| Chapter 9 |

Responsible Business – Energy Efficiency Solutions

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1. Introduction

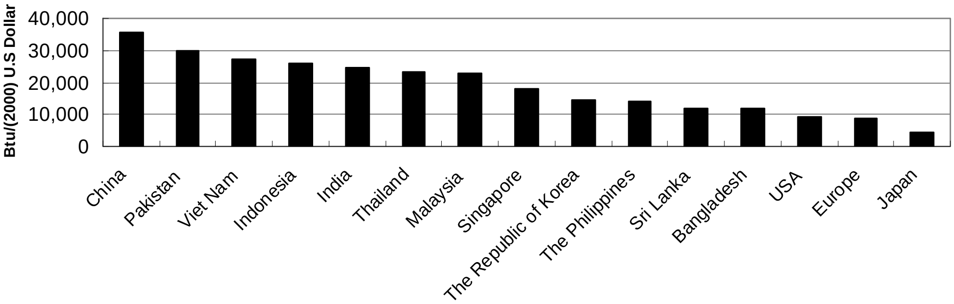
As the debate on global warming gains prominence in international policy regimes, there is a growing consensus that concerted action by the business sector to deal with climate change is both necessary and urgent. In most parts of Asia, business investment and industrial development is the major driver for economic growth and employment generation. But this economic development is interlinked with emissions and energy use. As highlighted in Chapter two, Asia currently consumes around 2,655 Million tonnes of oil equivalent (Mtoe) of energy per year accounting for 27% of the world's total supply. Industrial energy use is the source of about 80% of greenhouse gas (GHG) emissions in Asia, and its share of worldwide emissions increased from 8.7% in 1973 to 24.4% in 2005 (ADB 2006). This is expected to increase to 40% by 2030 if the current rate of industrial growth and energy consumption continues (WEC, 2001). For emissions to be reduced in a drastic way, industry will have to rely on non-fossil fuels for energy supplies. Today, Asian industries depend on fossil fuels for more than 70% of primary energy needs, so the adjustment needed is massive. Coal remains the major source of energy for China and India, at 70% and 37%, respectively. To cut emissions, industries can either drastically reduce fossil fuel use or strictly limit industrial energy demands through conservation. The challenge is that basic manufacturing industries will certainly continue to grow in Asia. The first option is not feasible at least in the short run; demand for energy continues to increase and there are doubts as to whether Asia can develop renewable energy sources fast enough to phase out coal-based plants (renewable energy currently account for less than 5% of the total supply). However, tapping the potential for energy efficiency (EE) gains holds considerable promise for Asian industries, as this can reduce electricity demand for fossil fuel, arrest climate change and yield business benefits.

Demand side EE is a good example of a "no-regrets" strategy for any business, irrespective of type and size. Improving EE simply implies using less energy to achieve the same amount of production and services. This chapter argues that a vigorous EE strategy could enable greater emission reductions than any other climate change alternative (and boost business performance). The key focus is on improving EE in manufacturing industries. EE measures typically have short pay-back periods and ultimately add to bottom line profits as energy prices increase. As the following section explores, the potential for EE programmes and policies in Asia remains immense, although there are several barriers for implementing specific measures. Accelerating EE measures will not only benefit business but will also increase energy security and step up the transition to a less carbon intensive economy. There is no apparent conflict between EE and sustainable development; a tension that permeates most other chapters of this White Paper. Through corrective policy measures and actions by business and intermediaries for promoting EE, it is possible to achieve a meaningful and effective near term goal of reducing GHG emissions, creating momentum towards the deeper cuts that will be necessary in the long run.

2. Decoupling energy use and industrial growth

Aware of the necessity to continuously decouple energy use, GHG emissions and economic growth, Asian countries have devised various policy measures to guide industries. As a result, some countries like Japan made exemplary advances in EE, while other developing countries are inching towards better energy performance (fig. 9.1). By comprehensively adopting EE measures, Japan has been successful in decoupling its economic growth and industrial energy use, so that growth in industrial output has been offset by a decrease in energy intensity; a combination of increasing efficiency, fuel and process changes and a shift to more energy efficient electrical appliances lie behind it. Japanese efficiency improvement programmes also produced long lasting improvements to industrial production processes, new product designs and business models that save energy without reducing levels of service (Medlock and Soligo 2000; Murokoshi 2005; Sugiyama and Ohsita 2006).

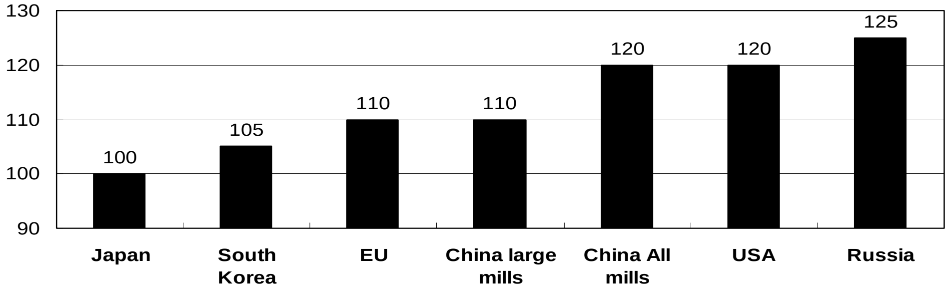
Figure 9.1. Energy consumption per GDP in selected countries (2005)



Source: BP (2007)

The factors behind varying levels of energy intensity include industrial structure, production processes, and domestic energy sources. Countries like China witnessed an industrial restructuring process in the 1990s, when the industrial portfolio was diversified to include light industries such as telecommunications and thus reducing energy intensity. However, Asia's industrial activity remains dominated by the manufacturing sector, which accounts for 36-42% of total energy consumption in many countries. Heavy industries like chemical and petrochemicals, iron and steel, cement, paper and pulp account for more than 70% of energy consumption in large industrial economies like China and India (IEA 2007). For example, the iron and steel industry consumes about 19% of total energy use and produces about 25% of the direct carbon dioxide (CO_2) emissions in India. However, a lot of energy is used ineffectively in Asia, either because of inefficient industrial production processes and obsolete technologies, or because of the low quality of raw materials. This partly explains why the average EE of iron and steel industries in China and India is lower than in Japan (fig. 9.2).

Figure 9.2. Comparative rates of energy use in integrated steel mills



Note: index based on 100 for Japan
Source: Yamada (2007)

As explained in Chapter two, improving EE is the most cost-effective mitigation option available at the national level. At the sectoral level, ample opportunities exist in the heavy industry sectors for improving EE by adopting the world's best technologies and production processes (table 9.1). These sectors can improve their EE significantly, by 18-26%, while reducing CO_2 emissions by 19-32%, simply by identifying options for improvement and applying proven EE measures. By reducing energy use per unit of output or service delivered, industrial enterprises could save money, reduce maintenance costs, increase productivity, and improve product quality.

Table 9.1. Energy efficiency improvement potential in key industrial sectors

Sectoral category	Energy efficiency improvement potential	
	Mtoe/year	$MtCO_2$/year
Chemicals/petrochemicals	120-155	370-470
Iron and steel	55-108	220-360
Cement	60-72	480-520
Pulp and paper	31-36	52-105
Aluminium	7-10	20-30

Source: IEA (2007)

Table 9.2 illustrates EE initiatives by selected world-class companies in key industries that provide compelling business cases of how to make a profit while saving 20–40% of energy use, with pay-back periods of less than one to five years.

EE improvement brings other socio-economic benefits too. Cost-effective energy savings at the factory level means lower dependence on fossil fuel imports and trade deficits, in the face of high and rising oil prices. For example, in 2004 net oil imports into China exceeded 100 million t/yr and accounted for about 45% of total oil consumption (Xu 2007). By 2010 the ratio of oil imports is predicted to approach 50%. Hence, improving EE means improved energy security for fast moving economies like China. Even without higher oil prices, there are sound business reasons to promote energy efficiency. Achieving EE requires services and technology, thus creating new business opportunities and jobs. Estimates for Germany indicate that more than 2,000 entrepreneurial jobs could be created for every 1 Mtoe saved as a result of investments in EE. Moreover, increased EE contributes to improved air quality by avoiding combustion of fossil fuels (Mohanty et al. 1997). Overall, EE is a significant contributor to sustainable development.

Since there are significant benefits and ample potential in almost all key sectors for improved EE, why is not there enough momentum to embrace it in Asia? Significant barriers remain for widespread adoption of EE measures that need to be identified and understood, if they are to be addressed.

Table 9.2. Benefits of energy efficiency improvement

Country and *sector*	**Business approach to EE**	**Environmental benefits**	**Investment**	**Economic Benefits**	
				Cost savings/yr	Payback period
Bangladesh *Pulp & Paper*	Production process improvement	Emission reduction: 100 tCO_2e/yr Fuel oil savings: 37.5 kl/yr	$3,448	$5,172	8 months
China *Chemical*	New technology/ equipment	Emission reduction: 51,137 tCO_2e /yr Coal reduction: 33,643 t/yr	$624,000	$1,225,033	6 months
India *Pulp & Paper*	Production process/ Equipment change	Emission reduction: 17,200 tCO_2e /yr. Coal savings: 11,520 t/yr	$46,512	$400,186	2 months
Iron & Steel	Process optimisation and good housekeeping	Emission reduction: 6,787 tCO_2e/yr Electricity savings: 7.6million kWh/y	none	$353,488	Immediate
Indonesia *Cement*	Production process/ equipment modification	Emission reduction: 24,349 tCO_2e/yr Electricity savings: 3 MVA	$170,000	$1,124,130	1.5 months
Philippines *Iron & Steel*	Good housekeeping	GHG emission reduction: 2,035 tCO_2e/yr Fuel savings: 678,487 l/yr	$2,545	$148,028	One week
Sri Lanka *Ceramics*	On-site recovery/reuse	GHG emission reduction: 126 tCO_2e/yr Kerosene savings: 49,000 l/yr	$60,000	$12,250	5 years
Iron & Steel	Improved process management and new technology	GHG emission reduction: 416 tCO_2e /yr Fuel oil savings: 150,000 l/yr	none	$30,000	Immediate
Thailand *Chemicals*	On-site reuse and recovery	Emission reduction: 15 tCO_2e/yr Electricity savings: 24,545 kWh /yr	$5,250	$5,406	One year
Vietnam *Ceramics*	Input material substitution and good housekeeping	Emissions reduction: 468 tCO_2e/yr Electricity savings: 130,200 kWh/yr	Negligible	$40,202	Negligible

Source: UNEP (2002b); UNESCAP (2003); WEC (2007); tCO_2e/yr = tonnes of carbon dioxide equivalent per year.

3. Barriers to energy efficiency improvement

Many studies (ADB 2006; IEA 2007) indicate significant potential for EE improvement in Asia, in the order of 25-30% per sector, of which only a fraction has been achieved to date. The energy intensity of Asia remains 1.5 to 4 times greater than G8 countries. Fast growing economies like China, even with strong energy conservation action plans, are struggling to attain their medium term targets. The EE investment opportunities available for businesses have remained largely undeveloped due to various policy, management, technology and financial barriers. These barriers can be analysed by grouping them into three categories—government intervention, public sector capacity and the support system—and will be analysed below.

3.1. Barriers related to government intervention

To reduce the waste of energy in industrial operations, appropriate government strategies, regulations and incentive mechanisms are needed. Many policy interventions in Asia are not well targeted, and perverse subsidies affect industrial decisions on investment in EE.

3.1.1. Lack of sectoral targets, standards and incentives

Unclear targets and poor planning by national governments could reduce the credibility of industries to invest in EE improvement. Formulating industrial development policies for short-term economic gains often ignores the importance of tapping EE potential and long-term sustainable development goals (UNEP 2006a). Integrating energy conservation policies with other resource policies and fixing progressive targets for high impact sectors, as well as designing standards for clean production processes and equipment, were found to underpin higher EE in the Organisation for Economic Cooperation and Development (OECD) countries (APO 2001). In Asia, the lack of standards and targets inhibits EE investments indirectly by leading industry to undervalue EE's contribution to company performance. In industrialised countries like Japan, greater energy savings are gained by developing energy standards for specific kinds of industrial equipment such as boilers, electric arc furnaces, low thermal refractory and rotary kilns. When those standards are combined with sectoral targets and financial incentives, EE is improved (box 9.1).

Taking up energy intensive industries like iron and steel, chemicals, pulp and paper is inevitable for Asia, necessitating large energy inputs, often supplied by coal-fired power plants. Developing countries in Asia have made little effort to set targets for energy savings in high impact sectors and new coal-fired power plants find no compulsion to adopt the best available world standards. Even if standards exist in countries like China, the design and implementation of such industrial codes requires information and procedural instructions that are often missing. Furthermore, in many cases, enforcement is less vigorous and incentive mechanisms, such as tax breaks or low-interest credit, are not well coordinated among the authorities. Hence, industries disregard the need to change obsolete production practices or to innovate with more efficient practices.

Box 9.1. How Japan achieved greater energy efficiency

The 1970s oil embargoes led Japan to focus on EE, resulting in a progressive energy conservation law, first enacted in 1979. That law stipulates (i) to identify energy intensive sectors; (ii) to appoint licensed energy managers for energy intensive industries; and (iii) to buy and use products that meet mandatory EE standards. In 1999, Japan adopted the Top Runner Programme to push manufacturers to meet EE standards by identifying the production process with the highest EE in the market at the time of standards setting and evaluating the potential for further EE improvements. This ensures that target values are set at a high level. Special labelling systems are also established so that users can readily obtain information about EE at the time of purchase. Quantitative estimates of the significance of this programme vary, but expected reductions in GHG emissions fall within the range of 16-25% of the entire national savings target by 2010, or about 29 million tCO_2e/yr. Progressively amended six times, the law includes a variety of fiscal incentives such as tax exemptions, special depreciation allowances and soft loans to promote energy conservation measures by designated industry sectors. A reduction of 1% per year in energy consumption levels by all designated factories was the main goal of the new law. The law also introduced special tax measures such as a rebate equal to 7% of the purchase price of EE equipment and loan support for energy efficient investments by industry. The Government offered a low-interest rate of 2.2% to industry for up to half the cost for a period of 1-30 years. Because of these and other measures, since the law was enacted in 1979, emissions from industries have been reduced from 524.23 million tCO_2e/yr in 1997 to 498.51 million tCO_2e/yr in 2003, despite the fact that Japan's industry continued to grow. Today Japan is a leading country in EE and has developed an industrial system that continuously improves EE. It is also important to note that the industrial structure of Japan changed over the last three decades, as polluting industries shifted overseas for economic reasons.

3.1.2. Presence of perverse subsidies

Under-pricing of energy through government subsidies is a policy impediment that undermines the cost-effectiveness of energy investments made by industry. In Asia, energy prices are under government control, and many countries subsidise it at the producer or consumer level somewhere between 10-30%. Even though governments have compelling socio-political reasons for providing such perverse subsidies to fossil fuel users, they often do not reflect the full environmental costs and nullify manufacturers' interest in EE improvements (Xia 2003). As a rule, countries that subsidise energy prices under-invest in EE. Subsidies to state-owned electricity utility companies as well as to public sector industries are another price distortion, causing industry to adopt inefficient technologies. Such subsidies have direct implications for primary energy use and increase dependence on imported fuel. In some countries like Indonesia, the average rate of subsidies is as high as 28% (table 9.3). Removal of such subsidies could reduce energy consumption by 7.1% with a net CO_2 reduction potential of 11%. The United Nations Environment Programme (UNEP) (2002a) projected that on average, the removal of consumption subsidies that have no environmental value can reduce energy use by 13% in the region, lower emissions by 16% and increase GDP by almost 1%.

Table 9.3. Impact of removing subsidies on energy consumption in selected countries

Country	Average price of gasoline* ($/L)	Average rate of subsidy (% of market price)	Annual economic gain (% of GDP)	Reduction in energy consumption (%)	Reduction in CO_2 emissions (%)
China	0.58	10.9	0.4	9.4	13.4
India	1.22	14.2	0.3	7.2	14.1
Indonesia	0.48	27.5	0.2	7.1	11.0
Iran	0.11	80.4	2.2	47.5	49.4
Kazakhstan	0.79	18.2	1.0	19.2	22.8
Russia	0.77	32.5	1.5	18.0	17.1

Note: prices as of December, 2007
Source: UNEP (2002a)

On the other hand, subsidies for introduction of energy efficient technologies and to support renewable energy (RE) resources can help to reduce emissions (De Araujo et al. 1995; Marcillo and Menke 2006). Most industrialised countries have been increasing these positive subsidies for energy security reasons.

3.2. Barriers related to private sector aspects

Investment in EE is eventually a business decision and corporate commitment is an important factor. Every company, irrespective of size, wants to obtain maximum profits at the least cost of investment. Business attitudes towards risk, managerial capacity, and poor corporate social responsibility (CSR) are some of the barriers that must be overcome.

3.2.1. Risk aversion characteristics

EE as a path to profit making is not viewed as an integral component of the corporate decision making process. In Asia, any alteration to achieve a positive change is often perceived by the business sector as disruptive to the present order (Kumar et al. 2005). This is common for both company management and employees. Corporate managers often consider the latest technologies as the only way to significantly improve resource efficiency, even when reductions are also possible by improving existing production processes, recycling of materials, better bookkeeping and introducing innovative management systems (box 9.2).

While technically competent managers are being developed at the company level across Asian economies to manage industrial growth, their capacity to appreciate global and national EE issues continues to be low. In one survey of energy utility and mining companies, limited awareness and lack of best practices were found to be a major hurdle in corporate efforts to enter into new energy-saving approaches (PricewaterhouseCoopers 2007). Even if awareness exists, factory managers consider opportunity costs before they make investments in EE (Morgenstern et al 2007). Thus, only EE investments that have proven short pay-back periods with little investment cost get final clearance from the top management.

Box 9.2. A business case of improving energy efficiency in China

The Qingdao Port Company in Shandong Province saved 3.62 million kWh of energy in a five year period. Even though operational capacity increased 15.8% per year, energy consumption was reduced by 8.9% per year over the same period. The saved energy is equivalent to 686 tonnes of oil and 578 tonnes of coal. The company achieved its energy savings by (i) establishing multiple levels of EE targets and an energy management framework; (ii) training workers on energy-saving methods; (iii) creating an incentive system for innovative ideas; and (iv) modernising equipment and machinery. The good performance on energy conservation and economic performance enabled the company to be recognised as a National Environmentally Friendly Enterprise in 2005.

Source: Qingdao Daily (2005)

This risk aversion barrier and business rationality displays a different dimension in public sector companies. For example, in China and India, heavy industrial sectors like steel and chemicals are still dominated by large state-owned organisations. Corporate management in these firms is less responsive to calls for improved EE as they can ignore market forces through tools like monopoly pricing or their ability to absorb losses.

3.2.2. Missing capacity of small and medium enterprises

In small-scale industries that dominate Asia's industrial sectors (about 70-80%), risk aversion is aggravated by a lack of resources (OECD 2005; CREM 2004). Despite their significant contribution to economic development in their capacity as suppliers to large industries, small and medium enterprises (SME) are energy inefficient since they continue to operate with obsolete technologies and production processes. On average, electricity accounts for 10% of production costs for SMEs in developing countries like Vietnam, but because of a lack of funds and skills, and with management accountability tied to short-term profits, managers defer attention away from energy saving. Small-scale operations also make investments on EE uneconomic on an individual basis by those industries (UNIDO 1997).

Furthermore, most SMEs are not registered, remaining part of the informal economy and therefore disconnected from government-sponsored capacity building programmes and venture capital provided by private financial institutions. From the lenders' point of view, assessing the creditworthiness of these industries is difficult, as they often have no reliable financial records and have difficulties meeting collateral requirements (Mohanty and Visvanathan 1997). Even if SMEs can establish their creditworthiness, they need to follow tedious procedures to gain access to low-interest loans earmarked for improvements in EE. Many are turned off by the procedural delays and do not want to obtain commercial loans, even if offered at low-interest rates (CREM 2004).

3.3. Barriers related to supporting systems

Improving EE depends on access to technology, availability of financial capacity and capable human resources. The competence of Asian business in this aspect is constrained by numerous forces.

3.3.1. Access to energy efficient technologies

OECD countries like Japan have a huge lead in technology and process development in almost all key sectors. The access to energy efficient technologies constitutes an important barrier to adoption by Asian industries. Generally, Asia has not kept up with technical innovations for energy savings, although China, India and the Republic of Korea have been successful in developing prototype technologies for light industries like food processing and textiles. Upgrading obsolete technologies in heavy industries like steel, cement, and paper is often found to be expensive, as new technologies need to be transferred from advanced economies. Box 9.3. illustrates how the high cost associated with importing technologies is a barrier to promoting EE in Sri Lankan steel mills.

Box 9.3. Cost of importing energy efficiency technologies in Sri Lanka

Raw steel is usually imported to Sri Lanka to meet rising demands. The cost of finished steel production is nearly four times that of raw materials, but the effect of value addition is very critical to the economy due to the limited supply of finished products. Sri Lankan steel mills opted to maximize profit by increasing total production, rather than by investing in EE measures because of (i) necessity to import all equipment and technologies for making improvements; (ii) high interest rates for investment capital; and (iii) the time required to implement EE measures.

Source: UNEP (2002b)

Technology transfers are often seen as a business-to-business interaction, but institutional barriers and policies influence the transactions. Lack of coordination and direction for technology/knowledge sharing constrains Asian businesses from adopting promising energy efficient processes already available elsewhere (Reddy 2001). The barriers include restrictive policies, such as intellectual property rights (IPR), which are imposed to ensure recovery of original technology development costs. Limited markets for technologies are also another important barrier. As specialized applications, new technologies often need to be customized for each factory, in either scale or operational features. This makes it difficult for technology suppliers to design uniform products to reap the benefits of small markets. Technology transfers that come as part of foreign direct investment (FDI) are often provided at less than favourable terms. Some studies show that government supported technology transfer programmes are often incompatible, and dumping outmoded production technologies is common (Tharakan et al. 2001; Yoshi and Yokobori 1997). Many companies purchase outmoded production equipment (or whole factories) from developed countries after the equipment has been depreciated and written off the seller’s accounts.

Furthermore, the transferred technologies may fail to suit local conditions (Thiruselvam et al. 2003). Technological and information incompetence in Asian industries also account for (i) high initial transaction costs in searching for and accessing information (APO 2005); (ii) limited availability of funds to upgrade technologies (Klessmann et al. 2007); and (iii) the inability of the workforce to acquire new skills (CREM 2004).

3.3.2. Availability of finance

Some technology options provide huge energy savings and a short pay-back period, but require a high initial investment, which is not easily available to many Asian companies. These companies simply do not have ready access to money or their banks do not have confidence to back them in undertaking new risks. Most private financial institutions operate on a risk minimisation approach and need collateral backing for loans. Under these circumstances, EE projects do not always produce acceptable appraisal results (UNIDO 1997). Capital rationing by financial institutions for more promising investment alternatives and the lack of technical capability in the banking sector to appreciate broader EE benefits are also barriers.

Venture capital for financing energy investments for small business is a new concept with very few institutions providing such financing. Emerging financial mechanisms such as energy service companies (ESCO), which provide the investment capital for a share of the financial savings, face many obstacles in trying to help companies willing to invest in EE (box 9.4).

Box 9.4. Barriers to the growth of energy service companies in Japan

To be successful, ESCOs need long-term contracts with their clients to cover the initial investment. Until recently, expenditure plans and contracts of government organisations were limited to five years in Japan, forming a critical barrier to adopt ESCO assistance. To remove this obstacle, a recent law allows government organisations to extend the contract period for up to ten years. Accelerating the growth of ESCOs among small business and households also needs new policy approaches. IGES (2007) is currently working on a household ESCO scheme that would attempt to solve the lack of profitability of ESCOs using collaboration and burden sharing by stakeholders. In this scheme, the local bank would serve as the financial service supplier, retail shops would provide electric appliances, environmental specialists serve as energy service advisers to households, and a local public body is the service coordinator. In another study on product service systems which analysed the sustainability potential of ESCOs and their business performance, IGES (2007) suggested an inter-ministry, multi-stakeholder working group to evaluate appropriate financial incentive mechanisms.

International finance options such as the clean development mechanism (CDM) have created unrealistic expectations among SMEs, which are unaware of its expensive processes and complicated criteria (Kumar et al. 2005). Businesses in industrialized countries, which are ready to help Asian business partners, are often hampered by the lack of information on the energy-saving potential available in the recipient companies. Moreover, in some transitional economies like Vietnam and Mongolia, access to foreign currency is controlled and, when foreign financing is available, investors are asked to bear the foreign exchange risks during the loan repayment period.

3.3.3. Capable human resources

Lack of technical education and training of employees is another barrier. The benefits of EE in environmental and economic terms are sometimes beyond the common sense of managers as well as employees but their involvement is important for proper implementation at the factory level. Poor understanding of the functional characteristics of EE measures will increase the costs, hamper the achievements of desired results and even disrupt the production process if not implemented correctly. In one survey of employees, a large-scale chemical manufacturer in India discovered that illiteracy was a major hurdle in improving energy performance (Jose 2005). In small and medium-sized factories, incompetence in tackling EE measures also stems from management decisions to lay off skilled employees to increase profit margins. Energy support services from non-core activities for small industrial units and when skilled technical staff are replaced by less capable employees, efforts to seek and improve EE are set back.

4. Asian initiatives towards improved energy efficiency

Despite these barriers, in the last two decades Asian governments and business have both shown an interest in EE as the quickest and most cost-effective way to address the environmental and economic challenges of climate change. Actions undertaken can broadly be grouped into governmental plans, private sector voluntary initiatives, and actions undertaken by intermediaries in promoting specific EE programmes across the region.

4.1. Action at the government level

Key policy actions taken by the Asian governments aimed at improved EE include energy conservation policies and financial incentives.

4.1.1. Energy conservation policies

Before the 1990s, the objective of most energy policies was to enhance national energy security by securing an adequate supply to meet industrial needs (table 9.4). Recently a handful of countries like China, the Republic of Korea, India, and Thailand have adopted legislation on EE or conservation. In China, improvements in EE are directly addressed in the 2007 Energy Conservation Law, which stipulates that enterprises should use clean energy technologies and mandates industrial authorities to issue a list of obsolete energy intensive equipment to be retired permanently from the production system. The Republic of Korea’s Rational Energy Utilization Act is similar to a law promulgated by Japan in the 1970s, which aims to stabilise energy demand, creates incentives for the efficient use of energy and promotes the development of energy-related technologies. The Energy Conservation Act of 2001 in India promotes EE by specifying energy conservation standards and labelling requirements for industrial equipments and prescribes energy audits for energy intensive factories. Thailand enacted the Energy Conservation Promotion Act in 2002 to provide a regulatory framework for EE and conservation investment in factories across different sectors under public-private partnership audit programmes.

Table 9.4. Energy efficiency policies in selected Asian countries

Policy Type	East Asia					South east Asia						South Asia	
	China	Hong Kong	Japan	The Republic of Korea	Taiwan	Indonesia	Malaysia	The Philippines	Singapore	Thailand	Vietnam	India	Sri Lanka
Country Strategy	o		o	o			o	o		o		o	
National energy policies	o		o		o	o	o				o	o	o
Regulatory instruments	o		o	o	o			o		o		o	
Energy audits			o		o					o		o	
Energy conservation fund			o							o			
Financial incentives			o	o	o		o	o		o	o	o	
Tax incentives			o	o			o	o	o				
Energy performance standards	o		o	o	o		o	o		o			
Mandatory product labels			o	o				o		o			
Voluntary product labels	o	o	o	o	o	o			o	o	o	o	o

Experience from 11 Asian countries shows that industrial customers who received audits reduced their electricity use by an average of 3-7%, with higher energy savings achieved when the factories followed the recommendations (Ming 2006; Cogan 2003; UNEP 2002b; UNEP 2006b; UNESCAP 2004; UNIDO 1997). The Indo-German Energy Efficiency Project in India proved that when 50-60% of the recommendations were implemented, energy savings in the order of 5-15% were possible (Kumar et al. 2005).

Mandatory energy performance standards appear to be the most widely adopted process tools across newly industrialised countries. In Taiwan, for example, mandatory EE standards were established for industrial products like motors, boilers, transformers, water chillers and heating, ventilation and air-conditioning systems. Typically, the standards call for EE of 5-25% greater than the average products in service (Nordquist 2006). While targets and standards have been introduced in other countries like China and Thailand, these measures have not been effective, due to factors such as unrealistic standards. Many Asian countries are following OECD standards, which are often too high to be applicable in developing countries (World Bank 1992). Setting standards for EE is not just a technical matter, but also involves checking and creating an enabling environment for the wise use of energy. Company considerations such as technology, costs, and awareness, which induce industrial behavioural change, are different in developing Asia and simply adopting OECD standards will not be effective.

The lack of institutional capacity is another factor. Most energy conservation departments operate with few personnel and limited resources. Inadequate institutional coordination is also problematic in many Asian countries. In Vietnam, Electricity of Vietnam is implementing a national energy conservation programme, while the Ministry of Industries is providing financial incentives for factories to deploy EE technologies, but there are no links between the two programmes. The budget for the Bureau of

Energy Efficiency in India is only 0.3% of potential EE investment in the electricity sector. There are successful institutions, of course, like the Korea Energy Management Corporation, which is the lead agency in EE, dissemination of technology and climate change mitigation. Its coordinated efforts to establish standards and provide adequate financing to industry resulted in EE improvements in the order of 40-50% in key sectors like steel and cement. Hence, to improve EE, it is essential for governments to review the existing policies and institutional structures, and analyse successful working models to set and implement effective standards and sector targets.

4.1.2. Economic instruments

Grants, low-interest soft loans and subsidies are popular policy measures, provided by the government to industry as incentives for improved EE. These measures are often combined with an extended pay-back period, making them very attractive. Special funds were set up in some countries to activate sector level actions. In Thailand, for example, a revolving fund was established to develop an EE finance market. Similar funds in India use public finance to help industry make better investments in energy consumption and train staff for EE. Another example is the energy conservation loan programme being implemented by China, which requires industries to commit 7-8% of total investment to improve EE. Since its inception in the 1990s, this programme has stimulated widespread uptake of energy efficient technologies. As a result, energy consumption slowed down at a rate of 4.8% per year during the last decade, compared to 7.5% in the previous decade, while GDP continues to grow as fast as 9.5% (Xia 2003).

A few countries like the Republic of Korea, Singapore, and Malaysia are experimenting with the use of disincentive systems, such as energy taxes, to achieve higher efficiency and the economic and environmental benefits that come with it. However, such systems face difficulties in achieving the targets due to the low fee structure and lack of incentives. Emitting industries in the Republic of Korea are prepared to pay the low fees, rather than invest in EE. Opponents of market-based instruments argue along the lines of competitiveness, fearing that domestic industries would be wiped out by multinationals if such disincentives are introduced. Targeting other economic incentives such as tax credits and depreciation have also been a challenge in several countries. Incentives suffer from a free rider problem, where incentives support investment such as deployment of technologies that would have been made anyway. Identification and effective targeting of clearly defined industrial beneficiaries is needed in designing new economic instruments to promote EE.

Many Asian countries remain plagued by heavily subsidised oil prices. Several energy experts believe that until these subsidies are significantly reduced or even removed, other incentive mechanisms will not fully work (Sathaye and Bouille 2001; Kasahara et al. 2005; Intrachooto and Horayangkura 2007). Governments of developing countries in Asia are often faced with an uncomfortable trade-off between the environmental and social effects of reforming subsidies. Occasionally there are good reasons for retaining an element of price subsidy to improve the social conditions of weaker groups. In recent years, however, many governments have started reviewing the validity of subsidies as concerns grow about the environmental consequences of encouraging excessive energy use. Japan has phased out all subsidies for coal since the 1980s. In 1992, China decided to open the market for coal and abolished the subsidies to state-run coal companies. Successively, the product tax of 3% was replaced by a value added tax of 13% and the total coal subsidy was reduced from $750 million in 1993 to $240 million in 1995. These measures helped to reduce coal use in China by 5% between 1997 and 2001. In summary, there is a need to review perverse subsidies to ensure that socio-economic benefits do not need exceed environmental costs.

4.2. Actions taken by the private sector

The private sector in Asia is undertaking voluntary action, either unilaterally or in agreement with governments, to implement EE measures as a way to gain recognition, achieve financial and social benefits, and to stave off the possibility of stricter regulations.

4.2.1. Unilateral voluntary certification programmes

One type of unilateral environmental voluntary commitment is the adoption of ISO14000 standards. Even though they do not have the force of law or government policy, in many cases the ISO 14000 series is becoming the *de facto* codes of practice as the market recognizes the value of such voluntary approaches. Since its launch in 1999, the uptake of ISO 14001 has been rapid in Asia and it has become the most commonly used quality assurance metastandard. Asian corporations comprise approximately 40% of the world's ISO 14000 certified companies. As of December 2007, Japan leads with 13,104 certificates, followed by China (8,865), the Republic of Korea (2,610), India (1,900), Taiwan (1,463), Thailand (974), Singapore (573), Malaysia (566), Indonesia (369), and the Philippines (312), showing widespread uptake across the region. ISO certification is usually awarded to a production facility under the condition that it complies with a set of environmental performance criteria. EE requirements are part of the criteria to encourage factories to engage in a continuous improvement process. The impact of such programmes on SMEs is an important consideration. In many cases, such as engineering spare parts, steel casting works, brick kilns and others, SMEs have difficulty in meeting international EE and environmental standards because they do not have the necessary capital resources. Reaching these small companies and providing special support to adopt voluntary environmental management systems need urgent attention, not only for climate change reasons.

4.2.2. Bilateral cooperation between businesses

Business-to-business cooperation is rapidly emerging in increasingly globalised Asia. Asian companies in global supply chains receive peer pressure from multinational companies (MNC) to improve their energy performance. MNCs with strong brand name reputations are under intense pressure from customers, regulators, and investors to transfer home country environmental standards to their suppliers in the developing countries of Asia. The MNCs are willing to provide technical assistance to ensure that neither they nor their suppliers are subject to criticism by consumers while collectively improving their environmental and energy performance (box 9.5). Planned in the right way, environmental requirements by MNCs on developing country suppliers could have the same effect as national environmental regulations and trigger innovations (ADB 2005).

Box 9.5. Supply chain management of Toyota Motor Corporation

TOYOTA Green Purchasing Guidelines
Toyota issued its environmental purchasing guidelines in 1999. In March 2006, Toyota reviewed and revised the Environmental Purchasing Guidelines, which request suppliers to proactively promote environmental initiatives. The new guidelines were named the "TOYOTA Green Purchasing Guidelines". The major revisions are (i) in addition to requests to implement environmental initiatives, items with regard to the social aspects of supplier business activities have been included; (ii) initiatives that were begun after the initial purchasing guidelines had been issued (such as responses to the EU ELV1 Directive, responses to Eco-VAS 2 and environmental initiatives during logistics activities of contracted transportation companies) have been included; (iii) against the background of Toyota's globally expanding environmental initiatives, suppliers are asked to implement environmental measures like CO_2 emissions reduction, in their production activities; (iv) to further reduce CO_2 emissions during logistics operations, suppliers are asked to implement environmental initiatives in their purchasing and logistics activities. The recent revision also expanded the scope of supplier categories targeted. Approximately 550 suppliers of equipment, and construction and logistics services were added to the existing list of parts and materials suppliers, increasing the total number of companies covered by the new guidelines to about 1,000. Toyota plans to gradually expand the application of the revised guidelines to the newly included suppliers through consolidated companies in Japan and overseas. By these measures and other approaches, the company has reduced its CO_2 emissions substantially.

Source: TMC (2006)

4.2.3. Voluntary agreements

New approaches to improving EE at the sectoral level include voluntary agreements, which are contracts between a private company or an industrial association and the government. The scope of the agreement can vary, but essentially the private sector promises to attain a certain level of EE improvement within a specified time frame. Business associations of industrialised countries like Japan have adopted such voluntary agreements as a self regulating form of EE improvement (box 9.6). To date, more than 3,000 such environmental and pollution control agreements are being negotiated between the Government and companies in Japan. In return, governments promise to refrain from imposing strict regulations, in the broader interest of industrial growth.

There are few examples of such negotiated agreements in other economies of Asia (ADB 2005), but such voluntary agreements could play an important role in climate change mitigation in the future. While companies can use the voluntary commitments to acquire recognition and other regulatory benefits, governments can target the reduction of GHG emissions with a carrot and stick strategy. Intensive stimulation and design of appropriate incentive mechanisms would make business associations more willing to act upon such voluntary efforts.

Box 9.6. Japan steel industry's Voluntary Action Plan

Japan's most prominent business association, Keidanren, declared a Voluntary Action Plan on the Environment in 1997. In the plan, individual firms are bound within their respective industrial associations to cut emissions. This means that the commitments, of which emission targets are the most significant, are set at the sectoral level; not by individual firms which try to continuously improve their EE measures. As part of the Plan, the Japan Iron and Steel Federation (JISF) devised its own action plan to reduce energy consumption by 10% for the year 2010 compared to 1990 levels. Measures implemented consist of (i) energy savings in the iron and steel making process; (ii) effective utilisation of plastic and other waste materials; (iii) energy savings through steel products and by-products; (iv) energy savings through international technical cooperation; and (v) utilisation of waste energy in areas around steelworks. At the end of 2006, 68 companies were participating in the programme, accounting for 97.4% of energy consumption within the industry. To date, the steel industry's energy consumption shows a 6.9% reduction from1990 levels.

Source: Yamada (2007)

4.3. Actions taken by intermediaries

Several intermediaries are already helping industry to tackle the technology, finance and managerial barriers associated with climate change in Asia. Specific actions include the following.

4.3.1. Energy service companies

In recent years, Asia has witnessed the emergence of companies that supply EE solutions and are paid from the energy savings achieved. ESCOs are emerging as a response to the unavailability of technical expertise at factory level and lack of project financing. Also, there is a great need for such intermediaries by SMEs, as it is often impractical or prohibitively expensive for small companies to identify, assess and implement the technological improvements by themselves. ESCOs help their industry clients to improve EE by designing and installing energy efficient equipment, financing energy efficient projects and providing risk guarantees for energy savings. Japan is leading the region with more than 1,300 ESCOs. The World Bank and Asian Development Bank (ADB) are instrumental in promoting ESCOs in countries where energy markets are in transition. From 1998, with the cooperation of the World Bank, China has promoted around 400 energy management companies, providing EE audits and services at no initial cost, but with a performance based contract for later payments. Since 2003, the ADB has provided funds for ESCO activities in India (box 9.7), Malaysia, the Philippines and Thailand to catalyse business opportunities in the EE markets.

In spite of their key role, private banks are reluctant to finance ESCO operations until performance contracting has been successfully demonstrated, thus limiting the uptake of such services by SMEs. Policies to strengthen the financial capacity of ESCOs to develop and implement projects will have an important impact on EE gains by SMEs in Asia.

Box 9.7. Energy service companies in India

India has a small but growing community of ESCO entrepreneurs. Some of India's first ESCO demonstration projects implemented through performance contracting and guaranteed savings include (i) energy-efficient lighting retrofitting for the New Delhi Municipal Corporation facility, which resulted in a 48% load reduction, from 264 to 138 kWh; (ii) a demand-side management programme for a public electric company that resulted in savings of 5.04 million kWh/year; and (iii) a 135-room five-star hotel in Hyderabad which saved 25% of the hotel's annual energy bill. Indian ESCOs typically do not have large assets to bank upon. Therefore, while they have the technical capability to identify and custom-design projects that deliver energy savings, they are often unable to convince their clients, investors and bankers about the certainty of delivering those savings.

Source: Cherail (2007)

4.3.2. Multinational joint venture companies

Technology transfer from industrialised economies to developing Asia is also happening in the form of joint ventures (JV) by MNCs. FDI in countries like China, India and Vietnam swelled about ten times compared to the 1980s and most MNCs are concentrated in automobiles, electronics, chemicals, and petroleum and mining. The production technology of MNCs is more energy efficient than domestic companies and is often used as a prime vehicle for technology transfer and modernizing obsolete facilities. Since domestic companies tend to be recipients of capital, the transfer of technology depends on the market power of the MNCs and IPRs. Strong protection of IPRs can improve technology transfers through JVs. Achieving success in this area also relies on the negotiating skills of domestic companies, international agreements, and government inputs to enable the legal framework.

Organisations like the World Business Council for Sustainable Development (WBCSD) are active in formulating new initiatives such as the Eco-Patent Commons, a mechanism by which businesses pool and provide free access to environmentally beneficial patented processes, such as production processes that conserve energy. IBM, Nokia, Sony and Pitney Bowles are the first four businesses to participate in the Eco-Patent Commons and have collectively donated thirty-one patents. A driver behind the initiative was to reduce barriers created by IPRs in the transfer of technologies between companies and countries, and to open access to environmentally sound technologies for developing countries.

4.3.3. Research and development support for SMEs

Many supportive measures are being undertaken by intermediaries to improve the energy performance of SMEs. Financing schemes such as the countryside loan fund of the Land Bank of the Philippines, the Small Industrial Development Bank of India and the National Development Bank of Sri Lanka target SMEs to adopt EE measures through concessional loans. Policymakers and industry representatives point out that the direct costs and transaction costs of imported technologies, even with financial support from banks, are still prohibitively high and often not compatible with local conditions.

Countries like China and India have excellent capacities for science and technology research, but research on energy efficient technologies that suits small-scale business operations has not been given priority. The research and development (R&D) funds allocated to EE technologies are only a fraction of the total industrial technology research. Moreover, inadequate attention is paid to domestic R&D of innovative and cost-effective technologies and transfer from laboratories to industry (Yoshi and Yokobori 1997). Strengthening local R&D is especially important for technologies that are not produced internationally but meet the needs of SMEs.

4.3.4. International development assistance

International support for Asian industries to improve EE is also provided by bilateral official development assistance (ODA) programmes and by multilateral development banks (table 9.5).

Table 9.5. Bilateral and multilateral cooperation on energy efficiency

Project	Type of aid	Target sector	Lending organisations	Time frame
Energy Efficiency Training	Technical assistance, capacity building	Industry, government	JICA	1980s – present
Green Aid Plan: Energy Efficiency Projects	Technology development	Industry (steel, cement, chemical), electric power	METI and NEDO	1992 – present
Dalian Energy Centre	Technical assistance	Industry	MOFA, JICA, ECCJ	1992 – 1998
Energy Conservation Centre, Thailand	Technical assistance	Government, Industry	METI, NEDO, JICA,ECCI	1999-2005
Industrial Boiler Project, China	Technical assistance, Technology Development, Market development	Boiler manufacturing industry	World Bank – Global Environmental Facility	1995-2004
Chiller Replacement Programme, Thailand	Technical assistance, market development	Chiller Manufacturers	World Bank – Global Environmental Facility	1998-2003
China Energy Conservation and Resource Management project	Technical assistance	Government, Electric power, industry	ADB	2005-present
China Industrial Energy efficiency	Technical assistance, technology development	Industry (chemical, cement, steel)	ADB	1996-2001
Energy efficiency Fund	Technical assistance, market development	Diverse	ADB	2006 - present
ESCO Fund	Technical assistance, market development	ESCOs, industry, buildings, public/government	ADB	2003 - present

Countries, like Japan, that are more energy efficient help industrialising countries of the region through technical and economic cooperation. The Japan International Cooperation Agency (JICA), the Japan Bank for International Cooperation (JBIC) and the Ministry of Economy, Trade and Industry (METI) are instrumental in sending technical experts and offering low-interest loans for EE investment. Major recipients of ODA for industry are in low-to-medium income countries.

The Greenhouse Gas Emission Reduction from Industry in Asia and the Pacific (GERIAP) project is an initiative by UNEP to assist Asian companies to become more energy- and cost-efficient through strategies that improve EE, prevent carbon emissions and reduce operational costs. More than 40 companies from the cement, chemicals, ceramics, steel and paper sectors have participated in this pilot project in Bangladesh, China, India, Indonesia, Mongolia, the Philippines, Sri Lanka, Thailand and Vietnam. By undertaking EE measures, participating companies have reduced emissions by more than 85,000 tCO_2e/yr, while making annual profits of more than $4 million (UNEP 2002b).

Multilateral agencies like the World Bank and the ADB are sponsoring projects on demand side energy management, focusing on electrical power supply and chemical, cement and steel industries. Their current strategy of project-based, government-chosen technology transfers, however, is often found to be slow and inflexible. More emphasis could be given to business-to-business cooperation as well as building the capacity of institutions to make sound policy decisions.

5. Conclusions and recommendations

5.1. Recommendations

EE is of equal interest to business and government. In a recent worldwide survey, 60% of 2,192 corporate executives regarded climate change as strategically important (McKinsey 2007) and many companies have prepared strategies to curtail their own GHG emissions. The recent increase in oil prices highlights the business case for investing in EE options. As business has to provide the largest share of GHG reductions, national performance in mitigating climate change depends on helping them to improve EE. Several studies (AIT 2007; Hward and Vallery 2007; Kainuma et al 2003; UN 2004) indicate that developing countries in the Asia-Pacific region can save 25-30% of their energy use with the current state of technology and level of industrial development. The benefits of EE can be further enhanced by using renewable energy sources such as wind, solar power or bioenergy as well as cleaner and more efficient coal technologies. With significant investments in EE, savings may go as high as 60% in key manufacturing industries (APO 2001). However, uptake of effective and efficient energy production processes and technologies are hampered by policy, as well as financial, managerial, and technological barriers. Asian governments, the private sector and other intermediaries are making efforts to overcome these barriers and improve the energy performance of industries. Case studies have demonstrated that focused business efforts combined with appropriate policy instruments can yield greater energy savings.

Addressing all barriers may not be possible by a single approach and so a combination of prioritised approaches by different actors should be formulated, starting from the immediate concerns with low-cost solutions. Considering the urgency of tackling GHG emissions and recognizing the potential contribution of EE improvements, immediate action should be undertaken across the region. The key element in effective EE strategies is implementation of combined actions in a parallel, coordinated and consultative manner. Priority recommendations include the following.

(i) ***Placing EE at the centre of development policy*** - Governments in Asia should place EE at the centre of industrial development policy, as it yields quick, tangible environmental and economic benefits. Bringing EE to the centre, however, needs close coordination among relevant government departments like industry, energy, environment, trade and business associations. They need to agree on common objectives, which will necessitate a systematic review of key sectoral policies. At the beginning of each fiscal year, existing policies, programmes and action plans can be adjusted so that they support, or at least do not conflict with, government efforts to integrate EE into developmental policies. This annual review could be undertaken by relevant ministries, overseen by a lead agency responsible for drafting integrated energy action plans.

(ii) ***Setting progressive standards and benchmarks*** **-** Asian governments need to think of new standards and sectoral benchmarks that could provide improved market signals for EE. For sectors that consume or waste significant amounts of energy, competitive targets for the best environmental performance should be set up based on international standards. Many studies suggest that the most effective way to achieve sectoral targets is to establish progressive energy performance standards through collective efforts and mandating audit programmes. Tight standards, ambitious targets and liberal incentives will also stimulate innovation at the company level, which would ensure a natural turnover of obsolete production processes. Annual plans should review the success of measures taken during the previous year, in terms of energy saving and cost-effectiveness, as a basis for setting new targets. These targets and standards could be accompanied by voluntary agreements by business associations or public-private partnership accords, with the implied threat of mandatory programmes if voluntary approaches are not effective.

(iii) ***Promoting better use of subsidies and state aid*** **-** Public policies could continue their use of targeted subsidies to support energy-efficient technologies and production processes. Specific initiatives such as tax credits and accelerated depreciation for energy efficient technologies and servicing models have been found to be effective at removing the barriers to EE by reducing the investment pay-back periods and minimising the perceived performance risks. State subsidies that depress the price of energy can provide a significant disincentive for EE investments by industry. If such price controls were made more market-responsive, a more favourable investment climate could be created to encourage EE.

(iv) ***Accelerating private sector voluntary actions*** **-** Asian business efforts to become the world's most competitive companies depend on tackling EE issues. In light of the challenges posed by climate change, industrial ability and economic stability cannot be achieved without major advances in responding to calls from global market forces. Industries in Asia must be prepared to enter into voluntary agreements with the government to set standards and targets for energy efficient production processes and to reduce the market share of the least efficient processes. Integrating voluntary environmental management standards such as ISO 14000 into operational policies could provide a new impetus to EE. New supply chain partnerships, JVs and FDI need to be accompanied by targeted actions to improve EE.

(v) ***Stimulating the role of business associations*** **-** Business associations in key industrial sectors should enter into agreements with governments to save energy and reduce GHG emissions in exchange for access to low-interest loans to finance EE investments and guarantees of stable policies. High energy-consuming sectors can learn from the experience of better performing economies which have witnessed a growing number of voluntary action plans to reinforce sectoral level investments in EE. Business associations should also collect best practices on a regular basis for dissemination by networking with counterpart associations in OECD countries and the WBCSD. Setting sectoral targets and benchmarking product standards could be one of the objectives of establishing such databases. Establishing one stop energy centres for receiving information on best practices, technologies, finance and training has the potential for widespread dissemination of best business practices. Such institutions could be established as a public-private partnership in the initial stages, but become self-supporting later.

(vi) ***Special support for SMEs* -** SMEs face a myriad of problems. They could be addressed by a single window system, wherein a specialised institution with sufficient resources could assess their technology needs and finance EE improvements. This would avoid the ambiguity of the present system with separate technology evaluation and financial assessment. Moreover, research and development policies should be made consistent and coherent with financial and technological policies that promote EE in SMEs. Increased public and private investments on domestic research, as well as transfer of technologies from laboratory to industry, will allow Asian SMEs to develop more appropriate energy efficient technologies that meet their needs. Research investments in limited but key sectors may provide huge cost savings if the technology is proven successful and sold to neighbouring countries. ESCOs could play an important role in improving the EE of SMEs. Current financial schemes for employing ESCOs need careful review and appropriate adjustments. There is an immediate need to revise the legal framework for bankable projects, and also to develop innovative financing products and deal structures. These steps would work towards reducing transaction costs, which could also mitigate project implementation risks. Revision of the legal framework for bankable projects and development of innovative financing products and deal structures to reduce transaction costs that could also mitigate project implementation risks are an immediate need. As EE lending is a new business for the financial institutions involved, capacity building of banking staff to understand the unique nature of SMEs and the importance of energy saving is also an urgent need.

(iv) ***Integrating EE in international cooperation* –** The current international framework for improving investment in EE is inadequate. Bilateral and multilateral aid agencies, which command strong resources and technical expertise, are always well placed to overcome the inherent barriers to improved EE. They should aim to create green lead industries in developing Asia. Green lead industries set high energy performance standards that can be subsequently adopted in other companies in the same sector or other countries. Creating lead green industries requires long-term and ambitious policies as well as technological leadership. Bilateral, multilateral and international organisations could help developing countries in Asia in analysing and prioritising the barriers, selecting key sectors for strategic support for leapfrogging and developing action plans. With support from the international business community, they can create innovative financial mechanisms, such as a seed capital assistance facility, currently being promoted by the UNEP.

5.2. Future research agenda

As there is little doubt that EE not only contributes to reduced GHG emissions, but also to bottom line business profits and national energy security among others, a lack of information appears to be a major barrier to more widespread adoption. Accordingly, the future research agenda should focus on collecting detailed case study data from all sectors and all company sizes on successful EE implementation. In particular, the effectiveness of internal and external energy audits in Asian companies, supply chain partnership programmes, and foreign direct investment needs additional research.

As governments may be concerned that additional support to industry in the form of seed funding to initiate company wide EE plans could be criticised as being too pro-business, the multiple co-benefits of EE (employment creation, clean air, health effects, energy security, start up industries etc.) also need to be documented through additional research. EE is not only good for business; it is also good for the economy, the environment, and the community—all of the elements of sustainable development.

Asian governments generally spend very little on R&D, yet express reservations about IPRs and other barriers to the transfer of technologies from developed countries. Major increases in R&D expenditure on EE technology suited to local conditions, company structures, and Asian resource endowments would yield very high returns.

Finally, industrialised countries like Japan demonstrate that national GHG emissions would have been much higher had they not implemented EE programmes long before climate change was a burning issue. Developing countries in Asia now have an opportunity to emulate this success. Cooperative South-South research on policy transfer and diffusion in the field of EE would help to ensure that best practices in Asia are widely disseminated.

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Part III