Scaling up energy efficiency: bridging the action gap

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Background paper

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The demand for energy has been increasing faster than in the past, and at the same time energy prices are high and volatile, creating a serious problem of energy security for many countries. Considering that most energy is derived from fossil fuels, it is now accepted that increasing energy supply following the projected path is a grave threat to the global climate. Improving the efficiency with which energy is produced and used is important because this addresses policy objectives related to both energy security and the global climate.

In the Reference Scenario of the International Energy Agency (IEA, 2006) – that is with no interventions to change the trend – global primary energy demand will increase by 53 percent by 2030 compared to demand in 2005. During this period, oil demand is expected to go up by 38 percent and reach 5.8 billion tons, heightening vulnerability of oil importing countries to supply disruptions. Since most of the energy consumption increase (70%) is expected from developing countries, they are expected to face increased problems related to energy security.

The supply-side investment requirement in the Reference Scenario is very high - over $20 trillion in real terms over the 2005-2030 period; according to the International Energy Agency over 60 percent of this investment will be needed in developing countries and economies in transition. It would be a Herculean task for developing countries to find this investment capital, meaning that supply shortages that act as a brake on their economic growth can be expected.

The cost of energy shortages can be very high. According to one survey (WB, 2006b), lack of electricity services is a “major and frequently severe obstacle to doing business” for about 25 percent of firms in Latin America, 38 percent of firms in South Asia and 44 percent of all firms in sub-Saharan Africa. Without adequate supplies of energy far too many people in developing countries will continue to be denied access to modern energy and the services it makes possible. They will instead continue to depend on traditional polluting sources of energy to the detriment of their health.

Under the International Energy Agency’s Reference Scenario global carbon-dioxide (CO_2) emissions are expected to increase by a similar percentage (55%), reaching 40 Gt in 2030. This is because most of the increase in energy consumption (83%) is expected to be met by fossil fuels. This, in turn, will lead to an increase in atmospheric CO_2 concentrations, accelerating global warming and climate change.

The importance of energy efficiency

The Alternative Policy Scenario of the International Energy Agency sets out what could happen were energy security and climate abatement policies currently in the pipeline or under consideration to be fully enacted. By 2030 global CO_2 emissions would be 16 percent lower than in the Reference Scenario – and, most importantly, they would have peaked. Energy efficiency improvements are comfortably the most important measure to reach policy

objectives related to energy security and global CO_2 emissions in the Alternative Policy Scenario. Energy efficiency accounts for 40 to 53 percent emission reductions in the long-term projections to 2050 of the International Energy Agency. Other measures, including increased use of renewable energy and nuclear power, account for the rest.

Furthermore, improved energy efficiency also leads to economic efficiency. In particular, in developing countries where energy is in short supply, the increased availability of energy as a result of increased efficiency of its use leads to direct economic gains. The cost of investment in end-use efficiency improvements are half of those of comparable supply side costs. Simply put, energy efficiency improvements bring about synergetic gains in climate, energy and competitiveness priorities. (See also Appendix 1.) A detailed study of energy usage indicators in the member countries of the International Energy Agency from 1973 to 1998 found that, had it not been for improvements in energy efficiency, energy demand in these economies would have been 50 percent higher in 1998 than it actually was. A finding that reveals efficiency improvements made a greater contribution to the satisfaction of energy services over that time frame than any single fuel; including oil.

Rising appreciation of the benefits of efficient use of energy in recent years has led many governments to place increased attention on energy efficiency policies. As a result, successful experiences have been built up in many countries and these are being expanded. However, if the major opportunities are to be seized, the process of diffusion of energy efficiency measures, however, needs to be accelerated and coverage widened. The Finnish Government-sponsored Lahti conference on energy audits in 2006 was a step in that direction. The current workshop 'Scaling-up energy efficiency: bridging the action gap' is taking that effort further by providing a forum for sharing of successful energy efficiency implementation experiences amongst various stakeholders – and by considering what activities and mechanisms need to be put in place at the broader international level if a large proportion of the cost-effective savings opportunities are to be realised.

The potential for energy efficiency improvement

Estimates of the quantity of possible cost-effective energy savings vary but all studies indicate a large potential. The potential ranges from between 10 to 30 percent over the next two to three decades in industrialized countries (IEA, 2002) to between 50 and 90 percent in the case of new installations in developing countries and 20-50 percent in existing installations (Goldemberg et al., 1994). The World Energy Assessment (WEA, 2000) indicates possible primary energy savings of the order of 25-35 percent in industralised countries and up to 30-45 percent for developing countries owing to their old capital and vehicle stock. Potentials in transition economies lie somewhat in-between, with about 40 percent potential for energy savings being average.

The World Energy Council (WEC) has carried out a detailed study of the potential energy savings, and indicates efficiency opportunities in power plant performance improvement, energy savings in buildings, household appliances, industrial processes, and the transportation sector. The opportunities to save energy exist in every step in the energy value chain - from primary energy production to generation, transmission, and end use. The potential savings are high; for example plant efficiency in new power plants has improved to 45 percent from 30 percent, and can go as high as 85-90 percent for a state-of-the-art combined heat and power plant (WEC, 2006). For end uses, WEC estimates saving potential of 25 percent by 2020 and 40 percent by 2050, and suggests developing countries adopt a leapfrogging approach by installing the most modern technologies.

Both developed and developing countries need to pursue energy efficiency opportunities to reduce their vulnerability to volatile energy markets, increase economic efficiency and competitiveness, reduce future greenhouse gas emissions, and ensure that the energy needs of the poor can be met. Capital stock needs periodic replacement, which opens up the opportunity for developed countries to replace this with efficient stock. In the case of developing countries, new capital stock is being added continuously, and big gains in energy efficiency can be achieved by leapfrogging in technology selection for the new stock. Combining the technology with policy measures such as real-time energy pricing can lead to increased energy efficiency by influencing choices of the energy consumers.

Cost estimates to move to a lower carbon scenario vary widely but $40 billion dollars a year can be considered a reasonable figure (WB, 2006b). This seems manageable when compared with estimates of investment in energy by the International Energy Agency – $300 billion annually for developing and transitioning countries.

The EU estimates that using energy inefficiently costs more than €100 billion annually (EU, 2006). Energy efficiency is seen as the most effective way to improve security of energy supply, reduce carbon emissions, and increase competitiveness while realizing these savings. Development of a large market for energy-efficient technologies and products is also seen as a by product of policies favoring efficiency. The EU, therefore, has adopted an Action Plan for Energy Efficiency, with the objective to realize an EU energy saving potential of over 20 percent by 2020. This is expected to reduce CO_2 emissions by 780 Mt, more than twice the EU reductions needed under the Kyoto Protocol by 2012 (EU, 2006). The EU expects to achieve more than €100 billion in annual fuel savings through the initiative.

What is holding energy efficiency back?

What holds energy efficiency back is a combination of various market failures and imperfections, including imperfect competition, externalities, imperfect information, high transaction costs, and organizational failure. Appendix 2 indicates the types of market failures

and common market barriers faced by energy efficiency projects. The barriers to energy efficiency are well known and various governments have tried to address them through specific regulations or programmes. Government policies or programmes that aim at correcting these market failures inevitably run into generic barriers (not necessarily market barriers) at different levels in the economic sectors that created the market failures at the first place. These barriers interlink with each other and are difficult to solve with policies or programs that aim at removing only one or two barriers. Inadequate or inefficient policies themselves often in turn create more barriers rather than ease them. Barriers are often perceived to be more prominent in the developing countries than the developed ones, although they are widespread in both. These underlying generic barriers that cause market failures and create market barriers for energy efficiency include:

1. Financial barriers

Installation of energy efficient equipment, buildings and appliances requires additional funding, especially at the initial stages. Although the energy savings in the product use cycle would compensate for these additional investments and, generally, comfortably exceed the original extra costs, users often fail to choose energy efficient options. This is often due to lack of information on the relative efficiency of products and services, lack of information on the cost-effectiveness of energy-efficient choices, constraints in initial funding, and split- or insufficient incentives to make pertinent decisions. The financial sector can also be reluctant to finance energy efficiency projects due to their potentially high credit risks, small investment nature, and lack of financing history and expertise.

2. Limited technological expertise

In developing countries the current industrial base does not have sufficient energy efficient technological capacity, which manifests itself in two ways: insufficient capacity for designing and manufacturing energy efficiency products, and the inability to deploy energy efficient technologies and practices in the marketplace. Technological asymmetry also exists, more so in the developing countries; small and medium enterprises generally have less access to energy efficiency technologies than their publicly-owned counterparts and large private or multinational companies.

3. Barriers at the information level

Information barriers are often seen as one of the major factors impeding the efficiency of the energy market, both in financial and energy consumption terms. In less developed countries where information dissemination is generally weaker, information gaps are present in all aspects of the market: consumers lack knowledge to purchase efficient end-use equipment; producers have little knowledge about technologies that would enable them to make efficient products and do so efficiently; energy end-use providers are unacquainted with efficient technologies and thus unable to provide adequate information to customers; and decision

makers of firms lack effective management tools and procedures to account for the economic benefits of efficiency improvements. Many of these problems also occur in more developed countries but usually to a less degree.

4. Barriers at the managerial and individual levels

One of the largest causes of inertia is that energy efficiency is not a main concern for most businesses or individuals. This is possibly the result of combined barriers described above. Energy efficiency often interferes – sometimes even conflicts – with companies' and individuals' daily routines and tested-and-true common practices. It is often disconnected with short-term and long-term managerial goals such as increasing production or expanding market share. Policies and incentives often are not sufficient to get individuals to change their daily routines and conventional way of doing business. This "inertia" is evident in industries, designers and builders, and individual energy users.

5. Barriers at the institutional level

Governments, especially in developing countries, often have limited capacity in designing and implementing energy efficiency policies and programmes. Designing and implementing effective policies and regulatory environments requires resources, which have generally been undersupplied even in more developed economies. Even where there is a favorable regulatory environment, local governments – on whom the enforcement burden often falls – have a limited work force and little expertise to undertake all the tasks stipulated by law. Among the obligated tasks, supervision and inspection require large numbers of professionals with sufficient knowledge on energy efficiency and experience in various engineering fields.

What has been done and is being done?

Several countries, international agencies and donors have programmes to support energy efficiency measures. A brief sample of these now follows.

The G8 Gleaneagles agreement on Climate Change, Energy and Sustainable Development of 2005 committed G8 governments to take action towards a cleaner and more sustainable energy future, mostly via the promotion of energy efficiency. As a contribution to this effort the International Energy Agency is identifying best practices in energy efficiency policies in the major end-use sectors and will report its findings to the G8 summit to be held in Japan in 2008. The identified best practices are expected to fill the gaps in existing energy policies, address market barriers and save energy at low cost. Four recommendations –covering lighting, tyres, standby power and set-top boxes– were submitted to the 2006 St Petersburg summit and twelve more proposals –covering buildings, transport, industry and end-use equipment– will be submitted to the 2007 Heiligendamm G8 summit.

The G8 Gleneagle's summit also triggered new work in the World Bank on the development of an Investment Framework on Clean Energy and Development and within the Renewable Energy and Energy Efficiency Partnership (REEEP) to help support efforts in developing countries. The International Energy Agency is also in the process of initiating a new international Implementing Agreement to support collaborative activities on Efficient End-Use Electrical Appliances & Equipment.

At the national level the United States of America have implemented an Energy Efficiency and Renewable Energy Programme (EERE) to promote energy efficiency and renewable energy. The Energy Star programme in the US helps households and businesses identify efficient energy solutions, and has been very successful, with yearly savings reaching US$14 billion in 2006. Several other OECD countries have been able to increase the efficiency of appliances by setting standards, requiring efficiency labeling and other regulatory measures.

The recently adopted EU Energy Efficiency Action Plan (EEAP) sets out a comprehensive package of measure that requires member states to take a variety of actions and sets a goal of a 20 percent reduction in total primary energy supply by 2020. The measures include binding energy efficiency requirements for appliances, buildings, cars, and electricity generation; improving energy efficiency awareness; facilitating financing of energy efficiency projects; energy taxation; and setting up an information exchange mechanism on best practices. The EEAP seeks to transform the EU energy market into one where the most energy efficient buildings, appliances, processes, cars and energy systems prevail. The EU also plans, under EEAP, to promote energy efficiency in non-member states through agreements with trading partners and international organisations.

The European Union's Global Energy Efficiency and Renewable Energy Fund (GEEREF), to be launched in mid-2007, is an innovative financing instrument that offers new risk-sharing and co-funding options for various commercial and non-commercial investors, and maximises the leverage of public funds. The fund will provide support to renewable energy and energy efficiency project developers and SMEs in developing countries.

International organisations such as the World Bank, IFC, GEF, UNEP, UNDP and others have been supporting the promotion of energy efficiency in developing countries through a variety of projects. Since the GEF was established in 1992 it has supported $900 million of energy efficiency projects in developing countries. Ongoing and completed projects account for $600 million of GEF financing; with financing leverage of approximately five times the total project value, the total investment figure can be quantified at some $3 billion. GEF has successfully implemented energy efficiency projects in many developing countries, which can be helpful in identifying the conditions for project success. Now in its fourth phase, an allocation of about $350 million is expected for energy efficiency through the GEF's Operational Programme 5.

GEF-4 will focus on dissemination of experiences and lessons learnt and promote networking approaches for sharing information.

The World Bank group (primarily WB and IFC) has been the single largest investor in energy efficiency worldwide. The group has committed $447 million to energy efficiency projects in 2006, inclusive of funds from GEF and its carbon finance operations. IFC accounts for roughly 75 percent of this total. In 2004, the World Bank committed to scale up its support and adopted a target of 20 percent annual growth in lending for energy efficiency (and renewable energy) projects for the five year-period starting in 2005. The actual increase in investments in the energy efficiency area has surpassed the commitments in the first two years.

Several developing countries have also taken initiatives to improve energy efficiency, often with support from international agencies and / or donors. Many success stories on energy efficiency programmes are now available and there is a need to replicate and scale-up these efforts. Increasing interest in energy efficiency initiatives in developing countries means good recipient country demand, and interest in bilateral and multilateral efforts. For example, China intends to reduce energy intensity by 20 percent by 2010.

At the intergovernmental preparatory meeting to CSD 15 in New York, the EU urged all governments to adopt targets for energy efficiency improvements. Developing countries also supported measures to improve energy efficiency through the adoption of supportive policy frameworks, power sector reform, equipment certification, and labeling programmes. Developing countries will in many instances need support to achieve the targets they are increasingly setting for themselves.

Issues that the workshop will address

Improving energy efficiency is increasingly recognized as the most effective short term measure to reduce the emission of greenhouse gases as a means of mitigating climate change. An international conference in Lahti in 2006 highlighted the potential value of energy audits as a key technical tool in identifying energy efficiency investment opportunities, and called for a programmatic effort to advance its better international use. This workshop takes the initiative further and aims to explore how the experienced gained in past efforts to promote energy efficiency can be utilized to accelerate the process of reaching higher levels of energy efficiency. There is increasingly useful experience available from different efforts around the world that aim to promote better energy efficiency through a variety of measures, including support for establishing standards and labelling programmes, establishment of policy and measures databases, creation of financing support mechanisms, and various efforts that encourage (or require) energy audits, among others.

As noted earlier, although there is growing high-level political interest in energy efficiency, many countries have yet to put in place general and sector-specific policies that drive improvements in efficiency. In other words, there is an action gap that in part can be traced to lack of information on, or appreciation of, effective approaches taken by governments and other authorities. The workshop will suggest measures as to how the action gap can be filled and the potential of energy efficiency in reaching policy goals for energy, climate and development realised to a greater extent.

The overriding aim of the workshop is **to explore ways to scale-up the delivery of energy efficiency on an international scale**. In particular, it aims at achieving the following objectives:

- To identify promising approaches to realise energy efficiency improvements, in particular as regards their potential for replication and scale-up. Conditions under which replication of successful approaches is possible will be brought out, as will the specific gaps that need to be filled. This will be based on analysis of successful energy efficiency programmes as 'case studies' presented in the workshop and discussions.
- To sound out key development aid donors and recipients about their interest in developing energy efficiency projects and programmes based on these approaches.
- To provide policy recommendations for the consideration of the Commission on Sustainable Development, the G8 and other international policy debates.

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Appendix 1: Analysing Energy Efficiency

The phrase 'energy efficiency improvements' encompasses a potentially very large range of actions. Not surprisingly, 'energy efficiency' can be examined from a number of distinct perspectives – notably from the points of view of macro-economic trends, economic planning, policy design and micro-economic developments.

At a macro-economic level efficiency gains can be achieved, in principle, through both technological improvements and structural changes in the economy. However, the latter are not very amenable to direct policy influence and thus are not considered here.[i]

From an economic planning perspective, technological improvements can be realised in two broad sets of sectors: new and existing facilities. This distinction is useful in that the approaches utilised – regulatory tools or financing mechanisms – in each sector are often different.[ii]

From the point of view of policy design, labels and standards have proven to be the most cost-effective choice among an expanding set of instruments.[iii] Yet, they remain uncommon in developing countries, where second-hand appliances are popular, which reduces the scope and potential of these measures.

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i Structural energy savings are the result of broad trends in economic development – for example, changes in sources of industrial value added, which evolve only very slowly [WB, 2006a].

ii In the case of new facilities and in broad restructuring projects for existing facilities, regulatory tools are best suited to encourage investors to adopt energy efficient technologies. Conversely, publicly-backed financing mechanisms appear to be more appropriate for projects aimed at improving energy efficiency in existing facilities. A joint study [WB, 2006a] by the World Bank and the UNEP Risø Centre elaborates on these points:

> *Improving technical energy efficiency in new facilities is especially important over the longer term, and particularly in fast-growing economies. However, the individual investors who build new power plants, transport systems, industrial capacity or buildings must weight many factors in deciding on technology and designs, and energy efficiency is only one factor – and often a minor one to them. The challenge for governments in this case is to influence the broad technology choice decisions of investors, to encourage them to adopt energy efficiency solutions. The main tools which governments can use to intervene here are policy and regulatory tools.*
>
> *Reviewing how to improve energy efficiency in existing facilities, it is important to further distinguish among different markets and types of projects to decide the most appropriate ways to intervene. Often, major energy efficiency gains can be achieved through investment in broad restructuring projects – to revamp entire production processes in industrial enterprises, or overhaul urban transportation systems, for example. In these cases, too, energy efficiency is only one of many factors involved in the selection of technologies by investors, and the tools available to promote energy efficiency are again primarily policy and regulatory tools aimed at influencing those choices. In other cases, however, there are specific projects aimed at just improving energy efficiency – by replacing outdated boilers, utilising wasted heat or industrial gases, or installing more efficient electrical equipment, for example. Here, development and financing of specific energy efficiency investment projects is required.*

iii Commonly cited [WEC, 2004] instruments include efficiency standards and labelling for household electrical appliances, innovative financing schemes for energy efficiency, and negotiated agreements with large energy consumers or equipment manufacturers. In addition, reliance on local energy information centres is increasing, as is the packaging of measures (for example, audits and financing schemes), to provide flexibility to the regulated actors.

At the micro-economic level a breakdown of the economy into discrete sectors such as transport or power generation is often used. From this point of view there is broad agreement that very cost-effective efficiency gains can be realised in the building and, to a lesser extent, electricity generation and industry sectors.[iv]

[iv] As a part of a broader effort to review the "status and prospects for key energy technologies and [assess] their potential to make a difference by 2050", the International Energy Agency has published forecasts [IEA, 2006a] of the energy savings potential of "technologies that already exist or are under development". This analysis reveals that improvements in energy efficiency in the period to 2050 can reduce emissions of greenhouse gases by a factor of one-third to one-half, compared to the trends expected under current policies.
According to these forecasts, in the year 2050 and compared to a baseline scenario, commercially available energy efficiency technologies could bring about important savings gains in the buildings, electricity generation and industry:

- emissions of CO_2 from *buildings* would be reduced by over one-third, with electricity savings from space heating accounting for almost half of the overall emission reductions projected;
- emissions of CO_2 from *electricity generation* would be reduced by almost one-third through end use efficiency measures, while generation efficiency would have a much more modest impact;
- emissions of CO_2 from *industry* would be reduced by almost one-half through end use efficiency measures, while process innovation and product efficiency contribute by five percent each.

Appendix 2: Energy Efficiency Market Failures

The most common types of energy efficiency market failures and market barriers includev:

1. Externalities in energy prices:
   - the price of fossil fuels does not reflect the real costs of carbon and other environmental externalities.

2. Imperfect competition
   - due to imperfection information: financial institutions are not always familiar with energy efficiency projects and overestimate the risk factor, which ultimately puts these projects at disadvantage vis-à-vis traditional investments

   - due to subsidies: government imposed energy subsidies often distort the market in developing countries.

3. Information asymmetries:
   - imperfect information: banks are unfamiliar with the energy efficiency business model of using energy savings as a revenue stream guaranteed through performance contracts – and thus overrate the risk factor of these projects

   - perceived performance: investors are reluctant to finance energy efficiency projects where the impact on the company's productivity cannot be quantified from the outset, which is often the case.

4. Transaction cost:
   - financial scale: because energy efficiency projects are typically small they result in disproportionately high transaction costs, which makes them unattractive to financial institutions

   - hidden costs: fear of cost overruns associated with poor performance, transition problems, and internal (company) and external (financier) transaction expenditures undermine, often unduly, the confidence of potential investors

   - cost of debt and equity: energy efficiency companies are often thinly capitalised and rarely have sufficient collateral and track records to secure the capital needed for start-up, operation and expansion.

5. Organizational failure:
   - 'split-incentive': those who make decisions (such as landlords) save costs upfront by purchasing the least efficient equipment, at the expense of those who bear the costs (such as tenants) and without due regard to the overall return on investment.

v Based on [UNEP, 2006]: *Public finance mechanisms to increase investment in energy efficiency – a report for policy-makers and public finance agencies*. United Nations Environment Programme. Paris