



# **Study on the Energy Savings Potentials in EU Member States, Candidate Countries and EEA Countries**

## **Final Report**

for the European Commission  
Directorate-General Energy and Transport

**EC Service Contract Number TREN/D1/239-2006/S07.66640**

### **Project Partners:**

**Fraunhofer-Institute for Systems and Innovation Research  
(Fraunhofer ISI) (Coordinator)**

**ENERDATA (Grenoble, France)**

**Institute of Studies for the Integration of Systems ISIS (Rome, Italy)**

**Technical University (Vienna, Austria)**

**Wuppertal Institute for Climate, Environment and Energy WI (Wuppertal, Germany)**

Karlsruhe/Grenoble/Rome/Vienna/Wuppertal, 15. March 2009, revised

**Disclaimer:**

The contents and views contained in this report are those of the authors, and do not necessarily represent those of the European Commission.

**Important notice:**

The energy efficiency potentials calculated in this report as well as those presented on the website related to the project (<http://www.eepotential.eu/>) are based on a scenario approach which underlies the calculations. The activity drivers underlying this scenario approach have been derived mainly from European Energy and Transport Trends to 2030 (Update 2005). This document was chosen as the basis for our work because it contained the most recent EU-wide projections available by the time. During the validation of the results of this potential study with a variety of EU Member States it was noted that some of the drivers in the EU projections deviate quite considerably from drivers used at the national level. The choice of the drivers naturally impacts on the energy efficiency potentials: in fact the larger a given driver, the larger the related energy efficiency potential. The authors do not necessarily view in the same way all the development of the drivers used at the EU level. However, in order to keep this document harmonised with the EU projections, we relied on the drivers as provided. In future efforts these differences need to be investigated further to improve the precision of the work.

**Contact:**

Wolfgang Eichhammer  
Breslauer Str. 48, 76139 Karlsruhe, Germany  
Phone: 0721/6809-158, Fax 0721/809-272  
E-Mail: wolfgang.eichhammer@isi.fraunhofer.de  
Web: www.isi.fraunhofer.de

**Project staff:**

Wolfgang Eichhammer, Fraunhofer ISI  
Tobias Fleiter, Fraunhofer ISI  
Barbara Schlomann, Fraunhofer ISI  
Stefano Faberi, ISIS  
Michela Fioretto, ISIS  
Nicola Piccioni, ISIS  
Stefan Lechtenböhmer, Wuppertal Institute  
Andreas Schüring, Wuppertal Institute  
Gustav Resch, TU Vienna

## Contents

	Page
<b>Summary .....</b>	<b>1</b>
<b>1 Background and Objectives of the Study.....</b>	<b>15</b>
1.1 Introduction .....	15
1.2 Objectives of the study .....	18
<b>2 Overview of the Approach and the Report.....</b>	<b>19</b>
<b>3 General description of the methodology for the calculation of the potentials and scenario philosophy .....</b>	<b>20</b>
3.1 General structure of the methodology .....	20
3.2 Classification of energy efficiency potentials .....	24
3.3 Operational definition of energy efficiency potentials.....	28
3.4 Three steps for the calculation of potentials.....	30
<b>4 Data for the reference scenario .....</b>	<b>37</b>
<b>5 Overview of the results for the EU27 .....</b>	<b>40</b>
<b>6 Residential electric appliances (incl. IT appliances) and lighting.....</b>	<b>49</b>
6.1 Residential electric appliances .....	49
6.1.1 Description of the sector/end-use .....	49
6.1.2 Sector-specific / use-specific data sources and modelling issues ..	49
6.1.3 Step 1 – Definition of energy saving options .....	53
6.1.4 Step 2 – Technology costs.....	54

## II

6.1.5	Step 3 – Definition of the four scenarios .....	56
6.2	Residential information/communication (IT) appliances .....	64
6.2.1	Description of the sector/end-use .....	64
6.2.2	Sector-specific / use-specific data sources and modelling issues ..	64
6.2.3	Step 1 – Definition of energy saving options .....	67
6.2.4	Step 2 – Technology costs .....	68
6.2.5	Step 3 – Definition of the four scenarios .....	68
6.3	Residential lighting .....	73
6.3.1	Description of the sector/end-use .....	73
6.3.2	Sector-specific / use-specific data sources and modelling issues ..	74
6.3.3	Step 1 – Definition of energy saving options .....	75
6.3.4	Step 2 – Technology costs .....	75
6.3.5	Step 3 – Definition of the four scenarios .....	75
6.4	Results appliances (incl. IT appliances) and lighting .....	76
6.4.1	Overall results .....	76
6.4.2	Results residential electric appliances .....	81
6.4.3	Results residential information/communication (IT) appliances...	91
6.4.4	Results residential lighting.....	94
<b>7</b>	<b>Residential buildings .....</b>	<b>98</b>
7.1	Useful energy demand of residential buildings .....	98
7.1.1	Description of the sector/end-use .....	98
7.1.2	Sector-specific / use-specific data sources and modelling issues ..	99
7.1.3	Step 1 – Definition of energy saving options .....	100
7.1.4	Step 2 – Technology costs .....	115
7.1.5	Step 3 – Definition of the four scenarios .....	127
7.2	Heating devices .....	135

### III

7.2.1	Description of the sector/end-use .....	135
7.2.2	Sector-specific / use-specific data sources and modelling issues	135
7.2.3	Step 1 – Definition of energy saving options .....	137
7.2.4	Step 2 – Technology costs.....	139
7.2.5	Step 3 – Definition of the four scenarios.....	139
7.3	Sanitary Hot Water .....	141
7.3.1	Description of the sector/end-use .....	141
7.3.2	Sector-specific / use-specific data sources and modelling issues	141
7.3.3	Step 1 – Definition of energy saving options .....	142
7.3.4	Step 2 – Technology costs.....	144
7.3.5	Step 3 – Definition of the four scenarios.....	144
7.4	Results residential sector .....	146
7.4.1	Results useful energy demand of residential buildings .....	146
7.4.2	Results heating devices .....	150
7.4.3	Results sanitary hot water .....	153
7.4.4	Results overall residential sector (including electricity) .....	155
<b>8</b>	<b>Energy efficiency potentials in the transport sector .....</b>	<b>160</b>
8.1	Energy efficiency potentials from technical measures.....	160
8.1.1	Description of the sector/end-use .....	160
8.1.2	Sector-specific / use-specific data sources and modelling issues	160
8.1.3	Step 1 – Definition of energy saving options .....	166
8.1.4	Step 2 – Technology costs.....	167
8.1.5	Step 3 – Definition of the four scenarios.....	167
8.2	Modal Shift.....	176
8.2.1	Description of the sector/end-use .....	176
8.2.2	Sector-specific / use-specific data sources and modelling issues	176

8.2.3	Step 1 – Definition of energy saving options .....	177
8.2.4	Step 2 – Technology costs .....	178
8.2.5	Step 3 – Definition of the four scenarios .....	178
8.3	Behavioural measures .....	189
8.3.1	Description of the sector/end-use .....	189
8.3.2	Sector-specific / use-specific data sources and modelling issues	190
8.3.3	Step 1 – Definition of energy saving options .....	190
8.3.4	Step 2 – Technology costs .....	192
8.3.5	Step 3 – Definition of the four scenarios .....	192
8.4	Results transport sector .....	193
8.4.1	Results technical measures .....	193
8.4.2	Results modal shift.....	195
8.4.3	Results behavioural measures .....	197
8.4.4	Results overall transport sector.....	199
<b>9</b>	<b>Industry .....</b>	<b>201</b>
9.1	Process technologies .....	201
9.1.1	Description of the sector/end-use .....	201
9.1.2	Sector-specific / use-specific data sources and modeling issues	205
9.1.3	Step 1 – Definition of energy saving options .....	209
9.1.4	Step 2 – Technology costs .....	210
9.1.5	Step 3 – Definition of the four scenarios .....	211
9.2	Electricity consuming cross-cutting technologies .....	212
9.2.1	Description of the sector/end-use .....	212
9.2.2	Sector-specific / use-specific data sources and modelling issues	215
9.2.3	Step 1 – Definition of energy saving options .....	216
9.2.4	Step 2 – Technology costs .....	218

9.2.5	Step 3 – Definition of the four scenarios.....	221
9.3	Heat generation cross-cutting technologies.....	224
9.3.1	Description of the sector/end-use .....	224
9.3.2	Sector-specific / use-specific data sources and modelling issues	226
9.3.3	Step 1 – Definition of energy saving options.....	226
9.3.4	Step 2 – Technology costs.....	229
9.3.5	Step 3 – Definition of the four scenarios.....	230
9.4	Results industry .....	232
9.4.1	Results process technologies .....	232
9.4.2	Results electricity consuming cross-cutting technologies.....	236
9.4.3	Results heat generation cross-cutting technologies.....	237
9.4.4	Results overall industrial sector .....	238
<b>10</b>	<b>Tertiary sector .....</b>	<b>248</b>
10.1	Heat uses in the tertiary sector .....	248
10.1.1	Description of the sector/end-use .....	248
10.1.2	Sector-specific / use-specific data sources and modelling issues	248
10.1.3	Step 1 – Definition of energy saving options.....	251
10.1.4	Step 2 – Technology costs.....	252
10.1.5	Step 3 – Definition of the four scenarios.....	252
10.2	Electricity uses in the tertiary sector .....	256
10.2.1	Description of the sector/end-use .....	256
10.2.2	Sector-specific / use-specific data sources and modelling issues	268
10.2.3	Step 1 – Definition of energy saving options.....	269
10.2.4	Step 2 – Technology costs.....	278
10.2.5	Step 3 – Definition of the four scenarios.....	278
10.3	Results tertiary sector .....	279

10.3.1	Results heat uses in the tertiary sector .....	279
10.3.2	Results electricity uses in the tertiary sector.....	283
10.3.3	Results overall tertiary sector.....	288
<b>11</b>	<b>The Energy Saving Database (ESP) and the link to MURE .....</b>	<b>293</b>
11.1	Database purposes (model inputs, presentation of outputs).....	293
11.1.1	Contents of the database .....	294
11.1.2	Disaggregation level .....	298
11.2	Database main structure.....	299
11.3	Detailed operational structure of the database .....	300
11.3.1	Input data files .....	300
11.3.2	Output data from the models .....	302
11.3.3	Public database.....	302
11.4	Interface with the MURE model.....	304
<b>12</b>	<b>References.....</b>	<b>305</b>

## Summary

### Objectives of the analysis

During the last years fundamental changes have occurred that convey to energy efficiency improvements and energy conservation an even larger importance than it already had in view of mitigating climate change: The oil price and other fossil fuels have reached during some period levels of up to 147 US\$ per barrel before dropping again to less than half that level in expectation of a possible economic recession period. The extreme price volatility shows that there is shortage of energy supply and as soon as the world economy turns well, the shortness of fossil fuel carriers translates to higher energy prices. At the same time prices for input fuels to electricity generation have also risen considerably, driving electricity prices up for the consumer. In addition, the European Emission Trading Scheme (EU ETS) has induced a further increase in the electricity prices and will continue to do so in the post-Kyoto period after 2012. Lastly, on the policy side with the Directive 2006/32/EC on Energy End-use Efficiency and Energy Services (ESD) an important policy instrument was introduced for energy efficiency and needs to be filled with life despite some complexity in the determination of energy savings as compared to autonomous changes.

In this context a comprehensive analysis of the technical and the economic potentials appeared as necessary as without the realisation of these potentials the targets of the Energy Efficiency Directive cannot be reached. **The main focus of this report is to prepare the analytic basis for an in-depth discussion of economic energy efficiency potentials in the different energy-end uses.** The current high energy prices and possibly powerful energy efficiency policies can strongly enhance the uptake of energy efficient technologies and procedures. In addition, they may also trigger important innovation effects such as scale and learning effects that occur when energy efficiency technologies are used in a broad manner and that will drive the cost differential of more efficient technologies compared to less efficient technologies down.

This study therefore aimed:

- To estimate in a harmonised manner (technical and economic) energy savings potentials for each EU27 Member State, as well as for Croatia and for other countries of the European Economic Area EEA (Norway, Iceland and Liechtenstein).
- To develop a tool to assess national NEEAPs and to ascertain if they sufficiently take into account the existing energy savings potential within a country, and to identify the sectors where the national savings targets established under the ESD Directive can be met most cost effectively.

In order to achieve these two objectives the following main steps described in the following section have been carried out:

- to establish a common methodology for calculating energy savings potentials and its data requirements and to develop a harmonised and interacting energy savings potential calculation model based on the MURE simulation tool.
- to identify and present the energy savings potentials in a user-friendly way. For this purpose a database<sup>1</sup> was developed on the Internet capable of generating and presenting present and future energy savings potentials for each of the countries involved in this study as well as for suitable groupings such as the EU27, EU25, the EU15 and EU-12 (new Member States including Bulgaria and Romania) and the EEA countries as groups.

### **Methodology of the analysis**

The general structure of the methodology used in the study to derive energy efficiency contains the following elements:

- The project and the central part of the evaluation of energy efficiency and energy savings potentials at the demand side is based on the bottom-up *MURE simulation tool*. MURE (Mesures d'Utilisation Rationnelle de l'Énergie, [www.mure2.com](http://www.mure2.com)) has a rich technological structure for each of the four demand sectors (residential, transport, industry and services) in order to describe the impact of energy efficient technologies. The structure described in a technological manner in MURE comprises modules for:
  - Residential Sector Buildings
  - Residential Electric Appliances
  - Transport Sector
  - Industrial Sector: Processes
  - Industrial Sector: Electric Cross-cutting Technologies (pumps, ventilators, compressed air...)
  - Industrial Sector: Electric Cross-cutting Technologies (pumps, ventilators, compressed air...)
  - Service Sector Buildings
  - Service Sector Electric Appliances
  - IT Appliances (all sectors)
  - Demand-side CHP (all sectors)

---

<sup>1</sup> The database on Energy Saving Potentials (ESP Database) is currently available under restricted access at <http://www.eepotential.eu/>. After a broader review of the contents the EU Commission may decide on a public access to the database.

- We also determined the potentials for decentral renewables such as solar thermal collectors and decentral PV. We used for this purpose the **Green-X model** run by TU Vienna in cooperation with Fraunhofer ISI. It must be emphasised, however, that the main focus of the work has been on the final demand sectors, given that they are the focus of the EU Directive for Energy Efficiency and Energy Services. Biofuels used for the transport sector were not taken into account although they may potentially reduce green-house gas emissions.
- We developed a *flexible and user-friendly database* which (i) gathers the data inputs (scenario data and technology data) *for communication with the MURE simulation model* and (ii) *allows for a suitable presentation and structuring of the main model inputs and results concerning the analysis of energy saving potentials for external communication purposes*. This database was developed newly based on the current input/output structures of the MURE demand simulation model.
- We developed further an interface that allows *feeding data to the two input databases and the output database*. Again it is important to distinguish whether the data fed to the database are for communication with the models and the potential analysis or for external communication purposes. For the latter, data were prepared in a more aggregate manner allowing to present results in a user-friendly way. Concerning the technology database behind the potentials this relies mainly on updated information in the MURE simulation tool, on further national sources and on the Odyssee database, supported by additional information from auxiliary sectoral models such as the residential model run by the Wuppertal Institute or an industrial model run by Fraunhofer ISI. Concerning the scenario inputs we made use of the official projections and statistical data available at both the EU and the national levels although adaptations needed to be considered. However, we limited these adaptations to data not available in the PRIMES model used for the official EU projections in order to remain compatible, despite the fact that one or the other figure in the official projections could give rise to substantial debate (such as for example the future development of transport mobility which, in our view, appears largely overestimated. The Odyssee database was used as an essential tool to calibrate future scenario data as well as social drivers such as increased comfort factors, general rebound effects etc.

### **Classification of energy efficiency potentials and development of scenarios**

The following Table shows a possible classification of the potentials to be calculated and the scenario approach derived from this classification. This classification distinguishes in a matrix approach the dependence of the potentials on drivers and policies to enhance technology diffusion on one hand (vertical classification in the

matrix) and technological/economic restrictions on the energy savings potentials on the other hand (horizontal classification in the matrix).

*Selection of energy saving potentials*

		Restrictions on the energy saving potentials			
		Best available technologies and practices *	Cost-effectiveness for the whole country	Cost-effectiveness for the consumer with usual market conditions	
		1	2	3	Baseline (1) - Autonomous Progress + Older policies (APS)
<b>Dependence on drivers, technology innovation and policies to enhance technology diffusion</b>	static	(X)	X	X	Autonomous Progress + Recent Policies (APS+RP)
	Dynamic				
	(autonomous)	-	-	X	
	(autonomous + recent policies)	-	-	X	
	Dynamic (additional): (1) high barriers / high transaction costs (energy price or policy induced)	X	X	X	
	Dynamic (additional): (2) low barriers / low transaction costs (energy price or policy induced)	X	X	X	

**Technical Potential (4) (TP)**

**Economic Potential - High Policy Intensity (3) (HPI)**

**Economic potential - Low Policy Intensity (2) (LPI)**

The **technological/economic restrictions on the energy savings potentials** can be distinguished as follows:

- *No restrictions, maximum technical potentials*: what can be achieved with the best available technologies available whatever the costs and prices.
- *Cost-effectiveness for the whole country*: what can be achieved with the best available technologies available, which are economic on a country-wide basis (typically a discount rate of 4 % could be used for energy saving investments for this case). Also barriers would be largely removed in such a context.

- *Cost-effectiveness for the consumer with usual market conditions*: what can be achieved with the best available technologies, which are economic for the consumer with the usual market conditions today and reflecting consumer preferences and barriers (typically a discount rate of 8-15 % or higher could be used for energy saving investments for this case).

In the vertical classification in the above matrix needs word "dynamic" has three dimensions:

- whether or not the energy saving potentials *depend on the future development of drivers* such as the economic or social development (e.g. the stock of existing buildings, appliances, equipment of a type may be increasing or decreasing over time etc.)
- whether or not the energy saving potentials takes into account that *technology diffusion is a process in time* which might occur autonomously during normal reinvestment cycles or could be influenced by market energy prices or energy efficiency policies
- whether or not *technological innovation* (learning by searching) and *scale effects* (learning by doing) is taken into account that leads to a decrease in the cost of energy saving technology over time.
- The dynamic dimensions of the potentials **lead to the necessity to define scenarios to realise the potentials**.

In order to reduce complexity in the definition of the potentials it was necessary to reduce the number of potential definitions to present a clear picture of the potentials.

- The **Static Potential** all in all does not appear as very meaningful, even considering the economics of the energy saving measures.
- Considering the **Dynamic Autonomous Potential** for energy savings appears as necessary, especially in the light of the Directive for Energy Efficiency and Energy Services, which tends to make a distinction between autonomous savings and policy-induced savings, although this distinction may lead to some subjective choices. The dynamic autonomous potential may also be titled in a short-hand way as the **Baseline**. As already mentioned previously the baseline excludes very recent policies where the success is not yet given for granted. In order to show the impacts of these policies, a variant was defined which adds the supposed impacts of the policies to the Autonomous Potential.
- In the third line of dynamic parameters in the Table the most adequate choice is a potential which is characterised by a **low policy intensity**, i.e. by considering an **additional technology diffusion of BAT beyond autonomous diffusion only to a realistic level driven by increases in market energy prices and comparatively low level energy efficiency policy meas-**

**ures** as in the past in many EU countries. In this case it is rather likely that consumer decisions will be motivated by cost-effectiveness criteria based on usual market conditions. Barriers to energy efficiency will persist.

- From the last line there are two types of potentials which are important in the selection: They describe the **additional technology diffusion of best energy saving technologies (BAT) to the maximum possible, either technically or economically**. In the case of maximum economic potentials the most suitable choice of the economic criteria is to consider cost effectiveness from a country perspective, given the fact that one can assume in such a case a **high policy intensity** which reduces transaction costs for the consumer by suitable measures. Barriers to energy efficiency are mostly removed.

For the calculation of these potentials the following three steps were carried out for each energy use:

- **Step 1: Set up saving options.** For this step it was necessary to define first possible saving options and then describe their technical performance as well as their possible penetration in the future
- **Step 2: Describe cost development.** For each of the technology options identified in the previous step it is necessary to describe the investment costs and maintenance costs of each option. These cost categories are described in general as differential costs compared to a standard technology or standard development, unless there is an acceleration of the investment cycle beyond the usual values. In such cases the full costs, or a larger cost may be applied to the options scaled to the acceleration of the penetration of the energy efficient technologies. In addition it is also necessary to consider that the differential costs will evolve dynamically over time. Over the past decade an important body of empirical evidence has been gathered on energy efficient demand technologies which shows this important effect.
- **Step 3: Set up the scenario mix.** The different options defined in Step 1 may generally be realised altogether in a certain mix up to a given time horizon. It is therefore necessary to describe different scenarios of how they mix, depending on the potential considered.

### **Drivers for the reference scenario**

In order to ensure compatibility with official DG TrEn projections, it was decided to rely for this exercise on the choices of drivers of the baseline scenario calculated with the PRIMES model. From these projections drivers such as the number buildings, energy prices, the development of value added of industry etc was chosen in order to be consistent with these projections. However, the future development of unit consumptions, intensities etc. was allowed to evolve according to the knowledge implemented in the MURE model because otherwise it would have been difficult to maintain consistency in the figures. Hence it cannot be expected that the overall energy consumption evolves totally in the same way as in the PRIMES projections.

The version of the PRIMES projections used was European energy and transport: Trends to 2030 – Update 2007<sup>2</sup>. The new baseline takes into account policy developments up to the end of 2006 and is based on higher energy import prices compared to the 2005 edition of the baseline.

*Prices for EU imports of fossil fuels in \$ / boe in US\$2005*

	2005	2010	2015	2020	2025	2030
Oil	54.5	54.5	57.9	61.1	62.3	62.8
Gas	34.6	41.5	43.4	46.0	47.2	47.6
Coal	14.8	13.7	14.3	14.7	14.8	14.9

Source: European Commission (2008)

The 2007 Baseline scenario includes policies and measures implemented in the Member-States up to the end of 2006. Differences with the present work may arise from the fact that the PRIMES baseline includes impacts from the building directive, while our baseline excludes the impacts from the Directive only the Autonomous Progress Scenario + Recent Policies does include this. On the other hand, in difference to previous PRIMES projections no success was assumed any more for the CO<sub>2</sub> agreement for cars, although some further progress was assumed.

Assumptions on discount rates used in this study are reported in the following table together with PRIMES discount rates. All these rates are in real terms, i.e. after deducting inflation.

*Discount rates used in PRIMES and the present study*

	PRIMES	Present study	
		LPI	HPI
industry	12%	30%	8%
services and agriculture	12%	8%	6%
Households	17.5%	8%	4%
Private passenger transport	17.5%	8%	4%
trucks and inland navigation	12%	8%	6%
Public transport energy investment	8%	8%	4%

Source: EU Commission (2008) for the PRIMES column

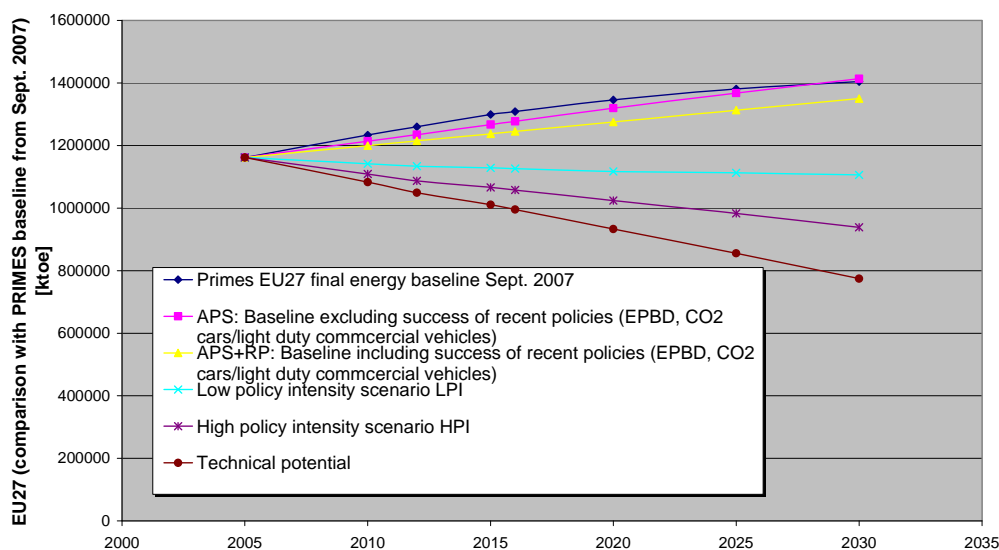
<sup>2</sup> European Commission (2008): European energy and transport: Trends to 2030 – Update 2007. Luxembourg: Office for Official Publications of the European Communities, 2008. [http://ec.europa.eu/dgs/energy\\_transport/figures/trends\\_2030\\_update\\_2007/index\\_en.htm](http://ec.europa.eu/dgs/energy_transport/figures/trends_2030_update_2007/index_en.htm)

## Results

### Scenarios

- 4 scenarios were considered: **Autonomous Progress Scenario APS** (which comprises autonomous progress and earlier policies such as the labelling Directives for electric appliances but excluding the success of important recent EU policies which are not yet fully implemented such as the EU Performance Directive for Buildings and the CO<sub>2</sub> standards for cars and light duty commercial vehicles). A **variant of the Autonomous Progress Scenario** which includes the success of these recent policies (**APS+RP**). **Low Policy Intensity Scenario LPI** (which implies continued high barriers to energy efficiency, a low policy effort to overcome the barriers and high discount rates for investments in energy efficiency). **High Policy Intensity Scenario HPI** (which implies removing barriers to energy efficiency, a high policy effort to overcome the barriers and low discount rates for investments, options are economic on a life cycle basis). **Technical Scenario** (includes also more expensive but still fairly realistic options; no exotic technologies).
- Energy price assumptions are conservative, for crude oil as the leading energy around 61\$2005 in 2020 (real prices), 63\$2005 in 2030 (real prices). The 61\$ in 2020 implies a price of 83\$ in nominal terms in 2020 (assuming an inflation rate of 2 % annually), while the 63 \$ in 2030 correspond to 105 \$ nominally in 2030.
- Final energy consumption is still on the rise in the APS+RP scenario. It stabilises in the LPI Scenario, while the HPI and the Technical Scenarios curb the final energy demand by 2020 as compared to the baseline (APS).

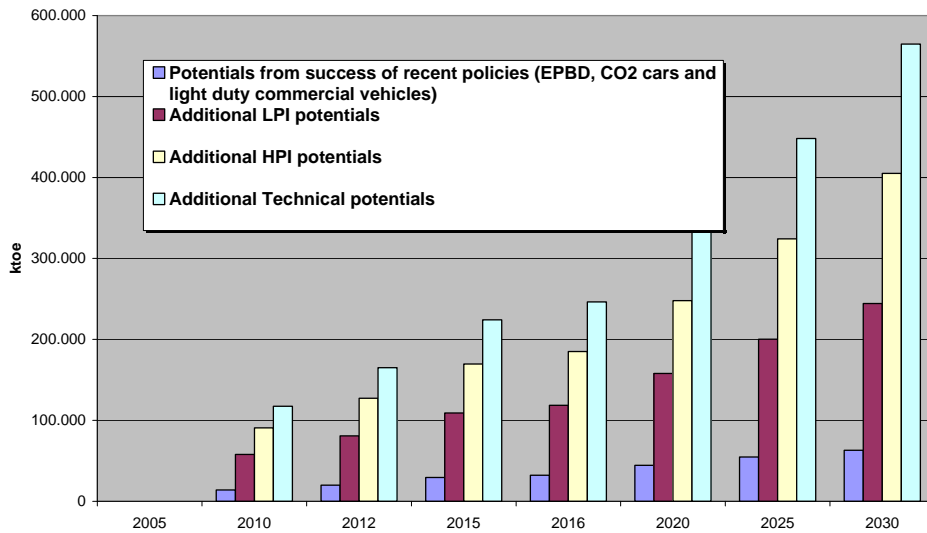
### Scenario development and comparison with the PRIMES baseline



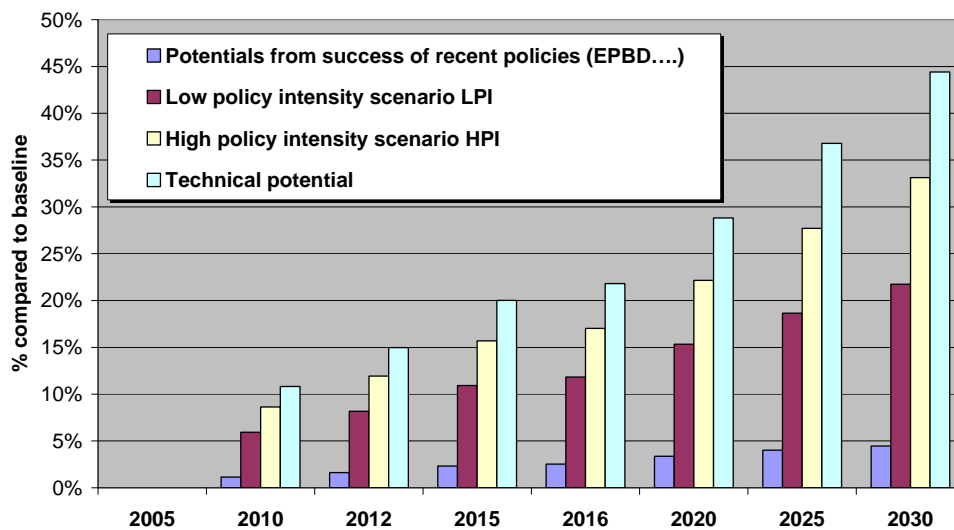
## Potentials

- In 2020 the **LPI potentials** may reach 158 Mtoe for the EU27 (15 % compared to APS); in 2030 244 Mtoe (22 % compared to APS) are achievable in economic terms. In 2020 the **HPI potentials** may reach 248 Mtoe for the EU27 (22 % compared to APS); in 2030 405 Mtoe (33 % compared to APS) are achievable in economic terms. In 2020 the **Technical Potentials** may reach 336 Mtoe for the EU27 (29 % compared to APS); in 2030 565 Mtoe (44 % compared to APS) are achievable. Potentials from the (still supposed) success of recent policies (EPBD, CO2 standards for cars and light duty commercial vehicles) reach 44 Mtoe in 2020 and 63 Mtoe in 2030.

*Energy efficiency potentials in the different scenarios (ktoe, compared to APS)*



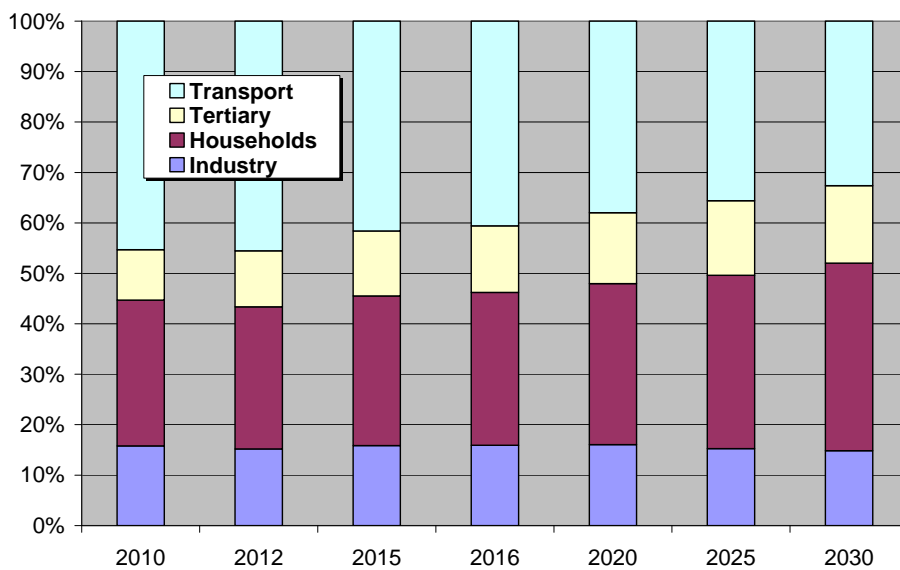
*Energy efficiency potentials in the different scenarios (% compared to APS)*



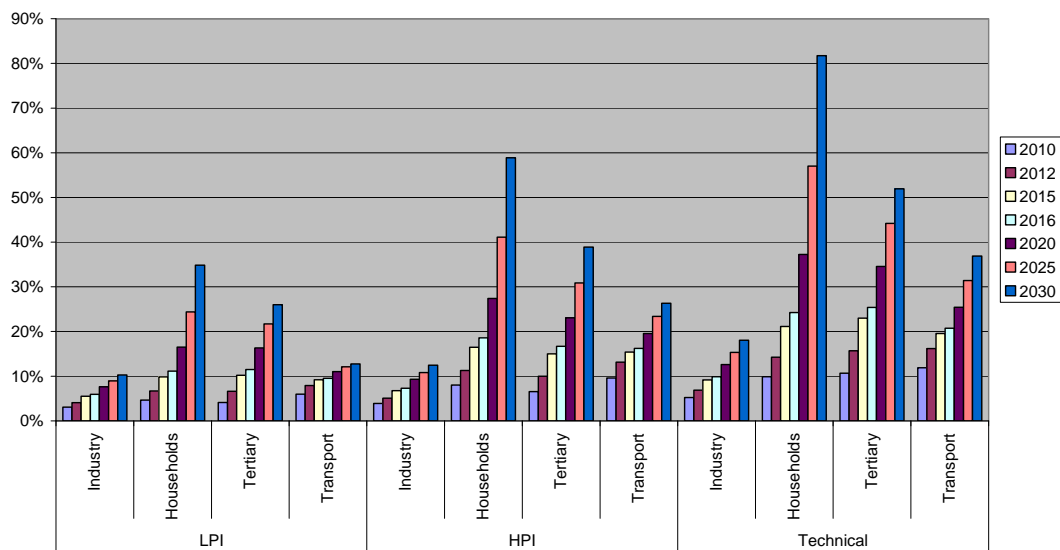
**Sectoral contributions**

- At the short term (2010) transport, non-EU ETS sectors (in particular cross-cutting technologies such as electric motor applications) and electric applications in the residential/tertiary sectors may have the largest potentials. At medium term (2020) the contribution from the building sector (residential and tertiary) to the potentials grows larger. The contribution of the buildings to the potentials is largest in the HPI and Technical Potential scenarios and for the longer term up to 2030. This would imply an early mobilisation of these potentials through measures due to the longer lead times.

*Sectoral contributions to the potentials over time in relative terms*



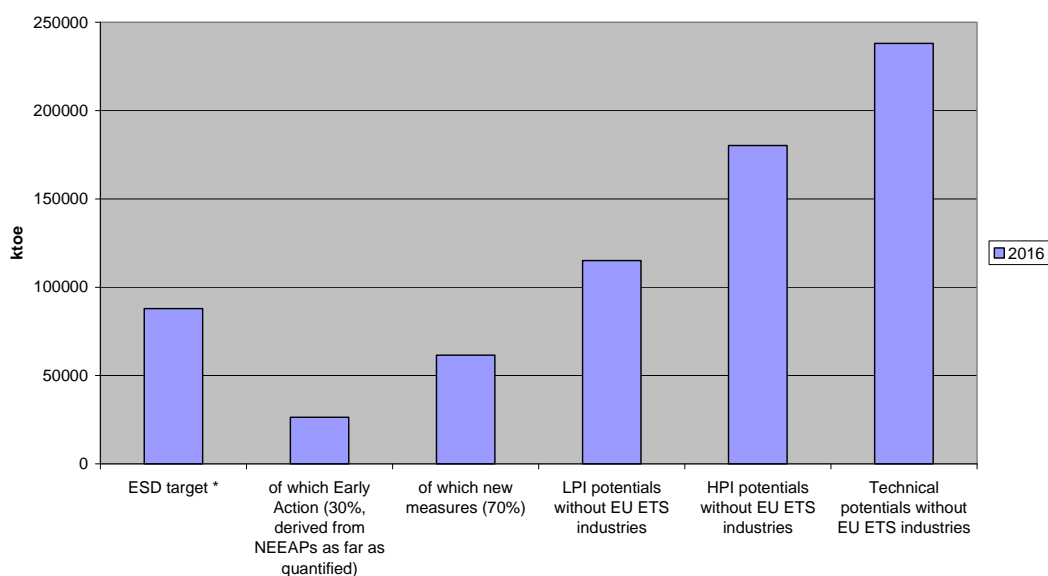
*Sectoral potentials over time compared to the APS in percent*



### Comparison with ESD Targets in 2016

- For the comparison with the 9 % target of the ESD, the target was calculated as average for the period 2001-2005 from Odyssee data, excluding EU ETS industries. It should be noted that the ESD target is calculated on a historic 5-years period while the potentials calculated here are calculated with respect to the Autonomous Progress Scenario.
- Potentials for this comparison are also without EU ETS industries. Potentials in non EU ETS sectors are considerably larger than for the EU ETS sector, especially for electricity
- If all proposed measures in the National Energy Efficiency Action Plans (NEEAPs) will be new measures than they represents an effort broadly in the range of the LPI scenario.
- Early action measures undertaken 1995 to 2007 are admitted under the ESD. They are not included in the potentials as calculated here. In fact, they are part of our baseline. If Early Actions represent 30 % which is rather realistic when looking at the NEEAPs then the new effort represents less than the LPI potentials. Some countries have even 50 % Early Action. This implies that between the new action and the HPI potentials there is still some gap open for further action in future NEEAPs. If there is in addition autonomous progress included in the actions than the effort is even less.

### Comparison of the potentials (excluding EU ETS industries) with the targets of the Energy Service Directive in 2016



\*(calculated from the Odyssee Indicators by excluding EU ETS Industry on a sectoral basis and averaging 2001-2005)

### *Comparison with 20% target in 2020*

- The 20% target is a primary energy target hence includes also the conversion sector and renewables. For this reason it can not be really compared here to the potentials calculated here, which are pure demand side potentials.
- Nevertheless, the comparison of the potentials with the baseline in percentage points shows that even the HPI reaches 22% in 2020 that is the 20 % reduction target is rather demanding if it is to be reached by demand side measures only. Possibly additional measures on the primary energy side and renewable, or measures which are currently more expensive (and which are in the technical scenario) need to be taken on board.

### *Comparison of the potentials (including EU ETS industries) with the 20% target for energy of the EU Commission*

