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# MAKING ENERGY-EFFICIENCY HAPPEN: FROM POTENTIAL TO REALITY

## An assessment of policies and measures in G8 plus 5 countries, with recommendations for decision makers at national and international level

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## Executive Summary

**The proposed 20% energy-efficiency improvement by 2020 in the building, transport and power sectors is achievable in G8 and G5 countries**

The potential identified in this study exceeds the 20% proposed by the German G8 presidency. Potentials for energy-efficiency improvement range from an average of 25% for fossil-fired power generation to an average of 40% for transport (Figure 1). The energy-efficiency improvement potential for CHP is given separately. The use of CHP reduces energy demand for heating in buildings and industries. As there is an overlap between the implementation of CHP and the energy-efficiency improvement potential for buildings, the energy-efficiency improvement potential for heating in buildings and industries will be lower when additional CHP is implemented.

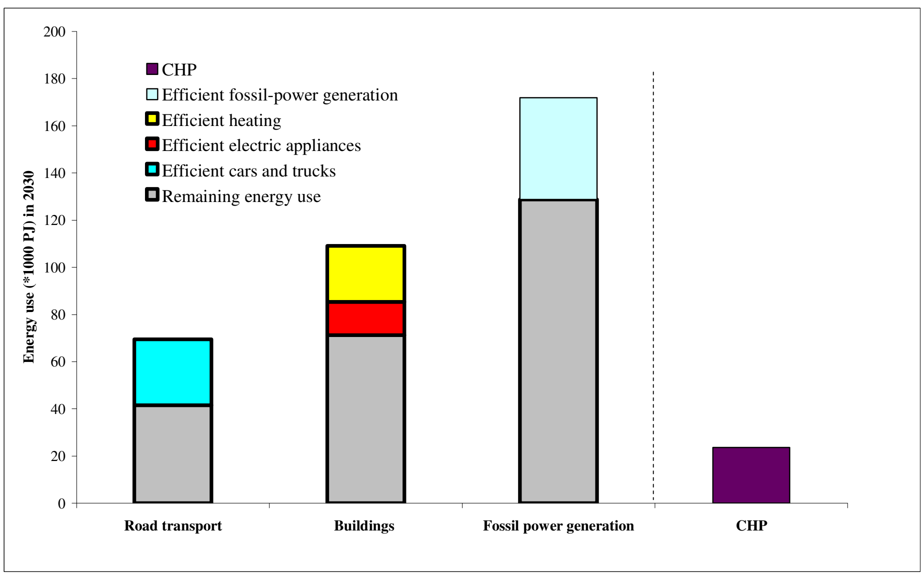


Figure 1 Potential for energy-efficiency improvement in 2030 for the G8 plus 5 countries compared to the Reference Scenario.

**G8 and G5 countries can achieve efficiency improvements well beyond 20% in the transport and building sector**

G8 as well as G5 countries can achieve efficiency improvements that go beyond the 20% proposed by the G8 Presidency. The reduction potential in the transport sector ranges from 25% to almost 50%, whereas potentials in the building sector range from 30% to 45%.

**Reduction potential in the power sector ranges from 4% to 45%**

Reduction potential in the power sectors varies considerably from country to country. The largest reduction can be achieved in China, India and Russia.

**The portfolio of policy instruments applied is very diverse and effectiveness varies from country to country**

The applied portfolio of policy instruments to stimulate energy-efficiency is very diverse. This is resulting from the fact that market barriers that need to be overcome differ by country and by sector.

**Gaps in energy-efficiency policies can be found across all sectors and countries with the transport sector clearly standing out**

In all G8 countries, there exist blank “policy spots” and policies that are not very effective. The analysis showed that energy-efficiency gaps can be found across all sectors. It can be concluded that in most countries the transport sector is lagging furthest behind.

**Energy-efficiency is emerging on the agenda of the G5 countries**

Energy-efficiency is emerging on the agenda of G5 countries. Policy development regarding energy-efficiency in G5 countries is less advanced than in G8 countries, but energy-efficiency is certainly on their agenda and a lot of policies are ‘in the pipeline’.

**A combination of “tailor” made and sector specific policies is needed for each country to achieve large-scale energy-efficiency improvements**

Large-scale energy-efficiency improvements can be obtained in all economies. Societies’ infrastructure - transportation systems, building stock, industrial facilities and energy supply networks – seem resistant to improvements in energy-efficiency. Various barriers such as a lack of knowledge and legal and institutional issues, contribute to a slow diffusion and adoption of energy-efficient technologies. There are no "silver bullet" technologies or policies that can alone yield all the potential energy savings. A broad range of policies and measures need to be deployed.

**Opportunities to speed up energy-efficiency improvements and increase the impact of policies include…..**

**…..working according to the ‘polluter pays’ principle.**

Introducing the ‘polluter pays’ principle by increasing the level of taxes on fossil fuels and at the same time phasing out subsidies for conventional energy sources.

**…..setting clear targets for energy-efficiency and sanctions for non-compliance**

Setting clear and transparent future targets for energy-efficiency are an important prerequisite for achieving energy savings. Regular monitoring and sanctions for non-compliance are important ingredients for a successful energy-efficiency strategy.

**…. introducing performance based standards for new and existing buildings**
Introducing performance based standards for new and existing building is an effective instrument to achieve energy-efficiency in the building sector. Timely adjustments and tightening of the standards to technology progress and penalties for non compliance are important elements for effective performance based standards.

**……introducing minimum efficiency standards for house appliances and office equipment including maximum levels for standby power use**
Preferably these standards should be set on the international level (especially in the EU). Timely adjustments and tightening of the standards to technology progress and penalties for non compliances are important elements for effective minimum efficiency standards.

**….introducing binding minimum efficiency standards for new passenger and freight vehicles**
Introducing ambitious binding minimum efficiency standards (or $CO_2$ standards) for passenger and freight vehicles is an effective way to reduce transport energy use. Energy use could be further reduced if next to it a maximum is set on cars allowed on the market or that these cars are submitted to very high taxation.

**…..setting clear and ambitious caps on the greenhouse gas emissions of the power sector could speed up efficiency savings**
Setting clear and ambitious caps on the greenhouse gas emissions for the power sector is an effective instrument to speed up efficiency improvements in the power sector. The current European Emissions Trading Scheme and the planned schemes for the US and Canada are, in principle, effective instruments to limit energy use of the power sector.

**Increased international cooperation is a key for tapping the huge energy efficiency potentials in G5 and worldwide.**
Today such cooperation takes place in the context of traditional bi- and multilateral development programmes and in new international and bilateral initiatives on energy and/or climate. A general recommendation that can be made to all these programmes: Place energy efficiency high on the agenda!

**Energy efficiency should be given a higher priority in technology cooperation and new international and bilateral initiatives**.
Energy efficiency should be fully mainstreamed into all supply-side activities. Demand-side energy efficiency should be given greater attention. International agreements or action plans should be monitored by an international institution.

**Joint energy performance standards among G8 and G5 could remove the most inefficient products from the world market…**

…but are challenging to negotiate and enforce among those countries. Further options for international policy cooperation include: joint labeling, joint procurement, exchange on policy design, negotiations on removal of trade barriers, and financing initiatives.

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# WWF policy recommendations

**This section contains policy recommendations by WWF to the G8 Summit in Heiligendamm. Recommendations in this section were formulated by WWF drawing on the findings of this report, but also include recommendations for sectors and issues not covered in this report**

**Overarching recommendations**

1. Countries should adopt national efficiency targets that double the rate of improvement of economic energy intensity annually, as one necessary contribution to limit global warming to below 2°C. Such targets for economic energy intensity improvement would need to be translated into national policies for enhanced energy conservation and energy-efficiency in a variety of sectors.
2. Next to national targets, a set of joint activities should be adopted, focusing on those activities that would be strengthened by G8 and G8 plus G5 cooperation (compared to national action only or UN-level cooperation).
3. As the G8 lacks an institutional home, monitoring mechanisms and compliance systems of international law to ensure effective implementation, agreed energy-efficiency measures and related implementation action could, as in the Gleneagles process, be placed under a broader multilateral umbrella, including the UNFCCC and the IEA.
4. G8 countries should take appropriate measures to support G5 countries in reaching their adopted targets, through the G8 plus 5 process as well as in bilateral relations. This includes cooperation on and alignment of regulatory frameworks and economic instruments; capacity building and technology development, deployment and transfer; and the mainstreaming of energy-efficiency investment (including through public finance). Support should be sufficient in speed, scale and range.
5. G8 plus G5 energy-efficiency actions may inspire and foster a broader international agreement on energy-efficiency. Preparatory work for such an agreement should provide clarity with regards to the purpose and added value as well as institutional requirements and potential instruments.
6. While business plays an important role in the development and deployment of energy-efficient technologies, the overall responsibility for improving energy-efficiency in all sectors must not be deferred by governments which need to set the appropriate regulatory and financial frameworks.
7. G8 plus 5 activities on energy-efficiency should adequately involve business as well as civil society.
8. Carbon markets are a key driver for improved energy-efficiency. The G8 plus G5, therefore, need to agree that at the UN climate conference in December in Bali, negotiations are launched which ensure the continuation, deepening and expansion of carbon markets beyond 2012.

**Potential actions by all countries to increase energy-efficiency by sector:**

1. Buildings - excluding electricity consumption: Stronger insulation standards, support for energy-efficient heating systems including district heating supply, tax-incentives for energy-efficient retrofit of housing envelopes. Standards should also cover existing building stock, not simply new buildings. G8 countries should facilitate and support capacity building in countries with low building standards, in particular those facing rapid urbanisation. A yearly progress report should be published to monitor and assess country improvements (G8 to decide about publishing body, i.e. IEA).
2. Electronic consumer goods: Dynamically increase minimum energy-efficiency standards, VAT reduction for most efficient products, labeling of most efficient products. If global energy-efficiency standards are to be set, a common measurement system is necessary.
3. Reduce stand-by losses: Following the IEA proposal, countries should harmonise policies to reduce standby power use and limit it to no more than 1 Watt per device.
4. Extend preferential access in trade agreements to most efficient products (according to BAT and labeling).
5. Promote public procurement favoring the most efficient equipment/services in the public sector (i.e. street lighting, car/buses fleet, office equipment).
6. Electricity supply: Set minimum efficiency standards for all power stations, strong expansion of CHP (and cooling) in both public and industrial energy sector, much better grid and load management including grid retrofitting (to reduce distribution and transmission losses).
7. Industrial sector: Incentives for material efficiency including increased recycling and replacement of energy-intensive products, energy-efficient motor drives, energy-efficiency audits in particular in SMEs and service sector, dynamically increased and product-specific benchmarks and sectoral targets.
8. Transport: Strongly enhanced governmental investment programs in public and efficient rail transport both for freight and passengers, maximum energy consumption and CO2 g/km average emission standards for new cars and lorries.

**Potential actions by G8 countries:**

1. In order to encourage green public procurement, governments should provide designated offices with tailored information packages with up-to-date information on procurement rules, a calculator for life-cycle cost, existing cost-effective saving potential.
2. Facilitate innovative financing schemes and contractual tools, such as micro-credit, joint ventures between private companies and local authorities, third party financing or public guarantees on bank loans to private enterprises in order to encourage energy-efficiency investments at the national and international level.
3. Facilitate cooperation between international financial institutions and programs in order to promote synergies in energy conservation policies, best practices, and the diffusion of the best existing technologies.
4. Each country should introduce tax breaks for energy-efficiency investments, higher taxes/fees for wasteful practices, incentive schemes such as reduced VAT rates to support the purchase of energy-efficient products. Taxation should encourage buying the most efficient products and services or, at least, discouraging from buying the most consuming and/or polluting.

## List of abbreviations

| | |
|---|---|
| ACEEE | American Councel for an Energy-Efficient Economy |
| AID-EE | Active Implementation of the proposed Directive on Energy Efficiency |
| AP6 | Asia-Pacific Partnership on Clean Development and Climate |
| BEE | Bureau of Energy Efficiency India |
| CDM | Clean Development Mechanism |
| CFL | Compact fluorescent lamp |
| CHP | Combined Production of Heat and Power |
| DSM | Demand Side Management |
| EC | European Commission |
| EEAP | Energy Efficiency Action Plan |
| EEC | Energy Efficiency Commitment |
| EIT | Economies in Transition: countries of the former Soviet bloc |
| EPA | Environmental Protection Agency |
| EU | European Union |
| EU-ETS | European Union Emission Trading Scheme |
| GDP | Gross domestic product |
| GHG | Greenhouse gases |
| IEA | International Energy Agency |
| IEEJ | Institute of Energy Economics Japan |
| IPCC | Intergovernmental Panel on Climate Change |
| JI | Joint Implementation |
| KP | Kyoto Protocol |
| NGO | Non-governmental organisation |
| OECD | Organisation for Economic Co-operation and Development |
| PV | Photovoltaic |
| REEEP | Renewable Energy and Energy-efficiency Partnership |
| SMP | Sustainable Mobility Plan |
| TFC | Total final energy consumption |
| UN | United Nations |
| UNFCC | United Nations Framework Convention on Climate Change |
| WEC | World Energy Outlook |
| WEC | World Energy Council |
| WTO | World Trade Organisation |
| WWF | World Wide Fund for Nature |

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# 1 Introduction

## 1.1 Introduction: Provide Input for the Heiligendamm Summit

From 6 to 8 June 2007 Heads of State and Government from G8 plus G5 countries and the European Commission will meet in Heiligendamm at the German coast of the Baltic Sea. The German G8 Presidency has chosen the theme "growth and responsibility" for this Summit. Climate change and energy-efficiency are among the priority issues on the German G8 agenda. The energy track focuses on approaches, targets and activities to make headways nationally and internationally on energy-efficiency. In particular, it is being suggested that G8 countries should agree to 20% overall energy saving targets, coupled with a 20% by 2020 (based on 2005) energy saving target for each of the three key sectors, buildings, transport and power production.

Given the need to keep global warming well below 2° C compared to pre-industrial levels, WWF stresses the need to set a dedicated framework for tackling energy-efficiency. The findings of the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) have resulted in a great deal of public interest. The IPCC states that action by governments is required to halt dangerous climate change and deal with its impacts (IPCC, 2007)[1].

In parallel to this development, the question of energy security has gained interest at the highest political level. In search for answers to halt dangerous climate change *and* tackle energy security issues, energy-efficiency offers a vast, but mostly untapped, potential to meet both objectives.

The Heiligendamm Summit provides an opportunity to agree on broad targets and objectives for future cooperation. With this report, WWF seeks to inform the debate about ways towards tapping the massive energy-efficiency potentials in and between relevant countries. The report focuses on opportunities for the building, transport and power sector.

[1] IPCC (2007) Summary for Policymakers. Working Group III contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report Climate Change 2007: Mitigation of Climate Change. Bangkok, 4 May 2007

## 1.2 Energy-efficiency Policies: Historical Context

Energy-efficiency policies have a long history. They were first introduced as a response to the oil price shocks of the 1970s. Energy-efficiency has improved considerably since the 1970s. Next to government policies energy-efficiency improvement resulted from a response to energy price increases and supply uncertainties, as well as independent technology improvements. Figure 2 provides an overview of changes in TFC (Total Final energy Consumption), GDP (Gross Domestic Product), and energy service demand and intensities (energy use per unit of sub-sectoral activity) for eleven IEA countries in four time frames. Figure 2 shows that significant improvements in energy intensity were achieved in the 1970s and 1980s. Since then intensity improvements have slowed down, one of the reasons being a diminished attention for energy-efficiency policies.

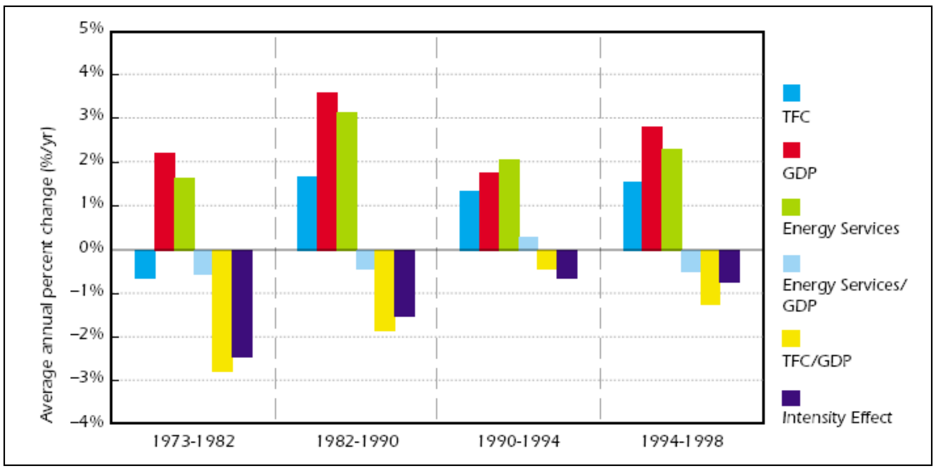


Figure 2: Changes in TFC (total final energy consumption), GDP, Energy Service Demand and Intensities, IEA-11 (IEA 2004)[2]

In the last two of years energy-efficiency policies have come back on the political agenda, partly because the European Union declared that it wants to accelerate energy-efficiency improvements to 2% per year as part of its strategy to combat climate change and secure energy supply (EC 2007)[3].

[2] IEA (2004) Oil Crises & Climate Challenges. 30 Years of energy use in IEA countries. OECS/IEA, Paris, France. 2004.
[3] EC (2007) Council of the European Union. Brussels European Council 8/9 MARCH 2007. 7224/1/07. May, 2, 2007.

## 1.3 Energy-efficiency Policies: Overcoming Market Barriers

Given high energy prices, why do firms and consumers fail to take advantage of all the energy-efficiency opportunities available to them? The difference between the actual level of investment in energy-efficiency and the higher level that would be cost beneficial from the consumer's (i.e., the individual's or firm's) point of view is often referred to as the 'efficiency gap' or the 'implementation gap'. The existence of such unrealized opportunities for energy-efficiency implies that there are numerous market barriers (or failures). Market barriers refer to any obstacles that contribute to a slow diffusion and adoption of energy-efficient technologies. Market barriers to energy-efficiency identified in the literature are very diverse and consist of many different types of impediments, obstacles and hurdles. Table 1 provides an overview of barriers for energy-efficiency improvement. It must be noted that in literature barriers are looked at from a lot of different perspectives and sources resulting in diverse ways of classifying barriers.

Table 1 Barriers for energy-efficiency improvement (Ecofys et al, 2007)[4]

| |
|---|
| **Technical barriers**. Options may not yet be available, or actors may consider options not sufficiently proven to adopt them.<br>**Knowledge / information barriers**. Actors may not be informed about possibilities for energy-efficiency improvement. Or they know certain technologies, but they are not aware to what extent the technology might be applicable to them.<br>**Economic barriers**. The standard economic barrier is that a certain technology does not satisfy the profitability criteria set by firms. Another barrier can be the lack of capital for investment. Also the fact that the old equipment is not yet depreciated can be considered as an economic barrier.<br>**Institutional barriers**. Especially in energy-extensive companies there is not a well-defined structure to decide upon and carry out energy-efficiency investments.<br>**The investor-user or landlord-tenant barrier**. This barrier is a representative of a group of barriers that relate to the fact that the one carrying out an investment in energy-efficiency improvement (e.g. the owner of an office building) may not be the one who has the financial benefits (in this example the user of the office building who pays the energy bill).<br>**Lack of interest in energy-efficiency improvement** may be considered as an umbrella barrier. For the vast majority of actors, the costs of energy are so small compared to their total (production or consumption) costs that energy-efficiency improvement is even not taken into consideration. Furthermore, there is a tendency that companies, organisations and households focus on their core activities only. |

[4] Ecofys, Lund, Wuppertal, Politecnico (2007). From Theory Based Policy Evaluation to SMART policy design. Summary report of the AID-EE project. Ecofys, Utrecht, 2007. www.aid-ee.org

A good understanding of the different market barriers or failures is essential in defining potential effective policies. As market barriers and failures that need to be overcome differ per sector and country the applied portfolio of policy instruments is also very diverse. Table 2 provides an overview of different types of instruments applied to improve energy-efficiency and typical circumstances in which to apply the instrument.

Table 2 Overview of typical instruments applied to improve energy-efficiency and typical circumstances in which to apply the instrument (Ecofys et al, 2007)

| Type of instrument | Typical circumstances in which to apply this instrument |
|---|---|
| **Energy performance standards for buildings, cars or appliances** | • When dealing with a target group which is:<br>1) unwilling to act (e.g. voluntary agreement not fulfilled), or<br>2) difficult to address (e.g. land-lord – tenant problem)<br>• When aiming at removing the worst products or services from the market<br>• When dealing with rather uniform technologies |
| **Mandatory targets/tradable permits certificates** | • When aiming at energy savings in large end-user groups which are difficult to address<br>• When knowledge, financial and institutional barriers play a role |
| **Labelling of appliances, cars, buildings** | • When there is a knowledge / information barrier<br>• When dealing with large consumer or service sector groups<br>• When dealing with rather uniform technologies<br>• When planning to introduce a performance standard at a later stage<br>• When there are large differences in energy performance between similar units |
| **Financial / fiscal instruments** | • When there is a financial barrier in place<br>• When an informative instrument (e.g. energy audit) needs financial incentives to attract the target group |
| **Energy tax / energy tax exemption** | • When dealing with large target groups<br>• When aiming to internalize external costs |
| **Information / education / training** | • When there is a knowledge barrier<br>• When dealing with large target groups |
| **Energy audits** | • When there is a knowledge barrier for buildings and production facilities |

| Type of instrument | Typical circumstances in which to apply this instrument |
|---|---|
| **Voluntary agreements to save energy** | • When dealing with a small number of actors with which you need to negotiate or a strongly organized sector<br>• When there is much relatively cheap energy saving potential (low hanging fruit) |
| **Co-operative or public procurement programme** | • When there are sufficient possibilities to bundle large buyers of energy-efficiency technologies<br>• When there is a limited number of market actors supplying energy-efficiency technologies<br>• When potentials for further development and market transformation of new technologies are large enough |

## 1.4 Energy-efficiency and Climate Change

Various recent studies have shown that improving energy-efficiency is one of the key elements to combat climate change. On 4 May 2007 the final report of *Working Group 3 of the IPCC* showed that there are substantial emission reduction potentials per sector that can be implemented by 2030 (see Figure 3). Energy-efficiency is considered one of the key mitigation technologies to achieve these reductions.

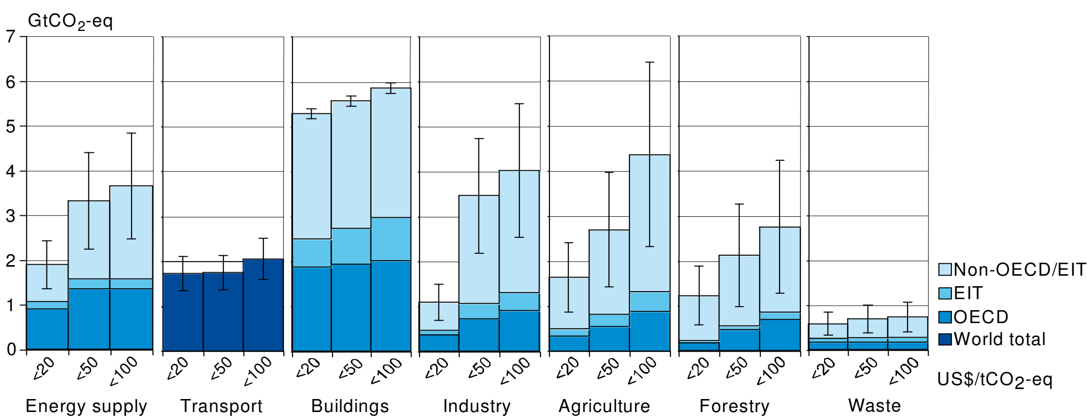


Figure 3 Estimated economic greenhouse gas emission reduction potential in Gt of $CO_2$-equivelants for different world regions (OECD, EIT and non OECD/EIT). The potentials are estimated for various carbon prices respectively 20, 50 and 100 U$ per ton of $CO_2$ (IPCC 2007)

In its own scenario *Climate Solutions: WWF's vision for 2050*, WWF has found that the known sustainable energy sources and proven technologies could be harnessed between now and 2050 to meet a projected doubling of global demand for energy services, while achieving the significant (in the order of 60%-80%)

reductions in climate-threatening emissions, enabling a long-term stabilization of greenhouse gas concentrations at 400ppm CO2e (parts per million) (WWF, 2007)[5].

In their *Alternative Policy Scenario* in the World Energy Outlook (WEO) the *IEA* assessed the impact of current policies in tapping these huge energy-efficiency potentials. In the WEO Reference Scenario, which provides a baseline vision of how energy markets are likely to evolve without new government measures to alter underlying energy trends, global primary energy demand increases by 53% between now and 2030. Over 70% of this increase comes from developing countries, led by China and India. The Alternative Policy Scenario demonstrates that the energy future can be substantially improved if governments around the world *implement the policies and measures they are currently considering*. In this scenario, global energy demand is reduced by 10% in 2030. Improved efficiency of energy use contributes most to the energy savings and furthermore shows that these policies are very cost-effective (see Figure 4). The analysis shows that total energy investments are lower in the Alternative Policy Scenario than in the Reference Scenario: consumers spend US$2.4 trillion more in 2005-2030 in more efficient cars, refrigerators etc, while producers spend almost US$3 trillion less. The higher initial investments by consumers are more than outweighed by fuel-cost savings. The Alternative Scenario also shows that much more policy effort is needed to tap the huge energy-efficiency potentials available.

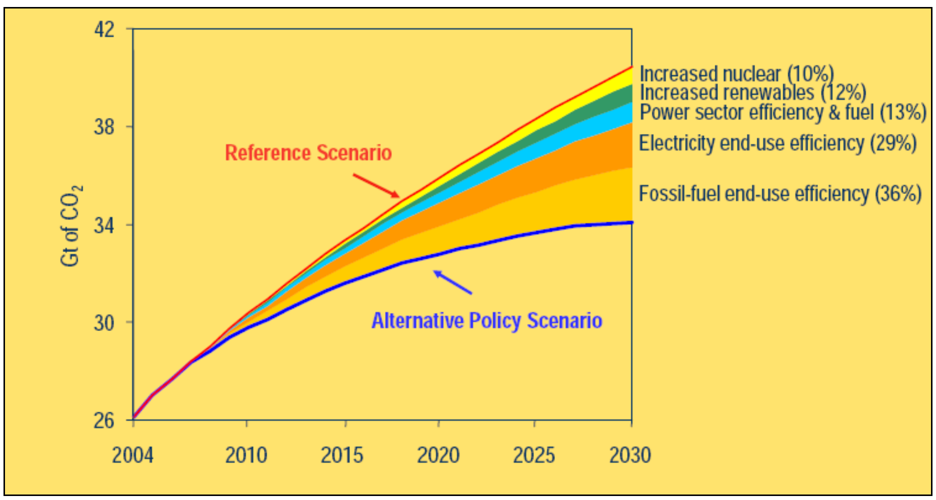


Figure 4 Global $CO_2$ emission in the reference and alternative policy scenario of the WEO (IEA 2006)[6]

WWF and others have criticized the Alternative Policy scenario for not being in line with the 2° C climate stabilisation target. Other scenarios, e.g. EU COM (2007), project greater emissions reductions through policy measures for the same

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[5] WWF (2007). Climate Savers. WWF Vision for 2050. WWF International, Switzerland.
[6] IEA (2006) World Energy Outlook. OECD/IEA, Paris, France. 2006

period of time. The IEA Alternative Scenario can therefore be interpreted as a rather conservative policy scenario.

## 1.5 Conclusion and Reading Guide

Various studies show that further gains in energy-efficiency are still possible in all economies. However, societies' infrastructures - their transportation systems, building stocks, industrial facilities and energy supply networks - impose a certain resistance to improvements in energy-efficiency. Furthermore, various market barriers contribute to a slow diffusion and adoption of energy-efficient technologies. There are no "silver bullet" technologies or policies that can alone yield all the potential energy savings or make large-scale energy-efficiency improvements easily achievable. Savings are possible, but a broad range of policies and instruments needs to be deployed.

WWF asked Ecofys to produce a report providing an overview of energy-efficiency potentials, current energy-efficiency policies in place in the G8 plus 5 countries, and recommendations for improvement of policies and international cooperation to ensure that the energy-efficiency potentials are implemented.

Chapter 2 provides an overview of the applied methodology, chapter 3 provides the results of our inventory and analysis for the G8 plus 5 countries. Chapter 4 explores options and challenges of different types of international policy and technology cooperation. Chapter 5 summarizes the findings of the other chapters and gives recommendations for policy improvements in and between the G8 plus G5.

# 2 Methodology and Data Sources

## 2.1 Introduction

This chapter starts with setting the scope for our analysis, and the methodologies applied to determine the energy-efficiency potentials and effectiveness of the policies in place.

## 2.2 Scope: Sectors

The analysis is limited to the building, transport and power sectors. In our analysis we distinguished between:

- Buildings residential – fuels: This includes fuel consumption in the household sector (e.g. used for space heating and warm water production).
- Buildings residential – electricity: This includes electricity consumption in the household sector (e.g. for space heating, warm water production, cooling, lighting and use of appliances).
- Buildings non-residential – fuels: This includes fuel consumption in non-residential sector (including commercial and non-commercial service sector).
- Buildings non-residential – electricity: This includes electricity consumption in non-residential sector (including commercial and non-commercial service sector).
- Transport – passenger: This includes energy use for passenger road transport.
- Transport – freight: This includes energy use for freight road transport.
- Power sector: This includes energy use for the production of electricity.

This analysis does not look into opportunities for savings in the industrial and agricultural sectors.

## 2.3 Scope: Energy-efficiency Policies

There is a whole range of energy-efficiency policies in place that are initiated on various government levels. Within the framework of this project energy-efficiency policies are defined as an overall set of activities by the government or another funding or implementing agent to promote energy-efficiency, normally existing of a coherent package of different policy instruments, with specific overall targets and strategies. This definition covers the whole range of policies from e.g. financial support for research on and development of energy-efficient technologies to fiscal instruments stimulating market introduction of mature technologies.

Within the framework of this project we concentrated on the category of policies we called *measurable energy-efficiency policy instruments* defined as a specific activity initiated by the government or another funding or implementing agent directly targeting energy end-users to stimulate them to implement energy-efficiency measures, which is aimed to result in concrete verifiable energy savings. An example of a measure for which the impact is hard to measure is are e.g. information campaigns and training programmes. These instruments are often implemented to support the implementation of "measurable" instruments.

Taking the instruments summarised in Table 2 as a starting point, we concentrated on the following types of instruments.

- **Energy performance standards**. This includes mandatory standards on energy use for e.g. the building sectors, appliances and cars.
- **Mandatory targets/tradable permits**. This includes energy-efficiency obligations (like e.g. Energy-efficiency Commitment in the UK, trading of white certificates in Italy and France) but also emission trading systems (like the EU Emissions Trading Scheme) which potentially contribute to energy-efficiency improvements.
- **Labelling.** This includes all initiatives to inform consumers by indicating on a label the energy performance of various consumer goods.
- **Fiscal instruments**. This includes instruments to lower up front investments in energy-efficiency measures. This includes subsidies, fiscal instruments, soft loans, etc.
- **Energy/$CO_2$ tax:** This includes all instruments increasing the cost of energy carriers with the aim to stimulate more efficient use of these energy carriers.
- **Voluntary agreements.** This includes voluntary agreements with specific sectors or suppliers to save energy or improve energy performance of products.

The above list does not include 'soft instruments' such as information campaigns, trainings, and education. These instruments are mostly in place to support the implementation of another instrument or to support the general energy-efficiency strategy for a country. We therefore did not analyze them separately but did take these into account when assessing the effectiveness of the various instruments.

## 2.4 Energy-efficiency Potentials: Methodology and Data Sources

### *2.4.1 What is energy-efficiency?*

Energy-efficiency is defined as output divided by input, where energy is an input. The reverse of energy-efficiency is input divided by output, often indicated as "specific energy consumption" or "energy intensity". The overall energy intensity of a country can be measured by dividing energy use over gross domestic product (GDP). In general energy-efficiency continually improves at low rates, typically at

1% per year. This is generally referred to as the autonomous energy-efficiency improvement. The autonomous energy-efficiency improvement is a result of technological development and is not policy-induced. Please note that a decline of the energy over GDP ratio can also be caused by other factors than energy-efficiency improvement such as structural changes in the economy (e.g. by a shift from heavy industries to services).

By implementing policies aimed at reducing energy demand, an overall energy-efficiency improvement rate of 2% per year is often considered achievable. Blok (2005) shows that higher energy-efficiency improvement rates in the range of 3-3.5% are also possible. These higher rates are a result of continuous innovation in the field of energy-efficiency. For industrialized countries, this means a reduction of primary energy use by 50% in 50 years compared to current levels. This means that in spite of the doubling of energy use under business-as-usual conditions, the energy use can be as low as 50% of the current level (Blok, 2005)[7].

### 2.4.2 Energy-efficiency improvement potential

The energy-efficiency improvement potential is determined relative to a reference scenario and is thus additional to autonomous energy-efficiency improvement already occurring in the reference scenario.

A distinction can be made between theoretical potential, technical potential and cost effective potential (see Figure 5). The technical potential represents the potential that could be achieved with available technologies and is smaller than the theoretical potential. In this study we will focus on the technical potential and give a few examples of the cost effective energy-efficiency potential. Cost effective means that direct costs of energy saving measures (e.g. investment costs and maintenance) are equal or lower to the direct benefits of a measure (e.g. reduced energy consumption) over the lifetime of the measures. Future costs and benefits are discounted to the base year. The cost effective potential is larger than the market potential, due to market failures and social obstacles such as a lack of knowledge, institutional barriers (well known is the landlord-tenant problem) and organisations barriers (such as organisation decision structure in firms). Policies aimed at reducing social obstacles and market failures are needed to tap the cost effective potential.

[7] Blok, K. (2005). Improving energy-efficiency by five percent and more per year? Journal of Industrial Ecology. Volume 8, Number 4. Massachusetts Institute of Technology and Yale University

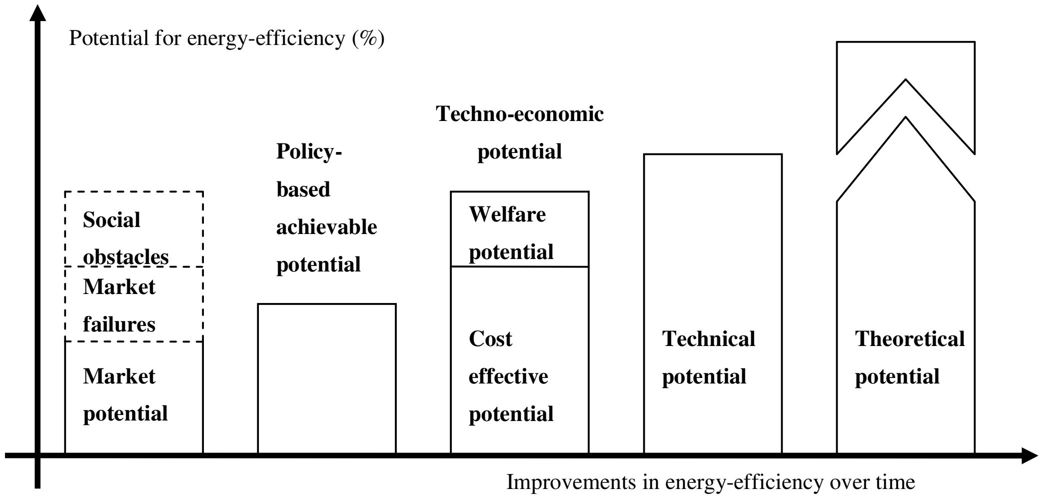



Figure 5 Potentials for energy-efficiency (Michelsen 2005)[8]

The (technical) energy-efficiency improvement potential in this study is based on a number of assumptions. These assumptions are described per sector below.

### 2.4.3 Examples of energy-efficiency measures

Table 3 shows important energy-efficiency improvement options that are possible per sector.

Table 3 Energy-efficiency improvement measures

| Sector | Measures |
|---|---|
| Power sector | • Improve energy-efficiency of power generation by retrofit of existing power plants<br>• Replacing inefficient power plants by new efficient power plants<br>• Increase the use of Combined Heat and Power generation (CHP). |
| Transport | • Improve energy-efficiency of cars and trucks by increased use of hybrid vehicles or fuel cell vehicles<br>• Improve energy-efficiency of vehicles through development of engines |
| Buildings | • Implement efficient appliances in households and services (washing machines, dishwashers, TVs, refrigerators, computers, printers etc) and reduce stand-by losses.<br>• Improve energy-efficiency of lighting<br>• Improve heat insulation and buildings design |

[8] Michelsen, C (2005) Exploring policy space: Interactions between policy instruments on household energy-efficiency. The case of domestic cold appliances in Germany. Paper developed in the course of the AID-EE project, Lund/Wuppertal.

**Power sector**

Energy-efficiency improvement of fossil power generation:

- We assume that the average energy-efficiency of fossil-fired power generation can be increased to 55% in 2030. The autonomous energy-efficiency increase for fossil-fired power plants is assumed to be 0.7% per year.

Energy savings by implementing CHP:

- We assume that 35% of fuel consumption (excluding feed stocks) in buildings and industries can be reduced by implementing CHP. This is based on the assumptions that 80% of fuel consumption (excluding feed stocks) in buildings and industry is used for heat generation and that 50% of the heat generation in buildings and industries can be generated by CHP. This leads to an estimated energy savings of 35% when taking into account the energy-efficiency of CHP (85-90%) in comparison to the typical energy-efficiency when heat and power is generated separately with an energy-efficiency of 90% for heat and 40% for power.

**Road transport**

We assume that the average energy-efficiency of passenger and freight transport can be increased to 4 litre gasoline equivalent (g.e.) per 100 vehicle km (v.km) and 4 litre g.e. per 100 tonne km (t.km) in 2030, respectively. The current efficiency is based on the energy-efficiency of the region a country is located in, as given in the table below. The autonomous energy-efficiency increase of road transport is assumed to be 1.2% per year in the reference scenario.

Table 4 Specific fuel consumption by cars and diesel trucks in 2000 (IEA/SMP 2004)[9]

| Region | Fuel intensity (litre g.e. per 100 v.km / t.km) | |
|---|---|---|
| | Cars | Trucks |
| OECD Europe | 8.0 | 7.0 |
| OECD North America | 11.5 | 6.0 |
| OECD Pacific | 10.6 | 11.9 |
| Transition Economies | 10.3 | 10.3 |
| China | 11.4 | 11.2 |
| East Asia | 11.9 | 9.0 |
| South Asia | 11.2 | 10.4 |
| Latin America | 11.8 | 9.8 |
| Africa | 13.9 | 12.8 |
| Middle East | 12.0 | 12.0 |

[9] IEA/SMP (2004). IEA/SMP Model Documentation and Reference Case Projection. L. Fulton (IEA) and G. Eads (CRA) for WBCSD's Sustainable Mobility Project (SMP), July 2004.

Table 5 shows the share of energy use for passenger and freight transport in the total energy use for road transport in 2030 based on the IEA/SMP Model for transport per region. We take these values for the countries located in the regions to estimate the potential for energy-efficiency improvement in 2030 in comparison to the reference energy demand.

Table 5 Share energy use for passenger and freight transport in total energy use for road transport in 2030 (IEA/SMP, 2004)

| | **Passenger** | **Freight** |
|---|---|---|
| OECD North America | 75% | 25% |
| OECD Europe | 62% | 38% |
| OECD Pacific | 64% | 36% |
| Former Soviet Union | 70% | 30% |
| Eastern Europe | 77% | 23% |
| China | 63% | 37% |
| Other Asia | 50% | 50% |
| India | 59% | 41% |
| Middle East | 36% | 64% |
| Latin America | 59% | 41% |
| Africa | 68% | 32% |

**Buildings**

- For buildings we assume that the thermal energy-efficiency and the energy-efficiency of electric appliances can be reduced by
    - 2.5%/yr for countries with an energy-intensity of 7 MJ/US$[10] or below,
    - 3%/yr for countries with an energy-intensity between 8-15 MJ/US$ and
    - 3.5%/yr with an energy intensity above 15 MJ/US$.

These energy-efficiency improvements include autonomous energy-efficiency improvement[11]. The energy-intensity of the countries considered in this study is given in the table below.

[10] MJ primary energy supply per U.S. Dollar GDP at 2000 prices.
[11] The autonomous energy-efficiency improvement for buildings is assumed to be 1.2%/yr for the United States, Canada, South Africa and EU countries; 2% for China, India and Russia; and 0.9% for Japan, Brazil and Mexico (based on WEO 2006).

Table 6 Energy-intensity of economy per unit of GDP in 2004

| | Energy intensity (MJ/US$) in 2004 |
|---|---|
| Japan | 5 |
| United Kingdom | 6 |
| Italy | 7 |
| Germany | 7 |
| France | 8 |
| United States | 9 |
| Mexico | 11 |
| Brazil | 13 |
| Canada | 14 |
| China | 36 |
| South Africa | 36 |
| India | 41 |
| Russia | 82 |
| **Worldwide average** | **13** |

**Reference scenario**

No literature source was available for this study that includes reference scenarios for all countries considered. Therefore a number of different literature sources are used (see Table 7).

Table 7 Literature sources for reference scenario

<table>
<tr><th>Country</th><th>Reference scenario</th><th>Base year</th><th>End year</th></tr>
<tr><td>United States</td><td rowspan="3">IEA World Energy Outlook 2006</td><td rowspan="3">2004</td><td rowspan="3">2030</td></tr>
<tr><td>Japan</td></tr>
<tr><td>Russia</td></tr>
<tr><td>Canada</td><td>National Energy Board (2003) “Scenarios for Supply and Demand to 2025”</td><td>2000</td><td>2025</td></tr>
<tr><td>France</td><td rowspan="4">European Union (2004) “European energy and transport scenarios on key drivers” based on PRIMES and ACE model.</td><td rowspan="4">2000</td><td rowspan="4">2030</td></tr>
<tr><td>Germany</td></tr>
<tr><td>Italy</td></tr>
<tr><td>United Kingdom</td></tr>
<tr><td>Brazil</td><td rowspan="3">IEA World Energy Outlook 2006</td><td rowspan="3">2004</td><td rowspan="3">2030</td></tr>
<tr><td>India</td></tr>
<tr><td>China</td></tr>
<tr><td>South Africa</td><td>Base year is taken from IEA Energy Balances 2006. End year is an extrapolation based on GDP growth rate for Africa from IEA WEO 2004 and autonomous energy-efficiency improvement of 1.2%/yr.</td><td>2004</td><td>2030</td></tr>
<tr><td>Mexico</td><td>IEA World Energy Outlook 2004</td><td>2002</td><td>2030</td></tr>
</table>

### 2.4.4 Examples of economic potentials

The economic energy-efficiency potential is less than the technical potential because the economic potential excludes measures that are not cost-effective. Still the cost-effective potential is generally considered to be substantial. Below a few examples are given of estimates for cost-effective energy-efficiency improvement potentials:

- For the United States an analysis of eleven studies, done by ACEEE (2004)[12], shows a median technical potential of 33% for electricity and 40% for gas, and a median economic potentials for electricity and gas of 20% and 22% respectively. The median achievable potential in a period of 20 years, is 24% for electricity (an average of 1.2% per year) and 9% for gas (an average of 0.5% per year).
- A study by Marbek Resource Consultants and M.K. Jaccard and Associates (2006)[13] for Canada estimates that the economic energy-efficiency potential is a reduction of energy demand by 14% in 2025 in comparison to the reference energy demand.
- The IEA World Energy Outlook gives two scenarios. The first is the reference scenario and the second is an alternative scenario (Alternative Policy Scenario). The second scenario includes policy measures under consideration in the field of energy-efficiency and increased use of renewables and nuclear. In this scenario the worldwide energy demand is reduced by 10% in comparison to the reference scenario, at no extra costs. This means that a cost-effective energy-efficiency increase of at least 10% would be feasible, when taking all measures together.

## 2.5 Co-benefits of energy-efficiency

There are more benefits to energy-efficiency investments than energy savings and climate protection. They offer various economic and social opportunities.

*Cost savings*

With rising gas and oil prices, energy costs are an increasing burden on both developed and developing countries, especially if fossil energy sources are imported. Less need for foreign currency is especially important for developing countries. The large economic energy-efficiency potential discussed in the last paragraph proves that increasing energy-efficiency means large cost savings to a country's economy.

[12] The Technical, Economic and Achievable Potential for Energy-Efficiency in the U.S. – A Meta-Analysis of Recent Studies Steven Nadel, Anna Shipley and R. Neal Elliott. American Council for an Energy-Efficient Economy. http://www.aceee.org/conf/04ss/rnemeta.pdf

[13] Demand side management potential in Canada: energy-efficiency study. Summary Report submitted to: Canadian Gas Association. http://cga.ca/publications/documents/SummaryReportFinal.pdf

*Matching rising energy demand and securing energy supply*

For transition countries like China and India, matching the rising energy demand of their fast growing economies poses a major challenge. In this situation energy-efficiency becomes a key to keep up sustainable economic growth.

*Providing energy services in developing countries*

As examples like South Africa's efficient lighting initiative demonstrate, energy-efficient technologies are suited to provide energy services to low-income groups in developing countries which cannot afford high energy costs.

*New business opportunities*

Improving energy-efficiency creates new business opportunities for innovative businesses.

*Employment effects*

A study published by the EU Parliament estimates that improvements in energy-efficiency create 3 to 4 times the number of jobs created by investments in additional energy supply. According to the study, investments in cost-effective energy-efficiency improvements "almost always have a positive impact on employment:

- The direct effect – which accounts for a third of employment benefits – comes from the labour required to implement the initial energy-saving investment.
- The indirect effects – which come from re-investing the savings generated by energy-efficiency measures – account for two-thirds of the total impact on employment." (EU Parliament 2007)

## 2.6 Inventory and Effectiveness of policies: Methodology and Data Sources

The inventory and assessment of energy-efficiency policies include the following steps:

- **Step 1**: Inventory of most important policies currently in place or for which political agreement has been reached to implement them at short notice. We focused on the instrument(s) with the expected largest impact at the national level and limited the amount of instruments further analysed per sector to two.
    - **Results step 1**: Table holding an overview of the most important policies in place including the most important 'white spots' per country.
- **Step 2**: Assessing the effectiveness of the identified policies per sector. The effectiveness (but in literature also referred to as the impact) of policies is defined as the extent to which a policy instrument makes a difference compared

to the situation without the policy instrument. Within the framework of the project we are not able to analyse the effectiveness of the various policies in great detail in a quantitative manner. We analyzed the effectiveness by using a checklist per type of instruments. The checklist includes a general set of qualitative success factors per type of instrument, which we identified within the framework of the EU funded project AID-EE in which over 20 different instruments were analysed (www.aid-ee.org). We assumed that the more qualitative success factors are in place the more effective an instrument will be in a specific country. Because of lack of time and data we were not able to fill out the checklist in detail for all instruments. In these cases the assessment of effectiveness was based on expert judgement by Ecofys.

   - **Result step 2**: Table providing insight on the effectiveness of the instruments per country and examples of successful and failed policies (what worked well and what did not).

- **Step 3**: Assessing the overall effectiveness of the policy package in place and recommendations on (changes in) energy-efficiency policies to tap the available energy-efficiency potential.
   - **Results step 3:** Table with overview on result of assessment.

# 3 Country analyses

## 3.1 Introduction

This chapter holds an overview of the individual country analysis of the G8 plus 5 countries. For each country the following information is provided:

(1) General characteristics per country. Providing an overview of population, GDP, (fossil) power generation (TWh), and energy use in the building and transport sector.
(2) The second part provides an overview of energy use in the base year (2004), energy use under the reference scenario (i.e. energy use if only current policies are being implemented), indication of specific energy use per sector (energy use per capita or GDP), and finally an overview of the energy saving potential in the end year (in which we take into account normal stock turnovers).
(3) The third part includes the policy assessment. The table indicates the type and effectiveness of policies in place for the analysed sectors. Colour coding is used to indicate effectiveness: green for very effective; orange for reasonably effective and red for not very effective. The table furthermore analyses 'white spots' in policies and holds recommendations on how to accelerate energy-efficiency improvement per country. A 'white spot', or a blank cell, indicates that there is no (significant) policy instrument in place to improve energy-efficiency for this certain sector.

## 3.2 EU energy-efficiency policy framework

First, an overview of the European Union's energy-efficiency policy framework is given, since this influences policies of Germany, France, Italy and the United Kingdom, four of the G8 countries that are members of the European Union.

The Energy Efficiency Action Plan (EEAP) was a response of the EC on a call of several European Member States to put forward a realistic strategy on energy efficiency. The strategy has to lead to an annual saving of 2.7% a year and an absolute cut in energy use. This means that efficiency improvements on the European level need to be doubled. A large number of European Directives and voluntary agreements have been introduced in the last decade aiming to improve energy efficiency. Figure 6 provides an overview of the most relevant policies directly or indirectly influencing energy-efficiency currently in place. According to the EC "full implementation and enforcement of the existing and future regulatory frameworks is essential". The Commission has therefore rigorously pursued – through legal means – proper transposition and application of Community law affecting energy efficiency, including legislation on the internal energy market, buildings, and appliances (EC, 2006)[14].

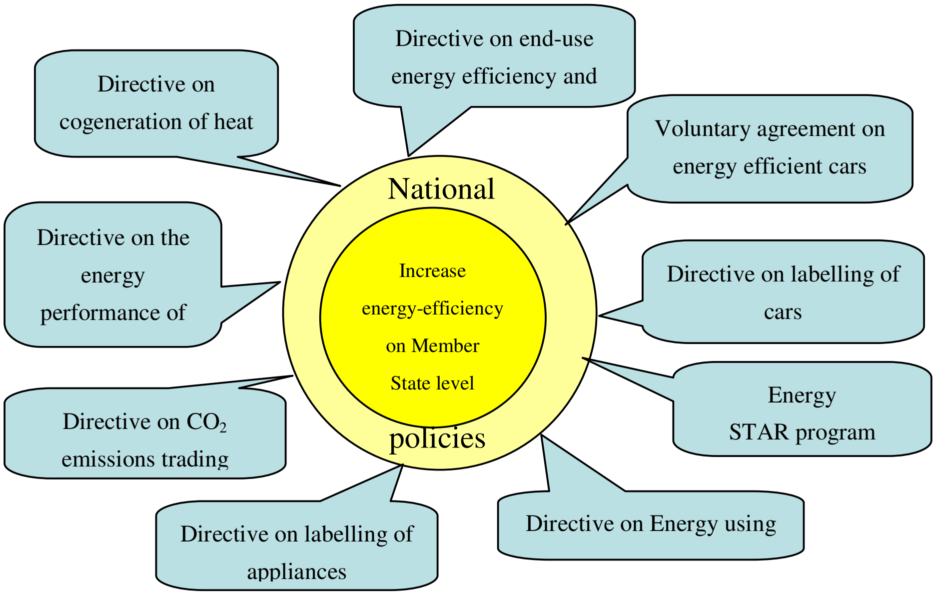



Figure 6 Overview of EU directives that directly or indirectly influence energy-efficiency improvements in EU Member States

According to the EEAP half of the saving target can be achieved by implementing the existing legislation, while new measures should contribute to the remaining half. The EU Spring Council in March 2007 included the energy saving target proposed by the EEAP in the new EU energy policy for Europe, aiming at reducing GHG emissions by 30% by 2020[15]. This target, however is not binding.

The most important **directives** include:

- **Directive on Labelling of appliances** (1995)[16]. Member States are obliged to provide various household appliances and light bulbs with a label. The current directive does not see to a frequent update of the labelling system. This leads to the situation that in some Member States the markets for some appliances predominantly have an A-label. According to the Commission's EEAP the labelling system should be revised every 5 years resulting in only 10-15% of the appliances holding an A-label.

[14] EC (2006) Action Plan for Energy Efficiency: Realising the Potential. European Commission. Brussels, 19.10.2006 COM(2006)545 final
[15] Compared to 1990, provided other developed countries commit to a comparable reduction. Council of the European Union, Presidency conclusions (March 2007)
[16] Directives on energy labelling of household appliances: Electric refrigerators, freezers and their combinations (2003/66/EC), Electric ovens (2002/40/EC), Air-conditioners (2002/31/EC), Dishwashers (1999/9/EC), Washing machines (96/89/EC), Combined washer-driers (96/60/EC), Lamps (98/11/EC), Electric tumble dryers (95/13/EC)

- **Labelling of passenger cars** (1999/94/EC). Member States are obliged to provide passenger cars with a label showing the $CO_2$ emission per kilometre.
- **Energy Performance of Buildings Directive (EPBD)** (2002/91/EC). Member States are among others obliged to: (1) develop energy standards for new building and buildings that undergo major renovations with a floor area over 1000m², (2) introduce an energy certificate for buildings, (3) and introduce periodical inspection of heating and cooling installations. In the EEAP the EC announced that it wants to increase the impact of the EPBD by introducing an obligation to install passive heating and cooling and introducing energy standards for buildings below 1000m².
- **Directive on Emission Trading** (2003/87/EC). The Directive puts a cap on the $CO_2$ emissions of large (combustion) installations in the industry and power sector. Installation owners can either choose to take emission reduction measures themselves (among which energy-efficiency measures) or buy $CO_2$ permits to comply with their cap.
- **Directive on cogeneration of heat and electricity (CHP)** (2004/8/EC). The Directive aims to increase the implementation of high efficiency CHP. The Directive is mainly aimed at removing barriers for CHP like fair access to the grid. The EEAP suggest extending the directive with minimum efficiency requirements for district heating and micro generation.
- **Directive on Energy using products (Ecodesign)** (2005/32/EC). The Directive sets design rules for energy using products like household and office appliances. Currently the design rules of the first 14 product categories are being developed[17].
- **Directive on Energy-efficiency and Energy Services** (2006/32/EC). This Directive sets a non-binding energy saving target of 1% per year in the period 2008-2017. It aims to set a framework for tightening energy-efficiency policies on the national level. Each Member state must submit a national Energy-efficiency Action Plan every 3 years, as of June 2007.

The most important voluntary agreements include:

- **Energy Star Programme** (2003/269/EC). This includes the voluntary labelling of office appliances. Current criteria for carrying the label are not very strict. When the label is introduced 60% of the market already qualifies and after one year 80% qualifies. The agreement has been renewed in December 2006: new criteria should be introduced as of 2007. Only 25% of the products on the market should qualify for the label[18]

[17] Product include: boilers, water heaters, computers, imaging, television, standby chargers, office lighting, street lighting, room air, cold commercial, domestic commercial, motors, washing

[18] Agreement between the Government of the United States of America and the European Community on the coordination of energy-efficiency labeling programmes for office equipment (28.12.06)

- **ACEA-covenant** (1990/2000). Voluntary agreement with the European (ACEA), Japanese (JAMA) en Korean (KAMA) car producers on limiting the $CO_2$ emissions of new sold passenger cars to a maximum 140 gram per $CO_2$/km by 2008. In February the EC announced that it opts for a legally binding target of 130 gram km by 2012 through technological improvement and additional 10 g/km decrease through non technological measures, i.e. tyres pressure, driving behaviour etc (EC, 2007)[19].

[19] EC (2007) Communication from the Commission and the Council and the European Parliament. Results of the review of the Community Strategy to reduce CO2 emissions from passenger cars and light-commercial vehicles. Brussels, 7.2.2007 COM(2007) 19 final

### 3.3 Germany

The energy-intensity for Germany in 2004 is low with 7 MJ/US$2000. The energy consumption for transport and buildings per capita is 28 and 51 GJ/capita in 2004, respectively.

The potential for energy-efficiency improvement is largest for buildings: 29% in 2030[20]. This is a savings potential of nearly 1300 PJ in 2030 in comparison to reference energy demand. The estimated energy savings potential for road transport is 24% (or 720 PJ) in 2030, and for fossil-fired power generation 21% (or 1200 PJ) in 2030. By implementing CHP energy savings are estimated to be possible of around 1045 PJ in 2030.

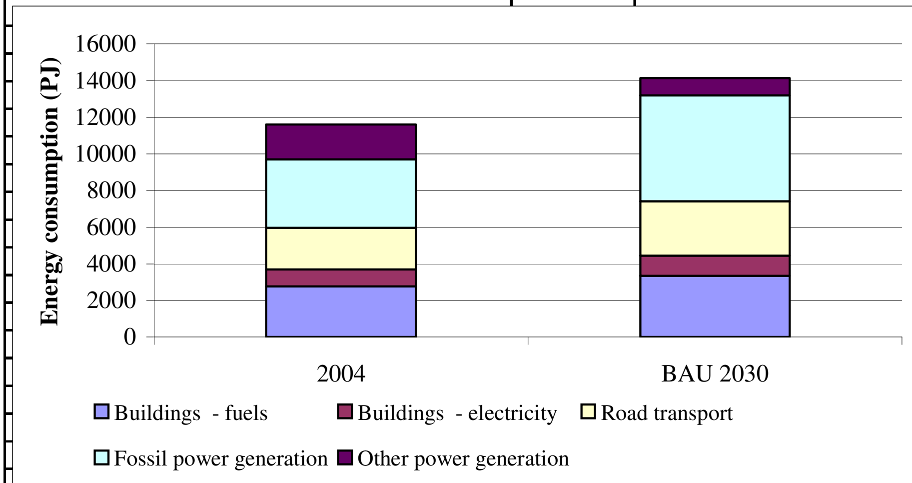
Germany's energy-efficiency policies include energy savings standards for new as well as existing buildings. Investments in new as well as existing buildings are financially supported through subsidies and a soft loan programme. Financial resources are, however, limited and only small part of the building stock can be reached. Effective policies to reduce energy use in the transport sector are missing. For the power sector the European Emission trading scheme is the major instrument but so far had limited impact because cap was not set very tight. Incentives for CHP are insufficient to attract large new investments in CHP.

| GERMANY | | |
|---|---|---|
| **Population and GDP** | | |
| Population | 83 | Million |
| GDP | 1953 | Billion US$ at 2000 prices |
| **Power generation** | | |
| Total power generation | 610 | TWh |
| Fossil power generation | 377 | TWh |
| **Energy use road transport and buildings** | | |
| Road transport | 2271 | PJ |
| Buildings total | 4213 | PJ |
| Buildings residential - fuels | 2158 | PJ |
| Buildings residential - electricity | 505 | PJ |
| Buildings non-residential - fuels | 606 | PJ |
| Buildings non-residential - electricity | 414 | PJ |
| Buildings - heat | 530 | PJ |

[20] In Germany there is discussion that with political support the potential in the building sector can be larger than 1300 PJ.

## GERMANY

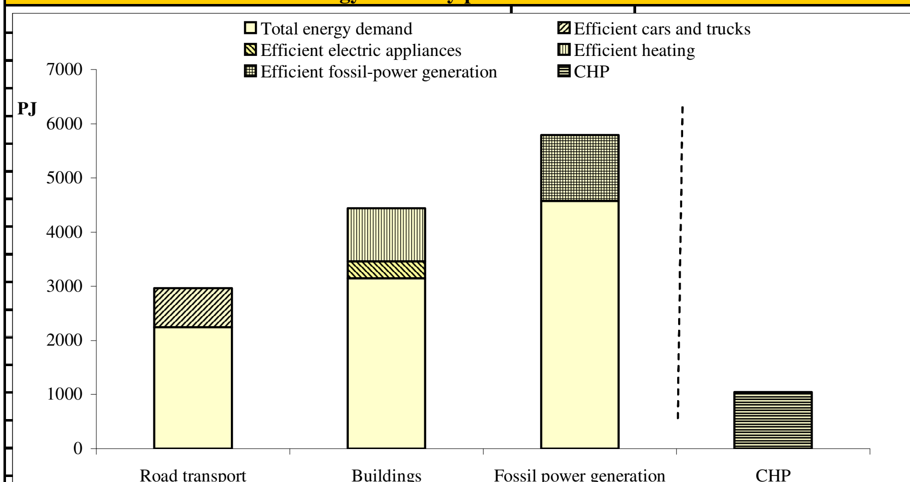
**Energy consumption for buildings, transport and power generation (PJ)**




**Specific energy consumption in 2004**

| | | |
|---|---|---|
| Energy intensity economy | 7 | MJ/US$2000 |
| Buildings total | 51 | GJ/capita |
| Buildings residential - fuels | 26 | GJ/capita |
| Buildings residential - electricity | 6 | GJ/capita |
| Buildings non-residential - fuels | 7 | GJ/capita |
| Buildings non-residential - electricity | 5 | GJ/capita |
| Road transport | 28 | GJ/capita |
| Energy-efficiency power sector | 44% | |
| Fossil power generation | 36% | kWh produced / energy input |

**Energy efficiency potentials for 2030**




**Sources**

EU (2004)

**Remarks**

- For Germany, heat consumption by buildings is equal to 6 GJ/capita. This heat consumption is included in the graphs in fuel consumption of buildings.
- Energy consumption for buildings and transport refers to final energy consumption. Energy consumption by fossil power generation refers to primary energy use.

| GERMANY | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Type and effectiveness of energy efficiency policies in place** | | | | | | | | |
| | | **Sectors** | | | | | | |
| | | Buildings residential - fuels | Buildings residential - electricity | Buildings non-residential - fuels | Buildings non-residential - electricity | Transport - passenger | Transport - freight | Power sector |
| **Type of instruments** | Energy performance standards | | | | | | | |
| | Mandatory targets/tradable permits | | | | | | | |
| | Financial / fiscal instruments | | | | | | | |
| | Energy tax / energy tax exemption | | | | | | | |
| | Voluntary agreements | | | | | | | |
| | Labelling | | | | | | | |
| | Feed-in tariff (bonus) for CHP | | | | | | | |
| | **Overall effectiveness policies** | | | | | | | |

**Overall analysis of policies in place**

• Energy savings ordinance (“ENEV”): Building standards for new and majorly renovated buildings; standards are ambitious, but there are no penalties in place. They work reasonably well for new build-ings, but they are not consequently applied for modernisation; proper implementation remains a challenge, despite information programmes.
• Building rehabilitation programme: Subsidies for energy efficient building renovation; instrument is effective, but not enough to cover German building stock
• Building certificates: Certificates comply with European Building Directive. Intransparency: they are based on average consumption of building, not on performance.
• Energy labels for appliances: Transparent system, but need to be adjusted to technology progress (European task);
• "Energy Star": voluntary energy label for office equipment with low effectiveness
• CO2 emission label for passenger cars: not very effective as long as there is no standard
• Eco tax: Electricity tax; exemptions for energy intesive industry (and in the first years also electric heaters) weaken the impact; tax income is used to lower non-wage labour costs.
• Emission trading scheme (EU-ETS): Good instrument, but over-allocation of certificates by German NAP I; grandfathering gives extra profits to power production companies.
• CHP law: Premium feed-in tariff scheme; tariffs are only paid for existing plants and new plant <2MW, not addressing industrial CHP potentials; energy suppliers pay low prices to CHP producers, therefore incentive turns out to be too low to attract investments.

**Overall analysis of effectiveness of policies in place**

• Building sector policies: reasonably effective for new buildings, partly effective for renovated buildings; blank spot: efficiency standards for electric appliances and equipment
• Transport sector: reasonably effective tax system; blank spot: missing standards
• Power sector: introduction of EU-ETS is good in principle, but not very effective so far; CHP policy has been a failure

**Policy recommendations**

• Impose penalties for non-compliance with building standards
• Provide further financing to speed-up renovation process
• Introduce standards for electric appliances & equipment
• Enforce CO2 standards for passenger vehicles (EU level)
• Extend standards to freight sector
• New CHP policy to tap CHP potentials
• Stricter CO2 allowance allocation in EU-ETS

**Sources**

Expert interviews
www.aid-ee.org
www.bmvbs.de
http://www.verivox.de/power/Oekostrom_Oekosteuer.asp
www.bhkw-infozentrum.de

### 3.4 France

The energy-intensity for France in 2004 is 8 MJ/US$2000. The energy consumption for transport and buildings per capita is 29 and 43 GJ/capita in 2004, respectively.

The potential for energy-efficiency improvement is largest for buildings: 38% in 2030. This is a savings potential of nearly 1260 PJ in 2030 in comparison to reference energy demand. The estimated energy savings potential for road transport is 24% (or 540 PJ) in 2030, and for fossil-fired power generation 12% (or 140 PJ) in 2030[21]. By implementing CHP energy savings are estimated to be possible of around 700 PJ in 2030.

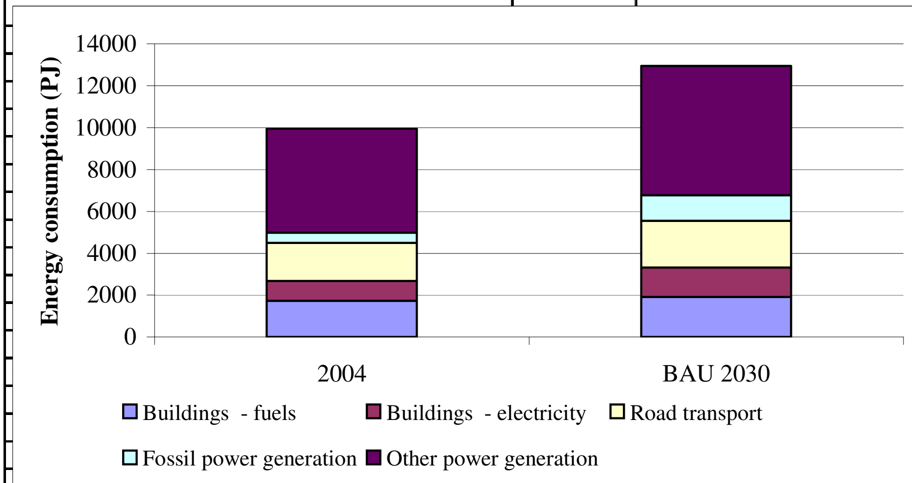
Energy efficiency policies in France are mainly induced by the European Directives and by the 2005 national Framework-law on energy. France has introduced an energy/CO2 labelling on cars at national level and the EU labelling on houses and appliances. There are subsidy schemes for energy efficient equipments in buildings (e.g. windows, boilers) and cleaner vehicles. The recently introduced White Certificates Scheme could be a pilot for such a scheme at EU level. But the mandatory caps put on energy providers are not much ambitious in the first period (2005-2007). To realize the CHP potentials, ambitious new measures would be needed as the actual trend of development is flat.

| FRANCE | | |
|---|---|---|
| **Population and GDP** | | |
| Population | 62 | Million |
| GDP | 1415 | Billion US$ at 2000 prices |
| **Power generation** | | |
| Total power generation | 567 | TWh |
| Fossil power generation | 56 | TWh |
| **Energy use road transport and buildings** | | |
| Road transport | 1812 | PJ |
| Buildings total | 2681 | PJ |
| Buildings residential - fuels | 1503 | PJ |
| Buildings residential - electricity | 528 | PJ |
| Buildings non-residential - fuels | 233 | PJ |
| Buildings non-residential - electricity | 416 | PJ |
| Buildings - heat | 0 | PJ |

[21] The national overall efficiency of the power sector is quite low because of the high number of nuclear plants and not much CHP. The choice of France to equip many of its buildings with electric heating also induces a large waste of primary energy in the building sector.

## FRANCE

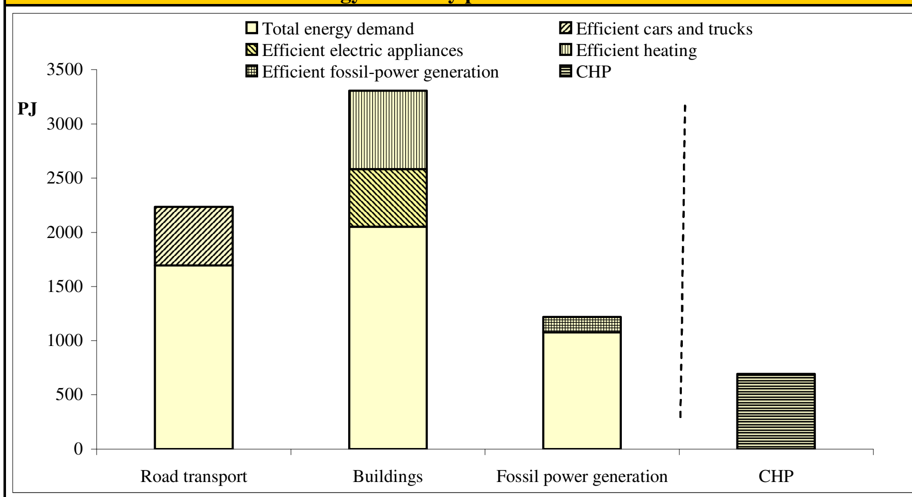
**Energy consumption for buildings, transport and power generation (PJ)**




**Specific energy consumption in 2004**

| | | |
|---|---|---|
| Energy intensity economy | 8 | MJ/US$2000 |
| Buildings total | 43 | GJ/capita |
| Buildings residential - fuels | 24 | GJ/capita |
| Buildings residential - electricity | 8 | GJ/capita |
| Buildings non-residential - fuels | 4 | GJ/capita |
| Buildings non-residential - electricity | 7 | GJ/capita |
| Road transport | 29 | GJ/capita |
| Energy-efficiency power sector | 37% | |
| Fossil power generation | 41% | kWh produced / energy input |

**Energy efficiency potentials for 2030**




**Sources**

EU (2004)

**Remarks**

Energy consumption for buildings and transport refers to final energy consumption. Energy consumption by fossil power generation refers to primary energy use.

ECOFYS

| FRANCE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Type and effectiveness of energy efficiency policies in place** | | | | | | | | |
| | | **Sectors** | | | | | | |
| | | Buildings residential - fuels | Buildings residential - electricity | Buildings non-residential - fuels | Buildings non-residential - electricity | Transport - passenger | Transport - freight | Power sector |
| **Type of instruments** | Energy performance standards | | | | | | | |
| | Mandatory targets/tradable permits | * | * | * | * | | | |
| | Financial / fiscal instruments | | | | | | | |
| | Energy tax / energy tax exemption | | | | | * | * | |
| | Voluntary agreements | | | | | | | |
| | Labelling | | | | | * | | |
| | | | | | | | | |
| | **Overall effectiveness policies** | | | | | | | |

**Overall analysis of policies in place**

- Building standards. Thermal building code was reinforced as of July 2005. Expected impact: energy saving of 15% compared to 2000. Only new buildings (private and commercial) are considered.
- Tax credit scheme. For existing building stock a tax credit scheme has been reinforced in 2005. The tax credit varies from 50% for equipment using renewables (e.g. solar water heaters) to 15-40% for other equipment (e.g. insulation).
- Labelling of buildings. Compulsory energy label scheme for buildings (November 2006) in accordance with the European directive on energy performance of buildings.
- CO2 oriented financial/banking product for households.
- Subsidy scheme for clean fuels vehicles.
- EU energy labels for appliances: Transparent system, but need to be adjusted to technology progress (EU task).
- Emission trading scheme (EU-ETS): Good instrument, but over-allocation of CO2 allowances in the first phase. Due to nuclear power generation in France no real effect on efficient in power sector.
- AERES: voluntary agreement on emission reduction prior to EU-ETS. Includes French energy sector.
- * Compulsory energy and CO2 car labelling: recently implemented
- * Additional taxation for powerful cars above 200gCO2/km: recently implemented.
- * White certificate scheme: Implemented in 2007. Mandatory targets imposed on the electricity and gas distributors to promote energy efficiency measures by demand side actions. Can become an important measure affecting thermal and electrical efficiency in the building sector. Energy intensive industry is excluded.

**Overall analysis of effectiveness of policies in place**

- Building sector policies: reasonably effective for new buildings, but not effective for renovated buildings and non-residential buildings.
- Transport sector: interesting new policies in passenger transport are under implementation but insufficient policy in the freight sector.
- Power sector: past improvement due to voluntary agreements (AERES) but the introduction of the (manadorty) EU-ETS has not been very effective.

**Policy recommendations**

- Impose ambitious mandatory standards in building renovation
- Financial mechanisms for green renovation
- Increase control for non-compliance with building standards
- Enforce CO2 standards for passenger vehicles (EU level)
- Extend standards to freight sector
- Better CHP policy
- Stricter CO2 allowance allocation in EU-ETS
- Improve white certificate scheme with lower caps and penalties

**Sources**


MURE/Odysee, Energy Efficiency Profile of France, 2007

ADEME/Enerdata, Energy Efficiency Policies and Measures in France in 2006

IEA Policies and Measures Database

### 3.5 Italy

The energy-intensity for Italy in 2004 is low with 7 MJ/US$2000. The energy consumption for transport and buildings per capita is 29 and 31 GJ/capita in 2004, respectively.

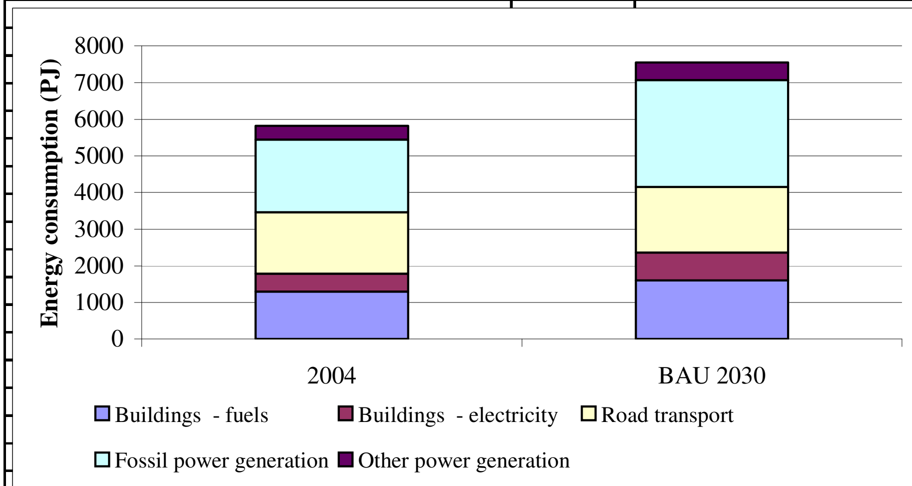
The potential for energy-efficiency improvement is largest for buildings: 29% in 2030. This is a savings potential of nearly 700 PJ in 2030 in comparison to reference energy demand. The estimated energy savings potential for road transport is 24% (or 440 PJ) in 2030, and for fossil-fired power generation 6% (or 180 PJ) in 2030. By implementing CHP energy savings are estimated to be possible of around 580 PJ in 2030.

January 2006 introduced the White Certificate system that imposed energy saving targets on the gas and electricity distributions. Effectiveness of the system cannot be assessed yet. This system potentially could have substantial impact on the building sector. As in most countries transport is an important white spot in energy efficiency policies.

| ITALY | | |
|---|---|---|
| **Population and GDP** | | |
| Population | 58 | Million |
| GDP | 1114 | Billion US$ at 2000 prices |
| **Power generation** | | |
| Total power generation | 293 | TWh |
| Fossil power generation | 237 | TWh |
| **Energy use road transport and buildings** | | |
| Road transport | 1669 | PJ |
| Buildings total | 1785 | PJ |
| Buildings residential - fuels | 1024 | PJ |
| Buildings residential - electricity | 240 | PJ |
| Buildings non-residential - fuels | 269 | PJ |
| Buildings non-residential - electricity | 252 | PJ |
| Buildings - heat | 0 | PJ |

**ITALY**

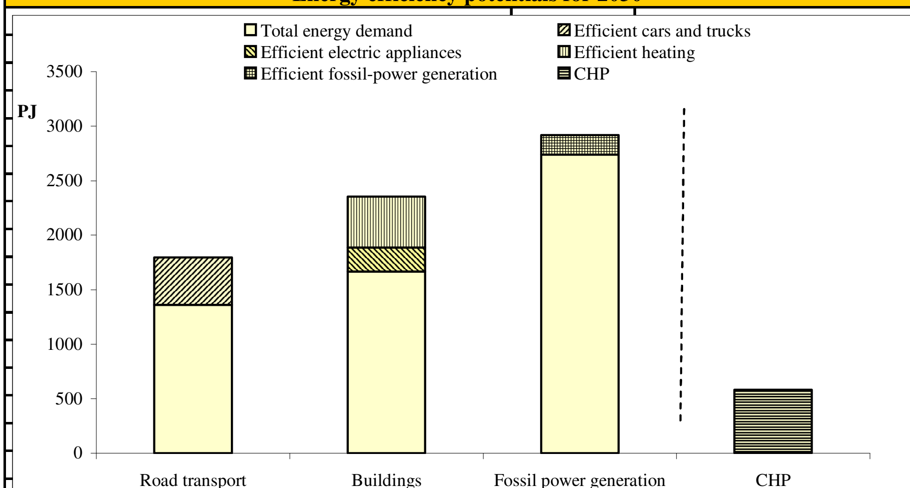
**Energy consumption for buildings, transport and power generation (PJ)**




**Specific energy consumption in 2004**

| | | |
|---|---|---|
| Energy intensity economy | 7 | MJ/US$2000 |
| Buildings total | 31 | GJ/capita |
| Buildings residential - fuels | 18 | GJ/capita |
| Buildings residential - electricity | 4 | GJ/capita |
| Buildings non-residential - fuels | 5 | GJ/capita |
| Buildings non-residential - electricity | 4 | GJ/capita |
| Road transport | 29 | GJ/capita |
| Energy-efficiency power sector | 53% | |
| Fossil power generation | 43% | kWh produced / energy input |

**Energy efficiency potentials for 2030**




**Sources**

EU (2004)

**Remarks**

Energy consumption for buildings and transport refers to final energy consumption. Energy consumption by fossil power generation refers to primary energy use.

## ITALY

### Type and effectiveness of energy efficiency policies in place

| Type of instruments | | Sectors: Buildings residential - fuels | Buildings residential - electricity | Buildings non-residential - fuels | Buildings non-residential - electricity | Transport - passenger | Transport - freight | Power sector |
|---|---|---|---|---|---|---|---|---|
| | Energy performance standards | | | | | | | |
| | Mandatory targets/tradable permits | | | | | | | |
| | Financial / fiscal instruments | | | | | | | |
| | Energy tax / energy tax exemption | | | | | | | |
| | Voluntary agreements | | | | | | | |
| | Labelling | | | | | | | |
| | CHP | | | | | | | |
| | **Overall effectiveness policies** | | | | | | | |

### Overall analysis of policies in place

- Building standards: Degree to improve the energy efficiency in new buildings (2005), complies with the EU directive on energy performance of buildings. Only new buildings are considered.
- Refurbishing existing buildings: Fiscal incentive for expenses done to refurbish exsisting buildings in place since 1992. Has a significant impacts given the relatively low efficiency level in Italian buildings.
- EU energy labels for appliances: Transparent system, but need to be adjusted to technology progress (EU task).
- White certificates: Mandatory targets imposed on the electricity and gas distributors to promote energy efficiency measures by demand side actions. Effectuated since january 2006. It is considered the most important measure affecting termal and electrical efficiency in the building sector.
- Voluntary agreements and financial support in transport sector: Since 1990 over 60 different policies have been acitvated. The policies are fragmented (due to the characteristics of the Italian transport sector) and have limited effect.
- Emission trading scheme (EU-ETS): Good insturment, but over-allocation of CO2 allowances in the first phase. Switch from oil and coal to natural gas redused sector's carbon emissions significantly since 1997.
- CHP: Financial incentives for CHP production are paid for by end-consumers. This has led to an increase in CHP production capacity: 2005 electricity production from CHP approximately 12% of total.

### Overall analysis of effectiveness of policies in place

- Building sector policies: reasonably effective for new buildings, partly effective for renovated buildings, first in EU to implement white certificate scheme.
- Transport sector: fragmented policy and not very efficient; blank spots: standards and freight.
- Power sector: introduction of EU-ETS is good in principle, but not very effective so far; CHP policy has effect.

### Policy recommendations

- Impose EU directive on labeling of buildings
- Impose penalties for non-compliance with building standards
- Provide further financing to speed-up renovation process
- Enforce CO2 standards for passenger vehicles (EU level)
- Extend standards to freight sector
- Additional incentives to tap CHP potentials
- Stricter CO2 allowance allocation in EU-ETS

### Sources

UNFCC National Communications Italy, 2006
MURE/Odysee, Energy Efficiency Profile of Italy, 2006
IEA Policies and Measures Database

### 3.6 United Kingdom

The energy-intensity for United Kingdom in 2004 is very low with 6 MJ/US$2000. The energy consumption for transport and buildings per capita is 28 and 43 GJ/capita in 2004, respectively.

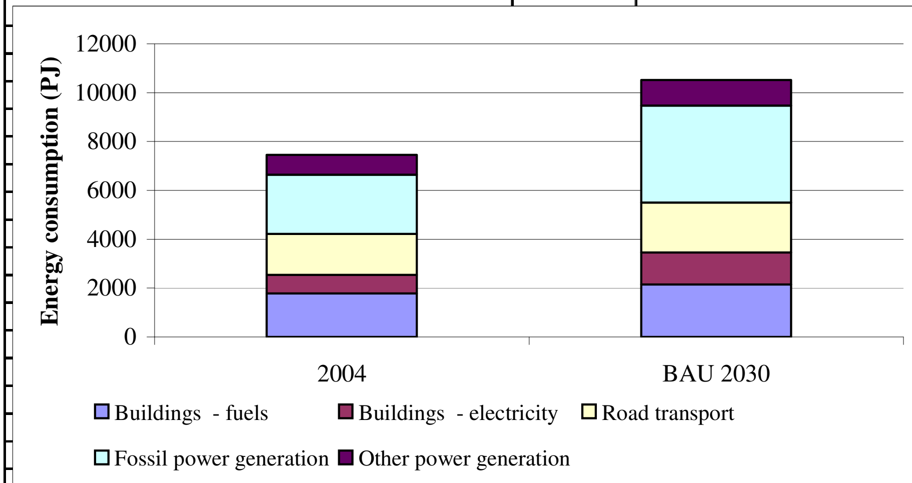
The potential for energy-efficiency improvement is largest for buildings: 29% in 2030. This is a savings potential of nearly 1000 PJ in 2030 in comparison to reference energy demand. The estimated energy savings potential for road transport is 24% (or 490 PJ) in 2030, and for fossil-fired power generation 4% (or 170 PJ) in 2030. By implementing CHP energy savings are estimated to be possible of around 780 PJ in 2030.

United Kingdom's energy-efficiency policies include among other the Energy Efficiency Commitment (EEC) which imposes an obligation on energy and gas suppliers to save energy with their customers. Saving were mainly achieved in the household sector (fuel as well as electricity savings) and in the first commitment period the target was overachieved.

| UNITED KINGDOM | | |
|---|---|---|
| **Population and GDP** | | |
| Population | 60 | Million |
| GDP | 1591 | Billion US$ at 2000 prices |
| **Power generation** | | |
| Total power generation | 393 | TWh |
| Fossil power generation | 296 | TWh |
| **Energy use road transport and buildings** | | |
| Road transport | 1681 | PJ |
| Buildings total | 2581 | PJ |
| Buildings residential - fuels | 1460 | PJ |
| Buildings residential - electricity | 416 | PJ |
| Buildings non-residential - fuels | 323 | PJ |
| Buildings non-residential - electricity | 343 | PJ |
| Buildings - heat | 40 | PJ |

**UNITED KINGDOM**

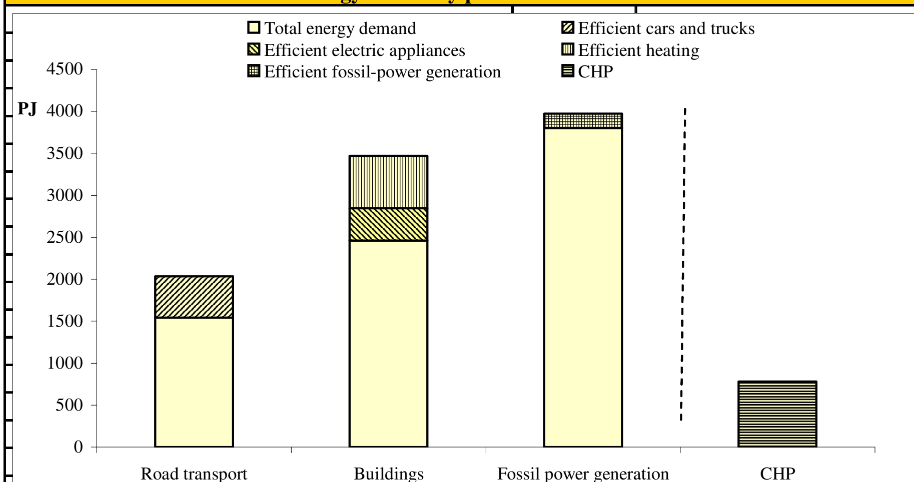
**Energy consumption for buildings, transport and power generation (PJ)**




**Specific energy consumption in 2004**

| | | |
|---|---|---|
| Energy intensity economy | 6 | MJ/US$2000 |
| Buildings total | 43 | GJ/capita |
| Buildings residential - fuels | 24 | GJ/capita |
| Buildings residential - electricity | 7 | GJ/capita |
| Buildings non-residential - fuels | 5 | GJ/capita |
| Buildings non-residential - electricity | 6 | GJ/capita |
| Road transport | 28 | GJ/capita |
| Energy-efficiency power sector | 44% | |
| Fossil power generation | 44% | kWh produced / energy input |

**Energy efficiency potentials for 2030**




**Sources**

EU (2004)

**Remarks**

Energy consumption for buildings and transport refers to final energy consumption. Energy consumption by fossil power generation refers to primary energy use.

| UNITED KINGDOM | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Type and effectiveness of energy efficiency policies in place** | | | | | | | | |
| | | **Sectors** | | | | | | |
| | | Buildings residential - fuels | Buildings residential - electricity | Buildings non-residential - fuels | Buildings non-residential - electricity | Transport - passenger | Transport - freight | Power sector |
| Type of instruments | Energy performance standards | * | * | | | | | |
| | Mandatory targets/tradable permits | * | * | * * | * * | | | |
| | Financial / fiscal instruments | | | | | | | |
| | Energy tax / energy tax exemption | | | | | | | |
| | Voluntary agreements | | | | | | | |
| | Labelling | * | | * | * | | | |
| | Energy Efficiency Committment | | | | | | | |
| | **Overall effectiveness policies** | | | | | | | |

**Overall analysis of policies in place**

• Building standards: Building regulations have been updated in 2006. Standards are based on CO2 emissions of buildings, thus also covering electric equipment like air conditioners. CO2 standards have been lowered by 20% compared to 2002, but are still not very ambitious. Positive aspects: percentage of efficient lighting required, mandatory pressure testing for houses. –Blank spot: Energy efficiency standards for commercial buildings.
• *Energy performance certificates for buildings: From June 2007, energy performance certificates will be required for all houses when they are sold ( implementation of EU Building Directive).
• Stamp duty for homes: Fiscal scheme for buildings (3% tax); tax exemption for houses meeting zero carbon standards
• Energy Efficiency Commitment (EEC): Obligation on gas and electricity suppliers that sets mandatory targets for the promotion of higher energy efficiency in the residential sector; effective policy that overachieved its target in the first period, but does not apply to non-residential sector.

• Voluntary agreement with European Automobile Manufacturers' Association (ACEA):Commitment of car manufacturers to decrease CO2 emission of average new passenger cars sold in the EU down to 140 g CO2/km. Most likely target will not be met, therefore EU plans to introduce mandatory emission standards for 2012 (EU task).
• CO2 emission label for passenger cars: not very effective as long as there is no standard
• Road fuel escalator: Fuel tax increasing annually by 3 percent above inflation; policy was abandoned in 2001because of public protests. Tax level has been frozen or only slightly increased since then, which decreased the effectiveness of the policy.
• Graduated vehicle excise duty: Tax relief for low emission cars; tax levels and tax relief are too low to be effective
• EU-ETS: Good instrument, but over-allocation of CO2 allowances in the first phase; return to coal has increased power sector's carbon emissions significantly since 2003.

• Exemption of CHP and renewable electricity from Climate Change Levy: Eligible CHP plants (according CHP Quality Assurance programme) and renewable en-ergy plants are exempted from Climate Change Levy, a levy on non-domestic supplies of electricity supply. Incentive is not strong enough to promote CHP on a large scale.
• * "Code for sustainable homes" (announced): New, ambitious standards have been announced for 2007. They foresee massive CO2 emission reductions for new buildings: 25% until 2010, 44% until 2013, zero carbon in 2016.
• * Energy Performance Commitment (under consultation): Cap and trade certificate scheme for large commercial buildings
• * Supplier obligation (under consideration): Another potentially ambitious policy under consultation is the supplier obligation. It would put a cap on total energy sold by energy suppliers.

**Overall analysis of effectiveness of policies in place**

• Policies in the building sector have shown only moderate effect so far, but new ambitious policies are under implementation; blank spot so far: non-residential buildings
• Transport sector polices were reasonably effective in the 1990s, but have stagnated since then; blank spot: missing standards
• Power sector: introduction of EU-ETS is good in principle, but not very effective so far; CHP policy to weak to push development

**Policy recommendations**

• Impose planned building standards
• Impose supplier obligation
• Enforce CO2 standards for passenger vehicles (EU level)
• Extend standards to freight sector
• Additional incentives to tap CHP potentials
• Stricter CO2 allowance allocation in EU-ETS

**Sources**

Expert interviews, http://www.defra.gov.uk/environment/energy/index.htm, www.planningportal.gov.uk, www.ofgrem.gov.uk, www.politics.co.uk,
www.aid-ee.org, UNFCC National Communication 2006

### 3.7 Canada

The energy-intensity for Canada in 2004 is relatively high with 14 MJ/US$2000. This is partly a result of the high energy consumption in buildings, which is 82 GJ/capita in 2004. This is the highest energy consumption for buildings of the observed countries.

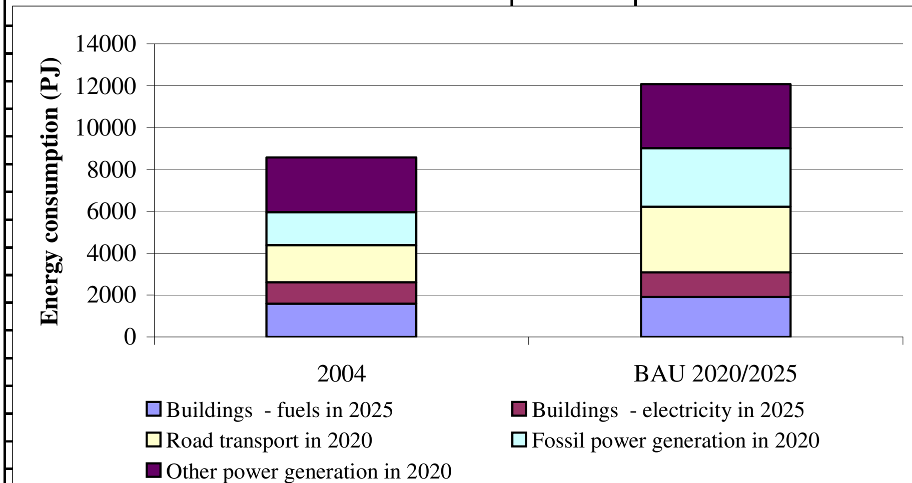
The potential for energy-efficiency improvement is especially large for road transport: 39% in 2020. This is a savings potential of nearly 1200 PJ in 2020 in comparison to reference energy demand. The estimated energy savings potential for buildings is 32% (or 990 PJ) in 2025, and for fossil-fired power generation 23% (or 650 PJ) in 2020. By implementing CHP energy savings are estimated to be possible of around 700 PJ in 2025.

Policies at the federal government level include regulatory/legally-binding standards, labelling, and financial incentives, all supported by software, training and outreach. Financial incentives offered by the federal government are notable but limited in application. The current minimum energy performance standards for energy-using equipment tend to follow US standards, although many categories are un-regulated.

| CANADA | | |
|---|---|---|
| **Population and GDP** | | |
| Population | 32 | Million |
| GDP | 787 | Billion US$ at 2000 prices |
| **Power generation** | | |
| Total power generation | 598 | TWh |
| Fossil power generation | 164 | TWh |
| **Energy use road transport and buildings** | | |
| Road transport | 1772 | PJ |
| Buildings total | 2619 | PJ |
| Buildings residential - fuels | 777 | PJ |
| Buildings residential - electricity | 544 | PJ |
| Buildings non-residential - fuels | 816 | PJ |
| Buildings non-residential - electricity | 482 | PJ |
| Buildings - heat | 0 | PJ |

## CANADA

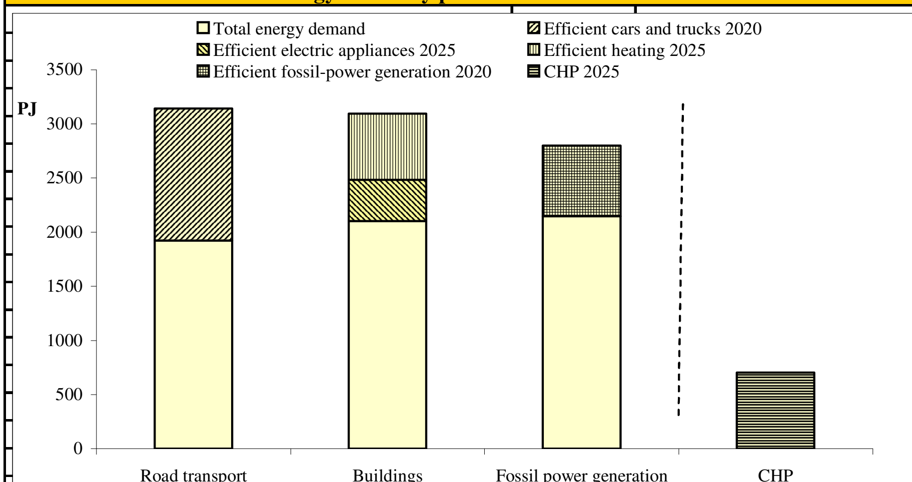
### Energy consumption for buildings, transport and power generation (PJ)




### Specific energy consumption in 2004

| | | |
|---|---|---|
| Energy intensity economy | 14 | MJ/US$2000 |
| Buildings total | 82 | GJ/capita |
| Buildings residential - fuels | 24 | GJ/capita |
| Buildings residential - electricity | 17 | GJ/capita |
| Buildings non-residential - fuels | 26 | GJ/capita |
| Buildings non-residential - electricity | 15 | GJ/capita |
| Road transport | 55 | GJ/capita |
| Energy-efficiency power sector | 60% | |
| Fossil power generation | 38% | kWh produced / energy input |

### Energy efficiency potentials for 2020/2025




### Sources

### Remarks

The estimated economic potential in services sector is 340 PJ in 2025 and for households 220 PJ in 2025. [Marbek Resource Consultants and M.K. Jaccard and Associates, 2006]
Energy consumption for buildings and transport refers to final energy consumption. Energy consumption by fossil power generation refers to primary energy use.

| CANADA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Type and effectiveness of energy efficiency policies in place** | | | | | | | | |
| | | **Sectors** | | | | | | |
| | | Buildings residential - fuels | Buildings residential - electricity | Buildings non-residential - fuels | Buildings non-residential - electricity | Transport - passenger | Transport - freight | Power sector |
| Type of instruments | Energy performance standards | | | | | | | |
| | Mandatory targets/tradable permits | | | | | | | |
| | Financial / fiscal instruments | | | | | | | |
| | Energy tax / energy tax exemption | | | | | | | |
| | Voluntary agreements | | | | | | | |
| | Labelling | | | | | | | |
| | **Overall effectiveness policies** | | | | | | | |

**Overall analysis of policies in place**

Canada is a federation of ten provinces and three territories, with shared jurisdictions and divisions of responsibility regarding energy efficiency. Several provinces have set ambitious conservation/efficiency targets, although there is no overarching/national energy efficiency strategy or target.

Federal energy efficiency requirements flow from the regulation of international and interprovincial trade, notably energy performance standards and labelling for energy-using equipment and fuel efficiency standards for vehicles. Several notable programmes aimed at improving energy efficiency include financial incentives to incorporate energy-efficent technologies in transport and retrofit approximately 200,000 homes.

**Overall analysis of effectiveness of policies in place**

The federal government has strong tools for advancing energy efficiency, including regulatory/legally-binding standards, labelling, and financial incentives, all supported by software, training and outreach. However there is no national, economy-wide commitment to energy efficiency improvement, which limits targeting of sectors, deployment of technologies, and meeting timelines.

Some provinces have referenced, adopted or improved on the guidance provided by the national model building code which is not itself enforceable or ambitious. Financial incentives offered by the federal government are notable but limited in application.

The current minimum energy performance standards for energy-using equipment tend to follow US standards, although many categories are un-regulated. Auto fuel efficiency follows the same pattern, although overall fleet fuel economy tends to be higher. It is unclear how effective a voluntary agreement to reduce transport-related emissions will be by 2010. High-level policies including fiscal instruments (energy pricing/taxes) and tradable permits have not been utilized.

**Policy recommendations**

- Establish ambitious energy-efficiency and energy demand reduction target on a national, economy-wide level.
- Raise minimum energy performance standards for a wider range appliances, for vehicles and for residential and non-residential buildings.
- Widely deploy financial/fiscal instruments to drive uptake of efficient technologies including in household and commercial markets.
- Introduce financial incentives and standards to improve energy-efficiency of freight transport.

**Sources**

IEA Energy Efficiency Policies and Measures Database
IEA Climate Change Policies and Measures Database

### 3.8 United States

The energy-intensity for United States in 2004 is 9 MJ/US$2000. The energy consumption for transport is extremely high in the United States with 75 GJ/capita in 2004. As a comparison the energy consumption for transport in France, Japan, United Kingdom, Italy and Germany is in the range of 25-29 GJ/capita in 2004.

The potential for energy-efficiency improvement is especially large for road transport: 39% in 2030. This is a savings potential of 11100 PJ in 2030 in comparison to reference energy demand. The estimated energy savings potential for buildings is 38% (or 10700 PJ) in 2030, and for fossil-fired power generation 18% (or 7200 PJ) in 2030. By implementing CHP energy savings are estimated to be possible of around 4900 PJ in 2030.

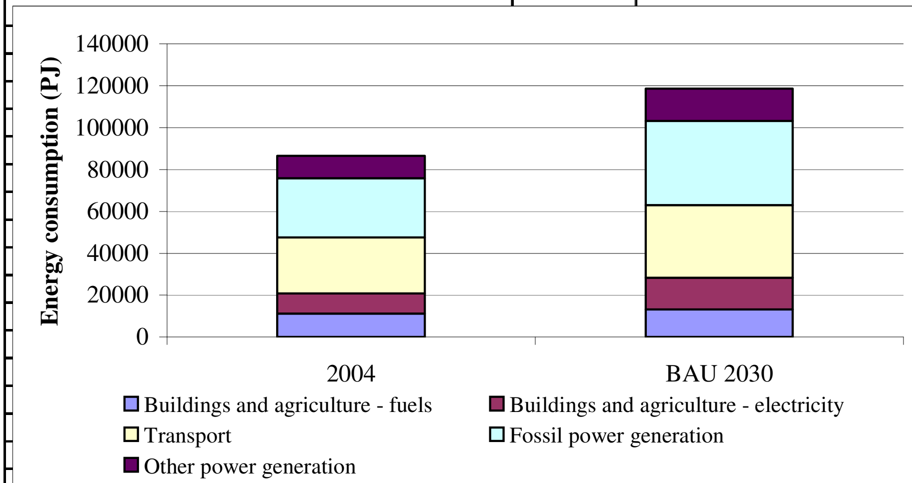
Main policy instruments to improve energy-efficiency in the United States are mandatory energy-efficiency standards for buildings and vehicles; voluntary energy labelling for office appliances and some household appliances; and voluntary agreements for freight transport and CHP. The effectiveness of most policies is limited because:

- Few financial incentives are present.
- The energy consumption of a limited number of appliances in buildings is currently regulated by standards.
- Few policies are present to increase the currently low energy-efficiency of fossil-fired power generation.

|  UNITED STATES | | |
|---|---|---|
| **Population and GDP** | | |
| Population | 294 | Million |
| GDP | 10704 | Billion US$ at 2000 prices |
| **Power generation** | | |
| Total power generation | 4148 | TWh |
| Fossil power generation | 2891 | TWh |
| **Energy use road transport and buildings** | | |
| Road transport | 22103 | PJ |
| Buildings total | 19507 | PJ |
| Buildings residential - fuels | 6453 | PJ |
| Buildings residential - electricity | 4658 | PJ |
| Buildings non-residential - fuels | 3945 | PJ |
| Buildings non-residential - electricity | 4425 | PJ |
| Buildings - heat | 26 | PJ |

**UNITED STATES**

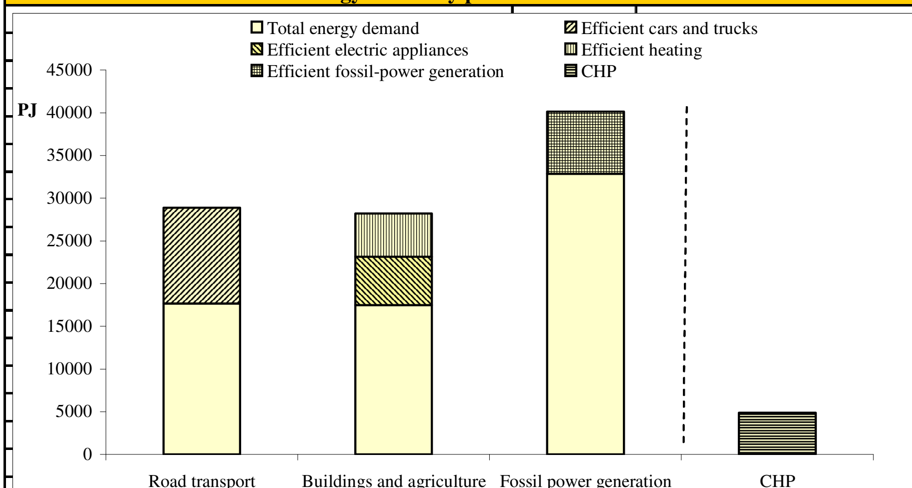
**Energy consumption for buildings, transport and power generation (PJ)**




**Specific energy consumption in 2004**

| | | |
|---|---|---|
| Energy intensity economy | 9 | MJ/US$2000 |
| Buildings total | 66 | GJ/capita |
| Buildings residential - fuels | 22 | GJ/capita |
| Buildings residential - electricity | 16 | GJ/capita |
| Buildings non-residential - fuels | 13 | GJ/capita |
| Buildings non-residential - electricity | 15 | GJ/capita |
| Road transport | 75 | GJ/capita |
| Energy-efficiency power sector | 40% | |
| Fossil power generation | 38% | kWh produced / energy input |

**Energy efficiency potentials for 2030**




**Sources**

IEA World Energy Outlook 2006
IEA Energy Balances 2006

**Remarks**

Energy consumption for buildings and transport refers to final energy consumption. Energy consumption by fossil power generation refers to primary energy use.

| UNITED STATES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Type and effectiveness of energy efficiency policies in place** | | | | | | | | |
| | | **Sectors** | | | | | | |
| | | Buildings residential - fuels | Buildings residential - electricity | Buildings non-residential - fuels | Buildings non-residential - electricity | Transport - passenger | Transport - freight | Power sector |
| **Type of instruments** | Energy performance standards | | | | | | | |
| | Mandatory targets/tradable permits | | | | | | | |
| | Financial / fiscal instruments | | | | | | | |
| | Energy tax / energy tax exemption | | | | | | | |
| | Voluntary agreements | | | | | | | |
| | Labelling | | | | | | | |
| | | | | | | | | |
| | **Overall effectiveness policies** | | | | | | | |

**Overall analysis of policies in place**

• Mandatory energy-efficiency standards are in place for buildings, cars and light trucks.
• A voluntary labelling system (Energy Star) is present for office appliances and number of household appliances.
• Tax credits are present for consumers who purchase hybrid vehicles and who make certain energy-efficiency upgrades in their homes.
• A voluntary partnership is present between various freight industry sectors and the EPA (SmartWay Transport), which establishes incentives for fuel efficiency improvements by applying innovative strategies and technologies.
• To stimulate CHP a voluntary partnership is present. Partners in the programme agreed to work with the EPA to develop and promote projects. Financial incentives are offered at state and federal level and include grants, tax incentives, and low-interest loans.
• In 2000, the government and the building industry released a 20-year plan to improve the energy efficiency of the new commercial buildings. The goal is to reduce the energy use of new commercial buildings by 20% by the year 2010, and by 50% by 2020.

**Overall analysis of effectiveness of policies in place**

• The improvement in overall fuel economy of cars and trucks seems limited due to an increased market share of light trucks and sport utility vehicles.
• The energy consumption of a limited number of appliances in buildings is currently regulated by energy standards
• Few financial incentives are present for energy-efficiency improvement.
• No specific energy tax is present to reduce energy demand, only normal taxes apply fuel and power consumption.
• There is a heavy reliance on voluntary partnerships in sectors where literature indicates other approaches are more appropriate.

**Policy recommendations**

• Tighten fuel efficiency standards for cars and light trucks.
• Expand financial incentives for energy-efficiency improvement in buildings and transport.
• Expand energy-efficiency standards for electric appliances.
• Introduce energy labelling system for cars.
• Introduce policies to increase the currently low energy-efficiency of fossil-fired power generation.
• Establish energy-efficiency targets

**Sources**

IEA Energy Efficiency Policies and Measures Database
WEC Energy Efficiency a Worldwide Review 2004

### 3.9 Russia

The energy-intensity for Russia in 2004 is extremely high with 82 MJ/US$2000. This is the highest energy-intensity of the observed countries.

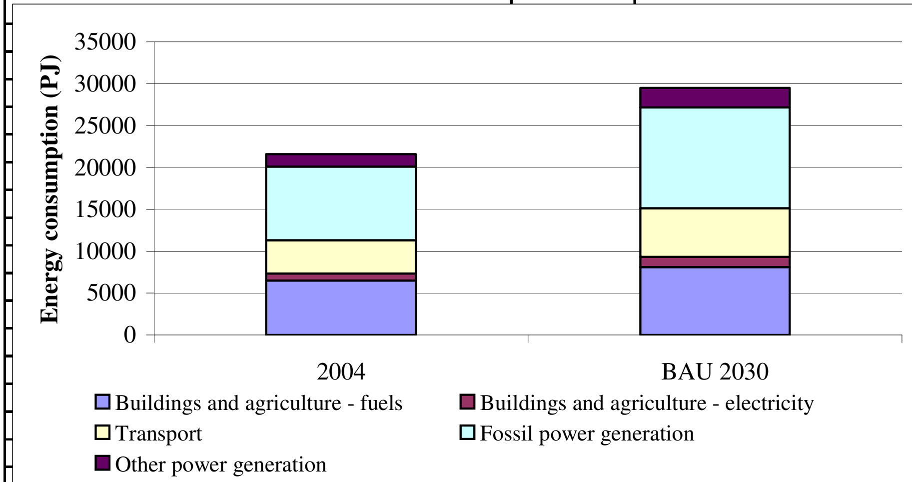
The potential for energy-efficiency improvement is especially large for fossil-fired power generation: 46% in 2030. This is a savings potential of 5500 PJ in 2030 in comparison to reference energy demand. The estimated energy savings potential for road transport is 44% (or 1100 PJ) in 2030, and for buildings 33% (or 3100 PJ) in 2030. By implementing additional CHP, energy savings are estimated to be possible of around 1200 PJ in 2030.

There are almost no energy efficiency policies in place in Russia. Joint Implementation could pay a role in bringing energy efficient technologies to Russia.

|  **RUSSIA** | | |
|---|---|---|
| **Population and GDP** | | |
| Population | 144 | Million |
| GDP | 329 | Billion US$ at 2000 prices |
| **Power generation** | | |
| Total power generation | 930 | TWh |
| Fossil power generation | 606 | TWh |
| **Energy use road transport and buildings** | | |
| Road transport | 1676 | PJ |
| Buildings total | 6498 | PJ |
| Buildings residential - fuels | 2251 | PJ |
| Buildings residential - electricity | 516 | PJ |
| Buildings non-residential - fuels | 163 | PJ |
| Buildings non-residential - electricity | 251 | PJ |
| Buildings - heat | 3317 | PJ |

## RUSSIA

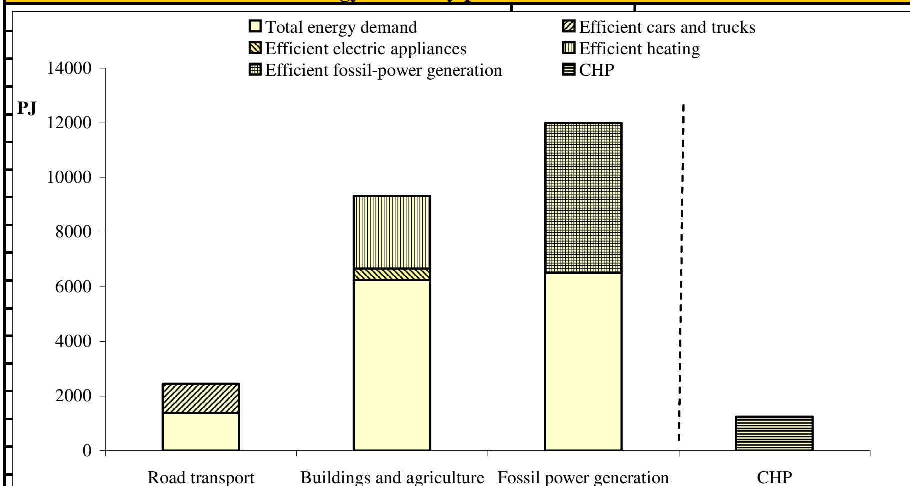
**Energy consumption for buildings, transport and power generation (PJ)**




**Specific energy consumption in 2004**

| | | |
|---|---|---|
| Energy intensity economy | 82 | MJ/US$2000 |
| Buildings total | 45 | GJ/capita |
| Buildings residential - fuels | 16 | GJ/capita |
| Buildings residential - electricity | 4 | GJ/capita |
| Buildings non-residential - fuels | 1 | GJ/capita |
| Buildings non-residential - electricity | 2 | GJ/capita |
| Road transport | 12 | GJ/capita |
| Energy-efficiency power sector | 76% | |
| Fossil power generation | 25% | kWh produced / energy input |

**Energy efficiency potentials for 2030**




**Sources**

IEA World Energy Outlook 2006
IEA Energy Balances 2006

**Remarks**

>For Russia, heat consumption by buildings is equal to 23 GJ/capita. This heat consumption is included in the graphs in fuel consumption of buildings.
>Energy consumption for buildings and transport refers to final energy consumption. Energy consumption by fossil power generation refers to primary energy use.

| RUSSIA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Type and effectiveness of energy efficiency policies in place** | | | | | | | | |
| | | **Sectors** | | | | | | |
| | | Buildings residential - fuels | Buildings residential - electricity | Buildings non-residential - fuels | Buildings non-residential - electricity | Transport - passenger | Transport - freight | Power sector |
| **Type of instruments** | Energy performance standards | | | | | | | |
| | Mandatory targets/tradable permits | | | | | | | |
| | Financial / fiscal instruments | | | | | | | |
| | Energy tax / energy tax exemption | | | | | | | |
| | Voluntary agreements | | | | | | | |
| | Labelling | | | | | | | |
| | | | | | | | | |
| | **Overall effectiveness policies** | | | | | | | |

**Overall analysis of policies in place**

• In her 2003 Energy Strategy, Russia acknowledged the importance of energy efficiency and the necessity "to implement a complete system of legal, administrative and economic measures which stimulate the effective energy use". According to the strategy, such a sys-tem should consist of a variety of regulatory measures, economic incentives and informa-tion campaigns. None of the "hard" measures has been implemented so far.
• According to the government, some demonstration programmes (show-case zones of high energy efficiency) and regional energy conservation programmes have been started.
• According to the state standards for energy-consuming production, efficiency indicators and indicators of energy consumption are required for energy-consuming products.
• Further energy efficiency improvements are realized only on local level in some munici-palities. In the future Joint Implementation could play a role.

**Overall analysis of effectiveness of policies in place**

With practically no energy efficiency policies in place, energy efficiency in Russia is very low.

**Policy recommendations**

• Implement concrete and measurable policies
• Set mandatory standards and targets
• Lower institutional barriers for Joint Implementation

**Sources**

• Enery Policies of IEA countries; IEA 2006
• The Energy Strategy of Russia for the Period of up to 2020, Moscow 2003
• Y. Bushuyev, A. Makarov, A. Mastepanov and N. Shamrayev: A new policy for Russia: Implementation experience. Moscow 2006 (http://www.worldenergy.org/wec-geis/publications/default/tech_papers/17th_congress/4_2_06.asp)

### 3.10 Japan

The energy-intensity for Japan in 2004 is low with 5 MJ/US$2000. This is the lowest energy-intensity of the observed countries.

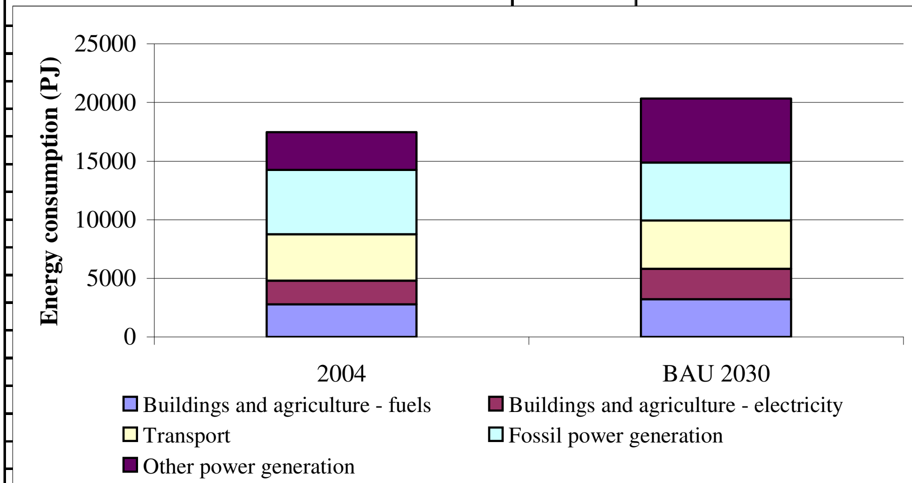
The potential for energy-efficiency improvement is estimated to be largest for transport: 48% in 2030, or 1600 PJ in 2030 in comparison to reference energy demand. The estimated energy savings potential for buildings is 35% (or 2000 PJ) in 2030, and for fossil-fired power generation 4% (or 200 PJ) in 2030. By implementing additional CHP, energy savings are estimated to be possible of around 1200 PJ in 2030.

Japan's has a long history in energy efficiency policies. Well-know instruments include the Top Runner programme including competitive energy efficiency for a large range of consumer products.

| JAPAN | | |
|---|---|---|
| **Population and GDP** | | |
| Population | 128 | Million |
| GDP | 4933 | Billion US$ at 2000 prices |
| **Power generation** | | |
| Total power generation | 1071 | TWh |
| Fossil power generation | 681 | TWh |
| **Energy use road transport and buildings** | | |
| Road transport | 3243 | PJ |
| Buildings total | 4392 | PJ |
| Buildings residential - fuels | 1021 | PJ |
| Buildings residential - electricity | 986 | PJ |
| Buildings non-residential - fuels | 1358 | PJ |
| Buildings non-residential - electricity | 1001 | PJ |
| Buildings - heat | 25 | PJ |

**JAPAN**

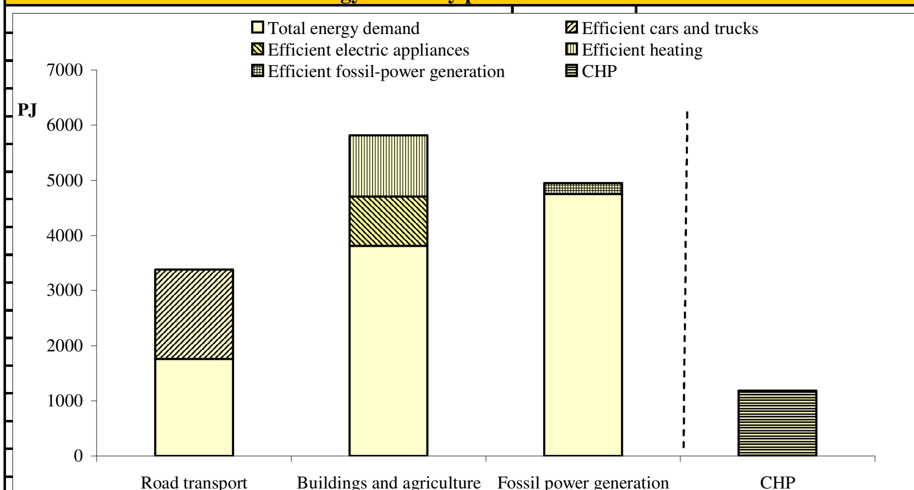
**Energy consumption for buildings, transport and power generation (PJ)**




**Specific energy consumption in 2004**

| | | |
|---|---|---|
| Energy intensity economy | 5 | MJ/US$2000 |
| Buildings total | 34 | GJ/capita |
| Buildings residential - fuels | 8 | GJ/capita |
| Buildings residential - electricity | 8 | GJ/capita |
| Buildings non-residential - fuels | 11 | GJ/capita |
| Buildings non-residential - electricity | 8 | GJ/capita |
| Road transport | 25 | GJ/capita |
| Energy-efficiency power sector | 44% | |
| Fossil power generation | 44% | kWh produced / energy input |

**Energy efficiency potentials for 2030**




**Sources**

IEA World Energy Outlook 2006
IEA Energy Balances 2006

**Remarks**

Energy consumption for buildings and transport refers to final energy consumption. Energy consumption by fossil power generation refers to primary energy use.

| | | JAPAN | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Type and effectiveness of energy efficiency policies in place** | | | | | | | | |
| | | **Sectors** | | | | | | |
| | | Buildings residential - fuels | Buildings residential - electricity | Buildings non-residential - fuels | Buildings non-residential - electricity | Transport - passenger | Transport - freight | Power sector |
| **Type of instruments** | Energy performance standards | | | | | | | |
| | Mandatory targets/tradable permits | | | | | | | |
| | Financial / fiscal instruments | | | | | | | |
| | Energy tax / energy tax exemption | | | | | | | |
| | Voluntary agreements | | | | | | | |
| | Labelling | | | | | | | |
| | | | | | | | | |
| | **Overall effectiveness policies** | | | | | | | |

**Overall analysis of policies in place**

- Top runner program: Competitive energy efficiency standard for electric appliances & equipment, heaters and cars; manufacturers are requested to improve energy efficiency level of their products within a specified period to the best available efficiency standard in the base year. Best product sets standards for next period.
- Financial/fiscal scheme: Tax deduction for high-efficiency equipment (lighting, air conditioners) and subsidies for efficient water heaters; blank spot: no support for building insulation.
- Energy-saving labels for home appliances: Transparent label informing consumers about energy conservation standard achievement (coupled with the to runner prrogrmme). The label only applies to 16 appliances, including TV, refrigerators, air condition, personal computers, lightings and heating equipments.
- Fuel economy labels for vehicles: Label that states if car is “fully compliant with fuel economy standard” or “plus 5% of the fuel economy standard”
- Keidanren’s Voluntary Action Plan: Voluntary committment of industry and power sector to reduce GHG emissions below 1990 level by 2010; participants can choose between absolute CO2 or energy consumption target and energy/CO2 intensity target, which compromises overall absolute reduction target. Power companies chose a CO2 intensity target (-20% CO2 emissions per unit of output until 2010). Total energy consumption and CO2 emissions of sector have been increasing.
- CHP: Tax credits for households and district developments to apply CHP; CHP in the power sector remains a blank spot.

**Overall analysis of effectiveness of policies in place**

- Policies are quite effective and energy efficiency is high in all sectors, but increase of energy efficiency has been offset by increasing use of cars, electric appliances, and power production. Total energy consumption has bee rising.
- Blank spots:
  - No policies to improve overall energy performance of buildings (incl. insulation)
  - Absolute reduction target for power sector
  - Policies to tap CHP potential

**Policy recommendations**

- Impose absolute reduction targets on power producers
- Introduce policy to tap CHP potential
- Set overall efficiency standards/targets for buildings, not just for certain appliances

**Sources**


www.eecj.or.jp
http://www.keidanren.or.jp/english/policy/pol058/index.html
Kensuke Kenekiyo: Lowering Energy Intensity Towards Sustainable Development. IEEJ, 2006
Submission to the Third Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol, UNFCC 2007

## 3.11 Brazil

The energy-intensity for Brazil in 2004 is 13 MJ/US$2000. The energy consumption for transport and buildings per capita is low with 11 and 7 GJ/capita in 2004, respectively.

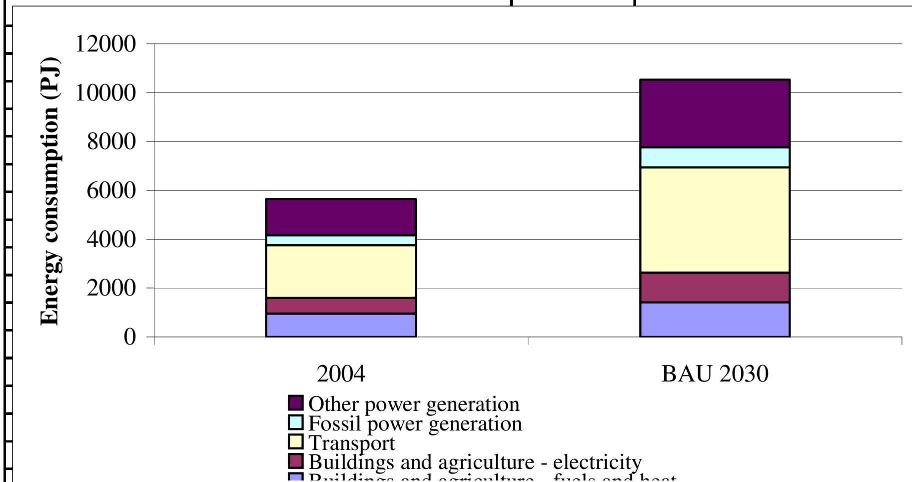
The potential for energy-efficiency improvement is especially large for road transport: 47% in 2030. This is a savings potential of 1900 PJ in 2030 in comparison to reference energy demand. The estimated energy savings potential for buildings is 43% (or 1100 PJ) in 2030, and for fossil-fired power generation 20% (or 160 PJ) in 2030. By implementing CHP energy savings are estimated to be possible of around 540 PJ in 2030.

In Brazil, a number of policies for improving energy-efficiency are present, including energy performance standards for electric motors and labelling for electric appliances and for gas-power stoves. The effectiveness of the current policies in place is however limited since the energy performance standards still need to be determined for many appliances and few financial incentives are in place.

|  **BRAZIL** | | |
|---|---|---|
| **Population and GDP** | | |
| Population | 184 | Million |
| GDP | 655 | Billion US$ at 2000 prices |
| **Power generation** | | |
| Total power generation | 387 | TWh |
| Fossil power generation | 33 | TWh |
| **Energy use road transport and buildings** | | |
| Road transport | 2004 | PJ |
| Buildings total | 1253 | PJ |
| Buildings residential - fuels | 616 | PJ |
| Buildings residential - electricity | 283 | PJ |
| Buildings non-residential - fuels | 66 | PJ |
| Buildings non-residential - electricity | 289 | PJ |
| Buildings - heat | 0 | PJ |

**BRAZIL**

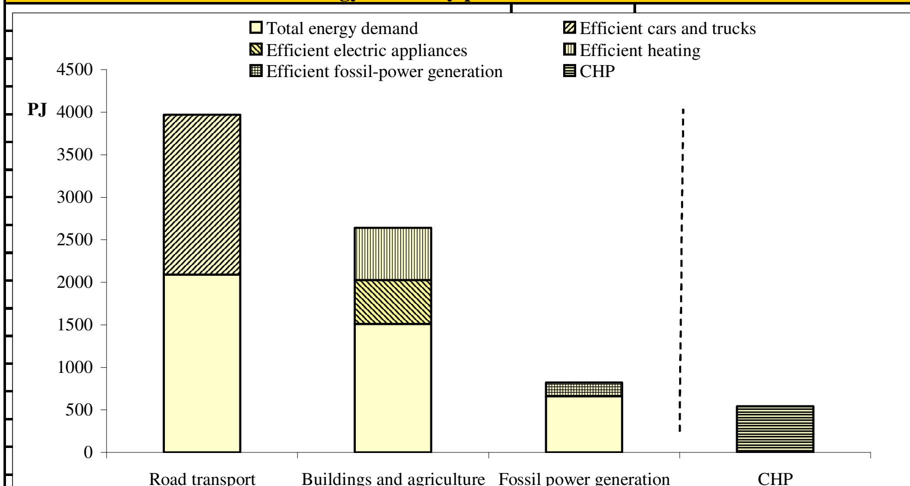
**Energy consumption for buildings, transport and power generation (PJ)**




**Specific energy consumption in 2004**

| | | |
|---|---|---|
| Energy intensity economy | 13 | MJ/US$2000 |
| Buildings total | 7 | GJ/capita |
| Buildings residential - fuels | 3 | GJ/capita |
| Buildings residential - electricity | 2 | GJ/capita |
| Buildings non-residential - fuels | 0 | GJ/capita |
| Buildings non-residential - electricity | 2 | GJ/capita |
| Road transport | 11 | GJ/capita |
| Energy-efficiency power sector | 84% | |
| Fossil power generation | 37% | kWh produced / energy input |

**Energy efficiency potentials for 2030**




**Sources**

IEA World Energy Outlook 2006

IEA Energy Balances 2006

**Remarks**

Energy consumption for buildings and transport refers to final energy consumption. Energy consumption by fossil power generation refers to primary energy use.

| BRAZIL | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Type and effectiveness of energy efficiency policies in place** | | | | | | | | |
| | | **Sectors** | | | | | | |
| | | Buildings residential - fuels | Buildings residential - electricity | Buildings non-residential - fuels | Buildings non-residential - electricity | Transport - passenger | Transport - freight | Power sector |
| **Type of instruments** | Energy performance standards | | | | | | | |
| | Mandatory targets/tradable permits | | | | | | | |
| | Financial / fiscal instruments | | | | | | | |
| | Energy tax / energy tax exemption | | | | | | | |
| | Voluntary agreements | | | | | | | |
| | Labelling | | | | | | | |
| | **Overall effectiveness policies** | | | | | | | |

**Overall analysis of policies in place**

In Brazil, a number of policies for improving energy-efficiency are present. Energy performance standards are set for electric motors. Labelling is voluntary for electric appliances and mandatory for gas-power stoves and ovens. A tax reduction is present for compact fluorescent lamps and high efficient motors.

**Overall analysis of effectiveness of policies in place**

The effectiveness of the current policies in place is limited since:

• Labelling of appliances is present but is for most appliances voluntary and not mandatory.

• Energy performance standards still need to be determined for many appliances.

• Some fiscal instruments are present, but could be further expanded.

**Policy recommendations**

• Adopt minimum efficiency standards for appliances, thermal efficiency of buildings, energy-efficiency power generation and fuel efficiency vehicles.

• Make the labelling program compulsory.

• Expand fiscal instruments for energy-efficiency improvement.

**Sources**

WEC Energy Efficiency a Worldwide Review 2004

### 3.12 Mexico

The energy-intensity for Mexico in 2004 is fairly average with 11 MJ/US$2000. The energy consumption for transport and buildings per capita is 16 and 9 GJ/capita in 2004, respectively.

The potential for energy-efficiency improvement is especially large for buildings: 43% in 2030. This is a savings potential of 700 PJ in 2030 in comparison to reference energy demand. The estimated energy savings potential for road transport is 39% (or 1500 PJ) in 2030, and for fossil-fired power generation 20% (or 900 PJ) in 2030. By implementing CHP, energy savings are estimated to be possible of around 400 PJ in 2030.

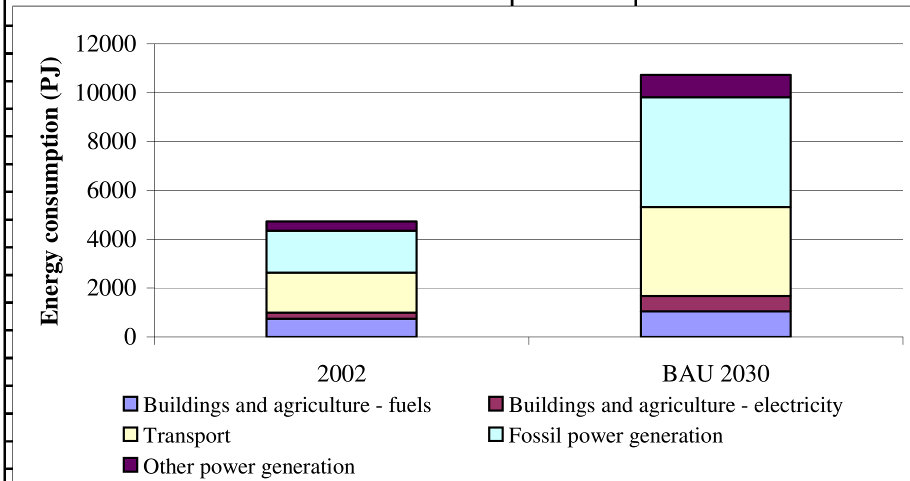
Mexico has implemented several energy efficiency programs, including energy efficiency standards for electric devices and gas boilers. Fiscal incentives are available for services, households and transport. A voluntary energy label identifies products with outstanding electric energy saving properties and is accompanied by financial incentives and campaigns. Recommendations are to:

- Introduce mandatory labelling system for buildings and transport.
- Define fuel efficiency standards for vehicles
- Introduce additional financial incentives for energy-efficiency measures

|  **MEXICO** | | |
|---|---|---|
| **Population and GDP** | | |
| Population | 104 | Million |
| GDP | 619 | Billion US$ at 2000 prices |
| **Power generation** | | |
| Total power generation | 224 | TWh |
| Fossil power generation | 179 | TWh |
| **Energy use road transport and buildings** | | |
| Road transport | 1695 | PJ |
| Buildings total | 903 | PJ |
| Buildings residential - fuels | 608 | PJ |
| Buildings residential - electricity | 147 | PJ |
| Buildings non-residential - fuels | 78 | PJ |
| Buildings non-residential - electricity | 69 | PJ |
| Buildings - heat | 0 | PJ |

**MEXICO**

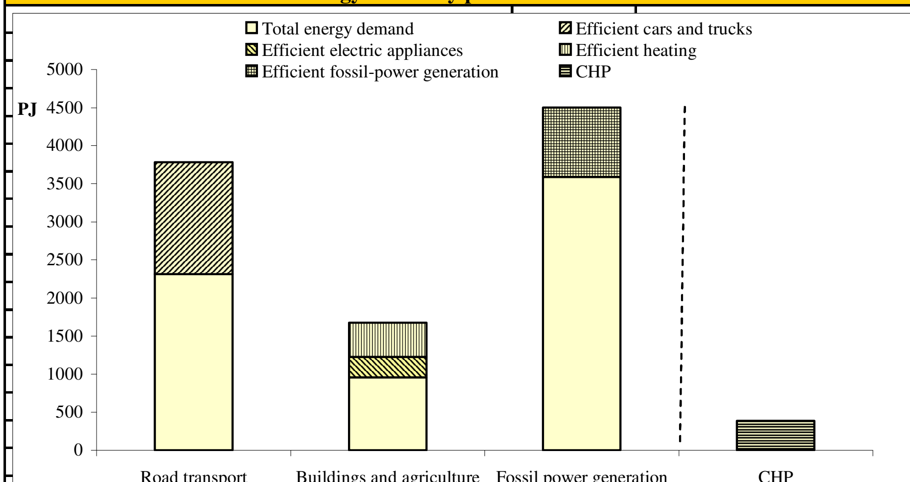
**Energy consumption for buildings, transport and power generation (PJ)**




**Specific energy consumption in 2004**

| | | |
|---|---|---|
| Energy intensity economy | 11 | MJ/US$2000 |
| Buildings total | 9 | GJ/capita |
| Buildings residential - fuels | 6 | GJ/capita |
| Buildings residential - electricity | 1 | GJ/capita |
| Buildings non-residential - fuels | 1 | GJ/capita |
| Buildings non-residential - electricity | 1 | GJ/capita |
| Road transport | 16 | GJ/capita |
| Energy-efficiency power sector | 39% | |
| Fossil power generation | 37% | kWh produced / energy input |

**Energy efficiency potentials for 2030**




**Sources**

IEA World Energy Outlook 2004

**Remarks**

Energy consumption for buildings and transport refers to final energy consumption. Energy consumption by fossil power generation refers to primary energy use.

| MEXICO | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Type and effectiveness of energy efficiency policies in place** | | | | | | | | |
| | | **Sectors** | | | | | | |
| | | Buildings residential - fuels | Buildings residential - electricity | Buildings non-residential - fuels | Buildings non-residential - electricity | Transport - passenger | Transport - freight | Power sector |
| **Type of instruments** | Energy performance standards | | | | | | | |
| | Mandatory targets/tradable permits | | | | | | | |
| | Financial / fiscal instruments | | | | | | | |
| | Energy tax / energy tax exemption | | | | | | | |
| | Voluntary agreements | | | | | | | |
| | Labelling | | | | | | | |
| | **Overall effectiveness policies** | | | | | | | |

**Overall analysis of policies in place**

Mexico has implemented several energy efficiency programs and standards, developed by the National Commission of Energy and the Environment ("CONAE"). Energy efficiency standards have been issued for many electric devices. Some of them also refer to non-electrical appliances, like gas boilers, thermal insulations, etc. Fiscal incentives, investment subsidies and soft loans are available for services, households and transport.

**Overall analysis of effectiveness of policies in place**

• The FIDE seal is a voluntary energy label that identifies products with outstanding electric energy saving properties and is accompanied by financial incentives and campaigns.
• Most financial incentives are in the form of interest free lones. The effectiveness of the instrument may be higher with incentives that reduce the costs of measures to a higher extent.
• The performance standards are considered to be effective since they are comparable to future US standards, which they sometimes even surpass.

**Policy recommendations**

- Introduce mandatory labelling system for buildings and transport.
- Define standards regarding fuel efficiency of vehicles
- Introduce tax rebates or subsidies for energy-efficiency measures
- Use present subsidies on consumption in the residential sector to subsidize energy-efficiency measures

**Sources**

WEC Energy Efficiency a Worldwide Review 2004

### 3.13 South Africa

The energy-intensity for South Africa in 2004 is very high with 36 MJ/US$2000. The energy consumption for transport and buildings per capita is 12 and 17 GJ/capita in 2004, respectively.

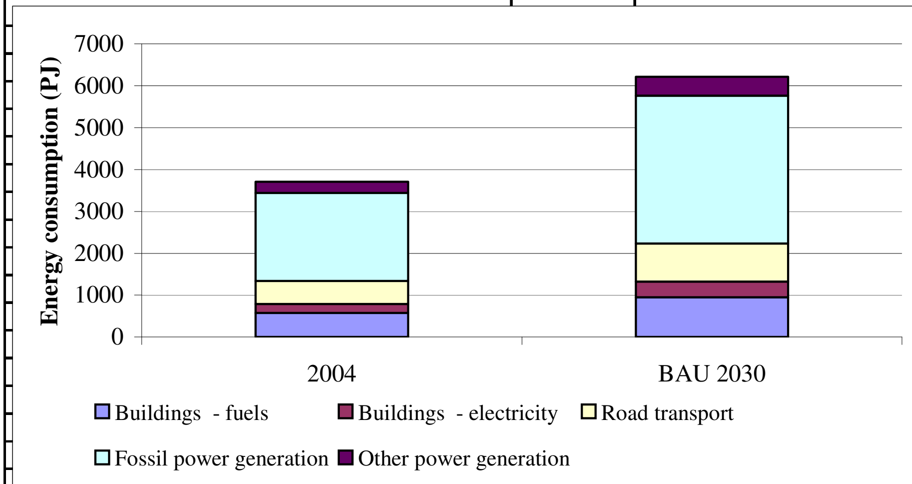
The potential for energy-efficiency improvement is especially large for road transport: 47% in 2030. This is a savings potential of 430 PJ in 2030 in comparison to reference energy demand. The estimated energy savings potential for buildings is 46% (or 600 PJ) in 2030, and for fossil-fired power generation 20% (or 700 PJ) in 2030. By implementing CHP energy savings are estimated to be possible of around 340 PJ in 2030.

South-Africa's energy-efficiency policies are limited. However, a number of policies are 'in the pipeline' including energy performance standards for buildings and appliances and incentives for the transport sector.

| SOUTH AFRICA | | |
|---|---|---|
| **Population and GDP** | | |
| Population | 46 | Million |
| GDP | 151 | Billion US$ at 2000 prices |
| **Power generation** | | |
| Total power generation | 242 | TWh |
| Fossil power generation | 214 | TWh |
| **Energy use road transport and buildings** | | |
| Road transport | 545 | PJ |
| Buildings total | 790 | PJ |
| Buildings residential - fuels | 488 | PJ |
| Buildings residential - electricity | 130 | PJ |
| Buildings non-residential - fuels | 81 | PJ |
| Buildings non-residential - electricity | 90 | PJ |
| Buildings - heat | 0 | PJ |

## SOUTH AFRICA

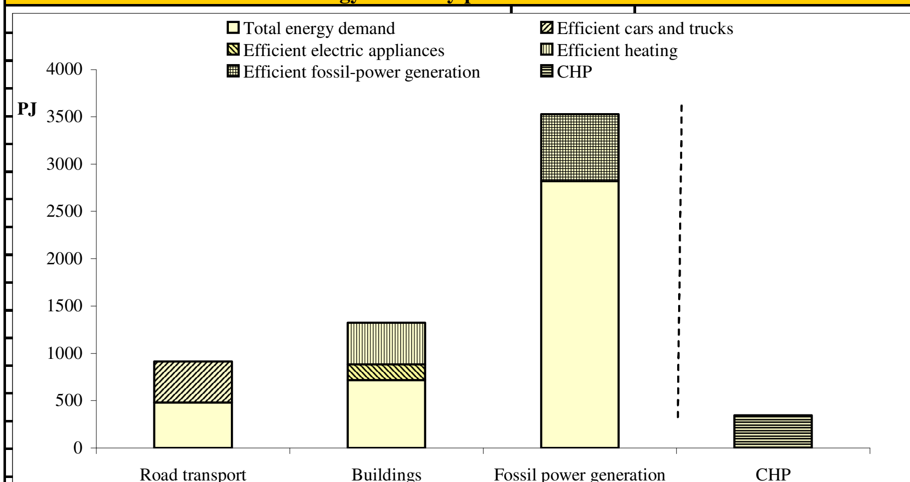
**Energy consumption for buildings, transport and power generation (PJ)**




**Specific energy consumption in 2004**

| | | |
|---|---|---|
| Energy intensity economy | 36 | MJ/US$2000 |
| Buildings total | 17 | GJ/capita |
| Buildings residential - fuels | 11 | GJ/capita |
| Buildings residential - electricity | 3 | GJ/capita |
| Buildings non-residential - fuels | 2 | GJ/capita |
| Buildings non-residential - electricity | 2 | GJ/capita |
| Road transport | 12 | GJ/capita |
| Energy-efficiency power sector | 37% | |
| Fossil power generation | 37% | kWh produced / energy input |

**Energy efficiency potentials for 2030**




**Sources**

**Remarks**

Energy consumption for buildings and transport refers to final energy consumption. Energy consumption by fossil power generation refers to primary energy use.

## SOUTH AFRICA

**Type and effectiveness of energy efficiency policies in place**

| Type of instruments | Buildings residential - fuels | Buildings residential - electricity | Buildings non-residential - fuels | Buildings non-residential - electricity | Transport - passenger | Transport - freight | Power sector |
|---|---|---|---|---|---|---|---|
| Energy performance standards | * | * | * | * | | | |
| Mandatory targets/tradable permits | | | | | | | |
| Financial / fiscal instruments | | | | | * | * | |
| Energy tax / energy tax exemption | | | | | | | |
| Voluntary agreements | | | | | | | |
| Labelling | | | | | * | * | |
| Eskom DSM Programme | | | | | | | |
| **Overall effectiveness policies** | | | | | | | |

**Overall analysis of policies in place**

• In 2005 South Africa announced "energy efficiency strategy" which aims to improve en-ergy efficiency by 15% in 2015. Planned measures include:

- Energy efficiency standard for office buildings
- Standard for energy efficient housing
- Efficiency labels for household appliances
- Efficient lighting programme
- Efficiency labels for motor vehicles
- Fiscal incentives for transport fuel efficiency
- Creating a supportive policy framework for energy service companies

• So far, few energy efficiency policies are implemented.

• Efficient Lighting Programme: The Efficient Lighting Initiative initiated by GEF/IFC and co-funded by state Eskom dis-seminated CFLs to low-income households. After the end of the three years programme, Eskom continues to distribute CFLs.

• DSM Programme: The State owned electricity supplier Eskom operates a Demand Side Management Program focusing on load management, industrial equipment and efficient lighting. Eskom currently finds itself in a position where the demand for electricity occasionally exceeds the available supply.

• Appliance labelling campaign: The Department of Minerals and Energy initiated an appliance labelling campaign, start-ing with refrigerators.

**Overall analysis of effectiveness of policies in place**

With only few energy efficiency policies in place, there remain huge untapped energy ef-ficiency potentials. The full implementation of the Energy Efficiency Strategy would be a major breakthrough. Promising initiatives have been taken in the residential electricity supply sector.

Positive developments could also be stimulated by CDM; several energy efficiency projects are in the CDM pipeline.

**Policy recommendations**

• Speed up implementation of Energy Efficiency Strategy
• Introduce mandatory efficiency standards for buildings and cars
• Introduce measures to decrease carbon intensity of power production
• Lower administrative barriers for CDM

**Sources**


• http://www.dme.gov.za/pdfs/energy/efficiency/ee_strategy_05.pdf
• 2006/2007 South Africa Yearbook, www.dme.gov.za/dme/energy/refso.htm
• Winkler, H., van Es, D.: Energy efficiency and the CDM in South Africa: constraints and opportunities. Journal of Energy in southern Africa, 18(1), 02/2007

### 3.14 India

The energy-intensity for India in 2004 is high with 41 MJ/US$2000. The energy consumption for transport and buildings per capita is very low with 1 and 9 GJ/capita in 2004, respectively. This is the lowest energy consumption per capita of the observed countries.

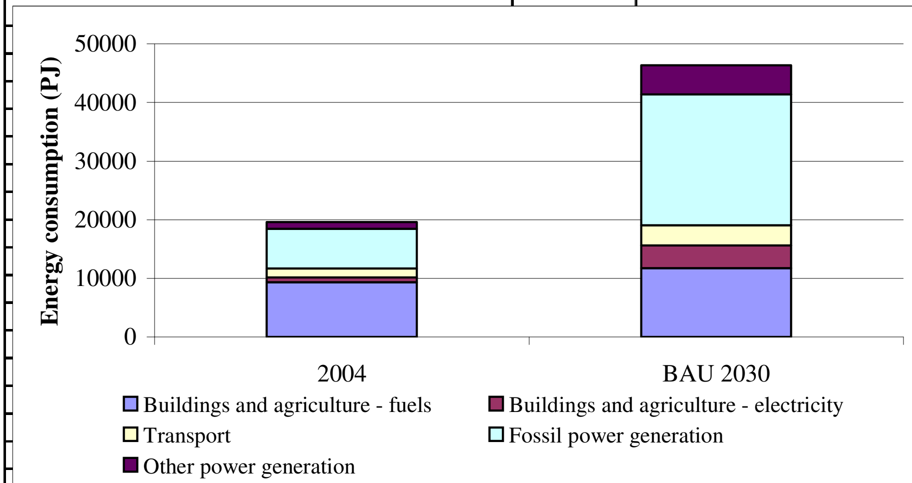
The potential for energy-efficiency improvement is especially large for road transport: 47% in 2030. This is a savings potential of 1300 PJ in 2030 in comparison to reference energy demand. The estimated energy savings potential for buildings is 33% (or 5200 PJ) in 2030, and for fossil-fired power generation 35% (or 7800 PJ) in 2030. By implementing CHP energy savings are estimated to be possible of around 4300 PJ in 2030.

India is developing energy-efficiency policies for the building sector with energy standards for buildings and labelling of appliances. Policies for the transport sector at not yet present and should be developed. The energy-efficiency policy can be made more consistent.

| INDIA | | |
|---|---|---|
| **Population and GDP** | | |
| Population | 1080 | Million |
| GDP | 581 | Billion US$ at 2000 prices |
| **Power generation** | | |
| Total power generation | 668 | TWh |
| Fossil power generation | 535 | TWh |
| **Energy use road transport and buildings** | | |
| Road transport | 1270 | PJ |
| Buildings total | 9855 | PJ |
| Buildings residential - fuels | 9284 | PJ |
| Buildings residential - electricity | 344 | PJ |
| Buildings non-residential - fuels | 114 | PJ |
| Buildings non-residential - electricity | 113 | PJ |
| Buildings - heat | 0 | PJ |

## INDIA

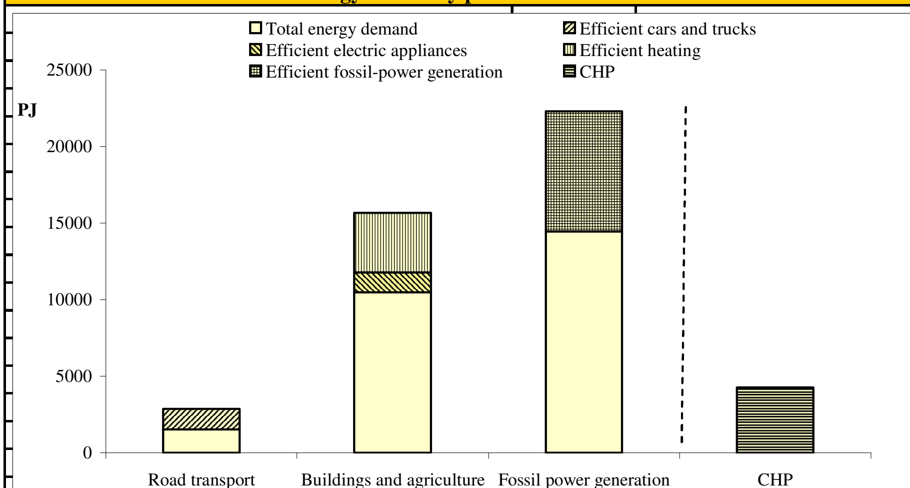
**Energy consumption for buildings, transport and power generation (PJ)**




**Specific energy consumption in 2004**

| | | |
|---|---|---|
| Energy intensity economy | 41 | MJ/US$2000 |
| Buildings total | 9 | GJ/capita |
| Buildings residential - fuels | 9 | GJ/capita |
| Buildings residential - electricity | 0 | GJ/capita |
| Buildings non-residential - fuels | 0 | GJ/capita |
| Buildings non-residential - electricity | 0 | GJ/capita |
| Road transport | 1 | GJ/capita |
| Energy-efficiency power sector | 34% | |
| Fossil power generation | 30% | kWh produced / energy input |

**Energy efficiency potentials for 2030**




**Sources**

IEA World Energy Outlook 2006
IEA Energy Balances 2006

**Remarks**

Energy consumption for buildings and transport refers to final energy consumption. Energy consumption by fossil power generation refers to primary energy use.

**INDIA**

**Type and effectiveness of energy efficiency policies in place**

| Type of instruments | Buildings residential - fuels | Buildings residential - electricity | Buildings non-residential - fuels | Buildings non-residential - electricity | Transport - passenger | Transport - freight | Power sector |
|---|---|---|---|---|---|---|---|
| Energy performance standards | * | * | * | * | | | |
| Mandatory targets/tradable permits | | | | | | | |
| Financial / fiscal instruments | | | | | | | |
| Energy tax / energy tax exemption | | | | | | | |
| Voluntary agreements | | | | | | | |
| Labelling | | | | | | | |
| Others | | | | | | | |
| **Overall effectiveness policies** | | | | | | | |

**Overall analysis of policies in place**

India's energy policy mainly focuses on energy security. In December 2005 the draft report on Integrated Energy Policy was released. The draft identifies a 25% potential for improvement in energy intensity. Under the Energy Conservation Act of 2001, a labelling programme for six electrical items and a draft building code were launched in 2005. They have both not yet been effectuated. Voluntary labelling exists for refrigerators and window air conditioners.

**Overall analysis of effectiveness of policies in place**

The Integrated Energy Policy on improving energy intensity is considered as inconsistent and inefficient. Energy labelling will become mandatory for six electrical items, but is not yet effectuated. A building code is being developed. There is no policy for the transport sector. India has a large number of CDM projects in the pipeline, some of which are energy efficiency programmes.

**Policy recommendations**

- Speed up implementation of building code and mandatory labelling
- Energy efficiency policy for the transport sector
- more consistent Integrated Energy Policy
- Lower administrative barriers for CDM

**Sources**

IEA 2006: Energy policies of IEA countries 2006 review
IEEJ 2007: Energy Strategies in China and India and Major Countries Views, by Hiroyuki Ishida
WEC/ADEME 2004: Energy Efficiency: A Worldwide Review. Indicators, Policies, Evaluation
BEE 2006: Draft Energy Conservation Building Code

### 3.15 China

The energy-intensity for China in 2004 is high with 36 MJ/US$2000. The energy consumption for transport and buildings per capita is low with 2 and 12 GJ/capita in 2004, respectively.

The potential for energy-efficiency improvement is especially large for road transport: 49% in 2030. This is a savings potential of 5400 PJ in 2030 in comparison to reference energy demand. The estimated energy savings potential for buildings is 33% (or 9200 PJ) in 2030, and for fossil-fired power generation 27% (or 18000 PJ) in 2030. By implementing CHP energy savings are estimated to be possible of around 7000 PJ in 2030.

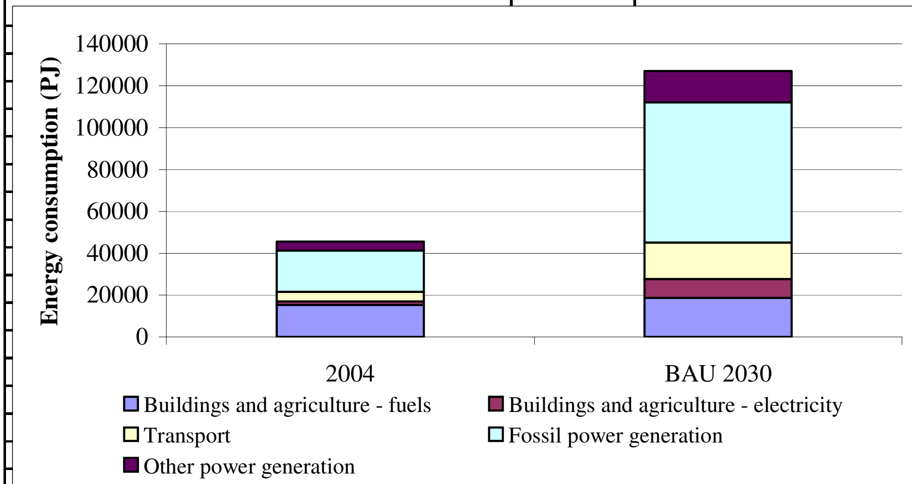
China's 11th Five Year Plan, announced in 2005, established an ambitious goal of reducing energy intensity by 20% between 2005 and 2010. China is considered to have developed a comprehensive appliance standard and labelling program. Policy recommendations are to:

- Introduce financial energy efficiency incentives – such as subsidies, grants, loans, and tax relief for buildings, transport and power generation.
- Introduce standards and labelling for passenger and freight transport.

| CHINA | | |
|---|---|---|
| **Population and GDP** | | |
| Population | 1303 | Million |
| GDP | 1904 | Billion US$ at 2000 prices |
| **Power generation** | | |
| Total power generation | 2237 | TWh |
| Fossil power generation | 1613 | TWh |
| **Energy use road transport and buildings** | | |
| Road transport | 2938 | PJ |
| Buildings total | 15320 | PJ |
| Buildings residential - fuels | 12209 | PJ |
| Buildings residential - electricity | 922 | PJ |
| Buildings non-residential - fuels | 1232 | PJ |
| Buildings non-residential - electricity | 509 | PJ |
| Buildings - heat | 449 | PJ |

**CHINA**

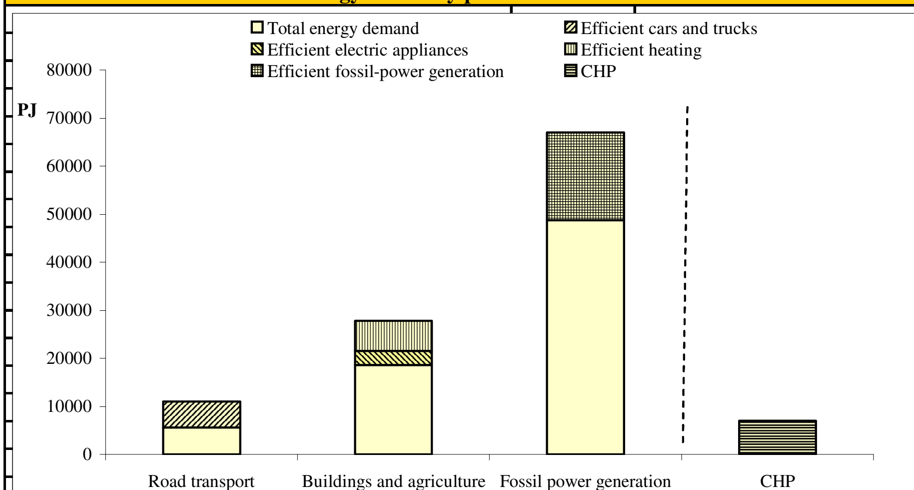
**Energy consumption for buildings, transport and power generation (PJ)**




**Specific energy consumption in 2004**

| | | |
|---|---|---|
| Energy intensity economy | 36 | MJ/US$2000 |
| Buildings total | 12 | GJ/capita |
| Buildings residential - fuels | 9 | GJ/capita |
| Buildings residential - electricity | 1 | GJ/capita |
| Buildings non-residential - fuels | 1 | GJ/capita |
| Buildings non-residential - electricity | 0 | GJ/capita |
| Road transport | 2 | GJ/capita |
| Energy-efficiency power sector | 34% | |
| Fossil power generation | 33% | kWh produced / energy input |

**Energy efficiency potentials for 2030**




**Sources**

IEA World Energy Outlook 2006
IEA Energy Balances 2006

**Remarks**

Energy consumption for buildings and transport refers to final energy consumption. Energy consumption by fossil power generation refers to primary energy use.

| | CHINA | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Type and effectiveness of energy efficiency policies in place** | | | | | | | |
| | | **Sectors** | | | | | | |
| | | Buildings residential - fuels | Buildings residential - electricity | Buildings non-residential - fuels | Buildings non-residential - electricity | Transport - passenger | Transport - freight | Power sector |
| **Type of instruments** | Energy performance standards | | | | | | | |
| | Mandatory targets/tradable permits | | | | | | | |
| | Financial / fiscal instruments | | | | | | | |
| | Energy tax / energy tax exemption | | | | | | | |
| | Voluntary agreements | | | | | | | |
| | Labelling | | | | | | | |
| | **Overall effectiveness policies** | | | | | | | |

**Overall analysis of policies in place**

China's Energy Conservation Law entered into force in 1998, focusing on energy conservation management, rational utilization of energy and advancement of energy conservation technology. Further efforts by the government have included the reduction of coal and petroleum subsidies.

China's 11th Five Year Plan, announced in 2005, established an ambitious goal of reducing energy intensity by 20% between 2005 and 2010. One of the key initiatives for realizing this goal is the Top-1000 Energy-Consuming Enterprises program, which sets energy consumption targets for enterprises.

**Overall analysis of effectiveness of policies in place**

- China is considered to have developed a comprehensive appliance standard and labelling program.
- Few incentives for energy-efficiency improvement in the transport sector are present.
- Few financial incentives for energy-efficiency improvement are present.
- No specific energy tax is present for reducing energy demand.

**Policy recommendations**

- Introduce financial energy efficiency investment incentives – such as subsidies, grants, loans, and tax relief for buildings, transport and power generation.
- Introduce standards and labelling for passenger and freight transport.

**Sources**

WEC Energy Efficiency a Worldwide Review 2004

# 4 Policy and technology cooperation between G8 and G5

## 4.1 Introduction

Increased policy and technology cooperation both between G8 and G8+5 could play a major role in tapping the large energy efficiency potentials in the G5 countries. Cooperation among the industrialized countries and among the developing countries also opens up opportunities to increase energy efficiency on a global scale. The main question is how to organise such cooperation effectively.

The need for cooperation on energy efficiency issues has been emphasized by many governments and institutions. Energy efficiency both plays a role in traditional bi- and multilateral development cooperation programmes and in new international and bilateral initiatives on energy and/or climate. Some current initiatives on energy efficiency cooperation are summarised in this chapter. Most of these initiatives have ambitious targets or rank energy efficiency high on their list of policy goals, but many show deficits in their implementation. In order to ensure effectiveness, a number of factors need to be considered, including institutional support (with clear work-programmes and timelines), sufficient financing, an adequate range of measures (i.e. focus on one technology only or an ineffectively broad "shopping list"), the involvement of stakeholders, monitoring and enforcement provisions. As many initiatives are of fairly recent dates (most of them having been adopted within the last three years), results are still difficult to assess. They will, therefore, not be evaluated individually.

**Technology cooperation**

The IPCC Special Report on technology transfer defines the term "technology transfer" as "a broad set of processes covering the flows of know-how, experience and equipment for mitigating and adapting to climate change amongst different stakeholders such as governments, private sector entities, financial institutions, non-governmental organizations (NGOs) and research/education institutions" (IPCC 2000)[22]. Technology transfer does not need to be from developed to developing countries only. There are some successful examples of "South-South" and "South-North" technology transfer of clean technologies, e.g. PV and solar

[22] IPPC (2000) IPCC Special Report. Methodologies and technological issues in technology transfer. A Special Report of IPCC Working Group III, http://www.grida.no/climate/ipcc/tectran/index.htm

water heaters from China (Blok et al. 2005)[23], biomass technology from Brazil and India, and wind energy from India. Most commonly, technology cooperation is implemented as part of institutional development cooperation between developed and developing countries, but there are also many other public and private initiatives. Since supporting policies and regulatory frameworks strongly influence the success of technology transfer, technology cooperation is often supported by policy consultancy or cooperation. In this context, technology cooperation provides important support to one of the prerequisites to boosting energy efficiency: capacity building and training. However, while energy efficiency does play a role in most technical cooperation, it tends to come second to a predominant focus on large-scale supply-side infrastructures. Energy efficiency should be given a higher priority in technology cooperation. It should be fully mainstreamed into all supply-side activities, and demand-side energy efficiency should be given greater attention.

**Policy cooperation**

Policy cooperation in this context is defined as the transfer, exchange or joint design of policies. This process can take place among governments on bilateral, multilateral or international level, or among policy makers and international institutions. In a wider sense, IPCC states that international political efforts to address climate change "can include diverse elements such as emissions targets; sectoral, local, sub-national and regional actions; RD&D programmes; adopting common policies; implementing development oriented actions; or expanding financing instruments" (IPCC 2007)[24]. An example of energy efficiency policy cooperation is the China Sustainable Energy Programme initiated by the Energy Foundation, an international NGO. The program supports capacity building and policy transfer through linking Chinese experts with "best practices" expertise from around the world.

As already mentioned, policy and technology cooperation are often interlinked, they will, therefore, not be examined separately.

**Types of international cooperation**

International cooperation can take place bilaterally, plurilaterally (among selected countries) or multilaterally. Multilateral cooperation is characterized by a) involving a wide array of countries and b) taking place within or on the basis of an international institutional framework, e.g. the UN, the WTO or – for action on climate change – the UNFCCC. Under the Kyoto Protocol of the UNFCC, the flexible mechanisms constitute a special type of international cooperation and financing mechanism to abate climate change, notably the Clean Development Mechanism (CDM) and Joint Implementation activities (JI).

[23] Blok, K. et al. (2005) Towards a Post-2012 Climate Change Regime. Final Report. Contracted by the European Commission, DG Environment. Brussels, June 2005.
[24] IPCC (2007) Summary for Policymakers. Working Group III contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report Climate Change 2007: Mitigation of Climate Change. Bangkok, May 4th, 2007.

The following paragraphs highlight some examples of international cooperation efforts to increase energy efficiency.

## 4.2 Examples of bilateral cooperation[25]

**Bilateral technology cooperation (development aid)**

For quite some time energy efficiency technology transfer has been subject to the technical cooperation between developed countries and developing countries.

The European Union and its member states are involved in several hundred climate change or energy related technical cooperation programmes and projects, many of them dealing with energy efficiency. Also the other G8 countries operate technical cooperation programmes. While these programmes have contributed to progress on climate protection and the fulfilment of energy needs, a number of problems ought to be tackled, including a lack of policy coherence and a lack of coordination between donors. The mainstreaming of climate change mitigation and adaptation which is, since 2003, underway at EU-level, therefore needs to be intensified, particularly in the context of Country Strategy Papers, National Indicative Programmes, and Memoranda of Understanding with recipient countries. Parallel processes are needed at EU member state level. Supply and demand-side energy efficiency should play a key role in that. Furthermore, the EU and its member states should coordinate their energy- and climate related technology cooperation more effectively. The challenge is too big and resources are too scarce to hold on to scattered approaches rather than embark on a division of labour and increase of synergies.

It is important to note that the philosophies behind technical and political cooperation vary fairly widely between different donor countries, combining in differing ways ownership approaches (where the recipient country is strongly involved if not driving the priority-setting process, e.g. in the framework of MoU on technological cooperation) and criteria- or conditionality-based approaches (e.g. good governance). Similarly, the rationale behind technical and political cooperation in recipient countries also varies, ranging from direct financial interest to bringing in expertise and/or to develop own expertise. Some recipient countries – particularly those who start to act as donors themselves, e.g. China in Africa – hold on to development cooperation with donor countries less because of money rather than because of continuing existing institutional frameworks for cooperation and exchange.

[25] Major input to this chapter was provided by Anja Köhne, WWF Policy Advisor on "Energy & Climate issues in EU Foreign Policies"

Increased action on energy efficiency within technological cooperation needs to take these different approaches into account. All in all, it requires that energy efficiency climbs the priority list both on the side of the donor and of the recipient countries. The G8+5 process could come to an agreement on this point.

**EU bilateral dialogues on energy issues**

As part of their foreign policy, many G8 governments engage in bilateral dialogues focussing on energy supply and energy security, but sometimes also sustainable energy and energy efficiency.

The EU is, since 2006, developing an overall external energy strategy, as element both of its EU Energy Package and of its formulation of a Common Foreign and Security Policy. WWF has called on the EU, in the formulation of this external energy policy, a) to explicitly include the below 2°C-limit in the goals, and b) to focus the external energy policy of the EU at global energy needs rather than exclusively European energy interests. Furthermore, the European Commission, hand in hand with the Council Presidencies, has considerably extended its foreign climate policy over the past years.

Next to the development of overarching external energy and climate policies, energy and climate issues, including energy efficiency, feature increasingly on the agendas of the growing array of more or less formalised third country relations of the EU. Each of these bilateral relations have different status and formats, ranging from full-blown partnerships with institutional back-up, strategic partnerships, to looser partnerships, the latter of which often fall in the remit of EU-relationships with third regions rather than third countries (e.g. EU-LAC, EU-OPEC, ASEM, European Neighbourhood Policy, etc). And within the different status of these bilateral relations, energy and/or climate issues feature differently, depending on the interests at stake – with energy being almost the defining pillar of EU-Russia relations from the beginning, whereas it only recently became an issue vis-à-vis countries such as China and India.

EU external energy and climate policies so far complement rather than coordinate or replace member states´ external energy and climate relations. While it is unlikely that an EU external energy policy will fully replace member state policies, more decisive coordination and cooperation would be useful.

Energy efficiency cooperation of the EU therefore needs to be mainstreamed into the three key arenas of EU external energy policy: the overarching policy formulation, the relations with third countries and regions, and the member states´ external policies. Countries which are both EU and G8/G8+5 members have a key role to play in this.

- The EU-Russia Energy Relations.

EU-Russian relations belong to the longest-standing bilateral relations of the EU, culminating in a Partnership and Cooperation Agreement (PCA) which needs to be re-negotiated soon. Building on the PCA, several working structures and processes have been established, including a Permanent Partnership Council on Energy with several subgroups. Overall, energy has always been one of the main topics of EU-Russian relations, with the EU aiming at defusing its energy dependency on Russian imports by increasing interrelations and interdependency. A major bone of contention is the Energy Charter, which Russia has not ratified so far. In 2005, an EU-Russia Energy Dialogue was initiated by the EU to promote energy efficiency as a means to stimulate modernisation of the energy sector in Russia. It foresees an Action Plan on energy efficiency and stresses the role of JI in promoting energy efficiency. This and other EU-Russia joint activities, while tackling the right problems on the supply side (particularly of infrastructures such as pipelines, production facilities and grids), are insufficient when compared to the attention given to EU-Russian activities relating to other energy infrastructure problems (e.g. interconnectivity). Plus they neglect the considerable (and socially beneficial) energy saving potential on the demand-side (households, buildings, transport, industrial installations) (Köhne 2006)[26].

There are annual EU-Russia summits, several Troika-meetings (Troika = European Commission and current and upcoming Council presidency), and an array of meetings at working / civil servants level. Business involvement in EU-Russia relations is high, particularly of big energy companies, while civil society is hardly involved (on both sides).

- The EU-China Partnership on Climate Change and the EU-China Energy and Environment Programme.

The EU-China Partnership on Climate Change was launched in 2005. It seeks to develop concrete cooperation efforts in the area of climate change and energy, in a wide array of activities, including cooperation on market-based instruments, R&D, technical cooperation on several technologies, and a China-EU Action Plan on Industrial Co-operation on Energy Efficiency and Renewable Energies. Since the adoption of the 11th Five Year Programme of China, which includes the goal to improve energy intensity by 20% by 2010, the 2005 stated commitment of the EU and China to "co-operate to realise our respective goals of significantly improving the energy intensity of our economies" has intensified. Furthermore, the EU and China agreed to set up a coal fired demonstration power plant with carbon capture and storage, an agreement supported by a UK-China and an EU-China MoU of early 2006, and by a feasibility study currently underway. Predating the EU-China Climate Agreement of 2005, the EU-China Energy and Environment Programme (EEP) aims to promote sustainable energy use in China, in particular energy policy

[26] Köhne, A. (2006) New Arenas for Climate Policy: Energy & Climate Issues in EU Foreign Relations. KyotoPlus Paper September 2006. http://www2.kyotoplus.org/uploads/koehne_kyotoplus_fin.pdf

development, energy efficiency, renewable energy and natural gas. EEP-activities include energy efficiency in industrial model plants in key sectors as well as cooperation with the first Chinese energy contractors. Inspite of the sketched progress, however, more decisive and immediate action is needed to make better use of EU-China relations to improve energy efficiency on both sides on a large scale.

There are annual EU-China summits (often in connection to ASEM as well as EU-India summits), Troika-meetings and an array of meetings at working / civil servants level. Business involvement in EU-China relations so far is not formalised, but increasing. Civil society involvement in China-EU relations is, though informal, fairly substantial.

- The Clean Development and Climate Change within the Joint Action Plan on the India-EU Strategic Partnership

While India-EU relations have already reached a higher status than EU-China relations, being formalised as a strategic partnership, and while the EU and its member states run extensive technological cooperation programmes on energy in India, policy cooperation between India and the EU on energy and climate is not as developed as between the EU and China. There are several reasons for that, ranging from overall Indian geo- and energy politics to a situation of lack of trust on climate issues back in 2005. Still, in 2005, parallel to the EU-China partnership agreement on climate, a chapter on Clean Development and Climate Change was inserted into the Joint Action Plan on the EU-India Strategic Partnership, which includes the pledge to cooperate on energy efficiency and conservation. Cooperation on the increased use of the CDM between the EU and India reflects increasing interest in India on this mechanism. While concrete outcomes still remain to be seen, some progress was made (including regular working-level meetings and better mutual understanding) which should help future outcomes. One element of the strengthened institutions is the India-EU Energy Panel, which runs working groups on issues, including energy efficiency. However, the overall impression is that traditional fossil fuel infrastructures as well as cooperation on nuclear energy (e.g. through the ITER-project) rank higher on the agenda than concrete and scaled-up action on energy efficiency.

There are annual EU-India summits (mostly in autumn, often in connection to ASEM as well as EU-China summits), Troika-meetings and an array of meetings at working / civil servants level. Business involvement in EU-India relations is formalised in form of an EU-India business round table. Considering the lively civil societies on both sides, civil society involvement is less substantial than would be expected, and they hardly interact on India-EU relations so far.

- The European Commission-Brazil Dialogue.

EU-Brazil relations are so far covered in the framework of EU-LAC (Latin-American and Caribbean countries) summits. In 2006 the European Commission and Brazil agreed to set up a dialogue on the environment and climate change dimension of sustainable development.

- EU-US energy and climate relations

Transatlantic relations have gone through waves of intensification and stagnation through the decades. The most recent EU-US summit in April 2007 has seen the endeavour, mainly driven by the German EU-presidency, to move towards a transatlantic internal market. As a result, a framework for advancing transatlantic economic cooperation was concluded, which aims at removing barriers to trade both between the transatlantic partners and, by joint action, in the rest of the world. This goal is very much in line with the aims of the Transatlantic Business Dialogue, which brings together some twenty major businesses. Some of the elements of this transatlantic trade policy might have repercussions on energy efficiency policy, e.g. if an aggressive joint EU-US policy on global Intellectual Property Rights (IPR) protection does not allow for IPR-policies supporting energy efficiency. Next to the above mentioned agreement on transatlantic economic integration, the EU and the US also adopted a summit statement on energy security, efficiency, and climate change, which foresees, among others, cooperation on the improvement of energy efficiency (especially in transportation, buildings and appliances), the implementation of a previously drawn up energy efficiency work plan, further work on the EU-US energy star agreement, and the discussion of potential joint efforts to promote energy efficiency in third countries to enhance EU and US energy security. However, the EU-US statement on energy security, efficiency and climate looks stronger on clean coal, biofuels, and other activities, than on energy efficiency.

To conclude: There are a number of other EU-dialogues, including with Japan and Canada, which are not covered here in detail due to a lack of space. While EU-Japan energy relations offer quite some scope, particularly on energy efficiency, action and understanding has been hampered in recent years due to the political dynamics around international climate policy and to an increasing pre-occupation of EU energy and climate policy makers towards the +5-countries, notably China, India and Brazil.

It is too early to assess the success of these dialogues. The approach of complementing and reinforcing international climate change agreements as well as supporting national policies and programmes by bilateral agreements and action programmes seems promising. Particularly, bilateral relations seem to offer some advantages: policies are less complex and thus agreement and progress more easily achieved; institutional frameworks, accountability and reliance seem to be more decisive; and such agreements and activities tend to be supportive and complementary to UN processes and their implementation, rather than running the wanted or unwanted risk of taking attention away from real and multilateral action.

**US bilateral initiatives**

The US is engaged in several bilateral initiatives to promote energy efficiency and renewable energy, e.g. the US-China Energy Efficiency and Renewable Energy Protocol[27]. These initiatives have a clear focus on technology development and transfer.

**Japanese bilateral initiatives**

Also Japan's cooperation activities mainly focus on the transfer of "best available technology"[28]. An example is the Climate Technology Initiative of the Ministry of Economy, Trade and Industry (METI), that implements industrial energy efficiency projects throughout Asia, e.g. in China, India, Indonesia, Thailand and Vietnam.

**Triangles, cooperation, triangles and competition**

Recent years have seen the emergence of multiple bilateral and plurilateral initiatives on energy and climate, many of which run in parallel or even in competition, sometimes with converging, sometimes with differing approaches. The most notable cases are EU- and US-relations with Russia, India and China, as well as Indian-China energy cooperation and Russian energy relations with China. The G8 could serve as a forum for open discussion on these energy triangles, with a view to identify issues and activities where cooperative approaches are more efficient to ensure energy and climate security, and more effective to avoid energy conflicts.

## 4.3 Pluri- and multilateral cooperation

**The G8 Gleneagles Dialogue**

The Gleneagles Dialogue was launched at the G8 Gleneagles Summit in July 2005 under the UK presidency. It aims to bring together the 20 countries with the greatest energy demand, including the G8 and G5 countries, to informally discuss new measures to tackle climate change in a complementary process outside of the formal negotiations under the UNFCCC[29]. It also monitors the implementation of the G8 Action Plan on Climate Change, Clean Energy and Sustainable Development adopted by the G8 heads. The International Energy Agency was asked to support the dialogue with technical expertise (see textbox). The World Bank and other international financial institutions were involved to create a new investment framework for clean energy and development.

The Gleneagles Dialogue was publicly perceived as a milestone for international cooperation when it was announced in 2005. G8, however, is lacking an implementing body that could enforce or monitor the process, beyond the specific

[27] http://www.energy.gov/news/4535.htm
[28] Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol. Analysis of mitigation potentials and ranges of emission reduction objectives of Annex I Parties. Third session, Bonn, 14–18 May 2007.
[29] www.g8.gov.uk

mandates given to IEA. It might be a solution to give IEA a broader mandate in the future context of G8+5, but this would create new problems, since IEA only represents OECD countries, and as the current IEA-mandate is stronger on traditional energy policies rather than energy efficiency and climate protection.

**IEA's G8 Gleneagles Programme**

The IEA's G8 Gleneagles Programme aims to promote energy-sector innovation, better practice and use of enhanced technology (IEA 2005). It focuses on six broad areas:

- Alternative energy scenarios and strategies.
- Energy efficiency in buildings, appliances, transport and industry.
- Cleaner fossil fuels.
- Carbon capture and storage.
- Renewable energy.
- Enhanced international co-operation.

Within the task "Energy efficiency in buildings, appliances, transport and industry", IEA has announced the following steps:

- In-depth indicators to provide "state-of-the-art" data and analysis on energy use, efficiency developments and policy pointers.
- Construction of the world's leading database on efficiency codes and standards for buildings, appliances and surface transport to pinpoint lessons learned and best practice for varying situations and climates.
- For industry, an authoritative, comprehensive overview of existing and potential efficiency performance that identifies areas where intensified efforts could add value in both industrialised and developing countries.

(Source: http://www.iea.org/G8/index.asp#effi)

**Asia-Pacific Partnership on Clean Development and Climate (AP6)**

The Asia-Pacific Partnership on Clean Development and Climate (AP6) was set up by the US, Japan, China, India, South Korea and Australia as an integrative approach to poverty, energy needs, air pollution and climate[30]. The partnership is characterized by its members as "sector-by-sector bottom-up approach", in which private companies cooperate in the development, spread and transfer of clean and efficient technologies (AWG3 Japan 2007)[31].

The AP6 has been heavily criticized by NGOs, including WWF, for its lack of content as well as for the intention of the USA and Australia to use AP6 to undermine the Kyoto Protocol and carbon markets more general. Köhne (2006)

[30] http://www.asiapacificpartnership.org

[31] AWG 3 (2007) Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol. Analysis of mitigation potentials and ranges of emission reduction objectives of Annex I Parties. Third session, Bonn, 14–18 May 2007.

mentions a number of AP6 weaknesses: "Lack of integration with the international climate frameworks (with the US originally understanding the AP6-venture even as alternative to UNFCCC/KP); misguided philosophy concerning global energy system transformation; weak institutional structures and working mechanisms; limited funding; lack of concrete activities; incoherence with scientific findings on climate mitigation needs; disregard for the adaptation challenge". AP6's effect on energy efficiency improvements are not known, but may be questioned for the above mentioned reasons.

**Renewable Energy and Energy Efficiency Partnership (REEEP)**

An innovative example for an international policy initiative on energy efficiency is the Renewable Energy and Energy Efficiency Partnership (REEEP). REEEP is a global public-private partnership that structures policy and regulatory initiatives for clean energy, and facilitates financing for energy projects. Backed by more than 200 national governments, businesses, development banks and NGOs, REEEP contributes to international, national and regional policy dialogues. Aim is to accelerate the integration of renewables into the energy mix and to advocate energy efficiency. Energy efficiency projects supported under REEEP include

- Financial Models for Energy Efficiency in Water Services across South Africa
- Development of an Energy Efficiency Programme for the Brazilian Market
- Micro-lending for Energy Services in North Karnataka and Gujarat

(www.reeep.org)

## 4.4 CDM and JI

Important mechanisms for cooperation on climate saving activities are the clean development mechanisms under the Kyoto Protocol, Joint Implementation (JI) and Clean Development Mechanism (CDM).

**CDM**

So far energy efficiency projects do not account for large numbers of CDM projects (Winkler & van Es 2007)[32]. According to (de Coninck et al. 2007)[33], by January 2006 only 1 of 63 registered CDM projects dealt with energy efficiency. (Ellis &

[32] Winkler, H. & van Es, D. (2007) Energy efficiency and the CDM in South Africa: constraints and opportunities. In: Journal of Energy in Southern Africa, Vol. 18(1), 02/2007.

[33] De Coninck et al. (2007) Technology transfer in the Clean Development Mechanism. ECN 2007, http://www.ecn.nl/docs/library/report/2007/e07009.pdf

Karousakis 2006)[34] count 9 out of 172 CDM projects by May 2006. The situation looks better considering project at the PDD or validation stage. According to (Fenhann 2006)[35], 87 energy-efficiency projects are in the long CDM pipeline, most of them in the industrial sector. Examples of registered non-industrial energy efficiency CDM projects are the Kuyasa low-cost urban housing energy upgrade project, Khayelitsha, Cape Town, South Africa, and the improvement in energy consumption of a hotel in India[36].

Despite increasing numbers of energy efficiency projects, their total share in CDM remains low. One of the reasons for this is that end-use efficiency potentials are often dispersed which leads to higher transaction costs of this project type under the CDM. Furthermore, as energy efficiency is multi-faceted, it is harder to develop methodologies for this project type under the CDM than it is for other project types. Further barriers include controversial argumentation of additionality[37] in times of high commodity prices, disclosure of otherwise confidential industrial production data for monitoring, and lack of required technological process know-how of host country authorities (Haslinger 2007)[38].

To address the under-representation of energy efficiency projects under the CDM, various approaches have been discussed lately, the most prominent ones being bundling and programmatic CDM. While a bundle consists of individual CDM projects submitted together for registration, a programme of activities (PoA) represents a framework registered as one CDM project under which targeted activities are identified. The number of activities, their location as well as emission reduction are however not known beforehand. Furthermore, approaches extending the CDM from the project-level to more sectoral or policy-based approaches are considered as potential options for lowering transaction costs and scaling-up investments in energy efficiency in developing countries[39].

To promote high quality CDM and JI projects catalysing the market for renewable energy resources and end-use energy efficiency, WWF has initiated the Gold Standard, the first independent best practice benchmark for CDM and JI. It is based on a clear assessment framework, meeting different criteria regarding sustainability

[34] Ellis, J.& Karousakis, K. (2006) The Developing CDM Market: May 2006 Update. IEA/OECD, http://www.oecd.org/dataoecd/36/4/36737950.pdf

[35] Fenhann, J (2006) CDM projects in the pipeline. Excel spreadsheet. Roskilde, UNEP Risø Centre 2006, www.cd4cdm.org/Publications/CDMpipeline.xls

[36] http://cdm.unfccc.int/Projects/registered.html

[37] (Winkler 2006) argues that doubts about additionality are a misconception for small projects, considering methodologies for energy efficiency CDM projects in place.

[38] Haslinger (2007) Barriers to energy efficiency in JI/CDM. Conference Presentation. UNIDO, Vienna, March 2007, http://www.resourcesaver.com/file/toolmanager/O105UF2012.pdf

[39] Sectoral CDM is an approach where emissions reduction credits are generated from public and private actions in a single sector (e.g., electricity). In S-CDM, all activities in a sector would be covered, not just the ones that necessarily reduce emissions. For further reading see Ogonowski et al. (2006) Greenhouse Gas Mitigation in Brazil, China and India: Scenarios and Opportunities through 2025. Center for Clean Air Policy, November 2006

and practicality of procedure. The Gold Standard was developed in conjunction and consultation with a wide range of environmental, business and governmental organizations, and supported by consultants with experience in project development and verification like Ecofys[40].

**JI**

Joint Implementation could become an interesting option for energy efficiency cooperation with Russia, Ukraine and other Eastern European countries. Options are explored by a number of European companies, among them Ecofys/One Carbon. Accreditation of JI projects will be possible from 2008 onwards, however Russia did not foresee the necessary administrative provisions yet.

## 4.5 International energy efficiency standards

In the current discussion about possible future G8+5 energy efficiency agreements, joint energy efficiency standards have been proposed as one option for international cooperation. This option is also favoured by WWF.

In general, energy performance standards can be considered a good policy option, especially under the following circumstances (AID-EE 2006)[41]:

- When aiming at removing the worst products or services from the market.
- When dealing with rather uniform technologies.
- When dealing with a target group which is unwilling to act or difficult to address.

On a global scale, joint energy efficiency standards hold the potential of putting an end to the dumping of inefficient products in developing countries and stimulating global market transformation. To negotiate and implement such standards remains a challenging task, however, both on a political and a practical level. A number of difficulties need to be addressed:

- Setting energy performance standards is easier in developed countries, where in general the available technology is more advanced, and know-how and skilled labour are often in house. Standards are more difficult to impose in developing countries that are lacking administrative capacities and skilled labour. When setting standards, provisions should be adopted to facilitate training for the affected work forces, and to ensure skilled monitoring through public institutions.
- Standards are more difficult to implement in sectors where a large number of small operations are involved, as opposed to tightly permitted sectors like electricity generation.

[40] http://www.panda.org/about_wwf/what_we_do/climate_change/solutions/business_industry/offsetting/gold_standard/index.cfm
[41] AID-EE (2006), see www.aid-ee.org

- Joint standards require comparable products. While it is feasible to set common standards for products like cars, appliances, electric and electronic equipment, this is more difficult for buildings, whose design and components differ regionally, with local industries involved. Also building codes are differently structured in different countries. It might be an option to look for similar regions and products, instead of striving for a global standard.
- Developing countries will not be easily convinced to adopt the same standards as developed countries, since in most cases those standards would be more challenging for them than for the developed countries. Joint standards should therefore leave room for adaptation to the countries' situation. Developing countries should already become involved in the conceptual stage of the standard design, to focus on co-benefits for their particular situation. Financial commitment by the developed countries to facilitate technology transfer could become an important issue in the negotiation process. New business opportunities and options for South-North technology transfer should also be explored.
- Already joint product standards between two or more countries with big home and export markets, e.g. China, Japan, the US or the EU could create economies of scale that would establish a leading standard.

# 5 Conclusions and policy recommendations

## 5.1 Conclusions and recommendations on potentials and energy-efficiency policies

**The proposed 20% energy-efficiency improvement by 2020 in the transport, building and power sector is achievable in G8 and G5 countries.**

The potential identified in this study exceeds the 20% proposed by the German G8 presidency. Table 8 provides an overview of the estimated market potential for the G8 plus G5 countries. Energy use in the building sector can be reduced by 35%. More energy-efficient household appliances and office equipment, and improving insulation and building design are the most important options. Savings in the transport sector can reach 40% in 2030. More efficient engines and developments of hybrid and fuel cell cars and trucks are the most important options[42]. The power sector has room for energy-efficiency improvements among others by using CHP-units and building more efficient plants.

Table 8 Potential for energy-efficiency in 2030 for the G8 plus G5 countries compared to the Reference Scenario

| **Energy-efficiency potential (PJ)** | **Road transport** | **Buildings** | **Fossil power generation** | **CHP** |
|---|---|---|---|---|
| *Total energy demand* | *69,420* | *109,132* | *17,1913* | |
| Efficient cars and trucks | 27,851 | | | |
| Efficient electric appliances | | 14054 | | |
| Efficient heating | | 23804 | | |
| Efficient fossil-power generation | | | 43,185 | |
| CHP | | | | 23,649 |
| ***Percentage reduction per sector*** | ***40%*** | ***35%*** | ***25%*** | |

[42] Fossil energy use of the transport sector can be further reduced through changes in modal shift, investing in public transport, spatial planning measures, and the use of biofuels etc. Within the timeframe of this project we were not able to quantify the impact of these types of measures.

**G8 and G5 countries can achieve efficiency improvements well beyond 20% in the transport and building sector**

G8 as well as G5 countries can achieve efficiency improvements that go beyond the 20% proposed by the G8 Presidency. The reduction potential in the transport sector ranges from 25% to almost 50%, whereas potentials in the building sector range from 30% to 45%.

**Reduction potential in the power sector ranges from 4% to 45%.**

Reduction potential in the power sectors various considerably from country to country. The largest reduction can be achieved in China, India and Russia.

**The portfolio of policy instruments applied is very diverse and effectiveness varies…**

The applied portfolio of policy instruments to stimulate energy-efficiency is very diverse. This is resulting from the fact that market barriers that need to be overcome differ by country and by sector.

**…but some common denominators can be identified**

Despite the very diverse nature of the energy-efficiency policy portfolio some common factors can be identified:

- Most G8 countries have *standards* in place to stimulate energy-efficient use of heat in the residential as well as the non-residential housing. Standards for electrical appliances and or motor systems are in place in less than half of the countries analysed. Standards are an effective instrument when dealing with consumer groups otherwise difficult to address and when aiming to remove worst products or services from the market. Effectiveness of standards could be improved by timely adjusting and tightening the standards to technology progress and improve enforcement.
- All countries have *labelling* systems in place for electrical appliances. The EU Member States also have labelling systems in place for passenger cars. Labelling is a good way to inform large customer groups on the energy performance of products but has limited impact when it is not linked to other policy instruments (like financial support and standards) and when not timely adjusted to meet technology progress.
- Policies to stimulate the use of *cogeneration of heat and electricity* (CHP) are very diverse, ranging from investment support, feed-in tariffs, mandatory targets and voluntary agreements. Liberalisation of energy markets hampered further uptake of CHP in the last decade in a number of countries.
- The *European Emission Trading Scheme* is currently the most important instrument in place for the power sectors in EU countries. Up to now the scheme had limited impact on efficiency improvement because the caps on $CO_2$ were not very tight in the first phase. Other G8 countries have voluntary agreements and fiscal measures in place but impact on efficiency improvements is limited.

- In most countries *energy taxes* are not directed towards getting the price right for fossil fuels and working towards the “polluter pays” principle. The level of energy tax is in most countries insufficient to encourage efficient use of energy. Furthermore, existing subsidies, state aids and tax exemptions which incentives emissions are identified and either phased out or reformulated to remove the undesirable incentives part of the policy.
- Most countries have *financial instruments* in place like soft loans, subsidies, fiscal instruments. Effectiveness of financial instruments is in most cases limited because the list of eligible technologies is not updated regularly resulting in a large share of free riders.

**Gaps in energy-efficiency policies can be found across all sectors and countries with the transport sector clearly standing out**

In all G8 countries, there exist blank “policy spots” and policies that are not very effective. The analysis showed that energy-efficiency gaps can be found across all sectors. Some countries have distinguishable policy “cultures” that make an instrument more effective in one country than in others (e.g. voluntary agreements in Japan). It can be concluded that in most countries the *transport sector* is lagging furthest behind.

**Energy-efficiency is emerging on the agenda of the G5 countries**

Energy-efficiency is emerging on the agenda of the G5 countries. Policy development regarding energy-efficiency in G5 countries is less advanced than in G8 countries, but energy-efficiency is certainly on their agenda and a lot of policies are ‘in the pipeline’.

**A combination of “tailor” made and sector specific policies is needed for each country to achieve large-scale energy-efficiency improvements**

Large-scale energy-efficiency improvements can be obtained in all economies. Societies’ infrastructures - transportation systems, building stock, industrial facilities and energy supply networks - seem resistant to improvements in energy-efficiency. Various barriers such as lack of knowledge and legal and institutional issues contribute to a slow diffusion and adoption of energy-efficient technologies. There are no "silver bullet" technologies or policies that can alone yield all the potential energy savings. A combination of tailor made and sector specific policies are needed for each country.

**Opportunities to speed up energy-efficiency improvements and increase the impact of policies include…..**

**…..working according to the ‘polluter pays’ principle.**

Introducing the ‘polluter pays’ principle by increasing the level of taxes on fossil fuels and at the same time phasing out subsidies for conventional energy sources.

**…..setting clear targets for energy-efficiency and sanction for non-compliance**
Setting clear and transparent future targets for energy-efficiency are an important prerequisite for achieving energy savings. Regular monitoring and sanctions for non-compliance are important ingredients for a successful energy-efficiency strategy.

**…. introducing performance based standards for new and existing buildings**
Introducing performance based standards is an effective instrument to achieve energy-efficiency in the building sector. Timely adjustments and tightening of the standards to technology progress and penalties for non compliance are important elements for effective performance based standards.

**……introducing minimum efficiency standards for house appliances and office equipment**
Implementing minimum efficiency standards for household appliances and office equipment is an effective way to save energy. Preferably these standards should be set on the international level (especially in the EU). Again timely adjustments and tightening of the standards to technology progress and penalties for non compliances are important elements for effective minimum efficiency standards. One idea could be introducing a competitive element for updating of standards.

**….introducing binding minimum efficiency standards for new passenger and freight vehicles**
Introducing ambitious binding minimum efficiency standards (or $CO_2$ standards) for passenger and freight vehicles is an effective way to reduce transport energy use. Energy use could be further reduced if next to it a maximum is set on cars allowed on the market or that these cars are submitted to very high taxation. Again timely adjustments and tightening of the standards to technology progress and penalties for non compliances are important elements for effective minimum efficiency standards.

**…..setting clear and ambitious caps on the greenhouse gas emissions of the power sector could speed up efficiency savings**
Setting clear and ambitious caps on the greenhouse gas emissions for the power sector is an effective instrument to speed up efficiency improvements in the power sector. The current European Emissions trading schemes and the planned schemes for the US and Canada are in principle effective instruments to limit energy use of the power sector. An important prerequisite is that emission caps are ambitious and strict penalties are in place in for non-compliance.

## 5.2 Conclusions and recommendations on bilateral and multilateral cooperation

Increased international cooperation is a key for tapping the huge energy efficiency potentials in G5 and worldwide. Today it takes place in traditional bi- and multilateral development cooperation programmes and in new international and bilateral initiatives on energy and/or climate. A general recommendation that can be made to all these levels: Set energy efficiency high on the agenda!

**Technology cooperation**

While energy efficiency does play a role in most technical cooperation, it tends to come second to a predominant focus on large-scale supply-side infrastructures. Energy efficiency therefore should be given a higher priority in technology cooperation; it should be fully mainstreamed into all supply-side activities, and demand-side energy efficiency should be given greater attention.

**EU bilateral cooperation**

The EU has started bilateral relations on energy and climate issues with major G8 and G5 countries, but coordination between external energy and climate policies and also with EU Member States needs to be improved.

Energy efficiency cooperation of the EU should be more decisively mainstreamed and scaled up in the three key arenas of EU external energy policy: the overarching policy formulation, the relations with third countries and regions, and the member states´ external policies. Countries which are both EU and G8/G8+5 members have a key role to play in this.

**Multilateral cooperation - the G8 process**

The G8 Gleneagles Dialogue started an ambitious process of international action. However, G8 as a process is lacking an implementing body that could enforce or monitor the process, beyond the specific mandates given to IEA. Countries should consider extending an informal mandate to the IEA to monitor implementation of energy efficiency actions by the G8.

**CDM & JI**

Energy efficiency projects do not account for large numbers of CDM projects. To overcome the main barriers of high transaction costs and challenging methodologies, bundling, programmatic and sectoral approaches should be pursued. On the short term, host countries could improve their administrative procedures for CDM/JI.

**International Standards**

Energy performance standards can be a very effective policy instrument, if implemented in the right way. The development of joint energy performance standards among industrialized and developing/transition countries, e.g. G8+G5, could remove very inefficient products from the world market and end the dumping of such products in developing countries. However, standard setting is difficult in certain sectors and constellations, especially in the building sector. Also from a political point of view standards are not easy to negotiate. To make joint standards convincing to developing countries, they should leave room for adaptation to the countries' situation. Further more, developing countries should already become involved in the conceptual stage of the standard design.

**Further recommendations on policy cooperation**

Global standards are not the only policy option to achieve energy savings. Intermediate steps might be quicker to implement, especially if no international agreement is reached. Such options include:

- **Joint energy labels** can be very effective if associated to joint standards, as they provide consumers precious information regarding energy consumption/efficiency of products. Cooperating on energy efficiency labels, even before standards are in place, might prove helpful to get developing countries engaged in energy efficiency policy cooperation.
- A bilateral or plurilateral agreement on **joint public procurement**, e.g. efficient air-conditioners in public buildings in the EU and China, could be a show-case energy saving measure relatively easy to negotiate, still giving a clear signal to the countries' public.
- Very valuable might be the establishment of an **exchange process between policy makers** how to design and implement energy policies effectively. What are success factors and barriers of the specific policy type? What are the challenges of imposing the policy? What solutions were found in other countries?
- **Innovative financing** concepts and the removal of trade barriers for energy efficiency solutions could open up new business opportunities in developing countries, stimulating South-South or even South-North technology transfer.

# ANNEX: Detailed potentials per country

G8+5

| Energy-efficiency potential (PJ) | Road transport | Buildings and agriculture | Fossil power generation | CHP |
|---|---|---|---|---|
| *Total energy demand* | *69420* | *109132* | *171913* | |
| Efficient cars and trucks | 27851 | | | |
| Efficient electric appliances | | 14054 | | |
| Efficient heating | | 23804 | | |
| Efficient fossil-power generation | | | 43185 | |
| CHP | | | | 23649 |
| ***Percentage reduction per sector*** | ***40%*** | ***35%*** | ***25%*** | |

BRAZIL

| Energy-efficiency potential in 2030 in comparison to Reference Scenario(PJ) | Road transport | Buildings and agriculture | Fossil power generation | CHP |
|---|---|---|---|---|
| *Total energy demand* | *3969* | *2638* | *824* | |
| Efficient cars and trucks | 1877 | | | |
| Efficient electric appliances | | 518 | | |
| Efficient heating | | 608 | | |
| Efficient fossil-power generation | | | 164 | |
| CHP | | | | 543 |
| ***Percentage reduction per sector*** | ***47%*** | ***43%*** | ***20%*** | |

CANADA

| Energy-efficiency potential in 2030 in comparison to Reference Scenario(PJ) | Road transport | Buildings | Fossil power generation | CHP |
|---|---|---|---|---|
| *Total energy demand* | *3140* | *3094* | *2799* | |
| Efficient cars and trucks 2020 | 1218 | | | |
| Efficient electric appliances 2025 | | 379 | | |
| Efficient heating 2025 | | 612 | | |
| Efficient fossil-power generation 2020 | | | 653 | |
| CHP 2025 | | | | 704 |
| ***Percentage reduction per sector*** | ***39%*** | ***32%*** | ***23%*** | |

CHINA

| Energy-efficiency potential in 2030 in comparison to Reference Scenario(PJ) | Road transport | Buildings and agriculture | Fossil power generation | CHP |
|---|---|---|---|---|
| *Total energy demand* | *11031* | *27800* | *66983* | |
| Efficient cars and trucks | 5434 | | | |
| Efficient electric appliances | | 2974 | | |
| Efficient heating | | 6211 | | |
| Efficient fossil-power generation | | | 18246 | |
| CHP | | | | 6993 |
| ***Percentage reduction per sector*** | ***49%*** | ***33%*** | ***27%*** | |

FRANCE

| Energy-efficiency potential in 2030 in comparison to Reference Scenario(PJ) | Road transport | Buildings | Fossil power generation | CHP |
|---|---|---|---|---|
| *Total energy demand* | *2236* | *3308* | *1221* | |
| Efficient cars and trucks | 542 | | | |
| Efficient electric appliances | | 531 | | |
| Efficient heating | | 726 | | |
| Efficient fossil-power generation | | | 141 | |
| CHP | | | | 694 |
| ***Percentage reduction per sector*** | ***24%*** | ***38%*** | ***12%*** | |

GERMANY

| Energy-efficiency potential in 2030 in comparison to Reference Scenario(PJ) | Road transport | Buildings | Fossil power generation | CHP |
|---|---|---|---|---|
| *Total energy demand* | *2968* | *4438* | *5790* | |
| Efficient cars and trucks | 720 | | | |
| Efficient electric appliances | | 317 | | |
| Efficient heating | | 976 | | |
| Efficient fossil-power generation | | | 1217 | |
| CHP | | | | 1045 |
| ***Percentage reduction per sector*** | ***24%*** | ***29%*** | ***21%*** | |

INDIA

| Energy-efficiency potential in 2030 in comparison to Reference Scenario(PJ) | Road transport | Buildings and agriculture | Fossil power generation | CHP |
|---|---|---|---|---|
| *Total energy demand* | *2858* | *15659* | *22304* | |
| Efficient cars and trucks | 1335 | | | |
| Efficient electric appliances | | 1300 | | |
| Efficient heating | | 3873 | | |
| Efficient fossil-power generation | | | 7847 | |
| CHP | | | | 4279 |
| ***Percentage reduction per sector*** | ***47%*** | ***33%*** | ***35%*** | |

ITALY

| Energy-efficiency potential in 2030 in comparison to Reference Scenario(PJ) | Road transport | Buildings | Fossil power generation | CHP |
|---|---|---|---|---|
| *Total energy demand* | *1796* | *2353* | *2921* | |
| Efficient cars and trucks | 436 | | | |
| Efficient electric appliances | | 220 | | |
| Efficient heating | | 466 | | |
| Efficient fossil-power generation | | | 182 | |
| CHP | | | | 584 |
| ***Percentage reduction per sector*** | ***24%*** | ***29%*** | ***6%*** | |

JAPAN

| Energy-efficiency potential in 2030 in comparison to Reference Scenario(PJ) | Road transport | Buildings and agriculture | Fossil power generation | CHP |
|---|---|---|---|---|
| *Total energy demand* | *3381* | *5820* | *4952* | |
| Efficient cars and trucks | 1620 | | | |
| Efficient electric appliances | | 896 | | |
| Efficient heating | | 1112 | | |
| Efficient fossil-power generation | | | 199 | |
| CHP | | | | 1185 |
| ***Percentage reduction per sector*** | ***48%*** | ***35%*** | ***4%*** | |

MEXICO

| Energy-efficiency potential in 2030 in comparison to Reference Scenario(PJ) | Road transport | Buildings and agriculture | Fossil power generation | CHP |
|---|---|---|---|---|
| *Total energy demand* | *3782* | *1675* | *4503* | |
| Efficient cars and trucks | 1467 | | | |
| Efficient electric appliances | | 268 | | |
| Efficient heating | | 447 | | |
| Efficient fossil-power generation | | | 912 | |
| CHP | | | | 387 |
| ***Percentage reduction per sector*** | ***39%*** | ***43%*** | ***20%*** | |

RUSSIA

| Energy-efficiency potential in 2030 in comparison to Reference Scenario(PJ) | Road transport | Buildings and agriculture | Fossil power generation | CHP |
|---|---|---|---|---|
| *Total energy demand* | *2452* | *9337* | *11997* | |
| Efficient cars and trucks | 1084 | | | |
| Efficient electric appliances | | 415 | | |
| Efficient heating | | 2670 | | |
| Efficient fossil-power generation | | | 5483 | |
| CHP | | | | 1239 |
| ***Percentage reduction per sector*** | ***44%*** | ***33%*** | ***46%*** | |

SOUTH AFRICA

| Energy-efficiency potential in 2030 in comparison to Reference Scenario(PJ) | Road transport | Buildings | Fossil power generation | CHP |
|---|---|---|---|---|
| *Total energy demand* | *913* | *1322* | *3529* | |
| Efficient cars and trucks | 433 | | | |
| Efficient electric appliances | | 169 | | |
| Efficient heating | | 436 | | |
| Efficient fossil-power generation | | | 710 | |
| CHP | | | | 343 |
| ***Percentage reduction per sector*** | ***47%*** | ***46%*** | ***20%*** | |

UNITED KINGDOM

| Energy-efficiency potential in 2030 in comparison to Reference Scenario(PJ) | Road transport | Buildings | Fossil power generation | CHP |
|---|---|---|---|---|
| *Total energy demand* | *2035* | *3471* | *3973* | |
| Efficient cars and trucks | 494 | | | |
| Efficient electric appliances | | 387 | | |
| Efficient heating | | 625 | | |
| Efficient fossil-power generation | | | 170 | |
| CHP | | | | 780 |
| ***Percentage reduction per sector*** | ***24%*** | ***29%*** | ***4%*** | |

UNITED STATES

| Energy-efficiency potential in 2030 in comparison to Reference Scenario(PJ) | Road transport | Buildings and agriculture | Fossil power generation | CHP |
|---|---|---|---|---|
| *Total energy demand* | *28859* | *28219* | *40119* | |
| Efficient cars and trucks | 11192 | | | |
| Efficient electric appliances | | 5680 | | |
| Efficient heating | | 5044 | | |
| Efficient fossil-power generation | | | 7261 | |
| CHP | | | | 4874 |
| ***Percentage reduction per sector*** | ***39%*** | ***38%*** | ***18%*** | |