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The Lessons of Practice:

Domestic policy reform as a way to address climate change

Nigel Lucas, IISD

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Table of Contents

List of Figures

List of Tables

Executive Summary

The objectives of this paper are threefold: to review experience to date with policy reforms that can help mitigate climate change, to review work on indicators of the effort put into policy reforms and their effectiveness and to draw lessons about how the international community can support developing countries to strengthen domestic policy reform and to reflect the success of those efforts in financial transfers. The proximate motivation is the Bali Action Plan, which suggests that developing countries can adopt mitigation actions, supported and enabled by technology, financing and capacity-building, in a measurable, reportable and verifiable manner (MRV). It is the relationship between policies and measures and the need for MRV that this paper explores.

The paper first reviews the experience of national energy policy reform. It focuses on developing country experience, though we note that this experience is hard to assess except against the benchmark of what has been normal practice in the developed world. The second section deals with the experience of assessing selected policy reforms, both in terms of the efforts put in to making policy work and the success achieved in reducing energy use and greenhouse gas (GHG) emissions. The third section draws upon the first two to provide ideas as to which areas of policy reform combine promise (in terms of potential effectiveness at mitigating GHG emissions) with the need for measurability, verification and reporting and convincing mechanisms to deliver the necessary technical assistance.

The paper reviews the normal scope of energy policy and concludes that a significant part of energy policy has no strong and consistent correlation with climate change. Policies on security of supply, industrial structure, market rules and ownership may affect GHG emissions, but in a secondary and unpredictable manner. The key policies to consider are price reform, energy efficiency and the promotion of low carbon fuels.

Price reform has been analyzed from political and economic perspectives and through several case studies. In Iran and Egypt, distorted prices incur high costs to the economy and analysis demonstrates the immense benefits of reform. The price reform programs of Thailand and Indonesia offer many lessons. History shows that developing countries often resist price reform for a mix of political and social factors that are hard to disentangle. Governments may offer low prices to compensate for lack of democracy and freedom. Subsidies are defended as a means to protect the poor when there is little or no social service and welfare system. This argument is often specious. In many cases, the subsidies are regressive; simply removing the subsidy would benefit the poor if additional revenues were transferred to pro-poor programs.

Prices can be successfully reformed by governments that make clear the association of reform with tangible benefits through improved social services or cash compensation. The reversal of reform in

times of high oil prices is a constant temptation. Automatic linkages to international prices, fuel adjustment clauses for electricity and (preferably) liberalized markets can avoid this. If the poor are to be directly compensated, then cash transfers that replace most if not all subsidies are the best option. New information technologies can help with implementation. The lessons from successful price reform are that it improves public finances, strengthens the energy sector, reduces emissions, leads to greater end-use efficiency and, in well-functioning administrations, provides sufficient additional budgetary resources to compensate the poor.

Promotion of efficiency through public policy is frequently win-win in that the policies are cost-effective in their own right and also make major contributions to reducing GHG emissions. They may also bring detectable improvements in the local environment.

An energy efficiency law is necessary for mandatory functions such as audits, designation of energy managers, reporting, labelling, standards (for equipment and buildings), tradable certificates and the creation of an energy efficiency agency. A legal basis may be required for other interventions, but regulations involving financial interventions can often be included in normal budgetary processes. Drafting an energy efficiency law is one thing; enforcing its provisions is another. In this respect, performance in developing countries is often lamentable, bedevilled by weak administration and corruption. The law would normally establish an agency as a regulatory focus for energy efficiency. Best practice indicates that the agency should be separate from government to escape the most restrictive constraints on recruitment and financial control. Developing countries often find it hard to achieve this distance. Technical assistance is needed to propose effective governance and management procedures, to help train adequate staff and to organize proper regulatory compliance.

Labelling appliances according to energy use is a valuable practice that can be effective at a low cost, though the obstacles are proportionally greater in developing than developed countries. Developing the negotiating skills to achieve agreement on specifications and legislation, the investment and training required for testing and the organization and verification of compliance are serious challenges. Regional centres and regional agreements on procedures and protocols and shared testing centres would reduce costs in small countries and be a big advantage. Generally, countries resist this kind of sharing, and technical cooperation programs may be better placed than national governments to promote these centres. Labelling specifications need to be updated regularly, otherwise there is no requirement for manufacturers to go beyond the requirements of the regulations; in theory, the label can become a hindrance to progress. Standards are updated regularly in developed countries, but this is more of a problem in developing countries where all resources, including consensus building and legislative time, are scarce. Labelling also acts as a non-tariff barrier to trade. Transparency, notification of standards and other measures are essential to assist developing countries in complying with new standards and to retaining or gaining market access.

Financial instruments are an essential tool in promoting efficiency, but they should eventually pave the way for spontaneous action by the private sector; they should be temporary means to transform markets, not permanent corrections. Financial incentives for energy efficiency are rarely efficient, but they draw the attention of energy users to the importance that government gives to the issue of energy efficiency; they induce some actors to perform in line with the intended policy goals, and these actions can in turn influence others. Fiscal measures are unlikely to be effective in developing countries because of weak tax regimes. Loan guarantees work best where the banking system already recognizes the potential of energy efficiency investments. Grants and concessional finance are probably the easiest and most effective measures in lower income countries and should progress to loan guarantees, circumstances permitting.

Energy service companies (ESCOs) have been widely promoted as a mechanism to deliver capital and knowledge to companies that cannot deploy these resources themselves. With some exceptions, ESCOs have been successful mainly in industrialized countries. Determinant factors include the size and openness of the banking system; the financial, technical and business experience of staff engaged in ESCOs; and access to appropriate subjects, especially large institutions and offices.

Buildings are a vital focus for energy efficiency in developing countries, as they are large consumers of energy. The rate of new building in developing countries is far higher than anywhere else in the world. Buildings will last for decades and will determine energy use for a very long time. Large improvements in their energy efficiency can be achieved at a low cost, but developers will not normally make those improvements because of various chronic market failures. The case for public policy intervention is strong. Many countries do not have building standards that include energy efficiency. Energy use is not seen as a major aspect of construction; safety and physical integrity of the structure are the classical priorities and this is quite hard to change. Even where building standards exist, they are not well enforced. A study by the Asia Business Council found that while all eleven economies studied had building energy standards on paper, most had failed to produce significant energy savings. This is a clear priority for technical cooperation.

Public policy to promote low carbon fuels has some points of similarity with energy efficiency policy and some points of difference. There are two main differences. First, in many cases renewable energy is not win-win; it requires substantial subsidy even in the absence of conventional market failures. Its justification lies in redressing global market failures; in particular, the failure of the market to satisfactorily price climate change, and to some extent, myopia associated with resource depletion. Second, some renewable energy technologies feed electricity into conventional networks and thereby may allow the use of new policy instruments, both nationally and in international exchange.

The panoply of instruments used to support energy efficiency can often serve to support renewable energy, though renewable energy may require higher levels of support. And that support may see a more prominent role for obligations laid on selected actors than is the case for efficiency policy. Obligations to blend biofuels into vehicle fuels are a main element of policy to support these technologies. Obligations on utilities to source electricity from renewable energy (renewable portfolio standards) are also important instruments in some countries. Where renewable energy is first converted to electricity, it is possible to channel financial subsidies directly though the electricity sector by means of feed-in tariffs. Conventional tendering can also be a channel for subsidy because the tender can be restricted to renewables.

The effectiveness of feed-in tariffs and renewable portfolio standards to promote low carbon alternatives in industrial countries is reasonably well demonstrated. For developing countries, however, the problem remains that the technologies are high-cost and require subsidy, which reduces budgets for higher priority needs such as health and education. The availability of international subsidies through the Clean Development Mechanism (CDM) moderates the financial loss to some extent, especially since credits under the CDM have been eligible to trade on the European Emissions Trading System (ETS), but the implicit values of carbon in the policies to support renewable energy in developed countries are far higher than the values of carbon in trading systems.

The review of technical cooperation in energy policy reform concludes that, although there has been some success in transferring best practice, the condition of policy and enforcement in developing countries still leaves much to be desired. The single biggest obstacle is a lack of priority in government. Governments are generally preoccupied by external and internal security, by delivering growth and employment and by health and education. Energy is a relatively low priority and, within the energy sector, the main emphasis is on ensuring adequate infrastructure and low cost supply.

Energy efficiency and the promotion of low carbon energy are not priorities in most developing countries. If the adoption of nationally appropriate mitigation actions (NAMAs) were to become a significant source of financial transfers, these activities might become more attractive. NAMAs would need to be accompanied by a considerable effort on the part of developed countries in terms of financial assistance, technical assistance and capacity building. Such a scheme would require careful monitoring, reporting and verification, which require indicators.

The second part of this paper addresses the value of indicators in contributing to the measurement, verification and reporting of the policy commitments. Indicators are now ubiquitous, in our daily life, in business and in all the services of government. There are indicators for all stages of the policy cycle, from inputs, through outcomes of instruments in the form of behavioural and technical change, to final impacts.

MRV might conceivably be based on indicators of:

- inputs (the financial, human, technical or organizational resources used in the endeavour);
- outputs (objectively verifiable indicators that demonstrate the progress made in implementing the measures, e.g., the creation of a minimum energy performance standard);
- outcomes (immediate effects on the regulated subject, e.g., the offer of new products and retooling of production lines); and
- impacts (direct measurements of the improvements that the program is designed to bring about, e.g. more efficient products and lower energy use).

Outcome indicators can be helpful in the design of policy and in making sure it does what was intended. There are no readily available sets of outcome indicators for energy policy in developing countries—they are a function of the policies adopted. To construct indicators will be expensive. Experience in other contexts suggests it is very hard to use outcome indicators to compare implementation of policy in different countries. As well, the relationship between outcomes and impact can be remote; it is strongly influenced by the complementarity of chosen policy instruments, the environment in which they are located and the skill and extent of enforcement.

The use of outcome indicators as a basis for reward for energy efficiency measures is not feasible. Such indicators do not exist in developing countries and the link between outcomes and impact is too obscure to give comfort that, in rewarding effort, one is also rewarding impacts and contributing to mitigating climate change. The relationship depends too strongly on factors that cannot be accurately assessed, such as the complementarity of chosen policy instruments, the environment in which they are located and the skill and extent of enforcement.

Only impact indicators can address these challenges with any degree of certainty. Even here there will be many difficulties. The problems experienced with the CDM in baseline definition and additionality would be magnified many times. Many indicators would be required, reflecting multiple policy instruments and the data to be collected and analyzed would be more troublesome because it applies to large groups of users rather than to individual projects.

The definition of methodologies and accreditation of NAMAs would need to be done on a country-by-country basis by an international pool of experts. The work would be significant and would probably require dedicated data gathering and analysis. It is unlikely that the necessary data to support such work will exist in-country. Considerable work and capacity building would be needed to bring the data to the level that would be required.

Measurement and verification of the impacts of NAMAs would also require a considerable effort in national monitoring of markets to detect changes in behaviour and technology. Detailed analysis

would be necessary. It would be important to ensure that these national efforts are put in place along with the NAMAs. There would be the same problems of baselines and additionality as have been experienced with the CDM.

The value to be assigned to inferred GHG emission reductions under NAMAs still needs to be determined. It should be significantly discounted from the value of carbon in trading systems because there will always be significant risk that the GHG emissions from the policy are overassessed; additionality criteria will not normally be satisfied. The most practical approach is to set the value of emission reductions under NAMAs at a level that makes NAMAs work. One way of doing this would be to set maximum quotas for NAMAs within trading systems. The quotas would represent the maximum volume of reductions that the industrialized countries are prepared to support in a first instance. Initially, reductions might be tradable at par to other certificates, or at a ceiling level, but the offer would be small. As the offer of NAMAs increases above the quota, so the price for emission reductions under the PAM scheme would fall. The disadvantage of this scheme is that it increases perceptions of risk to the developing country, as there is no guarantee of the future value of the reductions achieved. It does, however, manage the concern of developed countries that they would be paying for vast quantities of emission reductions that are profitable anyway.

Grid-connected electricity from low carbon sources offers special opportunities. It is rarely financially viable without significant subsidy. The implicit value of CO_2 avoided in support policies in developed countries is far higher than that observed on carbon exchanges. It is not reasonable to expect poor countries to bear such costs, but it is important to support such work because the largest potential for much renewable energy is found in developing countries. The impact indicators for these technologies are very easy to assess; electricity generated from renewables can be measured easily and the guarantee of origin is problem free.

We propose that certificates of origin are purchased by developed countries. This stands in continuity with the bridging Directive of the EU that allows CDM credits to be traded on the ETS. Some innovation would be needed. One option would be to allow developed countries to set the avoided carbon against their GHG reduction commitments. This arrangement would effectively credit the renewable investment with the value of carbon on the trading systems of developed countries. This may not be sufficient to call out large volumes of new investment; in most cases, it requires greater subsidy than the avoided costs of carbon.

An alternative is to allow developed countries to purchase certificates of renewable origin from developing countries and to set those against renewable portfolio obligations. This would be the simplest way of providing the huge investments that would be needed to mobilize large resources of renewable energy, for example, concentrated solar power in North Africa. The idea is hard to adapt

to the feed-in tariffs used in Europe, but they could be modified to run in parallel with a renewable portfolio scheme confined to purchases from developing countries.

Sustained, coordinated and well-targeted technical assistance (TA) is essential to maximize the potential of developing countries to contribute to mitigating climate change. There are several issues:

- How can the amounts of TA be allocated to developing countries?
- How can the effectiveness of that assistance be monitored?
- How can it be recorded?

In this context, outcome indicators could be of value. The state of a country's energy policy could be judged by an international panel, drawing on local knowledge, and the results then ranked and attributed a composite indicator. A set of norms can then be constructed for the technical assistance to be offered for improving these composite indicators. Adjustments can be made for country size and salient characteristics of various sorts (income level, climate, area). Implementation of the technical assistance and later evaluation would be guided by a more detailed set of outcome indicators according to the country requirements.

The process described here is complex and demanding of resources, but no more complex or demanding than at present. The World Bank, regional development banks, multiple UN agencies and bilateral donors all have large head offices and offices in most, if not all, developing countries. They assign immense effort to programming, planning, implementing and evaluating work. The arrangements proposed here could simplify those processes through improved coordination towards common goals.

Introduction

The objectives of this paper are to review experiences of policy reforms that can help mitigate climate change, to review work on indicators of the effort put into policy reforms and their subsequent effectiveness, and then to draw some tentative lessons about how the international community might support developing countries within the framework of the Kyoto process in their efforts to strengthen domestic policy reform and to reflect the success of those efforts in financial transfers.

The wider goal of the work is to feed into the research and consultation program at the International Institute for Sustainable Development (IISD), which is aimed at identifying ways in which trade and investment policy might most effectively serve the goal of addressing climate change, outlining in detail the challenges and possible modalities associated with the various policy options. This work will support the international trade policy community as it searches for ways to mainstream climate change objectives into its own efforts, providing a foundation of analysis that can inform the coming discussions and decisions.

The proximate motivation for this present paper is the requirement in the Bali Action Plan, adopted by the Conference of the Parties (COP) in Bali as decision 1/CP.13, (UNFCCC, 2007). Within this Action Plan, the COP

1. *Decides* to launch a comprehensive process to enable the full, effective and sustained implementation of the Convention through long-term cooperative action, now, up to and beyond 2012, in order to reach an agreed outcome and adopt a decision at its fifteenth session, by addressing, inter alia:

   [. . .]

   (b) Enhanced national/international action on mitigation of climate change, including, inter alia, consideration of:

   [. . .]

      (ii) Nationally appropriate mitigation actions by developing country Parties in the context of sustainable development, supported and enabled by technology, financing and capacity-building, in a measurable, reportable and verifiable manner;

   [. . .]

(d) Enhanced action on technology development and transfer to support action on mitigation and adaptation, including, inter alia, consideration of:

(i) Effective mechanisms and enhanced means for the removal of obstacles to, and provision of financial and other incentives for, scaling up of the development and transfer of technology to developing country Parties in order to promote access to affordable environmentally sound technologies;

(ii) Ways to accelerate deployment, diffusion and transfer of affordable environmentally sound technologies;

[. . .]

(iv) The effectiveness of mechanisms and tools for technology cooperation in specific sectors;

(e) Enhanced action on the provision of financial resources and investment to support action on mitigation and adaptation and technology cooperation.

It is the relationship between national mitigation actions, technology transfer and the requirements for monitoring, reporting and verification that this paper seeks to explore. There is controversy as to whether the requirement for MRV in the text in paragraph b(ii) refers to measures for mitigation or simply to financial support, or both. Most opinion appears to be that the requirement applies to both, so technology, financing and capacity-building must be quantified (Winkler, 2008).

This paper is divided into three sections of decreasing length. The first section reviews the experience of national policy reforms in areas that promise significant reductions in greenhouse gas emissions, and in particular, energy price reform, energy efficiency and the promotion of low carbon fuels. The main focus is on policy reforms in developing countries undertaken spontaneously or with technical assistance, but some note is taken of developed country experience with domestic policy reform. The second section deals with experience in assessing policy reforms, both in terms of the efforts put in and the success achieved. The third section draws upon the first two to provide some ideas as to which areas of policy reform combine promise, in terms of potential effectiveness at mitigating GHG emissions, with the need for measurability, verification and reporting and convincing mechanisms to deliver the necessary technical assistance.

1.0 Energy Policy Reform

1.1 Scope

1.1.1 Brief history of technical assistance in energy

There is extensive experience from technology assistance in efforts to reform national energy policies. It is useful to situate modern technological assistance in the context of an historical development. The origins go back before the First World War, when the colonial powers sought to manage the development of their colonies, and in particular, their infrastructure and agriculture. This process continued within the international institutions that took up technical cooperation after the Second World War and following the collapse of the European colonial system. The initial emphasis of these international institutions was on the finance of infrastructure. Electricity was a priority by reason of its assimilation with development and the large capital costs involved. Bilateral donors tended to follow the same path, with the dual aims of maintaining colonial alliances and protecting their civil engineering contractors and equipment manufacturers. The World Bank was then, and has been ever since, the largest player and in many ways an intellectual leader. The model began to change in the late 1960s and early 1970s as the consequences of the Yom Kippur War and oil embargo made clear the need to treat the energy sector as a whole in order to create diverse and robust structures. Energy efficiency, amongst other aspects of energy policy, received more attention. The importance of a wider energy policy and planning capacity became apparent and donors began to support national ministries and agencies in these functions.

Steadily, the field of concern widened, first as social issues of redistribution were addressed and the local environmental impacts of unconstrained development became intolerable. A wider range of international institutions with regional responsibilities entered the scene; many UN agencies became more actively involved and, very importantly, nongovernmental organizations (NGOs) became major players in the environmental area and indeed began to lead the intellectual debate in many respects. The most recent shift has been to recognize the importance of climate change and all donors have realigned their policies to reflect this. The Global Environment Facility (GEF) is a central example. The GEF was established in October 1991 as a $1 billion pilot program in the World Bank to assist in the protection of the global environment and to promote environmental sustainable development. In 1994, at the Rio Earth Summit, the GEF was restructured and moved out of the World Bank system to become a permanent, separate institution. The decision to make the GEF an independent organization enhanced the involvement of developing countries in the decision-making process and in the implementation of the projects. It is now a global partnership of 178 countries, international institutions, NGOs and the private sector with a remit to address global environmental issues while supporting national sustainable development initiatives. Energy efficiency and the promotion of renewable energy have been prominent in the portfolio.

Along with this multiplication of actors and extension of the scope of energy assistance, the importance of donors as funding agencies for investment in the sector has deteriorated. As energy systems, especially power systems, developed it became impossible for international institutions to provide more than a small part of the necessary finance. Moreover, the strong conditionality imposed on loans from these institutions was increasingly perceived to outweigh the slightly more attractive rates compared to commercial finance. This tendency coincided with a global shift towards liberalized and privatized energy markets. The obvious adaptation of the donors was to support the entry of private capital by providing advice on the reform of practice to match modern trends. So again, the emphasis of technical assistance moved towards capacity building and institutional strengthening. Structural reform of the power sector in itself does not have strong consequences for climate change, but it is closely associated with price reform and this has critical consequences. Structural reform also hands immediate responsibility for investment and operating decisions to private companies and so has important consequences for public policy formulation, legislation and regulation to ensure these decisions are coherent with the public interest. The entry of regulators into the policy arena changes the possibilities and practice of public policy intervention.

An instructive sub-plot within this story arose from the break-up of the USSR and especially the accession of the Central and Eastern European states to the EU. The accession process required, in principle, that the acceding states should match EU legislation and practice across the board, including energy. These countries were inefficient users of energy and had little regulation or standards for efficiency; the upgrading of practice in energy efficiency required extensive technical cooperation. The main delivery of this cooperation was through the European Bank for Reconstruction and Development (EBRD) and the PHARE program of the EU.[1] PHARE was originally created in 1989 to assist Poland and Hungary in its accession to the EU, but it was eventually extended to cover all of Central and Eastern Europe and for a while the countries of the Western Balkans. A similar program, TACIS, was created for the ex-CIS countries.

An evaluation of PHARE came to the conclusion that the program had worked best in the sectors that were strongly linked to the accession process and were recognized as clear political priorities (European Commission, 2007b). This is an interesting finding, as it is a widespread sentiment among those performing technical cooperation, rarely expressed in writing, that a substantial part of technical cooperation is not wanted by beneficiaries, who therefore cooperate half-heartedly, and that cooperation works best when it is in the clear and immediate interests of the recipient.

1.1.2 Energy policy and climate change

The objectives of energy policy have converged internationally and now almost all published policies and strategies reflect three broad objectives:

[1] See http://europa.eu/legislation_summaries/enlargement/2004_and_2007_enlargement/e50004_en.htm.

- Energy security
- Appropriate environmental mitigation
- Properly functioning energy markets

The interpretation of these objectives can vary substantially among countries. Energy security, for example, in the case of an oil exporter would mean securing markets, whereas for an importer it will mean securing supplies. The environment in developing countries may be less of a priority than rich countries, and where it is a priority, it is more likely to reflect high levels of urban air pollution rather than global climate change. Even this very visible and costly problem is given disproportionately little attention by national policy-makers and the still worse problems of indoor air pollution are given virtually none at all (Poverty-Environment Partnership, 2008). If action is so restrained, even when the causes are entirely domestic and government has the means of control at its disposal, then there is little chance of spontaneous action for climate change that will bring any direct benefit.

"Properly functioning energy markets" is also subject to interpretation. The basic need is for rational energy pricing, subject to adequate social protection. This need may not always be publicly recognized by the governments of countries where distortions are worst. Price reform is unpopular and has lead to the fall of governments. This objective can include also liberalized, privatized and properly functioning markets. Logically, such a stage should come after proper pricing, but often the two go together.

Energy efficiency can be included most easily under the environmental objective. This is probably where most industrialized countries would locate it. It can also be incorporated into appropriate markets; developing countries might put it there because of its link to economic competitiveness of traded goods and services.

For the present purpose, we need to decide which aspects of energy policy overlap with the mitigation of climate change. Security of supply may have some secondary implications for climate change, for example if a country decides to build coal-fired electricity generating plants to diversify away from natural gas imports from perceived unreliable suppliers and/or high gas prices from monopolistic or oligopolistic suppliers. Despite this possible significant contradiction between security of supply and climate change obligations, we choose to ignore those aspects of energy policy that bear directly on security. If we were to include them, the implication would be that countries would be rewarded for tweaking their security of supply policies to recognize the higher carbon content of some fuels. In practice, it would be difficult, if not impossible, to know whether a decision to choose low carbon fuel were actually made on that basis. The consequences of that decision can anyway be picked up later in some output indicator that relates observed GHG emissions to observed energy use.

The relationship between climate change and structural reform (privatization and liberalization) is complex. It is often asserted that structural change is beneficial to the environment. There is little economic reason why ownership should have any particular beneficial bias towards the climate. The main purpose of reform is economic efficiency, which should lead, all other things being equal, to lower prices and higher demand, and therefore to higher emissions. This contradiction between liberalization and climate change objectives is unpopular and often intellectually resisted. What is true is that structural reform is often associated with price reform, indeed is used as an instrument to that end. Price reform is beneficial to the climate.

The circumstances differ considerably between developed and developing countries. In Europe, one of the main drivers for privatization was to achieve lower prices through greater efficiency. Lower prices lead to higher use and greater impact on climate. It is sometimes alleged that, under private ownership, utilities in Europe have preferred to opt for low lead time gas-fired plants that the old state-owned utilities would not have built, and this has reduced emissions. There is little or no evidence to support this and, even if true, it would simply be a contingent consequence without causality.

In developing countries, the relationship is more difficult to untangle. Price reform and structural reform are independent processes that are best conducted in sequence and not in parallel. Privatization and liberalization should follow price reform, because then the market risks are less if markets are free and the sale of the assets is therefore more profitable. In practice, the two reforms are often linked and structural reform is used as a vehicle to achieve and maintain price reform. The relationship between structural reform and beneficial impacts on climate change is still contingent; the beneficial impacts stem from price reform not structural reform per se.

In this paper, I take the view that the impacts of structural reform on climate change are secondary; the beneficial impacts as normally conceived are more properly assigned to associated price reform, which is discussed here on its own merits. This treatment in no way ignores the possibility that countries may use structural reform as a mechanism to achieve price reform.

There are also some conflicts between local environmental control and climate change. Local and regional emissions are often best managed by end-of-pipe technologies. Mechanisms to manage the local environment can be ambiguous for climate change. Improvements in vehicle efficiency may reduce emissions from a vehicle by 5 per cent, whereas a catalytic converter can take out 99 per cent; the catalytic converter in turn imposes an efficiency loss and increases emissions of CO_2. Lower sulphur specifications for diesel fuel can reduce local pollution but lead to lower efficiency and higher GHG emissions at the refinery. Of course, these concerns should be addressed in an integrated manner to find the best management practice, but it should be acknowledged that there are some conflicts. We exclude from our discussion all aspects of energy policy aimed directly at

controlling local emissions (e.g. Flue Gas Desulphurisation) again on the grounds that it would be disproportionate to resist a vital process because of secondary consequences elsewhere.

The main areas of energy policy that are left to us are therefore price reform, energy efficiency and promotion of low carbon energy sources, and it is on these that the discussion will focus. Within the broad topic of energy efficiency, we include transport and urban planning. Rational energy pricing cannot be easily dissociated from its implications for the poor. Logically, one might argue that consideration of poverty has no place in energy policy and that public policies to support poor people should be found in Departments of Social Security. Even in developed countries this argument is not normally seen as acceptable. For example, the relief of fuel poverty is now a recognized concern of energy policy in the UK, (BERR, 2001). In developing countries, the two issues are even less dissociable because energy subsidy is used as a mechanism of income redistribution and of social security; these concerns are central to the stubborn maintenance of subsidy programs against all economic logic and must be recognized.

This is a long preamble to come to the obvious conclusion that price reform, energy efficiency and low carbon fuels are the main aspects of energy policy that affect climate change, but it is important to recognize that they represent only a small part of the scope of energy policy in total and that other objectives of energy policy may to a certain extent conflict or reinforce.

1.2 Price reform

It is well-established that energy demand is price sensitive, especially demand for electricity. The most reliable results come from industrialized countries. A review of data from 20 Organization for Economic Cooperation and Development (OECD) countries concluded that the long-run electricity price elasticity was between -0.9 and -1.0, (Verbruggen & Couder, 2003). These calculations are not easy to do; the many methodological difficulties and consistent time series over the long periods required are often not available; for these reasons there is less evidence from developing countries. A recent study by Roy, *et al.* (2006) of own-price elasticities in some large developing countries estimates them at between -0.80 and -1.76, comparable to other estimates from previous econometric studies cited in their report. Elasticities for other fuels are generally somewhat lower, but also significant. So, price reform will save large quantities of energy, especially in the long-run, and can make a substantial reduction in GHG emissions from countries with distorted prices.

The International Energy Agency (IEA) (2008c), in its *World Energy Outlook 2008,* estimated energy subsidies in the 20 largest non-OECD countries at $310 billion, considerably up from the 2005 estimate of $250 billion. The worst offender was Iran, which contributed more than $55 billion to the total, and the next four largest subsidies were in Russia, China, Saudi Arabia and India. Oil and

gas producers appear well up the list, because of the political pressures to share domestic mineral wealth in the most obvious way.

In fairness, one should recognize that around two thirds of subsidies in the global economy occur in OECD countries. Those subsidies are heavily concentrated on agriculture, mining, road transport and manufacturing, and the agricultural subsidies in OECD countries account for over 30 per cent of all subsidies worldwide. Non-OECD countries mainly subsidize energy, water, fisheries and some agriculture (Pearce, 2003). But it is with energy subsidies that we are concerned here.

1.2.1 The costs of subsidy

The World Bank review of "win-win" policy reform policies makes three important points about these subsidies (Chomitz, 2008).

- They are burdensome: they represent from two to seven times greater expenditure than government expenditures on health in (for example) Bangladesh, Ecuador, Egypt, India, Indonesia, Morocco, Pakistan, Turkmenistan and Yemen.
- They are poorly targeted: poor peoples' share of the subsidy is usually less than their share of population.
- They increase emissions of CO_2: for example, countries that subsidize diesel fuel emit twice as much CO_2 per capita as other countries with similar per capita income.

Where distorted prices exist, revision of prices to reflect economic costs of supply is firmly in the interests of national economies. There is an immense amount of literature on this topic (see for example IISD, 2006). Subsidies put a large strain on public accounts and weaken foreign trade balances. They also tend to devastate the state-owned enterprises that are normally a victim of the practice. The most common form of subsidy in developing countries is to keep prices low and then to compensate the state-owned supply enterprise. Compensation is normally minimal and keeps the enterprise in a position of dubious solvency in which investment in new plant and networks is hindered and the enterprise loses credibility as a counter-party for long-term fuel purchases, as would be required, for example, in contracting gas. Maintenance of plants is delayed to save money leading to low availability, poor reliability and low efficiency. The low consumer prices stimulate demand, putting more pressure on the enterprise and compounding its losses; the enterprise is caught in a vicious circle. The excess demand over the economically rational demand of course causes excess emissions of GHGs. Investments in energy efficiency throughout all sectors of the economy are discouraged, as are alternative forms of supply, such as renewable energy and cogeneration.

1.2.2 *The case of Iran*

Iran, it was noted, is top of the subsidy league table. The World Bank studied the environmental impacts of these subsides in its Energy-Environment Review (EER) of Iran (World Bank, 2004b). This is an interesting case study that repays detailed study because the approach is comprehensive, covering subsidy reform, sectoral efficiency investment, consumer prices, local damage costs and climate change impacts.

The base-year for the study was 2001. At that time, the subsidies were equivalent to 17.8 per cent of the Iranian gross domestic product (GDP) and the stated pricing policy was to keep energy prices constant in real terms. The EER estimated that if these policies were to continue to 2019 then the subsidy would be equal to 20 per cent of GDP and that consumption of energy and emissions of GHGs would more than double. The study investigated the policy options to control and decrease environmental impacts. Local environmental damage was estimated explicitly using damage costs assessed in Europe, but adjusted for Iranian conditions. Impacts on the global environment were assessed as physical emissions.

The EER examined separately price reform policies and sectoral measures to improve efficiency. It assessed the opportunity costs of fuels as a function of border prices for traded goods and long-run marginal costs for electricity. It concluded that subsidy levels were very high. Table 1 shows some examples.

Table 1: Subsidy levels as percentages of opportunity costs

Fuel	Subsidy as % of Opportunity Cost
Gasoline	68
Kerosene	91
Gasoil	90
Natural gas	75
Electricity for agriculture	98
Electricity to homes and commerce	88

The EER examined three scenarios for price reform in which subsidies were eliminated by: (a) 2009, at the end of the Fourth Five Year Economic and Social Development Plan; (b) 2014, at the end of the Fifth Plan as an intermediate price reform scenario that might lessen acute public reaction and lower pressure on the consumer price index and (c) by the end of the Sixth Plan; as very slow price reform. This last scenario, it was noted, would require price increases phased over 15 years and could be difficult to sustain.

The main results were:

(a) In a "business as usual" scenario, primary energy requirement and final energy consumption would more than double from 2001 to 2019, with corresponding detrimental effects on the amount paid as subsidies, on local damage costs and GHG emissions. Subsidies and damage costs would not only increase in absolute terms, but also as percentage of GDP.
(b) Fast price reform by 2009 without sectoral measures would decrease the damage costs and GHG emissions by half. It would increase overall financial benefits to the state and bring bigger environmental benefits in the intervening period 2004 to 2019; however, it would have the strongest impact on the consumer price index (CPI) of all scenarios (13.9 per cent increase over the period in which the adjustment took place).
(c) Elimination of energy subsidies in 2014 without sectoral measures would reduce energy consumption at that date by half and result in a 50 per cent decrease in damage costs. However, both energy consumption and damage costs would still be higher than in 2001. The rate of increase of the CPI would be 6.7 per cent over the period.
(d) Applying sectoral measures without price reform would lead in 2019 to some, though not very substantial, reduction in energy consumption and damage costs, because few measures would be adopted at the low prices.
(e) The combination of price reform and sectoral measures would bring energy consumption in 2019 almost to the level of 2001, and would actually result in a decreasing environmental impact, and lower GHG emissions.

The major conclusions from this analysis were that: a) rapid price reform is the best strategy for the environment, and b) a combination of price reform plus appropriate sectoral measures could allow economic development with little or no increased local and global environmental impact. This could be described as win-win-win.

1.2.3 The case of Egypt

A sister study to the Iranian EER was performed in Egypt (Lucas, Wooders, & Cupit, 2003). This analysis projected that, without any mitigating action, net domestic consumption of energy would increase by 73 per cent over the decade from 2000 and CO_2 emissions would increase by 80 per cent, assuming that all energy prices were maintained at their current levels (in real terms). The study again examined the effects of price reform with and without a package of sectoral measures. Reductions in energy demand and CO_2 emissions from the successful implementation of the package of policies and price readjustment would be significant. It was estimated that by 2010/11 savings could be achieved of:

- 26 per cent of energy demand and 23 per cent of CO_2 emissions from price readjustment;

- Nine per cent of energy demand and 11 per cent of CO_2 emissions from the package of policies;
- Approximate reductions of 30 per cent of energy demand and 28 per cent of CO_2 from the combined program.

The study only examined a restricted range of the most effective sectoral measures and no doubt larger reductions could be achieved with a greater range of interventions.

1.2.4 Why distortions persist

The World Bank Independent Evaluation Group studied the effectiveness of price reform projects undertaken by the Bank. More than 250 activities have been launched. The evaluation found that success has been achieved in the transition countries and that in these cases energy prices had been successfully adjusted toward market levels, and the intensity of CO_2 emissions had consequently dropped substantially. It is interesting that the evaluation should emphasize these successes because it strongly reinforces the conclusion noted earlier from the evaluation of PHARE projects in the transition countries (European Commission, 2007b) that projects work best when beneficiaries recognize that they contribute to a perceived political priority, as was the case with accession countries that were obliged to bring themselves into line with EU levels as a condition of a much-desired accession.

In other cases, the success has clearly been more nuanced. In the cases of Egypt and Iran cited earlier, for example, there were only modest increases in prices after the analysis was complete and it is not at all clear that they were necessarily related to the reform effort. In many countries, price reform studies by prospective donors and cooperation agencies are tolerated, but not acted on. A good example is in Lebanon, where electricity tariffs have remained unchanged since 1994, despite a string of recommendations from assistance projects that they should be revised (Chaaban, *et al.*, 2006).

The question arises as to why countries persist in what apparently is a perverse refusal to reform. The reasons are complex and vary from country to country. Guiyang (2007) makes the case that, in China at least, these subsidies represent rational policy responses to identifiable and important political issues; the author goes on to claim that "interventions are explicitly designed or intended to support energy policy goals" and that governments can, by these actions: "encourage or discourage the use of special fuels" (p. 93).

> [In the developed nations,] the major problems associated with energy consumption involve air pollution, global warming and traffic congestion. In these countries it would make sense to tax petroleum fuels heavily and encourage the

> use of nuclear power and gas against coal, and make electric power freely available. In the undeveloped and developing world, major problems associated with energy consumption involve environmental protection, energy supply and energy security. Therefore obviously a policy of affordable energy supply should be guaranteed, in particular, infrastructure construction such as electric network and gas pipeline systems should be encouraged." (Guiyang, 2007, p. 93).

It is difficult to accept this argument for several reasons. First, it is evident that air pollution and traffic congestion are far worse problems in Beijing than in most cities in developed nations (IGES, 2003). Second, it is hard to see the logical connection between subsidies and infrastructure construction. Indeed, subsidies will hinder investment by reducing available funds in the sector.

Guiyang (2007) also argues that:

> subsidies may help industries to adapt to new environmental regulations, assist new emerging industry and improve competitiveness in international market. In a short time, subsidies can reduce pollutant discharge, encourage energy conservation; in a longer time, subsidies can promote investment in pollution control so that reducing pollution, saving energy, promoting economic growth, benefiting future revenue and employment. (p. 95)

Again, it is hard to see this as other than special pleading. If company profits are increased by energy subsidy, there is no reason to believe that they will spend them on environmental controls and energy conservation. If adaptation to new environmental regulations is impeded by budgetary constraints, then it can be targeted directly. The same is true of energy conservation. In any case, support to industrial adjustment cannot constitute an argument for subsidies to retail consumers.

A very interesting alternative explanation from the perspective of political science is offered by Andresen, (2008). Empirical research reported by Andresen showed a significant negative correlation between measures of political freedom and petrol prices, which is to say, authoritarian regimes have lower prices. It is also certainly striking that in the list of the top five polluters cited earlier (Iran, Russia, China, Saudi Arabia and India) the first four are all semi-authoritarian. In public choice theory, there are two main mechanisms through which society influences politicians and the policy-making process. In the first, politicians bribe voters with policies in order to get their vote. In the second, special interest groups bribe politicians to get the policies they want. Voters in a democracy have the choice between withdrawing their support for a party and engaging with the party in order to change policies. In authoritarian and semi-authoritarian regimes, this option is less viable. In China, there are no alternative parties to which one may switch allegiance; in Russia, opposition is purely nominal. The conclusion drawn in Andresen's paper is that, from a public

choice perspective, there is a systematic bias in authoritarian regimes in favour of lower energy prices. This bias is caused both by the corrupt environment of those regimes, and by the behaviour of the public, who, deprived of their opportunity to have meaningful elections, are left with only the possibility of protest. To forestall protest, a government offers policies that will please their constituency. One reason for the link through corruption may be that authoritarian regimes are more corrupt, so those with an interest in low energy prices can pay politicians to enact regulations to lower prices or use taxpayers' money to give subsidies. It may also be that government officials gain financially from illegal oil and gas trading schemes made possible by price regulation.

It is hard to judge the correctness of this analysis; it certainly has a chilling plausibility. If true, it is important because authoritarian regimes figure highly among the countries with the largest subsides (IEA, 2008c) and the biggest developing country emitters; it may be hard and expensive to devise adequate compensation for the losses such regimes may perceive.

The reasoning may also apply more than is commonly thought to fledgling democracies. In Thailand, for example, in February 1980, the Kriangsak government announced sudden increases in the prices of oil, gas and electricity. This action provoked opposition from elected politicians and demonstrations by students and workers. As opposition grew, Kriangsak resigned (LePoer, 1987). The price reform was certainly not the only reason, but it was the proximate cause. Old as this precedent may be, it has not been lost on subsequent generations of politicians in the country and no doubt politicians elsewhere are sensitive to the same possibility.

The usual interpretation of the persistence of energy subsidies is more charitable; it is simply that in developing countries it is hard to redistribute income. Tax collection is weak; social security is often next to non-existent and energy subsidies represent an opportunity to channel resources to the poor. The argument is compelling in some respects but has important flaws. In the case of electricity, the poorest consumers do not have access, so subsidy does them no good at all. There is a small attraction to electricity subsidies for a small initial consumption per connection (lifeline tariffs) because the existence of the network and the metered connection means that subsidies can, to some extent, be targeted to small consumers. Fuel subsidies are much harder to target. A general fuel subsidy accrues to the rich as well as the poor and, as the rich consume more, they benefit more.

1.2.5 The case of Indonesia

The case of Indonesia illustrates many of the above points. In Indonesia in 1998, another authoritarian regime, energy price rises finished off the Suharto era. There were many compounding reasons, but it was riots in the streets following price rises in May 1998 that provoked the end (Gupta, et al., 2000). The highly subsidized price of energy, compounded with the Asian currency crisis, eventually combined to make the fuel subsidies one third of the budget of Indonesia. Massive

price rises were inevitable; in January 2003, the government again increased fuel prices, but in May of the same year (2003), street protests forced President Megawati's government to rescind the price rise amid fears for her presidency. Prices were increased by President Susilo Bambang Yudhoyono in 2005, once more provoking violent demonstration (BBC, 2005), but in this case, they were maintained. The price increases were imposed in two stages. In March, the prices for diesel and gasoline were raised by around 29 per cent and in October the price of kerosene to households was raised 186 per cent, and gasoline and diesel by 87.5 per cent and 105 per cent respectively. Industry was to pay market prices. This still left prices well below international levels. Kerosene was still only at 32 per cent of the world price, while gasoline and diesel prices were 77 per cent and 69 per cent of the world level respectively. A timetable was set for completely phasing out of fuel subsidies, but it was not met and has never been updated. No mechanism was established to link future prices to international levels on an automatic basis.

The government again increased subsidized fuel prices on May 24, 2008 by an average 28.7 per cent, provoking further protests, although fuel remained among the cheapest in Asia, (IEA, 2008a). A monthly cash handout scheme was introduced, intended to pass on USD$1.5 billion of the savings on fuel subsidies to about 19 million poor families. This, it is claimed (World Bank IEG, 2008), contributed to eventual acceptance of the increases. The recent decline in international oil prices has been associated with rapid back-tracking; by mid-January 2009, regular gasoline prices had been cut three times and were right back where they were before the increases of 2008 (Arman, 2009).

The equity implications of the price rises in Indonesia in 2005 have been analyzed using theories of public finance (Olivia & Gibson, 2006). The basic methodological proposition is that if a reform is optimally designed, then the costs in terms of social welfare of the last unit of government expenditure that is saved by cutting subsidies (or raising taxes) on each good should be equal. Using budget survey data from 29,000 Indonesian households, the authors estimated a demand system for five energy sources that was then used to calculate the marginal social cost of price changes for each item. The results of the survey suggested that kerosene was not predominantly the fuel of the poor and that a majority of the kerosene subsidies were not be captured by the poor, especially in rural areas. The paper concluded that, under certain plausible assumptions, all of these energy sources were attractive candidates for price increases, when compared with the social cost of revenue raised from taxes on other goods and services. The calculations also show that reducing expenditure on subsidies by allowing further increases in the consumer price of kerosene would be desirable, taking into account both efficiency and equity. In other words, even without an explicit safety net for poor consumers, the benefits to them of the increased public expenditure in other areas more than offset the loss in welfare from the subsidies.

The general tenor of these conclusions is echoed in the Indonesia Public Expenditure Review (PER) (World Bank, 2008c) and in recent policy research (Agustina, et al., 2008). The PER observes that

the impact on the national budget of the fuel subsidy reductions was enormous. The 2005 fuel price adjustments reduced the budget deficit by US$4.5 billion for that year. The October 2005 increase alone had a positive impact on the 2006 budget of US$10 billion. Spending on public health also rose strongly, although it is still extremely low. The PER nevertheless is clear that there is a long way to go in Indonesia, both in eliminating fuel subsidies and in stabilizing the linkage to international prices thereafter; the linkage may be created either by liberalizing markets or by instituting an automatic administrative response.

Electricity prices were unchanged after the 2005 reform. Indeed, power prices have been only partially adjusted to reflect changes in costs since 1999. The average revenue received per kWh in 2007 was about USD 6 cents, while costs were about USD 12 cents. The difference between costs and revenue is made up by the subsidy. The size of the subsidy in 2005 was Rp 10–15 trillion ($1.6 billion2). The 2008 Budget estimate was for an electricity subsidy of Rp 29.8 trillion ($3.2 billion), soon revised to Rp 60.3 trillion ($6.4 billion). Indonesia's Finance Ministry estimated in May 2008 that the combined subsidies for fuel and electricity industry would total some $20.5 billion in 2008, about 20 per cent of the national budget, outstripping spending on housing, law and order, health and education combined (IEA, 2008a). The subsidy is regressive, although less so than fuel subsidies before the fuel price increases. In 2005, the subsidy for household electricity was Rp 11 trillion, of which the poorest ten per cent of Indonesians received Rp 900 billion and the richest ten per cent received Rp 1.3 trillion, 44 per cent more in total than the poorest decile. Benefits to other population groups rose steadily from the poorest to the richest deciles (World Bank, 2008c).

This case study of Indonesia is rich in lessons. It shows the hysteresis imposed on price transmission by political manipulation in the face of potential social unrest; it shows the remarkable inequity of subsidies; it shows the amazing distortions they can impose on public expenditure; it shows the potential for price rises to be made palatable if associated with perceptible improvements in social services and/or targeted hand-outs and it shows how hard it is to maintain reforms if they are not based in liberalized markets.

1.2 6 The case of India

Some countries have tried to target fuel subsidies by restricting sales of subsidized energy to certain identified groups of poor people. The longest experience of this is in India. The scheme operates through the Public Distribution System (PDS). The PDS was originally developed in the 1960s to ensure distribution of food to deficit regions and to prevent shortages from becoming famine. It is also used to target kerosene subsidies. The subsidized fuel is distributed by four state oil companies that are guaranteed by government a certain return post-tax. Kerosene supplied through the PDS is

[2] All dollar figures in this text refer to US dollars unless otherwise specified.

sold at the "fair price" shops that sell subsidized goods. The allocation of kerosene by the central government is based on historical patterns rather than on demand or on relative poverty levels.

It is difficult to reach any firm judgement on the efficiency of this system. Some see it as a part of the crown jewels of a socialist and caring India under constant threat from the World Bank and Indian liberals, but others see it as a chronically inefficient and wasteful structure. A partially positive evaluation was conducted by the National Council of Applied Economic Research (NCAER, 2005). The NCAER study was founded in a large sample survey of urban and rural households to determine the amount of kerosene that they bought, the purpose for which they used it, the price they paid and the source of supply. The survey suggested that about 94 per cent of all rural households used kerosene for some purpose, mainly for lighting, although some also for cooking; 95 per cent of these users sourced kerosene through the PDS. In urban areas, about 69 per cent of households reported use of kerosene and 82 per cent sourced the fuel from the PDS. The total volume of kerosene distributed through the PDS is around 11 million tonnes

The NCAER estimated the diversion of subsidized kerosene from its intended beneficiaries by comparing the volumes of kerosene supplied by the government with the estimates obtained by aggregating the purchases reported by households. The gap between the two numbers is about 36 percent. The NCAER estimated that about half of this is diverted to adulterate diesel and half is diverted to other households without a ration card at black market prices. At the time of the survey, the price on the open market was 21 Rs/litre and the subsidized fuel was 10 Rs/litre. The NCAER concluded that the scheme was successful in terms of its deep penetration into low-income groups, but showed clear signs of inefficiency.

Other authors have been less kind; at the highest level, the Prime Minister of India found that:

> Equity does not always imply offering subsidies. If such subsidies do not reach the poor, they do not in fact address the objectives they are meant to address. I find we spend far too much money funding subsidies in the name of equity, with neither equity objectives nor efficiency objectives being met. Can we find more rational solutions to the problems of imbalances and inequities in growth? (Singh, 2007)

Some have suggested that direct financial transfers could be more efficient, (Kapur, Mukhopadhyay & Subramanian, 2008). These authors cite a Planning Commission report (Planning Commission of India, 2001) to the effect that:

> Accountability in the monitoring process is very weak. The fear of adverse remarks has prevented officials from reporting poor performances. Concealment

> of shortcomings and manipulation of data have been resorted to, to cover poor performances. Due to concealment of weaknesses in programmes, appropriate corrective actions are not taken. Monitoring units tend to shift responsibilities for poor performances to line departments. Monitoring Units and the Departments furnishing data and reports are not held accountable for false pictures created by them.

The authors proposed a direct transfer of cash to individuals below the poverty line to replace part, but not necessarily all, of the PDS services; kerosene would be a prime choice. They argue that there are now robust technologies for making cash transfers that are reliable, transparent and monitorable. The key issue is to establish an individual's identity; once identity is established, then ineligible beneficiaries can be removed over time as the process of verification is strengthened. They suggest piloting the scheme in areas where there is great poverty and where the performance of the PDS has been poor.

The Government of India did attempt to introduce a scheme using smart cards, but not adopting cash transfers. The Ministry of Petroleum and Natural Gas planned to issue smart cards to families living below the poverty line (BPL families) in three districts across three states—Bihar, Uttarakhand and Maharashtra. The state governments involved opposed the scheme, largely, it seems, because the sales would be only to BPL families and this would reduce the number of people who would benefit.

1.2.7 Cash transfer schemes

Most cash transfer schemes take their inspiration from Oportunidades in Mexico. This is a social assistance program founded in 2002, and designed to alleviate poverty by providing cash payments to poor families dependent on family compliance with program requirements, such as attendance of children at school. Cash payments are made from the government directly to families to decrease overhead and corruption. We cannot pursue this line further, because it drifts too far from energy price reform and climate change, but it is an important reference because the economic logic suggests that subsidies should be replaced in the main by direct payments, and advances in information technology might soon make this possible. The experience of the Mexican program is therefore important. The program has been independently monitored by the International Food Policy Research Institute (IFPRI, 2001), mostly positively.

1.2.8 Conclusions

We can draw some conclusions from this discussion of price reform:

- Price reform programs improve public finances, strengthen the energy sector, reduce

emissions, lead to greater end-use efficiency and provide sufficient additional budgetary resources to compensate the poor.

- Price reform programs are resisted in developing countries by a combination of political and social factors that are hard to disentangle.
- In many cases, simply removing the subsidy would benefit the poor as long as the additional revenues were transferred to pro-poor programs.
- Experience of targeting subsidies to low-income groups is mixed; they can succeed in terms of access, but are expensive and prone to corruption and misuse.
- Once privileges of this sort are established they are hard to reverse.
- There is some evidence that if price reform programs are associated with tangible benefits through improved social services or cash compensation then they will be accepted and can be sustained.
- Backsliding in times of high oil prices is a constant temptation. Automatic linkages to international prices, fuel adjustment clauses for electricity and (preferably) liberalized markets can avoid this.
- If the poor are to be directly compensated, then cash transfers that replace most, if not all, subsidies are the best option. New information technologies can help with this.

1.3 Energy efficiency

1.3.1 The logic for public policy intervention

Before we can examine the policy instruments available to implement energy efficiency policy, we should know what are our reasons to intervene. The basic idea of a competitive liberalized market is that prices reflect costs, and that therefore the decisions taken by private operators recognize all the consequent cost implications. For any given distribution of income, market decisions lead to the optimal allocation of resources for society. This model is an important reference and decisions of the market should be respected, but markets do fail. They fail to protect the environment; distortions arise from subsidies to state industry or market manipulation by dominant actors. Policy intervention to control market behaviour should be made with caution and should be linked to identifiable market failures. The market failures that are most commonly alleged to exist in energy conservation are the following:

(i) **Distorted energy prices:** In developing countries this may be the most important market failure. Where energy companies, mainly gas and electricity, are owned by the state, prices may be controlled to levels well below marginal costs. Rational and optimal decisions by investors are therefore not rational and optimal decisions for the community.

(ii) **Externalities:** Some consequences or effects of individual decisions are not considered in the private appraisal of an individual consumer or producer—the "external costs" of climate change in this case especially.

(iii) **Poor information:** Energy users, especially small- and medium-sized companies and private households, often are not aware of the saving potentials and they do not have access to the appropriate information.

(iv) **Agent-principal dilemma:** The user of a building or plant is often not the owner, for instance in rented buildings. The owner seeks to minimize the investments in the building, because he does not directly perceive the benefits of energy savings; the user may prefer an efficient solution, but does not have the choice.

(v) **Budgetary constraints:** All enterprises operate under budgetary constraints. There is much anecdotal evidence to suggest that the rate of return required for energy efficiency projects is higher than the true cost of capital. Public entities often have tight budgets fixed by government allocation with no reference to market conditions; they are frequently the most tightly constrained. Regulations governing use of public funds can sometimes make it difficult for them to finance energy efficiency investments from savings in running costs (which makes it hard to promote investment with promotional loans).

(vi) **Poor investment appraisal:** Some enterprises may not have the skills for rational investment appraisals. Consumers require a very short payback period because energy conservation is not considered as a core business function.

It is useful also to bear in mind that many energy efficiency investments, although nominally cost-effective, are rather small and therefore have to bear high transactions. This can be true even of moderately large industrial modifications to existing plants, for example installing heat recovery on a kiln. The budgetary price of the heat exchanger may be low compared to the expected savings but there will be the costs of design, procurement, existing ancillaries, realignment of ducting, down time for installation and always the fear of some unforeseen deterioration of the product quality. Public policy can be effective by helping to reduce these transaction costs through standardization, demonstration, information and establishing workable financial models.

1.3.2 A taxonomy of policy instruments

There is an array of policy instruments that can be used to address these market distortions. The IEA database of energy efficiency instruments in use in its member countries recognizes nine categories and 40 sub-categories, and then six different sectors to which each instrument might individually apply (IEA, 2009). Many policies and measures are in force in member states; France has 65, Germany 36, Japan 65, the UK 66 and the U.S. 71. There is some similarity in the targets and instruments used in different countries, but a wide range of implementing modalities and generally somewhat different emphasis. Systematic comparison is difficult.

The taxonomic structure employed by the IEA is good and complete, but does not reflect closely the kind of programs that have developed through technical assistance that reflect a less developed legal and institutional structure. The taxonomy that we adopt in this study is as follows:

Corrective Measures:

- Price Reform
- Institutional and legal reform
- Labelling
- Research, development and demonstration
- Financial incentives
- Support for energy service companies (ESCOs)

Compensating Measures:

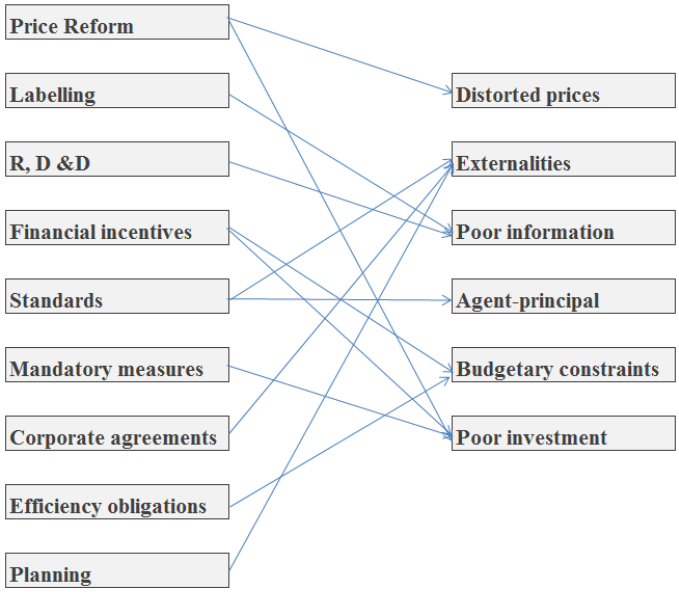
- Standards
- Mandatory measures (e.g. compulsory audits and management obligations)
- Corporate agreements
- Efficiency obligations
- Transport and spatial planning

The measures have been divided into two groups. Correcting measures try to correct the perception of costs in the market without interfering with the market, so that the autonomous demand and supply decisions of the market participants lead to a result that is close to the desired economic first-best optimum. Compensating measures accept that there is a market failure that cannot be corrected. Therefore, the government introduces measures to change (or regulate) the market decision-making process. Where possible, economists prefer corrective measures because they least disturb the working of market processes so all the advantages of the competitive system are maintained.

A slightly less elaborate taxonomy has been used by UNDP (2008) in their analysis of key points of the Bali Action Plan.

Figure 1 attempts to show how the policy instruments relate to the identified market distortions. It is purely schematic; in reality, instruments have complex and multiple impacts. Legal and institutional reform is not included because it has a bearing on all the issues.

Figure 1:Instruments and their effects



1.3.3 Legal and institutional reform

1.3.3.1 Energy efficiency law

The whole economy can be seen as a complex energy conversion process. Making this process more efficient requires intervention in a host of ways. Some idea of the myriad of laws and regulations that exist can be gleaned from the IEA database on policy measures for energy efficiency. It is sensible to examine where the legal basis for these wide-ranging interventions can be found and, in the case of deficiencies, make provision for the needs in an energy efficiency law. There are many such laws in place throughout the world and they have different forms. The following list contains the most frequently occurring topics.

- Recognizing energy efficiency as an appropriate subject of legislation and regulation
- Identifying and communicating in a policy document or national plan the principles of energy efficiency policy
- Identifying through technical analysis the potential for saving and prioritizing the sectors with highest potential
- Defining policy interventions to promote energy efficiency (e.g., fiscal and financial incentives, tradable certificates, and regulations)

- Drafting of legislation to implement policy interventions
- Setting penalties for default
- Creating institutional structures to promote energy efficiency
- Assigning staff in proper numbers and with proper qualifications to the institutions and ensuring adequate finance for the institutions
- Drafting national programs for short- and long-term management of energy efficiency
- Assigning responsibility to promote energy efficiency at national, regional and municipal levels
- Monitoring and evaluating progress

Some laws are comprehensive and control large parts of energy efficiency policy; others are framework laws that set out the principles and then elaborate specific issues through secondary legislation. The choice among these options should reflect a pragmatic balance of practical issues. Legislation takes time to prepare and to progress through the legislative process; this argues in favour of bundling issues. On the other hand, if different instruments are in a suitably advanced stage to implement then it may be more practical to proceed rather than to wait for others to be available. Moreover, energy efficiency is a dynamic process; as savings are made, so methods that are more aggressive will be needed and therefore the legislative portfolio will inevitably develop with time.

Study of the IEA database of energy efficiency measures in member countries give a good impression of the topics that have mainly required legal support (IEA, 2009). Education and outreach is an important part of energy efficiency, but it would not normally require significant legislation. Financial incentives are among the most frequent instruments of policy for energy efficiency. Little of this requires legislation dedicated to energy efficiency. Much of this again falls within the normal state budgetary processes. A dedicated fund for energy efficiency might require specific legislation, although in many countries it could be introduced through the budget.

Policy processes are an important part of implementing energy efficiency. It is by this process that market failures are detected, possible policy interventions are scrutinized and analyzed; their efficiency is estimated; choices are made; responsibilities are assigned; priorities are identified; targets are set and the public is sensitized. Policy processes could include the design of programs and plans, creation of long-term visions and the establishment of new institutions.

Energy efficiency can be enhanced by appropriate public investment. Insisting on efficient equipment in public procurement can be an effective manner of stimulating local manufacture of efficient equipment. This would probably require no more than an internal government decision. In some countries, it could be implemented through an inter-departmental voluntary agreement.

Research, development and demonstration can also stimulate local manufacture, especially funds for demonstration plants and maybe for testing centres. This would not require special legislation. Voluntary agreements are arrangements, normally between industry and government, to make specified savings. Of their nature, they need no legislative support. Indeed the industrial party normally cooperates in order to avoid legislation.

The areas that certainly require legislation are the imposition of obligations through regulation. These can include mandatory audits, mandatory designation of energy managers, reporting, mandatory labelling, standards (for equipment and buildings) and tradable certificates.

The case of Central and Eastern Europe (CEE) may be of some interest to developing countries. On accession to the EU, the CEE countries were obliged to prepare legislation of equivalent effect to existing EU Directives on energy efficiency. There was therefore strong activity across the region to produce single comprehensive laws that fulfilled all the requirements of the EU in energy efficiency. These laws were essentially framework laws that made provision for three elements: an energy efficiency agency, labelling and standards, and regulations for buildings. The details of the activities and specific regulations were mainly postponed to later regulations.

The Alliance to Save Energy made an interesting review of Energy Efficiency Laws in the CEE and in the New Independent States, (MUNEE, 2003). The same website contains copies of several of the laws from these countries. Local consultants were contracted to reply to questionnaires on the content and efficacy of legislation. They drew two main conclusions:

- The type of law does not matter. Some legislation is essential, but the review found no evidence that the structure of law had any detectable impact on a country's ability to improve energy efficiency.
- Enforcement and funding is critical. The main element determining the effectiveness of policy for energy efficiency is whether it is adequately funded and properly enforced. A basic legislative competence is necessary, but the determining element is the enforcement and funding.

These are important lessons. Legislation is needed, but enforcement and funding are critical.

Some developing countries have energy efficiency laws. Generally, these are framework laws that have been gradually developed in detail. Often they also include an agency to implement parts of the law. China is a good example of this approach. The principal legislation is the law on Energy Conservation of the People's Republic of China from 1997 (Peoples Republic of China, 2008). The law was amended in 2004. The Energy Conservation Law is a framework law that includes provisions for energy conservation management, rational energy utilization, technological

innovation, legal liabilities and some supplementary rules. The objectives are to improve energy efficiency and to protect the environment, to ensure economic and social development and to meet the needs of people's livelihood.

The law requires various organs of the Government of China to encourage energy efficiency and renewable energy. The state should formulate energy conservation policy, compile energy conservation plans and incorporate them into the economic and social development plans of the nation. It is also charged to develop policies and plans that ensure rational energy utilization, and coordinate those plans with environmental protection and economic growth, to stimulate and support technology R&D and scientific research in energy conservation, dissemination, information and awareness.

The law makes provision for cogeneration, labelling, standards, audits and demonstration programs, but there are almost no specific provisions. The formulation of specific regulations and activities is left to various departments of central and local governments. Implementation has been rather variable. Problems include:

- Variable enforcement across the country;
- Chronic underfunding;
- Contradictory broader policies (e.g. consumer price subsidies); and
- An absence of market based instruments (fiscal and financial incentives).

Thailand introduced an energy efficiency law at an early stage, in 1992. This law has some aspects of a framework law but includes, in some cases, a detailed regulation. It establishes a fund financed from a levy on fuel taxes and lays down detailed rules for the operation of this fund; it introduces the concept of designated facilities—facilities characterized by the types or quantities of energy use, or methods of energy utilization. These facilities are then subject to somewhat onerous obligations and reporting requirements. The effects have been generally positive. The provisions for promotion of energy-efficient equipment have underpinned the innovative labelling program lead by the utility, and the energy conservation fund has been broadly successful.

In the Philippines, the main law governing energy efficiency is the law establishing the Department of Energy in 1992. This law made provisions for an Energy Utilization Management Bureau with extensive and well-specified responsibilities. The impact has been limited. There have been some very good achievements in the Philippines, mainly of a technical character, but the implementation has been poor because of a lack of funds and a lack of real priority in enforcement.

We may conclude from this brief review that energy efficiency law is necessary for certain critical functions such as mandatory audits, mandatory designation of energy managers, reporting,

mandatory labelling, standards (for equipment and buildings), tradable certificates and the creation of an energy efficiency agency. A legal basis may be required for many other interventions, but it can often be found in normal budgetary processes.

Drafting an energy efficiency law is one thing; enforcing its provisions is quite another, and in this respect, performance in developing countries is often lamentable, bedevilled by the usual problems of weak administration and corruption. Enforcement is an area that could well benefit from technical assistance.

1.3.3.2 Energy saving funds and public service obligations

Public policy costs money and has to be funded. Some instruments are more costly than others. Anything that aims to stimulate investment is likely to be especially costly. Revenues for this can be allocated from the normal state budget or can in some manner be obtained from the energy user by a hypothecated tax. There are many variants on these themes. The most common option is an energy saving fund administered by a state agency. Another option is to lay an obligation on energy suppliers to undertake energy efficiency programs and to fund the expenditure from their revenues. Fundamentally, this arrangement means that the user pays through higher prices. The instruments that are used are not of interest for this discussion; they are reviewed later. Here we consider only the funding options.

Funds from central government budgets have historically been common sources for energy efficiency and are still widely used. The Energy Savings Trust in the UK and the Carbon Trust are mainly funded by direct budgetary transfers agreed upon annually. About $50 million is allocated to the Energy Savings Trust and $130 million for the Carbon Trust. The Danish Electricity Savings Trust was financed initially (for one year) by a direct government grant and thereafter by a levy on electricity consumption amounting to about $20 million.

In developing countries, one of the best-known funds is in Thailand; the Energy Conservation Act of 1992 established the fund and allocated an initial capital of $60 million (Kingdom of Thailand, 1992). The Act also attributed to the fund annual revenues of comparable magnitude from a supplementary tax on all petroleum products sold in the country. The fund is used to finance three programs. They are compulsory, voluntary and complementary. The compulsory program focuses on energy conservation in private factories and buildings as well as government buildings consuming more than 1 MW or a total consumption of more than 20 TJ/year energy use. These facilities must keep regular records of their energy consumption; set targets and plans for conservation; audit and analyze operations to achieve the targets and report to the Department of Energy Development and Promotion. New facilities are required to improve their design to be more energy efficient before construction. The voluntary program provides financial support to approved groups that would like

to invest in energy conserving equipment, introducing and disseminating information on renewable energy, producing renewable energy, applying renewable energy technology for efficient use, developing new technologies and/or improving old ones. The complementary program creates awareness and promotes energy conservation to the general public. Human resources development and training programs for government staff are also included. About 60 per cent of the expenditure goes to the compulsory program and about 20 per cent goes to each of the voluntary and complementary programs.

Assessment of progress towards the end of the 1990s indicated that, although there had been extensive achievements in auditing and reporting, implementation of projects was impeded by budgetary constraints following the 1997 economic crisis. Among new measures to cope with this was an Energy Efficiency Revolving Fund with an initial allocation of $50 million.

Funds for loans under the Energy Efficiency Revolving Fund are provided from the Energy Conservation (ENCON) Fund to the banks at a zero interest rate and then onlent to customers for investment in energy efficiency at a rate capped by government. The allocation from the ENCON Fund to the Energy Efficiency Revolving Fund must be repaid in 10 years. The responsibility for the administration of the Energy Efficiency Revolving Fund was outsourced to the banks and this is perceived to have expedited disbursement. The Act was revised in 2007 without major implication for the funding process (Kingdom of Thailand, 2007).

An independent evaluation of the Fund prepared for the Asia-Pacific Economic Cooperation (APEC) was broadly positive (APEC, 2005). It argued that the financing model was simple and straightforward and was attractive to government because the main risk is the possibility of project proponents defaulting on loans, and this risk is borne by the bank and the developer, not covered by government. It found that the loans had to leverage significant additional investment in the project from non-government sources.

Malaysia has adopted a different funding scheme. Revenues for the Electricity Supply Industry Trust Fund come from voluntary contributions from the power companies; they contribute 1 per cent of their total annual turnover. The Trust Fund is used for a variety of purposes, including energy efficiency projects.

If it is to be effective, a fund needs to be administered well. It is not desirable that a fund should become an addition to the budget of the ministry, but separation is difficult to achieve in developing countries where ministries are under-resourced and sometimes see the management of financial resources as an opportunity for patronage. It is important to ensure the widest possible expertise when administering subsidy resources and, in this, to engage expertise and creativity from the different interests in energy efficiency. It is also desirable that there be some independence from the

ministry in administering the funds if they are to be regarded by others as a genuine resource available to the most efficient implementing body. There are also often advantages in escaping the inflexibility of state budgetary regulations. On the other hand, it is essential that the Energy Savings Fund administers its resources within the national framework of energy policy. There should therefore be an adequate link between the governance of the fund and the political level.

For example, the Electricity Saving Trust in Denmark is governed by a board appointed by the Minister for Environment and Energy. The board brings in the desirable expertise and interests from supply companies, other commercial companies, consumers, municipalities and county authorities, as well as environmental and energy organizations. To ensure a link to the Council for Energy and Environment that is responsible for energy policy, two of the board's members are appointed from among the members of the council. There are also regulations within the decree establishing the fund to ensure that the subsidy resources are used in accordance with the priorities and goals of energy policy. Moreover, the board must draw up an annual program of action and the minister can further provide a framework for granting subsidies to ensure coherence with energy policy goals, including indicating the main areas that shall be given priority. Governance in the UK is somewhat similar; the Carbon and Energy Trusts are private companies governed by boards that assemble wide expertise. The link to the political level is achieved by relating the annual grant to a specified set of activities and monitoring performance.

Transferring this arm's length approach to developing countries can meet with opposition. In Thailand, the Energy Conservation Act and the Fund are administered by the National Energy Policy Committee chaired by the Prime Minister. The National Energy Policy Committee oversees the National ENCON Fund Committee; this committee has a sub-committee that administers the fund and evaluates the proposals. The different parts of the Fund— "voluntary," "complementary," and "other"—are controlled by different agencies; this led to some difficulties. The Department of Energy Development and Promotion under the Ministry of Science, Technology and Environment (now the Department of Alternative Energy Development and Efficiency under the Ministry of Energy) was nominated to enforce the mandatory activities; the Energy Policy and Planning Office is responsible for funding pilot activities R&D and public relations programs. Members of the sub-committee are appointed by their ministry or agency. Initially, the fund was not effectively linked to energy policy; recently its operations have been guided by a formal strategy. The link to the political level is strong, but management of the Fund is rather exclusive. Direct access to the fund is limited to government agencies; they put forward proposals for funding of their programs, then, in turn, fund programs for private sector, NGO or other government recipients. This is one of the reasons why the fund has been less successful in recent years.

In Malaysia, a special committee called the Electricity Supply Industries Trust Account Committee (JAAIBE) manages the trust account. The Committee comprises representatives from various

concerned ministries and the electricity sector. The Secretary General, Ministry of Energy, Water and Communications, chairs the Committee. A Technical Committee has also been set up to assist the JAAIBE in evaluating applications for funding from the trust account.

A somewhat different approach has been adopted in Brazil. In 1998, the Brazilian regulator (ANEEL) issued a resolution obliging utilities to invest a minimum of 1 per cent of their net annual revenues in energy efficiency programs and R&D. Programs had to be approved by the regulator and were implemented by the utilities. Originally funds had to be allocated 0.25 per cent to end-use efficiency, 0.65 per cent to supply-side efficiency and 0.10 per cent to energy R&D. From 1998 to 2000, only utilities were responsible for the formulation and implementation of programs and this was seen as a distortion that limited social impact. In 2000, Congress changed the allocation of the resources and created a national fund: CTEnerg. The 1 per cent obligation went 50 per cent to utilities and 50 per cent to the fund. Utility activity was restricted to energy efficiency. In 2004, the entire approach came under political challenge, but after debate, a new law was approved reallocating the funds 40 per cent each for CTEnerg and utilities and 20 per cent to a public Energy Planning Company (EPE).

The Brazilian process and its effectiveness have been documented and evaluated (Jannuzzi, 2005). This appraisal confirmed the success of the approach in securing funds for energy efficiency and R&D, but stressed the need for better governance both of the regulated utility programs and for the centrally managed public benefit fund. It also drew attention to the lack of coordination amongst the main actors, which has precluded a strategic view of the purpose of public policy in the area. This lack of coordination indicates the limitations of action in the absence of public energy policies in which energy efficiency has a clear role. The evaluation also found it uncomfortable that there was no adequate evaluation of accomplishments, given the substantial resources involved.

Since the liberalization of energy markets, there has been a tendency in industrialized countries to turn away from financial incentives and funds towards obligations placed on suppliers. A good example is the Energy Efficiency Commitment in the UK, which was intended to improve the energy efficiency of existing households. This scheme placed on suppliers of gas and electricity an obligation to demonstrate programs that save specified amounts of energy related to their total supply volume (OFGEM, 2008). All supply in the UK is competitive, so the supplier simply builds the costs into his cost-base and has the usual interest of a commercial company in keeping his cost-base as small as possible. The requirement is enforced by the regulator; failure to comply is penalized in proportion to the deficit between the target savings for the supplier and the amount achieved. Savings do not have to be made within the supplier's own area; they can be in fuel oil, coal or transport fuels. The scheme has since been replaced by the Carbon Emissions Reduction Target, which is a similar commitment for a reduction in carbon emissions generated by the domestic sector.

France has recently introduced a similar scheme complemented by "white certificates." In this arrangement, suppliers of gas, electricity, heat or cooling whose supplies exceed a specified threshold, as well as suppliers of domestic heating fuel, are obliged to demonstrate that they either accomplished energy savings directly or have bought certificates from others who can show they have made savings. Costs can be recovered from customers with regulated tariffs.

An obligation is, in a sense, a specialized fund. The source of funds is the higher price that the supplier must charge consumers in order to finance the activities and investments required to meet the obligation. The fund manager is the supplier. The advantages of this approach are that:

- It is performance based; the supplier has every incentive to meet his obligation at lowest cost, and so will choose the best performing options that he can detect, and
- It fits well into the structure and behaviour of a competitive energy sector.

An evaluation of the experience of white certificates in Europe addressed the question of their value in developing countries (Lees, 2007). It judged that trade in white certificates required financial infrastructure and knowledgeable and skilled market players that might be lacking, whereas the concept of Energy Efficiency Obligations could be more easily transferred. Both arrangements work best in competitive electricity markets and these are hard to find in developing countries.

We can conclude that funds are the most widely used option in developing countries for financing policies and are likely to remain so. Their main weakness is a tendency to restrict the governance and access to a small group. It is desirable that funds be open and accessible on a competitive basis. This avoids charges of distorting political influence, ensures cost-effectiveness, provides wide publicity and promotes the idea of energy efficiency. It introduces new and capable actors into the energy efficiency business with commercial sense. Achieving this improved governance, access and monitoring should be the priority of technical cooperation.

1.3.3.3 An energy agency

Regulation and promotion of energy efficiency is administratively demanding. Responsibility must be assigned to appropriate institutions to prepare initiatives, draft regulations, monitor progress, ensure compliance, administer funds and perform other administrative activities. Some of these activities can often be handled by existing institutions. If fiscal incentives are adopted then these will be managed through the office responsible for taxation, but there will still be a need to confirm the technical acceptability of the investment. Compliance with standards for equipment and boilers will normally be performed by special corps of inspectors already engaged in standards work. Despite the need to involve existing institutions, it is often considered useful to create a specialized agency.

This agency would normally have the following responsibilities:

- Developing and disseminating targeted information to specific categories of users;
- Organizing training, acting as a liaison with universities and professional bodies;
- Developing energy efficiency standards;
- Conducting surveys; analysis of data and maintenance of database;
- Conducting or managing programs of certification and labelling;
- Liaising with other state institutions (e.g. taxation offices and inspectorates);
- Administering energy-efficiency funds;
- Specifying mandatory audits; certifying and/or licensing energy auditors;
- Designing short-term and long-term energy efficiency programs;
- Monitoring, evaluating and reporting on the implementation state activities and private initiatives;
- Designing and proposing new interventions as opportunities are identified.

Legislation would probably be needed to establish such an agency and to specify its duties and powers and those of any other government institutions that might need enhanced powers. The energy agency needs to be assigned the funds and staff to properly conduct its work.

Ownership and governance of such an agency is subject to the usual debates of public-private pre-eminence, national preferences and shifting fashion, hard to distinguish from changed need. The Energy Technology Support Unit (ETSU) in the UK, for example, was set up in 1974 as an agency operated by the UK Atomic Energy Authority (UKAEA) on behalf of the Department of Energy. Its function was to manage renewable energy and energy conservation research programs. The majority of projects managed by ETSU were carried out by external organizations in academia and industry. In 1996, ETSU became part of AEA Technology plc, which was separated from the UKAEA by privatization. The Energy and Carbon Trusts were later established as private companies, to generate innovative ideas, but with political influence over the appointments of senior management. We see here a shift from public to private, arguably because, as the topic matured, public involvement in implementation became less necessary, but possibly because the UK fell in love with the private sector.

In France, the energy agency has remained firmly in the public domain, but the history is equally revealing. Effort in the area started with the creation of the Agence pour les Économies d'Énergie (AEE), shortly after the Yom Kippur War. The AEE made strong efforts to promote efficiency and ran into difficulties with Electricité de France (EDF), the powerful state utility that was promoting electric heating. AEE lost the struggle and was quickly transformed into a less aggressive agency, with a less ambitious title—the Agence Française pour la Maîtrise de l'Énergie (AFME), which was

subsequently merged with ANRED (responsible for the environment) to become the Agence de l'Environnement et de la Maîtrise de l'Énergie (ADEME). Regardless of shifts in emphasis, implementation has remained firmly in the hands of government.

Practice in Denmark and the Netherlands is somewhat similar. The Danish Energy Agency was established in 1976 as an agency under a ministry, presently the Ministry of Climate and Energy; SenterNovem is an agency of the Dutch Ministry of Economic Affairs responsible for promoting sustainable development and innovation. In Finland, the Energy Audit Programme is administered by the ministry, but run by a state-owned company. In Japan, the Ministry of Energy, Trade and Industry is responsible for administration of energy efficiency programs, but to help in implementation, including the accreditation of energy managers and the dissemination of information, the government established the Energy Conservation Centre of Japan, funded by subsidies from the state budget, membership fees from industry and examination fees. A somewhat similar model has been adopted in Korea; the Korea Energy Management Corporation (KEMCO) is a government agency responsible for the implementation of energy conservation policies. It was established in 1980 by the Ministry of Commerce, Industry and Energy under the Rational Energy Utilization Act to implement policy. We have therefore a range of models in the industrialized world, of which the most common is an agency largely controlled by government, but with greater (France) or less (Japan, Korea) discretion in the formulation of ideas and instruments.

Developing countries have normally kept the implementation of energy efficiency regulations close to the ministry and have been reluctant to outsource. Implementation of the Energy Conservation Promotion Act (1992) in Thailand was assigned to the Department of Energy Development and Promotion (DEDP), now the Department of Alternative Energy Development and Efficiency (DEDE) under the Ministry of Energy. Initially, there were too few staff and insufficient management capabilities to do the job; consequently, the principal problem in the implementation of the law was the slow rate of approvals. DEDP attempted to accelerate the process by hiring external consultants to scrutinize applications and reports submitted by enterprises. This was unsuccessful, because such advisers were not accredited to act and approve on behalf of a government agency, so their work had to pass again through DEDP and the process actually slowed down. The procedure was then modified to incorporate accredited consultants with international experience to act on behalf of DEDP and scrutinize the various documents and proposals from the designated facilities in scrutiny. From the experience in Thailand we can learn that the implementation of a large program of detailed regulation of industry makes extreme demands upon the bureaucracy and that Thailand had severe difficulties in coping at the outset. There is also an immense demand for training that must be provided. Eventually, it was found necessary to contract out verification work to accredited consultants linked by Internet to DEDP. It is also possible that Thailand could have focused its regulatory effort more precisely and could have chosen specific firms more at risk of

non-compliance on which to concentrate. This idea is developed later in the section on future priorities for technical assistance.

Brazil offers an interesting case study of a developing country without a specialist energy agency. The energy efficiency program has been carefully documented (Jannuzzi, 2008); the funding mechanism of the program was described earlier (Jannuzzi, 2005). Funds are raised from a wire charge and a part is allocated to the utilities to spend on energy efficiency and part to a public fund, CTEnerg. Experience has been that the public fund spends most of its revenues on energy R&D and that utility programs have been disappointing. The disincentive to the utilities of lost revenues from energy efficiency prevents them from genuine compliance and control by the electricity regulator is too weak to overcome this problem. The lesson is that if implementation is to be performed through the utilities, then a rigorous regulation of compliance is needed.

The recent IEA Energy Policy Review of Indonesia contains a detailed analysis of the institutional structure for energy efficiency and contains some conclusions that have a more general application (IEA, 2008a). In Indonesia, there is no energy agency and not even a separate department within government that is responsible. The Ministry of Industry has the lead for energy efficiency policy and coordination, but it is executed through the Department of Electricity. Significant responsibilities for energy efficiency are distributed across two coordinating agencies, six ministries, multiple directorates in the ministries and four implementing agencies. Lacking a true focus for policy and implementation, the state's effort is dispersed and the powers and duties of different elements are obscured. Dispersed technical cooperation can add to the problem. Support of different agencies by different donors can enhance rivalry and sustain the efforts of individual agencies to seek the dominant role.

A good example of uncoordinated support is Vietnam, where the World Bank has focused its energy efficiency programs on the regulator, the Asian Development Bank has developed links with the Ministry of Industry and the UN has primarily dealt with the Ministry of Science, Technology and the Environment. Rivalry among government agencies is occasionally matched by that among donors.

We can conclude that the establishment of a regulatory focus for energy efficiency is essential to achieve clarity in execution. Responsibilities for implementation should also be clear and untrammelled by conflicting incentives. An energy efficiency agency can help in this. Ideally, it should be at least separate from government to escape the most restrictive constraints on recruitment and financial control. Finding adequately trained staff and organizing proper regulatory compliance will generally need attention, and technical cooperation can be valuable in this respect.

1.3.4 *Labelling*

Labelling, along with standards, is a policy measure introduced to overcome the market failure caused by asymmetric information. Potential users of equipment, faced with a choice of designs, may not have the skills and information to understand the consequences of their choice. They may be tempted to choose low-cost equipment with high energy consumption over higher price options that perform better. Manufacturers may not have an incentive to provide this information if they think that their comparative market advantages do not include greater efficiency than competitors.

Labelling and standards are means to prevent this. Under a labelling regime, manufacturers are obliged to describe the energy performance of their products according to some defined criterion, such as energy use or energy cost. This provides the consumer with the information needed to make an informed choice. Standards oblige manufacturers to meet certain criteria of minimum performance. In some cases, the goods that meet the standard are marked as such and inferior goods are allowed to remain on the market; in other cases, goods that do not meet the criteria are banned from the market. Labelling and standards are not exclusive; goods can be obliged to meet a certain minimum standards and then labelled according to their performance when it exceeds the standard.

Labelling and standards both require testing facilities and protocols; both require rigorous and competent enforcement. They are very often discussed together. They are separated in this paper, because the higher taxonomic principle used here is between compensating and correcting measures. Labels are measures that correct for deficiencies in information; standards compensate for the distortion. Both topics are promoted by a non-profit organization known as CLASP, established in 1999; their Web site contains an immense amount of information about both topics (CLASP, 2008).

Labelling of energy use was introduced in France in 1976 and now there are many programs throughout the industrialized world. The Energy Star program in the U. S. is well known. In the EU, labelling is implemented through a series of energy labelling directives governed by a Framework Directive; the labels run from G to A, with A being the best. The EU was particularly concerned to ensure that varying requirements across countries did not develop into barriers to trade. This is a concern that persists in relation to developing countries. Labelling is now entirely accepted and valued by consumers and is perceived to have contributed to accelerating improved performance of appliances and to have opened the way for new product development and market transformation. There may be no products in the A category at first, if it is judged technically possible to attain that level in the near future. For example, when labels were introduced for clothes dryers, the thresholds could only be met by using a heat pump, and there were no such products. Since the adoption of the clothes dryers labelling directive (95/13/EC – an application directive under the Framework Directive), heat pump dryers have been introduced and receive the "A" grade. The EU is now proposing to revise the Energy Label Directive to extend the scope to products that do not use energy, but have an impact on energy efficiency, such as tires (European Commission, 2008b).

The concept has spread far; at least 61 countries—representing 80 per cent of the world's population—use energy performance standards or labels for at least one product (Waide and Bernasconi-Osterwalder, 2008). Curiously, Iran, not known as a leader in energy efficiency, adopted the EU label, as a mirror image and with Persian script, on a voluntary basis. Labelling applies to refrigerators/freezers, evaporative coolers, centrifugal pumps and washing machines. Manufacturers can use the accreditation in their advertising. The program is administered by the Standards and Industrial Research Organization of Iran that assesses compliance by tests based on random selection.

In 1999, China launched a voluntary labelling scheme similar to Energy Star. A mandatory scheme was introduced in March 2005 for rating of the energy consumption level on a scale of one to five; it was initially for two products and was extended in 2007 to cover refrigerators, washing machines and air conditioners. The scheme runs parallel with a complementary scheme of minimum standards to remove/forbid products with low efficiency. It is implemented by China National Institute of Standards (CNIS) and compliance is based on self-declaration, registration and post market surveillance by local authorities. This monitoring is very weak; such monitoring as does take place gives priority to health and safety. China has also established the necessary infrastructure for testing the performance of appliances through three national testing laboratories accredited by the government's Certification and Accreditation Administration, and about 50 local testing laboratories. The responsibilities of the various government agencies are defined in the Standardization Law and accompanying regulations, which also specify penalties for non-compliance.

Thailand instituted a voluntary labelling scheme for refrigerators in 1994. It was unusual in that it was implemented by the electricity generating authority (EGAT). There followed air-conditioners in 1995, ballasts in 1998 and compact fluorescent lamps and electric fans in 2001. The requirements for refrigerators were raised by 20 per cent that year also. The labels for refrigerators and air-conditioners were rescaled again in 2006. The labels rank the products on a scale of one to five, where five is the best. The label also shows consumers the average energy consumption in kWh/year. Experience has shown that manufacturers and distributors choose not to label their products if they achieve a poor rating. There are no products in the market that carry labels of one or two; this is a consequence of a voluntary scheme. The label is awarded after testing a single unit from a sample of 30 units of the same model sent to the Thailand Industrial Standards Institute (TISI) laboratory.

The case of Egypt illustrates some of the obstacles that lie in the path of low-income developing countries in implementing labelling schemes and the role of technical assistance in overcoming these difficulties. There are three difficult stages in the process: the first is in defining the standards or criteria for labels; the second is providing testing facilities and elaborating the testing protocols; the third is ensuring compliance, which also requires access to testing facilities. In 1998, the GEF and

the UN Development Program (UNDP) provided $5.9 million to Egypt through the Energy Efficiency Improvement and Greenhouse Gas Reduction (EEIGGR) project to improve energy efficiency, including the elaboration of a labelling program. The EEIGGR successfully developed the energy efficiency criteria for room air conditioners and refrigerators. This is not a trivial step, because it is not sufficient to take criteria from other countries; the EEIGRR had to determine what models of appliances were most popular in Egypt, what improvements were feasible in Egyptian circumstances and to persuade manufacturers that they could practically comply. The Ministry of Industry, responsible for standards setting in Egypt then issued a regulatory decree to enforce the program (Government of Egypt, 2002). Enforcement in practice was prevented by the absence of a testing laboratory for appliances. A World Bank study assessed the viability of labels, among many other energy efficiency options, and recommended the development of appropriate facilities. The government of Egypt agreed to pay to upgrade existing facilities at the New and Renewable Energy Authority and the UNDP agreed to provide a further grant to provide training and supplementary equipment for enforcement (UNDP, 2004). The case illustrates how sustained and well-articulated technical cooperation with different bodies can drive the process forward.

Labelling appears, on the face of things, to be an effective low-cost measure. This is certainly true for industrialized countries. Current standards and labelling schemes within the OECD are credited with reducing total energy bills across the affected broad end-user sectors, for example, the residential sector, by between 10 and 20 per cent (Waide and Bernasconi-Osterwalder, 2008).

Labelling also acts as a non-tariff barrier to trade, although this is probably not a main motivation for its introduction. Transparency and notification of standards and other measures are essential to assist developing countries to comply with new standards and to retain or gain market access. International competition may be part of the rationale for the strong Chinese effort in this field. In Thailand, this was certainly not a motivation; the main intent was to reduce peak demand for electricity and save investment in generating plants, which is why EGAT is the implementer. In Egypt, an important driver has been a persistent pressure from bilateral and multilateral donors.

The obstacles are proportionally greater in developing than developed countries. The negotiation of agreement on specifications and legislation, the investment and training required for testing and the organization and verification of compliance are big challenges. To ensure compliance with voluntary labelling may be more difficult than with mandatory labelling, since there is no law to enforce.

Regional centres and regional agreements on procedures and protocols and shared testing centres would reduce costs and be a big advantage. Generally, countries resist this kind of sharing, and it is a goal that technical cooperation programs may be better placed to promote than are national governments.

Labelling specifications need to be updated regularly, otherwise there is no requirement for manufacturers to go beyond the requirements of the regulations; in theory, the label can become a hindrance to progress. Standards are updated regularly in developed countries, but more of a problem in developing countries where all resources, including consensus building and legislative time, are scarce.

1.3.5 Financial incentives

1.3.5.1 Overview

A recent review and evaluation of financial incentives by the World Energy Council distinguishes between economic and fiscal incentives (WEC, 2008b). Economic incentives are aimed at encouraging investment in energy-efficient equipment and processes by reducing the investment cost directly, and fiscal incentives are those actions that reduce the cost indirectly through the taxation system. Economic incentives can be further divided into investment subsidies and concessional finance. Investment subsidies change the perceived cost of an investment and concessional finance changes the financing conditions.

Fiscal incentives differ from other financial incentives in several ways. They do not need to be funded directly; they are funded indirectly in that they represent a loss of revenue to the state budget. Generally, they are available to all who qualify according to the terms of the exemption; there is no application and award process. For this reason, they are preferred by some as being less susceptible to corruption and to political manipulation. They can be managed through the normal tax compliance regime. Other financial instruments normally need to be funded explicitly.

Financial incentives are not without both theoretical and practical problems. On a theoretical level, the main problems are:

- They are difficult to align on performance;
- The incentives are hard to allocate effectively; and
- They discriminate against people excluded from the scheme.

Financial incentives generally serve only to lower the capital cost of an investment; their application is not affected by the subsequent operation of the investment. They are not therefore performance-based. For example, a company may take out a low interest loan for a heat exchanger. The heat exchanger may not be a cost-effective investment, but the investor receives the loan nevertheless. In a performance-based scheme, the investor would be rewarded directly for the performance of the investment, which is poor and therefore would receive no support. The advantage of performance-

based incentives is that they provide a stronger incentive to the investor to make sure that the investment is sound.

The ideal outcome of a financial incentive is to allocate funds to marginal projects, not to finance projects that would happen anyway without incentives and not to finance projects that should not happen at all. In the 1970s, France introduced a scheme of low interest loans. The designers of the scheme wanted to avoid the problem described here and devised a screening method that rejected projects with too high a rate of return and also projects with too low a rate of return. The problem was then to administer this scheme, because the analysis became very complicated and was easily susceptible to manipulation by the applicant.

Financial incentives can be inequitable. The UK introduced grants to condensing boilers for homes. Only relatively well off households could afford a condensing boiler and central heating so this scheme was essentially a subsidy to the rich. There are also schemes to provide insulation in poor households and these certainly benefit the households to whom they apply, but these also discriminate against poor people who cannot access the incentive.

From a practical point of view the difficulties with financial incentives are:

- They need considerable administrative capacity to assign, to monitor and to verify compliance;
- They need to be monitored and evaluated for effectiveness because their impact may be different from what was expected; and
- They are not effective for all classes of consumers.

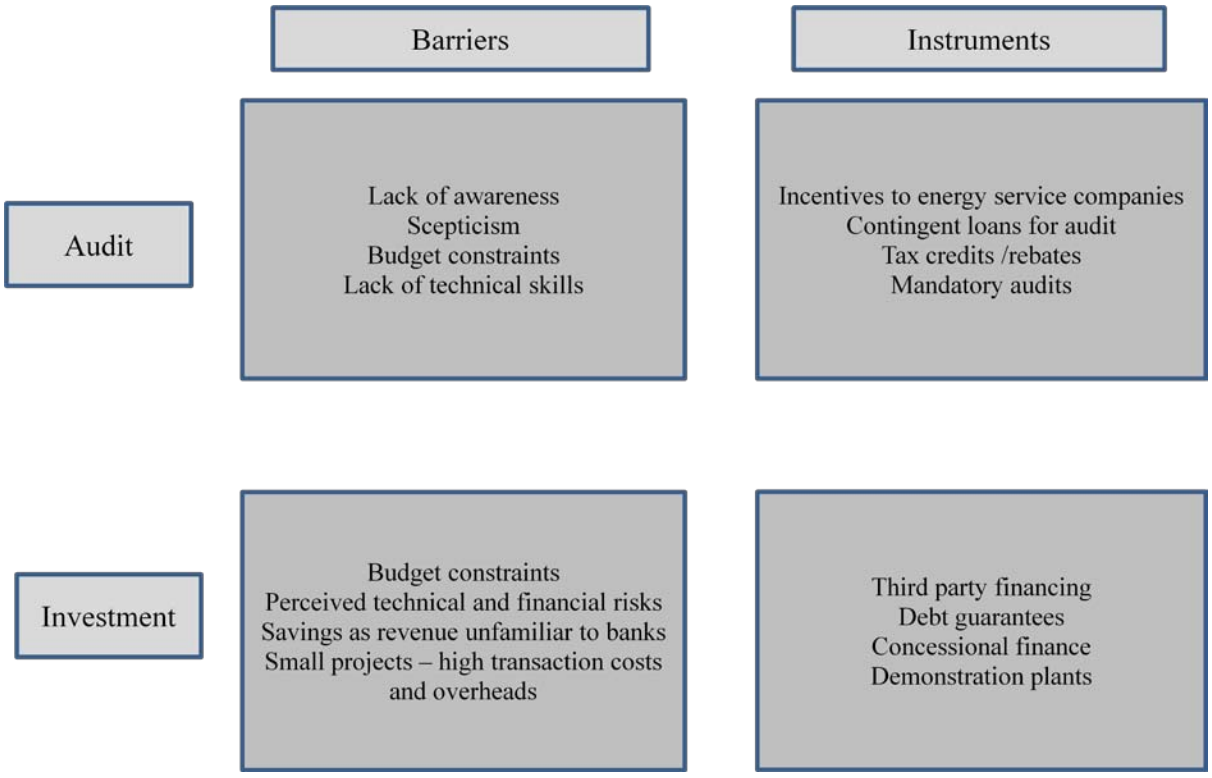
1.3.5.2 Financial incentives and the investment cycle

The successful development of energy efficiency projects is a continuum from the initial audit, through the project identification, feasibility study, planning and design, construction and operation and finally, evaluation. Figure 2 shows how this relationship might be conceptualized for the major steps of project identification and investment. Ideally, public programs of financial incentives should be coordinated to provide support through the cycle. The subsequent sections of this paper examine the experience of these instruments.

There are several useful accounts of experience of financing energy efficiency projects, on which this review draws. A detailed description of experience with public financing instruments throughout the investment cycle was provided by the Basel Agency for Sustainable Energy on behalf of UNEP Sustainable Energy Finance Initiative (BASE, 2006). The UN Environment Programme has published an analysis of risk implications in renewable energy projects that is also applicable to

energy efficiency (UNEP, 2006). The *World Bank GEF Energy Efficiency Portfolio Review and Practitioners' Handbook* is also interesting because GEF has funded much work in energy auditing, energy service companies and revolving funds across the world (World Bank, 2004).

Figure 2: Public finance instruments in the investment cycle



1.3.5.3 Grants for audits

Industry and commerce are generally unwilling to undertake audits without some stimulus from government. If companies thought the activity sound then they then they would already have done it, so the need for intervention to stimulate practice is generally agreed. The main choice is whether to impose a mandatory obligation by law, or to encourage activity by creating financial incentives. In OECD countries, in the main, financial incentives were initially adopted. Generally these schemes have passed out of energy policy in developed countries and been replaced by mandatory obligations of various forms. Generally, in developing countries, the mandatory option has been adopted from the beginning. This may be related to the higher availability of public finance in developed countries, the broader vision of industry and the dangers of corruption with grant systems. Policies of mandatory audits are discussed elsewhere.

Grants continue to be used for early stage investigations in some countries for municipalities. An example is the Green Municipal Fund (GMF) in Canada operated through the Federation of Canadian Municipalities (FCM). The GMF provides loans and grants to build capacity and support municipal governments and their partners in developing sustainable communities. The Government of Canada endowed FCM with CAD 550 million to establish GMF to provide a long-term, sustainable source of financing. The scope includes feasibility studies and field tests for the pre-feasibility and feasibility stages of projects (FCM, 2009).

The Global Environment Facility (GEF) has made extensive use of grants to initiate auditing practice in its programs. A good example is Egypt (EEIGGR, 2006), where the GEF project included 200 audits for government buildings, commercial and industrial establishments between 1999 and 2003. Following this, the project established eight energy service companies to provide advice in energy efficiency and financing and capacity building has been provided through training on energy auditing and other activities. Another published example is Malaysia (UNDP, 2006).

Generally, auditing has been a mainstay of many GEF projects in energy efficiency. The doubts that linger concern the quality and sustainability of the work. UNDP projects are locally implemented, with minimum use of international consultants. This has some advantages, but it tends also to reduce the quality of outputs, and maybe make them less convincing in the eyes of the companies concerned. There has certainly never been any comprehensive consolidated report on the impact of these auditing programs, and that is unfortunate.

World Bank GEF Energy Efficiency Portfolio Review and Practitioners' Handbook asserts, (World Bank, 2004d):

> Where possible, audit support should be partial and a portion withheld until the customer agrees to implement the project. With all such options, the appropriate intervention must be determined based on an in-depth analysis of country and market conditions, critical transaction barriers, current ESCO practices and availability of resources. A revolving energy audit fund could be very helpful in addressing the project development costs impediment for EE projects.

This scheme has apparently been applied in Bulgaria (World Bank, 2004d), but there appears to be no record of the outcome. The problem with this approach, which is attractive to governments, is that it does not much mitigate the risk perceived by industry.

1.3.5.4 Grants to investment

Subsidies to appropriate investment by consumers of energy are the most obvious of instruments to promote energy efficiency and were an important part of policy in the 1970s and early 1980s in industrialized countries. The number and design of grant schemes is limited only by the human imagination. Grants are best used to promote the early stages of market transformation and should be withdrawn as the market develops. A good example from the UK is the provision of grants to promote the sale of condensing boilers to residential consumers in the early stages of market penetration; these were withdrawn as the market developed. Now such boilers are required by regulation; current building regulations require all new boilers to be condensing if it reasonable to do so (Office of the Deputy Prime Minister, 2006). This is a good example of grants used to promote the early stages of market transformation.

In temperate climates, space heating is a very large energy use, relatively easily controlled by insulation. Many early programs were aimed at that market. In the United Kingdom, the government provided grants to improve the energy efficiency of residential building for many years. Analysis shows that the program was cost-effective even after accounting for free riders, changing energy prices and the extent to which efficiency improvements were used up as people simply turned up their thermostats (getting more heat for the same cost, rather than the same heat at less cost). The loft insulation grant program saved households £2.55 billion cumulatively during 1978–96, while costing the government and participants £1.23 billion (Shorrock, 1999). Grants are also commonly used in the UK to address fuel poverty. People with low incomes and the aged can access a variety of grants for insulation and heating improvements. In recent years, these programs have been delivered mainly by fuel suppliers as a part of the supplier obligation discussed in a later section. Other examples of successful grant schemes in industrialized countries have been described by the IEA (Geller & Attali, 2005).

The World Energy Council has recently published a review of policies for energy efficiency around the world including developing countries (WEC, 2008b). It found that subsidy schemes have been widely used in OECD countries, but less frequently outside the developed world. Two thirds of surveyed OECD countries have experimented with subsidy schemes, against one fourth of the countries for the other regions. Industry is the main sector receiving subsidies (about 30 per cent of all countries, 50 per cent in Europe), followed by households (about 25 per cent of all countries, 50 per cent in Europe).

Attitudes towards the effectiveness of grant schemes vary. One recent study claims that, "in general, the efficiency of grants programs in IEA countries was rather high [and] that the volume of the saved payments for energy resources during the full service life of this equipment was 3.5–5 times higher than the state investments" (Sustainable Energy Development Center, 2007, p. 10). Such analysis is incomplete; it does not address the full range of issues that need to be considered in

assessing the efficiency of a policy instrument. It does not start from a valid baseline; there is no consideration of what would have happened without the policy instrument and whether the policy instrument was necessary to induce the observed behaviour. Nor does such analysis assess the impact of "free riders"—consumers who would have carried out the investments even without the incentive

The WEC took a more sceptical view and concluded from their evaluation of grant schemes that they had several disadvantages. Free riders were a significant problem. The consumers for whom the schemes were intended were those who faced information and budgetary barriers. But in most cases, this group did not take advantage of the financial incentives, because they were unaware of their existence. The consumers who benefited were those that were aware and may well have invested anyway. This finding demonstrates the need to combine subsidy schemes with good dissemination of information.

On the administrative side, the WEC found that procedures for grants applications were often so bureaucratic that they deterred active investors. Industrial concerns in particular find bureaucracy and delay irksome. Subsidy schemes generally involve filling in long, cumbersome forms and entail long administrative delays. For industry, such costs and uncertainties often exceed the value of the grant, especially in smaller industries without dedicated energy staff.

The disadvantages can be reduced by more accurate targeting of subsidies. In most developed countries, the award of grants in the residential sector is now generally restricted to low-income households. They may also be restricted to certain types of investment, for example investments with high capital cost and long lead times, such as cogeneration. They may also be used to advantage in trying to create markets for new technologies or in association with other instruments such as labelling.

An interesting variant of grant schemes is the so-called feebate concept, developed in the 1990s. This is a system of government imposed surcharges (fees) and refunds (rebates) that are used to shift market purchasing preferences toward an economically, socially or politically desired goal. The idea has been applied quite frequently in transportation. For example, California's proposed "Clean Car Discount" program imposes a fee of up to $2,500 on new, high carbon-emitting vehicles and then rebates the fee to buyers of new low emission vehicles. The Rocky Mountain Institute in the United States has done considerable work on this concept (Rocky Mountain Institute, 2008).

1.3.5.5 Concessional finance

Grants have little impact if the consumer cannot find the remainder of the necessary funds. Concessional finance or soft loans may be more appropriate in such circumstances and of more

general appeal. Soft loans are loans that are made available to selected borrowers on more favourable conditions than those that the borrower would be able to obtain on the commercial capital market. Improved conditions may be low interest rates and/or interest-free grace periods that normally last until the project begins to generate revenues from the energy savings and the borrower can make payments. Concessional finance is most suitable in markets where there is no banking sector activity in the energy efficiency sector and where bank liquidity is poor. Many national governments have experimented with loan programs in circumstances where the local banking sector is not active. Soft loans have been used especially frequently for smaller residential and commercial borrowers.

There are many such examples in developed countries. The Canadian Green Municipal Investment Fund was described earlier (FCM, 2009). There is a similar initiative for municipalities in Scotland. In this scheme, the loan has to be repaid within the payback period of the investment, which varies from application to application. This is intended to ensure that funding the investment does not cause perceptible changes in the normal cash flow of the municipality and to limit the subsidy in a fair manner. It is an idea that has merit. Concessional loans are also applicable to residential consumers. In 2006, the French Government created a €10 billion fund to provide low-interest loans to domestic energy conservation projects. The measure is complementary to a tax-credit scheme introduced in 2005. So investments in domestic energy efficient equipment are entitled at the same time to a price reduction (through a tax credit scheme) and a low-interest loan (IEA, 2009). In Germany, the Climate Protection Programme for Existing Buildings was launched in January 2001 to provide financial support to the modernization of existing buildings to improve energy efficiency and reduce CO_2 emissions. Between 2001 and 2005, about 95,000 reduced interest rate loans worth €5 billion were approved. The program was evaluated favourably and in 2006, was extended by €1 billion per year until 2011 (IEA, 2009).

Soft loans may be especially applicable in developing countries because the first cost of an investment to an individual is a higher proportion of income than in developed countries. Loans are normally available on the commercial market to credit-worthy individuals and to provide an incentive the interest rate on concessional finance must be reduced below the commercial rate. The provision of a zero- or low-interest loan to cover the entire investment cost may be a more effective marketing strategy than offering a fraction of the incremental cost in the form of grants. It is also likely to be less expensive for the state. The direct cost to the state of an interest-free loan is the present value of the opportunity of the principal less the repayments the loan. Because the implicit discount rate of the consumer is probably greater than that of the state, the opportunity cost of the soft loan is likely to be less than the opportunity cost of the grants needed to produce an equivalent effect.

Concessional finance has been employed extensively in Eastern Europe under schemes financed by the EU, the EBRD and the European Investment Bank (EIB). These were often constructed under the PHARE cooperation program leading up to accession. A good example is the Hungarian Energy Efficiency Co-Financing Scheme. This is a joint scheme with the EU PHARE program that proceeds through a revolving fund, operating in the first instance to 2008. It is sponsored by the EU and the Ministry of Economic Affairs and managed by the National Bank. It is aimed at municipalities and businesses and the objective is to make loans available at low interest rates to energy users for investments in energy efficiency. The interest rate applied to the loan is calculated by averaging the cost of the PHARE grant with that of other available sources of funds, which includes EBRD and EIB. At least 10 per cent own contribution is necessary, (Hopper, *et al.*, 2005).

The Bulgarian Energy Efficiency and Renewable Energy Credit Line (BEERECL) takes an alternative shape. This credit line permits loans, technical assistance and grant support to energy efficiency and small renewable energy projects in industry. The facility is financed with €50 million from the EBRD, which is blended with a €10 million grant facility from the Kozloduy International Decommissioning Support Fund (KIDSF); it has been extended twice (EBRD, 2008). Private sector banks then on-lend the funds in amounts of €50,000 to €2 million, adding a fee for their services. Recipients can also get support for the principal of the loan, up to 7.5 per cent for energy efficiency. By 2006, 46 projects had been financed with loans worth more than €27 million and with a total project value of over €48.4 million. The same institutions provide concessional finance for households through a credit line of €50 million to Bulgarian Banks for on-lending for improvements in energy efficiency in residential properties. The attraction to banks is twofold: they benefit from an administration fee and they perceive a marketing benefit through access to companies who may not otherwise be their clients (BEERECL, 2009).

Soft loans have been used effectively in Thailand to accompany new initiatives. For example, they were used in conjunction with the introduction of ESCO programs. During the first phase of project implementation, the electricity utility EGAT provided loans to customers without interest, and therefore, the customers needed to repay the principal of the loan only. The state, through the Demand Side Management Office, made interest-free loans available to finance industrial energy conservation investments that used the performance contracting process. Private ESCOs entered into an agreement with customers to provide a turn-key operation of energy efficiency investment and a guarantee for energy savings performance of installed equipment. Customers paid back the cost of the investment over a pre-determined period. The DSM program in Thailand has also either directly financed or arranged for interest-free loans for energy efficient products, for example in the Green Building Programme and for Cool Storage Systems.

By 2005 the program had 66 projects approved and under construction with an average size of $0.8 million and an average payback period of 2.4 years. They covered co-generation, improved boiler

efficiency, biogas generation, improved chillers, control systems, lighting and fuel switching. The annual savings from the program were more than 18 GWh and 1.2 million litres of fuel oil per year. Each dollar of lending resulted in more than $10 of lifetime energy cost savings and every dollar lent from the fund leveraged approximately 60 cents in commercial bank lending. Six private banks participated and others have requested to become involved in the program because of the improved banking image and fee income (APEC, 2005).

The WEC also covered concessional finance in its review (WEC, 2008b). The survey showed that soft loans were less common than grants. About 36 per cent of all surveyed countries had such schemes (compared to slightly more than 41 per cent for grants). About 60 per cent of soft loan schemes were in Europe and 75 per cent in OECD. In non-OECD, industry is the main recipient of soft loans. The conclusion drawn by the WEC from its analysis was that soft loans have been less effective for industry than for residential consumers. Industry has access to finance on commercial terms; the advantages of concessional terms for loans rarely offset the problems of dealing with government, the conditionality, the delays and the uncertainties.

1.3.5.6 Loan guarantees

Because the risks of macroeconomic and financial stability are perceived to be higher in developing than developed countries, it is prudent for banks in developing countries to keep a high percentage of deposits in liquid assets. Central banks may also impose higher reserve requirements for this reason. Contracts in developing countries may also be difficult to enforce and problematic, leading banks to demand high levels of collateral. High levels of government borrowing may drive up interest rates and crowd out the private sector. Banks may have difficulty in assessing credit-worthiness of prospective borrowers because of deficient financial statements and financial records and an absence of credit bureaus. Bankers in developing countries may lack experience lending to the private sector; when banks were privatized recently or remain state-owned they may not have adequate skills of appraising credit-worthiness, project performance and risk. All these factors tend to restrict lending and borrowing.

Loan guarantees are an instrument of public policy that can alleviate these difficulties. A loan guarantee is a legally binding agreement under which the guarantor agrees to pay part or the entire amount due on a loan instrument in the event of non-payment by the borrower. Most multilateral development banks and bilateral development agencies have introduced partial loan guarantees as a mechanism to stimulate the involvement of private banks in loans for energy efficiency with the hope that it will initiate sustainable markets in this area. The partial loan guarantees made available under technical assistance are intended to reduce market-entry risks for lenders and encourage them into new sectors and to service new classes of borrowers. In the course of the technical assistance, the banks develop new skills and build appropriate internal procedures for assessing loans; this

creates the basis for spontaneous replication thereafter with national governmental supplying the guarantees. Eventually, the credit market should develop without guarantees or with commercial guarantees. Commercial loan guarantee programs charge fees to the lenders to cover administrative charges and the risks of default.

All financial interventions should aim to correct market failures and not to create new distortions. Partial loan guarantees should satisfy the following criteria, which are easier to specify than to meet:

- a market failure exists that means credit-worthy parties cannot borrow;
- the loan is "additional" and would not have been made without guarantee;
- moral hazard is minimized (i.e. the lender and borrower will continue to act prudently).

An example from a developed country is the loan guarantee scheme adopted in France in November 2000; it is a co-operative effort between the French development bank for SMEs (BDPME) and the French Agency for Environment and Energy Management (ADEME) with a funding of €17.8 million. This budget can guarantee up to €244 million in loans to the private sector and is restricted to SMEs more than three years old with less than €50 million turnover and less than 500 employees. Eligible investments include: high performance production, use, recovery and energy storage equipment; energy efficient modifications of production processes and renewables. The guarantee covers medium- and long-term risks over two to 15 years (IEA, 2009).

Loan guarantees are a central plank of the US Energy Policy Act of 2005, (US Department of Energy, 2005), that authorizes the U.S. Department of Energy to issue loan guarantees to eligible projects that "avoid, reduce, or sequester air pollutants or anthropogenic emissions of greenhouse gases" and "employ new or significantly improved technologies as compared to technologies in service in the United States at the time the guarantee is issued." In 2008, Congress authorized $38.5 billion in loan guarantee authority for innovative energy projects (US Department of Energy, 2009b).

There is considerable experience of loan guarantees for energy efficiency in Eastern Europe. The Hungarian Energy Efficiency Co-Financing Scheme, mentioned earlier, developed its activities along this path using $5.7 million of GEF funds pooled with a $12 million contribution from the World Bank's International Finance Corporation (IFC) (BEST, 2005). This movement from concessional finance to loan guarantees is quite rational and could be a plausible route for all developing countries.

IFC has built on this experience in Hungary and, in cooperation with the GEF, has extended the program to other countries of Eastern Europe. It has $18 million of GEF funds and bilateral donor support of $1.3 million, and has made available IFC funds of $30–75 million. It is now operating in

Estonia, Latvia, Lithuania, Slovakia and the Czech Republic. Schemes typically offer partial guarantees to local financial institutions along with some technical assistance to support project developers in developing bankable energy efficiency projects (IFC, 2005).

A good example of a loan guarantee fund in a developing country is the FIDE (Fideicomiso para el Ahorro de Energía Eléctrica); this is a trust created in 1990 by the Government of Mexico to promote rational electric energy use and energy saving. FIDE provides low- and zero-interest loans for domestic, commercial, industrial and municipal energy efficiency projects. It also operates a guarantee fund capitalized by FIDE ($440,000) and NAFIN, a Mexican development bank (approx $4.4 million). The objective is to increase the participation of the commercial banking sector in providing debt and other financing for energy efficiency. The guarantee program is operated by a commercial banking partner, BANORTE. The guarantee covers 75 per cent of the loan; the partner bank assumes the financing of the loan and the remaining risk of 25 per cent of the total debt granted. It appears that take-up of the concessional finance is more enthusiastic than the loan guarantees, which is predictable. It might make more sense to offer the facilities in series rather than in parallel.

Utilities can be useful agents in marketing schemes to customers and in providing technical advice. This capacity was been put to use in the IFC loan guarantee scheme in China. In May 2006, the IFC signed an agreement to provide the Chinese Industrial Bank with risk-sharing coverage; the intent was partly to help the Industrial Bank to establish a loan portfolio of energy efficiency equipment loans to small and mid-size energy users. The risk coverage was provided under IFC's China Utility-Based Energy Efficiency Finance Programme (CHUEE). Funds were also provided by the GEF and the Ministry of Trade and Industry in Finland. The IFC took a "first loss" position, guaranteeing private banks that they will not lose more than 25 per cent of their loans. The usual subsidiary objective was to familiarize Chinese bankers with the concept of funding energy efficiency investment in the expectation that sustainable programs would result and encourage China to self-finance its vast energy efficiency requirements. Consequently, the IFC program includes training for financial institutions in the principles and methods of risk-based lending. Apparently, the program was so successful that within six months of gaining Chinese government approval to provide guarantees with foreign currency, it had developed an energy efficiency pipeline of projects worth a total of over $650 million and the program was expanded with new funds, (Chandler & Gwin, 2008)

An evaluation of financing energy efficiency in several large developing countries carried out for the World Bank adds a cautionary note (Taylor, *et al.*, 2008). It found that loan guarantees are mainly useful where the banking system functions fairly well and the fundamental conditions that would allow energy efficiency lending to succeed are already in place. This judgment is extremely plausible, because if the information dissemination, basic technical competence for auditing, project selection and design are not in place then investment is anyway not possible. In the case of many developing

countries, it might be advisable to confine any loan guarantee scheme in the first instance to specific activities and small sums. After the basic technical capacity has been created, a more general loan guarantee scheme might be introduced.

1.3.5.7 Fiscal incentives

Fiscal incentives indirectly reduce the cost of an investment by intervention in the taxation system to reduce the tax paid by consumers who invest in energy efficiency. Popular fiscal instruments are accelerated depreciation (relevant to business activities in industry and commerce), tax credits and tax deductions (households). Reduction or exemption of VAT on energy efficiency investments or equipment is also practiced. In countries with high fiscal barriers to the import of technology, it is also common to reduce import duties on energy-efficient equipment.

Fiscal instruments have the same problems of targeting as most other financial incentives. Tax deductions are, for obvious reasons, most attractive to those who pay most tax. Fiscal incentives in Germany for double glazing became known as "the dentists' scheme" because dentists in Germany are perceived to be rich, pay high rates of tax and therefore borrowed from the scheme. To what extent this promoted investment that would not otherwise have occurred is unclear. From an equity perspective it was not an effective program.

Tax credits and rebates operate a little like energy taxes in that they change the relationship between the cost of energy and the cost of capital, but whereas taxes send a broad negative signal, tax credits and rebates allow government to choose which technologies it will support. The tax laws must then define precisely which investments or activities qualify and which do not. Tax credits are generally considered fairer than tax deductions. A deduction reduces the amount of income subject to tax; a tax credit directly reduces the tax itself. Tax credits are therefore worth the same to high and low tax payers. For example, since 1992, wind generators in the U.S. have been able to claim an income tax credit for each kilowatt hour of electricity they sell. The Energy Policy Act of 2005 (US Department of Energy, 2005) in the U.S. introduced a wide range of tax credits covering home improvements, cars, solar energy systems, fuel-cells, tax credits for home builders and tax credits for appliance manufacturers. Businesses that improve energy use in their buildings can claim a tax deduction per square foot; manufacturers of energy-efficient refrigerators, dishwashers and clothes washers can claim an income tax credit per machine produced during 2006 and 2007. Many of these incentives have limited life spans, targeting the transitional time for the new technology, avoiding long-term market distortions and reducing the long-term fiscal impact.

Accelerated depreciation is another way of providing incentives through the fiscal system. In France, some such schemes are equivalent to a subsidy of two to five percent, depending on the useful life of the installation. It is confined to businesses and most useful for large budget long-life

investments, because the impact of accelerated depreciation on the project appraisal is greater in these cases. Tax concessions have been provided in some countries for companies that make concrete commitments to energy efficiency and that meet their target, for example, Denmark and the UK. This approach does not seem to have been used in the developing world.

1.3.5.8 Selection of financial instruments

Important, but neglected, is the question as to how developing countries should select among the range of financial incentives open to them. By extension, this is also an important question for developed countries seeking to determine how best to encourage developing countries to contribute to international regimes of climate protection. The question is not easy; choice depends on the particular circumstances of each country and its institutional structure and behavioural peculiarities. In recent years, tools have been developed to help in this process. The most common is Regulatory Impact Analysis (RIA), of which several forms exist. RIA is a policy tool designed to identify and quantify, where possible, the impact of new regulations. It can also be used in the review of existing regulations. Best practice models of RIA often include the following:

- Alternative forms of intervention need to be reviewed and short-listed. There must always be a base-case against which alternatives are screened. Alternatives should include all available instruments, singly and in combination.
- For all the alternative forms of regulation that are retained for detailed study, all the relevant potential impacts need to be identified and where possible, quantified.
- The impacts and success of regulations depend on the behaviour of the regulated subjects. It is inefficient for government to try to second-guess what these might be and it is far more effective to consult with affected parties. As well as providing information on the acceptability of a proposal, consultation can be a vital support for evidence-based decision-making.
- Quantitative analysis of impacts is essential. The analytical method most commonly used is economic cost-benefit analysis.

Examples of the systematic implementation of this approach can be found in World Bank studies in Egypt and Iran (World Bank, 2004b) and Lucas, Wooders, & Cupit (2003). A definitive, generic study that narrowed down the options for developing countries might be developed within the Kyoto framework and would be a useful tool for taking the dialogue between developed and developing countries forward.

1.3.5.9 Conclusion

We can draw a few tentative conclusions from the preceding discussion:

- Permanent and comprehensive improvements in the capacity of developing countries to implement efficient processes, manufacture efficient products and adopt efficient practices will eventually require that the private sector underwrites these activities with its own capital. Public policy can only identify market distortions and barriers and seek to remedy them by judicious intervention.
- Financial institutions must perceive a benefit if they are to provide the money. Intervention in capital markets by public policy to facilitate lending for efficient practice is necessary, but should be targeted and temporary. Financial incentives should be temporary means to stimulate new behaviour, not permanent corrections to the market.
- Financial incentives for energy efficiency suffer from several defects. They are rarely economically efficient, but they draw the attention of energy users to the importance that government gives to the issue of energy efficiency; they induce some actors to perform in line with the intended policy goals and the actions of those actors can in turn influence others.
- Fiscal measures are unlikely to be the most effective measures in developing countries because of weak tax regimes. Loan guarantees work best where the basics are already in place. Grants and concessional finance are probably the easiest and most effective measures in lower-income countries and should progress to loan guarantees as circumstances permit.

1.3.6 Energy Service Companies

The original idea of Energy Service Companies (ESCOs) was that an entity other than the energy supplier should identify, design, finance, supervise and commission projects for a client, to be compensated by a share of the energy savings achieved over a defined period. The partition of savings was to be determined by a special contract known as an energy performance contract (EPC). Actual practice varies widely; some ESCOs will finance the project, others will organize finance. Implementation is not always easy and there are relatively few successful examples. The title ESCO is sometimes given to companies that just provide consulting services, but do not enter into an EPC. It is important to be clear what is meant.

The logic for ESCOs is that there are many profitable investments in energy efficiency that are not undertaken by energy users because they have not the technical knowledge or the finance—or both—to do so. The ESCO, with technical capacity and with access to its own or to third-party finance, intervenes and guarantees, fully or partially, the success of the project. The model does, however, bring with it its own problems. It greatly increases the transaction costs, because the

ESCO must negotiate with the company and quite possibly with the energy supplier. An important obstacle to any intervention in an industrial process is the fear of production staff that changes in the operating conditions will affect product quality; for most companies this is a much bigger concern than energy saving. If the investment is in the hands of a third party, the fears of the production staff will be enhanced. After all this is accounted for, the benefit, net of the additional costs, shared between both parties must be enough to provide an adequate risk-compensated reward to both parties. If the ESCO does not bring with it finance, then a part of the logic is destroyed, because the company must still borrow on its own account, although the guarantee of the ESCO, if it is a substantial enough company, may lower the bank's perception of risk.

ESCOs are not strictly a policy instrument; they are simply a business model. There is generally no legal barrier to a company establishing itself as an ESCO, but it is true that the business model is novel and in most countries it needs support from state initiatives of some sort. The ESCO business model has been successful and still is successful in North America. It is the experience there that underlies most of the attempts to transfer ESCO practice to developing countries and it is important to analyze.

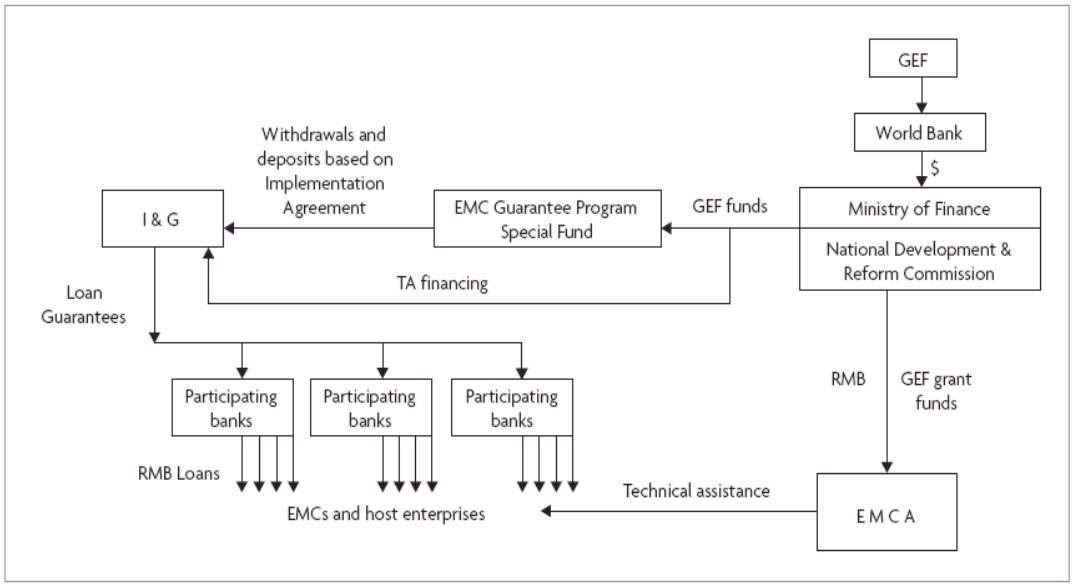
The U.S. ESCO industry received an important stimulus in the late 1970s from the Federal Institutional Conservation Program to promote energy efficiency improvements in state and local schools and hospitals (Hopper, *et al.*, 2005). The program was administered by state energy offices using federal grants for both technical assistance and capital investment. The financial conditions required equal funding from non-federal sources and this included payment from performance contracting with private partners. The Canadian ESCO model was also built mainly on the market from public buildings.

Public buildings have many advantages for ESCOs. Energy efficiency is not a high priority for the owners and occupiers and they have little technical capacity so there is little inclination to do such projects in-house. They are credit-worthy customers, eventually backed by the state, but they are not comfortable borrowing, so the performance contracting model is attractive. Projects in this market can easily be replicated because of the great similarity among the facilities of different clients. This lowers costs or increases profits, depending on circumstances. The Lawrence Berkeley National Laboratory surveyed 46 ESCOs in the U. S. and estimated that revenues were about $3.6 billion in 2006, of which energy efficiency accounted for about three quarters (Hopper, *et al.*, 2007). An important lesson for developing countries is that the best market is in retrofits to large buildings owned by institutional clients. Projects must be large to offset the transaction costs of putting together a performance contract. Small projects may be viable if they are aggregated.

International financial institutions have put much effort into trying to disseminate ESCO ideas in developing countries. The World Bank has provided an excellent (and fulsome) review of its

activities (Taylor, *et al.*, 2008). Following the success of a pilot program, in 2003 the World Bank/GEF introduced a loan guarantee scheme to help ESCOs in China to get commercial loans from local banks and to scale up operations. GEF contributed $22 million to an account of the Ministry of Finance. A guarantee program was operated by China National Investment and Guarantee Company. The flow of funds is shown in Figure 3 (Taylor, *et al.*, 2008). Note that EMCA refers to the Chinese Energy Management Company Association, which is a trade association of ESCOs, and RMB refers to renmimbi.

Figure 3: Flow of funds in an ESCO in China



The Bank estimates that there were more than 60 ESCOs operating in China at the end of 2006, with total annual investments guaranteed by energy performance contracts of about $280 million. The full service ESCO model in China covers the complete range of services:

- It performs an audit and identifies projects;
- It agrees with the client to an expected energy saving from the identified project and agrees how the financial benefit will be split according to the nature of the project and the financial conditions;
- It finances the project, possibly with the assistance of repayment guarantees by the client;
- It completes project procurement and equipment installation;
- It commissions, tests, trains, and maintains the equipment according to a maintenance agreement.

The EPCs are relatively short, over one to three years, but during that time the ESCO takes a large share of the estimated profit. Contract revision and reassessment of savings during the contract is apparently rare.

India got off to an early start developing ESCOs and had completed a large project by 1995, described in a report for ADEME and the World Energy Council, (Ürge-Vorsatz, *et al.*, 2007). The client was Bhoruka Steel Limited, in Bangalore, and the ESCO was INTESCO-Bhoruka Limited, a joint venture between a large US ESCO called INTESCO (International Energy Services Company) and the Bhoruka Power Corporation Ltd. The financing came from the Industrial Development Bank of India (IDBI). Bhoruka Steel was required by IDBI to guarantee the loan over the seven-year period of the contract and to undergo a credit review. The financing came as a conditional loan from IDBI's Innovative Funding of Scheme for Energy Savings (INFUSE) Programme, to be repaid out of the energy savings from the project and secured by the fixed assets acquired under the scheme. Of the estimated savings, the lender (IDBI) got 60 per cent, Bhoruka Steel, the customer, 20 per cent and INTESCO-Bhoruka (the ESCO) the remaining 20 per cent. As the useful life of the equipment is 20 years and the contract term only seven years, the customer achieved long-term energy and cost savings from the project. This was not a genuinely arm's length transaction as the two companies are closely related, but it was seen as a way of testing both the INFUSE Programme and the ESCO concept.

Despite this early success, the ESCO business has not taken off in India. There are about 20 ESCOs that employ some type of energy performance contracting business model, but most are small. The reason for the big difference between India and China may lie in the very different profile of industry in the two countries. India has many small and medium enterprises (SMEs), about 3 million, which account for 60 per cent of the country's GDP. The attitudes of such businesses are quite different from the large businesses in China and this may influence their perception of risk.

The concept of ESCOs received much attention in Brazil in the late 1990s, but there are today few ESCOs in the strict sense. The term is often used to describe companies providing energy consulting services on a fee basis. Most of the companies are small, with less than 10 employees, and do not have the financial capability to finance or guarantee projects. After the privatization of electric utilities, it was expected that utilities would establish ESCOs and develop projects for their customers as a means of complying with energy efficiency investment requirements mandated by ANEEL, the national electric power regulatory agency. Jannuzzi (2008) has evaluated the consequences. Utilities are obliged to include in their price a levy (which has varied from time to time, but which was most recently set in the 2007 law at 0.50 per cent), to be spent on energy efficiency of which at least 50 per cent must be spent on energy efficiency measures targeted at low-income households. In an environment where it is difficult for small companies to obtain medium-term credit from the banking system, this did promote some energy consulting services on a fee

basis, but not genuine ESCO contracts and it did not enhance capabilities for commercial bank financing, indeed it is inimical to such progress. There are logical flaws in using utilities as agents in this way. Under any rational pricing system, utilities enjoy a margin on their sales, and therefore if they are successful in saving energy, they reduce their profits. The other problem is that, because they have a source of funding from the levy, it does nothing to stimulate commercial funding, which in the long run is the correct route.

From this brief discussion we can conclude that, with some exceptions, ESCOs have been successful mainly in industrialized countries. Determinant factors include the size and openness of the banking system, the financial, technical and business experience of staff engaged in ESCOs, and access to appropriate subjects, especially large institutions and offices.

A comprehensive survey of ESCO activity across Europe detected many barriers (Bertoldi, Boza-Kiss, & Rezessy, 2007). These included:

- low awareness and lack of information about the ESCO concept;
- lack of trust and scepticism on the clients' side;
- high perceived risk;
- non-supportive procurement rules and public sector budgetary practice;
- lack of and limited understanding of established measurement and verification protocols for assuring performance;
- administrative hurdles and high transaction costs limiting willingness to participate;
- principal-agent problems in rented buildings and the public sector;
- aversion to outsource energy management tasks and allowing a third-party access to vital functions; and
- problems with the availability of financing.

These would be no lesser obstacles in developing countries.

1.3.7 Standards

1.3.7.1 Appliances

Standards are a step beyond labels because they seek not only to correct a market failure, but to compensate for it. They may also be a later stage in the management of appliance markets after consumers and manufacturers have become used to this type of intervention. There are two main ways of setting standards for appliances and equipment. The first way is to define minimum energy performance standards (MEPS) for different classes of products (e.g. refrigerators of a certain size and design), so that every unit within a certain class has to meet or exceed that standard; the

manufacturer is free to choose whatever design approach felt appropriate. Compliance can be verified by checking units at random. The second way is to set an average performance for the entire range of a manufacturer's output; compliance is more difficult because it involves aggregating across classes of product and requires more market information and more extensive testing. The first of these two approaches is more common. The EU has adopted some class agreements, but no such measures have been adopted in developing countries.

There has been relatively little post hoc evaluation of labels and MEPS. A main difficulty is that programs operate and have their effect over a long period and it becomes hard to speculate what would have happened if the standards had not been introduced. There has been a careful and detailed examination of the programs in Australia and the UK that recognizes the methodological problems, but after a series of approximations and assumptions concludes that both programs have been effective and efficient. In the case of the UK, the study assessed energy savings of more than 2 TWh/year in 2006, and likely savings of 3.5 TWh/year by 2010. In Australia, estimated savings rose from 20 GWh/year in 1986 to over 750 GWh/year. In both cases, the programs were highly cost-effective (Lane, Harrington & Ryan, 2009).

It is likely that performance in developing countries would be less, given the weaker enforcement. The general conclusion that standards work and are cost-effective probably still holds, but some clear evidence to that effect would be helpful.

There is scope for improved technical cooperation in strengthening compliance. Without good compliance, consumer confidence in the integrity of these programs is damaged. Lack of enforcement also harms manufacturers that have invested to improve the energy efficiency of the products that they supply and encourages them to avoid the regulation also. Nothing is more pernicious to regulation than the perception that other people are not observing the rules. Enforcement is often weak in developing countries and it should be a priority for enhanced cooperation.

There is also considerable scope for a generally better international cooperation on energy performance standards (ECEEE, 2008). It would be helpful to have an international alignment of testing procedures and protocols, comparable definitions and common approaches to establishing specifications. This would support developing countries and reduce the chances of creating non-tariff trade barriers.

1.3.7.2 Buildings

Buildings are an important special case because:

- The rate of new building in developing countries is far higher than anywhere else in the world;
- Buildings are large consumers of energy;
- Buildings last for decades and will determine energy use for a very long time;
- Large improvements in the energy efficiency of buildings can be achieved at low cost;
- Developers will not normally make those improvements because of various chronic market failures; and
- The principal-agent dilemma is especially acute

Buildings account for 40 per cent of primary energy in most countries and consumption is rising. The International Energy Agency (IEA, 2006) estimates that current trends in energy demand for buildings will stimulate about half of energy supply investments to 2030. The case for public policy intervention is strong.

The Asia Business Council (2007) has thoroughly analyzed building regulations and practice in Asian countries including China, India, Indonesia, Japan, Hong Kong, Malaysia, Philippines, Taiwan, Thailand and Singapore. This analysis is a valuable resource that provides an accurate diagnosis of the failings of energy efficiency programs in these countries; it clearly locates the problems in the poor enforcement of regulations and indicates how enforcement can be improved. It argues cogently for integrated policy where building regulations, labels and standards for appliances in buildings can complement financial incentives.

The view of this group is especially compelling because it comes from institutions based in developing countries that put their money into developing countries and it takes a "warts and all" approach. Its review of performance concludes that the main problem is enforcement. Unlike domestic appliances, buildings are custom-built, unique objects, requiring independently verified compliance that is based in reliable computer modelling. The easiest way to enforce energy standards is to incorporate them into the general building standards that govern all aspects of building construction, but even in countries where general building standards are enforced, enforcement of energy standards can be lax. While all eleven economies covered in the study have building energy standards on paper, most have failed to produce significant energy savings. The Chinese government itself has estimated half of new buildings do not comply with official energy standards.

The study contains a useful review of the factors that make for effective policy intervention. Table 2 is based on those findings.

Table 2: Policy instruments for energy efficiency in buildings

Policy instrument	Characteristics of effective programs	Leading examples
Minimum energy performance standards	Mandatory Financial feasible for majority of the market Harmonized with international standards Industry involved in development Legal framework clearly defined; compliance infrastructure in place; appropriate levels and numbers of staff Testing procedures and protocols established and facilities available Regulatory certainty through regular revision Awareness raising Government procurement Supported by R&D and support to local manufacture	Appliances: Japan and South Korea Buildings: Singapore. Japan, Taiwan, South Korea
Labelling	Mandatory Clarity of labelling Industry involved in development Legal framework clearly defined; compliance infrastructure in place; appropriate levels and numbers of staff Testing procedures and protocols established and facilities available Awareness raising Government procurement Financial incentives	Appliances: South Korea and Thailand Buildings: Singapore. Japan, Hong Kong, South Korea
Financial incentives	Incentives are performance-related Designed to complement standards and labelling programs Differentiated by target sector Accompanied by awareness raising High goals and modest incentives: 25–50 per cent of incremental price Simple to understand and to administer Accurate reporting and monitoring Compliance recognised by labels or ratings	South Korea, Thailand, Singapore. Japan, Taiwan

This analysis is useful and interesting. It confirms that an effective standards enforcement system requires several elements, including:

- Development of compliance manuals, forms and compliance software;
- An institutional framework with well-defined authority, responsibility and well-trained officials;
- An appropriate combination of incentive and penalty mechanisms;

- Effective monitoring and verification systems;
- Effective education and information distribution systems;
- Demonstration projects that show the cost and effect of energy-efficiency measures.

A comparable, but less detailed, study by the World Business Council on Sustainable Development covering more of the world came to similar conclusions regarding the need to integrate standards, financial incentives and effective enforcement and that, for this to happen, many different professions and interests must work coherently together (WBCSD, 2007).

1.3.8 Mandatory measures

An alternative to cajoling industry with incentives is to oblige it to undertake energy efficiency by mandatory measures. These can be multiple and include obligations:

- To carry out audits at regular intervals (for enterprises exceeding a defined threshold of energy consumption);
- To report to a central government database and possibly to communicate audit results to the public;
- To report energy consumption, saving measures and implemented measures;
- To propose action plans to implement the energy savings measures identified in audits;
- To carry out certain specified measures;
- To appoint an energy manager;
- Mandatory certification of auditors;
- Mandatory comparison to reference values (norms, benchmarking).

Some, or all, of these requirements may be confined to large users and made conditional on crossing a defined threshold of energy use.

There are advantages to mandatory energy audits. It is not necessary to convince participants of the value of measures; consequently programs can be implemented quickly. The disadvantages are that consumers tend to resent and resist mandatory instruments and comply formally but without intent to go further. Mandatory measures are not common within OECD countries; Japan and Australia are exceptions. Generally mandatory measures are more frequent in Asia and Eastern Europe than elsewhere. The WEC suggested that this may be explained by hierarchical cultures where regulation is accepted more easily (WEC, 2008b). In Asia, most energy laws derive more or less closely from the Japanese law. The basic law was drafted in 1979 and has been revised nine times. The latest version from 2005 is a very full and complex piece of legislation, with immensely interventionist

provisions (Government of Japan, 1979). It has inspired energy efficiency law across a large part of the region, except in the Philippines, which has a particular history.

The WEC (2008b) conducted a comparison of the requirements of mandatory audits over nine, mainly developing, countries that is summarized in Table 3.

Table 3: Mandatory measures in selected countries

Country	Scope	Threshold	Frequency	Mandatory Action Plan	Mandatory Energy Manager	Sanctions	Central database
Algeria	industry, transport, tertiary	2000 toe* 500 toe 1000 toe	5 yrs	√	√	√	√
Tunisia	industry, transport, tertiary/ residential	1000 toe 500 toe 500 toe	5 yrs	√			√
Bulgaria	industry, tertiary/ residential	3000 TWh 1000 m3	5 yrs	√		√	√
Romania	industry, tertiary	1000 toe	Various by sector		√	√	
Czech Republic	industry, tertiary	35 TJ	Once		√	√	√
Australia	industry, transport, tertiary	0.5 PJ	5 yrs			√	√
India	industry, transport, tertiary	30,000 toe or 5 MW	3 yrs	√	√	√	√
Taiwan	industry,	Various by fuel	1 yr	√	√	√	√
Thailand	industry, tertiary	20 MJ or 1 MW	3 yrs	√	√	√	√

** toe = tonnes of oil equivalent*

Table 3 reveals a variety of approaches that are characterized by different objectives and different choices of instruments. In Australia, the aim is to change business practices; in the other countries the intent is to move national industries towards efficient practice by imposing mandatory standards for industrial processes according to international best practice. Alternatively, industries can be benchmarked by product, comparing the specific energy consumption of a sector or with international best practice. All these efforts face serious methodological problems.

Most countries do not evaluate these programs, but those that do claim benefits. In Bulgaria, a sample of audits showed energy consumption savings of 30 per cent; the program is expected to save 50 ktoe/year by 2010; and 134 ktoe/year by 2016. In Australia, monitoring of case studies shows a typical saving of five per cent consumption, but also a "culture change" in management.

The common element to all these programs is the audit. It is indeed fundamental, because without an adequate description of how energy is used, no progress can be made. Frequency of audit varies among countries from the one-off audit in the Czech Republic to the annual audits in Taiwan. Penalties are applied in all countries except Tunisia and all countries require a mandatory energy manager, except Australia, Tunisia and Bulgaria. Every five years seems to be a common interval for auditing. It is common to hold a central database of audits and often this is done by a government agency, such as the Bureau of Energy Efficiency in India. The main concern in most cases is the lack of qualified personnel to analyze the information collected. This is a salutary reminder that governments should only collect data that they need and can use.

The fact that audits may be mandatory does not prevent them also being subsidized. Subsidies should be to encourage early adoption, so for example the subsidy program could be pre-announced to be 50 per cent in the first year, 30 per cent in the second year, 15 per cent in the third year and then zero. This should encourage firms to go quickly for audits, stimulating the market for service providers.

Audits do not in themselves save energy. They must be associated with other instruments. Sometimes these other instruments are mandatory, so in the limit industry is told to meet certain benchmarks and to find the resources itself. In other case the complementary action may be through incentives. This otherwise valuable scope to "pick and mix" instruments means that it is hard to compare the value of energy efficiency policies in different countries.

We also note that mandatory measures imply or depend upon the existence of considerable technical and administrative skills. For example there need to be the skilled people to make the audits and the people in industry to make sense of them. Compliance needs to be monitored and this is demanding in administrative and technical terms. Donors have frequently offered staff training and training

materials, but the effort needs to be sustained and coupled with real-life active programs into which these skills fit.

1.3.9 Voluntary agreements

An alternative, or sometimes a supplement, to regulation is the agreement with industry of voluntary undertakings to cooperate in energy efficient practices. Voluntary agreements between government and industry are attractive in some contexts because they allow industry a more flexible response than that which can be achieved by regulation and they avoid the kind of adversarial relationship implied by regulation. Two main types of agreements have been introduced. The first type comprises agreements between government and representative bodies of appliance manufacturers to reach specified improvements in the performance of appliances; the approach has also been extended to vehicles. The second type comprises agreements with individual process industries to improve their own on-site energy performance. Although voluntary, we include them within the group of "Compensating Measures" because they create binding obligations.

Industry can have various motivations to participate in these agreements. Appliance manufacturers may expect to persuade government to supplement their efforts with instruments aimed at stimulating purchases by consumers. It may in some instances be a mechanism to forestall regulation. This latter reason may also encourage participation in agreements to reduce energy use in industrial processes. Such agreements, although voluntary, may also be a condition for financial incentives.

Voluntary agreements were negotiated in many industrial countries in the 1990s and expanded and strengthened in subsequent years. The EU made a series of agreements with the European Committee of Domestic Equipment Manufacturers (CECED) to reduce energy use covering 90 per cent of the market for washing machines, refrigerators and freezers, dishwashers and water storage heaters. These were generally perceived to have been progressive and proactive and to have stimulated substantial investment by European manufacturers over the ten years that they were in place. The concept was put in question when CECED decided not to renew in 2007, on the grounds that enforcement of the EU's energy labelling scheme had been inconsistent and had undermined the industry's willingness to go to another phase of voluntary measures (CECED, 2007). The industry was also concerned that non-CECED importers had gained a growing share of the market. The combined consequence was that the cooperating industries felt that they were being squeezed out by "free-riders."

CECED pronounced itself in favour of new binding energy efficiency standards and not the voluntary agreements introduced a decade ago. For developing countries assessing the merits of voluntary and compulsory schemes, this is not encouraging. Enforcement is generally weak in

developing countries and the fact that the main industries feel voluntary schemes are not working must give rise for concern. CECED also argue in favour of financial incentives to replace old and inefficient appliances untouched by standards, voluntary or otherwise, but that is another, albeit important, issue.

There are no such voluntary agreements with appliance manufacturers in place in developing countries. In some countries labelling is voluntary, but that is not the same as a voluntary commitment to achieve specified targets for improved performance.

Voluntary agreements are a main element of policy in Europe for improving energy efficiency on industrial sites. A good example is Denmark. The main motivation for the enterprise is that a company entering an agreement obtains a rebate on its CO_2 tax. Approximately 330 Danish companies have entered into an agreement with the Danish Energy Authority, representing more than 50 per cent of the total energy consumption in industry. An evaluation of the program by the government showed that the objectives of the agreement were being met (Ericsson, 2006). Two kinds of agreements are permitted. The most common and simplest is an agreement between a single company and the state. It is also possible for a group of companies to sign a group agreement; this happens if a group of companies with similar processes feel that it is easier to negotiate as a group rather than singly. Each company must sign the agreement. Each agreement includes energy management, special investigations and investments in energy efficiency. The special investigations focus on specific areas of their primary production processes and aim to determine the possibilities of fundamentally improving the energy efficiency of the process. The company must submit reports on its compliance. All aspects of an agreement must be verified by accredited institutions. In case of non-compliance, the agreement is rescinded and the company becomes subject to full taxation, but this is rare.

The Netherlands has introduced Long-Term Agreements (LTAs) on energy use, a policy instrument for industrial energy conservation and industrial CO_2 emission reduction. Again, the program is supported by several additional policy measures, like subsidy schemes, tax reduction and information services. The executive responsibility is delegated to the Dutch energy agency (Vermeeren, 2008).

In developing countries, the dealings with industry are mainly of a mandatory character as described in the section on mandatory measures. There are a few exceptions. One is a pilot project to test the viability of voluntary agreements in China through a trial in two iron and steel companies in Shandong Province (Price, Worrell, & Sinton, 2003). There does not seem to have been a widespread adoption of the idea since.

A review of experience with voluntary instruments, not only in energy but across the environmental spectrum, adopted an equivocal position. It stressed the difficulties of constructing a baseline against

which to evaluate performance and drew attention to serious deficiencies in some programs and a failure to reach targets. It provided a considerable list of programs where evaluators had failed to show clear benefits. On the other hand, it concluded that the main failures were in design and implementation rather than in concept (Paton, 2002).

1.3.10 Transport and spatial planning

More than half of the global population now live in cities, and according to UN Habitat (2008), by 2030, it will be 60 per cent. Urban growth is most rapid in the developing world, where cities gain an average of 5 million residents every month. Cities consume enormous amounts of energy and they have great inertia; road systems and land use decided now will influence energy use for a hundred years. Cities form to exploit increasing returns to scale inherent in important activities such as transport and trading and in labour markets. In its extreme and simplest terms, the economies of scale in labour markets imply that all jobs should be easily accessible from all residences. Empirical evidence suggests that dominantly monocentric cities with well-defined central districts reduce journey times and therefore total volumes of pollution and greenhouse gas emissions. Over time, large cities tend to become less monocentric, journey times increase and the efficiency of public transport declines. Private transport becomes more attractive and this, combined with longer journeys, causes the use of energy use to rise. Dense monocentric cities have high land prices that restrict the size of homes and reduce land consumption and energy use. As the city increases in size, land prices may fall, houses get bigger and energy use increases.

In urban metropolitan areas, transport creates at least a third of total greenhouse gas (GHG) emissions. Promotion of public transport options is critical for reducing emissions in cities. Several cities have adopted policies for this purpose, including some in developing countries. A much-publicized example is the Eco-City of Dongtan in Shanghai, conceived to demonstrate the idea of an "eco-city." Dongtan was presented at the United Nations World Urban Forum by China as the first of four such cities to be designed and built in China. The cities are to produce zero GHG emissions and completely self-sufficient in water and energy (World Bank, 2008a). Dongtan city is planned for the island of Chongming, off the coast of Shanghai, to which it should be linked by bridge and tunnel with a high-speed rail link planned. The city is conceived to comprise low-energy buildings, making use of passive solar concepts and serviced by wind, solar and biofuel energy; waste is to be recycled and composted. The spatial organization of the city is compact, with mixed patterns of land use. Pedestrian and cycle routes are provided to reduce the demand for cars. The population should reach 25,000 by 2010 and around 80,000 after 2020. In reality, it appears that the site is still untouched and that planning permission given to the Shanghai Industrial Investment Corporation has lapsed (Moore, 2008).

Even if successful, these experiments are limited. The inertia of existing city infrastructure is immense and possibly definitive. There is an absence of human resources for the huge design and reconstruction effort that would be required to change existing cities and an absence of a real scientific basis for the design principles. Adequate green-field sites do not exist in much of the world and certainly not where present economic structures require mass labour markets.

Massive renewal of existing cities would be complex, difficult and contentious. The more appropriate approach is to rethink the planning, starting from an analysis of the relationship between spatial configuration and energy use (Theys, 2008). Transport use per capita in different cities can vary from one to 100. Cities in the U.S. are the least efficient with per capita consumption four to six times higher than in Europe. Asian cities achieve levels roughly half of Europe. The evidence suggests that the geographical distribution of economic functions is more important than simple spatial density. The conclusions of this analysis are that:

- There can be no ideal model for reform of city planning—the variables are too complicated to balance;
- Urgent needs must be reconciled with long-term benefits;
- The management and governance of urban space is complex and research is needed to identify effective decision-making strategies in this environment; and
- Research is also needed on how social needs interact with spatial organization.

1.4 Low carbon fuels

Low carbon technologies are many. They range from large, centralized options such as nuclear and carbon capture and storage through medium-sized plants like off-shore wind farms, large cogeneration, bio-refineries and vegetable oil production and processing and down to small biomass, domestic cogeneration, wind and solar plants feeding energy into decentralized grids.

The analysis described here will exclude nuclear power, and carbon capture and storage (CCS). It is doubtful that nuclear and CCS are immediate options for most developing countries. In the few cases where such options might be promoted, it would seem to be best done within the national policy framework without incorporation into Kyoto processes.

As noted earlier, public policy intervenes to correct market failures. For low carbon technologies, the most common failures are similar to those identified previously for energy efficiency, but with a different emphasis. Distorted energy prices, unrecognized external costs and poor access to technical information all play a part. There is, however, a significant difference. Many measures of energy efficiency are cost effective, but prevented by distortions of the conventional market. This is not the case for most low carbon options. Some low carbon options may be cost-effective, such as solar

water heating where there is good insulation. In these cases, the technology can be promoted exactly as for energy efficiency using standards, information dissemination, demonstration, financial incentives.

Many important low carbon technologies with very large resource bases are not win-win, even if the distortions of the conventional market are removed. They are justified by the external costs that they avoid, especially the external costs of GHG emissions. This normally means that they must be financially subsidized and financial incentives of one sort or another are critical to low carbon policy. Even attributing to renewable energy the value of the avoided externalities at present market values is generally not sufficient to make them economic.

Table 4 shows how the present value of the carbon credits for 1 kW of wind turbine operating with a capacity factor of 33 per cent, discounted at 10 per cent over 20 years depends upon the carbon credit. If no credit is offered then the value of the credits is nil. At $2/tonne (which was the order of magnitude of the value offered by the earliest carbon funds), the credit is worth about USD$34/ kW. This does not make much impact on a capital cost of maybe $1500 / kW. At USD$10/tonne, which is roughly what has been available from the European Trading System, it begins to be a significant discount, but not determinant. At $50/tonne, which is the value implicit in some European support schemes, GHG reduction becomes a major determinant of the economic analysis. The credits would be less at the higher discount rates required by private developers.

Table 4: Net present value of carbon credits for a typical wind turbine

Carbon credit $/tonne CO2equiv	Net present value $per kW
0	0
2	34
10	170
50	850

Some very good wind regimes in low risk environments may come somewhere near commerciality if the carbon credits are around USD$10–20/tonne, but a major roll-out of renewable energy in developing countries, and especially of solar energy, will require, at least initially, much higher subsidies than presently exist. Renewable energy developments in developing countries are at present mainly subsidized through concessionary loans and grants that disguise the true economic performance. The analysis is similar and more pessimistic for solar technologies.

The residual justification for public support is that over the long-term they will be an essential part of the way we cope with climate change and resource depletion.

Where low carbon fuel is used to replace fuels for heating and transport, the range of policy interventions is much as described for energy efficiency, but with a bigger emphasis on early market functions, such as research and demonstration to prove or improve the technical and commercial performance. Where low carbon fuels are used for electricity generation there is a new set of possible policy interventions by which subsidy support can be delivered through the regulation of the electricity industry.

For grid connected schemes there can be specific market failures relating to the conditions under which electricity may be fed into a national network. Excessive and unjustified costs of connection to the grid, inability to connect, disputes over responsibility for payment—these can impede renewable deployment. They may be, but are not necessarily, attempts at deliberate obstruction by network operators; the relationship between a national network with its own concepts of growth and independent generators with different agendas can be difficult. These various distortions should be corrected by fair regulation.

For the long-term deployment of low carbon options it will be necessary to do more than simply correct minor distortions. It may be necessary to revise the entire functioning of the grid to enable more efficient despatch and control of low carbon technologies and better incorporation of their specific characteristics into planning. This is the so-called "intelligent grid." Implementation of this approach will need public support initially through research, development and demonstration, and subsequently through radical regulatory change, maybe involving new primary legislation.

The taxonomy for low carbon policy interventions that we use here is:

- Price reform
- Institutional and legal reform
  - A special law
  - A special agency
- Financial incentives
  - Capital subsidies
  - Operating subsidies
- Dissemination of information
- Research, development and demonstration

1.4.1 Price reform

Subsidized prices for fossil fuels obviously discourage investment in renewables and other low carbon options. The issues under price reform are no different from those already described above (see Section 1.2) and no further discussion is needed. The other options for intervention are

analyzed below. There is now an immense volume of policy and legislation in countries all over the world pertaining to renewable energy. By 2009, policy targets existed in at least 73 countries and at least 64 countries had policies to promote renewable power generation (REN21, 2009). It is beyond the scope of this paper to review all this experience. Most of the instruments fall into a few classes and the examples cited below are thought to be typical.

1.4.2 *Institutional and legal reform*

The main institutional and legal elements that might be found in a policy to promote low carbon technologies are a clear-targeted strategy or road map, a specialized agency to implement public activities and a law specifically aimed at promoting low carbon fuels.

1.4.2.1 *Law*

China offers a good example of a framework law. The Renewable Energy Law has been effective since January 1, 2006; it is designed to "promote the development and utilization of renewable energy, improve the energy structure, diversify energy supplies, safeguard energy security, protect the environment, and realize the sustainable development of the economy and society." (The Renewable Energy Law of the People's Republic of China, 2005). The law empowers the provincial governments to develop renewable energy feed in tariffs and quotas for the purchase of renewable energy within their jurisdiction. Available instruments include:

- Targets, including technology-specific targets;
- Obligations on network operators to connect renewable energy facilities;
- Operating subsidies, including feed-in tariffs and competitive tendering; and
- Cost sharing arrangements to divide the costs of renewable energy generation and grid connection equitably amongst utilities and electricity end users.

Egypt has chosen a different route. There is no special law in Egypt to promote low carbon fuels, but there are important provisions of the draft electricity law that are relevant. The law sets out the procedures for the construction of grid-connected renewable generators and the compensation of the transmission company for purchase of power at higher prices than alternatives. The law in Egypt defines the process for procuring electricity generation plants using renewable energies. It provides for several options combining competitive bidding and a feed-in tariff. Under competitive bidding the New and Renewable Energy Agency (NREA) may request proposals for the construction and operation of plants to sell electric power to the transmission company at a rate approved by the Cabinet. Alternatively, the transmission company can call for public tenders to build, own and operate a plant as the basis for a subsequent power purchase agreement. It is intended, but not specified in the law, that the domestic content will be a part of the criteria for selection. It is also

foreseen that investors may, of their own volition, build a plant and sell to the transmission company on the basis of a standard power purchase agreement (PPA) of a take-or-pay character valid for 15 years, approved and announced by the cabinet. This is a feed-in tariff as described below. The law also requires the holders of licences for transmission and distribution licenses to connect renewable generators to its own network and to cover the corresponding investment needed for strengthening their networks.

Mexico adopted a new renewable energy law in 2008 that creates the power to require utilities to purchases electricity from renewable generation in accordance with a national target that is yet to be determined.

The renewable energy law in the Philippines provides for the powers to create renewable portfolio standards (see below, Section 1.4.3.2) and feed-in tariffs for wind, solar, biomass, small hydro and ocean power. The law also requires network operators to give priority in connection and transmission to renewable generators. It also allows consumers to choose to purchase renewable power from suppliers, and provides for tax and import-duty incentives for investment.

1.4.2.2 An agency

Most countries have found that a specialized agency is an important part of the promotion of renewable energy. The functions of such agencies may include research and development; provision of technical information (e.g. wind and solar atlas); promotion; management of financial incentives; management of concessions and development in the early stages. Not all these functions are necessarily best performed by such an agency, especially within a mature liberalized market.

The case study of Egypt is instructive. The Government of Egypt was quick to establish a specialized agency for renewable energy and this has certainly helped create a strong interest in commercial development. The New and Renewable Energy Authority (NREA) was founded in 1986 with the mission to lead research and development of renewable sources of energy. Subsequently, it has also acquired some responsibilities for energy efficiency. NREA is also a developer; it owns and operates all existing wind farms in Egypt and is planning several more. It is also effectively a regulator, establishing rules and procedures for allocating land for wind farms to developers and performing national planning for renewables. Clearly, there are conflicts of interest in the discharge of these various functions. There are advantages of having everything under one roof in the early days of development, but now, given the expected rapid rate of commercialization, it is generally agreed that reform will be needed.

India has made radical institutional changes to accommodate new and renewable energies and has a ministry with special responsibility for the matter. A central element of the renewable energy

program in India is the Indian Renewable Energy Development Agency Limited (IREDA), which was established in 1987 as a Public Limited Government Company with the objectives to:

- operate a revolving fund for the promotion, development and commercialization of new and renewable sources of energy (NRSE);
- assist in upgrading technologies; and
- extend financial support to energy efficiency and conservation projects and schemes.

By March 2007, IREDA had approved 1,816 projects with a generating capacity of 2,927 MW. The Indian example demonstrates clearly the importance of combining proper financial instruments with proper regulatory provisions.

In China, responsibility for renewable energy development is assigned by the Renewable Energy Law to the National Development and Reform Commission (NDRC). A detailed allocation of responsibilities has yet to be specified.

1.4.2.3 Targets

A targeted strategy can be a useful part of an aggressive policy to support low carbon fuels. Targets may be criticized because it is impossible to know at the outset if they are too easy or too hard and they are futile if not associated with plausible policy instruments. Despite this, they can be helpful in guiding the adoption of other policies and indicating necessary levels of financial support for budgetary purposes. They also help in monitoring progress.

For example, the European Union has set a target to source 21 per cent of electricity from renewable energy sources by 2010. Each Member State has a national indicative target for electricity from renewable energy sources to contribute towards the overall target (European Commission, 2001). The Directive further stipulates that Member States must improve their grid access for renewable energy generators, streamline and facilitate authorization procedures and establish a system for guarantees of origin.

The EU has also established a "20-20 by 2020" policy. This refers to the target to reduce greenhouse gas emissions by 20 per cent and to have 20 per cent renewable energy in total consumption by 2020 (European Commission, 2007a).

By 2009, policy targets existed in at least 73 countries (REN21, 2009). Some examples are shown in Table 5. It is difficult to comment on the effectiveness of these targets as, by their nature, their success will only be known in the long-term. What can be said is that as countries liberalize their energy markets, they lose the power to directly influence investment. They need, therefore, to be

able to design policies that will be effective in reaching their targets. It is not clear whether all counties have sufficient policy design capacity to achieve this. It may be an area where more technical assistance is needed.

Table 5: Renewable targets in selected countries

Country	Target	Date
Australia	45 TWh of electricity	2020
Bangladesh	10% of electricity	2020
France	4.9 GW solar	2020
India	14 GW	2012
Indonesia	9.5 GW geothermal	2025
Ireland	40% of electricity	2020
Jamaica	15% electricity	2020
Japan	14 GW and 53 GW solar	2020 and 2030
Kenya	350 MW wind and biomass	
Nicaragua	38% of electricity	2011
Russia	1.5% electricity	2010
Rwanda	90% electricity	2012

China provides a good example of target setting and its weaknesses. The NDRC's Medium and Long-Term Development Plan for Renewable Energy of 2007 establishes the guiding principles, objectives and targets, priority sectors, and policies and measures for the development of renewable energy in China up to 2020. For 2010, it sets the target to raise the share of renewable energy in total primary energy consumption to 10 per cent. By 2020, it will aim to raise this share to 15 per cent. The Plan also sets targets for key individual renewable energy technologies such as wind and solar photovoltaic (NDRC, 2007). The responsibility for achieving the renewable energy goals is not clearly assigned and without this clarity implementation may be problematic. Much will depend on how the regulatory system evolves.

The Indian government has also set specific targets for renewable energy (Government of India, 2006). By 2012 it expects renewable energy to contribute 10 per cent of total power generation capacity and to achieve a four to five per cent share in the electricity mix. This implies that renewables will compose 20 per cent of the 70,000 MW of total additional energy planned from 2008–2012.

1.4.3 Financial incentives

Renewable energy is already big business. An estimated $120 billion was invested in renewable energy worldwide in 2008. Most of this enjoyed some sort of financial support, either through capital or operating subsidies. There is growing availability of finance for developing countries;

support from international and bi-lateral donors was $2 billion in 2008, four times the figure of 2004. The international development banks committed nearly $700 million (excluding GEF funds and carbon finance). The Global Environment Facility disburses about $100 million per year (REN21, 2009).

1.4.3.1 Capital subsidies

Many financial incentives have been used in different countries to promote renewable energy. Support can either be offered to investment or to operation. Investment support for renewables is general delivered through the same type of instruments that are used to support investment in energy efficiency—capital grants, tax exemptions, soft loans and loan guarantees. Producers of renewable electricity are sometimes exempted from certain taxes (e.g. carbon taxes). In the Nordic countries, which apply high-energy taxes, these tax exemptions can be sufficient to stimulate the use of renewable electricity; in countries with lower energy tax rates, they need to be accompanied by other measures. From an economic perspective, capital subsidies are not an efficient instrument because they are not performance-related. They have a useful temporary function in promoting new developments because they lower perceptions of risk for the developer. They should not be used as vehicles for the long-term delivery of subsidy. This weakness has been specifically recognized by the Indian Planning Commission that justly remarked that subsidies "should be linked to outcomes (energy generated) and not just outlays (capacity installed)" (Government of India, 2006, para. 1.3.1., p. 5).

There are several well-established models through which middle- and low-income countries have provided subsidies for renewable energy. India has been promoting renewable sources for several decades with significant success. The main elements of strategy are a) to facilitate institutional finance from various financial institutions and b) to promote private investment through fiscal incentives, tax holidays, depreciation allowances and adequate tariffs for power fed into the grid. The program is primarily private sector-driven and a significant base for domestic manufacturing has been established. The annual turnover of the renewable energy industry in the country now exceeds $10 billion. The financial provisions are backed by clear regulatory arrangements that make explicit provisions for renewable power.

In Egypt, wind projects have been financed up to now with grants and low-cost loans. Funds and technical assistance were provided by Denmark (60 MW, 2001–2003); Germany (80 MW, 2001–2004); Spain (85 MW, 2006) and Japan (80 MW, 2007). The German, Spanish and Japanese developments have all applied for accreditation under the CDM, using methodology ACM2 for grid-connected electricity generation (Elsobki, 2009).

Financial incentives can also be made available to support manufacturing industry. India intends to become a major player in the photovoltaic business. National and state governments have introduced policies to support solar photovoltaic manufacturing in special economic zones, including capital investment subsidies of 20 per cent.

Many countries include a requirement to source equipment from domestic manufactures as a part of concession arrangements, for example, the wind concessions in Egypt. This also amounts to a capital subsidy to local manufacture as the domestic sourcing, all other things being equal, will lead to higher prices and therefore represent a transfer from the consumer to the manufacturer.

1.4.3.2 Operating subsidies

Electricity

Grid-connected renewable energy is rarely cost-effective in its own right; it must be subsidized if it is to be developed by private industry. There are two main ways of delivering the subsidy through regulation of operation. One is by offering higher prices than those available commercially; the other is by creating a second valuable good that recognizes the value of the carbon emissions avoided. The second scheme is operated by issuing certificates that certify the renewable origin and then obliging an identified group (normally suppliers) to buy them. This creates a market and therefore a price. A variant of this is the renewable portfolio standard (RPS) that places an obligation on electricity supply companies to produce a specified fraction of their electricity from renewable energy sources. Certified renewable energy generators earn certificates for every unit of electricity they produce and can sell these along with their electricity to supply companies. Supply companies then pass the certificates to a regulator to demonstrate compliance.

The offer of higher tariffs may also be created by tendering a concession, it being understood that the concession will be granted however the price achieved compares to market prices for electricity. This stands in continuity with traditional processes of tendering large plants to IPPs; it allows secondary criteria, such as percentage domestic content, to be added to the evaluation criteria. It also has the advantage that it can obtain all the rent from favourable sites, ensuring, in theory, the lowest prices. It has recently been adopted by Denmark for large developments.

Operating subsidies may also be delivered by a feed-in tariff that is made available to any generator. This arises out of the PURPA legislation in the U.S. and is generally suitable for relatively small developments, where the transaction costs of negotiating detailed PPAs would be too onerous.

Certificate-based schemes define a quantity of renewable electricity to be produced and market forces identify a price that is unknown at the outset; feed-in tariffs fix a price to be paid for renewable electricity, but it is unknown what volume will be offered.

Certificate systems have worked reasonably well for control of emissions (e.g. reduction of sulphur emissions from refineries in the U.S. or the European Trading System for greenhouse gases). They are probably the only operational system for any future mechanism of international trade in renewable values. Their use nationally to promote renewable energy has often been disappointing, certainly in the UK, because generation has been prevented by public objection to planning permission. Certificates have therefore been scarce and commanded a high value. The scheme has resulted in high prices and low renewable production. The RPS in the U.S. appears to have worked better. Feed-in tariffs have been successful in calling out large volumes of renewable energy in several European countries, (e.g. in Germany and Spain), but there is little control over location, timing and cost and they tend to be resisted by developing countries.

France offers a good example of a feed-in tariff that guarantees a price above the market price for renewable electricity. The terms are differentiated by technologies. Bonuses can also be granted to take account of positive effects on air quality, reducing CO_2 and the development of future technologies. Hydro tariffs offer 20 years at €60.7/MWh plus a bonus of €5–25/MWh for small installations and a bonus up to €168 /MWh in winter. Biogas is, for 15 years, at €7.5-9 /MWh. Onshore wind receives €82 /MWh for 10 years and €28–82 /MWh for the next five years, according to the site. Offshore, the conditions improve to €130 /MWh for 10 years and between €30–130 /MWh for the next 10 years, according to the site. PV gets €300 /MWh for 20 years, plus a bonus of €250 /MWh for grid integration. In the overseas departments it is €400 /MWh plus a bonus of €150/MWh for grid integration. There is also provision under French law for competitive tenders. Austria, the Czech Republic, Germany and several other European countries offer similar tariffs with somewhat different conditions. A variant of feed-in tariffs is to pay a premium to the producer on top of the electricity market price. This has the benefit of promoting competition among producers. Spain operates this system; the size of the premium depends on the size of the plant and the type of renewable energy source.

The value of these subsidies far exceeds the value of the carbon saved as measured by trade on the ETS. A CCGT might generate about 625 kg of CO_2 per MWh. A premium of say $50/MWh therefore implies a value of carbon of about $80/tonne, which is far above what is observed on the ETS. Clearly, the implicit value of carbon in European renewable policy is very high. This has some consequences for the international trade in renewable values, which we will discuss later.

The UK was the first country to introduce a certificate system for renewable energy. In its present form, it comprises an obligation on all electricity suppliers to supply a specific proportion of electricity from electricity from renewable energy sources or to pay a penalty buy-out price. The quota was 7.9 per cent in 2007/08, increasing in steps to 15.4 per cent by 2015 (where it will remain until 2027). The Federal Government of Belgium combines a green certificate system with

guaranteed minimum prices for 10 years (20 for offshore wind). The tariffs are: offshore wind €107/MWh; onshore wind €50MWh; hydro power €50MWh; solar power €150MWh.

A third vehicle for conveying subsidy is by tendering**.** A request for proposals is announced for the provision of a certain amount of electricity from a certain technology source, and the subsequent competitive bidding should ensure that the most efficient developer wins. Denmark uses tendering for the development of off-shore wind projects and so far this has proved to be an effective instrument. French law permits tendering for large projects.

The general view of the experience with these various support systems is probably that well-adapted feed-in tariff regimes are generally the simplest support scheme for promoting renewable electricity. But, the quota system is a relatively new instrument, and it may become more effective over time. Tendering is suitable for large developments where the concession is in government hands (IEA, 2008b; European Commission, 2009). By 2009, at least 64 countries had policies to promote renewable power generation (REN21, 2009), mainly in developed countries.

Examples in developing countries are relatively few, but Egypt offers a good and thoughtful treatment of the possibilities. It intends initially to use competitive bidding for large resources on land owned by the state. The requirement for high domestic content will help support and develop the national wind industry. The competitive bidding should help reveal prices that developers will accept and can inform the feed-in tariff that is proposed later for smaller projects (Elsobki, 2009). The draft electricity law in Egypt provides for a fund, to be named the "Fund for Development of Power Generation from Renewable Energies," established by and affiliated to the Cabinet of Ministers. The purpose of the fund is to compensate the transmission company for the purchase of electric power from the renewable generators. The fund will be financed mainly from allocations of the public budget of the state. The fund's statutes and governance are to be set by Decree.

In China, the system is similar, but less sympathetic to foreign investment. Prices for wind power are established either by tender under the Central Government's national concession program or negotiated on a case-by-case basis for individual wind projects that are not part of the concession program. The national concession program requires that 70 per cent of the value of turbines be manufactured in China. Only Chinese companies have ever won the tenders to build wind power plants, possibly because they do not seek commercial returns on their investments (Baker & McKenzie, 2009). The results of the concessions are then used as a guide price for the negotiated projects. This process tends to keep prices down and foreign investors out. A feed-in tariff for wind has been mooted in China for several years, but appears not yet to have been adopted.

The report of the Indian working group on new and renewable energy for the XIth Five-year Plan recommended the introduction of policy guidelines for effective feed-in laws and/or feed-in tariffs

for grid connected renewable power. The Tariff Policy announced in January 2006 adopted instead an RPS type of intervention and competitive tender. The policy authorized states to establish a minimum percentage for purchase of energy from renewable sources, taking into account availability of such resources in the region and its impact on retail tariffs. It also authorizes procurement by distribution companies at preferential tariffs implemented, as far as possible, through a competitive bidding process.

India does have a feed-in tariff for solar power. The national government permits feed-in-tariffs for solar power up to a limit of Rs15/kWh ($0.30/kWh). West Bengal in March 2008 was the first state to issue a tariff at Rs11/kWh ($0.22/kWh).

South Africa has a pure feed-in tariff for wind energy, introduced in March 2009 by the National Energy Regulator of South Africa. The tariff is set at ZAR1.25 ($0.131) per kWh over 20 years. It is clearly too early to assess its impact. The Philippines has created the powers to impose both renewable portfolio standards and feed-in tariffs for wind, solar, biomass, small hydro and ocean power.

Operating subsidies can also be delivered in conventional ways. For example, for wind energy in India there is an income tax exemption for 10 years, 80 per cent accelerated depreciation, sales tax exemption and excise duty exemption. The tax exemptions amount to an operating subsidy; in certain circumstances the accelerated depreciation also. India has also offered for many years a 10-year tax holiday for geothermal energy (Government of India, 1961).

Biofuels

Tax relief on biofuel for transport and obligations to blend biofuels with vehicle fuels are the two most common instruments used to promote biofuels. Tax relief on biofuel sales allows biofuel producers to sell their product at higher cost to retailers; obligations to blend biofuels with petroleum products require retailers to source certain volumes whatever the cost and to pass those incremental costs on to consumers as higher prices. The financing of the subsidy is different in the two cases: tax breaks reduce tax income; obligations are financed through higher prices. Obligations can therefore be more appealing to the state, but the higher prices can damage the public perception of biofuels and obligations are difficult to implement and monitor. Obligations are more equitable because the user pays rather than the general tax payer.

In Europe, there is a formal target for future consumption of biofuels that can only be met with strong market intervention. The historic record reveals an initial focus on tax reliefs, then a stronger resort to obligations, and eventually a general retreat from subsidy as the environmental costs of some biofuel production chains became clearer. In 2005–2006, all Member States, except Finland, used tax exemptions as the main support measure. Obligations to blend were only used by Austria,

France and Slovakia. Since 2007, more than half of Member States have adopted obligations, often reducing the tax concessions at the same time (European Commission, 2009).

Various measures of capital subsidy to different phases of the production process are in place in different countries. Subsidies may be directed to the producer, to conversion and consumption. Producer subsidies are very common in agricultural policy in both developed and developing countries. Tax reliefs for the processing industry are sometimes used to support the conversion phase. Tax reliefs or grants for the purchase of new flexible fuel vehicles or the conversion of conventional engines are sometimes used to help move the vehicle market towards biofuels. Ireland and Sweden have such policies. Public procurement has been used also for similar purposes; in Poland the "Long Term Biofuel Promotion Project 2008–2014" requires government departments to gradually replace their fleets with vehicles able to use liquid biofuels.

The best-known biofuel program in a developing country is in Brazil. Ethanol from sugar cane has been used as a fuel in Brazil since the 1930s and was blended up to 50 per cent in gasoline during the Second World War. Interest in the technology was rekindled after the Yom Kippur War. The government launched a program in 1975 for wide scale manufacture and use. A federal law from October 1993 established a mandatory blend of 22 per cent ethanol and authorized the Executive to vary the prescribed blend within defined limits. Since July 2007 the mandatory blend is 25 per cent ethanol and 75 per cent gasoline.

The Brazilian government provided strong policy support for the production and use of ethanol. Among the instruments were low-interest loans for agro-industrial ethanol firms, guaranteed purchases by the state-owned oil company Petrobras and a price for ethanol fixed at 59 per cent of the government-set gasoline price at the pump. These incentives made ethanol production competitive. Brazil is now the world's second largest producer of ethanol fuel and the world's largest exporter. One should also note that the industry benefits from very advanced sugar cane agricultural practice and a sophisticated food processing industry, as well as a very large land mass.

The main developing country interest in biofuels is often as a cash-crop for export to industrialized countries where prices are better because of the obligations. An example is Indonesia. Energy policy objectives are based on the Presidential Decree No. 5 of 2006 on National Energy Policy and its Blueprint of National Energy Management (IEA, 2008a). They include ambitious objectives for renewables, in particular, by 2025 to increase the use of:

- geothermal from 1.9 per cent to more than 5 per cent;
- biofuel to more than 5 per cent;
- other renewable energy (RE) from 0.5 per cent to more than 5 per cent.

But currently there are no obligations on domestic users so, unless policy is reformed, the biofuels will flow to industrialized countries where prices are higher.

Some developing countries have also introduced domestic obligations. A comprehensive list of obligations is given in the Renewables Global Status Report (REN21, 2009). The entries for developing countries are listed in Table 6.

Table 6: Biofuel obligations in developing countries

Country	Obligation and intended date of introduction
Argentina	E5 and B5 by 2010
Bolivia	B2.5 by 2007 and B20 by 2015
Brazil	E22 to E25 existing (slight variation over time); B3 by 2008 and B5 by 2013
Chile	E5 and B5 by 2008 (voluntary)
China	E10 in 9 provinces
Colombia	E10 and B10 existing
Dominican	E15 and B2 by 2015
India	E5 by 2008 and E20 by 2018; E10 in 13 states/territories
Jamaica	E10 by 2009
Malaysia	B5 by 2008
Paraguay	B1 by 2007, B3 by 2008, and B5 by 2009; E18 (or higher) existing
Peru	B2 in 2009; B5 by 2011; E7.8 by 2010
Philippines	B1 and E5 by 2008; B2 and E10 by 2011
South Africa	E8–E10 and B2–B5 (proposed)
Thailand	E10 by 2007 and B10 by 2012; 3 per cent biodiesel share by 2011
Uruguay	E5 by 2014; B2 from 2008–11 and B5 by 2012

Note: E and B indicate ethanol and biodiesel, respectively. The numbers that follow the letters indicate the mandated percentage of those fuels to be mixed with conventional gasoline.

There are, of course, risks associated with biofuels. The World Bank report on biofuels notes upward pressure on food prices, intensified competition for land and water, and possibly deforestation (World Bank, 2007). Clearance of certain types of land for biofuel crops can release large volumes of methane.

1.4.3.3 The CDM and related mechanisms

An important potential mechanism for the support of low carbon technologies is the CDM, and in particular its relationship to the Emissions Trading System of the EU.

On July 2, 2003, the European Council formally adopted the Emissions Trading Directive, which sets the framework for the European Emissions Trading Scheme (ETS) and requires member states to limit their CO_2 emissions to pre-defined levels. The scheme divides into two periods: the first ran

from 2005 until 2007, and the second runs from 2008 to 2012. A third phase begins in 2013 and runs until 2018. Governments across the EU are required to establish mechanisms that allocate national allowances to obligated installations. If a company fails to surrender sufficient allowances to its government at end of each yearly reconciliation period, it is fined and must purchase the equivalent shortfall for retirement the following year.

The importance of the CDM to developing countries is that companies in the ETS can use certified emission reductions (CERs) from the mechanism to meet their commitments as a consequence of an EU Directive (known as the Linking Directive). This has increased demand for CERs and established a higher price than previously prevailed. The impact on the economic evaluation of some low carbon technologies is significant.

The ETS is in the process of revision, and in the future the allocation of allowances to emit will be made by auction. This will raise a great deal of money, a small portion of which will be used to support reform in developing countries. Use of the this part of the revenues will be at the discretion of the European Commission (European Commission, 2008).

1.4.4 Dissemination of information

Information is a public good and its production and dissemination through public policy can be a significant aid to investment by reducing risk. Public information reduces the risk to users and developers of spending money and effort in measuring a resource or appraising an investment only to discover that it is not commercially viable.

Information can be compiled and made available to the public at many points in the technical chain from resource to use. Information about the cost and performance of technology, for example solar water heaters, can induce private investors to act who otherwise would have been unaware of the possibilities. Such information should be free if it is to be effective.

An important aspect of the dissemination of information at the stage of commercialization is the compilation of reliable and detailed information about national low carbon resources. Information of this nature, to be made available to support commercial investment, might be free or sold, according to circumstances and level of detail.

For example, NREA has compiled a wind atlas for Egypt with the support of the Risø National Laboratory. A wind atlas for the Gulf of Suez was published in 1996 and updated in 2003. A wind atlas for the whole country was complied in 2005. Developers would probably wish to make their own measurements before committing capital and it is in the interests of NREA that they should do

this in order to ensure that the technical risk in this respect lies with the developer. The atlas, however, represents an excellent source of basic information for potential investors.

A range of software is available for predicting wind climates, wind resources and power productions from wind turbines and wind farms. The most common is WAsP which is developed and distributed by the Wind Energy Division at Risø in Denmark. A dedicated Web site maintains a list of wind atlases worldwide (Risø, 2009). The USA, Europe and Australia have all made available such information, as have Algeria, Brazil, Egypt, Georgia, Jordan, Russia and South Africa.

Similar data for solar are available in many countries, but there seems to be no central compilation of sources.

1.4.5 Research, development and demonstration

Many promising low-carbon technologies are still relatively immature, at stages on the innovation chain where large investments are needed to bring them to commercial status. In such cases, particularly in the context of climate change where technological evolution is urgently needed, there may be a case for government support in the form of research, development and demonstration of some key technologies.

The biofuel sector provides a good example. The production of biofuel feedstock can damage the environment through impacts on biodiversity, water consumption, quality of water and soil. It may sometimes increase GHG emissions when, for example, jungle is cleared or wetlands are drained for plantations. Because of this concern, there is increasing awareness of the need to monitor closely the impacts of each biofuel development and also to move to second-generation biofuels (such as enzymatic hydrolysis and gasification of ligno-cellulosic biomass based on waste from agriculture, forestry and timber industries). This will require very substantial expenditures on research. The U.S. is committing $800 million under the Recovery Act including large scale demonstration plants (US Department of Energy, 2009a).

Europe has allocated €59 million in 7th Framework Research Programme and there are European national programs of comparable magnitude. In the view of some, second generation biofuel technologies are more likely to develop from discrete advances around existing industries such as food processing and pulp and paper than from new dedicated biorefineries.

Few developing countries can match this kind of expenditure, but the results will be important for their agriculture and forestry sectors. They need to monitor work closely, do whatever research is needed to become informed buyers and regulators, to participate where they can in international research projects and to influence research agendas.

Subsidies for research and development are used, in some cases, in developing countries. In India, the Ministry of New and Renewable Energy subsidizes 100 per cent of a project's cost in government R&D institutions, and 50 per cent in the private sector. The R&D subsidy for the private sector may be enhanced for initial stages of technologies that have longer time-horizons. Subsidy support for R&D is only available for firms with a majority Indian stake. Firms with foreign majority stake can take advantage of subsidies if they have local Indian partners or if the R&D they provide is delivered at lower costs and in shorter time than R&D provided by firms in India (Tyagi, 2008).

1.5 The future for technical cooperation

1.5.1 The track record

There are few, if any, truly objective, sceptical and critical analyses of technical cooperation projects in energy efficiency and renewable energy. The chronic deficiency is always the absence of a base case; what would have happened if the cooperation had not taken place? For the most part, published, consolidated material originates from the international institutions that are committed to the approach, or from other involved parties. Some institutions publish reviews of their activities, although there must be some limits as to the extent an organization can truly evaluate itself. The Independent Evaluation Group (IEG) in the World Bank, for example, is supposedly independent, but is still a unit of the World Bank that reports evaluation findings directly to the Bank's Board of Executive Directors.

It is true, however, that the IEG is not always docile. Their report on Bank's involvement in the oil, gas and mining sectors chaired by Dr Emil Salim, a former Minister of Population and Environment in Indonesia, was deeply critical, even if the recommendations were diluted by subsequent negotiation (World Bank, 2004c). The IEG has undertaken a review of the Bank's effort in the reform of energy policy, but the bulk of material is not yet published (World Bank IEG, 2008). Independent evaluators are regularly contracted to scrutinize particular projects, but they have a built-in propensity to please, and often their reports are not published.

Anecdotal evidence tends to be less encouraging than in-house published evaluations. The practice of technical assistance generally assumes that beneficiaries want the work done. But in reality, projects are selected by donors on the basis of their agendas. More or less honest efforts are made to align these agendas on the interests of the beneficiary countries, but this alignment is never perfect. Beneficiary countries rarely contribute their own funds; if they do, it is generally as a condition of access to much larger loans. Their commitment to projects is therefore often weak. Their interest in the results may be minimal. Reports, which are sometimes mechanical in execution anyway, are shelved and forgotten. When a project does have a genuine basis of interest in a beneficiary, it may well evaporate following a change of Minister. By the time of the next administration, the project

might as well never have happened. There are exceptions; some projects do lead to sustainable changes in practice. There is a cumulative effect of water dripping on the stone. But the absence of a clear perception of real benefit by the beneficiary is often a limitation on the effectiveness of cooperation. A truly comprehensive review of technical cooperation, including systematic beneficiary appreciations should be undertaken as part of any exercise intended to bring the world of technical cooperation in energy efficiency closer to that of Kyoto.

There is much evidence of uncoordinated technical assistance by different donors to different national institutions. Slight differences in the agendas of donors, historic links, diagnosis of needs, even institutional rivalry can cause this. It is a wasteful practice because technical assistance, to be effective and to transform recipient institutions, needs to be cumulative. This is not achieved if it goes to different recipients or duplicates past work. Donors do try, through donor conferences, to coordinate support, but it does not always work. Better coordination is needed.

We have noted earlier that one of the most effective large programs of technical assistance was PHARE. This is not because it was especially well-planned or executed, but because there was a compelling political need for the results and a clear political intent to use them. If real, substantial and tangible benefits can be created within the Kyoto process for gains in energy efficiency by developing countries, this would completely change the face of assistance in this area.

2.0 Indicators

This paper has, up to this point, surveyed the experience of domestic policies and measures that have been employed to foster energy efficiency and renewable energy supply. It was noted at the outset that the international community may be working toward a post-Kyoto future that envisions more systematic international support for such policies under the auspices of the UNFCCC. While the final shape of these negotiations is uncertain at this point, one thing is known: whatever support is offered, it will need to be measured, reported and verified as per the mandate of the Bali Action Plan.

The remainder of this paper explores how that might take place. As in the first part of this paper, the analysis here draws on what is now an extensive literature on indicators, and specifically on the history of experience with assessment of support for domestic policy reform.

2.1 The nature of indicators

2.1.1 Measurement and manipulation

It is widely believed that, to manage a phenomenon, it is necessary to measure it in some way. The premise is contestable, but it underpins the idea of indicators. If we try to lose weight, we might measure body mass. This is an indicator. If we are trying to improve our health, we might measure the Body Mass Index (BMI) which is somewhat more complex. We should also perhaps stop smoking and drinking alcohol and eat more fruit and vegetables, about which the BMI will tell us little. We need more indicators and surely they will be provided.

An indicator is simply any statistic that purports to tell us how well we are doing in a particular endeavour. Even in apparently simple cases it may not be possible to describe all aspects of the endeavour in a single number. For example, we may wish to develop indicators for power system reliability. There are many options; we can start by measuring the proportion of time over a period that the power system has failed. If we consider three days in a year, that would seem to be better than five days a year. But maybe the three days a year are made up of 100 short incidents and the five days a year are made up of 10 long incidents. This might change our preference. To overcome this, we can design frequency and duration indicators that tell us how frequently, on average, the system fails and for how long. This is apparently an improvement. But maybe next year the frequency is lower, but the average duration is longer. It is not evident how we judge whether this is an overall improvement. Neither of these measures indicates how deep the cuts in supply are; to lose 100 MW of power is worse than to lose 50 MW, so we need an indicator for amount of load lost as well. It is also important whether the system fails for many customers all together, but infrequently

or for few customers, but often. There are many other aspects that need to be captured. Even for this very straightforward case we need an extensive range of indicators to capture all we need to know, and even then, we may have difficulties in interpretation.

Another case is the pollution caused by sulphur from a power plant. The most obvious indicator is the total mass of sulphur emitted per annum from the stack of the plant. If we wish to know the impacts on human health, it is preferable to look at ground-level concentrations; immediately we have several options. We can average over an hour, a day, a year. We can average over a large area or only look at particular spots. None of these indicators is obviously superior; they all capture different aspects of the problem. If we are interested in long-range transport of sulphur, none of this is relevant; we have to look at the transfer from the source to multiple receptors across a region.

Multiple indicators are fine as long as they all point us in the same direction. The interpretation of multiple indicators may not be evident if they point in different directions. For example, the unemployment rate, GDP, money supply and consumer price index all measure performance in some part of the economy, but it may not be obvious how to interpret them taken as a group.

In some cases, we can aggregate indicators. For example, the aggregate energy use in a country is comprised of many fuels measured in different physical units; for coal it is tonnes; for oil it is barrels and for gas it is cubic metres. If all these go down from one year to the next, it suggests we are saving energy; if some go up and some go down it is not so clear. We regularly publish energy supply and demand balances expressed in a common physical numéraire, such as Joules or tonnes of oil equivalent. The process of converting the basic units for the different energy commodities into a single physical unit has some pitfalls, but it is generally accepted and if we believe it is misleading we can make more sophisticated adjustments. Other reductions of complex phenomena to a single indicator are more problematic. For example, we regularly convert the radiative forcing properties of different gases into a single numéraire, normally tonnes of CO_2 equivalent. There are actually quite basic assumptions of some consequence made in this reduction, but they are little known and generally ignored (Wallis & Lucas, 1994).

In most analysis of sustainable development, the indicators divide into three main groups: economic, environmental and social. Economic indicators are sometimes reduced to a single common numéraire measured in monetary terms, for example, US$. Much work has been done to try and assign monetary values to environmental impacts so that they also can be reduced to the same numéraire. If we could do this credibly, then decision-making would just mean choosing the outcome with the best value of the single numéraire. There is a limit to how far this can plausibly be taken and many participants in the debate reject the whole reductionist paradigm.

It is almost always possible to construct a single composite indicator by weighting each component indicator according to its perceived importance and then adding them. Sometimes the weights are defined by physical relationships. In other cases they may be more or less subjective. Sometimes composite indices can be constructed through a formula, as is the case for the BMI, which is defined as weight in kilograms divided by the square of the height in meters. The support for this is simply that it correlates empirically with cardio-vascular disease.

When indicators cannot be reduced, they are treated through various techniques of multi-criteria decision analysis (MCDA). MCDA establishes preferences by reference to an explicit set of objectives for the decision to be made and for which there are a set of indicators that measure the extent to which the objectives are met. MCDA provides ways of aggregating the indicators on individual criteria to provide indicators of the overall performance of options. There is a choice of many sophisticated mathematical techniques. A good manual has recently been revised and published by the UK government, with applications to environmental decisions (Department for Communities and Local Government, 2009). In an earlier form, this manual was used also by the World Bank and UN.

2.1.2 *Input, output, result and impact indicators*

The journey from policy through enforcement to success is long and not always safely made. Indicators are used to measure activity at various points along the way. Indicators should measure program objectives so there is an intimate relationship between *ex ante* program design, for example using a logical framework, and use of indicators for post hoc evaluation. The methodological basis for indicator design and its position in the project cycle is explained well in the manual provide by the European Commission with the immediate objective of helping monitor the expenditure on EU Structural Funds (Directorate-General Regional Policy and Cohesion, 2007).

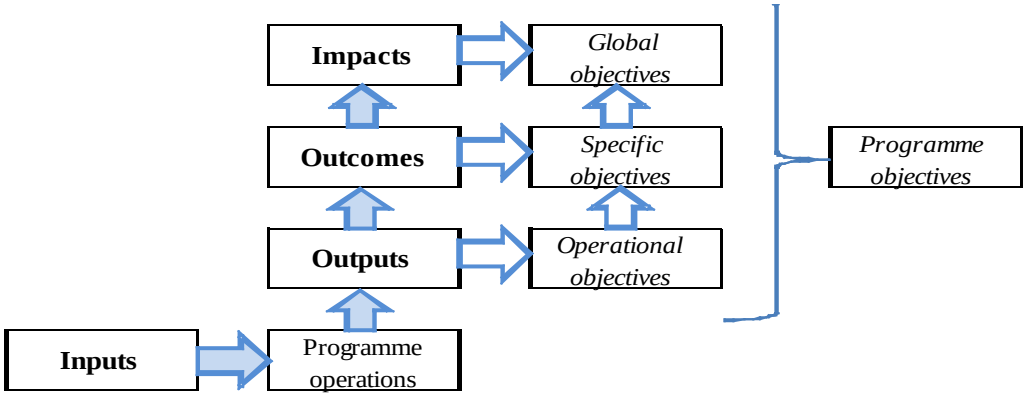
This manual distinguishes indicators that relate to four successive steps in the project cycle:

- Inputs are the financial, human, technical or organizational resources used in the endeavour;
- Outputs are objectively verifiable measures of quantities that demonstrate the progress made in implementing the measures;
- Outcomes are the immediate effects on the direct beneficiaries;
- Impacts are direct measurements of the improvements that the program is designed to bring about. They are the principal basis for assessing the success or failure of the endeavour.

(Note that the manual uses the term "results" rather than "outcomes," but the latter is more standard and we have changed it here).

The relationship of these indicators is shown in Figure 4, redrawn (with modifications) from the EU manual. The points where indicators have a function are shown with emphasis.

Figure 4: Indicators and the program cycle



The UK Treasury uses indicators to systematically set targets for the Executive Agencies of government. These were introduced twenty years ago in the belief that the executive functions of government should be carried out by well-defined business units within a framework of accountability to ministers. They work to targets that are agreed annually with their parent departments and ministers. The Treasury has set out the principles to be used in this exercise; structurally the approach is similar to that described earlier, although with a shorter chain of indicators, recognizing inputs, outputs and outcomes. The more important difference is that the Treasury manual describes the use of indicators for the governance of agencies; the EU manual that is mentioned earlier focuses on the evaluation of programs (HM Treasury, Cabinet Office and National Audit Office, 2003).

The International Network for Environmental Compliance and Enforcement (INECE) in its manual for practitioners (2008) also distinguishes between inputs, outputs and outcomes, but distinguishes between intermediate outcome and final outcome indicators**.** Intermediate outcome indicators measure change in the behaviour of the parties that the instruments address. Final outcome indicators measure the ultimate result the policy intervention is designed to achieve. Other authors make the same distinction but use the term "outcome" for "intermediate outcome" and "impact" for "final outcome" (Neij & Astrand, 2006). Boyle (2005) has reviewed a range of approaches.

In concrete terms, applying these considerations to energy reform, input indicators might include the number of personnel assigned to prepare programs, the technical assistance support and funds

assigned to support incentives. Output indicators measure what instruments come out of policy reform; the set could include the existence of a law and agency, a workable system of financial incentives, operational programs for standards and labelling, mandatory audits and energy price increases. Outcome indicators might include the decisions by appliance manufacturers to retool production lines, of consumers to buy efficient refrigerators and of banks to spontaneously lend for energy efficiency. Impact indicators would include energy use per unit of product in industry, average energy use of the appliance stock, energy use per vehicle-kilometre and numbers of buildings compliant with standards. The usual baseline problems apply; we do not know what would have happened in the absence of intervention so it is not strictly possible to prove causality between inputs and impacts.

In trying to measure the consequences of energy policy reform, we are not primarily concerned with the efficiency with which intentions are formed into instruments, so we do not need input indicators for this purpose. We do need them however as a record of commitment by industrialized countries to the support of policy processes within developing countries. A major concern is policy stringency; to this end, we need to be able to identify the instruments in place, but we also need to know how successful they have been in promoting technical change and in transforming the market. Both output and outcome indicators are of value for this purpose. Indicators of policy impact are essential, if only because these often are more objectively verifiable than intermediate indicators.

2.1.3 The need for indicators of energy policy stringency

The Bali Action Plan (UNFCCC, 2007) binds the parties to launch a comprehensive process to enable the full, effective and sustained implementation of the convention through long-term cooperative action. This includes "nationally appropriate mitigation actions by developing country Parties in the context of sustainable development, supported and enabled by technology, financing and capacity-building, in a measurable, reportable and verifiable manner." The last requirement implies objectively verifiable indicators of the actions concerned.3

An ad hoc working group on long-term cooperative action established under the UNFCCC polled members to determine what should be monitored and reported and what form support should take (UNFCCC, 2009). Suggestions listed in paragraphs 43 to 49 of their report, covered a wide range of options, a part of which were directed towards improving the data and information on emissions. Recurring themes among the observations on mitigation actions are well captured in the note from Japan that proposed "voluntary national action plans, including policies and measures for mitigation, by countries without binding commitments (other than major emitting countries, in particular LDCs and small island developing states), while major developing countries should report on specific

[3] There no consensus on whether the requirement for reportability, measurability and verifiability apply to the actions to be taken or to the financial support for those actions. In the present text we will assume that at some level both sorts of MRV would be necessary.

targets incorporated in the GHG emission inventories." (UNFCCC, 2009, para. 44[g]). The general drift of suggestions for support was that it should be based on needs identified by developing countries and should provide them with sufficient incentives to make demonstrative progress in achieving intensity targets. Help needs to be founded on criteria and indicators to prioritize support and should be verified by means of an international register of contributions. This brief summary of the UNFCCC poll is selective and some observations in the report run against it, but the general notion of voluntary commitments without penalty to actions self-selected by developing countries and supported by prioritized and recorded assistance is a strong theme.

To implement an arrangement of this sort would require considerable effort in measurement and recording. It is necessary to find indicators to record the input of technical and financial assistance; we need indicators to identify the needs and priorities for this assistance; we need indicators to measure the commitment of countries and we need indicators of impact to determine whether policies are ultimately successful. We may also wish to identify indicators on which rewards can be based.

The following sections first review the general experience with indicators, then examine the benefits of intermediate indicators for the assessment of policy reform in other areas. The analysis then moves on to examine proposals for and practice in applications to energy policy reform; it first reviews experience of intermediate indicators of policy and then indicators of the impact of policy reform. It then proposes a simple set of indicators that are useful in this context and considers how they might be used in practice to meet the needs identified here.

2.2 Experience of indicators

Indicators are widely used in many organizations to monitor the performance of units and groups. Indicators should relate to some activity within the control of the subject that properly captures the intended contribution of the subject to the overall goal of the establishment. Originating in business, they have now invaded all aspects of life. Academia, civil service, hospitals and other public services all have targets for performance and efficiency. Numbers of publications in journals, time taken for emergency services to answer a call, numbers of cancer operations performed—performance indicators and accompanying targets are ubiquitous. They are not without perverse consequences. They draw attention to what can easily be measured and they may focus attention on the easiest way of meeting targets rather than doing the best job in a wider sense. For example, a national health hospital in the UK might be tempted to operate on the easiest cases and send the most difficult as an overflow to private clinics.

By extension from their use to measure the performance of components within a big system, indicators are also used to measure the performance of a large unit in meeting a complex goal such

as sustainable development. For the immediate purpose, a seminal event was the undertaking at the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992, contained within Agenda 21 (UNCED, 1992).

> "Indicators of sustainable development need to be developed to provide solid bases for decision-making at all levels and to contribute to a self-regulating sustainability of integrated environment and development systems."

A working list of 134 indicators and methodological guides was eventually agreed upon and has been adopted by many countries. In developed countries, even small municipalities have elaborated indicators for their activities, but there is no penalty at any level for not doing this and no prescribed frequency of reporting. The process, and subsequent events, stimulated an immense amount of research on the topic. An excellent compendium of indicators of sustainable development was constructed by the International Institute for Sustainable Development (IISD) in 2002; their database is accessible by Internet and is regularly updated, (IISD, 2002). IISD was also commissioned by the UN Division for Sustainable Development to recommend improvements to the Agenda 21 approach (Pintér, Hardi & Bartelmus, 2005).

2.2.1 *The value of intermediate indicators of policy*

Cust (2008) has reviewed the use of intermediate indicators in a variety of contexts with the aim of understanding their potential role in informing and supporting reporting of climate change. Intermediate indicators, we recall, are those that verify our underlying behavioural theory of how the policy works. They intervene between input and impact indicators and cover output indicators that demonstrate the progress made in implementing the measures and outcome indicators that measure the effect on the regulated subject. He looked specifically at experience from the compilation and use of intermediate indicators for Sustainable Development in the UK, for agri-environmental programs under the EU Common Agricultural Policy, for science and technology policy across the OECD and for the EU Special Programme for Development Assistance in Africa. The review covered also the use of key performance indicators for firms in the construction industry in the UK.

The review emphasizes the considerable capacity that exists in industrialized countries to design, compile and interpret information using indicators and it demonstrates that intermediate indicators can help actors discuss and formulate policy options, design policy and improve performance. Finally, it concludes that intermediate indicators offer promise in facilitating greater cross-country cooperation, transfers and policy learning with developing countries in reporting domestic policies for climate change.

The review sounds a few cautionary notes. It draws attention to the limited capacity of developing countries to provide timely, comprehensive and reliable data. This, it notes, was a challenge for the application of indicators to the Special Programme for Africa. To apply current land-use, land-use change and forestry reporting systems to developing countries would require considerable time and money. Similar or greater difficulties might be expected in reporting indicators of policies for energy efficiency as, by their nature, these affect thousands of industries and millions of consumers. The review also records difficulties of Annex 1 parties in providing ex-post evaluations of the effects of policies and measures, even partially.

The experience of using indicators within the agri-environmental programs in the EU was also previously reviewed by Wilson and Buller (2001). Their analysis emphasized the complexity of identifying appropriate indicators and the difficulties of measuring them. They analyzed uptake, output, actor-related and procedural indicators and concluded that, although indicators were important tools to evaluate agri-environmental policy, their role is limited and the notion of what constitutes an indicator needs to be re-examined.

The paradigm of indicators and policy as constituting a continuously reinforcing feedback system may create its own problems. Wilson and Buller (2001) identified several distortions in policy introduced at different stages by using indicators. They found that policy design was directed towards instruments that could be measured; policy implementation emphasized targets that could be measured, and eventually improvement in indicators began to replace achievement of real benefits as the aim of policy. Specifically:

- Indicators may reinforce the design of policies that are easily quantified and may, therefore, increase the gap between policy instrument and policy success in the more problematic areas. We noted earlier that compliance is an important limitation on policies of energy efficiency.
- Once policies are agreed upon, less easily quantifiable targets may be neglected in favour of those that are easy to measure.
- Any published indicator takes on a life of its own beyond its original meaning; policy-makers are led to improve the figure but not necessarily to improve the underlying problem. This is an argument in favour of a wide range of indicators that can capture the dissipation of effort.
- Indicators cannot describe causality and only through the addition of many assumptions regarding baseline can they be considered plausibly to measure the effects of policy.

2.2.2 *Doing Business report*

This section presents some of the findings from a complex and influential product of the World Bank Group designed to identify by a system of indicators the best environments in the world in

which to establish a business. It has no direct relevance to sustainable development, but there is much experience from which we can learn.

The *Doing Business* evaluation is conducted by the World Bank and the IFC; the latest version is *Doing Business 2008* (World Bank, 2007). It was first conducted in 2004 and has been repeated annually thereafter; the whole exercise was evaluated by the Independent Evaluation Group in 2008 (World Bank, 2008b). This evaluation provides much insight that can be helpful in constructing a global report on the stringency of energy policy. It faces similar problems of identifying indicators to capture the essential elements, of finding mechanisms to measure those indicators and then finally of coming to some comprehensive judgement of whether policy is "good" or "bad," "better" or "worse." It grapples with the dilemma of balancing theoretical and practical merits.

Doing Business measures the burden of regulation to which business is subject in 178 countries and ranks the countries on 10 dimensions. It is conceived from the point of view of a company trying to establish a business in the country concerned and therefore tends only to record the disadvantages of regulation in this respect and to ignore the benefits that may accrue in social and environmental terms. It has been rightly criticized for this, but this deficiency does not matter here; we are concerned with what can be learnt from its experience of trying to do the task that it aims to accomplish, which is to advance the private sector development agenda of the World Bank Group.

Doing Business collects its information from often quite small groups of people who are considered to be knowledgeable about the relevant laws and regulations in the country concerned. These can be lawyers, accountants, officials or firms, especially international firms. The number of informants on each topic in a country is small. The evaluation revealed that the report is based, on average, on between one and four completed questionnaires per topic with some supplementary consultations. This must be a serious limitation on the reliability of the study. The limitation is not a critical limit to the value of the indicators in benchmarking progress and stimulating debate in a specific country. But it would be a concern if the data were used to make comparisons between countries. It is hard to accept that, if different informants were used, then the comparative ranking would be broadly unchanged.

This was also the view of the Independent Evaluation Group (World Bank, 2008b). Perhaps the most significant finding of the evaluation that should give pause to any emulator is that:

> the indicators have been highly effective in drawing attention to the burdens of business regulation, but cannot by themselves capture other key dimensions of a country's business climate. [...] [T]he Bank Group and stakeholders need to consider the DB indicators in a country context and interpret them accordingly. (World Bank, 2008b, p. xv)

This apparently obvious and innocent observation is rather important if it is intended to make any system of indicators a basis for reward. If the result of a system of indicators has still to be interpreted in a country context, then it cannot form a reliable basis for comparing one country to another. The evaluation also notes that: "The relevance of each indicator in a given country depends on the extent to which the law is actually applied, which DB does not aim to measure" (World Bank, 2008b, p. xv).

This, again, is a salutary observation. It is relatively easy to know whether a law exists; it is much more difficult to know whether it is effective. As noted on several occasions in the review of policy instruments in Part 1, regulatory compliance (or enforcement) is what developing countries find most difficult. Any effort to provide reliable cross-country measure of energy policy stringency will need to find reliable measures of how policy is enforced; if it cannot then it must moderate its goals.

There was also some doubt expressed as to the value of the DB indicators for planning and organizing reform. Most of the people interviewed by the evaluation team thought the indicators had value in motivating future reforms. Less than half thought it helpful as a contribution to planning future reform because it offers little guidance about the priorities among activities, their sequencing and coherence.

We should also note that the evaluation found that there is little empirical evidence to confirm that the intermediate indicators measured in *Doing Business* are correlated with impact indicators of what the evaluation is intended to reveal. Admittedly, the time series is not long; *Doing Business* only started in 2003, so this finding is built on shaky ground. Commander and Svejnar (2007a) found little evidence that the intermediate indicators have a robust relationship with business environment constraints and firm performance, as measured by revenue efficiency. A background paper commissioned for IEG evaluation, which is referenced by the IEG report to their Web site but is not there, apparently found no statistically significant relationships between the 2004 *Doing Business* indicators and growth rates. Another analysis by Commander & Svejnar (2007b) of the same material found that the impact of the business environment variables was very limited.

These cautionary findings are important and we summarize them baldly:

- After all the work has been done, countries cannot be directly compared.
- The indicators offer little guidance in implementing policy reform.
- The relevance of each indicator depends on how well provisions have been enforced.
- There is little evidence that intermediate indicators are simply related to impact indicators.

The assimilation of *Doing Business* to an evaluation of the stringency of energy policy has limitations, that is obvious, but these findings must be taken seriously in any assessment of what might be achieved.

Finally, we note that the data from *Doing Business* have been used by researchers in more than 800 academic papers. So it has made a modest, but important, contribution to impact indicators for academia.

2.3 Indicators of energy policy reform

2.3.1 World Energy Council

The World Energy Council (WEC) is at present engaged in a study to assess energy policy and practice worldwide. The preliminary methodology has been published (WEC, 2008b). The study is not directly aimed at monitoring, verification and reporting requirements within the UNFCCC, but addresses a wider need for a methodology to assess the stringency of energy policy in different countries and, to some extent, to compare them. The study is motivated by the perception of the WEC that there is an urgent need to explore, understand and communicate the components of successful energy policy. The WEC argues that it is uniquely positioned to conduct such an assessment because of the country committees that it has created across the world that can provide and verify data.

The methodology being used has three elements. The principal element is a macro study using weighted indicators to produce ranking within four main areas. This is complemented by a study of particularly effective policy measures within each country. Finally, countries are compared within five clusters to ensure some degree of similarity among the members of each group.

The four main areas considered by the assessment are the fitness of institutions (with two sub-areas), the economy (six sub-areas), social capacity (three sub-areas) and equity and the environment (two sub-areas). Within each sub-area there are specific attributes to be measured by indicators; there are thirty-two indicators in total. Weights are attributed to each indicator by application of principal components analysis. The WEC has cast its net widely, on the grounds that factors indirectly shaping performance are as important as factors that directly shape performance. Given this wide interpretation and the few indicators within each area, there is a high degree of aggregation in the indicators, and consequently in the overall ranking. Most of the information is taken from existing published indicators from the IEA, World Bank, IMF and the UN. Indicators include, for example, the rule of law, GDP growth rate, the Gini coefficient and power system reliability. There are no systematic indicators at the micro level, for example, appliance or building standards, financial instruments, support to audits and ESCOs. The micro level will be covered essentially anecdotally by analyzing particularly effective polices in each country.

The comparison of countries is planned to be made within five clusters defined by the level of income and the level of energy imports. This is a reasonable approach, and the comparison is probably acceptable at the high level of aggregation at which the WEC study operates. It might be more difficult to justify at a micro level, because as the WEC recognizes, "there is no ideal policy or suite of policies."

The study will surely meet the objective for which it is designed, providing a basis to compare, in a broad sense, the general political environment for sound, fair and effective energy policy and will contribute to a better understanding of the conditions under which different policy instruments work best. It does not, however, offer a basis on which to provide monitored, verified reports of progress in policy to foster energy savings and emission reductions. It lacks the level of detail and tangibility to be convincing in this respect.

2.3.2 *Policy-based commitments post-2012*

Neij & Astrand (2006) have developed the arguments in favour of outcome indicators to evaluate commitments to the reform of energy policy. They emphasize that evaluation of impact does not inform understanding of how policy instruments are affecting behaviour and technical change. To capture this information, one needs indicators that describe behaviour and technical change. These are outcome indicators in the previous discussion. Different indicators will be needed for different technologies because their behavioural consequences will be different.

Each indicator will need its own baseline that shows what would have happened in the absence of the intervention. It will also be necessary to prescribe an individual monitoring methodology, because all the indicators will need a different approach. These are demanding tasks and controversial. The authors describe such an evaluation for a Swedish program to promote new efficient energy using equipment. Initially the indicators described improved performance and price. Subsequently the set was extended to include sales data, market share, changes in the product offer and change in knowledge, attitudes and behaviour.

Evaluation showed that the outcome indicators improved understanding of how the policy worked and clarified the interactions between instruments, technology and institutions. They also helped identify where policy failed. It was not always possible to distinguish the effects of individual policy instruments because of their interactions. The technique is demanding in terms of data acquisition and in the professional skills of analysis. The work does not address the question of how outcome indicators would be integrated into negotiations under the UNFCCC and how, if at all, it could be used as a basis for reward.

A thoughtful analysis of the value of policy-based commitments as part of a post-2012 climate framework was made by the Pew Centre on Climate Change (Lewis & Diringer, 2007). In this perception, the policy-based approach creates an opportunity for developing countries to propose reform of national policies as a part of their contribution to the global effort. Such reforms would be voluntary and could range from economy-wide energy efficiency goals to sector specific standards. The analysis reviews the treatment of policy commitments in earlier climate negotiations; it recalls that the idea was prominent in the earliest discussions and that in 1991 the Intergovernmental Negotiating Committee for a Framework Convention on Climate Change considered and discarded similar ideas (UNFCCC, 1991).

> Another issue discussed at length by the Working Group was the possible inclusion of a section on national strategies and programmes. [. . .] This section did not find favour with many developing countries as it would constitute an interference in their domestic policy. As a means of ensuring the implementation of commitments on sources and sinks, reference was made to the concept of pledge and review.

The European Union, with its history of negotiated common policies, supported common and coordinated policies and measures. The United States preferred binding targets allowing greater flexibility in choosing domestic policies; in this vision, policies and measures were means rather than ends.

The policy-based approach developed by the Pew Centre differs from earlier proposals. It is not proposed as the primary component of effort, but as one of many forms of commitment into which developing countries might wish to enter and, unlike the harmonized policies and measures envisaged in early discussions, these commitments would be voluntary and tailored to national circumstances. The justification advanced for reviving the policy reform as an option is that a targets-only approach is not politically feasible in the post-2012 timeframe. Developing countries understandably see quantified emission limits as prejudicial to their main goals to pursue economic and social development and to eradicate poverty.

Among the instruments envisaged are technology standards, pricing reforms, and tax and other incentives, among others. The authors identify three priorities:

- To promote energy efficiency and conservation (e.g., energy intensity goals, vehicle fuel economy standards, building codes, appliance standards, industrial efficiency standards);
- To promote low- or no-carbon fuels and technologies; and
- To encourage carbon sequestration in land use and forestry practices.

Their analysis gives as the example that a country may offer to reform domestic energy policy, including specific policies such as efficiency standards for appliances or buildings, vehicle fuel economy standards, or efficiency targets in key industrial sectors. This is clearly very close to the ideas examined in the present paper.

Policies must be acceptable to other parties and therefore must be "tangible, meaningful obligations, not simply pledges." The central methodological element would be the judgements of an expert body to evaluate the expected impact of proposed policies and measures on emissions. On this basis, commitments would be negotiated among concerned parties. Implementation would be verified through periodic reports on progress. Submissions could be reviewed by competent judges to confirm compliance, judged on how well a country implemented its commitment, not on the achievement of a particular emission result. This is a critical methodological step. The basis on which these competent judges would make these decisions is not elaborated.

In parallel with the acceptance of the developing countries, the developed countries would provide incentives in the form of capacity building, technology transfer and finance. The main thrust of the proposal from the Pew Centre is to extend concepts from the CDM to incorporate policy commitments, aligning credits on expected outcomes of policy efforts. Policy-based crediting would face the same fundamental problems of additionality and verification as the CDM, but on a far larger scale; an alternative scheme of reward is to offer grants to help develop policy or long-term concessionary loans by financial incentives for low-carbon technologies.

A second important methodological step is the quantification of emission reductions to be expected from a commitment. Within the scheme proposed by Pew, this would not be the basis of reward, but it would be necessary for the negotiated agreement. It is not an easy assessment. It is hard to predict the influence that policy instruments will have on behaviour and it is still more difficult to estimate how well they will be enforced or administered. For example, a system of financial incentives for investments in energy efficiency may have little impact if loans are given to bad projects or are not disbursed at all. A system of mandatory audits will have no impact if there are no flanking measures of standards, incentives and information dissemination to facilitate the implementation of audit findings. These problems are addressed in the Pew Centre analysis, but their approach is not entirely convincing. In the case of energy efficiency standards, for example, they propose that emissions reductions be assessed by estimating the number of devices being replaced, multiplying that by the average savings of the devices being replaced and by the average number of hours the device operates annually. After adjustment with an emissions coefficient, this leads to GHG emission reductions. The authors admit to the uncertainty surrounding most of the data and the need to improve this, but they feel the approach is workable. The key judgement is whether the poor quality of the data means that the approach is unreliable, but operational or whether it means that the approach is without value. We will return to this question.

Tirpak (2008) has attempted to analyze the effectiveness of policy instruments for energy efficiency in supporting mitigation. His evaluation considered four criteria:

- the effectiveness of policies in achieving the intended environmental benefits;
- their cost-effectiveness;
- their distributional consequences (i.e. the extent to which instruments were fair and equitable); and
- their institutional feasibility (i.e. the extent to which instruments could be easily introduced into the legal, institutional and cultural environment).

The evaluation concluded that it was "difficult to rank policy instruments in an objective manner." To some extent this conclusion stemmed from the difficulty of weighting the separate criteria, which is a "subjective question, left to policy makers to decide" (Tirpak, 2008, p. 89). (It is not clear that all four criteria need to be measured for the purposes of the MVR requirements of the Bali Action Plan. They are obviously critical for the process of internal selection of instruments, but for the measurement of their impact on climate change a smaller set of criteria is adequate. Even so, the assessment made clear that ranking within a single criterion was challenging; again the author stressed that the effectiveness of most instruments depends on how well they are enforced. It is essentially impossible to rank instruments per se without consideration of the institutional environment in which they are implanted.

2.4 Impact indicators

2.4.1 Their application

Several authors have proposed mechanisms for achieving verifiable reductions in emissions that implicitly or explicitly adopt impact indicators.

The Centre for Clean Air Policy proposed in 2006 a scheme for extending the processes under the CDM to programs of activities that would result from adoption of specific policy measures (Schmidt, *et al.*, 2006). The proposal draws upon the conclusions of the UNFCCC conference held in December 2005 in Montreal where the parties decided (UNFCCC, 2005):

> that a local/regional/national policy or standard cannot be considered as a clean development mechanism project activity, but that project activities under a programme of activities can be registered as a single clean development mechanism project activity provided that approved baseline and monitoring methodologies are used.

Despite the first phrase, which appears to disallow the idea, this decision does seem to open the door to the inclusion of some policy instruments under the CDM. The proposal advanced by the Centre for Clean Air Policy was that such an arrangement has the potential to provide positive incentives for developing countries to adopt government policies, standards or goals, for example in energy efficiency that could be treated in a similar manner to CDM projects. The authors examined how this could be monitored. The discussion presupposes that monitoring will attempt to measure the emissions that can be attributed to the program (or policy), not evidently by tracing every single physical alteration from the baseline, but by sampling and inference. This still seems a daunting task.

The same institute later proposed a sectoral approach to GHG emissions reductions in developing countries, in which the ten highest-emitting developing countries in the electricity and selected industrial sectors pledge to meet voluntary, "no-lose" GHG emissions targets. No penalties are incurred for failing to meet a target, but reductions beyond the target earn emissions reduction credits (ERCs) that can be sold. Participating developing countries establish initial "no-lose" emissions targets, based upon their national circumstances, from sector-specific energy intensity benchmarks that have been developed by independent experts (Schmidt, *et al.*, 2008). Industrialized nations then offer financial and technical support to overcome barriers to technology transfer and deployment and as incentives to adopt more stringent emissions targets. The arrangement is proposed to include only the ten largest emitters in each sector on the grounds of simplicity and the fact that they constitute a disproportionate part of emissions. These attractions are evident, but such a restriction would cut off other developing countries from enhanced access to technology assistance and would be challenged. It is not a critical part of the proposal as an extension to include all other countries that wished to participate would not be especially troublesome.

The scheme functions on the basis of impact indicators, normally energy intensity of unit of product. The pledges made by participating developing countries would be determined by negotiations with the industrialized nations, based on benchmark energy intensity levels for major processes within each selected industrial sector as determined by panels of international experts. Agreement could be difficult as what is reasonable will be influenced by existing circumstances and the likely future of the industry within the country concerned.

The authors suggest that separate benchmarks be developed for new and existing facilities in each sector to reflect the differences between the technical availability of emissions reduction technologies, the cost of retrofit technologies versus new facilities, and the degree to which existing facilities have been fully amortized. But this is only the tip of the iceberg in terms of potentially influential factors; feedstock composition, product composition, ambient temperature, market positioning, and probably many other factors could be introduced. Once agreed upon, the energy intensity indicators would be converted into reductions of greenhouse gases and thence to tradable credits.

An alternative version of "pledge and review" has been elaborated by other authors (Winkler, 2008; Winkler & Davidson, 2002) and was proposed by the Republic of South Africa at a workshop in the framework of the convention under the formula "Sustainable Development Policies and Measures" or SD-PAMs. In this approach quantified reductions in emissions of GHGs would be achieved as co-benefits of actions motivated by local sustainable development; essentially the approach depends on the multiple benefits of "win-win" policies. A country would propose policies and measures that would primarily improve the sustainability of its own chosen development path and commit to implementing these with their own resources or with assistance. These SD-PAMs would have to be accepted by the international community and entered into a register. The proposal from the RSA envisages no further reward for the developing countries other than the co-benefits to domestic sustainability. There is therefore limited need for MVR. If the measures were implemented with the help of and possible technical assistance and finance from developed countries, then international review would presumably be needed. Among the instruments that could be included in this scheme are most instruments of energy efficiency; these generally create economic benefits and lower local, regional and global environmental impacts.

Winkler, Höhne & Den Elzen (2008) envisage that the effectiveness of policy should be judged by impact indicators. They have proposed four methods to quantify the impacts of such SD-PAMs: through case studies, national energy modelling, GHG intensities of different sectors and by global models. These different approaches might help one understand the impacts in general terms, but would not be sufficient to support the rigorous MVR requirements of the Bali Action Plan.

2.4.2 *Determination of impact indicators*

There has been much work on the determination of energy impact indicators, especially in developed countries. Since 1997, the International Energy Agency has been developing sets of indicators that convey how much energy is used for various economic and human activities (IEA, 1997). The work covers vehicles, industry and households and estimates GHG impacts as well as energy use.

More recently, the IEA has extended its data gathering and analysis to developing countries and has provided considerable technical support to improve the quality of data. There is nevertheless much that still remains to be done. The IEA declared recently that analysis of energy use, even in IEA countries, remains constrained by data quality and comparability (IEA, 2008). In non-IEA countries there is little or no detailed data available for most countries. Only aggregate information is available and even that is sometimes of doubtful accuracy. The situation is improving; the Asia-Pacific Economic Cooperation (APEC), are developing indicators and there is also activity in some large developing countries such as Mexico, China and South Africa.

Detailed data for industrial energy use is hard to obtain in both IEA and non-IEA countries. Reporting of industrial activity is generally not detailed enough to calculate physical indicators at a high level of disaggregation, for example energy use per tonne of different types of paper. The IEA report indicates that here also industry is beginning to address the issues.

The implication of this discussion is that the kind of data needed to construct reliable indicators of impact in developing countries is not available. Each analysis for each country is likely to need its own dedicated data gathering and analysis. There are three aspects (Garnier, 2009):

- Collect, process, release the necessary detailed statistics;
- Exploit the statistics, build indicators, analyze them to propose actions;
- Exploit the indicators, look at proposed actions, take decisions for policy and actions.

Much work is being done, but the task is enormous. The International Atomic Energy Agency (IAEA), in collaboration with several concerned international agencies, has developed a methodology to determine indicators of sustainable development, including energy indicators (IAEA, 2005). This was implemented in a joint project with the United Nations Department of Economic and Social Affairs (UNDESA) in Brazil, Cuba, Lithuania, Mexico, Russia, Slovakia and Thailand (UNDESA, 2005). The case studies were developed in each case by local research organizations. Some indication of the amount of work required is conveyed by the document of nearly 500 pages.

2.5 Input indicators

The Bali Action Plan requires not only that commitments to NAMAs be monitored, reported and verified, but also the inputs of technology, financing and capacity-building.[4] The indicators required are relatively straightforward as they comprise money, man-power and equipment. More cumbersome would be the recording and verification. It would help in this if resources from developed countries were channelled through a single institution, such as GEF. It will also be necessary to ensure that developed countries in some way make a fair contribution to this process and this could also be better judged with a single point of disbursement.

We do not go into these issues here in detail, but simply note that they have to be settled.

[4] It was noted above that there is no consensus on this interpretation of the text.

2.6 Lessons

In this section, we attempt to draw some conclusions about the practicality of using energy indicators for MVR as envisaged by the Bali Action Plan.

2.6.1 *Outcome indicators*

We draw the following conclusions from the review of outcome indicators:

- Outcome indicators help follow and understand the implementation of policy.
- Outcome indicators are expensive to collect and demanding of resources.
- There are no readily available sets of outcome indicators for energy policy in developing countries—they are a function of the policy set adopted.
- Experience in other contexts suggests it is very hard to use outcome indicators to compare implementation of policy in different countries.
- The relationship between outcomes and impact can be remote; it is strongly influenced by the complementarity of chosen policy instruments, the environment in which they are located and the skill and extent of enforcement.
- It is difficult to see that outcome indicators could be a basis to judge large scale transfers of resources.

2.6.2 *Impact indicators*

We draw the following conclusions from the review of impact indicators:

- Much data is available on energy end use, especially in developed countries. There are however severe deficiencies, especially in developing countries.
- Impact indicators are theoretically suitable as the basis for calculating large-scale transfer of resources, but will require much work.
- There would be the same problems of baselines and additionality as in the CDM.
- A measure may affect different indicators, but this is not a problem—if a measure contributes to reduce two impacts it is reasonable to credit it twice.
- Double counting of impacts must be avoided (e.g. improved appliances will reduce energy use in buildings, this must not also be counted in improved building performance).
- Considerable work and capacity building would be needed to bring the data to the level that would be required.

2.7 Recommendations

2.7.1 *Indicators to reward performance*

Much good work has been done in technical assistance for the reform of energy policy, and there are some significant achievements. The single biggest obstacle is a lack of priority in government. Governments are generally preoccupied by external and internal security, by delivering growth and employment and by health and education. Energy is a relatively low priority, and within the energy sector the main emphasis is on ensuring adequate infrastructure and secure, low cost supply. Energy efficiency and the reduction of GHG emissions are not priorities—there is no big pay off that justifies the effort required to overcome the sometimes significant obstacles.

2.7.2 *NAMAs*

If the adoption of NAMAs were to become a significant source of financial transfers this would change the perceived priority of energy efficiency policy and price reform. This innovation would need to be accompanied by a considerable effort on the part of developed countries in terms of financial assistance, technical assistance and capacity building.

The use of outcome indicators as a basis for reward is not feasible. The necessary indicators simply do not exist in developing countries, and the relationship between outcomes and impact is too complex to give comfort that, in rewarding effort, one is also rewarding impacts and contributing in reality to mitigating climate change. The relationship depends too strongly on factors that cannot be accurately assessed, such as the complementarily of chosen policy instruments, the environment in which they are located and the skill and extent of enforcement.

Only impact indicators can give this comfort with any degree of certainty. Even here there will be many difficulties. The problems experienced with the CDM in baseline definition and additionality will be magnified many times (but on the other hand, the number of projects under scrutiny would certainly be much smaller). Many indicators will be required, reflecting multiple policy instruments. The data to be collected and analyzed will be more difficult because it applies to large groups of users rather than to individual projects.

Definition of methodologies and accreditation of NAMAs would need to be done on a country-by-country basis by an international pool of experts. The work would be significant and would probably require dedicated data-gathering and analysis. It is unlikely that the necessary data to support such work will exist in country. Measurement and verification of the impacts of NAMAs will also require a considerable effort in national monitoring of markets to detect changes in behaviour and technology. Detailed analysis will be necessary. It will be important to ensure that these national efforts are put in place along with the NAMAs. In this respect, our proposal parallels that of the

Centre for Clean Air Policy (Schmidt, *et al.*, 2006).

Impact indicators could then be a credible basis for reward through the creation and trade of carbon reduction credits. It might be argued that there is no need to look at the impact of individual policy instruments and that all that is required is to monitor the overall or sectoral performance of the country against some agreed emissions target. NAMAs are then a tool not a means. This runs against the spirit of the Bali Action Plan that sees NAMAs as interim ends. An impact indicator and rewards linked to a single policy instrument gives comfort to a country that, after a big effort in some area, the benefits that it expected will not be eradicated by some massive increase of emissions elsewhere in the economy. Impact indicators for policy instruments are a reasonable balance between complexity and accurate relationship of reward to effort.

A process for assigning value to inferred GHG emission reductions under NAMAs needs to be determined. It should be significantly discounted from the value of carbon in trading systems because there will always be significant risk that the GHG emissions consequent on the policy are over-assessed. It is in the nature of most of the measures described here that they are win-win—they are directly beneficial to developing countries and logically should be implemented without external support. Additionality will not be provable in most cases. The value of the emission reductions should therefore not be aligned on the value of the reductions that are genuinely additional.

The most practical approach is to set the value of emission reductions under NAMAs at a level that makes NAMAs work. One way of doing this would be to set maximum quotas for NAMAs within trading systems. The quotas would represent the maximum reductions that the industrialized countries are prepared to support in a first instance. Initially, reductions might be tradable at par to other certificates, but the offer would be small. As the offer of NAMAs increases, so the price for emission reductions under the PAM scheme would fall. The disadvantage of this scheme is that it increases perceptions of risk to the developing country as there is no guarantee of the future value of the reductions achieved. It does, however, manage the concern of developed countries that they would be paying for vast quantities of emission reductions that are profitable anyway.

2.7.3 A reduced set of indicators

The Table 7 contains possible sets of output, outcome and impact indicators that would be appropriate for the energy efficiency policy instruments that we reviewed above. It is not intended as a definitive proposal, which would take a great deal of work and negotiation, but is simply included to provide a concrete idea of what would actually be needed.

Table 7: Output, outcome and impact indicators

Corrective Measures	Outputs	Outcomes	Impacts
Price Reform	Policy commitment to defined schedule for raise prices to economic costs	Creation of free competitive energy markets, or Clear administered link to international prices with specified frequency of review	Prices that reflect opportunity costs Overall reduction in energy use or CO_2 emissions per unit of GDP
Institutional and legal reform	Primary energy efficiency law approved by legislature Provisions for energy agency Provisions for standards and labelling Provisions for audits Provisions for financial incentives Obstacles to private energy service companies removed	Energy agency established with adequate budget, staff and powers Regulations for labelling of specified products Regulations for financial incentives Funds and resources assigned to pilot ESCO activities Regulations for minimum energy performance standards for specified products	No direct impacts
Labelling	Regulations for labelling of specified products	Certified testing sites established or identified Protocols for testing agreed Manufacturers invest to produce new designs Labels approved Appliances labelled Compliance systems introduced Procedure for periodic review	Numbers of high performance appliances bought Average energy use per group of appliances decreases
Financial incentives for audits	Regulations for financial incentives, including defined funding mechanism and responsibilities for implementation	Funding mechanism implemented Transparent, non-discriminatory system of access published and in operation Loans made Number of audits made Quality of audits evaluated	Energy use per unit of output in target group
Financial incentives for investments	Legal provisions for financial incentives, including defined funding mechanism and responsibilities for implementation	Funding mechanism implemented Transparent, non-discriminatory system of access published and in operation Volume of loans made Volume of funding from private banks Effectiveness of loans	Energy use per unit of output in target group

		evaluated Investment in energy efficiency	
Energy service companies	Obstacles to ESCO participation removed Funds and resources assigned to pilot ESCO activities	Pilot ESCO activities implemented Number of contracts written	Energy savings from contracted activities
Standards	Regulations for minimum energy performance standards for specified products Legal provision to remove sub-standard products from market Building standards introduced	Certified testing sites established or identified Protocols for testing agreed Manufacturers invest to produce new designs Compliance systems introduced Procedure for periodic review	Percentage of non-compliant appliances Average energy use per group of appliances decreases Average use per square metre of floor area improves
Mandatory measures	Regulations for mandatory audits, appointment of qualified energy managers, compliance with performance targets, reporting.	Number of audits accomplished Quality of audits evaluated Investment in energy efficiency Number of managers appointed Procedures for setting targets established Number of targets set Number of targets met Number of reports delivered	Energy use per unit of output in target group
Corporate agreements	Regulations if compulsory scheme	Numbers of corporate agreements in place Volume of commitments agreed Post hoc evaluation	Energy use per unit of output in target group
Efficiency obligations	Regulation Rules for source and allocation of funds	Volume of funds disbursed Number of customers affected Behavioural changes noted Investments leveraged/financed	Energy use per unit of output in target group
Transport and spatial planning	Restrictions on import/assembly of vehicles to improve fleet efficiency Regulations to permit incentives to public transport Planning guidance	Improved efficiency of stock Higher use of public transport Better planning	Less energy use per vehicle/km Improved public-private modal split Lower energy use for transport per capita

2.7.4 The special case of grid-connected renewables

Grid-connected electricity from renewables offers special opportunities:

- They are rarely financially viable, especially if the impacts on system reliability are assessed; as noted earlier the implicit value of CO_2 avoided is far higher than that observed on carbon exchanges
- It is not reasonable to expect poor countries to bear the incremental burden

- The impact indicators are very easy to assess; electricity generated from renewables can be measured easily and the guarantee of origin is problem free

Certificates of origin could be purchased by developed countries. Such an arrangement stands in continuity with the mechanism of the bridging Directive of the EU that already allows CDM credits to be traded on the ETS. Some innovation would be needed. One option would be to allow developed countries to set the avoided carbon against their GHG reduction commitments. This arrangement would effectively credit the renewable investment with the value of carbon on the trading systems of developed countries. This would probably not be sufficient to call out large volumes of new investment; it requires in most cases prices higher than the avoided costs of carbon. This can be seen from the value of the feed-in tariffs in developed countries that exceed by a considerable margin the value of carbon avoided.

An alternative would be to allow developed countries to purchase certificates of renewable origin from developing countries and to set those against renewable portfolio obligations and/or the commitments in Europe to achieve 20 per cent emissions reduction and 20 per cent share of renewables by 2020. This would be simplest way of providing the huge investments that would be needed to mobilize large resources of renewable energy, for example concentrated solar power in North Africa. The idea is not easily adapted to the feed-in tariffs widely used in Europe, but they could be modified to run in parallel with an RPS scheme possibly confined to purchases from developing countries.

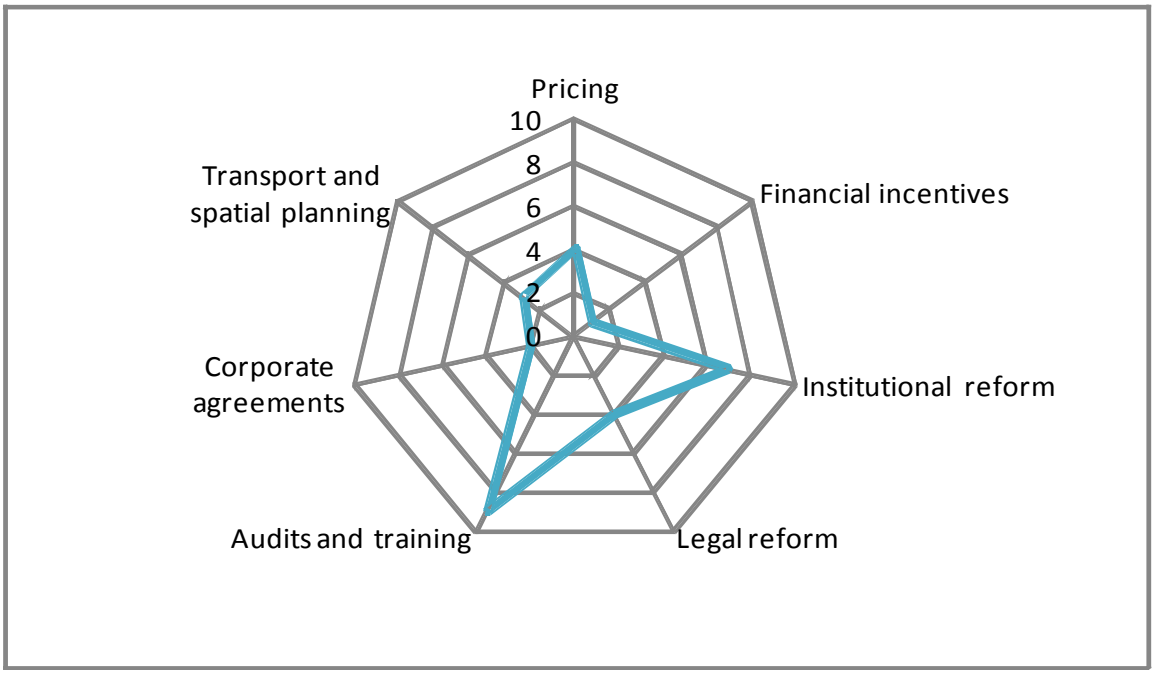
2.7.5 *Indicators to guide technical assistance*

Sustained, coordinated and well-targeted technical assistance is essential to maximize the potential of developing countries to contribute to mitigating climate change. There are several issues here:

- How can the amounts of technical assistance be rationally allocated to developing countries?
- How can the effectiveness of that assistance be monitored?
- How can it be recorded?

In this context, outcome indicators could be of value. The state of a country's energy policy according to some agreed-upon set of categories could be judged by an international panel, drawing on local knowledge, a little after the fashion of the *Doing Business* report, and the results then ranked and attributed a composite indicator. Performance in various policy categories is shown in Figure 5 for an imaginary country on a scale of 1 to 10.

Figure 5: Multi-criteria analysis of energy efficiency policy



A set of norms can then be constructed for the technical assistance to be offered for improving these composite indicators. Adjustments can be made for country size and salient characteristics of various sorts (income level, climate, area).

Implementation of the technical assistance and later evaluation would be guided by a more detailed set of outcome indicators according to the country requirements.

The process described here is complex and demanding of resources, but probably no more complex or demanding than the arrangements to deliver technical assistance as practised at present. The World Bank, regional development banks, multiple UN agencies and bilateral donors, all have large head offices and offices in most, if not all, developing countries. They assign immense effort to programming, planning, implementing and evaluating work. The arrangements proposed here could simplify those processes.

Finally, the technical assistance must also be monitored, verified and reported. This means that

developed countries will have to enter into binding commitments, according to some agreed-upon formula, to deliver money and resources for this purpose. To meet the MVR condition, contributions would either have to be registered centrally or disbursed through a central agency. The latter would be more efficient and more transparent.

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