

# GUIDELINES FOR STRENGTHENING ENERGY EFFICIENCY PLANNING AND MANAGEMENT IN ASIA AND THE PACIFIC



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#### **EXECUTIVE SUMMARY**

Developing countries around the world are projected to account for around 87 percent of the world's primary energy demand growth by 2030. Much of this growth in energy demand will occur in Asia which is witnessing rising population, high economic growth and rapid urbanization. Many countries are averse to the notion of energy conservation and efficiency and consider it their priority to first ensure economic growth and deal with energy saving later. A well-conceived energy efficiency strategy will not only allow them to achieve their goal with much lower energy consumption but also enable them to improve the living standards and quality of life, while making human and financial resources available for other aspects of societal development such as education, healthcare, etc.

#### ENERGY EFFICIENCY: THE LOW-HANGING FRUIT

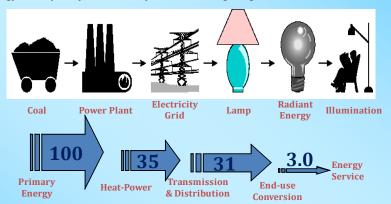
Energy efficiency is widely recognized as the "low-hanging fruit" in a country's pursuit of energy security, inclusive development, and transition to a low-carbon economy. Investment in energy efficiency could be very attractive as the incremental capital investment is recovered in a reasonable time period, energy costs are lowered, and energy productivity is enhanced, thus helping nations and businesses to be better prepared against any sharp hikes in fossil fuel prices.

The general goal could be to ensure a certain level of production and services with energy

#### Box E1.

#### Fossil-based Power Plant versus Virtual Power plant: Co-benefits of Energy Efficiency

The analysis of any energy system would show that there are huge losses between the primary energy supplied and the energy service rendered. Consider the case of a fossil fuel (coal or oil) fed into a thermal power plant to produce electricity that is transmitted and distributed through the electricity network to reach the end-user who converts the electricity into lighting by employing an energy-inefficient incandescent lamp. As the figure below suggests, <u>less</u> <u>than 5%</u> of the energy in the fossil fuel is actually delivered as lighting service.



**Sixty percent** of the energy in the fossil fuel is lost in the power plant whose efficiency is constrained by the 2<sup>nd</sup> law of thermodynamics. On the other hand, the fossil fuel demand can be divided by **4 times** just by substituting incandescent lamps by energy-efficient compact fluorescent lamps (CFLs). The incremental investment for this enduse technology substitution represents roughly **one-tenth** the investment needed to set up the infrastructure for supplying electricity for the lamps, the so-called **virtual power plant**. Furthermore, creating additional power generating capacity requires **several hundred times** more capital than building the facility to manufacture the CFLs. It can take **10 times** longer to recover the capital invested in the power plant than the lamp manufacturing facility. Finally, one should not underestimate the **additional jobs** created for manufacturing, distribution and **commercialization** of these lamps.

There are similar opportunities for changes in the way we build our homes and provide thermal comfort, manufacture products, grow our food or transport people and goods.

Source: Author

consumption optimized with respect to the cost. Asian countries face the added challenge of achieving the target of production and services while confronting energy supply constraints. The deficit in energy supply can very well be met by minimizing the "wasted energy." Wise investment in end-use efficiency can help avoid huge capital investments in power plants that have a long gestation period and are expensive to operate as well.

#### LACK OF HOLISTIC APPROACH TO ADDRESS ENERGY INEFFICIENCY

It is estimated that energy efficiency could make up for half of the reduction needed to drastically reduce greenhouse emissions by 2050 in scenarios with strong  $CO_2$  constraints. Despite the growing awareness about the merits of energy efficiency, and energy efficiency programmes and measures initiated in most parts of the world, countries in the region are still far from realizing the significant energy efficiency potential because of a number of institutional, informational, technical, financial, and market barriers that have not been effectively tackled. Taking account of the specific socioeconomic context of a country, energy efficiency policies need to be designed and implemented to address those barriers effectively.

UNESCAP recommends undertaking national level strategic planning and management of energy efficiency initiatives by adopting a four-step approach, as illustrated in Figure E1.

#### STEP 1: CRAFTING AN INSPIRING NATIONAL ENERGY EFFICIENCY VISION

The first step consists of formulating an energy efficiency vision that links it with national developmental goals, including those related to the energy sector. One needs to identify the main energy efficiency drivers (see Box 2).

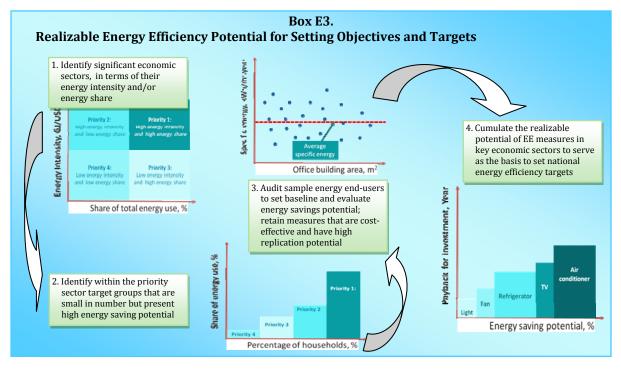
### Box E2. Principal Energy Efficiency Drivers for the Countries of Asia and the Pacific

- **Internal:** Enhanced energy security, easing infrastructure bottlenecks, reduced operating costs and improved competitiveness, job creation, etc.
- **External:** Lower carbon and ecological footprint of the energy sector, climate mitigation, regional/global environmental protection, etc.

Further, it is useful to undertake a SWOT (Strengths, weaknesses, opportunities and threats) analysis to assess the situation specific to the country in order to build scenarios of energy efficiency pathways. Actively **involving all key stakeholders** in the process is the key to get wider support among national decision-makers in consolidating the energy efficiency vision.

# STEP 2: TRANSLATING THE NATIONAL ENERGY EFFICIENCY VISION INTO OBJECTIVES AND TARGETS

The second step consists of translating this vision into objectives and targets. In order to set up realistic and well-quantified targets, UNESCAP proposes the approach illustrated in Box E3.



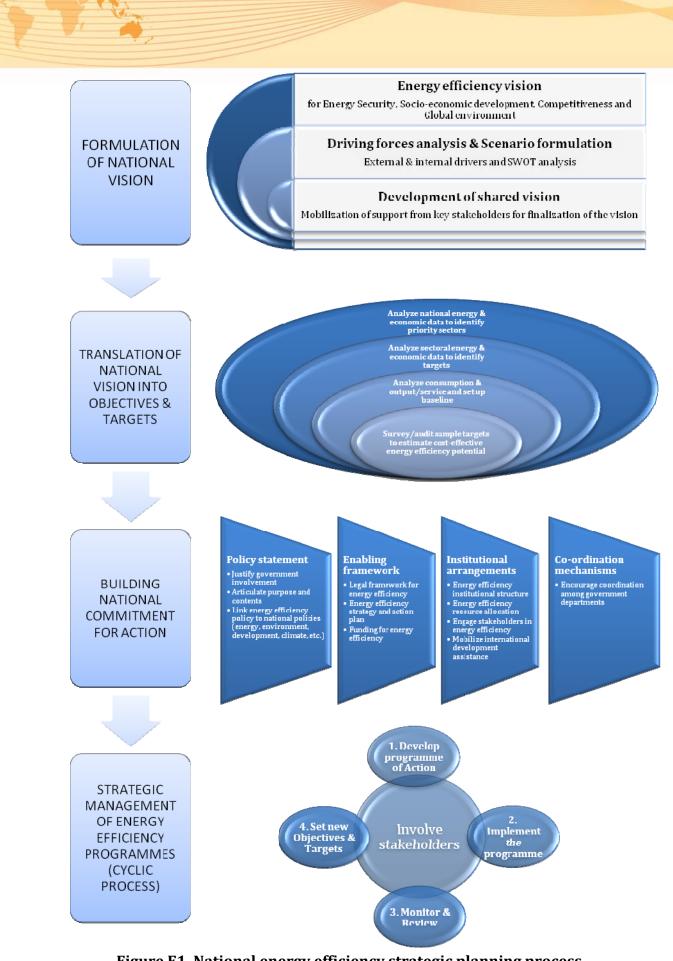


Figure E1. National energy efficiency strategic planning process

#### STEP 3: BUILDING NATIONAL COMMITMENT FOR ENERGY EFFICIENCY ACTION

The third step involves building national commitment for energy efficiency action through the development of (See Box E4 for detailed explanation):

- Policy statement,
- Creation of an enabling framework,
- Formulation of institutional arrangement, and
- Mechanisms for smooth coordination among all stakeholders.

# Box E4. Strategy to Build National Commitment for Energy Efficiency Action

The **policy statement** should justify why government intervention is necessary to promote energy efficiency and articulate well the purpose and the content of the national energy efficiency policy. In order to get broader consensus and support across all government departments, energy efficiency policy needs to highlight the link with existing national policies related to energy, environment, development, and climate change.

The policy statement should be supported by an **enabling framework** that provides the legal basis and the funding mechanism necessary for implementing an energy efficiency strategy and action plan.

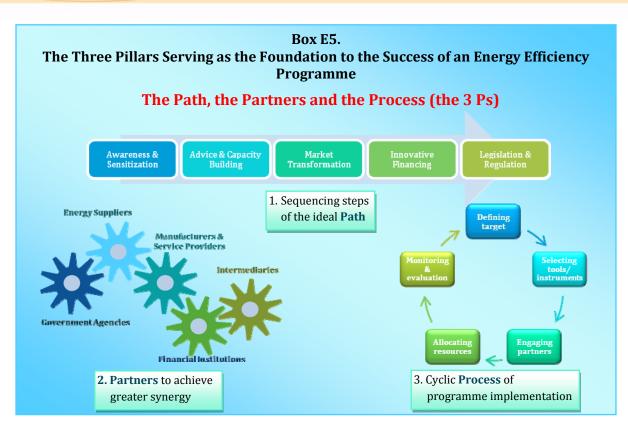
Depending on the context of the country, the most suitable **institutional structure** should be proposed that can be given the mandate to engage with stakeholders and to mobilize resources internally as well as through international development assistance.\*

The organization entrusted with the task of implementing energy efficiency policy and programmes should have the legitimacy/mandate to **coordinate activities** among relevant government departments and other stakeholders, including energy suppliers, in order to build consensus among all and ensure their active involvement.\*\*

- \* To learn more on the different models of energy efficiency institutions around the world and their pros and cons, refer to: ESMAP 2008, "An analytical Compendium of Institutional Frameworks for Energy Efficiency Implementation", Formal Report 331/08.
- \*\* For a more detailed reading on this particular subject of government initiatives and commitment to support the implementation of energy efficiency policy, refer to: OECD/IEA 2010, "Energy Efficiency Governance Handbook".

#### STEP 4: STRATEGIC MANAGEMENT OF ENERGY EFFICIENCY PROGRAMMES

The last step refers to the strategic management of energy efficiency programmes. The guidelines cover this particular aspect by recommending simple yet pragmatic strategies and action plans. The purpose of developing an energy efficiency action plan is to define activities targeted at addressing the various barriers to energy efficiency. National energy efficiency institutions can strengthen their capacity by adopting a "learning by doing approach" and in the process, gain experience and confidence.



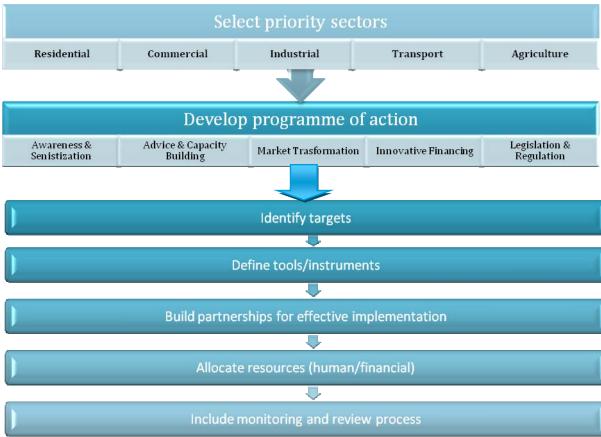


Figure E2. Energy efficiency strategy and action plan

UNESCAP proposes that the process involves the following steps for the smooth execution of each activity:

- Selecting the most suitable target(s) within the priority economic sector(s).
- Defining tools and instruments for effective implementation of a specific activity.
- Establishing institutional partnership and stakeholder engagement for better success.
- Allocating adequate human and financial resources and exploring ways and means to leverage funds from partners and stakeholders.
- Monitoring and evaluation in order to assess the success and drawbacks so that these factors can be taken into consideration in designing the next energy efficiency cycle.

#### ENGAGING THE RIGHT PARTNERS AND STAKEHOLDERS FOR EACH ACTIVITY

One of the most critical factors for the success of the programme is the manner in which the energy efficiency organization engages partners and involves stakeholders in the various activities aimed at removing barriers to energy efficiency. While some activities are to be performed in a completely unbiased and business-free environment in order to raise the confidence of target beneficiaries, other activities will need to be performed in a full-business environment.<sup>1</sup>

For example, awareness and sensitization as well as advice and capacity-building activities have to be conducted such that information or advice remains unbiased and factual without any exaggeration. Accordingly, due care should be taken to avoid engaging partners who may have vested interests. On the other hand, activities related to market transformation and innovative financing are aimed at making energy efficiency a business case. In this case, it is crucial to forge partnerships and involve stakeholders who understand the market well and are willing to take financial risks to some extent, with the knowledge that state support is extended to minimize perceived risks.

# LONG-TERM INSTITUTIONAL COMMITMENT TO REALIZE THE FULL POTENTIAL OF ENERGY EFFICIENCY

The analysis of energy efficiency policies of many industrialized and developing countries undertaken in this UNESCAP study shows the inconsistency of institutional commitment to energy efficiency over a sufficiently long time frame. Some of the reasons for this are large fluctuations in international energy prices over time or lack of patience and foresight of public decision makers who expect immediate results from energy efficiency actions. In such cases, the results fall far below their expectations because market players are not willing to participate in energy efficiency initiatives if they do not see long term signals from the government.

National decision-makers should therefore be patient and willing to provide sustainable institutional support and commit themselves to take up the challenge over much more than just one cycle of energy efficiency implementation.

<sup>&</sup>lt;sup>1</sup> In a business-free environment, the motivation to act is not linked with the objective of deriving financial gains whereas the main driving force under a full-business environment is to earn profit from all activities.

# REGIONAL AND INTERNATIONAL COOPERATION FOR SHARING KNOWLEDGE AND BEST PRACTICES

Lastly, energy efficiency movement can get a big boost and momentum through better sharing of knowledge and best practices among countries. Regional and international cooperation is therefore essential to accelerate the implementation of energy efficiency actions in individual countries and save resources by learning from the experience of countries that have taken a lead in this domain.

Regional cooperation can accelerate the energy efficiency movement through dialogues to identify policies and measures that have been tested and successfully adopted in individual countries and have the potential to be replicated within the same economic region. Such initiatives can help in more effective dissemination of information, experiences and good practices related to regulations, market transformation, education, capacity building, etc. This can lead to the introduction of common policies and measures in countries within the same economic zone and avoid the need to "reinvent the wheel". Measures that are unlikely to be implemented in smaller countries due to the lack of economies of scale can therefore be effectively addressed. Box E6 illustrates the scope for such regional cooperation through a concrete example.

#### Box E6.

#### **Scope for Regional Cooperation to Accelerate Energy Efficiency Implementation**

Regional benchmarking or regional testing facilities can be set up to develop minimum energy performance standards (MEPS) or mandatory energy labels for energy efficiency products and appliances, providing incentives for both manufacturers and end-users through the creation of a wider and diversified market.

Demonstration projects can be undertaken simultaneously in different countries to study the factors influencing their effectiveness and bring about policy changes necessary to tackle country-specific barriers.

In this regard, sub-regional bodies representing countries within the same economic zones in North, South and South-East Asia can be instrumental in establishing cooperation and mobilizing international technical assistance to enhance know-how and experience-sharing among national energy efficiency organizations.

<sup>&</sup>lt;sup>2</sup> The example of the European Union is noteworthy in this context; lessons learnt from individual country experiences and consensus built among the member countries have resulted in the development of harmonized regulations and standards within the European Union. Such regional initiatives have helped to avoid distortion of competition within the economic region and creation of a much larger market for energy-efficient products.

<sup>&</sup>lt;sup>3</sup> An energy efficiency e-tool (ee-Asia) is being developed along with these guidelines to serve this specific purpose.

#### **PREFACE**

Energy security is among the major concerns of countries in Asia and the Pacific. Punctuating this concern are the overdependence of many countries on imported energy resources to meet their increasing energy demand, the volatile prices of oil in the world market, the higher losses in energy production and use, and climate change attributed to the increasing concentration of greenhouse gases in the atmosphere due to the burning of fossil fuel.

The promotion of EE as a policy has often been identified as the most cost effective tool to manage the demand for energy. Developing and maintaining wide-scale energy saving policies are considered to be the most reliable, technically acceptable, economically affordable, and environmentally sensible way to overcome the negative consequences of energy production and consumption. Many countries in the Asia-Pacific region are actively pursuing energy efficiency measures in production and consumption of energy and developing alternative and renewable energy resources to diversify their energy mix as part of the overall energy strategy.

Energy efficiency programmes are not always sustained, especially during periods when oil prices are low. On the other hand, when energy prices shoot up, many governments tend to protect end-users by subsidizing energy and absorbing the economic liability. There is a general lack of opportunities for data exchange and systematic assessment of energy-saving policies among the countries. Institutional capacities for developing and implementing national policies on energy efficiency in some of the countries in the region are weak and thus require a great effort to improve legislation, regulation, and standardization, and other policy and institutional measures.

The United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) therefore considers it vital to tackle the above drawbacks by sharing appropriate policy options in order to strengthen institutional capacities. With support from the Korea Energy Management Corporation (KEMCO) of the Republic of Korea through the East Asia Climate Partnership, ESCAP initiated a project in 2009 with the title "Strengthening Institutional Capacity to Support Energy Efficiency in Asian Countries".

In the first phase of the project, a study was undertaken to assess the status of energy efficiency policies and institutional arrangements in Asian countries to identify the barriers and challenges, and compile case studies of best practices and successful programmes of institutional development for EE promotion within and outside Asia and the Pacific. A regional workshop was conducted in March 2010 to present the main findings and make policy makers better aware of existing institutional mechanisms, including barriers and challenges, for promoting energy efficiency. This activity led to the publication of the "Assessment Report on Energy Efficiency Institutional Arrangements in Asia."

One of the important conclusions of the regional workshop was the perceived need to assist those countries that have yet to establish suitable institutions for planning and implementing energy efficiency policies and activities. It was also observed that many other countries that have already created institutions may require improving their effectiveness to set and implant

policies on end-use energy efficiency, and ensure good collaboration among ministries, government agencies, and other relevant stakeholders. The second phase of the project was therefore aimed at developing **Energy Efficiency Guidelines** that include recommendations to strengthen energy efficiency planning and management in the sub-regions of Central, South, and South-East Asia.

The objective of these Energy Efficiency Guidelines is basically to make national policy makers and practitioners aware of "how to do the right things and how to do things right" in order to achieve energy

"Energy efficiency can serve as a stepping stone for ensuring green growth, eco-efficiency, and sustainable development."

efficiency goals and targets. They recommend simple yet pragmatic strategies, policies, and measures to strengthen institutional arrangements and capacities of national institutions promoting energy efficiency in Asia and the Pacific region. A particular focus is given to those countries that have yet to adopt necessary policies and institutional structure for promoting energy efficiency effectively.

The guidelines are accompanied by a continuously evolving e-tool that presents practical examples of the types of initiatives that could inspire national energy efficiency decision-makers to execute their strategies in a systematic and planned manner in order to achieve the set targets and goals.

The guidelines start by explaining how energy efficiency can serve as a stepping stone for ensuring green growth, eco-efficiency, and sustainable development. The difference between energy efficiency and energy intensity is explained as well as the factors that may influence the energy intensity of a country. While mentioning that it may not be fair to compare nations on the basis of their energy intensities, it goes on to define the need for each country to retrospect on the inherent constraints that impede the achievement of low energy intensity and to look for appropriate solutions to decouple the economic growth from energy consumption by taking into consideration country-specific barriers and challenges to effectively promote energy efficiency.

Section 2 describes the **energy efficiency strategic planning and management** approach. Starting with the formulation of a national energy efficiency vision, it highlights the relevance of energy efficiency governance, defined as the combination of several measures to support the implementation of energy efficiency strategies and programmes. It emphasizes the importance to create a suitable organization that serves as an effective institution to execute government policies and strategies. Finally, there is brief description of the recommended structure of the energy efficiency organization that includes sectoral units that remain responsible for the overall management of sector-specific activities and thematic groups that provide technical assistance needed for employing the tools and methodologies and defining criteria for monitoring and evaluating the effectiveness of the energy efficiency programme.

Section 3 explains the **process of setting up national energy efficiency objectives and targets**. Starting with the assessment of the need for energy efficiency and prioritization of energy efficiency targets, this section explains how preliminary activities can be undertaken to set the baseline and assess the techno-economic potential for energy efficiency and then

assist the targeted beneficiaries in achieving the techno-economic potential to the extent possible.

Section 4 of the guidelines presents an **analytical framework for energy efficiency promotion**, describing the path to be charted, the process to be followed, and the synergy to be created among various relevant stakeholders to realize the energy efficiency goals. It presents the target end-use sectors for energy efficiency implementation and emphasizes the need to set up realistic targets according to the means available.

The last section deals in more detail with the cyclic process of implementing the national energy efficiency strategy, taking the residential sector as an example for illustration. It includes sample examples of the types of actions that may be initiated by the organizations in-charge of promoting energy efficiency in their respective countries.

#### 1. ENERGY EFFICIENCY: STEPPING STONE FOR SUSTAINABLE DEVELOPMENT

# ENERGY EFFICIENCY, GREEN GROWTH, ECO-EFFICIENCY, AND SUSTAINABLE CONSUMPTION AND PRODUCTION

Having experienced the negative impacts of setting rapid economic growth targets in the form of resource scarcity, resource price fluctuations, and a sluggish progress towards the **Millennium Development Goals** (MDG), developing countries in Asia and the Pacific region have started realizing the need to adopt "**Green Growth**" as a new model for development. The Green Growth model basically involves shifting away from the conventional economic paradigm of maximizing the Gross Domestic Production (GDP) towards a new development paradigm of **maximizing economic, social, and ecological quality of growth** that focuses on employment generation, economic resilience, quality of life, and ecological sustainability.<sup>4</sup> One of the key targets of Green Growth is to propagate **Sustainable Consumption and Production** (SCP) as a panacea for our current woes related to resources, development, and the global environment.

The world business community has also taken the lead to address the adverse ecological impacts of industrial activities by creating the **World Business Council for Sustainable Development** (WBCSD) in 1992 and coining the term "**eco-efficiency**" that aims at reducing the ecological impacts of production while transforming value-added economic goods and services. Following this approach can result in an increase in resource productivity, thus supporting the business in establishing a competitive advantage in the global arena.

Energy Efficiency can be interpreted as the reduction of energy use for a given service or level of activity, or more aptly as the art of "Doing more with less".

The notion of energy efficiency is often associated with technological improvements (sustainable production, which requires innovation and legislation/obligation); it

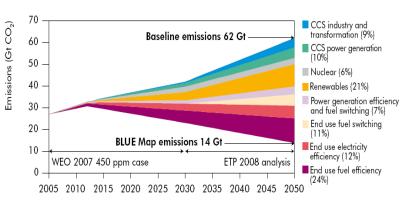


Figure 1. Technological options for energy-related emission reduction (Source: International Energy Agency)

however can also be achieved through better organization or management, and through behavioural changes (sustainable consumption, which requires raising awareness and incentives/ taxes). The energy technology perspective study conducted by the International Energy Agency (IEA) in 2010 concludes that under the **BLUE map scenario**, up to 36% of

<sup>&</sup>lt;sup>4</sup> During the 5<sup>th</sup> Ministerial Conference in Seoul, Republic of Korea, in 2005, the concept of Green Growth was adopted by 52 Member States of the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) as a common path for achieving environmentally sustainable economic growth. For further information: <a href="http://www.greengrowth.org/">http://www.greengrowth.org/</a>

the energy-related CO<sub>2</sub> emissions can be lowered through end-use fuel and electricity efficiency by 2050. <sup>5</sup>

**Energy efficiency** can therefore be considered as the **keystone** to achieve the goal of either "Green Growth" through the promotion of sustainable consumption and production at the country level, or "eco-efficiency" through resource productivity at the corporate level.

Energy efficiency is often looked upon as the "**low-hanging fruit**" that is waiting to be plucked with least efforts in our pursuit of energy security, inclusive development, and the transition to a low-carbon economy. Interestingly, studies conducted in different parts of the world to assess the marginal abatement cost (MAC) of greenhouse gas reduction have

shown end-use energy efficiency to be the cheapest among the various available options (see Figure 2 for an example of MAC curve for India). Investment in efficiency energy extremely attractive as the incremental capital investment is recovered in a reasonable time frame, energy cost is lowered, and there is an increase the energy productivity, thus helping nations and

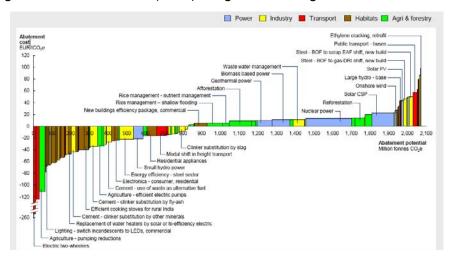


Figure 2. India's CO<sub>2</sub> abatement cost curve for 2030, showing many energy efficiency measures can be implemented at negative costs (Source: McKinsey India Cost Curve Model, 2009)

businesses to be better prepared against any sharp hikes in fossil fuel prices in the future. Moreover, unlike fossil-based energy supply options, energy efficiency does not have adverse impacts on water supplies, coastal wetlands, or coral reefs, or create spills, accidents, and fires that can cause explosions.

End-use energy efficiency is even more relevant in the context of **developing countries** which have the onus of investing in both energy supply and end-use technologies; wise investment in end-use efficiency can help avoid huge capital investment in power plants that have a long gestation period, and are expensive to operate as well. It has been shown that many end-use efficiency investments can lead to a negative MAC.

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<sup>&</sup>lt;sup>5</sup> OECD/IEA, 2010, Energy Technology perspectives 2010: Scenarios and Strategies to 2050

#### Box 1. The Economics of Investments in Energy Efficiency

A common example is the substitution of incandescent lamps by more efficient compact fluorescent lamps (CFLs); the incremental investment for this technology substitution represents one-tenth of the incremental investment that would have been needed to build additional power generating infrastructure in order to supply the electricity needed for the lamps. According to World Bank estimates, one million CFLs can reduce about 38 MW of peak electricity demand at a cost of US\$50-100 per kW, compared with supply costs of US\$500-2000 per kW. From the customer perspective, investment on a CFL pays back within 6 months to a year, depending on the prevailing electricity tariff.\*

Furthermore, creating additional power generation capacity requires several hundred times more capital than building the infrastructure necessary to manufacture such compact fluorescent lamps. It also takes much longer time to recover the capital invested on the power plant than the lamp manufacturing plant. Finally, one should not underestimate the additional jobs created for the manufacturing, distribution and commercialization of the lamps.

There are similar opportunities for changes in the way we build our homes and provide thermal comfort, manufacture products, grow our food or transport people and goods.

\* In Bangladesh, the electricity demand keeps growing at a rate of 500 MW per year due to population growth and industrialization. As a result, there is a deficit of over 2000 MW during peak hours and load shedding is a common phenomenon. As lighting alone accounts for 20 percent of the peak demand, the Government of Bangladesh, with support from the World Bank, has launched a large scale programme, known as Efficient Lighting Initiative of Bangladesh (ELIB), to reduce electricity peak loads. Phase I deployment of 10.5 million CFLs in 2010 is estimated have the same impact as installing 300 MW of additional generation capacity. Through an Emission Reduction Purchase Agreement, ELIB programme is expected to earn carbon revenue of over €6.5 million for a period of 3 years (2011-2013) from the first phase of 10.5 million CFLs.

Source: www.worldbank.ora/enerav

#### UNDERSTANDING ENERGY INTENSITY AND THE INFLUENCING FACTORS

Energy Intensity is defined as the ratio of energy consumption per unit output or activity. On the other hand, Energy Efficiency improves when a given level of service is provided with reduced amounts of energy inputs or services are enhanced for a given amount of energy input. Accordingly, an increase in energy efficiency would mean a decline in energy intensity. In reality, energy intensity includes not just energy efficiency but also some structural and behavioural components. For example, a decrease in energy consumption in steel manufacturing does not necessarily mean that steel production has become more energy efficient. Other factors such as changes in the structure of steel plants (production capacity, type of steel produced), changes in the fuel-mix, market demand for steel, or even the behaviour of steel plant staff can also affect energy intensity. Therefore, in addition to developing policy to address energy efficiency, it is also important to understand the influence of structural and behavioural components on energy intensity and explore policy options to address the associated issues.

When energy intensity of a whole economy is concerned (e.g., at the national level), it represents the most aggregate level of activity and is presented as the energy-GDP ratio which is calculated by dividing either primary energy consumption by the real GDP or final energy consumption by the gross value added of the various economic sectors. As the energy-GDP ratio does not require much detailed data, this indicator is widely used to undertake energy performance comparisons among countries or regions, energy intensity being used as a proxy for energy efficiency. As stated earlier, it does not however reflect the structural and behavioural factors that influence energy intensity. The influence of these factors that are not related to energy efficiency can be better understood only when data are gathered and analyzed at more disaggregated sectoral or sub-sectoral levels. Therefore, international comparison of simple energy-GDP ratios to assess the energy efficiency

"International comparison of simple energy-GDP ratios to assess the energy efficiency performances of countries tends to be unfair when one does not have a good understanding of the various factors that affect the energy intensity at the level of a country."

performances of countries tends to be unfair when one does not have a good understanding of the various factors that affect the energy intensity at the level of a country. Some examples of factors influencing the **energy intensity at the macro level are** elaborated below.

**Objective factors**: These include mostly physical parameters such as the geography (size, topology, and climate) as well as the population and demographics. A large country with relatively dispersed population would normally require more energy for transport and hence have a higher energy intensity compared to a densely populated small country. Similarly, a country with mountainous region will tend to have higher transport energy consumption than a country with flat regions. A cold country will need more energy to keep the population warm and comfortable than a country that is endowed with a climate that is comfortable round the year.

**Semi-objective factors**: These are more techno-economic in nature and refer to the structure of the economy, the infrastructure for energy production and consumption, the level of industrial development, and the lifestyle adopted by the population. The energy consumption pattern is directly influenced by the level of the economy or the per capita income and the percentage of population below the poverty line. Also, the country's economic activities and hence the energy intensity will also depend on the structure of the economy, whether it is a true market economy or not, whether there are plenty of foreign direct investments or shareholding investments or private/state investments, etc.

# "The rate and the stage of economic development influence the energy intensity of a country"

Energy intensity is influenced by the type of infrastructure for energy production and consumption, for example, the types of power plants, electricity transmission and distribution, and distribution network for other energy carriers. Sometimes, the rate of electrification determines the rate of access to more efficient energy sources.

Countries that have large mining sectors are relatively energy intensive. For example, the increase in energy intensity may be caused by exploration of resources located in deeper deposits or an increase in the production of liquefied natural gas. Government policies may lead to the shutdown of smaller inefficient plants or mining operations.

The rate and the stage of economic development influence the energy intensity of a country. During the process of industrialization, there is a shift from agriculture to relatively energy-intensive manufacturing. Moreover, traditional energies (mainly bio-energies) give way to more commercial forms of energy that allow for better integration of modern technologies

and practices. The **sectoral shifts in industries** have a direct impact on the energy intensity of a country. Such shifts may be linked to the type of natural resources a country has, or the shift in consumer demand for more electronic goods and services. The technological advancement or the changes in the industrial sector will also have an impact on the energy consumption behaviour. Along with the industrialization of a country, **modal shifts in the transport systems** due to the decentralization of business and industrial activities may influence the energy intensity. In the post-industrial phase, manufacturing gives way to the less energy-intensive services, helping to lower the energy intensity.

As for the changes in the lifestyle, the **urbanization rate** influences the energy intensity of a country. While urbanization may increase the need for transporting required foods and other commodities from rural to urban areas, it may reduce the travelling required between office and home, transport of goods and services, etc. Urbanization can also help in creating an easy access to more efficient sources and means of equipment and appliances. On the other hand, improvement in living standards may lead to greater appliance or car ownership, changes in the size of cars and household appliances, changes in the share of single family houses in the building stock, increase in the human comfort, diffusion of new services and appliances (air conditioning, personal computers, etc.).

Energy prices have a direct impact on the sub-sectoral energy efficiency of a country. An increase in **energy prices** will encourage more efficient use of energy or the producers may decide to substitute energy for other inputs such as labour and capital, where feasible. While appropriate energy pricing can be an effective tool to improve energy efficiency and internalize some externalities such as resource depletion and environmental degradation, it is politically more difficult to implement, especially in many developing countries.

# "Energy prices have a direct impact on the sub-sectoral energy efficiency of a country."

Many governments in the Asia-Pacific region tend to **subsidize the price of energy** with the reasoning that lower energy prices are beneficial for economic growth and can make the products and services more affordable. There are several **perverse impacts** of such short-sighted policies. When the subsidy is not properly targeted, it is the affluent class of the society consuming more energy that benefits the most from subsidized energy prices. Also, a low energy price is deterrent to the adoption of energy-efficient equipment and processes, eroding the competitiveness of manufactured products and services. Moreover, when the limited financial resources of the government are channeled to import fossil fuels at high costs and distribute them at subsidized rates, fewer resources are left to meet more critical needs of the society.

# CHALLENGES OF DECOUPLING ECONOMIC GROWTH FROM ENERGY CONSUMPTION

The previous section dealt with some examples of factors that may influence the energy intensity of a given economy or a country, showing why it may not always be fair to compare the energy performances of different countries using such a yardstick. However, each country needs to retrospect on the inherent constraints that impede its ultimate goal of

achieving low energy intensity. After all, irrespective of the inherited objective or semiobjective factors, all countries face the ultimate challenge of decoupling economic growth from energy consumption, and have some degree of freedom in making choices that allow them to **do more and better with less energy and investment**.

Developing countries with low per capita energy consumption are often averse to the notion of energy conservation and efficiency and consider it their priority to first ensure economic growth and deal with energy saving later. There is no doubt that these countries need more energy to achieve socioeconomic development but not for using energy inefficiently in meeting the rapidly growing demand for housing, industries, transport, and services. A well-conceived energy efficiency strategy will not only allow them to achieve their goal with lower energy consumption but also enable them to improve the living standards and quality of life, while making human and financial resources available for other aspects of societal development such as education, healthcare, etc. The general goal could be to ensure a certain level of production and services with the energy consumption optimized with respect

"Developing countries with low per capita energy consumption are often averse to the notion of energy conservation and efficiency and consider it their priority to first ensure economic growth and deal with energy saving later." to the cost. Many developing countries in Asia and the Pacific region have the added challenge of achieving the target of production and services while facing energy supply constraints. The deficit in energy supply can very well be met by minimizing the "wasted energy".

At the outset, it was explained how energy efficiency can serve as a keystone in maximizing the economic, social, and ecological quality of growth. In practice, however, one comes across several barriers and challenges to effectively promote energy efficiency. According to various studies undertaken in the past,

these barriers can be grouped into following categories:

- a. **Political and structural:** Structural characteristics of the political, economic, energy system which make energy efficiency investment difficult
- b. **Institutional:** Weak institutions to support energy efficiency; institutional bias towards supply-side investments
- c. **Regulatory:** No regulation to invest in cost-effective energy efficiency; subsidized energy supply
- d. **Information and awareness:** Lack of information on actual energy consumption and energy saving potentials, lack of knowledge of best practices and best available technologies
- e. **Behavioural and organizational:** Behavioural characteristics of individuals and organizations that hinder the propagation of energy-efficient technologies and practices
- f. **Technical:** Absence of affordable energy-efficient technologies suitable to the local context; inadequate capacity of energy users to identify, develop, implement energy efficiency projects

- g. **Market:** Market structures and constraints that prevent energy users from appraising the true value of energy efficiency
- h. Financial: High up-front costs of energy efficiency solutions and the low energy supply tariffs prevailing in many developing countries; lack of awareness of financial institutions of the financial benefits of energy efficiency investments, etc.

Considering the fact that each country varies from another structurally, socio-politically, and the barriers to and the

"Countries will have to identify policy measures that have scope for success within the prevailing socio-political context, and focus more on energy efficiency governance."

drivers for energy efficiency can be very different, it will be presumptuous to propose to individual countries representing a very large region concrete solutions regarding how they should adopt and implement energy efficiency policies and programmes in order to decouple energy use from economic development. Countries will have to identify policy measures that have scope for success within the prevailing socio-political context, and focus more on energy efficiency governance which is described further in the next section.

Learning from the experiences under comparable contexts, countries interested in achieving sustainable energy efficiency can initiate measures that have been successfully adopted elsewhere.

#### PURPOSE OF ENERGY EFFICIENCY GUIDELINES FOR THE UNESCAP REGION

The **Energy Efficiency Guidelines** are an attempt to recommend strategies, policies, and measures to strengthen the institutional arrangements and capacities of the national institutions promoting energy efficiency in the Asia and the Pacific region. These guidelines provide inputs to concerned decision-makers of national energy efficiency organizations on the path to be charted, the process to be followed, and the synergy to be created among the various stakeholders in order to realize the energy efficiency goals set by their respective governments.

The guidelines do not provide answers to what should be the **structure of the energy efficiency organization** because the choice of the organization is very much linked with the **country context** as well as many other factors such as historical development, culture, leadership, human resources, and, more specifically, the energy efficiency objectives set by the government. Moreover, the assessment report on institutional arrangement in Asia undertaken by UNESCAP confirms that many countries in the UNESCAP region have already adopted some institutional arrangement either by defining the role of existing institutions or by creating new ones.<sup>6</sup>

<sup>&</sup>lt;sup>6</sup> UNESCAP (2010), Assessment Report on Energy Efficiency Institutional Arrangements in Asia, United Nations Publication, ISBN: 978-92-1-120614-2

"These guidelines provide inputs to concerned decision-makers of national energy efficiency organizations on the path to be charted, the process to be followed, and the synergy to be created among the various stakeholders in order to realize the energy efficiency goals set by their respective governments."

The intent of the guidelines is to present an analytical framework that can be pursued to achieve energy efficiency goals. It highlights the fact that energy efficiency promotion is a cyclic process. Irrespective of whatever level of success a country may have achieved, there is always scope for further improvement as traditional barriers to energy efficiency are lifted, and there are further technological innovations as energy price keeps rising. The analytical framework defines the three pillars (Path, Partners and Process) that lay the foundation to a sustainable energy efficiency action plan. Government officials concerned with the subject will be able to initiate a gap analysis for assessing their present status in the cyclic process of energy efficiency promotion.

Countries which are just beginning and have yet to establish an **institutional arrangement** may take into consideration the different aspects presented in the guidelines to create a goal-oriented organization that is given the mandate and allotted the resources required to operate and implement the energy efficiency policy successfully.

# "The focus of these guidelines is to assist concerned decision-makers and practitioners in strengthening their institutional capacities."

On the other hand, countries which already have in place the institutional arrangement necessary to promote energy efficiency may wish to initiate a gap analysis by taking stock of institutional motivation and capacity (institutional history, mission, culture, leadership, human resources, and other core resources), institutional programmes (evaluation of programme management, process management, and inter-institutional linkages), and institutional performance (effectiveness, efficiency, adaptability, and relevance), and formulate a revised plan for addressing the weak areas and gaps.

The guidelines assume that a country is convinced of the need to adopt energy efficiency, has plans to or has already taken steps to identify barriers to energy efficiency promotion, and develop targeted energy efficiency policies and assign an institution to address these barriers. The focus of these guidelines is to assist concerned decision-makers and practitioners in strengthening their institutional capacities to develop a road map for targeted sectors, define institutional arrangements, and ensure stakeholders' participation in implementing time-bound action plans.



#### FORMULATING A NATIONAL ENERGY EFFICIENCY VISION

Depending on their **state of development**, countries in the Asia-Pacific region face **different types of challenges**. Economies of many countries are faltering during the current economic downturn; moreover, these countries are faced with the challenges of spiking oil prices linked with geopolitical instabilities, growing national competition for global energy supplies, and the adverse effects of climate change. Improved energy efficiency is being recognized worldwide as an effective response to these challenges. Thanks to the comprehensive and innovative approaches adopted by some governments in both developed and developing countries to stimulate demand for energy efficiency and manage its delivery, there is increasing evidence of the **numerous co-benefits of energy efficiency**: greater energy security, energy affordability, increased energy productivity across the economy, creation of jobs, smoother transition to a low-carbon economy, etc.

"It is paramount policy makers formulate an energy efficiency vision aiming to address developmental challenges that are specific to countries."

Keeping the above in mind, it is paramount policy makers formulate an energy efficiency vision aiming to address developmental challenges that are specific to countries. Consultation should be held with all decision makers involved in framing national policies in order to enhance their understanding of the role energy efficiency can play to ensure development and reduction of energy demand. An in-depth comprehension of the **main energy efficiency drivers**, both national and regional/global, is essential before undertaking a balanced analysis of the national strengths, weaknesses, opportunities and threats, and building scenarios of energy efficiency pathways that can be pursued to better achieve the national goals. Such exercise will ensure not only the political support necessary at the highest national level to prioritize energy efficiency in all aspects of socio-economic development, but also mobilization of adequate resources to translate the energy efficiency vision into practical actions and unlock the full energy efficiency potential.

"Any infrastructure which is not designed optimally for energy efficiency now would represent a lost opportunity to lock in lower energy consumption for several decades."

#### Box 2. Emphasis on energy efficiency in the national integrated energy policy

The Integrated Energy Policy (IEP) Report of 2006 laid out a vision of providing energy security to all citizens of India. The three pillars of sustainable development — economic, social and environmental - are to be addressed in the provision of adequate energy supplies. The vision also recognizes that fuel flexibility is important since energy carriers can substitute one another and hence an integrated policy can pay rich dividends. IEP lays adequate emphasis on energy efficiency and demand side management based on studies showing 20 to 25 percent energy savings potentials in the different economic sectors.

Source: Planning Commission of India. 2006, Integrated Energy Policy - Report of the Expert Committee

Of particular relevance is the huge infrastructure that is in the pipeline for implementation in developing countries. Any infrastructure, be it public or private, which is not designed optimally for energy efficiency now would represent a lost opportunity to lock in lower energy consumption for several decades.

#### RELEVANCE OF ENERGY EFFICIENCY GOVERNANCE

In all countries, government plays an important role in ensuring energy supply to support socioeconomic development. It is the observation of UNESCAP that some Asian developing countries have fallen into the so-called "vicious cycle" of energy inefficiency, starting with the policy of subsidizing energy supply below its cost in order to make it accessible and affordable. While the genuine need to address energy access and affordability issues is undeniable, subsidies that are not well targeted tend to have negative effects. For example, low energy prices do not motivate end-users to use energy judiciously or to get rid of outdated and inefficient equipment, technologies and processes. This in turn hinders the research and development efforts; moreover, manufacturers do not find any justification to innovate. This leads to higher demands for a given energy service, thus putting undue pressure on the energy supply. Due to the lack of resources, governments are not able to create the energy infrastructure and to supply the energy necessary for keeping up with the demand. In the process, various barriers are created which aggravate the overall situation, and lead to results that are exactly opposite to what was initially intended by the government.

Government intervention is therefore crucial to transform the "vicious cycle" of energy inefficiency into a "virtuous cycle" of energy efficiency by tackling barriers so that energy consumption can be decoupled from the economic growth. Initiatives of the government may include measures such as rationalizing energy tariffs, internalizing the social costs of pollution (and climate change risks), supporting research and development,

introducing incentives for the adoption of clean and energy-efficient technologies, addressing market failures, enforcing new efficiency standards, and ensuring coherence of policies in the long term. The challenge to scale up energy efficiency at the national level is huge considering the fact that energy supply is managed by a limited number of players whereas energy demand management concerns all energy consumers in the society.

"Government intervention is therefore crucial to transform the "vicious cycle" of energy inefficiency into a "virtuous cycle" of energy efficiency."

Activities may start with the declaration of government policy to formulate **an energy efficiency strategy** and undertake initiatives that justify government intervention; articulate the overall objectives, policies, and strategies to achieve the set targets; make institutional arrangements to develop laws, decrees, and incentive framework and implement targeted programmes; and allocate resources needed and the funding mechanisms to sustain energy efficiency activities. It may further include developing mechanisms to coordinate energy efficiency policies and programmes within and across levels of government, initiating consultative processes to engage key stakeholders, establishing frameworks and coherent programmes to encourage energy efficiency

investment, and defining the process to integrate energy efficiency with other development, environmental, and societal goals.

**Energy efficiency governance** finds its relevance in the above context. It can be defined as the combination of legislative frameworks and funding mechanisms, institutional arrangements, and coordination mechanisms, which work together to support the implementation of energy efficiency strategies, policies and programmes.<sup>7</sup>

#### INSTITUTIONAL NEEDS FOR ENERGY EFFICIENCY IMPLEMENTATION

In the overall **process of energy efficiency governance**, it is essential to create an energy efficiency agency or organization which serves as an effective institution with the key role of executing government policies and strategies through the coordination of energy efficiency policies and programmes, including programme design, administration, management, monitoring, evaluation, etc. Such agency should demonstrate strong leadership and have

"It is essential to create an energy efficiency agency or organization which serves as an effective institution with the key role of executing government policies and strategies "cycle" of energy efficiency."

the capacity to coordinate within and across levels of government, and engage key stakeholders in consultative processes to help build consensus. The onus of implementing energy efficiency improvement activities at the decentralized level lies with government services, regional and local authorities, service sector firms, manufacturers and distributors, households, etc. The role of the energy efficiency institution is to take the lead in promoting, supporting, and facilitating the creation of an enabling environment for the above stakeholders to execute activities in order to have the best impacts on the

economy, society, and the environment.

Studies conducted around the world have shown that there is no such universal model of energy efficiency organization. The **different types of energy efficiency organizations** that one comes across can be categorized as follows:<sup>8</sup>

- a. **Government agencies** that deal with all aspects of energy: energy security, supply, pricing, legislation, efficiency and conservation, renewable energy, etc.
- b. Government agencies specialized in energy efficiency, renewable energy, or clean energy
- c. **Independent statutory authorities** with the mandate of executing government energy efficiency policies and strategies
- d. "Parastatal" corporations in-charge of energy efficiency programme implementation
- e. **Public-private partnerships** to promote energy efficiency

<sup>&</sup>lt;sup>7</sup> OECD/IEA 2010, Energy Efficiency Governance: Handbook

<sup>&</sup>lt;sup>8</sup> For more detailed information on the subject: http://esmap.org/filez/pubs/10292008124258\_EE\_Institutional.pdf

f. **Nongovernmental organizations** specialized in implementing energy efficiency programmes

It is not possible to categorically say which energy efficiency organization is the best because each type of organization has its own advantages and drawbacks. The government may decide to adopt whatever model of energy efficiency organization suits best the country's political, cultural, and economic priorities. Irrespective of whatever structure of energy efficiency organization a country may opt for, a **statutory basis** is desirable in order to establish an effective energy efficiency institutional structure because it provides legal basis and legitimacy to the organization in terms of its authority, role, and means to carry out the energy efficiency mandate. The designing of the energy efficiency organization should be according to the specific policy implementation requirements and the economic sectors that are set as main targets.

Experience of energy efficiency promotion both in industrialized and developing countries has shown that a strong mandate from the government, consistent policy, and long-term commitment for supporting energy efficiency goals are the essential elements on which basis the energy efficiency agency can develop and flourish.

"Experience has shown that a strong mandate from the government, consistent policy, and long-term commitment for supporting energy efficiency goals are the essential elements on which basis the energy efficiency agency can flourish."

The **most critical aspect for the success** of an energy efficiency agency is the people who form the organization. They should have an appropriate background and training suited for the job and should project leadership and professionalism in their day-to-day activities involving interaction with the major stakeholders and beneficiaries. **Administrative and management autonomy** should be granted and adequate financial resources should be made available to them not only to cover the organizational expenditures but also initiate programmes and activities in order to achieve the energy efficiency targets set for specific sectors.

Taking into consideration the **specificities of the country**, the agency should design programmes that are well suited to the targeted economic sectors and empower the partners and stakeholders in making decisions at the decentralized level. For this to happen, the organization may need to be structured such that in addition to the central office conveniently located close to the central government, there may be satellite and branch offices located in bigger cities or industrial zones so that the local units are closer to the local stakeholders and have a better knowledge of the local requirements. They will then be able to develop programmes that are in line with the national objectives and meet the specific local requirements. With active interaction with the local decision-makers and through the consultation process, the local counterparts of the organization can leverage the local budget and funds, including those mobilized by private players, with national budget allocated specifically for energy efficiency promotion.

#### RECOMMENDED STRUCTURE OF THE ENERGY EFFICIENCY ORGANIZATION

The previous sections described the three pillars (path, process, and partners) and the economic sectors to be selected as a function of their relevance in the country. The organization responsible for energy efficiency can be structured such that it has units to set target, plan, implement, and monitor the outcome in the targeted sectors. On the other hand, it is also useful to have thematic groups that are specialized and are focused on each of the steps of the ideal path outlined. Figure 3 shows an example of the structure of the organization.

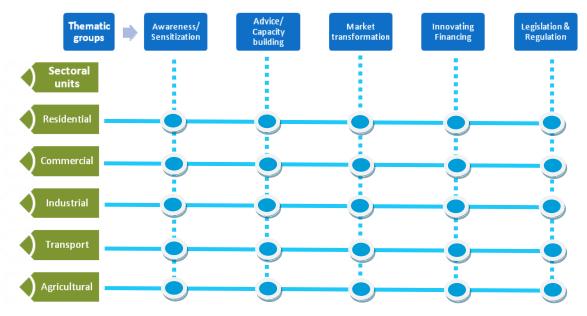


Figure 3. Organizational structure of the Energy Efficiency Organization

The sectoral units take the overall responsibility and are accountable for the overall management of activities in specific sectors whereas the thematic groups provide technical assistance in terms of tools and methodologies to be employed, identification of and interaction with relevant partners, defining the monitoring and evaluation criteria, etc.

#### 3. SETTING UP NATIONAL ENERGY EFFICIENCY OBJECTIVES AND TARGETS

An **Energy efficiency strategy** is aimed at tackling various barriers to the adoption of energy efficiency. As energy is diffusely connected with various aspects of our daily life, concerted efforts are necessary to initiate a myriad of small energy efficiency actions across the society in order to achieve significant energy savings. It is therefore essential that the energy efficiency strategy be well integrated within broader economic, social, and environmental policies and directives so that action can be taken across all sectors of the economy and energy users can optimize benefits by minimizing wastage and costs through the adoption of the most effective intervention mechanisms.

"The design of the energy efficiency strategy needs to prioritize actions that have the potential to achieve the maximum impact with limited resources."

Given the reality that governments have financial and human resource limitations, the design of the energy efficiency strategy needs to prioritize actions that have the potential to achieve the maximum impact with limited resources. According to the means available, actions should be prioritized, goal-oriented, realistic, and achievable in order to gain credibility. Achieving a goal helps to demonstrate the effectiveness of the programme (especially when the energy efficiency programme is just launched in a country) and give confidence to the organization mandated to implement the national energy efficiency programme in widening

the scope of intervention. Care should however be taken not to set a target that is too ambitious and is not based on ground realities.



Figure 4. The Plan-Do-Check-Act cyclic process

Based on the above, the overall energy efficiency strategy and action plan for a country can be developed following the well-known **Plan–Do–Check–Act (PDCA)** cycle in a time-bound manner (see Figure 4). This approach will be relevant at all times, irrespective of the fact whether the country is just initiating a process or has been practicing

energy efficiency for a long time. The only difference may be the level of sophistication in the development of a strategy and action plan (and prioritization of implementation measures according to

resources available) that are adopted in the planning process on the basis of the evaluation of the status of energy efficiency at the macro level and assessment of its effectiveness in attaining the national energy objectives. The planning process will be followed by the phase that involves implementing the plan by pursuing the path, mobilizing partners and following the process elaborated later in Chapter 4.

#### STUDY TO ASSESS THE NEED AND DEFINE ENERGY EFFICIENCY TARGETS

The overall energy efficiency promotion process is cyclic in nature because the potential for energy efficiency improvement is not static and the energy efficiency resource base is constantly expanding. Rapid technological innovations through research and development conducted around the world are leading to higher-efficiency appliances, products, and processes which become increasingly cost-effective as the fossil fuel prices rise due to the widening gap between demand and supply.

#### "The overall energy efficiency promotion process is cyclic in nature because the potential for energy efficiency improvement is not static and the energy efficiency resource base is constantly expanding."

Prior to undertaking concrete activities to improve the energy efficiency of the different economic sectors at the level of a country, it is important to have a good understanding of the real situation so as to identify the needs and prioritize the end-users that have significant

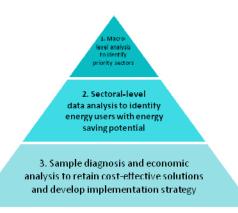


Figure 5. A top-down three-tier approach to assess cost-effective energy savings potentials

potential to lower the national energy demand. An example of a fairly simple approach is described below to highlight the manner the cyclic process can be initiated. As the organization gains experience and confidence, the programme can gradually become more sophisticated to meet with the future energy efficiency challenges.

Figure 5 proposes a top-down, three-tier approach to assess the potential for reducing

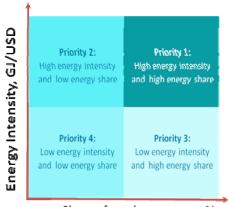
energy use cost-effectively. This would serve as the basis for setting energy efficiency

targets. Strategy can be formulated to prioritize measures and carry out concrete action in achieving the set target realistically. The implementation process outlined in Chapter 4 can

be followed and partners and stakeholders be engaged to tackle the perceived barriers through suitable policy measures.

The first step would be to start with macro-economic data available for the country and disaggregate energy data for different economic sectors in order to assess their importance in terms of their shares of energy use and energy intensities. As shown in Figure 6, the economic sectors can be grouped into **four distinct categories:** (1) high energy intensity and high energy share; (2) high energy intensity and low energy share; and (4) low energy intensity and low energy share.

This simple graphical presentation helps to set the base line and to prioritize the sectors in which greater



Share of total energy use, %

Figure 6. Energy characterization of the economic sectors

energy efficiency efforts should be made. Obviously, the sectors with high energy intensity and high energy share are automatically given the utmost importance. The next sections cover further detailed review of each of the economic sector to have a better grasp of the most important energy users within the sector and the pattern of their energy use.

The following steps are proposed for establishing sectoral energy efficiency strategies and are elaborated further in the subsequent sections:

- 1. Start with the **identification of the major targets** to ensure best impacts with least intervention.
- 2. Set up the baseline of energy consumption.
- 3. Identify the **techno-economic energy saving potentials** to set energy-efficiency targets and prioritize actions on the basis of their economic effectiveness.
- 4. Develop an **implementation strategy** in accordance with the resources available.
- 5. Outline the **mechanism for implementing an action plan** for each sub-sector.
- 6. **Collect relevant data** and parameters that **allow monitoring and evaluating** the effectiveness of energy efficiency measures to draw lessons.
- 7. **Plan the next cycle** by widening the scope of activities, retaining high-performing actions, and examining/modifying the underperforming programmes.

One should however keep in mind that the sectoral consumption structure can undergo a very quick evolution in rapidly-developing countries. A "**prospective modelling**' of scenarios of evolution in energy demand can contribute significantly to decision making on energy efficiency policies.

For example, the **Indian Bureau of Energy Efficiency (BEE)** presently does not consider any energy efficiency measures for the residential sector other than energy performance labelling of household electrical appliances. Almost all residential houses are presently not insulated or protected from the sun. Moreover, considering the huge demand for housing, a large stock of homes is yet to be built. Along with the economic development and search for better quality of life, it is estimated that an average Indian household will consume 5 times more electricity in 2020 as compared to the year 2000. The air-conditioner ownership at homes is still quite low now but many more households are likely to equip themselves with air conditioners in the future. These air conditioners may perform very well thanks to the mandatory requirement of energy efficiency labelling, they will however be used in buildings with quite poor thermal quality. In such circumstances, it is crucial to take into consideration the « future » energy saving potential so that appropriate policy measures can be adopted to influence the practice of constructing buildings that guarantee superior thermal performance.

#### RESIDENTIAL/HOUSEHOLD SECTOR

To start with, one may only consider residences/households in urban areas. An easy way to initiate the data gathering and analysis would be to focus on the main forms of energy use in the residential sector. Apart from electricity, fuel consumption may be high in countries that are located in cold regions. The energy utilities can be approached to gather statistical data of energy use to identify the small percentage of households

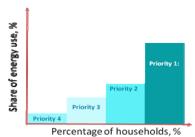


Figure 7. Identify high energy-consuming households

that account for the largest share of energy use (Priority 1 in Figure 7).

Surveys can be carried out among these households using standard sampling techniques to gather more pertinent data such as the share of individual versus collective housing (flats, apartments), year of construction, area occupied, household equipment and appliances ownership rate, etc. Such information can be further analyzed to have a fairly good idea of

the parameters that may have important influence on the energy use, and also to distinguish the influence of technology and usage (behavioural pattern) on the energy consumption.

For example, Figure 8 can be drawn on the basis of information on the annual energy consumption and area of the housing. The dotted red line shows the average specific energy use. Household appliance ownership rate is also a good example of assessing to what extent the targeted households are equipped with high energy—consuming appliances such as refrigerator, air conditioner, water heater, washing machine, dryer, cooking and heating stoves, TV, personal computer, etc.

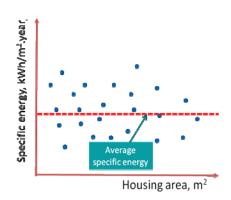


Figure 8 Specific energy consumption versus housing area

Further analysis would be necessary to know why some residential units covering more or less the same area have higher or lower specific energy consumptions than the average. For example, more detailed **energy surveys/audits** may be conducted in a selected number of housing units representing different sizes and both high and low specific energy consumption. Such surveys would provide information on the share of energy use according

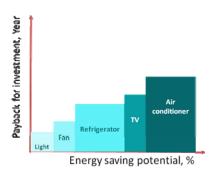


Figure 9. Cost-benefit analysis of energy efficient products

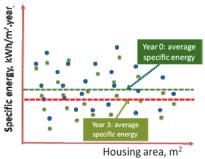


Figure 10. Comparing energy performance before and after programme implementation

to the type of appliance and the reasons for the differences in specific energy consumption among housing units of more or less the same areas.

By carrying out measurements of instantaneous power demands of different equipment and appliances and the number of hours of their use, one can conclude techno-economic analysis that compares costs and benefits of their substitution by more energy-efficient products. An example of cost–benefit analysis is shown in the adjacent figure.

Questions related to the typical barriers to the adoption of energy-efficient solutions at the housing level may shed light on the steps to be taken to overcome those barriers. Thus, starting with the analysis of the macro-economic data, followed by the techno-economic analysis can help to initiate the action plan for the residential sector; one can thus initiate the action plan for the limited number of high-energy consumers to achieve the best result. The initial action plan can be developed for a reasonable time span of 2-3 years, providing adequate time to cover all the steps from awareness and sensitization, to advice and capacity

building, market transformation, innovative financing, and legislation and regulation with the active support of suitable partners.

At the end of the allocated time span for the programme, the results can be evaluated to see to what extent the overall energy efficiency programme has been successful. For example, a survey of the same sample of housing units may show that the average specific energy consumption has come down by a certain percentage, and this can be largely credited to the effective energy efficiency programme (see Figure 10).

The results achieved can be compared to the initial target set to evaluate the overall success of the implementation programme and possible shortfalls to be considered prior to initiating a new cycle of implementation, by increasing the number of residential energy users, for example by including those in Priority 2.

#### **COMMERCIAL SECTOR**

Similar to the approach proposed for the residential sector, data gathering and analysis can be initiated by focusing on the main forms of energy use in the **commercial sector**. Apart from electricity, fuel consumption may be high in countries that are located in cold regions. The energy utilities can be approached to gather statistical data of energy use to identify the small percentage of commercial clients that account for the largest share of energy use.

Surveys can be carried out among these buildings using standard sampling techniques to gather more pertinent data such as the type of activity in the building (office, hotel, hospital, shopping centre, etc.), year of construction, area occupied, building equipment and appliances ownership ratio, etc. Such information can be further analyzed to have a fairly good idea of the parameters that may have important influence on the energy use, and also to distinguish the influence of technology and usage (behavioural pattern) on the energy consumption.

For instance, Figure 11 can be drawn on the basis of information on the annual energy consumption and area of the office building. The dotted red line shows the average specific energy use. Appliance ownership rate is also a good example of assessing to what extent the targeted office buildings are equipped with high energy—consuming appliances such as air conditioners, lighting devices, refrigerator, lifts, office electrical appliances, computers, printers, photocopiers, etc.

Figure 11. Specific energy consumption versus building area

Further analysis would be needed to know why some commercial buildings with the same type of activity and covering more or less the same area have higher or lower specific energy consumptions than the average. For example, more detailed energy surveys/audits may be conducted in a selected number of commercial buildings representing different areas and both high and low specific energy consumption. Such surveys would provide information on the share of energy use according to the type of heating or air conditioning system and use of appliance and the reasons for the differences in specific energy consumption among the buildings with similar functions and with more or less same areas. With the measurements of instantaneous power demands of the buildings as well as important

equipment and appliances and number of hours of their use, one can conclude technoeconomic analysis that compares costs and benefits of their substitution by more energyefficient products.

Questions related to the typical barriers to the adoption of energy-efficient solutions in commercial buildings may provide some insight of the steps to be taken to overcome those barriers. Thus, starting with the analysis of the macro-economic data, followed by the techno-economic analysis can help to initiate implementation activities in the commercial sector. One can thus initiate the action in a limited number of high-energy consumers to achieve the best result. The initial action plan can be developed for a reasonable time span of 2–3 years, providing adequate time to cover all the steps from awareness and

Year 0: average specific energy

Year 3: average specific energy

Office building area. m<sup>2</sup>

Figure 12. Comparing energy performance before and after programme implementation

sensitization, to advice and capacity building, market transformation, innovative financing and legislation and regulation with the active support of suitable partners.

At the end of the time span of the cyclic programme, results can be evaluated to assess the overall success. For example, a survey of the same sample of commercial buildings may show that the average specific energy consumption has reduced by a certain percentage, and this can be largely credited to the effective energy efficiency programme. The results achieved can be compared to the initial target set in order to evaluate the overall success of the implementation programme or any

shortfall in the target that can be quantified and the possible reason analyzed before initiating a new cycle of implementation, by increasing the number of commercial buildings.

#### INDUSTRIAL SECTOR

The industrial sector is more complex to deal with as it involves manufacturing of a wide range of products by using various types of processes. Moreover, while some industries concentrate on a single product, many others have facilities to have heterogeneous products from a single factory.

Just like the macro-economic analysis at the country level, the different industrial sub-sectors can be assessed according to their shares of the overall energy use in industry and their sub-sectoral energy intensities. As shown in Figure 13, industrial sub-sectors can be grouped into four distinct categories: (1) high energy intensity and high energy share, (2) high energy intensity and low energy share, (3) low energy intensity and high energy share, and (4) low energy intensity and low energy share. It is good to start with those industrial sub-sectors that are in the top right quadrant (Priority 1) so that there are greater



Share of industrial energy use, %

Figure 13. Energy analysis to prioritize industrial sub-sectors

chances of saving more energy by targeting a limited number of industrial sub-sectors.

For each of the industrial sub-sector retained, one can undertake a survey to gather data of annual production and annual energy consumption. These two data sets can help to plot a graph that correlates the specific energy consumption and the annual production. Figure 13

shows an example of analysis of the electricity consumption in cement industries for a particular country. The red line shows the average specific energy use to produce a ton of cement and the points above the red line consume higher than the average and show the theoretical potential for reducing their specific energy consumption. Further analysis would be required to figure out why some factories with more or less the same production have

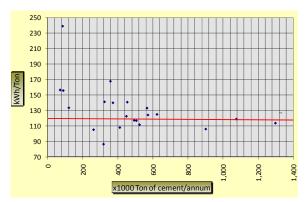


Figure 14. Specific energy use versus annual production (example of the cement sub-sector)

higher or lower specific energy consumptions.

More detailed energy audits may conducted in a selected number of factories representing different production rates and both high as well as low specific energy consumptions. Such energy audits provide answers to the questions regarding the difference in specific energy consumptions, which may be due to the differences in technical efficiencies of the processes/equipment and/or operational and maintenance practices. Measurements of the

instantaneous power demands of the energy intensive equipment in the factory and the number of hours of their usage can help in conducting techno-economic analysis of their replacement by more modern and efficient equipment. Similarly, the potential for energy savings through improved energy management and efficient operation and maintenance practices can also be assessed.

The survey including questions regarding the perceived barriers to the adoption of energy efficiency in the industrial subsector would help to identify areas where more focus needs to be given in order to overcome barriers. The above results will come in handy to develop a time-bound energy efficiency implementation plan for the specific industrial sub-sector and initiate all activities outlined in the ideal path to promote energy efficiency. With a monitoring and evaluation system in place, one can keep track of the actual savings achieved by comparing baseline set at the beginning of the programme and the improved energy

"With a monitoring and evaluation system in place, one can keep track of the actual savings achieved by comparing the baseline set at the beginning of the programme and the improved energy performances of industries after the first cycle of energy efficiency activities."

performances of industries after the first cycle of energy efficiency activities. And in case of any shortfall in the expected outcomes, one can critically analyze the areas of deficiencies and take up remedial action for further improvement in the next cycle of activities that may include greater number of industrial sub-sectors.

#### TRANSPORT SECTOR

The transport sector has the fastest growth of fossil energy consumption of all sectors in

"One of the effective options in Asia and the Pacific to reduce the energy consumption in the transport sector is to increase the efficiency of new motor vehicles." many countries. In the developing countries' context, this is even more pronounced because of the rapid growth in the number of passenger vehicles associated with rising population and income. In comparison with the other economic sectors, transport is one of the more challenging sectors for adopting energy efficiency measures because of the difficulty in establishing a reliable base

line in the absence of a wide set of data necessary to develop accurate transport energy efficiency indicators. Moreover, people have much more freedom when it comes to the selection of the mode of transport (air, rail, road, and water) and it is difficult to bring in effective policy measures, especially in developing countries where resources to provide adequate public transport services are often limited and there is a lack of a good set of indicators to initiate effective policy implementation.

One of the effective options in Asia and the Pacific to reduce the energy consumption in the transport sector is to increase the efficiency of new motor vehicles. Energy efficiency organizations need to target motor vehicle manufacturers in order to introduce standards and labelling programmes that help the buyers in making the right choice. However, this solution will not be adequate to deal with the transport energy problem because of the transport sector's heavy reliance on fossil fuels. Other important non-technical options to reduce the demand for fossil fuels include improved quality of urban public transport plans to popularize transport modes other than personal vehicles, higher fuel and vehicle taxes, and effective land use planning focusing on mixed activity zones that helps to contain urban sprawl and minimize the need to commute.

#### AGRICULTURAL SECTOR

The **agriculture sector** directly accounts for the lowest energy share in comparison with the other sectors of activity. Therefore, energy policies in many countries do not give much importance to this sector. However, one should not neglect the fact that with the rise in population and life style, demand for food keeps rising.

In developing countries of the Asia-Pacific region, there has been a major shift from the traditional low-energy agriculture to mechanized and fertilized-based food production in order to increase farm productivity. Draught animals have been replaced by tractors that mostly depend on fossil fuel. Water needed for intensive farming is supplied by using pumps either run on electricity or mechanical power. The traditional manner in which animal were fed in the past has been greatly replaced by animal feed that is now produced industrially. Similarly, with the erosion of the soil quality due to intensive agriculture, organic fertilizer has given way to chemical fertilizers that are highly fossil fuel intensive. Likewise, there is a greater trend to cultivate under a climatically-controlled environment, such as greenhouses, to enhance productivity. Hence, the **indirect energy** that goes to support the agricultural

sector is increasingly gaining importance and needs greater attention because it does not only concern energy use but leads to other significant impacts such as groundwater depletion, soil contamination, and ambient air pollution.

Energy efficiency actions targeted towards the agriculture sector may initially focus on those who are involved in **large-scale farming** as there is scope of greater energy saving potential by interacting with a limited number of actors. Some of the technical energy efficiency measures may include improving the energy efficiency of farm machinery and irrigation pump sets. Non-technical measures may include revival of organic farming that makes best use of agricultural residues to improve the soil quality and reduce the dependence on chemical fertilizers.



## THE THREE PILLARS TO ACHIEVE SUCCESS: PATH, PARTNERS, AND PROCESS

**Energy efficiency law and decrees** are considered as prerequisites for the effective promotion of energy efficiency in many countries. Laws and decrees provide a certain direction to energy efficiency policies by defining objectives as well as the policies and strategies to achieve them. Furthermore, these provide legitimacy for developing energy efficiency strategies and action plans for targeted economic sectors. Several Asian countries were able to draft the legal basis and develop energy efficiency strategies and action plans, particularly with technical assistance from bilateral and multilateral agencies. Experience from many developing countries shows, however, that the results expected from such strategies and action plans will not be achieved satisfactorily if there are no suitable institutional arrangement, funding, and coordination mechanisms in place for the effective implementation of the action plans.

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Though it may seem far-fetched, one can draw a parallel between promoting energy efficiency at the level of a country and **promoting "haute cuisine"** that consists of refined cookery practiced as an art form. Many countries are known for their distinct culinary practices though primary ingredients used for cooking may be the same as in other neighbouring countries. An instructional cookbook is a guide that includes a collection of recipes and provides a step-by-step guide to teach basic concepts and techniques. Similarly, **an analytical framework** covering the basic concepts and techniques is needed for an effective promotion of energy efficiency at the national level. Just as a good cookbook is based on proven cases of good recipes, the success in promoting energy efficiency also takes into consideration good practices and experiences around the world. The focus here is however more on the process than the end results which can vary according to the context of a specific country.

"The analytical framework described in this section to achieve energy efficiency goals is founded on three major pillars: the path to be pursued in a logical manner, the partners to be chosen among the various stakeholders to trade the path, and the process to be followed to achieve the target."

The analytical framework described in this section to achieve energy efficiency goals is founded on three major pillars: **the path** to be pursued in a logical manner, **the partners** to be chosen among the various stakeholders to trade the path, and **the process** to be followed to achieve the target.

#### PATH: SEQUENCING STEPS OF THE IDEAL PATH

Energy efficiency law and decrees give direction to policies, provide a legal basis, assign responsibility, specify funding mechanisms for undertaking energy efficiency activities, etc. The challenge for the institution responsible for energy efficiency promotion is **to tackle the various barriers in an organized manner** so that the targeted energy user becomes energy efficient.



The first barrier to address is the lack of awareness and understanding about the potential benefits that can be accrued from energy efficiency. Creating awareness and/or sensitization requires identification of the target groups and "speaking the language" they understand. The target groups in this case are not only the energy users but also politicians elected at the national or regional level as well as planners, policy makers, and economic players.

"The awareness campaign is not likely to be effective if it does not highlight the gains that the beneficiaries can reap, in the form of more affordable energy bills or improved industrial competitiveness."

While the national drivers for promoting energy efficiency may be to enhance energy security or contribute to global climate change mitigation efforts, the awareness campaign is not likely to be effective if it does not highlight the gains that the beneficiaries can reap, in the form of more affordable energy bills or improved industrial competitiveness. Hence this requires adopting a **communication strategy** that arouses interest among the target groups who start asking the question: if it is true, what energy efficiency options do I have to "reduce the energy bill of my office" or "lower the production cost in my factory" or "make my

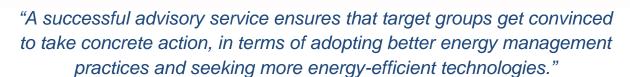
transport company more competitive" or "reduce the energy vulnerability of my community". It is very effective to target children and youth who are generally more committed than adults to bring about lasting changes in their behaviour for the sake of their future and the global environment.

In the matter of communication, the role of visual, audio, and print media cannot be underestimated. Care must be taken to keep the media persons well informed and updated on energy efficiency issues and the recent developments made in this field in terms of new policies, technological progresses, or incentive mechanisms. Other forms of communications to create awareness and sensitization can be well targeted seminars, conferences, and exhibitions in which the subject of energy efficiency can be easily incorporated. For example, the importance of energy efficiency in building practices can be easily demonstrated in an exhibition on "modern homes and buildings."

Suitable means have to be employed to make the communication strategy effective and adapted to the country's socio-cultural context, while ensuring at all times that the information remains correct, unbiased, and is not exaggerated. An effective way to sensitize important energy users is to publicize through various media the energy efficiency measures that have been successfully implemented. The message communicated should remain positive and the target audience should never be taken for granted. The message should not be restrictive in nature, particularly if people lack amenities or are living in conditions that are not so favourable. For example, there is no point in advising people to use more efficient household appliances if the grid electricity supply is erratic. Similarly, in the absence of any energy labelling programme, the customer has no way of knowing which appliance is more efficient in the market.



The second barrier to handle is the poor knowledge and inadequate capacity of the target groups to adopt energy-efficient technologies and practices. There is constant evolution of technologies with regards to the way energy can be used more efficiently. There is however a strong tendency to copy exactly the past designs in order to gain time. This discourages the adoption of any new and more efficient designs. Moreover, most energy users are highly sensitive to the initial investment cost and not so much the operating cost which includes the cost of energy needed to run their facilities. In the traditional thinking process, it is generally assumed that energy efficiency invariably adds to the costs and entails delays in project execution. Investment is mostly biased towards expanded production; as a result, it is easy to fund over-sized equipment but hard to fund energy efficiency. It is therefore necessary to assist important energy users to upgrade their knowledge on energy efficiency and help them to understand the multiple benefits of making investment not on first-cost alone but on the basis of life-cycle analysis.



A successful advisory service ensures that target groups get convinced to take concrete action, in terms of adopting better energy management practices and seeking more energy-efficient technologies for new or existing facilities. Just as in the case of awareness and sensitization, it is important to ensure that the advice given to intended beneficiaries remains credible, unbiased, and is not exaggerated. The energy end-use needs a trustworthy adviser who is not trying to "sell" some goods and services in the guise of providing advice. Typical advice to the interested party may be to point out the areas of inefficiencies, propose suitable solutions that may be either technical or non-technical in nature, make a preliminary assessment of the economic benefit of the proposed solution, and recommend reliable contact points from where further assistance may be available for in-depth analysis and support for implementation.

Another type of support may be in the form of **training and capacity building** of targeted energy end-users so that they are capable of making their own decision and taking appropriate steps towards the implementation of suitable energy efficiency measures. There can be different categories of training on the basis of requirement. For example, training can be in the form of specialized programmes aimed at managers, engineers, architects, technicians, and operators. On the other hand, training programmes can be developed around a specific subject, providing in-depth knowledge on a specific technique or method. In any case, training activities cannot be improvised but require considerable attention.

## Box 3. Capacity building of energy managers of key energy-using buildings and industries in Vietnam

The Energy Efficiency and Conservation (EE&C) Law of Vietnam promulgated in 2010 requires key energy-using buildings and industry to adopt energy management systems and best practices in order to reduce their energy consumption and costs. Further, a Decree has been announced in March 2011 to provide further guidance on the implementation of provisions in the Law.

Key energy-using buildings and industries are required to adopt an energy management model to be developed by the Ministry of Industry and Trade. They are required to conduct energy audits and propose solutions on the basis of the analysis of the cost-effectiveness of energy saving measures. Moreover, the Law obliges them to submit an annual and 5-year energy management plan for review by government authorities.

The Ministry of Industry and Trade is developing a training programme to enhance the capacity of energy managers so that they can lead their respective buildings and industries in not only meeting the obligations of the EE&C Law but also establish systems and processes necessary to improve their energy performance in a sustainable manner. The training curriculum follows the approach adopted by international energy management standards so that enterprises that pursue the measures proposed in the training programme will be capable of getting global recognition and widen the scope for business beyond Vietnamese borders.

Source: Author

People involved in providing training should be professionals with knowledge and experience, or educators with technical skills and methods.

Unlike the typical communication means that are normally adopted to provide information or sensitize the energy end-user, advisory services should be more personalized in nature to better convince the intended beneficiary.

"Unlike the typical communication means that are normally adopted to provide information or sensitize the energy end-user, advisory services should be more personalized in nature to better convince the intended beneficiary."

In addition to educating end-users, it is essential to **improve the competencies of professionals** such as architects, designing and consulting agencies, installers, service companies, etc. Instead of training such practitioners on their specific domains of interventions, they should be exposed to a **holistic approach to systems**. For example, all intervening players in the building sector should have an integrated view on how to deal with energy efficiency in buildings, starting with solar protection and building insulation to lighting, ventilation and air conditioning equipment.



Once target energy users are convinced of the ways in which they can reduce operating energy costs of their facilities, they will be keen to know from where and what cost they can get access to such energy-efficient technologies and processes. At this stage, it becomes important to address the **third barrier** related to the need to **create a market for energy efficiency**. In general, the private sector is most active in the marketplace and the government does not have much of a role to play there. However, when the energy efficiency market is not mature, equipment manufacturers and suppliers tend to market less efficient products that are "affordable" to their clients. As a result, energy-efficient products are not commercialized or due to the lack of economies of scale, their costs remain out of bound for most buyers. Government intervention may therefore be required to trigger the market transformation towards energy efficiency and make energy efficiency more affordable.

In this step, it is essential for the energy promoting institution to favour public and private cooperation so that the private sector participates actively in the programme implementation and the limited public funding is leveraged by private sector investment to accelerate the process of market transformation. It is a relatively inexpensive mechanism for stimulating innovation and competition among potential manufacturers of energy-efficient products by guaranteeing higher market share for their products.

Market transformation happens through **interventions that pull and push** the market simultaneously: manufacturers or suppliers influence consumers' behaviour by providing energy efficient products. For example, setting minimum energy performance standards (MEPS) helps to "push" highly inefficient products/appliances out of the market (on condition of not falling into commercial protectionism and in conflict with the World Trade Organization), and promote mandatory or voluntary labelling of quality on products that consume energy (e.g. energy star rating). Such instruments favour **market** "pull" by kindling innovation among manufacturers and assisting users in making the right choice to acquire products with higher quality, particularly for an equivalent price. Setting norms also forms

part of the market transformation instruments as it helps in clearly identifying the **Best Available Technologies (BATs)** and assuring main players.

"Government intervention may be required to trigger the market transformation towards energy efficiency and make energy efficiency more affordable."

Market transformation may take various forms. For example, one way of market transformation may be through support extended for projects that may demonstrate or validate the real energy saving potential of an energy-efficient but unproven technology or process. Successfully demonstrated projects serve as good models to convince others about their techno-economic viability and such projects normally lead to widespread replication.

Another effective way to accomplish market transformation may be to create or organize a wider market for the energy-efficient product by creating a higher volume of sale, which in turn can push the manufacturer to design and commercialize such products in large volume, thus bringing down the product price to a level that becomes more affordable. For example, in recent years a few Asian countries have opted for international public tenders for the procurement of large volumes of high-efficiency compact fluorescent lamps satisfying certain quality criteria, thereby creating huge domestic markets for such products. When manufacturers recognize the huge market potential for efficient products, they are able to divide the retail price of such products by at least two or three times in the domestic market.

The **medium or long-term objective** in such circumstances should be to establish an innovative "energy efficiency" sector which is in direct competition with the traditional "energy supply" sector.



In spite of the energy efficiency market transformation and solutions becoming cost-effective, target beneficiaries face the challenge of financing their projects because of the **fourth barrier** one comes across in reality: access to capital for **energy efficiency financing**. Financial players have a natural bias towards energy suppliers, and energy consumers find it more difficult to access finance at affordable rates in comparison with energy suppliers. Moreover, the fact that an energy efficiency investment does not generate revenue but leads to energy cost reductions is not well recognized by financial institutions whose lending is normally conditioned by the capacity of the borrower to generate revenue from the capital investment.



#### Box 4. Revolving fund to finance energy efficiency through national banks of Thailand

Under the Energy Conservation Promotion Act promulgated in Thailand, the ENCON Fund was established in 1992. The main sources of the fund came from levies on sales of petroleum products, surcharges on electricity sales and interest earned by the ENCON Fund.

In order to stimulate the financial sector involvement in energy efficiency projects, money was allocated from the ENCON Fund in 2002 to create an Energy Efficiency Revolving Fund (EERF). Thai Banks are eligible to have access to capital at zero percent interest rate from the EERF in order to lend it to facility owners, Energy Service Companies (ESCOs) and project developers for energy efficiency improvements. The loan amount was capped at approximately 1.4 million US\$ and this could be borrowed by potential clients for a maximum period of 7 years at a negotiable interest rate not exceeding 4 percent per year. The main purpose of this initiative was to demonstrate it to financial institutions that energy efficiency investments provided win-win solutions:

- Banks can boost their image by providing a full range of competitive services and value-added benefits to their customers;
- Clients are assured of getting attractive returns from energy efficiency projects and enhancing their competitiveness;
- Thailand's fossil energy demand is reduced, helping to minimize the vulnerability of oil price spikes and to improve the balance of payment; this also contributes positively to the fight against global warming and climate change.

Government's intervention was kept at a minimum, with a small number of staff carrying out the assessment of loan applications, administering loans and promoting the financing model.

In the first two phases of the project implemented in 2002 and 2005, Thai banks had made a total investment of 180.5 million US\$ on energy efficiency projects, with 94.7 million US\$ coming from the Revolving Fund. According to the official reports, energy savings were of the order of 73.8 million US\$ per year, providing a simple payback period of 2.44 years.

Source: Chirawut Chaiyawat, 2009, Thailand's Energy Conservation Fund: A Banker's Perspective, Asia Clean Energy Forum. Manila.

On the one hand, there is a need to create awareness among financial institutions that energy efficiency can actually render the loan repayment more attractive, especially in the unstable environment of sudden energy price hikes. On the other hand, the main challenge is to **avoid providing "free money" to promote energy efficiency** investment but adopt innovative financing mechanisms that address the genuine problem of the target beneficiaries not having access to funds to make energy efficiency investment. This is an important aspect to take into consideration in order to avoid market distortions because energy-efficient solutions that are intended to be financed should make business sense.

"Financial incentives through public funding can take various forms: grants, subsidies, or soft loan, tax allowances and accelerated depreciation."

Financial incentives through public funding can take various forms: grants, subsidies, or soft loans to shorten the time needed to recover the investment to a reasonable extent, tax allowances (or exemption from income or sales tax) and accelerated depreciation to spur energy efficiency investments, or other innovative forms such as third party financing, lease-purchase scheme, guarantee fund for energy efficiency projects, etc. A dedicated Energy Efficiency Fund can be created through national legislation in order to support such financial incentives in a more sustainable manner without depending on the national budget on an ad-hoc basis.



Once the above four barriers have been effectively tackled, the role of the energy efficiency institution in addressing the **fifth barrier**, that of **regulation and legislation**, becomes much easier. Instead of applying rules and regulations on the whole target group, the focus will be only on those errant beneficiaries that refuse to pursue the energy efficiency path in spite of all the efforts made to address the other important barriers to energy efficiency. If the regulation is applied in an effective manner, one can expect the whole target group to achieve the energy efficiency goal set by the government.

"Setting of energy efficiency standards for new products or construction projects can play a crucial role in the context of developing countries in Asia."

Regulations taking the form of energy codes, labels, and standards may serve various purposes: providing the required information to the intended beneficiary, ensuring a minimum guarantee on the energy efficiency performance of the equipment or product, or even eliminating very low-quality products from the market. Setting of energy efficiency standards for new products or construction projects can play a crucial role in the context of developing countries in Asia that have high demand for new installations and facilities associated with the rapid economic growth.

Before introducing any new regulation, there should be a **phase of creating awareness** so that those who will be affected by the regulation understand well its purpose and what measures they need to take to adhere to it. This phase may also involve the mobilization of resources needed to create favourable conditions and negotiate the time frame needed for enforcing the regulation. A very important factor that needs to be kept in mind is the futility of promulgating a law or regulation if its enforcement is lax or poor.



#### Box 5. Mandated energy efficiency labelling for high-energy consuming appliances in India

India is faced with a major challenge of the increasing gap between electricity demand and supply. This is mainly due to the high rate of economic growth and increased ownership of electrical appliances associated with affluence and improved lifestyle. Based on studies conducted with the initiative of the Government, energy performance labelling was identified as one of the least-cost options as it is effective in assisting beneficiaries to make informed-decision and save their monthly electricity bill, and helps to bridge the demand-supply gap without the need for investing in capital-intensive fossil-based power plants.

The Indian Bureau of Energy Efficiency (BEE) detailed studies to shortlist appliances that are either widely used or high energy consumers. Once this list was established, BEE consulted and closely collaborated with manufactures of the identified appliances to sensitize them and negotiate with them the time frame necessary to improve the energy performances of their products, by taking the associated technical and financial issues into account. Based on the agreement, BEE initially introduced a voluntary scheme for the manufacturers to display energy performance labels on their products sold in the market. Minimum efficiency performance standards were prescribed by BEE and appliances were rated on the basis of energy efficiency indicated by suitable number of stars ranging from 1 to 5 (from least to most efficient).

In January 2010, the energy performance label was made mandatory for four products with high potential to reduce electricity consumption and the peak demand: frost-free refrigerators, room air-conditioners, tubular fluorescent lamps and distributed transformers.

Source: www.bee-india.nic.in

The targets set in the standard should be achievable, and should provide scope for revision or updating with the passage of time.

## PARTNERS: GREATER SYNERGY THROUGH PARTNERSHIP

The overall process of implementing energy efficiency is quite complex as it aims at influencing a large number of energy end-users. Whatever may be the institutional structure of the organization mandated by the government to implement government's energy efficiency policy, it is quasi-impossible for this institution to resolve all the issues on its own. The path to achieving energy efficiency referred to needs the involvement of various groups of partners, both public and private. This ensures transparency in the energy efficiency strategy development process through extensive consultation with stakeholders; moreover, all partners understand clearly their responsibilities, and provide support for the successful implementation of programmes.

# "The path to achieving energy efficiency needs the involvement of various groups of partners, both public and private."

The role of the energy efficiency organization can be compared to that of a conductor of an orchestra. The primary duties of the conductor are to unify performers, set the tempo, execute clear preparations and beats, and to listen critically and shape the sound of the ensemble. It is important that the conductor be intimately familiar with all musical pieces selected for the performance. While an individual musician may only rehearse part of a musical score, the conductor of an orchestra must learn the entire score because he or she must know precisely when each instrument should be played in harmony. Like the conductor of an orchestra, the energy efficiency organization should have an overall understanding of the roles that the different stakeholders can play in order to collectively achieve the ultimate energy efficiency target.

During the discussion on steps to be followed to overcome barriers to energy efficiency, it was pointed out that some activities need to be performed in an objective and unbiased manner whereas some others need be performed in the business environment. For example, creating awareness, providing advice, and enforcing legislation and regulation are activities that are better performed by partners who can be considered neutral or unbiased.

On the other hand, market transformation and innovative financing require the intervention of market players.



The different partners who could take active part in the "energy efficiency" orchestra are categorized as follows:

- Government agencies, both at the national as well as regional/local level: Energy efficiency concerns both energy supply and energy demand improvements. Hence it is crucial to involve all concerned government bodies not only in executing energy efficiency activities but also in sensitizing all those who may have a traditional bias towards expanding energy supply (oil, coal, natural gas, electricity, etc.) at the cost of energy demand management in buildings, factories, transport modes such as trains, buses and ships, etc. Good coordination among government agencies can be ensured by defining clearly the purpose of their intervention and their specific areas of responsibility in terms of designing, launching, supervision, and monitoring of the programmes at the national as well as local level.
- Energy suppliers/providers: Faced with the huge capital and lead time needed to create energy infrastructure in order to cope with the increasing energy demand, energy suppliers can be an important partner to propagate energy efficiency. For example, those energy suppliers that incorporate energy efficiency within their resource plans are more effective in delivering energy efficiency. Energy suppliers have the specific advantage of knowing the market well through the close-knit commercial relationship established with their energy-consuming customers and have an easy access to the demographics of their clients. Moreover, in many Asian countries, such energy producers and distributors are under government control and are required to provide energy services at prices that are below the marginal cost of supplying additional energy, particularly in the case of electricity.
- Manufacturers and service providers: These private sector players who may be keen to improve their presence/share in the market through energy efficiency can be a natural partner to achieve energy efficiency market transformation. They can be involved in energy efficiency policy development to fully capture the benefits of the stakeholder engagement process. For example, public-private partnerships in the development of standards and labels for consumer appliances can help in setting realistic targets and time frame to achieve the ultimate goal. Similarly, incentives and promotional measures can encourage them to be involved in research, development, innovation, and demonstration in order to achieve energy efficiency market transformation much faster than the business-as-usual scenario.

- **Financial institutions**: When they are well informed about the relevance of energy efficiency both on the demand as well as supply side, financial institutions can become an important partner by formulating and taking active part in innovative financing schemes that create favourable conditions not only for consumers to invest in energy-efficient products and projects but also for manufacturers to upgrade energy efficiency of the equipment and system that they offer in the marketplace.
- Intermediaries operating in business-free environment: The intermediaries include all those who play a neutral role in communicating, awareness creation, provision of advisory services, setting standards and labels, etc. The target beneficiaries trust such partners to take a balanced and unbiased position. Intermediaries can be civil society, nongovernmental organizations (NGOs), research and development (R&D) institutes, training and learning centres, forum of professionals, such as Society of Architects or Engineers, association of energy auditors and managers, standards organizations, etc.

#### PROCESS: DEFINING THE STEPS FOR ENERGY EFFICIENCY IMPLEMENTATION

The process of energy efficiency implementation involves going one by one through the five steps of the path to promote energy efficiency (awareness and sensitization, advice/capacity building, market transformation, innovating financing, legislation and regulation). A set of activities that are to be planned on the basis of the quantitative target set for the priority sectors, and allocated resources and time frame for implementation.

"The process of energy efficiency implementation involves going one by one through the five steps of the path to promote energy efficiency."

The first step is to well define the targets of the priority sector(s). If a country is just in the process of starting this exercise, it is important to limit those targets to the major or most critical energy users so that it is easier to focus on a smaller group which has the potential to save a sizeable amount of energy. For example, some countries target "designated consumers" whose annual energy consumption exceeds a certain threshold.





Once the target is identified, one can make a judicious choice of **suitable tools and methodology** to be employed on the basis of the step chosen in the path towards energy efficiency. These tools and methodology need to be well tested and established so that the energy efficiency organization has reasonable optimism for implementing them successfully and achieving realistically the national target. This helps to demonstrate the effectiveness of the energy efficiency programme and leads to confidence

building. In this context, sharing of experiences from other countries and regions becomes relevant.

Once tools and methodologies are selected, it becomes easier to **identify partners** who should be solicited to implement tools and methodology on the targeted energy users. For example, if the step involves awareness and sensitization or advice and capacity building, partners should be chosen such that they are able to perform in a business-free environment.





The energy efficiency

organization can then hold discussions with selected partners to **evaluate resources required**, both human and financial, to implement the planned activities. As partners can be considered as stakeholders for achieving the energy efficiency goal, they should also be in a position to contribute part of the resources needed, while the resources mobilized through the energy efficiency organization serves as leverage. If

due to some reason or the other, the resources are found to be inadequate, then it may be required to review the energy saving target and the targeted energy users. This can be an iterative process till there is a consensus that the resources available can indeed help to achieve the set target.

"It is important to develop quantifiable indicators that may be employed more easily to evaluate the performance in terms of its success but also deficiencies and bottlenecks encountered."

Finally, it is crucial to adopt a mechanism to monitor and evaluate results achieved in that particular step of activity in comparison with what was expected in the planning stage. Unlike energy supply, it is not always easy to quantify actual savings achieved or impacts of an energy efficiency activity such as awareness and sensitization. Therefore, it is important to develop quantifiable indicators that may be employed more easily to evaluate the performance in terms



of its success but also deficiencies and bottlenecks encountered. Monitoring and evaluation thus helps to **draw lessons and fine-tune the implementation process** for the next cycle of policy and programme implementation by expanding or strengthening successful measures and modifying or dropping poorly performing programmes. It also helps the energy efficiency organization to establish better credibility vis-à-vis the government as concrete results justify the effectiveness of the public funds mobilized for this purpose and there are greater chances of convincing the government to allocate more resources and widen the base of the targeted energy users.

#### TARGET SECTORS FOR ENERGY EFFICIENCY IMPLEMENTATION

The targeted energy users can be broadly categorized into distinct groups such as residential, commercial/service, industrial, transport, agriculture, etc.

Depending on the state of economic development in a country, each group or sector may have greater or lesser importance. For example, a country whose economy is heavily dependent on the agricultural and agro-products may prioritize the agricultural sector. On the other hand, a country with a limited production base but with high potential for tourism may focus on the commercial/service sector, and may also include the transport sector.

"The choice of the sector may be based on criteria such as the national importance of the sector, sector's share of energy consumption, sector's energy intensity. It is important to involve partners at decentralized levels for the concrete implementation of programmes."

The choice of the sector may be based on criteria such as the national importance of the sector, sector's share of energy consumption, sector's energy intensity, etc. Irrespective of the importance of each of the sectors, initiatives that are mainly concentrated at a centralized or national level may not get best results and it is important to involve partners at decentralized levels for the concrete implementation of programmes. Moreover, the type of intervention in one sector may be quite different from that applied on another.

# SETTING REALISTIC TARGETS ACCORDING TO THE MEANS

Here is a **word of caution** on the energy efficiency target. Some countries set arbitrary targets for energy efficiency without a detailed study to analyze carefully not only the technical and economic/financial potential for energy efficiency but the inherent barriers that need to be addressed before energy efficiency can be achieved realistically. Secondly, while the potential for energy saving is quantified by methodical research and development, the budget allocated by most governments is found to be paltry in comparison with the resources made available for coping on energy supply front. As reported in a recent IEA

"It is important that the energy efficiency organization is guaranteed the level of resources required to meet the energy efficiency challenge, over a relatively long time frame."

study, most countries spend between 0.01% and 0.05% of their GDP on energy efficiency. Moreover, the data on resources are not linked to specific sectors, policies, and activities.

Hence, it is important that the energy efficiency organization is guaranteed the level of resources required to meet the energy efficiency challenge, over a relatively long time frame because more time is needed in the beginning to build and strengthen the

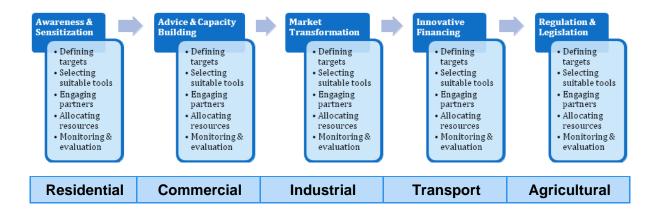
internal capacity of the organization as well as the capacities of partners with whom concrete measures are to be implemented.

Likewise, if due to some reason or the other the means allocated are limited, then targets should be adjusted accordingly, taking due care to avoid any exaggeration because the organization risks losing credibility at a later stage.

## 5. IMPLEMENTING ENERGY EFFICIENCY: EXAMPLE OF THE RESIDENTIAL SECTOR

Chapter 3 discussed in more detail how the national energy efficiency strategy and action plan can be established by undertaking a three-tier approach and setting the energy saving target on the basis of a techno-economic potential assessment. Experience around the world shows that in order to effectively tackle barriers, a multi-pronged approach with a package of measures leads to the best results instead of only focusing on legislative or market-based approaches. Keeping this in mind, UNESCAP proposes to follow a cyclic process to initiate energy efficiency promotion for all important sectors.

"In order to effectively tackle barriers, a multi-pronged approach with a package of measures leads to the best results instead of only focusing on legislative or market-based approaches."



This chapter covers a sample example of how the cyclic process of the energy efficiency promotion activity can be initiated for the residential/household sector. It covers all five steps of the path to achieve energy efficiency, as illustrated above.

## **AWARENESS AND SENSITIZATION**

Initial target groups for awareness and sensitization in the residential sector could be highend consumers whose homes or apartments are either heated or cooled to achieve thermal comfort. It is equally important to include all those with high household appliance ownership rate, especially as there is rapid growth in ownership of energy-intensive appliances in developing countries of Asia.



It is also effective to **target schoolchildren and youth** who can be positively influenced to adopt good behaviour and practices. Once they are convinced about the relevance of energy conservation and efficiency, they can educate other members of their families to eliminate energy wastage through the adoption of high-efficiency technology and lifestyle/behaviour changes, not only limited to their homes but also all other aspects of their daily lives.



The television and newspaper are powerful media to reach out to the population at large and create awareness. Therefore, such media can be retained as a tool to carry out the task of information, education, and communication (IEC) for the targets selected. The campaign should keep in mind the target group and adopt the method of communication accordingly. In the present context of a fast-moving world, the challenge would be to communicate the message within a limited span of time and in a manner that it leaves a lasting impression in their minds and instigates them not to maintain the business-as-usual approach.

# "The television and newspaper are powerful media to reach out to the population at large and create awareness."

Other effective ways to sensitize the residential sector are through the setting up of **energy information centres (EICs)** at locations with high footfalls or participation in exhibitions on household products and appliances. In recent years, many countries have adopted EICs as effective means of influencing the urban population to adopt energy efficiency measures.

Similarly, for schoolchildren and youth, more interactive pedagogical tools such as individual and collective games, comic strips, quizzes and competitions could be considered in order to make the learning process "fun." At no point in time should the tool undermine the intelligence of the children by pontificating or by emphasizing what is good for them.



Once visual and print media have been retained as communication and sensitization tools, media professionals should be involved as partners because they have the knowledge and experience. Before they can come up with the right communication tool, there will be a need to interact with them closely to make them better understand the subject and jointly search for the best way to convince the targeted population about the urgency of adopting energy-efficient technologies and practices.

Schools are ideal partners to communicate with the schoolchildren; hence, the teaching staff can be involved as partners to develop tools that can be integrated into the regular teaching curriculum. Similarly for the youth, one could contemplate mobilizing youth associations or centres that are dedicated to improving the skill and employability.

**Non-government organizations and consumer associations** are potential partners for setting up EICs and their regular operation. EICs are a good location to train youth so that they gain experience and find better job prospects with a deeper understanding of how energy wastage can be curtailed in our day-to-day life.

Depending on the size of the country, the national energy efficiency agency can establish working relationship with regional or local counterparts who can interact closely with partners involved for the media campaign as well as sensitization of schoolchildren and youth.



Once awareness and sensitization tools are selected and the partners identified, it would be possible to estimate the requirement of both human and financial resources for implementing the campaign over a time period that coincides with the period for which government budget is generally allocated, typically for a period of 3–5 years, often renewed on an annual basis. In this process, the national agency can negotiate and discuss with partners the possibility of leveraging the budget that may be allocated by the national budget in order to get better visibility and prominence.

This exercise is one of the most important steps because if an adequate budget is not available to carry out the implementation campaign satisfactorily with suitable partners and tools, then the final outcome may be disastrous. Hence, it may be necessary to revisit the previous steps and redefine the scope of activities such that they fit into the budget. If this happens, one should also revise the energy saving target set for the period accordingly so that they are realistically achievable and do not undermine the credibility of the energy efficiency policy and the organization.

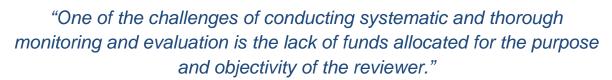


**Monitoring** the overall impacts of the awareness and sensitization programme is needed to evaluate the impacts of activities undertaken and document the lessons learned.

"Analytical methods can be employed to carry out the monitoring so that the results are both qualitative and quantitative."

Analytical methods can be employed to carry out the monitoring so that the results are both qualitative and quantitative. To evaluate actual achievement against targets, it is essential to **identify key statistics** to be collected at the programme designing stage so that it becomes much easier to monitor the actual performance against the set target.

For example, **statistical sampling** of the households can help to know what percentage of the population developed better awareness on energy efficiency by getting exposure to communication tools and how many among them think they should take the next step of identifying ways and means to reduce their energy consumption and cost. Similarly, monitoring can be done on the effectiveness of awareness and sensitization programmes targeted towards schoolchildren and youth.



One of the challenges of conducting systematic and thorough monitoring and evaluation is the lack of funds allocated for the purpose and objectivity of the reviewer. A certain percentage of the overall budget should be earmarked for evaluation. External experts with the required competence and skills need to be engaged to adopt standard methodologies and protocols for the evaluation process.

#### **ADVICE & CAPACITY BUILDING**

ADVICE & CAPACITY BUILDING Selecting Engaging Allocating Monitoring & TARGETS tools partners resources evaluation

In order to define who should be targeted for advice and capacity building to achieve energy efficiency targets in the residential/household sector, one needs to first understand that while the end-users in this sub-sector may be sensitized, it is the building sector professionals who are actually involved in the building construction and rehabilitation. Therefore, they need advice and their capacities to grasp energy efficiency concepts need to be strengthened.

When it comes to making the right choice in the purchase of household appliances, EICs can play an important role if appliances sold in the market have adopted some sort of energy efficiency labelling schemes or when it is possible to recognize an energy-efficient product on the basis of some standard test protocol.

ADVICE & CAPACITY Defining SELECTING Engaging Allocating Monitoring & TOOLS partners resources evaluation

All stakeholders involved in the development and rehabilitation of housing, including architects, engineers, technicians, managers, etc. lack technical, economic, and financial information required to make energy-efficient choices. They need to be advised on basic energy efficiency features in homes and apartments, new techniques that have been developed in the recent years to save energy and reduce operating energy costs, the cost-effectiveness of energy efficiency solutions, life cycle analysis, related government legislation and regulations as well as incentive schemes to propagate energy efficiency solutions.

"Dedicated need-based training programmes can be effective tools for capacity buildings of different groups of potential beneficiaries."

Dedicated need-based training programmes can be effective tools for the capacity building of different groups of potential beneficiaries. These training sessions can be tailored to suit the local reality. For example, there can be regular continuing education programmes, short-

term training and workshops, hands-on or on-the-job training for improving skills of technicians, etc.

One particular tool which has been encouraged by several organizations around the world is the assistance for decision-making through support for building capacity for energy surveys and audits.

To advise end-users in making the right choice to lower their energy bills, models and demonstration kits may be used as tools in EICs. As the Internet is getting increasingly popular as a quick source of information, simple and interactive software uploaded by EICs can serve the purpose of providing advice to the beneficiaries in a credible manner.



Based on identified tools, it is easier to engage partners who can help in advising and capacity building in a business-free environment. **Regular continuing education programmes** can be offered by professional academic institutes and research centres. Chambers of commerce and industry as well as associations of architects and engineers can be entrusted with the task of organizing short-term training and workshops for practitioners as well as hands-on practical training for technicians.

"Chambers of commerce and industry as well as associations of architects and engineers can be entrusted with the task of organizing short-term training and workshops for practitioners as well as hands-on practical training for technicians."

In some countries, qualified staff of EICs has taken up the challenge of providing in-house advice and capacity building of the personnel of big companies involved in construction and rehabilitation of buildings.

All these potential partners can be mobilized by holding dialogue with them and encouraging them to develop joint programmes which could be partially supported by the national energy efficiency organization through regional and local authorities.



Once the advice and capacity building tools have been retained and potential partners identified, the next exercise would be to **make the overall estimate of resources needed** to implement this activity, keeping the option open for leveraging efforts through **partnerships with regional and national authorities**, as well as institutional partners who will be instrumental in the execution of the action plan.

While doing this exercise, it is good for the national energy efficiency organization to develop its own capacity by learning to "cut the coat according to the cloth." Taking into account the national budget available for the purpose, negotiations can be held with regional and local authorities as well as potential institutional partners to strike a balance so that it is possible to implement the action plan successfully and cost-effectively. During the process if it is found that cumulated resources are not adequate to meet the set target, it may be necessary to revise the target so that it appears more realistic and achievable.

ADVICE & CAPACITY
BUILDING

Defining Selecting Engaging Allocating MONITORING targets tools partners resources & EVALUATION

Monitoring mechanisms should be designed to assess the effectiveness of various training and capacity building programmes. The procedure for gathering relevant information may include both qualitative as well as quantitative information to gauge the effectiveness of the overall advice and capacity building initiative as well as different activities undertaken through partnership.

#### MARKET TRANSFORMATION

MARKET
TRANSFORMATION

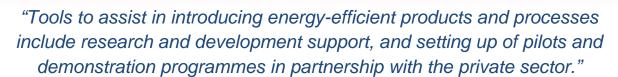
DEFINING
Selecting
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Market transformation is a crucial step to tackle barriers related to the absence of market for energy efficiency. Governments can play a crucial role by providing support to the private sector in accelerating the penetration of innovative energy-efficient technologies into the marketplace. Barriers to the development of energy-efficient products and processes can be identified and suitable action initiated in the form of research and development, demonstration, market research, etc. Government can further establish voluntary agreements with the private sector and lead by setting examples, thus creating the demand for more efficient products and achieving the economy of scale needed to make energy efficiency solutions affordable.

For the residential/housing sector, main targets of the energy efficiency organization are those in the private sector involved in manufacturing and marketing construction materials, and products, energy services and facilities management, and major housing developers.

MARKET Defining SELECTING Engaging Allocating Monitoring & TRANSFORMATION targets TOOLS partners resources evaluation

Tools to assist in introducing energy-efficient products and processes include research and development support, and setting up of pilots and demonstration programmes in partnership with the private sector. This aspect is particularly relevant for developing countries in Asia which are undergoing rapid economic development and infrastructural growth. Houses and the supporting system that are built today will have a long life span, and thus have an important bearing on the way energy will be used in the future to meet human need and comfort.



Tools to create rapid demand for energy-efficient products will be in the form of voluntary energy efficiency agreements, public-private partnerships, support for innovative mechanisms to develop the energy service market in order to guarantee the project performance and energy savings to the clients, etc.

TRANSPORMATION targets tools PARTIVERS resources evaluation	MARKET TRANSFORMATION	Defining targets	Selecting tools	ENGAGING PARTNERS	Allocating resources	Monitoring & evaluation
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Main partners of the energy efficiency organization to achieve market transformation in the residential/housing sector are all those who are actively involved in developing tools for designing, improving products and techniques for better thermal insulation and daylighting, researching on new technologies, processes, and control systems for optimizing energy use in heating and cooling systems, improving the performances of household electrical appliances and their standby energy consumption, etc.

Energy efficiency organizations can also engage with energy providers as active partners to accelerate market transformation. Energy providers, particularly electricity utilities, have been state-owned and supported in many developing countries in Asia. Their main focus in the past was on the supply side to meet the energy demand. But many energy companies are now unable to mobilize the capital necessary to cope with the rapid growth in energy demand associated with the economic development. As a result, they are looking at demand side options, both technical and non-technical, to curtail the energy demand during peak periods. As they have a widespread service and delivery network within the country and have long-term relationship with end-users, a strategic win—win partnership between the energy efficiency organization and energy utilities can accelerate the pace of market transformation by achieving economies of scale and lowering the cost of energy efficiency solutions considerably.



Market transformation would require much more resources than that necessary for awareness and advisory activities. While justifying budget allocation as incentives to achieve market transformation, care should be taken such that it does not lead to market distortions. One good reason for government intervention is the fact that such supporting mechanism will allow the penetration of energy-efficient technologies and products in the local market; moreover, thanks to economies of scale, their cost will actually come down, thus making them more attractive to potential customers. Similarly, government support for testing

innovative technologies in the market environment through pilot support and demonstration project makes sense because it helps to cover added costs involved in monitoring the

performance of such technologies and the risk taken by the party interested in testing the technology for the first time in the national or local context.

"The government contribution should be seen as seed money to leverage private sector investment for initiating market transformation and not as permanent subsidy."

However, the government contribution should be seen as seed money to leverage private sector investment for initiating market transformation and not as permanent subsidy. The government should also mobilize support from other partners, particularly energy utilities which have potential for revenue generation and which can benefit financially by deferring investment on supply side investments.



Since activities under market transformation involve **public-private partnerships**, it is important to appoint third-party independent bodies to carry out the performance monitoring to ensure neutrality. The evaluation method needs to be elaborated well right from the start so that it reflects rightly types of programmes that are commissioned and the information needed for evaluation can be treated meaningfully to draw conclusions on not only whether targets have been achieved quantitatively but also the quality of intervention and its lasting impacts.

"It is important to appoint third-party independent bodies to carry out the performance monitoring to ensure neutrality."



The main target groups for innovative financing of energy efficiency in the residential sector are financing institutions, investors, and end-users. Most financiers prefer traditional investments with quicker payback time; moreover, they apply a higher discount rate to energy efficiency investments because they assume such investments are more risky. Investors and consumers opt for lower-efficiency products because of their low initial investments.



Because traditional financial solutions such as leasing, loan financing and project financing are not adequate, more innovative tools are necessary to tackle financial barriers. Depending on the context of a given country, direct financial interventions may be

necessary. Some tools that may be adopted include grants and subsidies to enhance access to finance, fiscal measures, or preferential loans to encourage end-users to make energy efficiency investments. It may be easier to create incentives for those wishing to construct new housing. More efforts, and hence more innovations in financing are necessary for retrofitting existing buildings or inefficient heating or cooling systems.

Financial tools need to be accompanied by awareness, training, and capacity building programmes to ensure that initiatives are sustained by stakeholders beyond the period of support extended by the energy efficiency organization.



For the promotion of innovative financing, it is crucial for the energy efficiency organization to establish good a partnership within the government, especially with the Ministry of Finance which is the authority for making decisions regarding fiscal measures.

"It is crucial for the energy efficiency organization to establish good a partnership within the government, especially with the Ministry of Finance."

Since the success of the programme depends on the manner schemes are drafted to make all players accountable and to avoid "free riders" from benefiting financially from such schemes, it is important that the energy efficiency organization establishes good partnership with the legal department of the government for scrutinizing proposals and provide valuable legal advice to eliminate possible loopholes.

Some countries have created banks and financial institutions that mainly target housing development. By the virtue of their mandate, they can become strong partners to launch new schemes that are aimed at tackling hurdles to energy efficiency financing.

In countries where energy service companies (ESCOs) have been established, ESCOs can also serve as privileged partners and assist in developing projects and programmes that make full use of innovative financing options.



Resources mobilized for supporting innovative financing schemes will be mostly used to **leverage funds from banks and financial institutions.** The actual amounts necessary are very much country-specific and there cannot be any specific template to be used for the purpose.

"Some governments have created dedicated funds to support energy efficiency and renewable energy activities by imposing a small levy on fossil-fuel based energy consumption."

Some governments have created dedicated funds to support energy efficiency and renewable energy activities by imposing a small levy on fossil-fuel based energy consumption. This can provide a steady source of revenue to support energy efficiency promotional activities, including innovative financing.

Innovative financing options should be introduced in a time-bound manner in order to tackle market barriers and failures. Hence, in the initial phase, resources necessary for this activity can be substantial. But once the market matures and banks/financial institutions appreciate the positive contribution of energy efficiency and internalize solutions in their standard portfolios, the government funding for the innovative financing should be phased out.

The financing aspect involves banks which carry out due diligence and follow up closely with their clients for recovery of loan. Financial support from the government through financial institutions should be made with the understanding that no funds are allotted without meeting a set of criteria for the specific scheme, including the energy efficiency target and the acceptable range of financial returns for a given project.

"The loan recovery rate is a good criterion for judging the effectiveness of the energy efficiency scheme."

When funds are allocated as preferential loans, the loan recovery rate is a good criterion for judging the effectiveness of the energy efficiency scheme. Performance monitoring and verification protocols may also be employed to keep track of the project's energy efficiency performance in order to assess whether the beneficiary has actually been able to pay back the loan strictly on the basis of the savings from the energy efficiency project. If that is the case, the energy efficiency organization may find it a lot easier to communicate positive results and better convince financial institutions to support greater number of beneficiaries with more in-house funds in the future.

## **REGULATION AND LEGISLATION**

Regulatory instruments are aimed at controlling the use of energy through standards or the behaviour of energy consumers.

"Regulations that have been found to be highly successful in one country cannot be just transposed in another country without proper analysis and consideration."

Regulatory process involves carrying out the techno-economic evaluation of options that result in enhancing energy efficiency and improving the level of comfort in residential buildings. This process helps in identifying most relevant regulatory criteria and defining the level of requirements to meet those criteria. Regulations can be effective if conditions imposed are cost-effective in a specific country's context. Hence regulations that have been found to be highly successful in one country cannot be just transposed in another country

without proper analysis and consideration of factors such as technical feasibility, incremental cost of energy efficiency improvements, status of technology and its market analysis, knowledge and capacity of the professionals, etc.

High-energy consumers can be considered as initial targets in order to achieve tangible results and to gain legitimacy for further widening the scope of implementation.



Regulatory tools or instruments can be categorized into two groups: normative and informative. Normative instruments that have gained wide acceptance around the world are the building code and appliance standards. Examples of informative instruments are labelling and certification, and energy audits.

Building codes can be further divided into two types: prescriptive standards which include a list of energy efficiency measures (building envelope, lighting, heating, ventilation



and air conditioning, appliances, etc.), and **overall performance standards** which provide a much greater degree of freedom to choose any efficiency measures on condition that the total energy consumption does not exceed a predefined threshold that is calculated by taking into account a number of influencing factors, including the local climate.

Building codes are generally more stringent for new constructions in comparison with existing buildings because of technical and financial constraints of retrofitting an existing home or apartment. For new buildings, it is relatively easier to develop prescriptive energy efficiency standards for individual components, or the energy consumption threshold on the basis of innovative design options and cost-effective technological solutions. In comparison, similar approaches cannot be followed for existing building stocks that may be quite heterogeneous. However, it has been proved effective to make comprehensive energy audits mandatory for high energy–consuming buildings, requiring the building owners to adopt cost-effective energy efficiency solutions identified by such audits.

Appliance standards are imposed mainly to push manufacturers to produce more energy-efficient appliances. For example, a minimum energy performance standard helps to get rid of very energy-inefficient products from the market.



Effective implementation of regulation requires the involvement of many partners, particularly government institutions that are involved in the building sector and those dealing with legal matters, research and development centres, standards organizations, and experts in the building sector. The involvement of all these partners is required for defining legal requirements, and the development and elaboration of regulation. The success of the

implementation lies with regional and local partners having the mandate and authority to enforce the regulation.

The development and implementation of regulation is a process that needs considerable amount of time; hence, sufficient lead time should be given before the official imposition of any regulation.



Before the formal introduction of any regulation, it has to go through an introductory phase during which focus should be given on raising awareness, training and capacity building, market transformation, demonstration, public-private partnerships, financial and fiscal incentives, etc. Various partners to be engaged for the above purposes have already been specified.

Both human and financial resources are necessary during the development phase of regulations as well as their field tests and final enforcement. Therefore, based on the selection of regulatory measures and identification of partners, adequate resources should be allocated for each of the phases involved in implementing regulations effectively.

Funds should be allocated to research and development centres on a regular basis to ensure continuous research initiatives for improving energy performances of materials and products as well as developing new materials that can reduce energy use cost-effectively. It is also necessary to allocate adequate funds to evaluate the impacts energy efficiency regulations.



Monitoring and evaluation are crucial to determine whether the mechanism and the steps followed for regulation are perceived to be simple or not, how effectively the energy efficiency regulations have been adhered to, both factors of success and failures encountered during the enforcement process, etc.

The evaluation criteria should be defined right at the designing phase so that the monitoring methodology to be pursued and the protocol to be followed in gathering data during the monitoring process help in comparing the actual outcome with the target set.

On the whole, the success of the energy efficiency programme lies in adopting an approach that offers simultaneously the various instruments/measures outlined above as a package in order to address the problems holistically. These packages have to be designed for each target by taking into account national specificities.



Along with energy efficiency guidelines, UNESCAP has conceived "ee-Asia", an e-tool to assist Asian policy makers and practitioners from national energy efficiency agencies in getting a better understanding of how energy efficiency can be promoted in priority economic sectors. It recommends simple yet pragmatic strategies, policies, and measures to strengthen energy efficiency planning and management, and institutional arrangements and capacities of national institutions promoting energy efficiency in Asia and the Pacific region.

"UNESCAP has conceived "ee-Asia", an e-tool to assist Asian policy makers and practitioners from national energy efficiency agencies in getting a better understanding of how energy efficiency can be promoted in priority economic sectors."

**The e-tool is designed in two parts.** The first part includes 5 main sections that cover the main ideas presented in energy efficiency guidelines, as follows:

- 1. Welcome (objectives, contents, expected outcome, and summary)
- 2. Introduction to EE (energy efficiency as a stepping stone towards sustainable development)
- 3. EE vision and commitment (energy efficiency strategic planning and management)
- 4. EE strategy and action plan (setting up national energy efficiency objectives and targets)
- 5. EE analytical framework (analytical framework to achieve energy efficiency goal)

The second part provides a comprehensive approach to deal effectively with various barriers to energy efficiency, and describes how energy efficiency can be implemented successfully in different economic end-use sectors by adopting the 3Ps (Path, Partners and Process) in a systematic and planned manner. It includes examples of good practices from Asia and the rest of the world to give an insight of the whole range of initiatives that an energy efficiency organization may initiate to achieve the set energy efficiency goal.

The e-tool is designed such that it can be used for several purposes. Countries that are just initiating energy efficiency activities can get ideas and draw inspiration from the e-tool to establish energy efficiency action plan for targeted sectors. Policy makers and practitioners with prior experience of implementing energy efficiency can use the e-tool to conduct gap analysis to see if they have been implementing the different energy efficiency measures in a systematic manner. They can also learn from good practices and success stories of other countries and see to what extent they can adopt more innovative policies and action plans for the benefit of their energy efficiency stakeholders. Finally, countries that have already implemented interesting energy efficiency activities can contribute by sharing their good practices and lessons learnt for inclusion in the e-tool so that others can benefit from the knowledge shared.



# A1. Residential sector

Awareness/ Sensitization	Advice/ Capacity building	Market transformation	Innovative financing	Legislation/ Regulation
Voluntary labelling of buildings/ components (existing and new)	Regional and local information centre on energy efficiency	Voluntary agreements with producers of White/ Brown Goods	For investments in new buildings exceeding building regulation	Energy Performance Standards
Information campaigns (by energy agencies, energy suppliers etc)		Voluntary agreements with producers of ICT (e.g. on stand-by energy use)	For investments in energy efficient building renovation	Minimum thermal insulation standards
Detailed energy/electrical bill aiming at EE improvement		Voluntary DSM measures of energy suppliers and distributors	For the purchase of more efficient boilers	Minimum efficiency standards for boilers
		Technology procurement for energy efficient appliances and buildings	For the purchase of highly efficient electrical appliances	Compulsory replacement of old boilers above a certain age
			For other energy efficiency investments	Thermostatic zone control
			For investment in renewables	Control systems for heating (Regulation)
			For CHP investments	Mandatory heating pipe insulation
			For energy audits	Periodic mandatory inspection of boilers
			Reduced interest rates (soft loans)	Periodic mandatory inspection of Heating/Ventilation/AC
			Leasing of energy efficient equipment	Mandatory use of solar thermal energy in buildings
			VAT reduction on retrofitting investment	Minimum efficiency standards for electrical appliances
			VAT reduction on equipment	Mandatory measures for efficient lighting
			Income tax reduction	Mandatory labelling of heating equipment
			Income tax credit	Mandatory energy labelling of electrical appliances, etc.
				Mandatory energy efficiency certificates for existing buildings
				Mandatory energy efficiency certificates for new buildings
				Mandatory audits in large residential buildings

Mandatory audits in small residential buildings
Mandatory energy efficiency certificates for existing buildings

# A2. Commercial sector

Awareness/ Sensitization	Advice/ Capacity building	Market transformation	Innovative financing	Legislation/ Regulation
Voluntary labelling of office equipment	Voluntary energy audits	Voluntary agreements with actors of the building sector	For energy efficiency investment	Energy Performance Standards
Voluntary labelling of buildings	Training for top- level management/ energy managers	Voluntary agreements with public or private services	For investment in renewables	Minimum thermal insulation standards
Information campaigns (by energy agencies, energy suppliers etc)		Technology procurement for energy efficient buildings / components	For CHP investments	Minimum efficiency standards for boilers
Regional and local information centre on energy efficiency		Technology procurement for energy efficient appliances	For energy audits/ training/ benchmarking activities	Periodic mandatory inspection of boilers
Governing by example			Financial incentives for architects who integrate EE measures	Periodic mandatory inspection of HVAC
Energy efficiency/ renewables awards			Reduced interest rates (soft loans)	Maximum indoor temperature limit(s)
			Preferential loan guarantee conditions	Energy efficiency regulation for public lighting
			Tax reduction / Tax credit	Mandatory energy efficiency certificates for buildings
			Accelerated depreciation	Mandatory audits in large tertiary sector buildings
				Mandatory audits in small tertiary sector buildings
				Mandatory appointment of an energy manager
				Mandatory Energy Action Plan for municipalities
				Mandatory annual energy report for municipalities



# A3. Industrial sector

Awareness/ Sensitization	Advice/ Capacity building	Market transformation	Innovative financing	Legislation/ Regulation
Information campaigns (by energy agencies, energy suppliers etc)	Voluntary audits	Voluntary/Negotiation to reduce energy consumption/CO2 emission of industrial processes	For energy efficiency investment	Mandatory DSM for energy suppliers / other actors in energy sector
Voluntary labelling of cross- cutting technology (e.g. industrial motors)	Training for top-level management/ energy managers	Voluntary/Negotiation for cross-cutting technologies (e.g. industrial motors)	For investment in clean fuels (renewables, waste, natural gas, etc.)	Mandatory standards for the efficiency of electric motors
Regional and local information centres on energy efficiency		Technology procurement for energy efficient equipment	For CHP investments	Mandatory standards for the efficiency of industrial boilers
			For energy audits/ training/ benchmarking activities	Mandatory appointment of an energy manager
			Reduced interest rates (soft loans)	Mandatory audits for industrial processes / buildings
			Preferential loan guarantee conditions	
			Tax reduction / Tax credit	
			Accelerated depreciation for energy efficiency investment / renewables / CHP	
			Emission trading	
			Joint Implementation (JI)/ Clean Development Mechanism (CDM)	



# A4. Transport sector

Awareness/ Sensitization	Advice/ Capacity building	Market transformation	Innovative financing	Legislation/ Regulation
Information on public transport	Training on energy efficient driving behaviour	Voluntary agreement with car producers	For energy efficient vehicles	Mandatory fuel consumption standard
Promotion of cycling or walking		Voluntary agreement for trucks / light vehicles	For clean vehicles (bio- fuelled/ electric/ LPG / natural gas cars)	Mandatory speed limits
		Voluntary agreement for public transport companies	For the scrapping of old cars	Speed limiters for cars and motor cycles
		Technology procurement for energy efficient or green vehicles	City tolls	Speed limiters for lorries
			Highway tolls	Periodic mandatory inspection of vehicles / pollution control
			Tax on the purchase of cars (if linked to efficiency improvement)	Mandatory fuel substitution/ Removal of barriers to fuel substitution
			Annual vehicle tax (if linked to efficiency improvement)	Mandatory labelling of vehicles (EU)
			Mineral oil tax	
			For energy efficient vehicles	
			For clean vehicles (bio- fuelled/ electric/ LPG / natural gas cars)	
			For clean fuels (bio- fuels / LPG / natural gas/ low-sulphur fuels)	
			Tax deduction home/job travel favouring public transport	

**Energy security** is among the major concerns of countries in Asia and the Pacific. Punctuating this concern are the overdependence of many countries on imported energy resources to meet their increasing energy demand, the volatile prices of oil in the world market, the higher losses in energy production and use, and climate change attributed to the increasing concentration of greenhouse gases in the atmosphere due to burning of fossil fuel.

The promotion of EE as a policy has often been identified as the most cost effective tool to manage the demand for energy. Developing and maintaining wide-scale energy saving policies are considered to be the most reliable, technically acceptable, economically affordable, and environmentally sensible way to overcome the negative consequences of energy production and consumption. Many countries in the Asia-Pacific region are actively pursuing energy efficiency measures in production and consumption of energy and developing alternative and renewable energy resources to diversify their energy mix as part of the overall energy strategy.

Energy efficiency programmes are not always sustained, especially during periods when oil prices are low. On the other hand, when energy prices shoot up, many governments tend to protect end-users by subsidizing energy and absorbing the economic liability. There is a general lack of opportunities for data exchange and systematic assessment of energy-saving policies among the countries. Institutional capacities for developing and implementing national policies on energy efficiency in some of the countries in the region are weak and thus require a great effort to improve legislation, regulation, and standardization, and other policy and institutional measures.



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