental pollution indicators that can be utilized for analysis may be illustrated using a pyramid with different levels of data aggregation starting from individual statistics becoming larger in scope, to sub-sectoral, sectoral, national and up to international statistics. There are appropriate indicators corresponding to data aggregation level that can be utilised in planning and policy decision making for any kind of industry for that matter.



Source: Modified from (APERC, 2000)

Environmental Pollution and Energy Efficiency Indicator Pyramid

Barriers in Promoting E3ST

Unlike industries in developed countries, employing techniques for energy efficiency and pollution prevention has not been widely pursued in the developing countries, especially by the SMI sector. The barriers faced in adopting E3ST in the Asian context are discussed below.

Lack of Awareness, Education and Training

The owners/managers of SMI are commonly less motivated and interested to collect information on E3ST, whom to contact, where to get the required financial and technical help, government policy and initiatives on E3ST, etc. Detailed technical and information on E3ST in the form of Technology Fact Sheets (TFS), if developed and made available to potential users for the various industries would help in overcoming this important barrier. UNEP-NIEM-AIT have prepared and disseminated TFS for the pulp and paper industry giving information on the type of E3ST, financial benefits, environmental advantages as well as examples of its successful application (Visvanathan and Svenningsen, 1999).

A survey (Dasgupta, 1998) of small firms in Delhi, India, threatened with closure for non-compliance on pollution, showed that most owners relied on family or friends for advice on technological and process changes. This knowledge base is now outdated and unable to deal with the new technologies required for energy conservation and environmental compliance. Since many owners of SMI have little or no formal education and training, they fail to appreciate the limitations and maintenance requirements of E3ST equipment, a situation that could easily lead to equipment malfunction

Most SMI only have confidence in their own production technologies and do not believe in investing on E3ST as they do not want to take any risk on something not familiar to them. Also, industries do not like disclosing their energy audit reports fearing misuse of data that could damage company image. This conservative outlook impedes the increase in level of awareness and prevents healthy sharing of information among those involved in the SMI sector.

Financial and Economic Factors

SMI generally do not have sufficient capital for investing in efforts towards energy efficiency and pollution prevention. Though most energy efficiency activities require low investments, they do not generate a separate revenue stream that could help industries pay-off ensuing loans from financing institutions. For most SMI, short-term profits are usually preferred over long-term gains. This makes it difficult to sell the 'business' argument that greater efficiency and higher material recovery leads to improved profits in the long run. Township and village enterprises (TVE) in China do not have access to capital because, until recently, only two banks were allowed to have branches in rural areas, while lending was also difficult due to lack of suitable procedures and securities for loans (Worrell et al., 2001). Lack of finances also results in purchase of inferior technology or second-hand, low quality and inefficient devices or equipment.

Energy efficiency and environment protection have a low priority as compared to expansion for SMI even though the project viability may look sound. Though interest free or low interest loans, subsidies, tax holidays and duty exemptions are available in many cases, such financial incentives are generally seen by SMI as not worth the risk.

Uncertainty of energy prices, especially in the short term, often lead to higher perceived risks, and therefore to more stringent investment criteria and hence offer a higher hurdle rate in adopting energy efficient technologies. Due to the 'scale of economies' advantage for the large industry, SMI is forced to adopt inferior technology so that the end product price can be competitive. These technologies are energy inefficient and pollute more. Hence, fuel prices and irrational market response due to economic and socio-economic factors, make the SMI not respond favorably to E3ST use.

Lack of Coordination and Slackness in Implementation

Coordination among various agencies and departments is important in implementing policies on E3ST. The lack of it may lead to haphazard solutions. In the case of acid processing firms in Calcutta, India (Dasgupta, 1998), inefficient operations resulted in indoor and outdoor pollution. Due to lack of coordination between energy and environment departments, the proposed solution of constructing a central effluent treatment plant may not be beneficial since the solution did not address the main source of pollution which is inefficiency in process flow, work practices and poor knowledge of health and safety.

Lack of Integration at Policy Formulation

Various authorities or departments deal with management of energy and environmental issues separately, though the win-win possibilities of integrating them together are available, like in the case of E3ST. By and large, E3ST has not been recognized as an effective means of achieving energy and environment conservation goals at the policy level. Active collaboration between government and private industry is also important to find a collective solution. Consensus building will foster an atmosphere where technical and market information are made easily available to industries while encouraging them to adhere to government standards based on agreed timetables. This link is not found very often in these countries.

There is also a general slackness in implementing energy and environmental laws due to various factors. Lack of manpower, budget outlay of the agencies, external interventions, lack of facilities and information, and also due to delay arising from long legal processes, compound this situation. The lack of standards and labelling for industrial equipment and devices coupled with the limited knowledge of decision makers lead SMI to choices that are often technically inferior and many times do not offer comprehensive solutions.

Unfavorable Energy Pricing

The allocation of costs among consumers according to the burden they impose on the system has not been considered in energy pricing policies of the study countries. The equity issue has become dominant in the pricing policies and this creates disincentives in achieving energy efficiency in all segments. This is one of the barriers for innovative adaptations of E3ST, especially for SMI that have little capital. The environmental cost of energy generation has not been included in energy prices and still is a negative externality for these countries. This results in unfavorable responses to E3ST and deters industries from switching to cleaner fuels. Due to government regulated weak energy supply sources, most of these countries do not have a necessary customer information base to predict results of end use efficiency improvements (Munasinghe, 2001).

Lack of Research and Development

Generally, existing E3ST are affordable and most suitable for larger industries. Researches based on the short-term needs of the SMI sector are still lacking. Networks have not been developed to communicate research results in most of the cases. Majority of the research being carried out are focused on the technical aspects and applicability in terms of costs and revenues, which is not sufficient for SMI. Collaborative research among industries is very little.

Lack of Infrastructure

Space is an important constraint faced by SMI since many of them are located in thickly populated semi-urban areas. It is difficult for them to acquire additional space required to install new equipment or modify existing equipment (Tikkoo, 1992).

Other barriers include the 'invisibility' of energy efficiency and pollution mitigation measures and the difficulty of demonstrating and quantifying their impacts (Worrell et al., 2001).

Policy framework for E3ST

The first element in any framework is to set priorities. Priorities are based on collection and analysis of data including valuation of the various types of interventions. In this case, valuation of social costs and benefits was difficult due to the kind of available data and methodologies used. As observed in the study countries, there has been a great difficulty in obtaining data regarding SMI, its energy use and pollution generation.

The second element in the policy framework is to design cost-effective policy instruments that minimize costs, economize on scarce administrative skills, and are broadly acceptable to society. Policies used to improve sustainability can be clustered into three distinct but complementary groups: market based policies, which use pricing, taxes or marketable permits, etc. to modify behavior; regulatory or administrative policies that impose quantitative restrictions, enforce property rights, standards and screen investments, etc; and extra regulatory approaches to pollution control such as introduction of public disclosure requirements and increased use of the court system (World Bank Discussion Papers, 1994).

Market-based policies

The most important type of market-based policy reform is pricing reform. Full cost pricing (removing subsidies, internalising externalities) is fundamental in reducing the consumption of resources in all sectors. Full cost pricing of energy inputs and electricity will stimulate higher supply-side efficiencies, modernization of equipment, demand-side conservation, and capital flow from the private sector. Such reforms could stimulate investments in clean and renewable energy resources, particularly in rural areas that remain off the national grid. This may have a positive effect on SMI fuel mix.

Market-based approach to industrial pollution should be based more on experience than theory. Pollution charges, permits, financial subsidies, lower customer duties, etc. are widely used economic instruments.

Command and Control and other regulatory policies

This includes regulatory, legal and administrative reforms. In natural resources and energy conservation, widely used command and control methods include public effort to promote better adaptation of technologies through dissemination of information, applied research, improved extension, standards setting, tighter zoning, upgrading of technologies and fuel, etc. are.

Extra regulatory policies

This is low cost and requires relatively less government involvement and increased local participation. The introduction of this system is not significant in Asia. No community rights have been formalized in study countries.

Policy Options and Strategies to Promote E3ST in SMI

Governments and industries consider various management strategies to promote energy conservation and environment protection, either through policies or regulations. The various measures that could be undertaken to maximize energy efficiency and thereby minimize emissions pertaining to SMI are presented below.

EXAMPLE OF PREVENTIVE COST

It is estimated that through technological and managerial means (like peak load pricing), the industrial sector alone can reduce the need for additional power generation capacity by up to 3000 MW in the State of Maharashtra, India over the next 20 years. Considering the whole of India, this reduction in additional demand is projected to be 15,000 MW. At an average cost of Rs 3,300/kW, this makes up one-tenth of what is required for new capacity addition, ranging around Rs 35,000/kW at present. This would also result in preventing CO_2 emission by a maximum of 6.3 Mt/year assuming that the increase in demand is generated year round using coal.

(Source: Parikh, et al., 1997)

Action by Government and National Bodies

Unlike developed countries, developing country economies are highly dynamic. Therefore they promote both prevention and conservation through policy interventions. Promotion of prevention strategies rather than conservation in these counties are desirable since they could reduce enormous cost of conservation. Conservation involves retrofitting an existing technology or process to meet the requirements of a law or policy. For a new industry, clear preventive measures or guidelines would allow them to select the right technology to meet the norms thereby reducing the cost at the initial stage itself. Governments should promote guidelines of preventive strategies for new and proposed industries and conservation options for existing industries.

Under China's Energy Conservation Law adopted by Standing Committee of National People's Congress on 1st November 1997 and the Mega Power Policy of India, all new energy intensive industries need to obtain an environ-mental clearance before they are put up as a preventive measure. Provisions are made under the same Chinese law to penalize industries that consume excess energy and pollute more, as a conservation measure in existing industries. A similar law is being proposed in India under the Energy Conservation Bill 2000. However, similar policies have not been formulated in Sri Lanka, Vietnam or Philippines.

Use of Cleaner Production Technologies

Cleaner production (CP) or waste minimisation has become the corner stone for industrial pollution management in many countries. Unlike environmental regulations that compel the industry to meet the emission standards, cleaner production programs are voluntary for industries in most countries. A CP program begins with a waste audit in the production facility and identifies areas or processes where the industry could reduce waste, improve productivity and save costs.

CLEANER PRODUCTION SUCCESS STORY

The Department of Science, Technology and Environment, Vietnam (DOSTE), assisted by the United Nations Industrial Development Organisation and the Swedish International Development Cooperation Agency (Sida), implemented a Cleaner Production Demonstration Program in Ho Chi Minh City, Vietnam during 1995-1997. A summary of the results achieved by demonstration projects in five selected food, paper and textile processing facilities are:

Total investment:	US$ 242,000
Total savings:	US$ 962,700/year
Average pay back period:	3 months
Average wastewater reduced:	40%
Average organic load reduced:	30%
Average reduction in gaseous emission:	> 50%
Average reduction in solid waste:	30%

(Source: SMI Newsletter, 2000)

Energy audits are conducted as the first step in implementing Demand Side Management (DSM) programs to reduce power consumption. Energy audit programs estimate the energy consumption and efficiency of energy conversion in each process in an industry and outlines possible areas for intervention. Energy conservation laws of China compel the target industries to perform an energy audit before implementing any energy conservation project. These reports also help the industry to obtain any financial assistance that is provided by the government as a promotional incentive. DSM programs involve planning, implementation, and monitoring of utility activities designed to influence use of electricity by the consumer in ways that will produce desired changes in a utility's load shape (Swisher, et al., 1997).

Preliminary energy audits could lead to solutions that can be as simple as insulating hot and cold pipes, sealing air leaks, tune-up of boiler, etc. which normally results in 10-15% improvement in efficiency with little or no investment. Experience shows that just simple improvements in housekeeping could reduce pollution by more than 30-40%. Hence, SMI that are generally strapped for money can also implement E3ST with little or no capital investment.

LOW INVESTMENT, QUICK RETURNS

Study Country: ***India***

Program: Replacement of conventional motors with energy efficient motors in ring frames in spinning

Outcome:

- Investment: US $575
- Savings: US $426 per annum
- Payback period: 16 months

Study Country: ***Sri Lanka***

Program: Providing ceramic wool insulation to prevent heat loss in a biomass fired kiln in roof tile industry.

Outcome:

- Investment: US $1400
- Savings: US $ 1110 per annum, 50% savings on firewood and 50% reduction on dust & emissions
- Payback period: 15 months

Choice of Energy Mix

The type of energy source used by SMI is dictated by availability, price, reliability and convenience of use and not much on environmental considerations. Natural gas offers the lowest emission and coal combustion is the most polluting. However, deciding on the type of fuel for use in a typical application depends not only on end use efficiency or emissions, but also on whether it benefits or minimizes the cost of production as well as cost of treatment of emissions. Policies that target the promotion of E3ST could help the shift from polluting energy source to more efficient ones or the use of renewable energy, such as solar or biomass resources. For example, in Sri Lanka, due to increased price and scarcity of biomass, traditional industries are shifting from use of biomass for energy to fuel oil.

Promotion of renewable sources of energy like biomass, solar, wind and micro/mini hydro are also suited for small industrial sectors due to the current interest in pollution reduction. Solar/Biomass/Biogas based hot air or water can be used as process heat for direct utilization or to supplement the use of fossil fuels (preheating) in most SMI where process temperature requirements are low to moderate. Fuel wood can be made available on a sustainable basis through firewood plantations. Some governments offer incentives to promote use of renewable energy sources in the form of capital and interest subsidy, soft loans, etc. However, economically efficient pricing policies for the electric power sector and the incorporation of environmental externalities in the price structure are especially important in this context to create good incentives for economically efficient and environmentally sound fuel switching.

USE OF RENEWABLE SOURCES OF ENERGY IN SMI

Case 1: Mini hydro in Tea Industry in Sri Lanka

Mooloya Tea Factory is situated in the hill areas of the island. The factory constructed a mini-hydro plant to minimise their energy bills with assistance from the Industrial Services Bureau, Kurunegala, Sri Lanka. The plant could meet 80% of the total demand and operate for 9 months of the year. The average reduction in monthly consumption from grid was 55%.

Investment:	Rs 2 million (~US$ 25,000)
Total Savings:	Rs: 564,000 (~US$ 7,200/year)
Payback period:	3.5 years
Reduction in average Energy Cost:	37%

(Source: Industrial Services Bureau, Kurunegala, Sri Lanka)

Case 2: Solar energy in Tea Industry in India

A tea factory situated near Coonoor, India produces 0.75 million kg of orthodox tea per year using 239 tons of coal to meet its thermal energy requirements. The south facing roof of the factory was converted into solar air heater to supply pre-heated air to the furnace, thereby reducing the coal requirement and resulting in significant savings in energy and reduced pollution. The goverment of India offered a subsidy of about 30% of capital cost and 100% cost of the unit was depreciated in the first year. The payback period was less than 2 years.

(Source: Palaniappan and Subramanian, 1998)

Pollution Prevention based on Fuel Source or Pollutant

Policy intervention could be towards reduction or conservation of a particular energy source or a resultant pollutant. For example, China produces nearly 100% of the total coal requirement and imports less than 1% of its oil requirement. On the other hand, Sri Lanka imports nearly 100% of its oil requirement but 100% of the fuel wood requirement is met locally. Nearly 85–95% of the power production is from hydro resources. However, since the hydro potential is exploited to its capacity (80%), Sri Lanka is planning to build fossil-fuel based power plants to meet the demand. This will not only have an adverse impact on the environment but will also result in draining of foreign exchange by import of fuel. Increased cost of production of power due to shifting from hydro to thermal will have a trickling effect on the consumer also. This is a typical case where policies and strategies should focus on conservation or prevention of use of electricity and oil. Exploiting more of biomass resources may result in deforestation which will have an adverse effect on the ecosystem.

Similarly, policy measures could be based on any of the criteria pollutants. International pressure is presently focused on reduction of GHG emissions on a global level but on a local scenario, even formation of smog/smoke could be a priority issue for an area or region. Mostly, SMI are situated near to each other or in industrial estates and may thus create high local pollution as a cluster (Narayanaswamy and Scott, 2001).

SMI CLUSTERS AND LOCAL POLLUTION

Policy Intervention to Prevent Local Pollution

Agra, India is a city populated by glass industries using coal-fired furnaces, creating air pollution. Preserving monuments is also under the Environment Protection Act. Hence, the Pollution Control Board ordered closure of all SMI with inefficient coal furnaces and shifted them outside the city to save the Taj Mahal from marble corrosion.

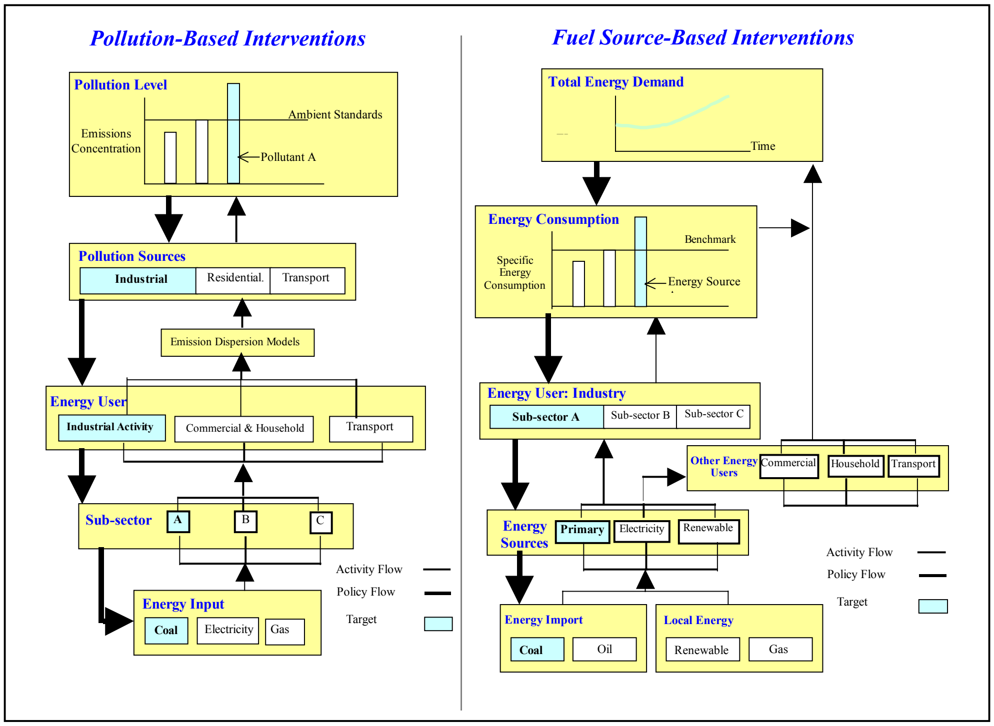
Legal Intervention to Clean-up Pollution

Tirupur, India has more than 4000 hosiery SMI. Out of 1800 tons of dyes consumed annually, 500 tons are released into wastewater streams. Only 464 SMI have treatment facilities and the others discharge effluents into municipal sewers. This has polluted a nearby dam that has become unsuitable for irrigation due to direct discharge of untreated effluents. Nearby surface water sources, tube wells and borewells at a depth of 90-150 m are also contaminated with chemical pollutants released by SMI. Based on complaints, the State High Court has ordered all the hosiery units to clean up the dam

(Source: Narayanaswamy and Scott, 2001)

Therefore, it is important to carefully assess which issue should be addressed first: local pollution or the global pressure on the use of certain fuels. In many countries, when the governmental mechanisms fail to address the problems correctly and in time, legal authorities intervene and provide a solution However, this happens on rare occasions and most such interventions take time.

In this regard, there are two models that could be adopted to identify the target for intervention in the SMI sector. Under pollutant-based intervention, the criteria pollutants which are above the norms, are



Models for policy intervention by identifying the target, which could either be pollutant or fuel source-based

identified and the sectors and sub-sectors that emit them are also identified. They are later associated with the specific fuel used in the sub-sector. A policy to reduce the specific pollutant is framed and targeted to the specific sub-sector. In the case of energy-based intervention, industrial activities whose specific energy consumption are higher than the benchmarked values are identified and associated with specific sub-sector activities and fuel mix. The policy could is framed based on the specific energy consumption to force the sub-sectors to use efficient technologies which results in reduced total energy consumption for the same industrial output.

Compulsion and Compliance

Sanctions based strategies ('command and control') aim to enforce regulations by compulsion and coercion, with a penal approach in dealing with deviant activity. An extreme example is the judicial order to close down industries. Successful implementation of this approach requires intensive monitoring to ensure that the standards are being met. In the event of non-compliance, the offender is penalized, which means there must be a comprehensive body of law to enforce it. Thus, monitoring requires resources and imposing penalties require legislation. The present structure of enforcement of policies in Asian developing countries is not firm and legal processes take a very long time. However, in a compliance-based approach, detection of deviant activity is the first step towards prevention, rather than prosecution. The industry and government agencies work together to reduce pollution. Compliance based strategies allow a flexible and participatory approach that can address needs at the sub-sectoral level. Further, SMI sector may not be able to absorb the impact of sanctions, which may even lead to closure of the SMI. Since SMI are the major source of employment potential, compliance based approach will be a better choice for dealing with SMI.

COMPLIANCE BASED POLICY ENFORCEMENT

In Bangkok, the Bang Kutien Experiment targets chemical units producing hazardous waste. The effluent likely to be produced in each SMI is estimated and agreed with the owner. The owner of each unit is then expected to ensure delivery of the waste to a central processing plant, within an agreed time frame. There is no charge for processing the waste, but heavy penalties are imposed for failure to deliver. (Source: Kritiporn, 1990)

In a similar programme in Hong Kong, 8000 small and micro units participated in a programme that requires the units to safely store liquid waste which are then collected free of charge. (Source: Lei and Yang, 1993)

Noting that more than 70% of all industrial establishments belong to the SMI sector and that they are old and traditional in nature, it may not be cost-effective to target for compliance. Promotion of preventive techniques and E3ST for new SMI by providing guidelines and specifying standards for energy usage could avoid the costs of retrofitting. Incentives could be offered to existing industries to motivate them to adapt conservation techniques.

Polluter Pays Principle

The development and deployment of E3ST in industries should also consider the application of Polluter Pays Principle. In the industrial context, initial payments to preserve and protect the environment come from the producer, but the real costs are shared between producers and their customers to some proportion. This policy is accepted in India, the Philippines, Sri Lanka and Vietnam. An Environment User Fee was collected in the Philippines since 1997 from industries which pollute within the standard limits and a six times higher fee was collected if they exceeded the limits, apart from the usual fines and penalties (PEM, 2000). However, in some countries like Vietnam where the costs are low, this regulation could not be implemented effectively.

AN ENERGY EFFICIENCY LOAN SCHEME

Pollution Control and Abatement Fund (PCAF) is a 5 million US$ fund established in 1995 in Sri Lanka to provide financial assistance to financially viable industrial enterprises towards waste minimisation, resource recovery, pollution control and abatement. The scheme had two components (a) Technical Assistance and (b) Credit Component. The loan could be obtained from any of the six participating credit institutions. Loan disbursement is effected only after obtaining the Environmental Protection Licence.

Under the Technical Assistance component, reimbursement up to 75% of cost towards cost of consultancy services for the investigation of waste minimization, preparation of designs, selection, supervision, installation and operation of the equipment is effected. Under the Credit Component, finance up to a maximum amount of US$ 128,000 per industry at zero real rate of interest is provided. Maximum repayment period will be 7 years including a maximum of one year of grace period. Security needed for the loan is a mortgage over the project assets. For projects that involve investment for modernization entailing a financial return in addition to the desired environmental effects, a loan amount of 50% of such costs would be provided and for all other cases it could be 100%. This loan could be used for purchase of equipment or phasing out of hazardous substances. Over 75 industries have benefited from this scheme.

(Source: PCAF promotional brochure, National Development Bank, Sri Lanka)

Financial Incentives

'Carrot and stick' approach is very much suitable in making industries adapt to energy conservation and/or pollution prevention techniques. Conservation policies provide some form of incentives to the existing industries or soft loans to motivate them to adapt efficient and clean technologies. Long term, low interest funding from International institutions like World Bank and GEF can be utilized by countries to establish a separate dedicated financial institution with equity participation from the Government to address E3ST financial issues. Among other study countries, China, India, the Philippines, and Sri Lanka offer financial incentives to those industries adopting pollution prevention measures and such a measure is yet to be adopted in Vietnam.

Energy Pricing, Tax and Subsidies

As mentioned earlier, demand for various types of fuels partly depends on price. For example, if coal is heavily subsidized against other fuels, industries shift towards using more coal than other fuels. If the prices are unrealistic and are too low, there is a tendency towards wasteful and inefficient use. Careful pricing mechanism including the costs for environmental impact of different types of energy sources should be adapted as an instrument to motivate the end user in switching from one type of energy source to another.

Many SMI may not be able to afford the high cost of pollution prevention devices and if subsidies are to be introduced, producer subsidies should be avoided and only the end user should be subsidised. However, any subsidy introduced should have a firm sunset provision. Economic incentives offered to end-of-pipe controls may be removed and instead be offered to E3ST. Tariff revision to those SMI using E3ST by the utility/government may also be considered for a specific period. An Energy Conservation Revolving Fund may help to meet the financial requirements of SMI wanting to adapt E3ST.

Integrate Issues on Energy and Environment in Planning Stage

The traditional energy planning carried out by considering the projected energy consumption and growth patterns of different sectors of the economy does not consider the end user energy saving potential or consequent environmental and social costs. This resulted in most countries investing a large sum of money in supply side extension. In the integrated model, consideration is given for the potential energy savings by different end users thereby reducing the investment costs in supply side expansion and brings in social and environmental costs into the planning process (Swisher, et al., 1997).

In most energy conservation strategies, the initial focus is on high-energy intensive industries. Similarly, the environmental policies differentiate the industries as high and low polluting. In an industrial sub-sector, leather is considered highly polluting based on the wastewater loads by the environmental regulation agencies, while foundry sector could be considered as highly energy intensive and highly polluting for an integrated effort in promoting energy conservation and pollution mitigation. Such comprehensive approaches could take into consideration measures for implementing E3ST at the policy formulation stage itself, leading to benefits.

Capacity Building and Information Exchange

Planning and implementation of energy conservation programs in an integrated manner needs a concerted build up of human resources and other capabilities. Most often lack of knowledge and "correct" information by SMI deters the effectiveness of the conservation programs. Demonstration projects, training, information education campaign, information clearing house for technology transfers, public awareness campaign, reporting of success stories, publication in media, awards, workshops and seminars are some of the methods adapted by many countries and institutions to disseminate the knowledge. UNEP has conducted many training

CLEANER PRODUCTION (CP) AUDITS AS AN ECONOMIC STIMULUS

The Ministry of Industry (MoI), Government of Thailand is promoting CP as a means of improving competitiveness for the Thai Small and Medium Enterprises (SME). Under an intensive program, MoI is conducting waste audits in 150 SME all over Thailand representing 10 industrial sectors such as food, palm oil, agro-chemical, textile, pulp and paper, cold rolled steel mills, tanneries, etc. The audits identify the scope for waste reduction, improved resource management and accomplish on-the-job-training for at least 10 persons from each enterprise and around 45 technical staff of the Ministry of Industry (mainly factory inspectors) on CP and waste minimization techniques.

(Source: Thailand Environmental Institute, www.tei.or.th/aprcp)

programs to create trained manpower targeting specific industries (UNEP, 1998). Since energy efficiency and environment protection are closely related, even Energy Services Companies (ESCO) can easily be trained to perform the role of implementing E3ST projects thereby converting them into Energy and Environment Services Company (EESCO). Under the proposed Energy Conservation Bill 2000 in India, financial assistance is provided to create awareness and provide information on the efficient use of energy and its conservation in industries.

Research and development (R&D) to improve energy efficiency and reduce pollution is mostly neglected especially in the SMI sector. This sector also cannot afford expensive R&D and pay for technology transfers. On the other hand, demonstration projects could help promote use of new technologies. Promoting networks through industrial association, organization of exhibitions, etc. help in disseminating information on E3ST to the industrial sector. Such networks could be expanded to research organizations, government agencies, financial institutions, manufacturers and suppliers of E3ST equipment, etc. Current energy policies of China, India, the Philippines and Sri Lanka promote R&D to develop indigenous energy efficient technologies but such an effort is yet to be announced by Vietnam.

Standards and Labelling

Motivating energy conservation and pollution reduction could be through setting standards and/or norms. This will guide investors to select the right technology at the initial stage itself. Generally environmental emission standards are for the whole industry and not for any particular technology or process. It is also pollutant specific and in some countries industry specific. Standards specify only the concentrations of specific pollutants that could be released to the atmosphere with or without treatment. The standards proposed should be gradual so that small manufacturers would also be in a position to comply. Energy conservation standards should be set-up for any appliance or equipment consuming, generating, transmitting or supplying energy.

Energy labeling specifies energy consumption especially for consumer products. Similar norms could be specified for industrial processes or sub-sectors. Norms could be technology specific; process specific, or industry sub sector specific. A procedure for compulsory affixing of labels and dissemination of information on the benefits of lifecycle costing must be established to help consumers make informed choices as opposed to their common low initial cost purchase behavior. Introduction of the energy labeling program may be started on a voluntary basis. China and the Philippines have taken initiatives to implement labeling to a few consumer itens and India follows voluntary labeling.

Such efforts are yet to be initiated in Sri Lanka and Vietnam.

Benchmarking is another method that is increasingly adopted both by industries and policy makers. This compares indicators with determined reference or target values (usually within a sector), obtained within or across companies, as a tool for deriving improvement measures and goals over present position (FEM, 1997). Indicators could be specific fuel consumption, specific emission or waste generation, specific material input, etc.

Creation of Industrial Estates

Siting industries within industrial estates or zones could also promote energy conservation and better environmental management. SMI in close proximities to the large industries would create a symbiosis whereby both industries could benefit. Some of the benefits are (UNEP, 1997):

- reduction in operating costs especially in materials, water and energy
- reduction in pre-treatment and off-site disposal costs
- reduction in environmental liability
- improvement in public image.

To the environmental and energy administrators, concentrating industries in one location would improve effectiveness of enforcement by cutting administration costs, and also help in implementing cleaner production and energy conservation programs. Industries can exchange by-products such as surplus energy, waste heat and other materials. This pattern of inter-company reuse and recycling reduces resource (raw material and energy) consumption. The wastes of individual SMI can be sent to a central processingplant where common treatment facilities are operated. This reduces overhead costs of SMI and helps them operate their facilities without needing any modification. All countries considered in the study encourage the creation of such industrial estates.

WASTE EXCHANGE

Peter Paul Philippines Corporation, a desiccated coconut production plant, generates 80,000 liters of wasted coconut water. In the past, this highly organic wastewater was discharged into the local sewage. Today the company collects the coconut water and transport to the Chia Meei plant located next door, where the coconut water is concentrated, frozen, and exported to Taiwan. In Taiwan another company turns it into a commercial juice drink. This initiative has lowered the organic load by 50% and annual operating cost by 10% of the wastewater treatment plant.

(Source: UNEP, 1997)

Major Players in Energy and Environment Policies & Laws

Manufacturers and equipment suppliers play an important role in informing and encouraging end users about the benefits of E3ST. It becomes more competitive and profitable for them when the enforcement of policies and laws is effective. Strict implementation of norms and standards would help the end user in selecting the right supplier and the right equipment. Equipment manufacturers also take a large portion of their R&D cost from the end users. Where the market is large like in China and India, local equipment manufacturers could afford to engage in their own R&D, while others would be totally dependent on foreign suppliers.

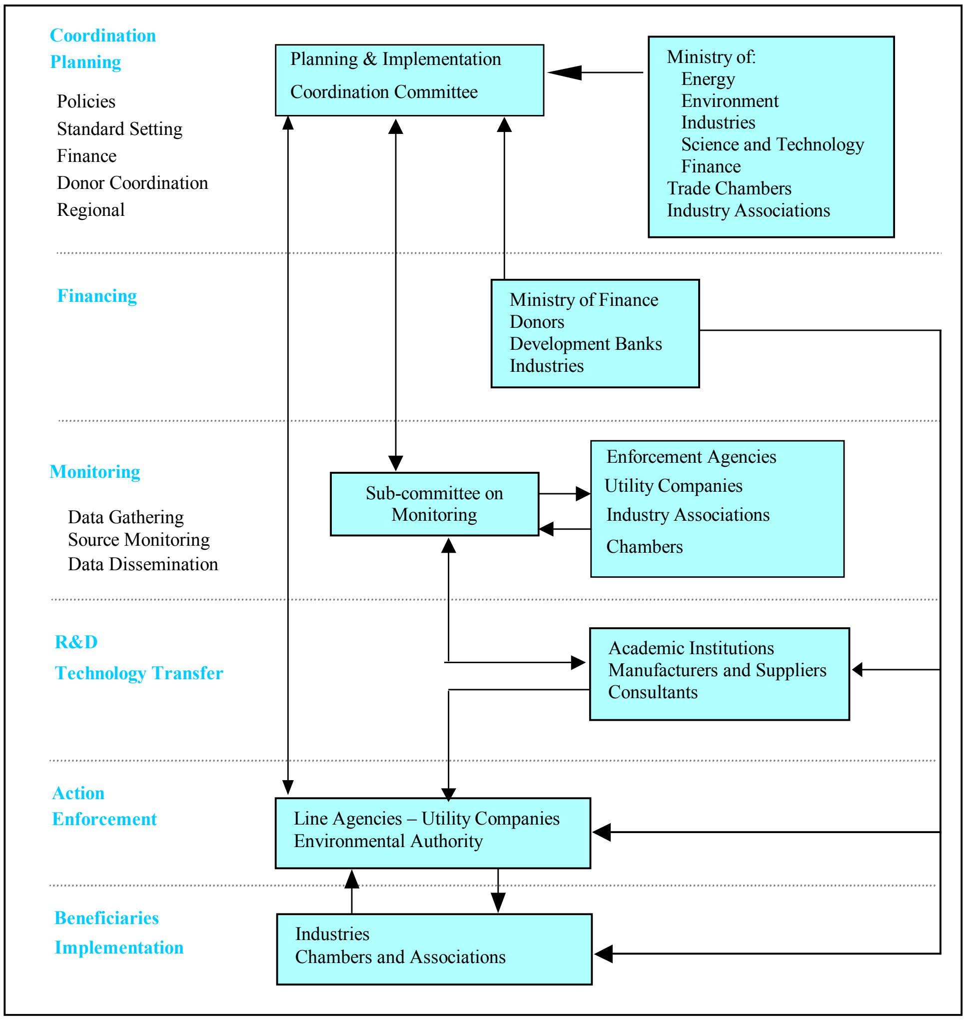
Whereas larger companies have been able to appropriate the concept of pollution prevention and efficient production, in many cases SMI lack the resources to develop this new capability. SMI have to rely on the initiatives, knowledge and capacities of other actors in this field. Studies conducted in Netherlands (de Bruijn and Hofman, 2000) to evaluate the effects of partnership networks for the promotion of pollution prevention in SMI and the role played by each actor within the network revealed that most pollution prevention projects succeeded in realising environmental improvements for the participating companies, but for the majority it is a one-time experience. Not much is learned about the art of pollution prevention itself. Another problem is that current partnerships are not able to involve more defensive companies through voluntary pollution prevention projects.

Policy makers, government, interest groups, associations and manufacturers can play a major role at the macro level and a significant role at the micro level in implementing E3ST. ESCOs, consultants, lead companies, and local conditions can play a major role at the micro level but their role will be limited at the macro level.

Policy Implementation and Responsibilities

Best plans are not useful if not implemented. It is helpful to determine who should take the ultimate responsibility for the promotion of E3ST where both energy and environment issues are well integrated. As of now, the different players involved in E3ST promotion from the two areas, energy and environment, are still acting independently of each other. For example, utility agencies are generally responsible only for generation and distribution of power. Their mandate does not permit regulating or prosecuting for high or inefficient energy consumption, except for defaulters of payment or theft. On the other hand, environmental regulators could only prosecute industries that do not meet emission standards but they cannot prosecute users for high or inefficient energy consumption. To overcome this, China and the Philippines have set up independent centers for implementation of energy conservation laws and programs.

Since there is a direct link between energy consumption and environmental pollution, a coordinated effort is needed to successfully implement conservation programs. However, the SMI sector faces some obstacles in carrying out voluntary programs like CP and DSM such as lack of in-house expertise and information, lack of understanding about laws and regulations, competition within the sub-sector and lack of trust in enforcement agencies. These conservation programs also need to be constantly updated to keep up with the rapid technological developments, therefore a reporting mechanism must be in place among the industries, government authorities and energy, environment and economic planners to facilitate exchange of information. An institutional arrangement must be established to ensure effective coordination and promotion of E3ST in the SMI sector.



Proposed institutional arrangement for coordination and promotion of E3ST

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APPENDIX A: CONVERSION FACTORS AND EXCHANGE RATES USED IN THE STUDY

Conversion Factors

1 Unit	MWh	0.086	toe
1 Unit	MWh	3.6	GJ
1 Unit	k toe	42	TJ
1 Unit	k Cal	4.2	kJ
1 Unit	kJ	0.2778/1000	kWh
1 Unit	MWh of Hydro Electricity	0.24	toe
1 Mt	Fuel Oil	0.98	toe
1 Mt	Coal	0.70	toe
1 Mt	Fuel wood	0.38	toe
1 Mt	Crude oil	1.03	toe
Sri Lanka Energy Balance-1997			
1 Yard	Firewood	325	kg
1 Liter	Fuel oil	0.86	kg
Calorific Value			
Diesel		43,744	k J/kg
Fuel wood		12,000	kJ/kg

Exchange Rates

Currency	Exchange Rate - US$		
	1987	**1992**	**1997**
China – Yuan	3.722	5.752	8.28
India – Rupees	12.877	26.2	39.28
Philippines – Peso	20.8	25.1	39.98
Sri Lanka – Rupees	30.763	46	61.285
Vietnam - Dong	9000	12500	14000

Source: UN, 1999.

APPENDIX B: SALIENT FEATURES OF ENERGY AND ENVIRONMENTAL POLICIES IN THE STUDY COUNTRIES

CHINA

The Energy Conservation Law of the People's Republic of China was adopted by the Standing Committee of the National People's Congress at its 28th meeting on 1 November, 1997 and was implemented on 1 January, 1998. The features include the following:

- Efficient and rational use of energy;
- Reduce energy consumption per unit of economic output;
- Reduce energy consumption per physical unit of production;
- Encourage new and renewable sources of energy;
- Energy saving certification and labelling system;
- Formulation of national standards of energy conservation subject to continuous improvement and perfection;
- Formulation of a system for discontinuing backward, over energy-intensive energy-consuming products and equipment;
- Energy conservation management in key target energy consuming industries (>10,000 tce);
- Target industries should conduct energy audits;
- Develop energy conservation responsibility system and reporting mechanism
- Awards for groups and individuals;
- Stop using energy consuming products within a stipulated time period;
- Establish energy management positions;
- Undertake energy conservation research and establish demonstration projects
- Establish Energy Conservation Fund;
- Development of Energy Efficient Building codes;
- Usage of energy for free or charged at a fixed fee is prohibited; and
- Legal powers to stop production and use of energy inefficient systems and devices.

Decision of the State Council on Issues Related to Environmental Protection - Directive of 1996 / 31:

- Policymakers should have a clear understanding and be responsible for improving the quality of environment;
- Regional environmental problems should be resolved in an earnest way and lay emphasis on key projects;
- Emerging polluting sources should be strictly controlled;
- The pace of resolving the lasting environmental pollution problems should be accelerated by setting up a deadline;

? Effective measures should be adopted to prohibit the transfer of waste to other regions;
? Natural reserves should be protected and utilized in a sound way so as to maintain the ecological balance;
? Environmental economic policies should be improved and funds for environmental protection should be increased;
? Environmental law enforcement should be enhanced and its supervision strengthened;
? Research on environmental sciences should be promoted and the development of China's own environmental industry should be greatly enhanced; and
? Public consciousness on environmental protection should be enhanced by means of education and publicity.

The 1979 Environmental Protection Law of China, and its revision during 1989, deals with:
? Air pollution control,
? Discharge standards, and
? Industrial Discharge control.

INDIA

The Mega Power Policy (1998) is aimed to achieve the following:
? To fuel the growth in the development of power sector. The Government's proposed policy on mega power projects would make thermal power generation mandatory at the coal pitheads.
? The mega power policy would cover power plants which are over 1000 MW capacity. Hydro power projects of more than 500 MW capacity also qualifies for this.
? Setting up of Regulatory Commissions is a pre-condition for beneficiary states.
  o Setting up of Power Trading Corporation
  o Tax holiday of 10 years can be claimed in any block of 10 years
  o Exempting equipment imports from customs duty and also propose to provide 15% price preference and deemed export benefits for domestic bidders
? Easing administrative controls like those relating to environment clearances
  o States have to privatize distribution in the cities having a population of more than one million
  o Projects would be offered to the developers only after all the clearances have been obtained
? The policy will be applicable to public as well as private projects.

Captive Power Policy is:

- ? To encourage captive power generation by the industries.

Environmental Policy:

- ? Government has published the policies in the form of Abatement of Pollution and the National Conservation Strategy and Statement of Conservation and Development.
- ? The comprehensive "National Environmental Policy" is being prepared by the Ministry of Environment and Forests
- ? ECOMARK - for household and other consumer products.

Cleaner Production – technology policy:

- ? Discourages import of obsolete technologies,
- ? Offers incentives for the development and adoption of indigenous EST,
- ? Ensuring technology transfers as provided in international conventions,
- ? R&D tie-ups,
- ? Soft-loans for adopting EST, and
- ? Establishing Waste Minimization Circles as a part of pollution prevention programs.

Environmental (Protection) Act, 1986, includes the following:

- ? Air Emission Standards,
- ? Industrial Emission Standards,
- ? Production Performance Standards (benchmarks),
- ? Wastewater Discharge Standards, and
- ? Disposal of Municipal Solid Waste.

This Act will be implemented by Pollution Control Boards (PCB), Factories Inspectorates, Insecticide Inspectorates, and Inspectorate of Explosives. Legal and institutional bases for implementing the act have been carried out. These include framing of rules, notification of standards, enlisting laboratories, strengthening state departments and PCBs, delegation of powers, identification of agencies for carrying out various activities, hazardous chemicals management and setting up of environment protection councils in various states.

Energy Conservation Bill 2000 (under notification) proposes to establish a statutory authority, Bureau of Energy Efficiency (BEE), to enforce the efficient use of energy and its conservation, and will have the following functions:

- ? Provides specific energy consumption standards for any equipment and appliance which consumes, generates, transmits or supplies energy;
- ? Describes the information required on labels applied to equipment or appliances;
- ? Prohibits the manufacture, sale, or purchase of equipment or appliances which do not conform to the energy consumption standards;
- ? Prepares guidelines for Energy Conservation Building Codes;

- ? Makes energy audit compulsory, especially for energy intensive units;
- ? Rationalization of petroleum fuels with a view to achieve optimum energy efficiency;
- ? Creates awareness and provides information on the efficient use of energy and its conservation;
- ? Promotes innovative financing for energy efficiency projects; and
- ? Encourages small and medium scale industries to implement technology up-gradation and gradually dispense with inefficient equipment and systems

When approved, the legislation would specify qualifications required for accrediting auditors, the manner and interval in which energy audits are conducted, and specify certification procedures for energy managers appointed by consumers. It would also mandate state governments to establish a fund called the 'Energy Conservation Fund' that would have the power to impose penalties in cases where provisions of the proposed legislation are contravened.

PHILIPPINES

Energy Plan 2001-2004 suggests:

- ? Supply Security and Reliability - Ensures sustainability of energy supply through continuous exploration and development of indigenous energy sources;
- ? Energy Affordability and Accessibility - To make energy accessible to all areas and sectors of the economy in view of the social equity and poverty reduction thrusts of the government;
- ? Environmental Quality - To enhance integration of energy and environmental policies and program implementation in the context of global and national initiatives to mitigate impacts of climate change and local pollution; and
- ? Consumer Protection - To protect consumers from market power abuses.

Philippines Environmental Policy (PD1151):
Sets statements namely, the National Environmental Goal, Right to a Healthy Environment, and Environmental Impact Statement.

Philippine Environmental Code:

- ? Prescribes guidelines for land-use management, natural resources management and conservation, utilization of surface and ground water, and waste management; and
- ? Promotion of Environmental Information Systems

Batas Pambansa Blg. 73 (1980):

- ? An Act to further promote Energy Conservation for other purposes;

Executive Order No. 123 (1993):

- ? "Power Patrol Program" for the promotion of energy efficiency through information dissemination.

SRI LANKA

There is no national energy policy. However, a Demand-Side Management Program is available with the Ceylon Electricity Board. The program concentrates mostly on demand-side management to reduce electricity consumption and provides consultancy.

National Industrial Pollution Management-Policy Statement 1996:

- ? Pollution prevention at source;
- ? Polluter Pays principle;
- ? Clustering industrial units in estates and parks; and
- ? Community, private sector and government interaction.

National Environmental Act No. 47 of 1980:

- ? Wastewater discharge standards
- ? Air pollution emission standards
- ? Environmental Impact Assessment
- ? Environmental protection licences

Industrial Promotion Act of 1990:

- ? Emphasizes efficiency requirements for setting up industries.

Sri Lanka Standards Act of 1964:
Specifies standards in Industries and Imports: Standards Institutions of Sri Lanka administers this act by laying down ISO standards which calls for considerable investments in energy efficiency.

Energy Conservation Fund Act 1985 (Statutory body in the Ministry of Power and Energy):

- ? Facilitates and promotes energy efficiency; capacity building; creation of network linkages; and promotion of R&D.

VIETNAM

There is no energy law (Decree on Energy Conservation and Degree on SMEs are under preparation).

Master Plan for Energy Conservation and Efficiency – Ministry of Science, Technology and Environment (MoSTE), 1998:

- Overall reduction of 8-10% total energy consumption and 3.5–5% peak load consumption;
- Reduction in consumption of coal, fuel oil, and electricity;
- Interventions planned are:
    - Short-term: non or low investment cost measures including improvement of energy management system and maintenance of equipment;
    - Medium-term: requiring investments with a payback period of less than 3 years;
    - Long-term: requiring investments with a pay back period of more than 3 years including replacements with newer and more efficient equipment.
- Plan also includes measures for institutional development.

Environmental Protection Law:

- Environmental Licensing schemes, and
- Environmental Impact Assessment for existing and new industries.

Vietnamese Environmental Pollution Standards:

- Ambient water and air quality standards, and
- Industrial discharge standards.

Agencies involved in policy implementation:

- Ministry of Industry is responsible for managing energy; and
- Ministry of Science Technology and Environment is responsible for environment management.

General Bureau of Hydrometeorology is the focal point to coordinate the activities of climate convention in Vietnam.