An international catalyst for energy efficiency

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1. SYNOPSIS

Are governments' approaches to energy efficiency adequate, and correctly targeted? A more international focus and efforts to facilitate harmonisation would ensure wider implementation of measures.

2. ABSTRACT

The world's economies have assumed global dimension. So has global warming. Energy efficiency is one of the most immediate solutions to mitigate greenhouse gas emissions. OECD countries are developing, implementing or reinforcing policies and measures to meet their Kyoto targets. Are they doing enough, notably in the transportation and buildings sectors? Are approaches sufficiently international? Should differently structured programmes of more global dimension be created?

The present paper examines the effectiveness of regional or international energy efficiency efforts. In both supply and end-use of energy, national energy-efficiency programmes address very similar challenges. Are we not using the same type of car all over the world? While user habits may vary, do we not use the same components in computers, lighting systems, industrial motor drives in our western economies?

The relevance of the International Energy Agency (IEA) "Implementing Agreements" is described. These Agreements offer a unique collaborative framework to promote clean, energy-efficient technologies and policies.

The author concludes by examining the context and reasons for stimulating further co-ordinated energy efficiency efforts, among the OECD countries at least. Pointing to recent international successes such as the International Standby Power Initiative, the author offers recommendations to facilitate international harmonisation as a vehicle to ensure wider implementation of energy efficiency policies. Should individual countries seek a legal framework for international collaborative energy efficiency drives, organisations like the IEA can offer one.

3. GLOBALISATION

Historians will certainly one day look back on this first decade of the third millennium as the time when globalisation really began to bite. Information technology has eliminated the hurdle of distance and accelerated the pace of progress. Multinational corporations are becoming increasingly powerful. Technological innovation is no longer confined to the industrialised nations; it is boosting productivity and transforming the nature of industry around the planet. Globalisation has radically changed the way in which the world economy functions. Policy-makers can no longer address challenges in isolation. In fact, globalisation has worked to transform those challenges into opportunities. The effectiveness of governments' action can only be enhanced if policies are shaped in harmony with approaches shared by multiple nations. A global perception can only reinforce the ability of those policies to anticipate future mutations and prepare for them.

Has the interdependence of the world's economies contributed significantly to economic growth? And will it sustain the boom that raised growth in world output by an estimated 4.9% in 2000, the highest increase for 16 years? Time will tell. What is sure, however, is that stark regional contrasts persist between the prosperous

populations of the industrialised nations and those still struggling against serious poverty in the developing countries. Annual rates of economic growth may seem encouraging in parts of the developing world, but the wealth gaps remain wide. As we so frequently hear, an estimated two billion people in this world have no access to electricity and the improved standard of living it offers. Even where economic advances have been seen in what we regard as the developing world, the environmental implications are significant. The potential for cost-effective energy-efficiency improvements in these countries is estimated at between 30% to 45%, notably because of the age of the capital stock and motor vehicles.

The picture is thus rather grim in relation to CO_2 emissions and one of the most important challenges facing mankind today: global warming. Energy efficiency is as crucial within the climate context as it is – along with fuel diversification – in reducing dependence on oil. It is no accident that the International Energy Agency has been asked by the European Union's finance ministers to focus on measures to boost energy efficiency and diversification, and to lead a co-operative effort in this field. Suitable forms for this are presently being considered.

4. IEA'S GRIM ENERGY-USE AND CO2 PROJECTIONS

Projections from the International Energy Agency (IEA) confirm that, in spite of the Kyoto Protocol commitments there is every sign that CO_2 emissions are set to pursue their relentless upward path.

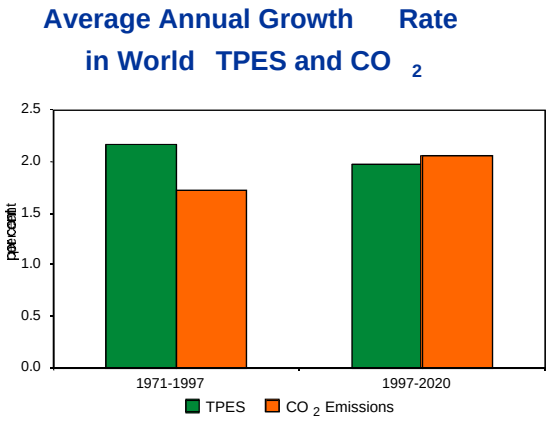
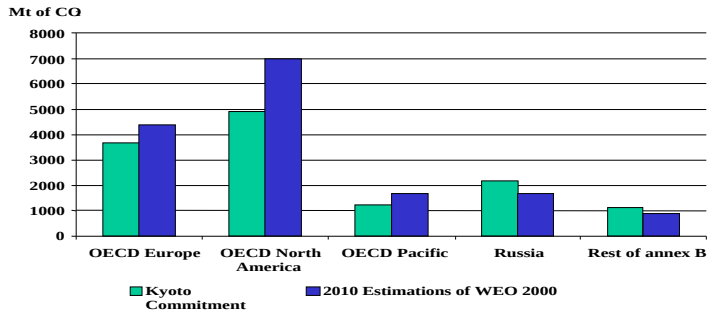


Figure 1

Source: *IEA World Energy Outlook,* 2000 edition.

Based on assumed economic growth of 3.1% per annum world-wide, the energy-use projections in the latest IEA *World Energy Outlook's* Reference Scenario point to an average annual increase in CO_2 emissions of 2.1% from 1997 to 2020. Unless the picture changes radically, we must therefore expect a 42% increase in global CO_2 emissions against 1990 levels by 2010, or an even more dramatic 60% increase against 1997 levels by 2020. Power generation in the developing countries is expected to account for almost one-third of the increase in global CO_2 emissions to 2020. This of course reflects the increase in global energy demand among the faster-growing developing nations as they industrialise, and as increased prosperity expands the acquisition of energy-consuming equipment. In China, for example, CO_2 emissions are expected to rise by almost 3.3 billion tonnes from 1997 to 2020, whereas the projected increase for the OECD area as a whole is not expected to exceed some 2.8 billion tonnes.

Figure 2. CO_2 emissions for Annex B countries



Source: IEA World Energy Outlook, 2000 edition

The scenario is alarming. While the Kyoto Protocol calls for reductions in the industrialised nations' CO_2 emissions by an average of 5.2% against 1990 levels by the period 2008 to 2012, we are instead threatened with a 42% increase in worldwide CO_2 emissions between 1990 and 2010; that is, unless governments act more decisively than at present.

Moreover, the Kyoto targets period from 2008-2012 is simply one staging post in what has to be an ongoing process of cleaning up our energy systems. Sustainability is all about making sure that whatever the current generations remove from the world's resources is counterbalanced by technological progress or other input that will be of equivalent or greater benefit to future generations. We must therefore regard the business of honouring the Kyoto commitments as part of the wider, longer-term task of de-carbonising our economies on a durable basis. If we wish to meet that goal then we should be targeting the reductions in CO_2 necessary to stabilise atmospheric concentrations of greenhouse gases at levels that do not result in catastrophic changes in our global climate. Scientists differ as to what emissions reductions are required to meet this obligation. But it seems clear that, unless we wish to take huge risks, we should reduce our emissions by 50% in relation to potential growth by the middle of this century.

Equally important, we must act now to reduce our dependence on imported oil products. In the European Union, for example, 50% of requirements are met by imported products. In the absence of adequate policy measures, that figure could rise to 70% over the next two or three decades. And something like 55% of the United States' oil is imported.

Many countries may be in a position to address both their fuel-mix needs and their Kyoto commitments through energy diversification. They will be moving to switch from coal to gas, from oil to gas, and sometimes from fossil fuels to renewables. If we are aiming for sustainability in the longer term, however, what we need to see are substantial reductions in actual demand for energy. Energy efficiency offers enormous potential here, particularly in the transport and buildings sectors. Well targeted policies to foster energy efficiency will become increasingly essential, moreover, as power market de-regulation and liberalisation drive down the cost of electricity. Consumers will need very powerful incentives to reduce their consumption of electricity.

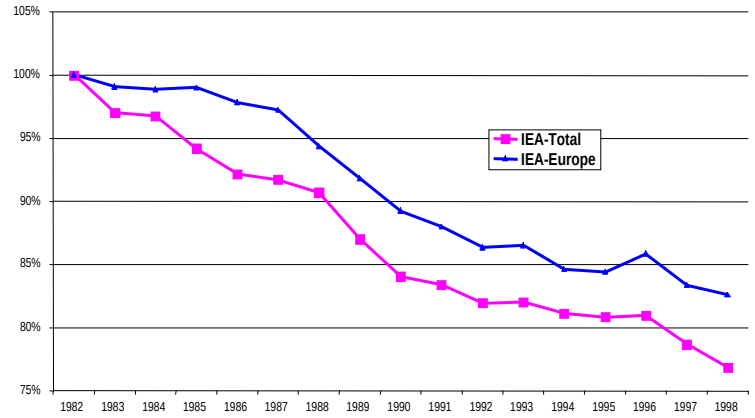
What are we to conclude from the IEA *World Energy Outlook's* projections regarding energy-use and CO_2 emissions? Do they reflect policy-making myopia in relation to the Kyoto commitments, and even more seriously impaired sight in relation to the decades beyond?

5. SPEEDY, MORE INTERNATIONAL EFFORTS ARE NEEDED

It would be unjust to suggest that little is being done to meet the challenge of climate change. Throughout the industrialised countries – and in many developing countries, too – policies and measures have been developed and implemented in past years to launch a two-pronged attack on CO_2 emissions. Based chiefly on enhanced energy efficiency and greater fuel diversification, these promise not only climate benefits, but also cost benefits.

New programmes are announced regularly, and we have clear evidence that such measures bring results. What is needed, however, is more widespread, more rapid action to convene policy-makers and expand international energy-efficiency efforts.

Figure 3. Total final consumption per GDP for IEA – Total and IEA-Europe (1982=100%)



Source: International Energy Agency

In working towards greater energy efficiency, IEA countries have come a long way over the past two decades or so. Total final energy consumption per unit of GDP has declined considerably since the first oil price crisis. At present, IEA countries use roughly 45% less energy to generate one unit of GDP than in 1973. This energy-intensity progress reflects enhanced energy efficiency in key end-uses, but also shifts in economic structure and consumer behaviour.

Energy efficiency improvements have stemmed from higher fuel prices and long-term advances in technology, as well as energy efficiency programmes. The fall in energy use per unit of GDP also reflects the effect of shifts in IEA countries away from energy-intensive manufacturing industries. It is interesting to note the inconsistent way in which oil prices affect overall energy intensity, which fell most rapidly during the years of high oil prices immediately following the 1973 oil shock. During the period of high oil prices from 1982 to 1986, however, the decline was much less sharp than over the subsequent four years when oil prices were lower. A partial explanation is the time lag as new technologies have worked their way into production processes and consumer appliances. Another is the ongoing nature of effects of already implemented energy-efficiency programmes.

Looking ahead, IEA analysis tells us that, up to the year 2020, world energy consumption per unit of output is nevertheless likely to continue falling by 1.1% per year, a rate in line with performance between 1971 and 1997. Behind that global figure of 1.1%, however, we see wide regional differences, with the transition economies taking a large share of the potential reductions in energy intensity.

We should not forget, however, that consumption of electricity is rising so fast that energy efficiency gains through use of more efficient generating applications can be cancelled out in some cases by the rate of increase in the sheer amount of power generated. Projected steadily growing demand for electricity, as more electricity-based services and appliances come into operation, underlines how essential it is to accelerate the energy-efficiency drive in both electricity supply and its end-use. And the expected sharp rise in energy demand among the developing nations points to the crucial importance of internationally co-ordinated efforts to make the cleanest, most energy-efficient power-generation plant available and economically attractive to them.

6. A SECTORAL OVERVIEW

Where have the IEA countries been concentrating their efforts to develop and deploy more energy-efficient technologies? And how are those efforts measuring up? Often working in close co-operation with industry, many IEA governments have developed specific energy-efficiency technologies, but energy R&D expenditures are declining. In a wide range of applications, increased government R&D expenditure would streamline these technologies and boost their chances of wider deployment. Equally important, easing new-generation

technologies into the market-place can be an impossible uphill struggle without government support. New technologies need investments to generate cost reductions through economies of scale and learning effects, so that the demand-pull and technology-push factors work in harmony. They also need the assurance of an appropriate policy and regulatory framework, as we see in the power sector.

Huge advances have been seen in development of more efficient **power-generation technology**. Co-generation, for example, is now a widely available option that provides heat (or cooling) in tandem with electricity. It can offer overall efficiency of up to 90%, using pretty much any sort of fuel and a wide range of available and emerging technologies. Well aligned with the trend towards smaller power-generating units, co-generation is particularly suitable for new power-producing installations in the developing world. The European Union, for its part, has set an objective to double co-generation's share in total gross electricity generation in EU member countries from 9% to 18% by 2010. And the United States has similar plans to double by 2010 the use of combined heat and power systems in commercial, industrial, and institutional buildings, and in communities throughout the nation. Both nationally and internationally, the industry is very dynamic, but barriers persist at national level. The required level playing field in the power markets is lacking in many countries, thus removing incentives to deployment.

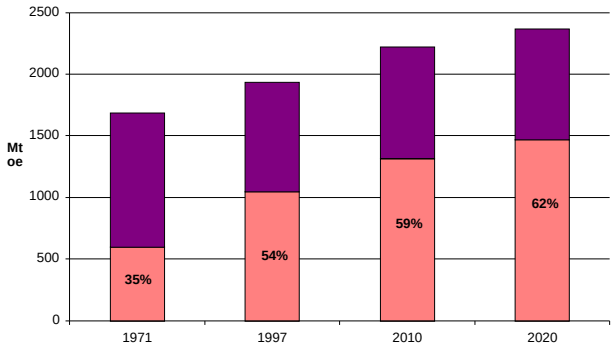
For classic power plants, a number of more efficient coal combustion technologies are already in the market-place and other advanced combustion technologies are close to commercial viability. We can expect major efficiency advances with natural-gas-fired technology, and natural gas combined-cycle technology is already in widespread use all over the world. Combined-cycle gas turbines can achieve efficiency of up to 55%, and improved design and materials could further increase efficiency and permit higher operating temperatures. Fuel cells, too, offer substantial potential, but will require investment on further technology streamlining.

A word should be said here about technologies using renewable and alternative energies. As we know, these are high on governments' development agendas, since they offer impressive potential for clean power generation in the medium and longer term, with the energy-efficiency inherent in a cost-free raw material. The IEA is heavily involved in work on collaborative international strategies to further enhance national energy policy frameworks to accelerate the already rapid advance in deployment of technologies for exploiting these energy sources. Non-hydro renewables are expected to be the fastest growing primary energy source over the coming years. Indeed, by 2010, the European Union wants 12% of all energy consumed in member countries to come from renewables. But a long haul lies ahead. While a very sure bet for widespread deployment in the longer term, these technologies cannot promise to assume a major share of the emissions-reduction burden quite yet. Hence the pressing need for speedier implementation of more energy-efficient technologies.

In **industry**, too, much progress has been made in advancing a wide variety of energy-efficient technologies and systems, offering large near-term benefits. Among many other ways of boosting efficiency, I would cite process integration. This umbrella concept covers the collected streamlining strategies, methods and tools which are being used to reduce energy consumption by up to 40% in the chemical, petrochemical and refining industries, as well as in pulp and paper or food and beverage processing. Greater awareness of these techniques would boost deployment. At a more micro level, we should mention high-efficiency industrial motors, drives and motor-driven systems, which are now available on the market and offer substantial potential, so long as the hurdles of low capital stock turnover and insufficient market awareness can be overcome. It would be desirable, moreover, to reinforce international harmonisation of energy-efficiency standards for electric motor drives.

In the aggregate, energy use in relation to manufacturing output (as measured by value added) has fallen pretty continuously in most IEA countries since the 1950s. From analysis of absolute values in energy requirements between processes in various industries and countries, "best practices", can be identified, notably for energy saving. Many IEA countries have implemented programmes to promote these "best practices", in some cases involving benchmarking against comparable industries world-wide. Much can be achieved by combining "best practice" programmes with energy audits to pinpoint energy-saving potential. A substantial number of governments have established long-term agreements with industry in this area to enhance energy efficiency. Harmonising these agreements internationally would bring the benefit of a level playing field among industries.

Figure 4. Share of the transport sector in OECD oil demand



Source: IEA World Energy Outlook, 2000 edition

The **transportation sector**, for its part, is claiming a growing proportion of total OECD oil consumption. From 35% in 1971 its share rose to 54% in 1997, and it is expected to reach 62% by 2020. Passenger cars and light trucks account for more than half of OECD transportation oil demand, but aviation fuel demand is forecast for the fastest growth. While fuel-efficiency advances in passenger cars and light trucks were rapid between 1975 and 1985, the trend has subsequently slowed, or even reversed. The IEA's *World Energy Outlook* Reference Case expects that, against 1990 levels, OECD-area CO2 emissions from transport will have grown by more than 60% by 2020. And this projection assumes success in meeting the emissions reductions targets by the European Union Voluntary Agreement and the Japanese Top Runner programme. The European Union aims at a 25% improvement in fuel consumption per kilometre by 2008, and Japan aims at a 17% reduction by 2010.

The good news is that recent IEA research suggests that significant technical potential exists for future fuel economy improvements. Our analysis of fuel economy potential for three countries – Denmark, Germany and the U.S. – indicates that even using only technology that is cost-effective at expected future fuel prices (i.e. that pays for itself through fuel savings to the consumer), up to a 25% reduction in new car fuel consumption can be achieved in Europe, and perhaps even in North America, by 2010. If you also consider more advanced – albeit somewhat more expensive – technologies such as hybrid-electric and fuel cell propulsion systems, much greater fuel economy improvements will be possible in the 2010-2020 time frame.

However, our recent analysis also suggests that much of this technology may be used not to improve fuel economy, but instead to continue to make vehicles larger and more powerful while keeping fuel economy relatively constant. If the trends of the past decade continue, Europe in 2010 could look a lot like the United States today, with roads full of large, heavy, sport-utility vehicles (SUVs) and vans. While the fuel prices and land use patterns in Europe are quite different from those in the United States, there are signs that SUVs are beginning to catch on in Europe.

In order to get the maximum fuel savings benefit from new technology, the right government policies must be in place. Governments can provide incentives for consumers to choose the most efficient vehicles available and for vehicle manufacturers to maximise the fuel economy of the vehicles they build, rather than increasing vehicle size, weight and power.

Governments have a number of tools available to help encourage consumers and producers move toward more efficient vehicles. These include fuel taxes, of course, but there are other options available as well. Countries could modify their existing vehicle sales taxes, which are typically *ad valorem*-based, and change some or all of this tax into one that varies according to vehicle fuel economy. Another is the type of "Top Runner" program adopted by Japan, where the most efficient vehicles in each market class set the standards that the others must eventually achieve. Finally, a co-ordinated international effort to improve vehicle in-use fuel efficiency might usefully be launched, for example by expanding the EU voluntary agreement to associate other countries and regions of the world. By bringing more of the world's vehicle markets into fuel economy harmonisation, manufacturers will have a clearer mandate to focus on producing vehicles that are efficient.

Meanwhile, there are indications that hybrid and fuel cell vehicles could be developed to offer better on-road performance than their current test results suggest. Indeed, hybrid-electric, in which manufacturers are showing

keen interest, along with fuel-cell vehicles could ultimately provide the key to near-zero-emissions in the transport system, but not in the short term. Generous government support will be needed to ensure that these vehicles achieve market penetration of any magnitude before 2010, or even 2015. In the meantime, a principal objective should be to steer drivers away from vehicles with heavy fuel consumption. Policies such as "feebates" – or vehicle fees and rebates based on vehicle fuel economy – could be used to increase the price differentials between more and less efficient vehicle choices. Such measures can be used to sharpen price distinctions between available models and encourage manufacturers to offer those with better fuel economy in each size class.

For the longer term, many innovative vehicle technologies are currently either available or in the advanced stage of development, including technologies for running vehicles on alternative fuels. While these fuels do not lessen the need for fuel efficiency gains, they can contribute to reducing climate-changing emissions. Government action could very usefully focus on more widespread programmes to weaken road-travel demand, notably through modal shifts to public transport. Government action can promote low-CO_2 bio-fuels, and educate the public about the links between transport and climate change, energy saving and the need to diversify away from oil in a sector that claims more than 54% of oil consumption. Urban planners should consider the transport implications when urbanisation programmes are on the drawing board.

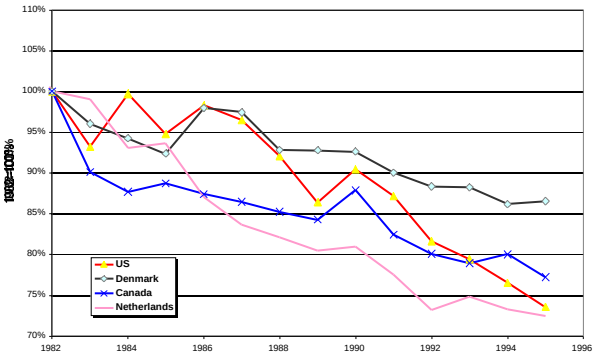


Figure 5. Space Heating Intensity (Useful energy per square metre, per degree-day)

Source: International Energy Agency

Roughly one-third of IEA countries' total final energy use is attributable to **residential & commercial buildings**. These buildings account for only 11% of oil demand, which places them third in the oil-consumption league after transportation and industry. But they account for almost 60% of total IEA-area electricity demand, and, in the European Union at least, 40% of total energy demand. Space-heating is the chief energy end-use in residential buildings in most IEA countries, and water-heating also draws heavily on the energy supply. Electric appliances account for the fastest growing end-use in buildings.

How are governments addressing the need to enhance energy-efficiency in buildings? To tackle space heating, policies are in place in most IEA countries to reduce energy use. In a number of countries, indeed, regular detailed household heating surveys monitor energy-saving efforts effectively. IEA data points to substantial advances in space-heating efficiency. In the United States and the Netherlands, savings of roughly 25% were achieved between 1982 and 1995 by reducing space-heating intensity. Denmark, for its part, saw a reduction of 50% over the longer period from 1972 to 1994.

Across the board, there remains considerable scope for efficiency improvements, in new and existing buildings alike. But a lack of consumer interest constitutes a major barrier. Required loan payback times are often short, while discount rates are high for investments in home energy-efficiency. Fear of inconvenience caused by renovations, coupled with poor awareness of likely benefits, compound consumer indifference; if indeed consumers have any say in decisions that are often taken by landlords, contractors or equipment suppliers wishing to limit up-front outlay. Such barriers can be overcome through government action to encourage energy audits, to implement energy labelling for buildings, and to enhance consumer awareness. Loan subsidies or tax credits for retrofit measures can help dismantle financial barriers. And retailing of energy-efficient heating or cooling by energy service companies, as opposed to sale of electricity, can provide expertise, also access to third-party financing.

Difficulties associated with modifying features in existing buildings creates an additional market barrier. Some options like wall insulation and new windows are very costly for retrofits but relatively inexpensive when a building is being extended or rehabilitated. New buildings are of course another matter, and here lies major unexploited potential for reinforcing existing building codes to link in the latest technologies. At the same time, codes could also be extended to cover refurbishment. A parallel effort is desirable to develop and market more efficient heating and cooling equipment, insulation materials and windows for both existing and new buildings. R&D efforts, procurement programmes, information campaigns and subsidies all have a major role to play here.

Electric appliances are consuming a rapidly growing share of electricity, as convenience and comfort appliances and equipment become increasingly sophisticated and desirable. In some countries, these now consume more of the energy used in new buildings than space heating. It has been proved that reductions of between 10% and 50% in the energy demand of equipment, particularly electrical appliances, is both technically feasible and cost-effective.

The information labelling and efficiency standards programmes in place in the United States have produced impressive results. The standards programme alone has generated a US$60 consumer investment in energy efficiency technology for each dollar spent on standards in place, resulting in net energy savings of between US$160 and US$220. It is expected that US standards will have reduced residential energy use by between 5% and 6% by 2010, bringing carbon emissions down by between 9 and 16 million metric tonnes on average per year over the same period. Global application of such standards could offer more than ten times the level of savings achieved in the United States.

In general, can it be said that energy efficiency is getting sufficient emphasis, as governments struggle to meet the greenhouse-gas emissions challenge and reduce dependence on fossil fuels? Climate change and fuel diversification often constitute policy-makers' dilemmas because the options are frequently limited and the issues can carry complex and sensitive social and economic implications. But, as we have seen, governments are far from inactive. As we have also seen, however, the transportation and buildings sectors need some priority attention if they are to realise anywhere near their full energy-efficiency potential.

In the transport sector, there is a clear role for government action to discourage the trend towards purchase of ever larger, more powerful vehicles. Approaches could focus on fiscal incentives and joint agreements with industry. At the same time, manufacturers should be encouraged to develop and deploy next-generation hybrid and fuel-cell vehicles through incentives. This will help reduce the risk to which both manufacturers and consumers expose themselves in adopting these new technologies, and so trigger the learning and scale-economy benefits that increase their cost competitiveness.

Where the buildings sector is concerned, serious action is needed to make consumers and contractors alike fully aware of – and interested in – energy-saving measures and devices. Energy audits, financial incentives, and well enforced building codes that cover refurbishment should be placed high on policy-making agendas. So should development of yet more efficient heating and cooling equipment, insulation materials and windows. Much more could also be done to optimise energy used in electrical appliances, notably through more vigorous energy-efficiency standards and labelling programmes. As we have seen, Japan's Top Runner programme offers an interesting example of how the most energy-efficient product in its class can be used as a locomotive that obliges products in the same class to eventually reach the same level of efficiency. International co-operation is clearly warranted, more particularly to reduce the proliferation of test procedures and labels that would otherwise result. An important step here has been the bilateral agreements established on IT equipment between the United States and the European Community regarding the broader application of the Energy Star labelling programme.

As we have seen in this sectoral overview of efforts and achievements, a recurring theme is the absence, or paucity, of internationally driven programmes to align energy-efficiency standards and requirements. Without question, joint action should be a top priority, drawing on the body of knowledge on lessons learned.

7. FOCUSING MARKETS, PLAYERS, MESSAGES

If we look at the general energy-policy picture, where could governments usefully direct more attention in order to promote greater energy efficiency? What might be individual countries' policy base from which to address the international energy-efficiency harmonisation effort? These questions have prompted much collaborative analysis. For example, the Danish Energy Agency, the Energy Charter Secretariat and the IEA joined forces to conduct a "first-ever" survey of energy efficiency policies and programmes, including case studies, in more than 50 countries. The work is published in the two-volume *Energy Efficiency Initiative.*

Where developing and transition economies are concerned, action in the field is often a priority. The Climate Technology Initiative (CTI), for instance, is active in addressing the particular technology needs of individual developing or transition-economy countries, and the issues involved in enhancing their capacity to attract and absorb these technologies. Launched in 1995 at the First Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC), the CTI brings together 23 countries , as well as partner organisations. It functions chiefly as a facilitator in uniting stakeholders in the drive to combat climate change.

The market is clearly a prime driving force for innovation and for influencing the choices that channel finance to the promotion of energy-efficient products. And market conditions can be enhanced. We can identify three main areas on which energy policy-makers could usefully focus.

- Ensuring an effective market structure, by :
  - Establishing real cost pricing, with "life line rates" if necessary;
  - Removing subsidies while applying taxes and levies as incentives; and
  - Establishing clear-cut rights and responsibilities where intellectual property ownership is concerned.

- Helping market actors to identify their potential advantages and to exploit them, by:
  - Studying consumer behaviour;
  - Informing and/or training in the energy-efficiency aspects of products and consumer behaviour; and
  - Providing technical training or business advice to motivate investments by Energy Service Companies and providers of third-party financing.

- Getting the markets focused on energy efficiency, by:
  - Fostering the creation of voluntary agreements with industry;
  - Implementing building codes and standards for minimum energy performance;
  - Incorporating energy efficiency factors into procurement programmes; and
  - Mobilising government purchasing power to stimulate the market for advanced technologies.

If we are to create greater consumer interest in energy efficiency, we need plentiful availability of energy-efficient products to satisfy that interest. As we have seen, investment in government energy technology R&D is on the decline, so action to ensure access to good technology should aim to foster:

- Concerted programmes for the development, adaptation and diffusion of energy-efficient technology, backed up if necessary with focused procurement;
- Learning about diffusion and removal of deployment barriers;
- Productive communication between all the market actors – manufacturers, end-users, distributors, utilities, business and technical associations, and governments.

If the multitude of energy-use decisions taken each day are to be influenced, national government energy policy alone will not suffice. The relevant local, national and regional authorities or energy-focus organisations must be involved, in order to develop the most broadly based supportive institutional framework possible. Such a framework can be fostered through action to ensure:

- Integration of energy efficiency into the sectoral policies relating to housing, commercial buildings, industry and transport;
- Availability of impartial expertise.

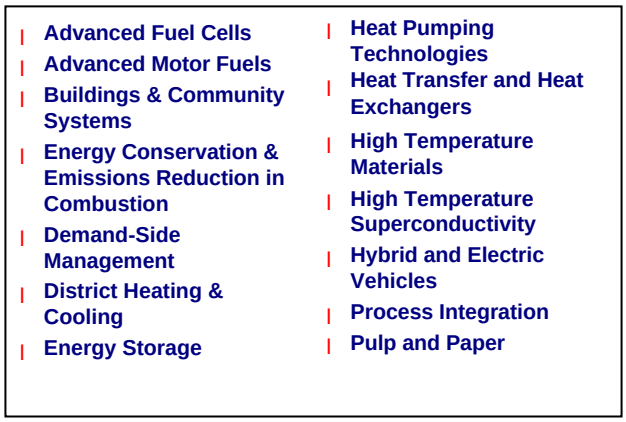
Finally, a dominant requirement of any energy-policy framework is its ability to convey a message of continuity to the market. Energy policies need to be based on manifestly strong analytical bases that draw on lessons learned, that respond to the imperatives of both energy demand and energy efficiency. If policies are to do their job – and be seen to do so – they should be systematically reviewed and revised to take account of evolving consumer preference, technological factors and other parameters. Moreover, international co-operation has a crucial role to play in harmonising efforts, uniting market forces and reinforcing policies for speedier technology dissemination. Action should therefore aim at:

- Clear, consistent policies;
- Demonstrated leadership;
- Effective policy monitoring;
- Strong international collaboration.

8. GETTING INTERNATIONAL EFFORTS RIGHT

Global challenges call for global responses. But global responses are often most effective when conceived using best-practice knowledge gained from experience at local level. While the thrust of energy efficiency efforts frequently targets the point of use through local energy efficiency programmes, many energy efficiency efforts are common to all economies because they are linked by key generic end-use technologies. In both energy supply and end-use, individual countries' energy-efficiency programmes address very similar challenges. After all, throughout the western world we use, generally, the same sorts of car, the same sorts of component in computers, in lighting system, or industrial motor drives. On the other hand, global responses do not remove the need for continued local responses. But are best-practice lessons being shared among nations to the maximum? Do we have adequate, well exploited structures for internationally co-ordinated R&D efforts and technology deployment programmes?

Figure 6. IEA end-use implementing agreements



Internationally co-ordinated efforts can be complex and difficult to bring to fruition. One obstacle to successful collaboration is a failure to recognise common best interests. In that context, a word or two should be said here about the IEA's **Implementing Agreements** structure, and its achievements in advancing collaborative energy technology research, development and demonstration. Founded more than twenty years before the 1997 Kyoto Protocol, this legal framework was designed to enable countries to collaborate in order to cut costs and share benefits. Some programmes deal with dissemination of energy-technology information, others with the actual R&D effort, including basic research or, as in one case, policy development through computer modelling. The broad range of technologies is covered: fossil fuel technologies, renewable energy technologies, efficient end-use technologies, and nuclear fusion science and technology. Many programmes focus on end-use technologies

and energy efficiency. The IEA Implementing Agreement on Demand-Side Management Technologies and Programmes, for example, has very actively promoted energy-efficient appliances through its Award of Excellence initiative, which has made awards for photocopiers, a heat-pump clothes dryer and electric motors.

Participants in IEA Implementing Agreements can be government organisations or business-sector entities nominated by their governments. Work is managed and run by the participants themselves, while the IEA's role is to provide the legal framework and certain support functions. Non-IEA Member countries also participate in the programme and currently represent about 10% of all Contracting Parties. They participate in the same way as IEA Member countries.

Industry is involved in many different ways, an involvement that constitutes the primary route for getting technologies into the market place. Some Implementing Agreements, in fact, consist largely of business-sector players. Others bring industry very heavily into play at the working level – notably in the development of work programmes – but they have a management structure largely made up of government officials. Intellectual property rights are naturally an issue in such activities. In many cases, industry is reluctant to collaborate and give away the economic benefits of their investment in research. But the programme has demonstrated that there are many areas where mutual benefits can accrue. Implementing Agreements naturally incorporate provisions to determine how intellectual property rights are to be defined.

There are currently some forty Agreements, incorporating more than 100 individual sub-projects. An average of 23 countries participate in each Agreement. Almost 500 contracting parties participate in the programme, which mobilises a total of between US$120 and US$150 million each year. There are two funding mechanisms. One is cost-sharing, where participants all contribute to a common fund covering the cost of some centrally-financed activity, such as operating an information centre or running a joint experiment. The other mechanism is task-sharing, where participants devote specified resources and personnel.

The IEA has published a volume of success stories resulting from the Implementing Agreement Programme. These successes derive from many different features of the programme, notably: costs reductions, a better ultimate product, accumulated ideas and information, also the ability to influence the market and influence policy development.

The International Standby Power Initiative provides an interesting example of how bringing together the right players at the right time can produce impressive results. This IEA-led Initiative grew out of a conference on energy-efficient appliances held in Florence in 1997. As we now know, standby energy consumption by domestic appliances is estimated to account for up to 10% of residential-sector electricity consumption in OECD countries, or the equivalent of a 60-Watt light bulb lit continuously in each household. As much as 1% of world CO_2 emissions is attributable to standby power waste, which can be reduced by as much as 90% without impairing an appliance's level of service or incurring major additional outlay on its purchase.

A series of three subsequent international conferences, in 1999, 2000 and in February 2001, attended notably by manufacturers from all over the world, have shaped and supported the Initiative, which has "institutionalised" the target of reducing standby power. An IEA publication, *Things That Go Blip in the Night – Standby Power and How to Reduce It***,** summarises the findings and accomplishments of the Initiative's two years of internationally co-ordinated effort**.** Taken up by industry as a marketing tool, the concept gained full legitimacy in 2000 when Australia formally endorsed the concept of a One-Watt target for appliance standby power consumption. The IEA's initial contribution was to help pinpoint the dimension of the stand-by loss phenomenon. It is now working to expand awareness of the problem among government policy-makers and industry decision-takers to foster more widespread concrete measures to stem the flow of standby-losses.

The Standby Power Initiative illustrates perfectly the powerful catalytic effect of generating more focused consciousness of an issue in the right circles. It is a question here of setting sure measures in motion to significantly enhance deployment of high-efficiency generic end-use technologies either currently available in the global market or poised for market entry. A crucial first step is to bring together players from the industrial and policy-making communities within the right context, and to come up with ideas.

9. CONCLUSIONS

International co-ordination, as we have seen, is a prime vehicle to ensure wider implementation of energy-efficiency measures. But a dynamic approach is needed to get the ball rolling and to keep it rolling. Appropriate international bodies exist that offer both strong convening power to bring energy policy-makers together and widespread access to technical expertise.

There is certainly broad scope for international action to bring energy efficiency higher up the political agenda. Let us look at some of the areas for priority attention, where joint policy moves could unite the forces to create international energy-efficiency initiatives _or revitalise existing programmes _with harmonisation of standards as a key objective where applicable.

- An efficient-car initiative, promoting such expedients as energy-efficient labels, energy-savings indicator techniques.

- Energy efficiency in Internet systems.

- Energy-efficiency as a priority in government purchasing.

- Promotion of cogeneration (combined heat and power).

- Energy-efficiency standards and labelling for:
  - Traded goods, along the lines of the recommendations made in the IEA's recent publication *Energy Labels & Standards*;
  - Lighting sources, lighting systems and luminaries;
  - Buildings, to combat existing large-scale energy losses in the building stock;
  - Windows and window components.

- Energy-efficiency standards for electric motor drives.

In all these areas we need to think internationally. But we also need to act internationally.