Synthesis: Energy Efficiency Trends and Policies in the EU

An Analysis Based on the ODYSSEE and MURE Databases

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ODYSSEE-MURE

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KEY MESSAGES

OVERALL ENERGY EFFICIENCY TRENDS AND POLICIES

Energy efficiency trends

- Energy efficiency improved by 15% at EU level between 2000 and 2013 (1.2%/year). There has been a net slowdown in the energy efficiency progress since the economic crisis: 1%/year since 2007[1], compared to 1.3%/year between 2000 and 2007.
- The household sector has achieved the largest energy efficiency improvement, with a regular energy efficiency gain (1.7 %/year). Gains for industry have been divided by a factor 2 since 2007. In transport, energy efficiency progress was in line with the average (1.2%/year) and was more rapid for cars than for transport of goods that was severely hit by the economic crisis.
- In 2012, the final energy consumption was 30 Mtoe lower than in 2000. This situation is the result of two main balancing effects: growth in the economic activity would have led to an increase of 100 Mtoe while energy savings contributed a reduction in final consumption by 180 Mtoe; other factors explaining the rest of the variation, such as demography, changes in lifestyle, modal shift in transport and structural changes in industry. The European targets as specified in the Energy Efficiency Directive EED are 1483 Mtoe primary energy (excluding non-energy uses) and 1086 Mtoe final energy to be reached in 2020. Data from the ODYSSEE database show that by 2013 primary energy for the EU28 was at 1567 Mtoe and final energy at around 1100 Mtoe that is, already relatively close to the targets.
- Without energy savings, final energy consumption would have been around 180 Mtoe higher in 2012 compared to 2000. Around 33% of the savings come from households, 32% from industry, 27 % from transport and 8% from tertiary.
- Differences between countries are still large in various aspects notably with respect to annual energy efficiency improvements which for the period 2000-2012 reach from 0.6% annual improvement to 3.3%.

Energy efficiency policies

- Across the countries and within a sector there are considerably variations in the approaches to energy efficiency policy. The reason for this observation may be that due to cultural differences and societal habits, measures have different effectiveness according to the country context. It raises, however, also the question whether the national set of measures can be extended to include other measure types which have not been experienced in the past.
- All in all, though there is some dynamics in the mix of measure types, the sectoral focus remains relatively stable. Fiscal measures astonishingly play a little role in the measure mix, except for the transport sector though the process of the National Energy Efficiency Action Plans (NEEAPs) seem to improve on this.

[1] 2007 is considered to be the last year not affected by the financial and economic crises which had first impacts in 2008. Some of the indicators considered in this brochure have therefore their starting point in 2007 as the last year without impacts of the crises.

- The recent economic and financial crisis, from 2008 to2012, had a profound effect on the policy making with Europe, especially in countries more strongly hit by the crisis. Financial programmes have generally been reduced in those countries while in some occasions financial subsidies for energy efficiency were used to stabilise the economy. This approach could have been more largely used to encounter the economic crisis, given that energy efficiency measures tend to support the local economy.
- The influence of the EU energy efficiency policy was already quite important; it became even more important, considering which measures have been proposed under the National Energy Efficiency Action Plans NEEAPs and the Art. 7 of the Energy Efficiency Directive EED at national level.
- Energy Saving Obligations have become an important instrument which many countries have introduced or are in the process of introduction due to the Energy Efficiency Directive: 16 countries have reported to rely on energy efficiency obligation schemes, generally combined with additional policy measures. The other countries will only use other policy measures as authorised by the Directive, the so called "alternative policies".
- The process of the National Energy Efficiency Action Plans NEEAPs was a large success with respect to evaluation practices spreading the use of quantitative evaluation methods across the Member States.
- Specific tools have been developed under the MURE database to define and identify successful energy efficiency policies, to structure and analyse interacting policies and to analyse selected policy fields such as behavioural policies.
- Scoring energy efficiency policies and trends aims to provide comparison indicators and comparable characteristics which help countries to understand whether their policies are comparable or better than in other countries or whether they can learn from other countries to improve their policies. For that purpose, scoreboards are useful instruments which gather in general multiple aspects which are, as far as possible, quantitatively evaluated and compared among countries.
- From the discussions with experts inside and outside the ODYSSEE-MURE project it is rather evident that there is a lot of interest in the results of such scoring and that the results spur a lot of discussion, both with respect to the methodology as well as with respect to the results.
- However, still a variety of questions remain to debate. One important question is in particular whether the ranking principle should be "hard" (each country is mentioned by its position in the ranking which combines the results from a number of indicators), by quartile or weak (each ranking criteria is shown separately).
- Such type of open questions need to be further debated and explored to come to an accepted European Scoreboard. Establishing such a Scoreboard is a learning process and different options should be explored and discussed.

INDUSTRY

Energy efficiency trends

- Industrial energy consumption remained roughly stable at EU level between 2000 and 2007 and has decreased rapidly since then with a contraction twice faster than industrial activity.

- As a result, industrial consumption was in 2013 17% below its 2000 level at EU level and only represented 25 % of the energy used by final consumers, compared to 29% in 2000.
- Between 2000 and 2007, the stability of consumption was the result of the balance between the increase in industrial activity and energy savings.
- Since 2007, more than half of the reduction in consumption was linked to the decrease in industrial activity and only one fourth to energy savings.
- Energy savings were 2.5 times lower since 2007 than over 2000-2007, as there has been a much slower energy efficiency progress since the recession (0.9%/year since 2007 compared to 1.9%/year before), because of a slower progress in most branches and even no more improvement for some others (e.g. steel, cement, machinery). On average, energy efficiency has improved by 1.4%/year in the EU since 2000.
- This slower progress in energy efficiency is due to the recession, as the consumption did not follow the reduction of activity, because, on the one hand the large equipment did not operate at full capacity and were thus less efficient, and, on the other hand, part of the consumption is not linked to the level of production.
- The market share of electricity, biomass and heat in industry has progressed significantly (+4 points for electricity since 2000; +3 points each for biomass and heat).
- Chemical industry is the main energy consuming branch with 19% of total industrial consumption in 2013, followed by steel with 18%; while the share of chemicals is progressing (+1.5 points at EU level since 2000), the share of steel is declining (- 2 points).
- Since 2007 the energy consumption has decreased in all industrial branches: steel and non-metallic minerals experienced the strongest reduction with consumption 25% lower in 2013 than in 2000.

Energy efficiency policies

- Financial measures are the by far dominating measure type in industry in almost all EU Member States. Around half of the policies addressing energy efficiency in industry can be attributed to this type. However, the new “Successful Policies” facility in MURE shows that in many countries the remaining part of the policies in place includes a broad mix of other types (incl. new market-based instruments).
- The financial crisis since mid 2008 did not considerably change the dominance of financial measures. They are still dominating the policy mix and became even more important since 2013. Only in some countries which were hardest hit by the crisis (esp. Ireland, Portugal, Italy, Spain and Greece), no or only very few new financial measures have been implemented after 2008.
- The Energy Efficiency Directive (2012/27/EU) also triggered new energy efficiency policies in the Member States. With regard to industry, these are especially measures introduced under Article 7 (energy efficiency obligations and/or alternative measures), mandatory audits (Article 8) and new certification/qualification schemes. NEEAP measures, i.e. measures reported in the NEEAP 1 and/or NEEAP 2 and/or NEEAP 3, constitute about 50% of the total measures in the industrial sector in MURE.
- There is no clear correlation between the impact level of the measures and the measure types. Both high-impact and low-impact measures are of various types. Only informative

measures usually have a relative low impact and are mainly seen as accompanying measures in a policy mix.

- Energy audits and energy management can be seen as important instruments to recognise and observe existing economic energy efficiency potentials by systematic procedures to gain knowledge and developing a strategy to achieve energy efficiency targets. Insofar they play a crucial role in a policy mix for the industrial sector. One central element to wider spread this kind of instruments in Europe is the implementation of Article 8 of the EED, which is, however, delayed in several Member States. To the date of June 2015, some Member States did not even deliver a national response to Article 8 to the European Commission.
- While several energy efficiency measures are already in place for small and medium enterprises (SMEs), more tailored programmes are needed to address their special needs. The MURE database shows several best practice examples from countries where SMEs already are an important target group for energy efficiency policies. An innovative approach are Learning Energy Efficiency Networks in Germany, which are based on a voluntary approach of 10-15 companies which set themselves energy efficiency targets and follow them up closely in a structured and moderated process which helps to reduce transaction costs. More common are subsidies for energy audits and energy efficiency measures which exist in a variety of countries.
- A suitable policy mix addressing energy efficiency in industry should both break down the most important barriers which hinder the up-taking of energy efficiency measures in companies: e.g. information and knowledge deficits, several uncertainties, low priority for energy efficiency investment or high transaction costs. It should also make use of the driving forces which facilitate the implementation of energy efficiency measures (as e.g. positive image of energy efficiency, motivated employees). A policy package for industry should therefore comprise regulatory as well as the other incentivising instruments ("stick and carrot"), where the regulatory instruments define the technological baseline. The other instruments may then either encourage the investor to undertake measures complying with this baseline or they may set incentives to even exceed the standards significantly and make use of more advanced technologies.
- If this kind of policy package is designed for industry, a specific energy use in industry will usually be targeted by several policy measures. For example the replacement of electric motors in industry is addressed by eco-design standards which aim at the components of a motor system. They are also addressed by subsidy schemes which promote improvements of motor components but also of systems. Further, top-runner programmes may help to develop the highly efficient part of the motor market to lower the cost through market penetration. In that case, measure interactions can occur, i.e. measures in the package may reinforce each other but they could also counteract against each other. These measure interactions have to be taken into account in order to assess the impact of the policy actions on the EU (or national) energy efficiency targets in a realistic manner. The new MURE "Policy interaction" facility provides a flexible tool to catch these impacts in a user-friendly way.

TRANSPORT

Energy efficiency trends

- The energy consumption of the transport sector has been decreasing quite rapidly since 2007 in the EU (%/year).
- Around 40% of that reduction is due to the economic recession, with a decrease in freight traffic and the stability of passenger traffic, and almost 60% to energy savings, mostly from passenger cars.
- As a result of these trends, consumption in 2013 was almost at the same level as in 2000 at EU level and in France and between 3 and 10% below in Germany, Italy, UK and Spain.
- Since 2007, the economic crisis resulted in a remarkable drop in the traffic of goods which was in 2012 11% lower than in 2007 at EU level. Passenger traffic remained stable despite population growth because of a slight decrease in passenger mobility (i.e. in km travelled per capita in one year. In addition, in most countries the average annual distance travelled by cars has been decreasing since 2007.
- The energy efficiency of transport improved by 1.2%/year in the EU between 2000 and 2013. Greater progress was achieved for both cars and airplanes than in the rest of the sector. Energy efficiency progress has slowed down for trucks and light vehicles since 2005 and even has virtually stopped since 2007: the dramatic fall down in freight traffic by road (by 2.5%/year over 2007-2012) led to a less efficient operation of trucks, as shown by the sharp decrease in load factors (trucks less loaded and increased empty running).
- The average specific consumption of the car fleet decreased from 8.1 l/100 km in 1995 to 6.8 l/100 km in 2012 at EU level, thanks to the progress achieved with new cars.
- The reduction in the specific consumption of new cars has accelerated since 2007 (3.7%/year compared to 1.5% between 2000 and 2007), mainly because of EU regulations on labelling, emission standards and national fiscal policies promoting the purchase of low emission cars. This acceleration was especially rapid in The Netherlands, Ireland, Sweden, Denmark, Finland and UK, where it was above 4%/year.
- There are now 11 countries with a specific consumption of new cars below 5 l/100km with Portugal, the Netherlands and Denmark in the lower range. The high share of diesel cars largely explains the good performances of these countries.
- All countries aim at decreasing the share of road in transport, as a way to decrease consumption and emissions. The results are not so bright as the share of public transport in total passenger traffic was the same in 2012 as in 2000 at EU level (18.5%) and the share of rail and water has been decreasing for freight transport.
- The stability in the share of public transport is the result of opposite trends with a decrease in the majority of countries but an increase in 11 countries, among which the largest countries. The Czech Republic and Austria have the highest use of public transport (around 3000 km/year), compared to an EU average around 2000 km. Belgium and Italy recorded the highest progression in the share of public transport since 2000 (over 3 points).
- For freight, The Netherlands and Sweden appear as the benchmark for all other countries as they are the countries with the highest share of rail and water transport (respectively 53 and 46%) and among the countries where this share is progressing.

- For road transport, alternative fuels (natural gas and biofuels) supplied around 5% of the consumption in the EU in 2013, of which 90% for biofuels. Around ¾ of the biofuel is biodiesel. Sweden is the leader for alternative fuels in transport, followed by France and Bulgaria.
- The transport sector represents an increasing share of total CO_2 emissions of final consumers: 43% in 2012 compared to 32% in 1990. Emissions from road freight transport were 33% higher in 2012 than in 1990 and made up 35% of the sector's emissions. Emissions from cars have been decreasing since 2000 because of the significant reduction in the specific emissions of new cars.
- In 6 countries, the specific emissions of new cars were below 120 g CO_2/km in 2013 (The Netherlands, Greece, Portugal, Denmark, France and Malta) and in total 12 countries were below the mandatory limit of 130g for 2015 for cars manufacturers. The share of low emissions new cars (i.e. below 100 gCO2/km) increased from 2.5% in 2010 to 15% in 2013 at EU level.

Energy efficiency policies

- The majority of the transport measures (about 70% of the total) concern the passenger modes with particular emphasis on the private car, and this is reflected in the corresponding energy consumption and traffic trends. In contrast, the approximately 30% of policy measures that directly or indirectly affect freight transport do not seem to have had a tangible impact on the corresponding energy efficiency and traffic indicators.
- In the same way the approximately 100 measures that address modal shift have not yet been able to noticeably affect passenger mobility habits and freight transport logistics and organization. Positive signs of change are indeed coming from some countries, especially with regards to the passenger modes, but it is too early to judge whether this is due to the measures that have been implemented or to the economic crisis. The energy efficiency potential of modal shifting is very high but is far from being realised.
- The energy efficiency improvements achieved in the private passenger mode seem to be mainly due to three sets of measures that represent the bulk of the energy efficiency policies enacted in this sector (based on the number and the estimated impact of these policies): those concerning the energy and CO_2 standards for new cars, those addressed to renew the car fleets and those addressed to traffic management. But to achieve a concrete and irreversible impact on the energy efficiency trends of this sector it is necessary to envisage integrated intervention strategies that impact on all the vehicle energy efficiency components (powertrain, market, use) and on the mobility patterns.
- To this end it would be useful to carry out studies to analyse the interactions and the potential of each of these energy efficiency components taking also into account that, presumably[2], a not negligible contribution to the energy and CO_2 savings come from the local measures.
- In contrast to the household and services sectors, in the transport sector EU legislation does not represent the major driver for the implementation of policies and measures. The

[2] The local measures and policies and the corresponding energy efficiency indicators are not taken into account by ODYSSEE and MURE

transport measures related to the EU legislation represent just 20% of total ongoing measures and the majority of them have been issued in the period 2000 – 2010. This means that the issuing of purely national measures is still rather high in this sector, with the possible exception of the measures concerning the introduction of biofuel in the fuel market that generally refer to the corresponding EU Directive (2003/30/EC). Specific measures in the transport sector refer to financial subsidies and fiscal measures such as the Bonus/Malus scheme in France.

HOUSEHOLDS

Energy efficiency trends

- Household energy efficiency has improved by 1.8%/year at EU level in the period 2000-2012, thanks to the energy efficiency improvement for space heating and the diffusion of more efficient new electrical appliances (e.g. labels A+ to A++).
- The household energy consumption per dwelling has been decreasing regularly in most countries since 2000 (1.5%/year at EU level). Since 2008, electricity consumption per household has also decreased in many countries.
- The efficiency of household space heating, measured in kWh or GJ/m^2, has improved steadily since 2000, by around 2.3%/year at EU level. The reasons are the deployment of more efficient new buildings and heating appliances and the renovation of existing dwellings. The low volume of construction since 2009 has, however, limited the impact of new dwellings standards. As a result of these trends, the share of space heating in total household consumption is declining (4 percentage points less than in 2000).
- The consumption of small electrical appliances has been growing rapidly until 2007 so that they now represent a higher share of the total consumption of appliances than large appliances. Large appliances are more and more efficient, with efficiency gains around 35% for cold appliances (refrigerators and freezers), washing machines and dish washers since 1990, thanks to labeling and eco-design regulations.
- The specific consumption per dwelling for lighting has decreased since 2000 in half of EU countries and at the EU level thanks to the diffusion of CFLs and LEDs.
- The increasing number of dwellings and appliances contribute to raise the household energy consumption. Their effect is however counter balanced by the energy efficiency improvements. Without these savings since 2000 the energy consumption of households would have been 60 Mtoe higher in 2012 at EU level.

Energy efficiency policies

- EU legislation is a major driver in policies and measures implemented in the household and services sectors. New measures have mainly focused on the implementation of EU legislation which has required massive effort and resources. The introduction of purely national new measures has, therefore, been limited. Examples of areas where further attention to the implementation of EU legislation is needed are:
    - building renovation strategies: there is room for improving the existing strategies and all countries have not yet adopted them;
    - energy certificates: there is still need for better visibility, consumer trust must be increased and databases on the certificates need to be developed;

    - public procurement: energy efficiency is not yet systematically integrated into public procurement processes.

- Smart meters and informative billing are empowering consumers to make better decisions and change behaviour. However, these need to be backed up by other energy services such as tailored advice as well as financing opportunities to actually induce change.
- Renewable energy production in buildings is promoted by a multitude of policies and measures. As a result, production of heat by heat pumps and solar is increasing. However, there are still considerable barriers in sales of surplus electricity to the network.
- Sectorial policies do not suffice in the transformation towards low carbon economy. Increased focus needs to be given to system level improvements. Some of the prerequisites for the transformation are effective inter-ministerial co-operation to avoid silo mentality, better spatial planning, innovative exploitation of the possibilities of digitalization and behavioural change.
- Energy efficiency and renewable energy entail multiple benefits beyond energy savings and CO_2 emission reductions. It is important to recognize them in programme design and evaluation in order to have a full view of the impacts. One example is economic gains which go well beyond savings in energy bills.

SERVICES

Energy efficiency trends

- Energy consumption in the tertiary sector increased rather rapidly until 2008, and has been decreasing since the economic downturn, by 1.5%/year.
- Electricity consumption has continued growing since 2008 but at a slower pace (1.1%/year, against +3%/year before).
- The energy intensity of services has decreased in almost three quarters of the countries, with a larger reduction for countries with high intensity in 2000; this also means that in one fourth of the countries it is still increasing.

Energy efficiency policies

- See the remarks on energy efficiency policies for households.

CONTENT

LIST OF FIGURES

LIST OF TABLES

LIST OF BOXES

1. INTRODUCTION

1.1. OBJECTIVE OF THE BROCHURE

The objective of this brochure is to analyse energy efficiency in each end-use sector in the EU and by countries (industry, transport and buildings). The analysis includes both a review of energy efficiency trends and of the policy instruments currently implemented to improve energy efficiency, based on the ODYSSEE and MURE databases. This should help policy makers and other parties involved in energy efficiency and CO_2 emission reduction to adapt current policies and to define new, effective policy measures. Although the main focus is on the improvement of energy efficiency, other drivers affecting the energy demand trend - such as industrial growth, structural changes, lifestyle changes, energy prices - are also considered.

This publication relies on data contained in the ODYSSEE database on energy efficiency indicators, with data on energy trends, drivers for energy use, explanatory variables and energy-related CO_2 emissions (Box 1), as well as on the MURE database gathering detailed information of EU energy efficiency policies, both at EU and at Member States levels (Box 2). Both databases are regularly updated by a network of national correspondents from all EU Member States, generally from the energy efficiency agencies. They are managed by a technical coordination, namely Enerdata for ODYSSEE and Fraunhofer-ISI and ISIS for MURE under the overall coordination of ADEME/.

Box 1 : ODYSSEE Database

The ODYSSEE database is used for the monitoring and evaluation of annual energy efficiency trends and energy-related CO_2 emissions. The energy indicators are calculated for the years from 1990 onwards (EU-15 countries) or from 1996 onwards (new Member States). The inputs for the indicators are provided by national energy agencies or institutes according to harmonised definitions and guidelines.

ODYSSEE encompasses the following types of indicators[3]:

- Energy/CO_2 intensities which compare the energy used in the economy or a sector to macroeconomic variables (e.g. GDP, value added).
- Unit energy consumption which compares energy consumption to physical indicators (e.g. specific consumption per tonne of cement, steel and paper).
- Energy efficiency indices by sector (ODEX) to evaluate energy efficiency progress (in %).
- Energy savings: amount of energy saved through energy efficiency improvements.
- Adjusted indicators to allow the comparison of indicators across countries (e.g. adjustments for differences in structure i.e. adjusted to the same value added structure).
- Benchmark/target indicators for energy intensive products (steel, cement, paper) to show the potential improvement based on countries with the best performance.
- Diffusion indicators to monitor the market penetration of energy-efficient technologies.

[3] The methodological issues and precise definitions of indicators and data are explained at the end of each sectoral brochure in a specific section, “Definitions and Glossary”.

Box 2 : MURE Database

The MURE database provides an overview of the most important energy efficiency policy measures in the EU Member States, Norway, Croatia and the EU as a whole. The database is structured by final energy consumption sectors (household, tertiary, industry, transport) and also includes a general cross-cutting section. At the level of sectors, the focus is on single policy measures in order to allow a specific analysis of each measure. More general programs comprising several measures are mainly described in the cross-cutting section of MURE. The homogeneity of the measure descriptions over sectors and countries is ensured by detailed guidelines. All measures are classified according to specific keywords, thus allowing queries based on criteria as e.g.:

- their status (completed, on-going or planned);
- their year of introduction and completion;
- their type: legislative/normative (e.g. standards for new dwellings), legislative/informative (e.g. obligatory labels for appliances), financial (e.g. subsidies), fiscal (e.g. tax deductions), information/education, cooperative (e.g. voluntary agreements) and taxes (on energy or CO2-emissions);
- the targeted end-uses and the main actors involved by the policy measures;
- their semi-quantitative impact: low, medium or high impact, based on quantitative evaluations or expert estimates;
- the end-uses involved and the quantitative impact of the policy measure related to a specific end-use (if this information is available).

In order to allow a separate analysis of policy measures from specific sources, two additional categories have been added to the MURE database:

- If a measure is included in the National Energy Efficiency Action Plan under the former EU Energy Efficiency and Service Directive ESD (2006/32/EC) and the Energy Efficiency Directive (2012/27/EU, EED) respectively, it is classified as “NEEAP measure” in the MURE database. A distinction is also made between the 1st, 2nd and 3rd NEEAPs and the reporting on energy efficiency obligation schemes and alternative measures under Article 7 of the EED. This allows an easy identification of policy measures reported in the NEEAPs and under Article 7 EED and a specific analysis of these policies.
- In order to separate of EU-wide measures which are common to all countries (mainly EU Directives) from pure national measures, a set of “EU measures” was defined in the MURE database.

In addition, for each policy measure a detailed description is available in the MURE database.

In order to make the use of these database easy to non-trained users and to enable the user to make its own analysis of indicators and policies, several support tools have been developed during the last two years (see Figure 1). Apart from the two databases themselves, these tools are the main analytical basis for this synthesis and the sectoral brochures.

Figure 1: ODYSSEE and MURE support tools (facilities) for indicator and policy analysis

There are ***five energy efficiency indicator facilities***:

- *Market diffusion facility:* Monitoring the progress in the market penetration of energy-efficient technologies
- *Decomposition analysis facility:* Explaining the change in energy consumption in a given period by various drivers (e.g. activity changes, structural changes, behaviour, efficiency improvement)
- *Benchmarking facility:* Comparison of the energy efficiency performance of a country with selected others by adjusted indicators
- *Energy saving facility:* Overview of historical and projected energy savings as compared to targets to be achieved
- *Energy efficiency indicator scoreboard:* Assessing and scoring the energy efficiency performance by sector and country

Further, there are **five energy efficiency policy facilities**:

- *Facility on specific policy topics:* Enables to query energy efficiency policies by selected topics (for example policies aiming at buildings, small and medium sized companies SMEs, energy management, consumer behaviour etc.)
- *Successful policies facility:* Aims at identifying successful and promising energy efficiency policies in the Member States based on a set of clearly defined success criteria
- *Policy interaction facility:* Enables to characterise packages of policies and their interaction
- *Policy mapper facility:* Visualisation of all policies aiming at a given end-use and related energy efficiency indicators
- *Energy efficiency policy scoreboard:* Assessing and scoring the energy efficiency policies by sector and country

1.2. CONTENTS OF THE REPORT

The first part of this report is dedicated to energy efficiency indicators and trends. This part of the report aims to review the trends observed in terms of energy use, energy efficiency and CO_2 emissions, at the level of all end-use sectors together (chapter 2) and in each end-use sector (industry in chapter 3, transport in chapter 4 and buildings in chapter 5). The analysis will mainly focus on the overall EU trends[4]; the differences between countries will also be highlighted, so as to pinpoint the countries with the most interesting trends. The analysis will cover the period 2000-2013, with a focus on the impact of the economic crisis (i.e. since 2007). The analysis makes large use of the energy efficiency indicator facilities mentioned previously, notably the decomposition facility - which helps to understand the driving forces behind the changes in energy consumption - and the energy saving facility, which analysis savings achieved and helps understanding the gaps to the energy efficiency targets.

[4] EU will refer to the EU 28 all along this brochure.

The second part of the report deals with energy efficiency policies, starting with a cross-cutting overview of the sectoral and national energy efficiency policies and their evolution (Chapter 6), followed by the main EU regulations addressing the different sectors as well as the impacts of National Energy Efficiency Action Plans NEEAPs on evaluation practices for energy efficiency measures (Chapter 7). The main focus is on the policies which were reported by the Member States in the National Energy Efficiency Action Plans (NEEAPs) under the Energy Efficiency Directive (EED). Chapter 8 then defines and identifies successful policies across the EU Member States. For that purpose we introduce the "Successful policy" Facility developed for MURE. In Chapter 9 we discuss the issue of designing effective policy mixes and introduce for this purpose the MURE Policy Interaction Facility and the MURE Policy Mapper which identifies policies aiming at the same targeted end-uses. Chapter 10 adresses selected policy areas, based on the MURE facility on "Policies by Topic". Focus is on measures for SMEs and behavioural measures.

Finally we also report on the first approach to a European Energy Efficiency Scoreboard with a focus on methodological questions. Scored are energy efficiency state, trends and policies. In other regions, notably the US where ACEEE established such a scoreboard, such efforts exist and provide hints how to design a European Scoreboard. The results developed so far help to understand the methodological questions and decisions and have been discussed extensively with energy efficiency experts. In the future the Scoreboard may evolve further towards a regular exercise of scoring.

This brochure summarizes three sectoral brochures available on the ODYSSEE-MURE website[5] that provides more in depth analysis of energy efficiency trends and policies on buildings, transport and industry.

[5] http://www.odyssee-mure.eu/publications/br/

2. OVERALL TRENDS

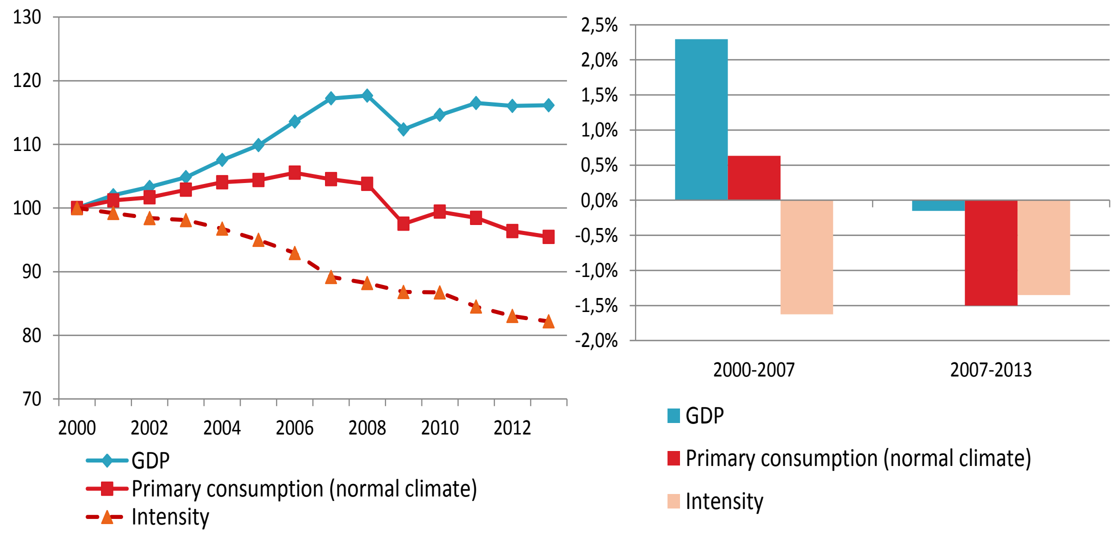
2.1. ENERGY CONSUMPTION TRENDS

Decrease of the energy consumption since 2007

The primary energy consumption has been decreasing rapidly at EU level since 2007 (by 1.5%/year), although the GDP only slightly decreased (Figure 2). Until 2007, the consumption had been growing much slower than GDP (0.6% /year compared to 2.3% for the GDP). As a result of these trends, the EU primary energy consumption was 5% below its 2000 level in 2013.

The primary energy intensity continued its historical trend after 2007, with a rate of reduction of 1.4%/year, which is only slightly lower than over 2000 to 2007 (1.6%/year).

Figure 2: Energy consumption and GDP in the EU[6]



Source: ODYSSEE

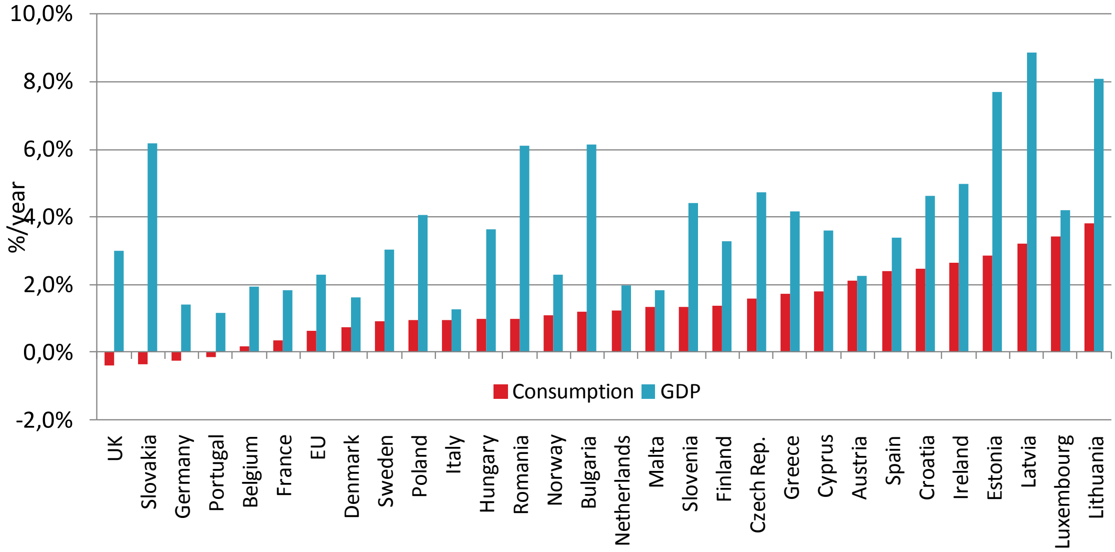
Until 2007, the trends by country show, as for the EU as a whole, a large decoupling between the primary energy consumption and the GDP. In most countries, high economic growth was possible with a low progression of the energy consumption (below 1%/year for 8 countries) and even a reduction in 4 countries (UK, Slovakia, Germany and Portugal) (Figure 3).

Since 2007, the primary energy consumption has decreased almost everywhere, except in three countries (Sweden, Estonia and Norway). In 9 countries, the rate of reduction has been quite significant (over 3%/year). In most countries the contraction of consumption was much larger than the GDP variation, which resulted in a significant decrease of the primary energy intensity.

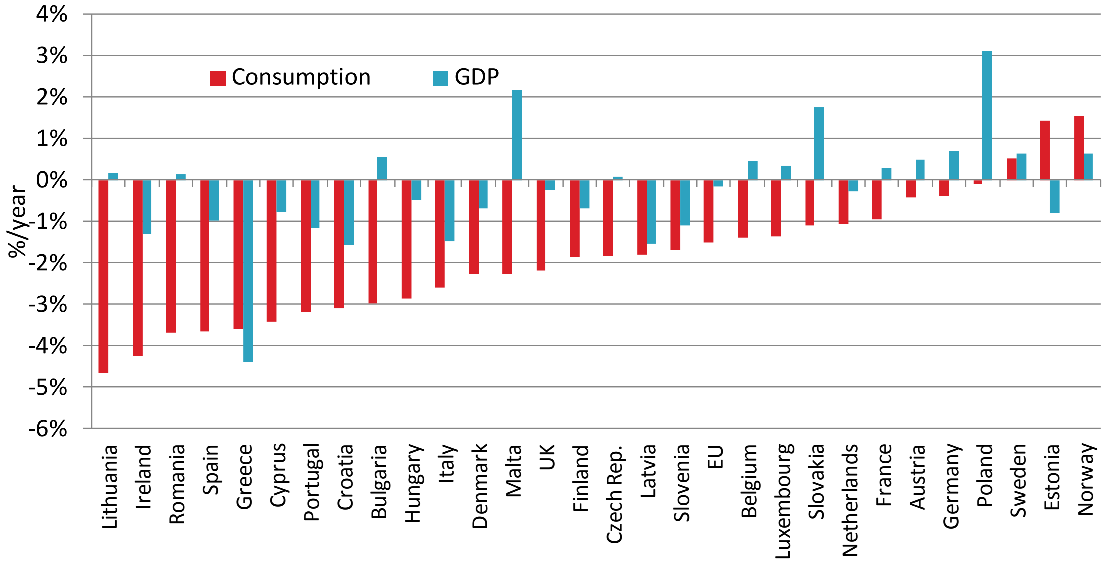
[6] Primary energy consumption at normal climate (i.e. with climatic corrections) calculated by Enerdata from Eurostat, excluding non-energy uses.

Figure 3: Primary energy consumption and GDP in EU countries

2000-2007



2007-2013

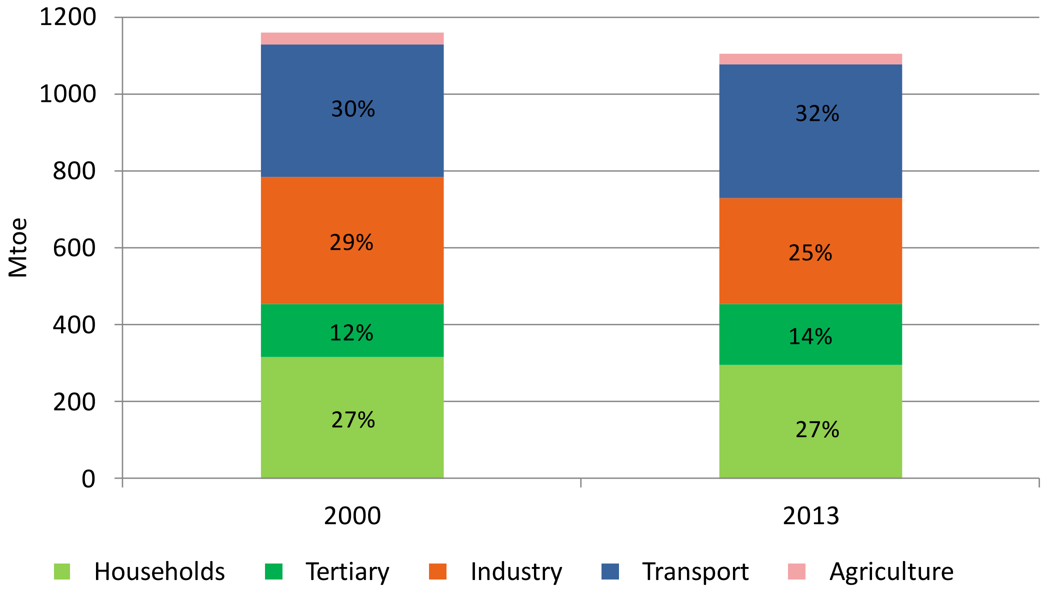


Source: ODYSSEE

Decreasing share of industry to the benefit of transport

Buildings (households and service sector) absorbed 41 % of the final energy consumption in 2013 (Figure 4). The share of industry has decreased significantly, from 29% to 25% between 2000 and 2013 while transport increased its contribution from 30% in 2000 to 32% in 2013. The sector mix between countries is quite diverse with a share of industry ranging from around 25% in Cyprus, Malta, Luxembourg or Denmark to more than 45% in Finland; the share of transport varies from less than 20% in Finland and Slovakia to more than 60% in Luxembourg and Malta. Buildings represent more than 50% of the consumption in Estonia, Hungary and Latvia, but only 27% in Spain and 17% in Malta.

Figure 4: Final energy consumption by sector in the EU

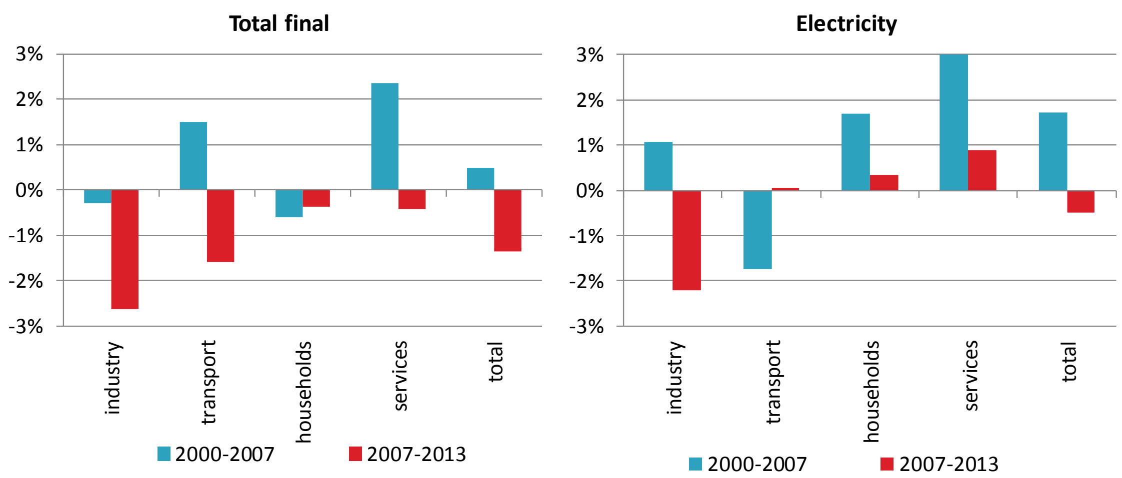


Source: ODYSSEE based on Eurostat (consumption at normal climate)

Decrease of the final consumption in most sectors since 2000

Since 2007, the final energy consumption has been decreasing rapidly (by 1.4%/year), with a stronger effect of the crisis in industry and transport than in buildings (Figure 5).

Figure 5: Final energy consumption trends by sector in the EU



Source: ODYSSEE, based on Eurostat; household and services at normal climate; agriculture not shown given its low share.

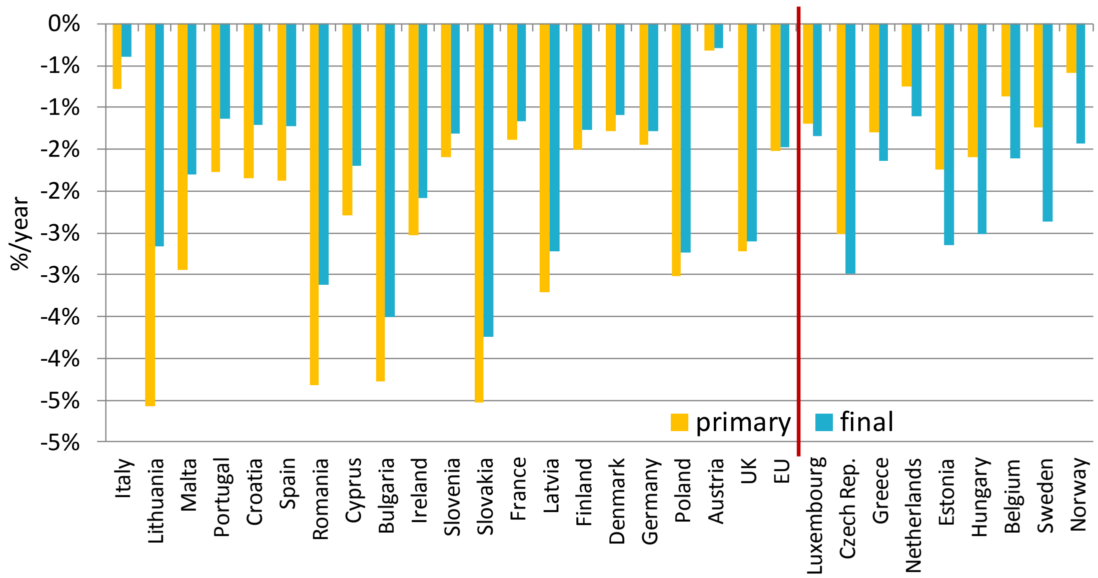
The electricity consumption decreased slightly (by 0.4%/year) after a rapid progression up to 2007 (close to 2%/year), especially in services. Partly this is an impact of the economic crisis and the following lower growth but partly this has been influenced also by saturation effects and energy efficiency policies such as eco-design standards and labels.

2.2. TRENDS IN PRIMARY AND FINAL ENERGY INTENSITIES

Since 2000, the primary energy intensity has decreased faster than the final intensity in three quarters of the countries, because of improvement in power generation efficiency.

Between 2000 and 2013, the primary energy intensity, i.e. the ratio between the energy consumption and the GDP, decreased faster on average than the final energy intensity in three quarter of EU countries and at the EU level (Figure 6). This trend is mainly due to improvement in the average efficiency of power generation linked to the large penetration of wind and solar power that replaced thermal or nuclear power generation[7], as well as to the diffusion of gas combined cycles.

Figure 6: Variation of primary and final energy intensities in EU countries[8]



Source: ODYSSEE

For the other countries, the final intensity has decreased faster than the primary intensity as higher losses in energy transformation or higher consumption of non-energy uses[9] have offset

[7] Wind and solar power generation are considered to have an efficiency of 100% in energy statistics, while thermal generation has an average efficiency below 40% and nuclear an efficiency of 33%.

[8] Energy intensities at normal climate.

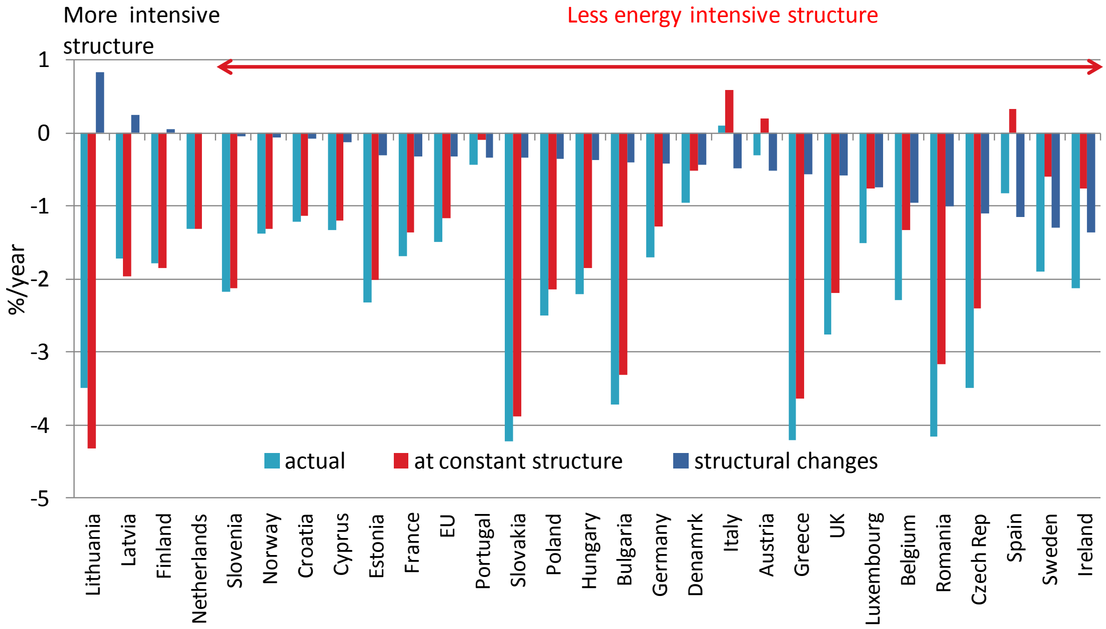
[9] Non-energy uses are included in the primary consumption but not in the final energy consumption.

part of the reduction in the final energy intensity. In The Netherlands, this trend is explained by an increasing share of non-energy uses, in Belgium, the Czech Republic, Hungary and Estonia by an increasing share of electricity in the final consumption[10], which leads to additional losses in power generation), in Sweden and Norway to a decreasing share of hydro in the power mix.

Structural changes to less energy-intensive sectors are generally contributing to the intensity decrease.

In the EU as a whole, the contribution of services to the GDP has increased from 64% in 2000 to 67% in 2013. This trend has contributed to decrease the final energy intensity, as services require around 7 times less energy per unit of value added than industry. In the same way, the greater contribution of less energy intensive branches in industry, such as equipment, also contributed to decrease the final intensity[11]. Between 2000 and 2013, these structural changes explain around 10% of the final intensity reduction[12] (Figure 7).

Figure 7: Impact of structural changes on the final energy intensity (EU)



Source: ODYSSEE

Most countries have moved to less energy intensive sectors. In 6 countries over 2/3 of the final energy intensity decrease is explained by structural changes (Ireland, Spain, Luxembourg,

[10] Apart from these countries, the highest progression of electricity was observed in Greece and Portugal (+ 5 points), followed by Cyprus and Spain (+4 points).

[11] The share of equipment in the industry value added increased by 5 points at EU level between 2000 and 2013.A detailed the analysis of structural changes in industry is available in the brochure dedicated to industry .

[12] The effect of structural changes is measured by the difference in the variations of the observed final energy intensity and a fictive final intensity at constant structure.

Belgium, Austria and Italy). In Spain, Italy and Austria, these structural changes have offset the impact of an increase in sectoral intensities. In Spain and Luxembourg, the higher growth in services explains most of this trend, whereas in Belgium and Austria, structural changes in industry are the main driver.

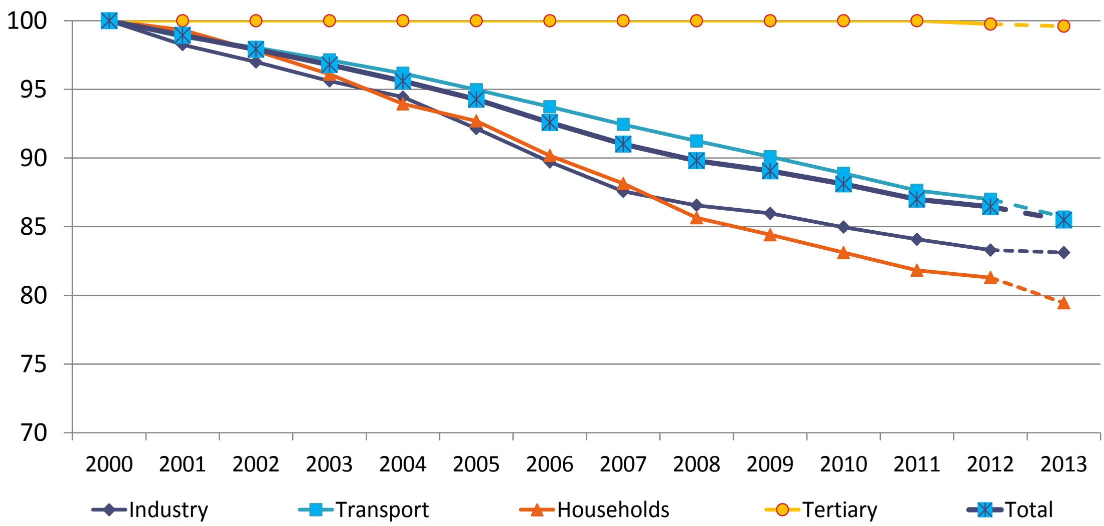
In Lithuania, Latvia and Finland, structural changes had a negative impact on the energy intensity reduction (the actual intensity has decreased less than the intensity at constant structure). In Lithuania and Finland, the main reason is the faster growth in industry than in services (2 points decrease in the share of services in the GDP), while in Latvia structural changes in industry (higher share of primary metals) explain the trend observed.

2.3. ENERGY EFFICIENCY PROGRESS IN THE EU

Slow down in energy efficiency progress since the economic crisis.

Energy efficiency improved by 1.2 %/year on average from 2000 to 2013 at the EU level or 15% over the period (Figure 8). However, the pace of progress has slowed down since the economic crisis: the annual gain has dropped from 1.3%/year between 2000 and 2007 to 1%/year between 2007 and 2013, mainly in the productive sectors (industry and transport of goods).

Figure 8: Energy efficiency progress in the EU (ODEX)[13]



Source: ODYSSEE

In industry, the pace of energy efficiency improvements has been divided by 2 since the economic crisis[14] (1%/year since 2007, compared to around 2%/year between 2000 and 2007). For

[13] The ODEX is calculated as a weighted average of the energy efficiency gains observed by sector (see sectoral chapters below for their calculation); it is in addition measured as 3 year moving average to limit the effect of short-term fluctuations (imperfect climatic corrections, behavioural factors, business cycles).

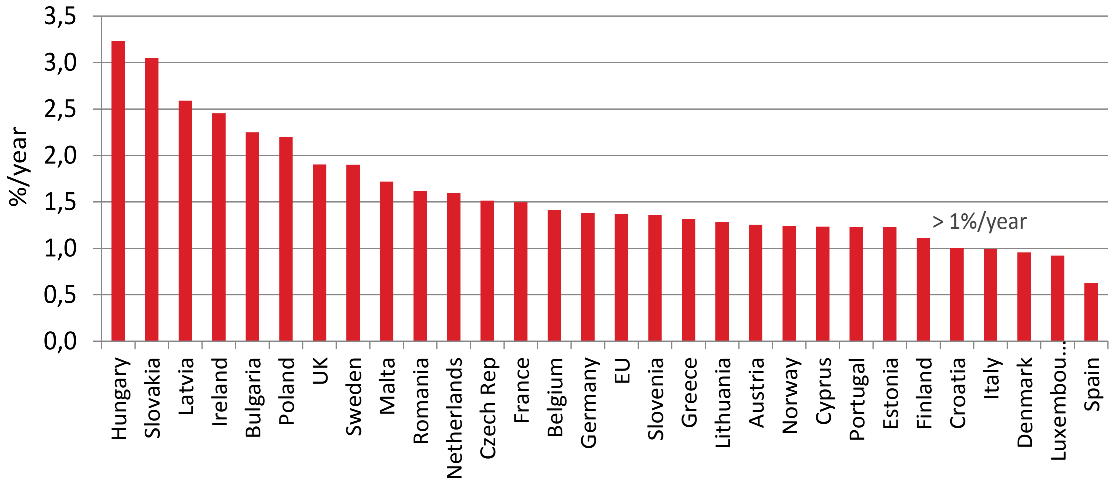
households, there has been a regular progress and larger gains than in the other sectors (1.7%/year). The gains in transport are roughly in line with the average (1.2%/year). In services, because of a lack of data by end-use, it is not really possible to capture the energy efficiency improvements with the indicators available[15].

Compared to bottom-up evaluations, energy efficiency gains measured in ODYSSEE have a broader scope and include all sources of energy efficiency improvements: policy measures, price changes, autonomous technical progress, other market forces, etc.

Almost all countries with an energy efficiency improvement above 1%/year

The improvement in energy efficiency is higher or close to 2 %/year in 6 countries since 2000 (Hungary, Slovakia, Latvia, Ireland, Bulgaria and Poland) (Figure 9). For 20 countries this improvement is between 1 and 2%/year.

Figure 9: Energy efficiency progress by country[16]



Source: ODYSSEE

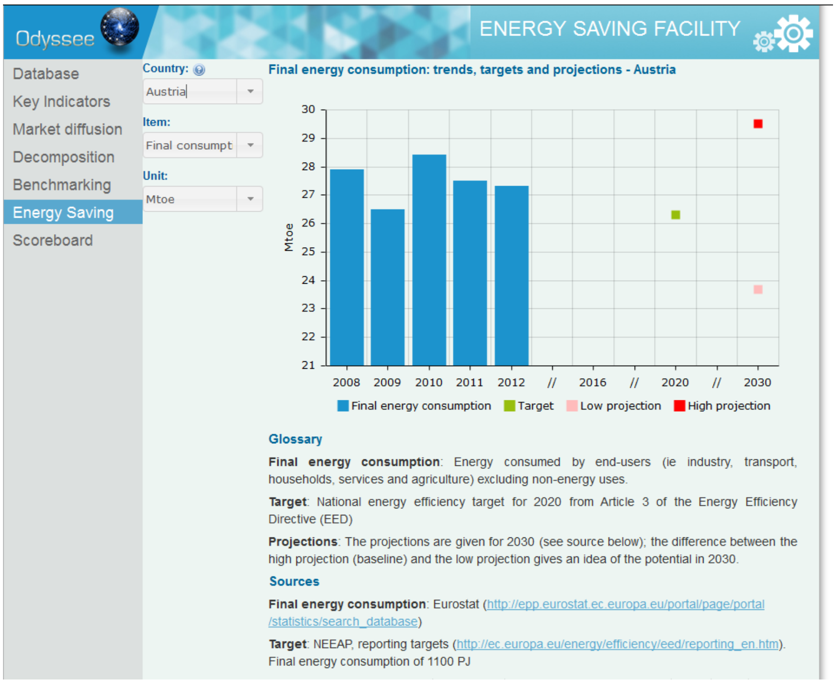
About 180 Mtoe of energy savings in 2012 (200 Mtoe in 2013[17])

The major analysis tool of the ODYSSEE database which allows establishing energy savings is the Energy Saving Facility (see a snap shoot for Austria from the facility which also provides information

[14] In the analysis of industry below, we comment on the different trends observed for industry and manufacturing due to the strong recession in construction (industry includes manufacturing, construction and mining).
[15] This is especially true for electricity where the diffusion of more efficient appliances has been offset by an increase use of air conditioning and ICTs.
[16] Services are not included in the analysis by country due to the difficulty of grasping energy saving with existing data.
[17] First estimates

in the targets and relevant projections for the country. This facility was applied to ease analysis of the energy savings achieved across the European Union.

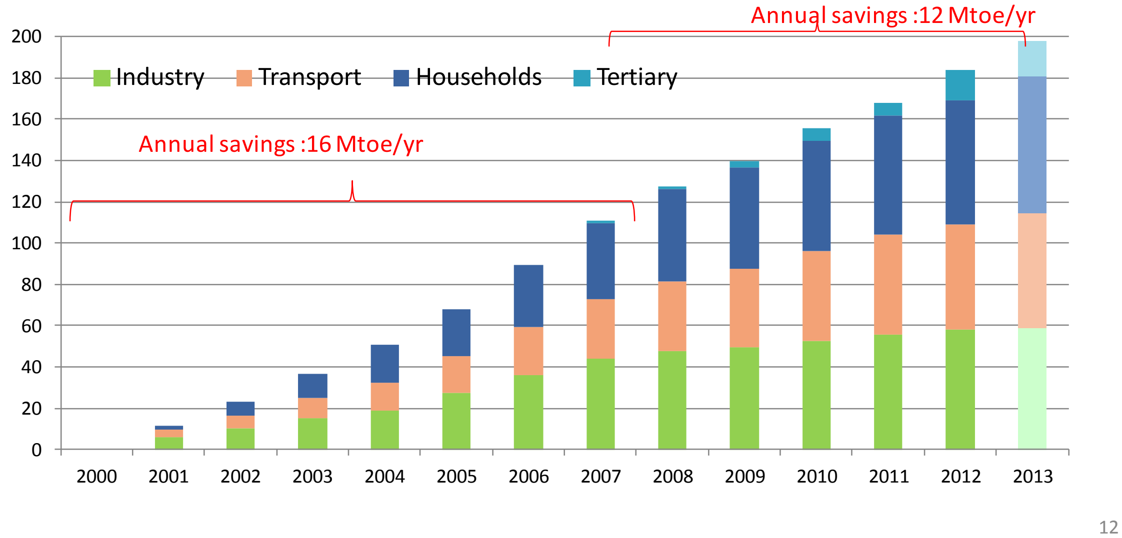
Figure 10: Example for Austria from the Energy Saving Facility of the ODYSSEE database



Source: ODYSSEE Energy Saving Facility, http://www.indicators.odyssee-mure.eu/energy-saving.html

In 2012, energy savings reached 180 Mtoe for the EU as a whole in comparison to 2000; this represents the equivalent of 17% of the final energy consumption (Figure 11).

Figure 11: Energy savings in the EU



Source: ODYSSEE (2013 estimates)

According to first estimates, energy savings can reach around 200 Mtoe in 2013. In other words, without energy savings, the final energy consumption would have been 200 Mtoe or 19% higher in 2013 compared to 2000. There was a lower progression of the annual additional energy savings since 2007, as a result of the economic crisis (12 Mtoe/year compared to 16 Mtoe/year before the crisis). In 2013, around 33% of the savings come from households, 30% from industry, 28 % from transport and 9% from tertiary.

2.4. EXPLANATORY FACTORS OF FINAL ENERGY CONSUMPTION VARIATION

In order to allow for an easy analysis of the driving forces of energy consumption, the ODYSSEE-MURE project has developed a decomposition tool[18] which separates the impacts of the main drivers for energy consumption.

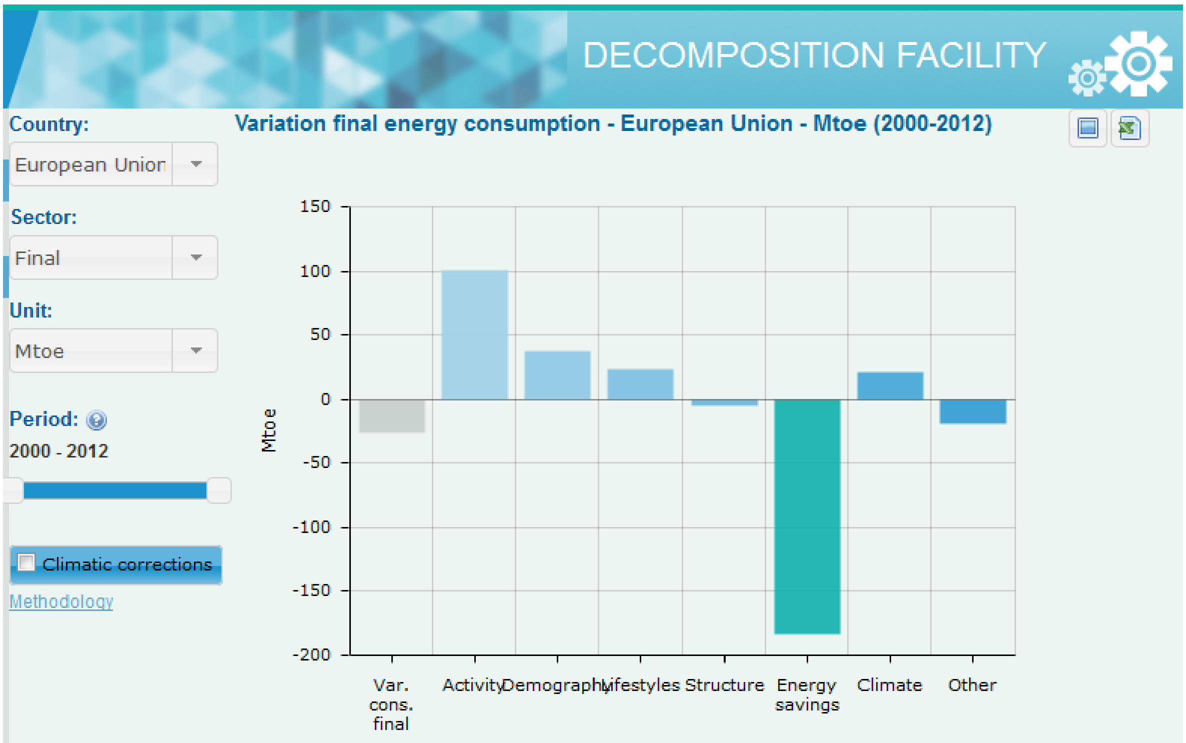
The variation of the final energy consumption between two years can be decomposed into several effects for each end-use sector, as follows:

- An activity effect due to an increase in the economic activity, measured by the value added in industry and agriculture, by the number of employees in services, and by the traffic of passengers and goods in transport;
- A demographic effect linked to the increase in the number of households (or dwellings) ;
- A structural effect due to a change in the structure of the value added in industry among the various branches, or due to modal shift in transport;
- A lifestyle effect due to an increase in the household equipment ownership and to larger homes;
- Energy savings, linked to energy efficiency improvements;
- A climate effect for households and services, measuring the effect of the different winter severity between the two years[19];
- A residual effect (“other”) capturing behavioral changes for heating and change in the valorization of products in industry (ratio value added over production).

[18] http://www.indicators.odyssee-mure.eu/decomposition.html

[19] If the consumption variation is based on energy statistics, it generally corresponds to data at real climate; if the consumption variation is based on data at normal climate, as before for the indicators, this effect disappears. The online decomposition tool on the ODYSSEE MURE web site gives the possibility to the use to work with the actual consumption or with the consumption at normal climate.

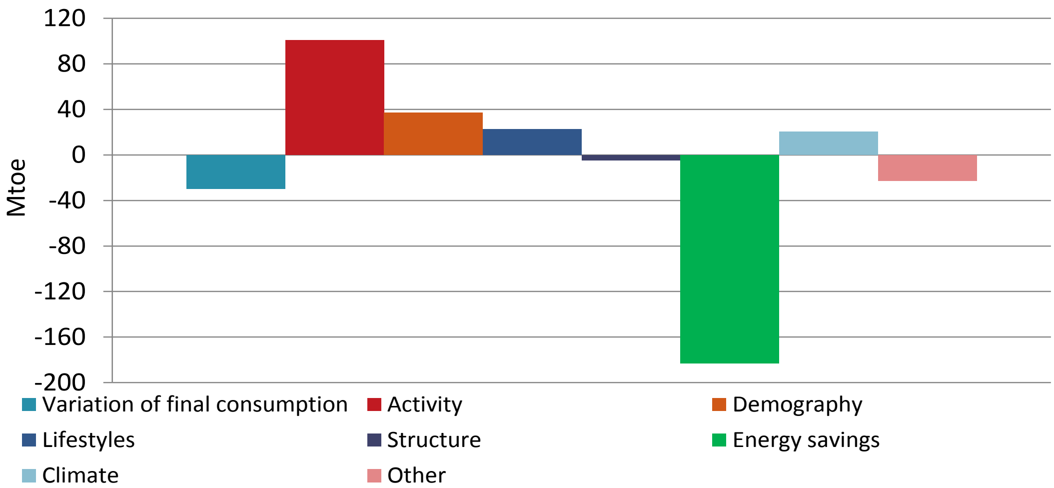
Figure 12: Decomposition facility in the ODYSSEE database



Source: ODYSSEE decomposition tool http://www.indicators.odyssee-mure.eu/decomposition.html

In 2012, the final energy consumption in the EU was 30 Mtoe lower than in 2000 (Figure 13*)* and about the same amount in 2013.

Figure 13: Drivers of final energy consumption variation between 2000 and 2012 (EU)

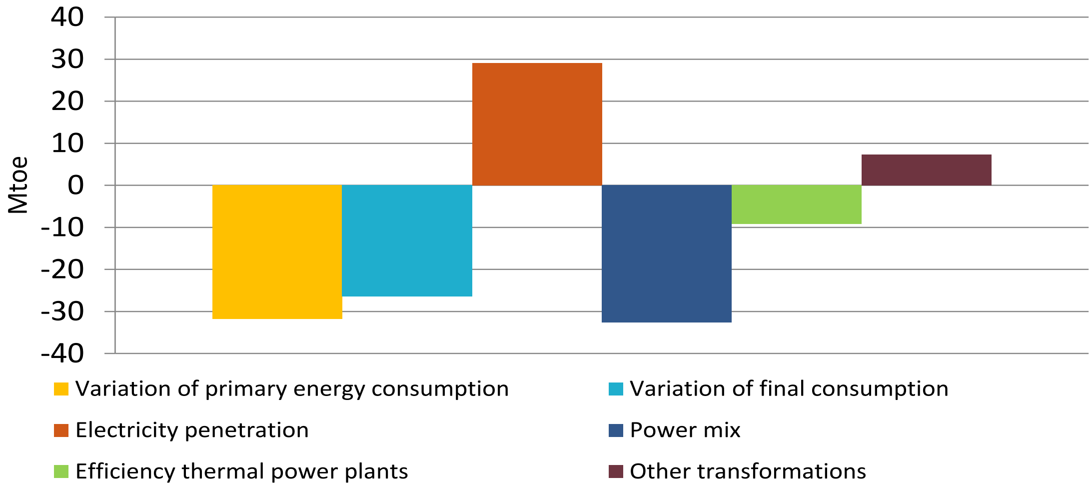


Source: ODYSSEE decomposition tool http://www.indicators.odyssee-mure.eu/decomposition.html

Four main factors contributed to increase consumption over the period, all things being equal: economic activity by around 100 Mtoe, demography by 40 Mtoe, lifestyles by 20 Mtoe and the colder climate in 2012, compared to 2000, by 20 Mtoe. Energy savings (180 Mtoe) more than offset the effect of these four drivers of consumption growth leading to the observed decrease in the final energy consumption.

The primary energy consumption decreased slightly more than the final consumption, because of changes in the power mix (higher share of renewables, lower share of nuclear) and improvements in the efficiency of thermal generation, as explained above with the primary and final intensities. These trends more than offset the effect of the penetration of electricity, which otherwise would have increased the primary consumption by 30 Mtoe

Figure 14: Drivers of the primary energy consumption variation between 2000 and 2012 (EU)



Source ODYSSEE

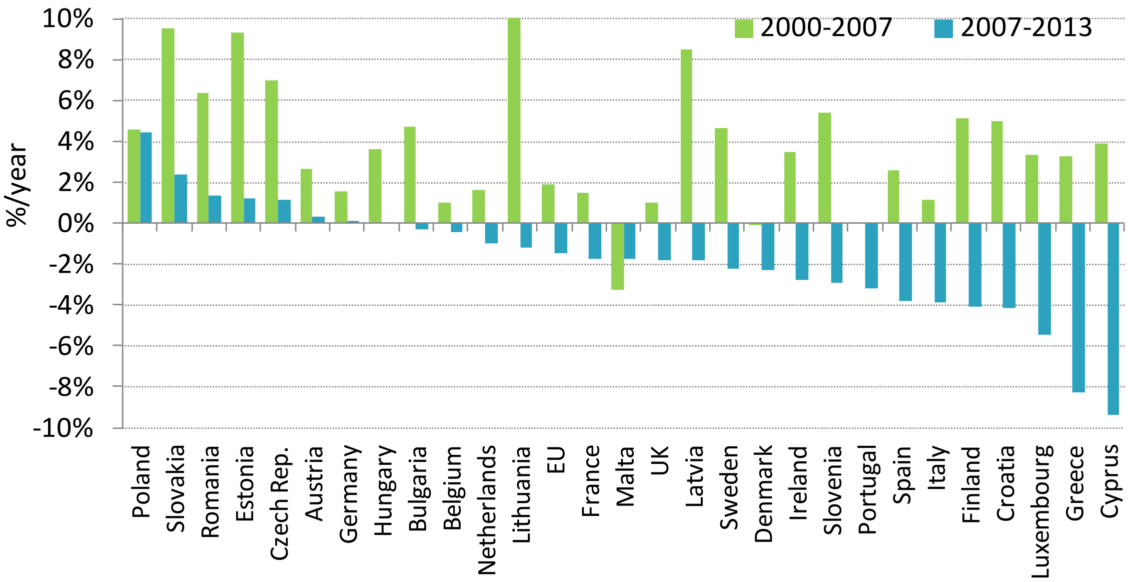
3. INDUSTRY

3.1. TRENDS IN ENERGY CONSUMPTION AND INDUSTRIAL ACTIVITY

Industrial recession in most countries since 2007

Since 2007, most EU countries have been hit by an industrial recession, except 5 countries (Poland, Slovakia, Romania, Estonia and the Czech Republic (Figure 15). At EU level, industrial activity contracted by an average of 1.5%/year between 2007 and 2013. This contrasts deeply with the period 2000-2007 when industrial growth averaged 1.9%/year.

Figure 15 : Trends in industrial activity



Source: ODYSSEE

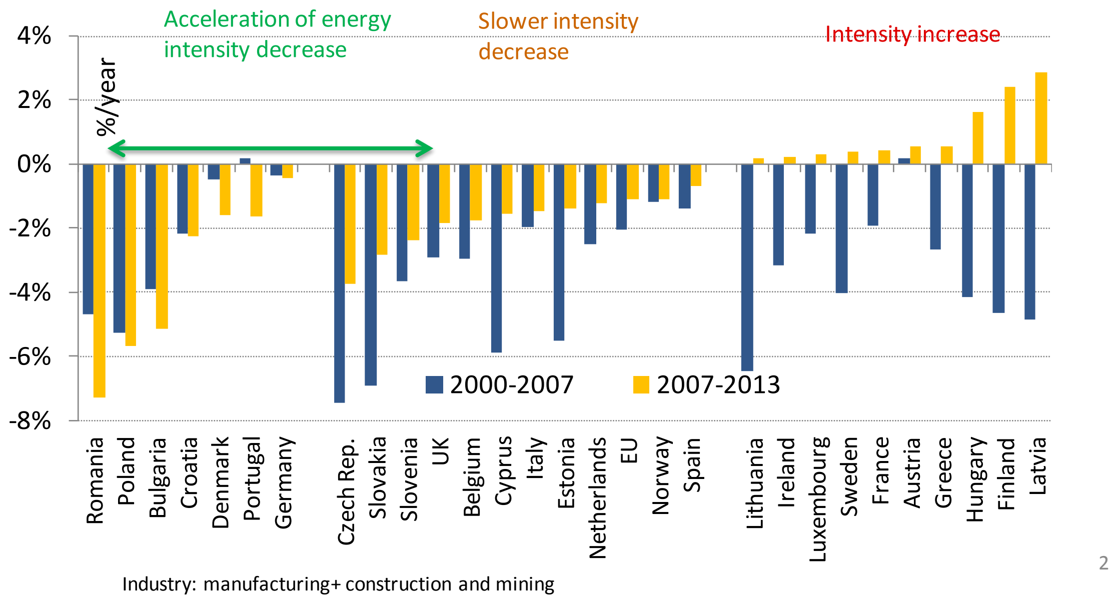
Impact of the crisis on the energy intensity trends observed in three fourth of countries

Until 2007, the energy consumption grew less rapidly than the value added in all countries, which was reflected by an intensity decrease everywhere (Figure 16).

In 11 countries and at EU average, the intensity continued to decrease after 2007, but at a much slower rate (1.1%/year compared to 2%/year before), and in 10 countries the intensity trend has reversed: in other words, the recession had an impact on the energy intensity trend of industry in three fourth of countries. This break in historical trends is mainly explained by the fact that energy consumption did not follow the reduction in energy consumption during the recession because of lower efficiency (Box 3). In 7 countries, however, generally countries with an industrial growth, the decreasing trend accelerated after 2007.

As a result of these trends, the energy consumption of the industrial sector[20] was in 2013 17% below its 2000 level at EU level.

Figure 16: Trends in the energy intensities of industry



Source: ODYSSEE

Box 3 : Business cycles strongly influence short-term energy intensity variations

The energy consumed per unit of production tends to decrease less (or even increase) in a period of recession for two reasons:

- First of all, process energy does not decrease proportionally to the activity as the efficiency of equipment drops if they are not used at full capacity.
- Secondly, part of the energy consumed is independent of the production level (e.g. heating and lighting): if production declines, only the former part of consumption decreases, but not proportionally.

Chemical industry is the main energy consuming branch

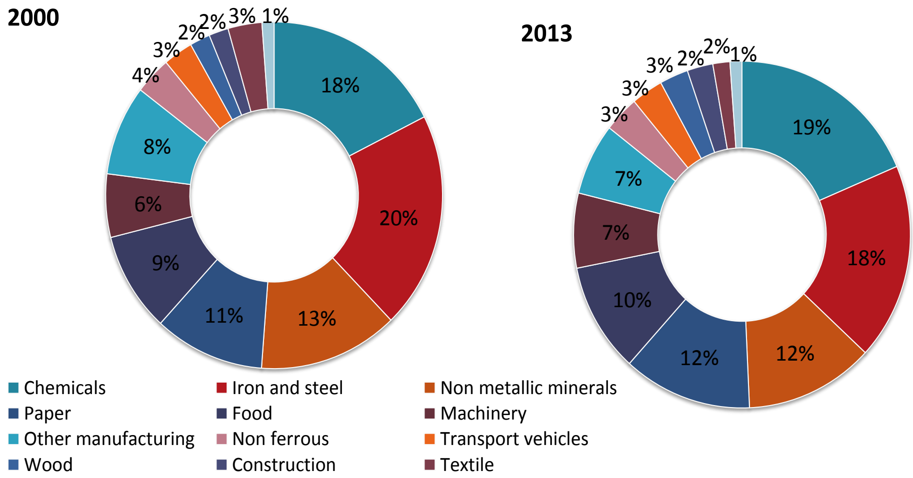
The chemical industry is now the main energy consuming branch with 19% of total energy consumption of industry in 2013 in the EU (Figure 17). Steel arrives in second position with 18 %, followed by non-metallic minerals and paper (12% each), and food (10%). The share of chemicals, paper and food is increasing (around 1.5 percentage points more compared to 2000), while the share of steel is declining (- 2 points). The share of all energy-intensive branches (steel, chemicals,

[20] Industrial energy consumption includes manufacturing industry, construction and non-energy mining; it excludes the energy used for non-energy uses (e.g. gas or naphtha used as feedstock in petrochemicals).

non-metallic minerals, non-ferrous and pulp and paper) still represents two thirds of the industrial consumption.

The breakdown of energy consumption by branch varies widely across countries: pulp and paper plays the dominant role in Finland (above 50% of the consumption) and Sweden, whereas in the Netherlands chemicals absorb the largest share of consumption (around 40%); non-metallic minerals is dominant in Cyprus (64%), Croatia and Portugal (around 30%), whereas in Slovakia and Luxembourg steel consumes above 50% of the total. In Ireland and Croatia, food industry is important (20%).

Figure 17: Distribution of energy consumption by industrial branch in the EU

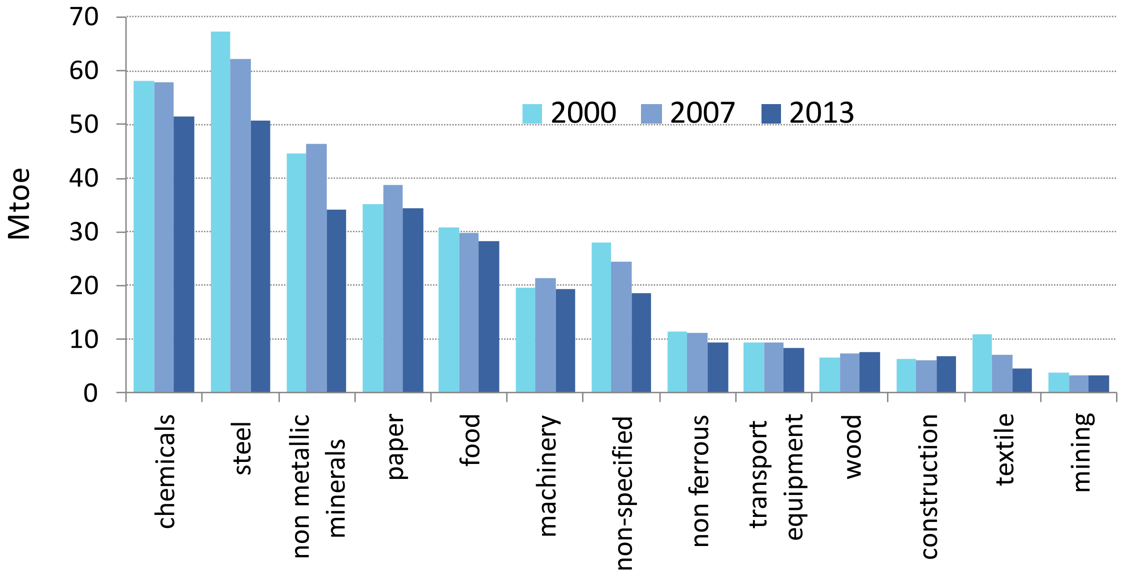


Source: ODYSSEE from Eurostat

Reduction of the energy consumption in all industrial branches since 2007

The energy consumption decreased in all industrial branches since 2007, and even since 2000 in several branches (steel, food, non-ferrous, transport equipment and textile). Steel and non-metallic minerals experienced the strongest reduction: their consumption was around 25% lower in 2013 than in 2000 (Figure 18).

Figure 18: Energy consumption trends by industrial branch (EU)



Source: ODYSSEE from Eurostat

3.2. ENERGY EFFICIENCY TRENDS

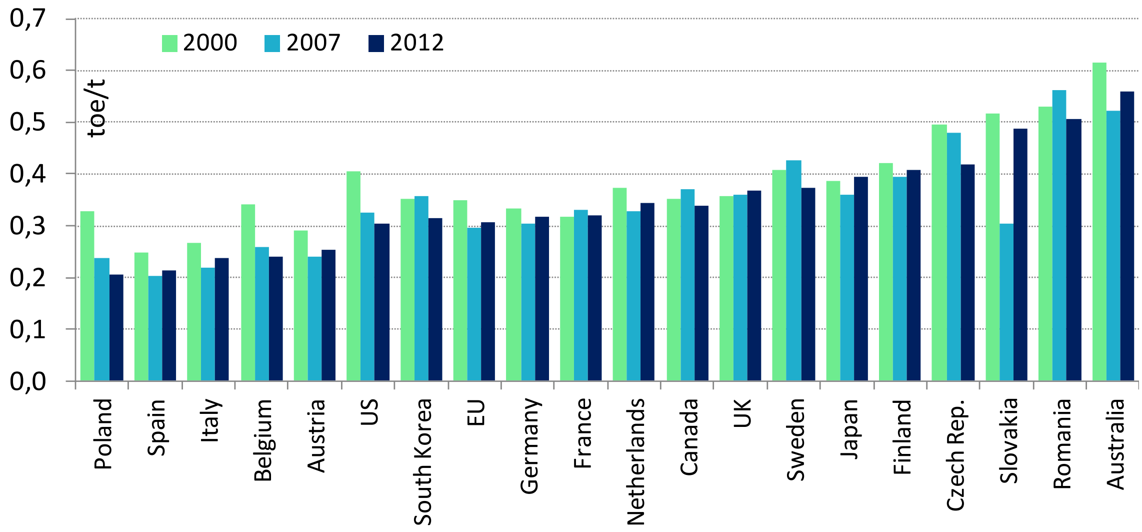
Steel, cement and paper represent around 40% of the energy consumption of industry. For these three branches, energy efficiency is usually captured by an indicator of specific consumption per tonne produced.

Decreasing specific energy consumption per tonne of steel until 2007

Until 2007, the average specific consumption per tonne of steel has been decreasing in most countries (by 2.2%/year at EU level) (Figure 19). Since 2007, there has been a slight increase in half of countries and at EU level (by 0.5%/year for the EU average). This deterioration of energy efficiency since 2007 is mainly explained by a lower rate of utilisation of the steel factories. In some EU countries however, this specific consumption has still been decreasing (e.g. Poland, Belgium, France, Romania and the Czech Republic), as a result of an increased penetration of electric steel, the less energy intensive process[21], and the closure of old and less efficient steel mills.

[21] The electric process requires 2 to 3 times less energy than the oxygen process (with electricity is converted in toe on the basis of its calorific value of electricity, as done here and by Eurostat.

Figure 19: Specific energy consumption per tonne of steel[22]



Source: ODYSSEE for EU countries and Norway, IEA for the other countries

Cement production is now less efficient than before the economic crisis in most countries

Trends in the specific energy consumption per tonne of cement are influenced by two main factors: the efficiency of clinker kilns and cement grinding and the ratio between the clinker and cement production[23]: the higher this ratio, the more energy is required to produce one tonne of cement.

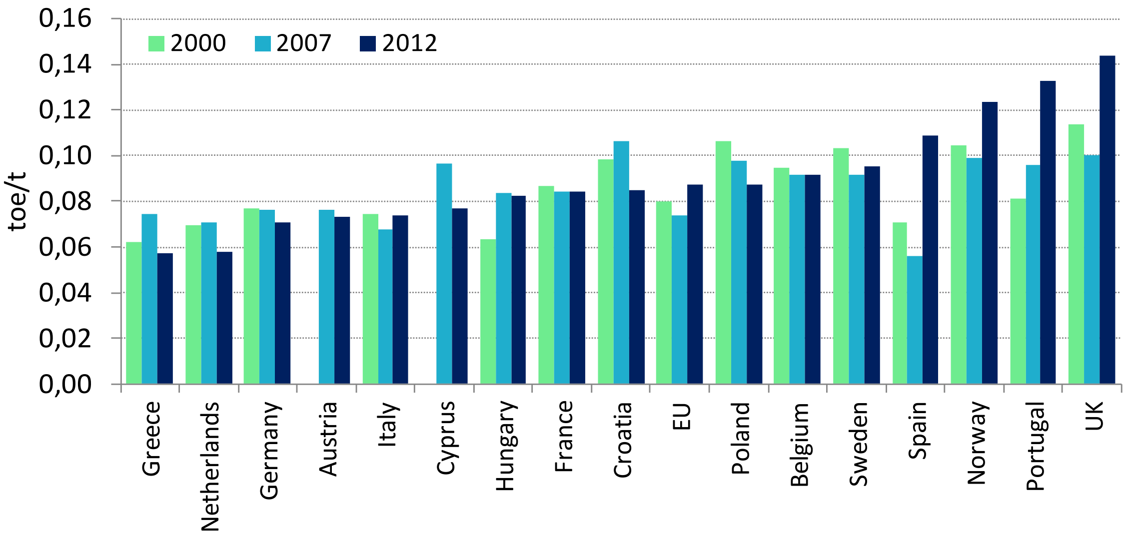
This specific consumption was higher in 2012 than in 2007 in 6 countries and at EU level (Figure 20). Such a trend is first of all explained by a deterioration of energy efficiency, especially significant in countries with a deep recession with plants operating at low capacity (e.g. Spain and Portugal, with a drop in production of 70% and 44% respectively). It is also linked to an increase in the ratio production of clinker/cement: this is the case in Portugal and Spain where, because of the contraction of the domestic market, they increased significantly their exports of clinker.

The specific consumption per tonne of cement has kept decreasing in 7 countries and remained stable in 3 others. This reduction reflects energy efficiency improvements but reflect as well, for some countries a decrease in the ratio clinker/cement production linked to increased imports of clinker and more additives in cement (e.g. in Germany, Austria, Poland, see Figure 21).

[22] Only countries with production > 4 Mt are shown.

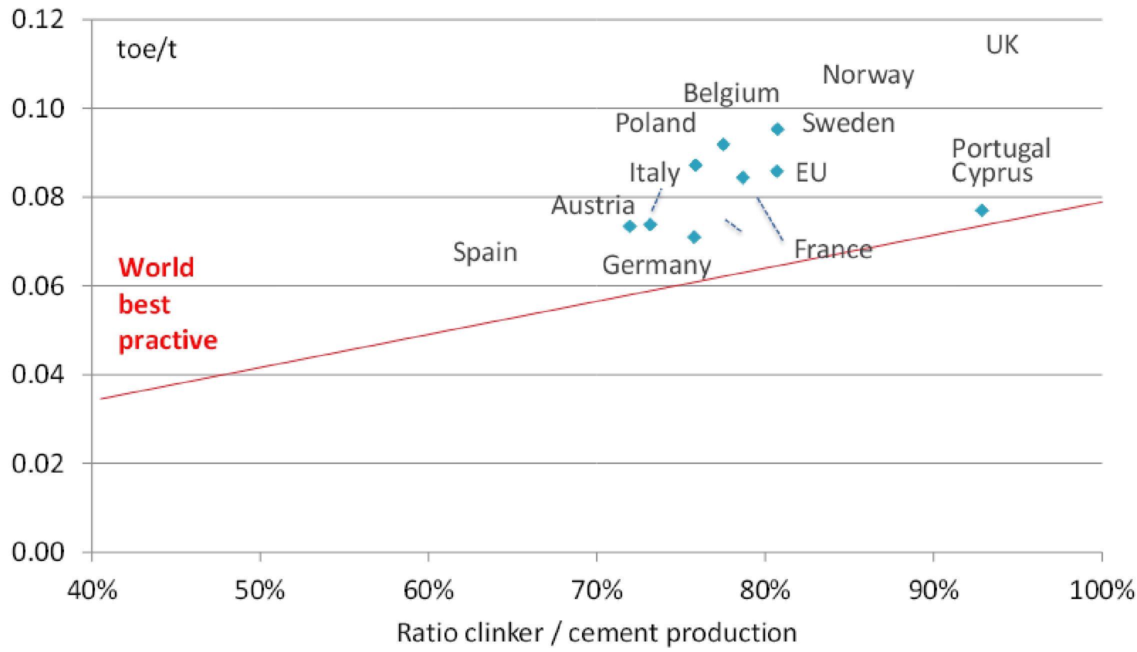
[23] Cement is made of a mixture of clinker and additives (e.g. ashes); the mix clinker/ additive vary with the quality of cement. Most of the energy consumption occurs for clinker production, and not for grinding clinker with additives. Countries can import part of the clinker they need it or even export their surplus. Importing clinker decreases the specific consumption, while exporting clinker will have the opposite effect.

Figure 20: Trends in the specific consumption of cement in EU countries



Source: ODYSSEE

Figure 21: Impact of the clinker/cement ratio on specific consumption of cement

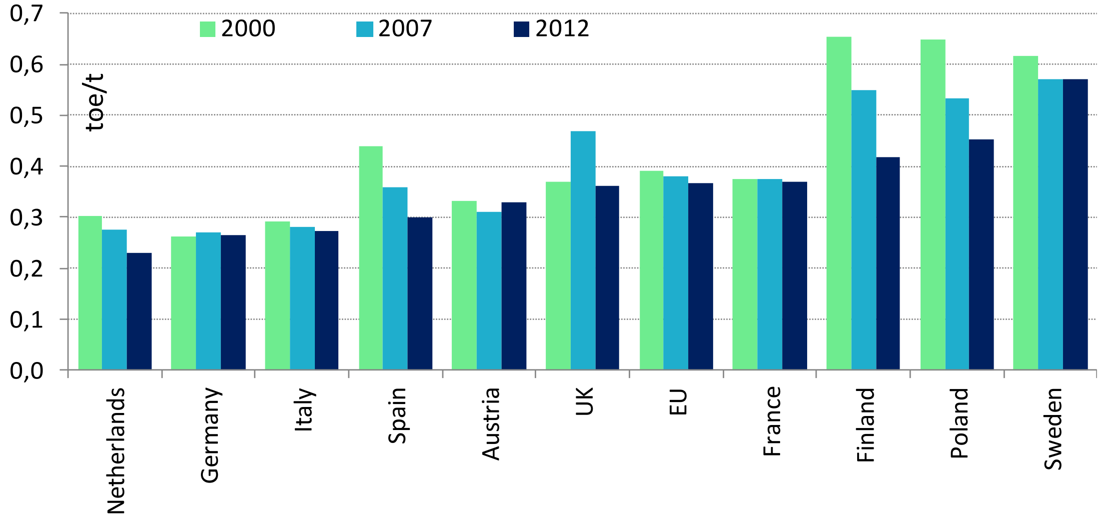


Source: ODYSSEE

The specific energy consumption per tonne of paper is generally decreasing

The specific energy consumption of pulp, paper and printing per tonne of paper has been generally decreasing in almost all countries since 2000 (-0.5%/year at EU level over the period 2000-2012) (Figure 22). Finland and Spain experienced the largest reduction (above 3%/year).

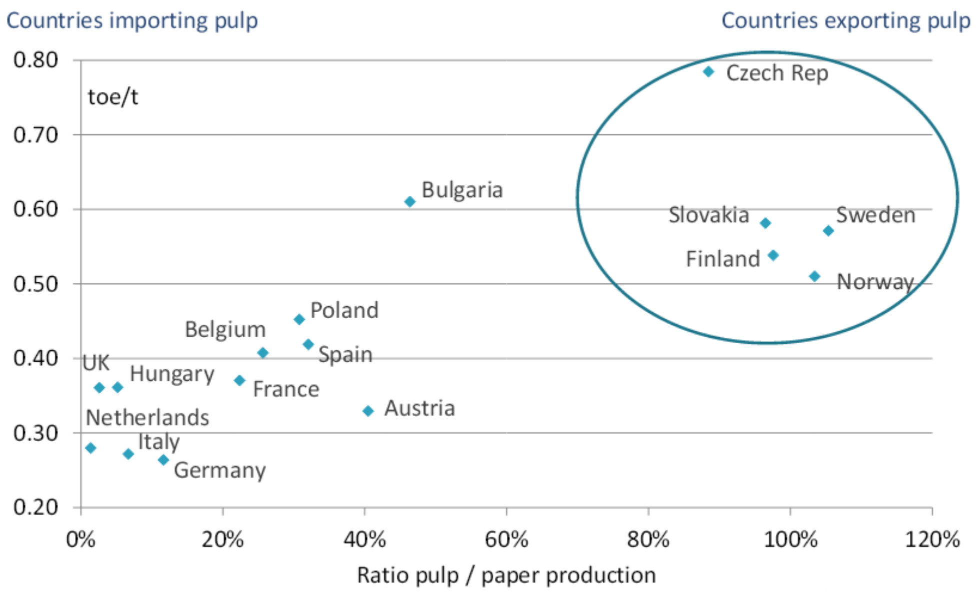
Figure 22: Trends in the energy consumption per tonne of paper[24]



Source: ODYSSEE

Differences among countries depend on the level of pulp production. Countries which are exporting pulp, such as Sweden and Finland, have the highest values.

Figure 23: Impact of the pulp/paper production ratio on the specific consumption of paper



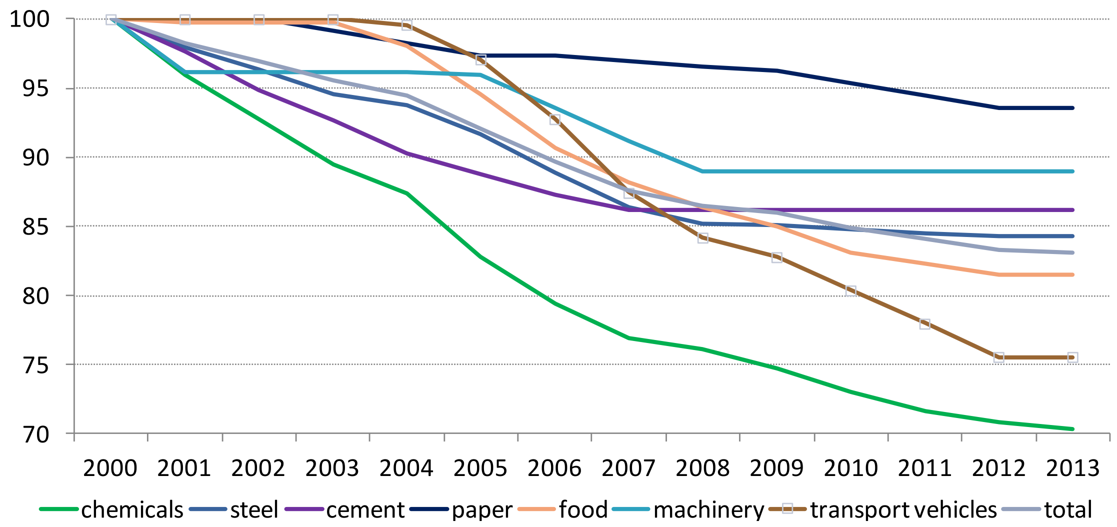
[24] Only countries with a production over 2 Mt are shown.

Energy efficiency has improved by 1.4%/year in industry in the EU since 2000.

Energy efficiency progress in the industry sector as a whole is measured in ODYSSEE with an index called ODEX. This index is calculated by weighting trends in the specific energy consumption indices of 14 individual branches, using as weight their share in the total industry consumption.

There has been a much slower energy efficiency progress since the recession in 2007 (0.9%/year from 2007 to 2013 compared to 1.9%/year from 2000 to 2007 as measured by the rate of decrease of ODEX), because of a slower progress in most branches and even no more energy efficiency improvement for some of others (e.g. steel, cement, machinery). The average energy efficiency progress in industry between 2000 and 2013 has been 1.4%/year on average (-17%) (Figure 24). The flat lines in industrial ODEX indicate the time periods when the technical ODEX has not been improving (for example due to low capacity use which increases apparent specific energy consumption).

Figure 24: Energy efficiency index in industry (EU, 2000-2013)

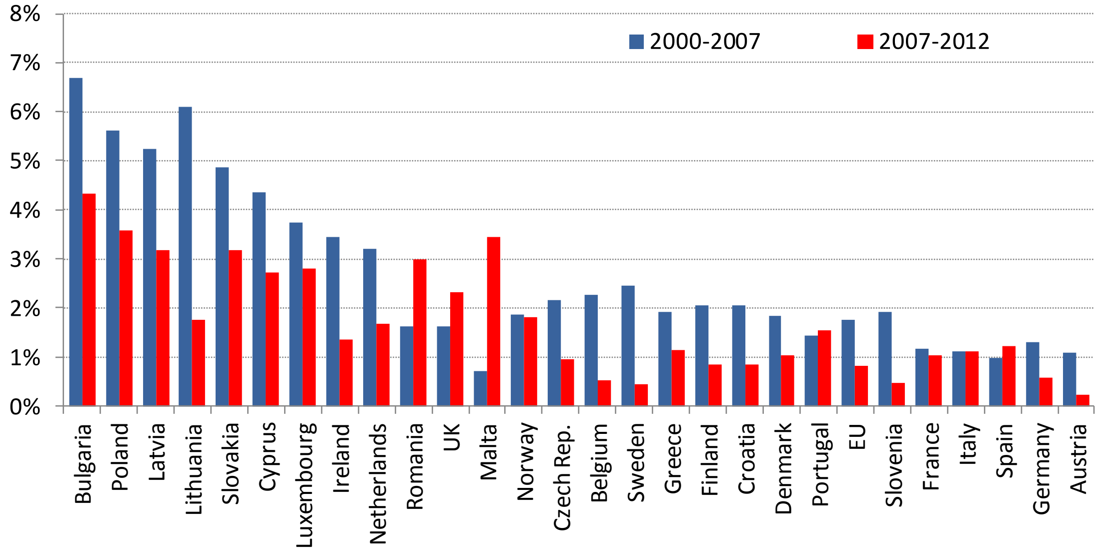


Source: ODYSSEE

Energy efficiency improved quite unevenly across countries over the period 2000-2012[25]: from above 4%/year in Bulgaria, Lithuania, Poland and Estonia; in a range of 2 to 4% in 6 countries (e.g. Cyprus, Romania, The Netherlands, Norway, UK and Latvia). As for the EU as a whole, a deterioration of energy efficiency is observed since 2007 in almost all countries due to the recession (Figure 25).

[25] The year 2013 is not yet available for all EU countries.

Figure 25: Energy efficiency trends in industry in EU countries (%/year)

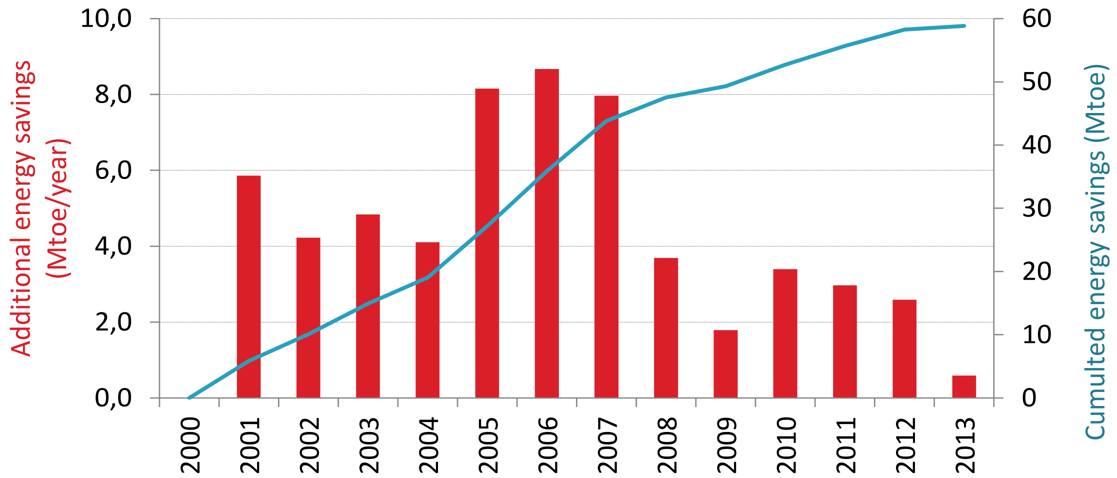


Source: ODYSSEE

The annual additional volume of energy savings has been divided by 2 since 2007

The energy efficiency progress resulted in energy savings that reached 60 Mtoe in 2013 in industry compared to 2000: without energy efficiency improvement, energy consumption would have been 60 Mtoe higher. However, because the economic crisis, the annual volume of energy savings has more than halved since 2007, from an average of 6.3 Mtoe/year over 2000-2007 to 2.5 Mtoe/year after (Figure 26).

Figure 26: Additional annual energy savings in industry (EU)



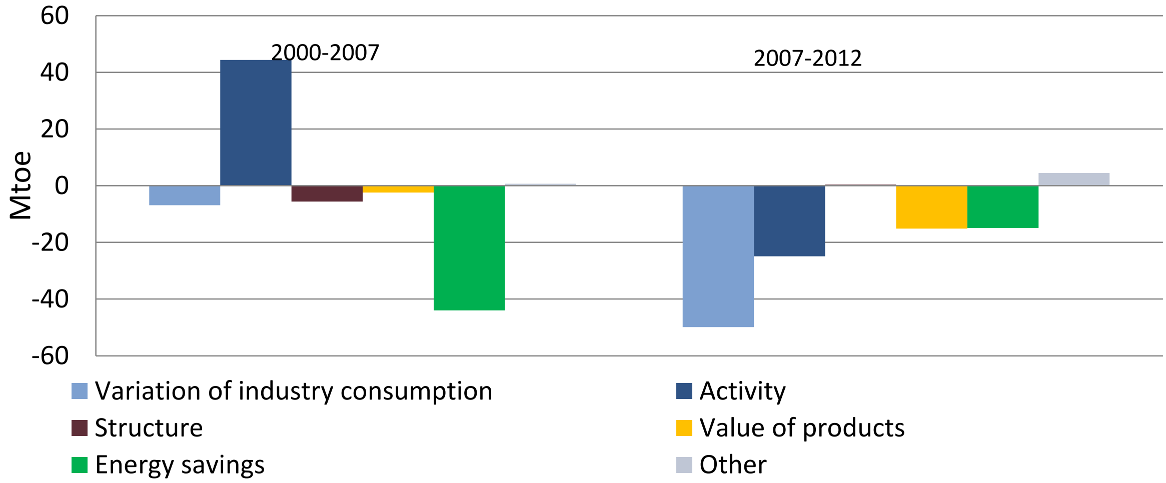
Source: ODYSSEE

3.2. DRIVERS OF ENERGY CONSUMPTION VARIATION

Above 50% of the consumption reduction since 2007 is linked to the recession and one quarter to energy savings

Since 2007 most factors contributed to decrease industrial energy consumption: more than half of the 50 Mtoe consumption reduction between 2007 and 2012 is explained by the industrial recession and the rest equally by energy savings and higher production value (Figure 27). Between 2000 and 2007, the stability of consumption was the result of the balance between the activity effect and energy savings of 44 Mtoe each.

Figure 27: Drivers of industry consumption variation: before and after the crisis



Source: ODYSSEE decomposition facility[26]

[26] http://www.indicators.odyssee-mure.eu/decomposition.html

4. TRANSPORT

4.1. TRENDS IN ENERGY CONSUMPTION AND TRAFFIC

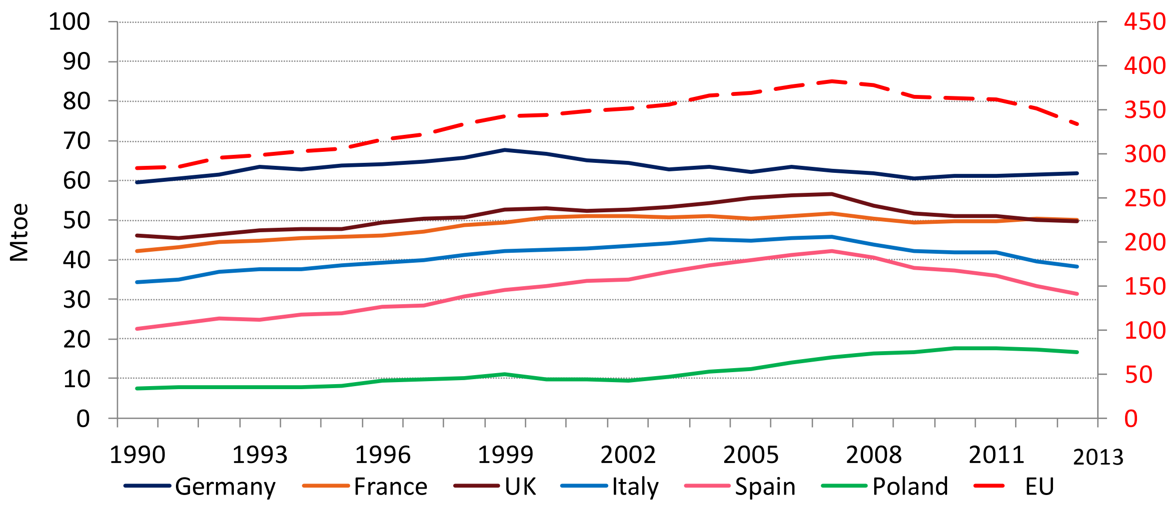
Decrease of transport consumption since 2007

The energy consumption of the transport sector has been decreasing quite rapidly since 2007 at EU level (by 1.6%/year from 2007 to 2013). This trend is mainly explained by a stable or decreasing consumption in the five largest EU countries: stability in Germany since 2005 and France since 2000 and decrease in UK, Spain and Italy with the economic recession (by 4.5 and 2.6%/year for Spain and Italy respectively) (Figure 28).

As a result of these trends, consumption in 2013 was almost at the same level as in 2000 at EU level and in France and between 3 and 10% below in Germany, Italy, UK and Spain. This trend has certainly also been enhanced by the economic crisis but a look to more advanced economies such as Germany or France, the saturation trends are visible already in the years preceding the crisis, while Poland was still on a growth path for transport energy consumption until recently, as this country is still in a catching-up process.

In some new member countries however, there was still a regular progression (e.g. by around 2%/year in Poland, Romania, or Slovenia). In some countries, consumption has been contracting very rapidly (e.g. by 5-6%/year in Greece, Ireland and Latvia).

Figure 28: Energy consumption of the transport sector[27]



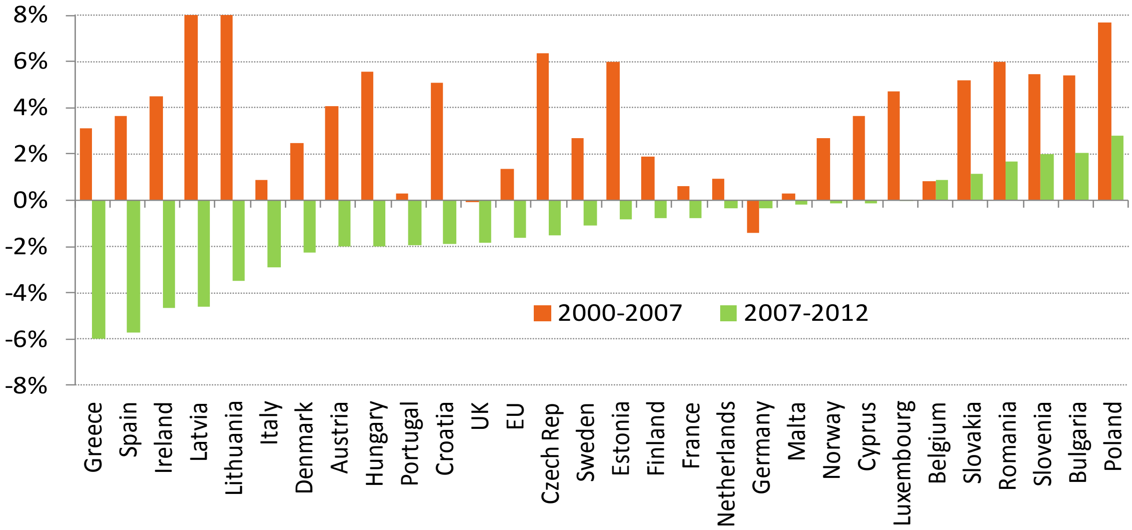
Source: ODYSSEE

[27] Transport consumption includes international air transport (Eurostat definition).

Cars account for almost half of the sector's total consumption (47% in 2013); trucks and light-duty vehicles arrives in second position with 30% and are followed by domestic and international air transport (14%). The shares of buses, rail transport, water transport and two-wheelers are around 2% each.

In almost all countries, road transport consumption has been decreasing since 2007, except in 6 countries (mostly new MCs) (Figure 29). In countries the most hit by the economic crisis (Greece, Spain, Ireland and Baltic countries), this trend contrasts strongly with the period 2000-2007.

Figure 29: Energy consumption of road transport

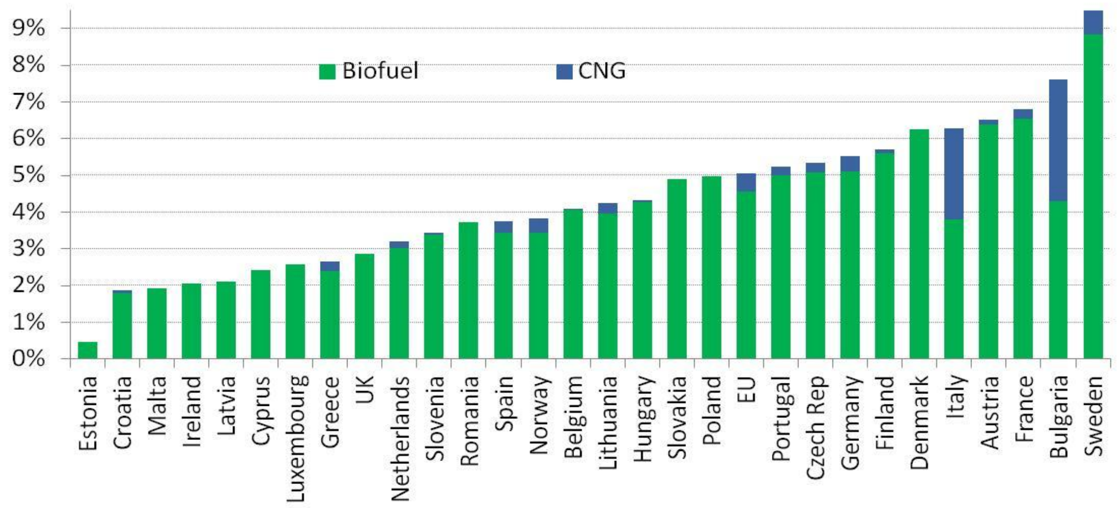


Source: ODYSSEE

Reduction of the high dependence on oil thanks to biofuels

Natural gas and biofuels supplied around 5% of the consumption of road transport in the EU in 2013, of which 90% for biofuels (Figure 30). Sweden is the leader, followed by France and Bulgaria (respectively 9.5%, 7.5% and 7%).

Figure 30: Share of biofuels and natural gas (CNG) in road transport (2013)



Source: ODYSSEE, Eurostat/AIE for natural gas (CNG)

The crisis had a large impact on freight traffic

The traffic of goods was deeply hit by the economic crisis: in 2012, it was 11% lower than in 2007. Passenger traffic was less affected but stopped growing after 2007, due a slight decrease in passenger mobility which just offset demographic growth. The level of mobility is very heterogeneous among countries because of differences in incomes, car ownership levels and country size and density (range of 6500 to 14000 km/year/per car with an EU average around 11000 km). This annual distance varies greatly among countries, from a minimum of around 8000 km to a maximum of 16000 km. The EU average is slightly above 12000 km/year

Car ownership also stopped increasing in most countries with the economic crisis and has even decreased in 4 countries. It varies significantly among countries: from 200-250 cars/1000 inhabitants in Romania and Latvia, to close or above 600 in Malta, Italy and Luxembourg, with an EU average around 465 cars per 1000 inhabitants in 2012.

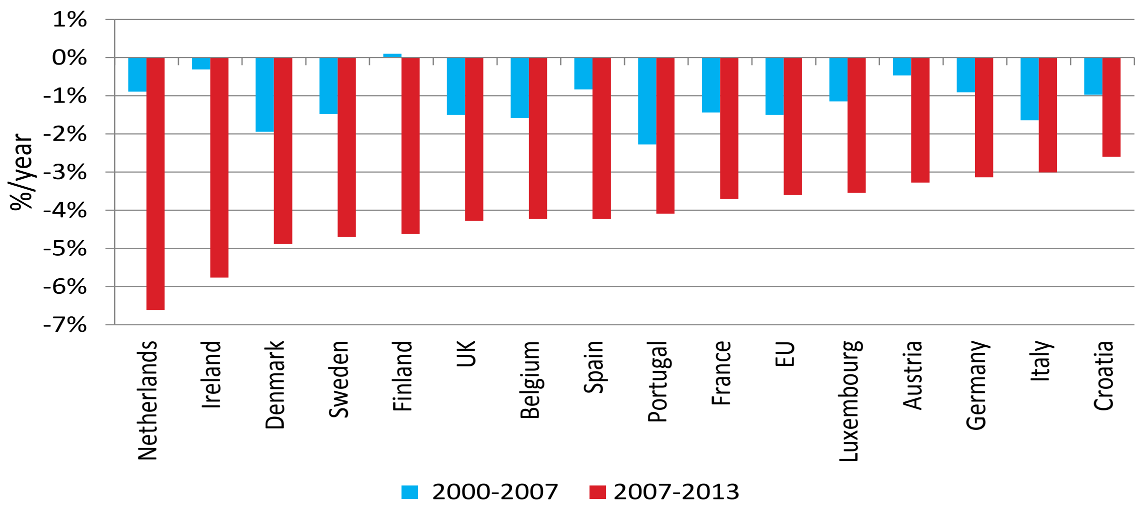
In most countries the average annual distance travelled by cars has been decreasing since 2007; this trend occurred even earlier, around 2000, in most EU-15 countries and in the EU as a whole. Also for the decrease in distances travelled, this is partly triggered by the economic crisis and partly by changing behavioural patterns with more reliance on local exchange instead of large distance travel.

4.2. ENERGY EFFICIENCY TRENDS

Acceleration of the reduction in the specific consumption of new cars since 2007

The specific fuel consumption of new cars has been decreasing very rapidly since 2007, mainly because of EU regulations on labelling and emission standards and national fiscal policies promoting the purchase of low emission cars, and probably also because of higher fuel prices. This acceleration was especially rapid in The Netherlands, Ireland, Sweden, Denmark, Finland and UK, where it was above 4%/year (Figure 31).

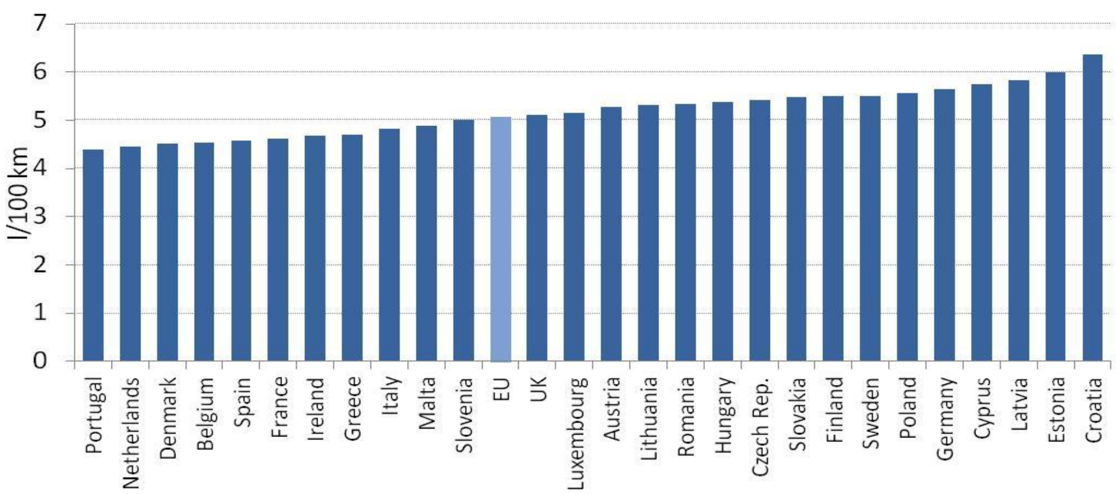
Figure 31: Trends in the specific consumption of new cars in the EU



Source: estimation ODYSSEE

In 2013, the specific consumption of new cars was 2.6 l/100km less than in 1995 at EU level. There are now 11 countries below 5 l/100km with Portugal, the Netherlands and Denmark in the lower range (Figure 32). The high share of diesel cars largely explains the good performances of these countries, where diesel cars made up more than 70% of new registrations. However, the CO_2-standards of the EU for cars are also playing a major role in this development.

Figure 32: Specific consumption of new cars in the EU (2013)

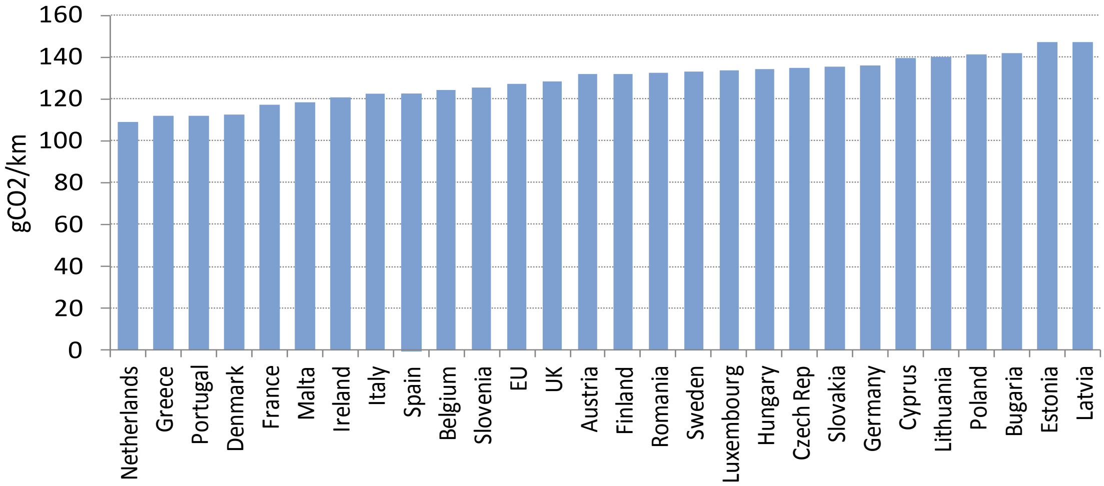


Source: Estimated by Enerdata based on data from EEA on gCO2/km

In 2013, six countries with specific emissions below 120 g CO_2/km for new cars

The average specific CO_2 emissions of new cars sold in the EU decreased from 186 g/km in 1995 to 127 g/km in 2013, which is below the mandatory target of 130 g CO_2/km in 2015 for cars manufacturers. In almost half of countries, new cars had emissions below 120 g CO_2/km in 2013 (Figure 33). In France, Denmark and The Netherlands, this trend can be mainly attributed to new vehicle taxation which gave incentives to buy smaller cars. For Malta, Portugal and Greece, the crisis reinforced the effect of policies.

Figure 33: Average CO_2 emissions of new cars (2013)



Source: EEA

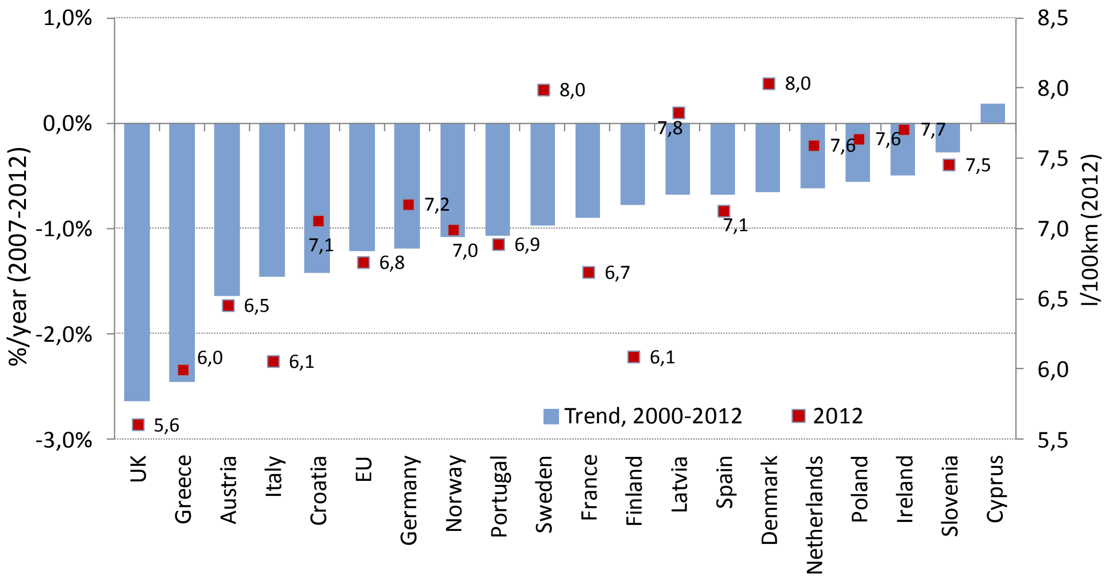
Diverse trends in the decrease of the car fleet's specific consumption

As over 80% of the cars on the road in 2012 have been produced after 2000 and 30% since 2007, the energy efficiency gains achieved with new cars had a direct impact on the average performance of the car fleet, as the oldest and less efficient cars are replaced by new ones. As a result, the average specific consumption of the car fleet decreased from 8.1 l/100 km in 1995 to 6.8 l/100 km in 2012 at EU level (Figure 34). The economic crisis since 2007 has slowed down the flow of new cars and thus the energy efficiency improvements: new registrations represented below 6% of the car fleet in 2012 compared to 8% in 2000.

The average specific consumption of the car fleet has decreased steadily in all EU countries although to varying degrees with trends above 5%/year in The Netherlands, Greece, and Ireland and an average reduction of 1%/year at EU level.

The average specific consumption of the car fleet ranged from a minimum around 6 l/100 km (UK, Italy, Greece, Ireland and Finland) to a maximum of 8 l/100 km (Sweden, Denmark) in 2012. The average car size and horsepower and the share of diesel are the most important factors behind the differences observed. Some of the most performing countries are also those with the fastest improvement (for instance UK or Greece).

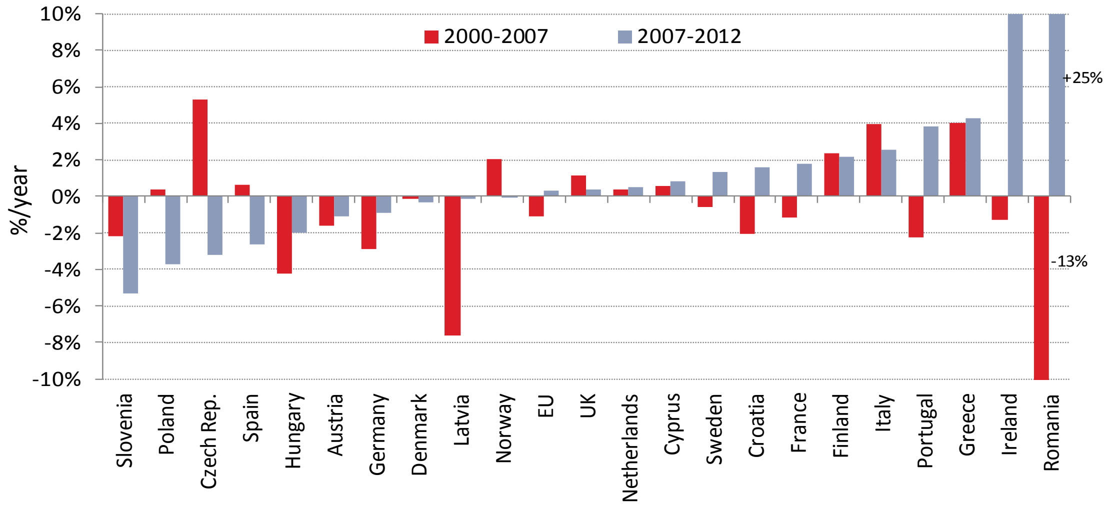
Figure 34: Level and trend in the average specific consumption of cars



Lower efficiency of road freight transport since 2007

Since 2007, the energy consumption per tonne-km has been increasing at EU level and in two thirds of EU countries reflecting a deterioration of the energy efficiency of freight transport: even if the efficiency of vehicles (in terms of l/100 km) did not change, the dramatic fall down in traffic (by 2.5%/year over 2007-2012) led to a less efficient operation of the vehicle fleet (trucks were less loaded and empty running increased) (Figure 35).

Figure 35: Change in the unit consumption of road freight transport per tonne-km

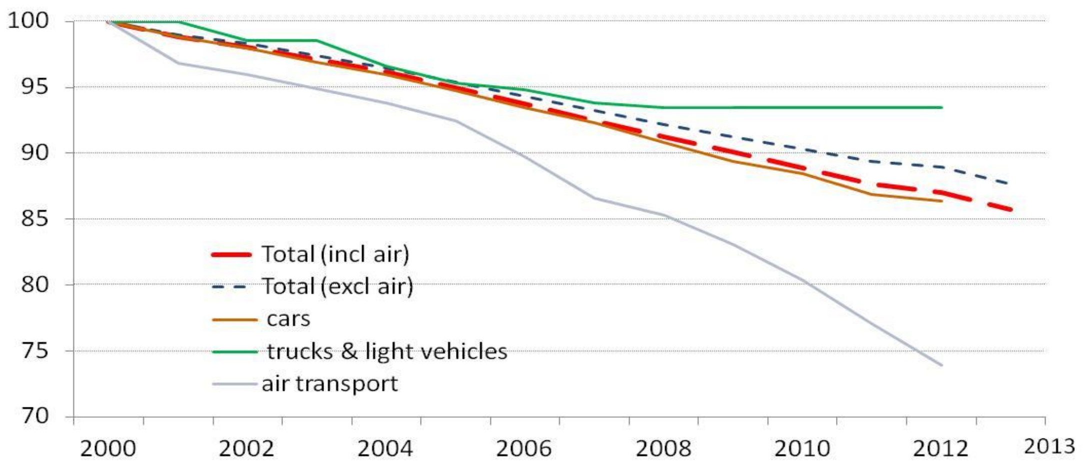


Source: ODYSSEE

Regular improvement of 1.2%/year in the energy efficiency of transport in the EU

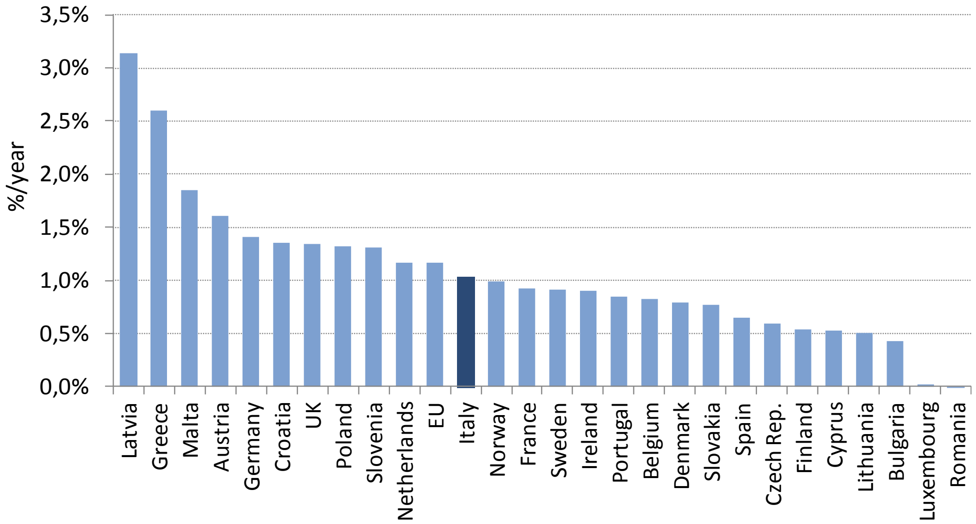
The energy efficiency of transport in the EU improved by 1.2%/year between 2000 and 2013, as measured according to ODEX. Greater progress was achieved by cars and airplanes (Figure 36)[28]. Energy efficiency progress slowed down for trucks and light vehicles since 2005, with even no more progress since 2007 because of the economic crisis, as explained above. In 12 EU countries, the rate of energy efficiency progress was above 1%/year (Figure 37).

Figure 36: Energy efficiency progress in transport in the EU



Source: ODYSSEE

Figure 37: Energy efficiency progress in transport in EU countries



Source: ODYSSEE

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[28] ODEX is a weighted average of the energy efficiency progress of each transport mode based on the following specific consumption: l/100 km for cars, buses and motorcycles; goe per tkm for freight transport; toe/passenger for air transport and goe per pkm for passenger rail. Only the trends of the main modes are shown.

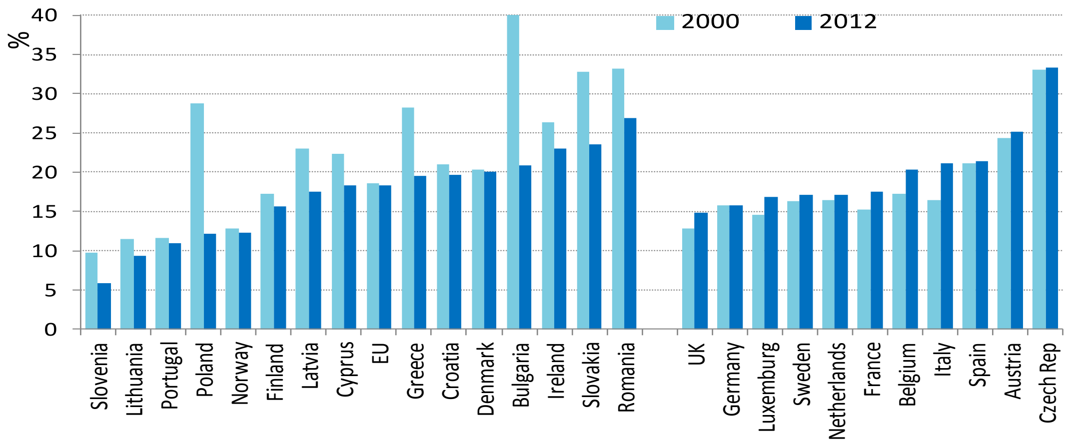
4.3. TRENDS IN MODAL SHIFT FOR PASSENGER TRANSPORT

Energy efficiency improvements in transport can come from more efficient vehicles, but also from a shift of part of the traffic from road (cars or trucks) to more efficient modes: public transport for passengers (rail, metro, buses), or rail and water for goods. Indeed, all countries are implementing measures to change the present modal split that is dominated by cars and trucks.

Stable share of public transport at EU level

At EU level the share of public transport in total passenger traffic was the same in 2012 as in 2000 (18.5%) (Figure 38). This stability is the result of opposite trends with a decrease in the majority of countries but an increase in 11 countries, among which the largest countries. Four countries have a share of public transport over 20%: Italy, Spain, Austria and The Czech Republic. The highest progression of public transport is observed in Italy (+ 4 points), Belgium (+3) France, UK, Luxembourg (+2). The decline of public transport is the highest in new member countries (especially in Poland, Latvia, Slovakia and Bulgaria).

Figure 38: Share of public transport in passenger traffic[29]



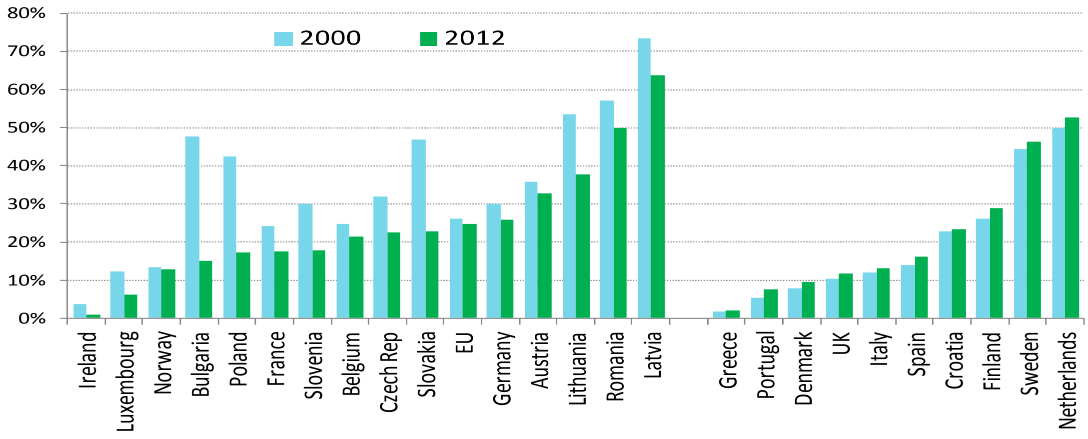
Source: ODYSSEE

For freight transport, the share of rail and water is decreasing in most countries; in other words, the trend is moving in the opposite direction to the intention of policy makers to promote public transport (Figure 39). The greatest reduction can be seen in new member countries, especially in Poland, Slovakia and Bulgaria. The share of rail and water transport has slightly increased or remained stable in seven countries. The Netherlands and Sweden are the countries with the highest share of rail and water transport (respectively 53 and 46%) and are among the few countries where this share is progressing. In 2012 the share of rail and water varied greatly among

[29] Traffic measured in passenger-km.

countries, from less than 10% for Greece and Ireland to above 50% for Romania, the Netherlands and Latvia.

Figure 39: Share of rail and water in total freight traffic



Source: ODYSSEE

5. BUILDINGS[30]

5.1 TRENDS IN HOUSEHOLD ENERGY CONSUMPTION

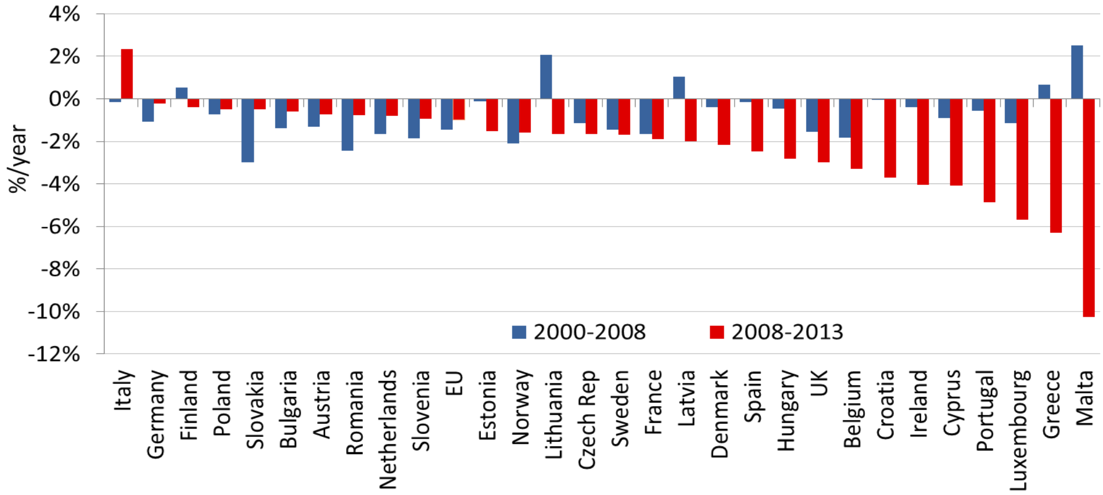
Regular decrease in the energy consumption per dwelling

The household energy consumption per dwelling has been decreasing constantly at the EU level and in most EU countries since 2000 (average rate of 1.5%/year for the EU average). This trend is explained by energy efficiency improvements driven by various types of policy measures and higher energy prices since 2004 (+64%) and, since 2008, by the recession (household income at the same level in 2013 as in 2008). The decreasing trend was especially rapid in 5 countries (Ireland, Cyprus, Portugal, Luxembourg and Malta), above 4%/year (Figure 40).

Since 2008, decrease of electricity consumption per dwelling in many countries

Electricity consumption per dwelling has been decreasing since 2008 in 19 countries and at the EU level (-0.4%/year), with a strong contraction in Cyprus, Croatia and Ireland (over 3%/year). In 10 countries, there has been a progression despite the recession, especially in some southern countries (Spain and Greece) due to air conditioning, as well as in Finland, Luxembourg, Romania, Bulgaria and Estonia (Figure 41).

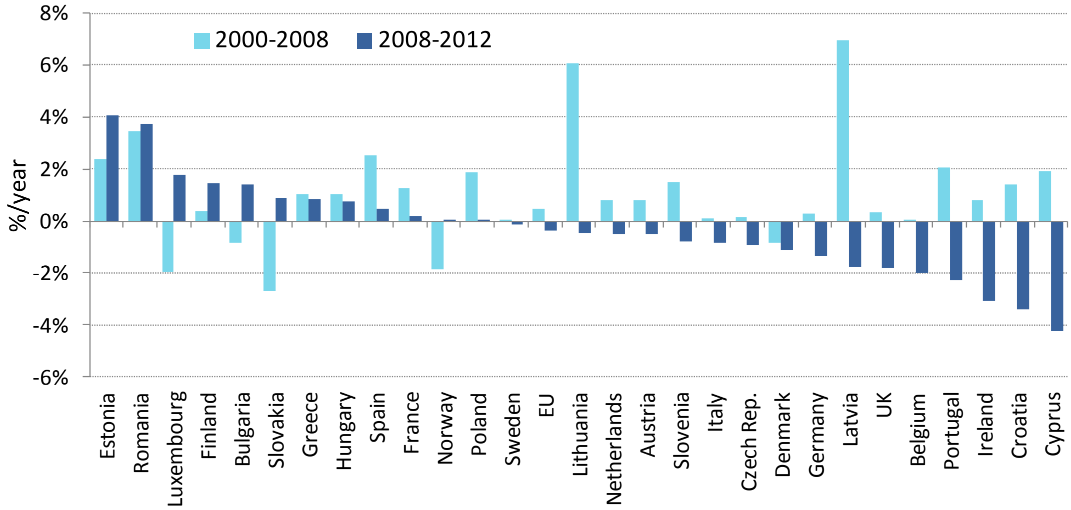
Figure 40: Trend in the household energy consumption per dwelling



Source: ODYSSEE; consumption at normal climate

[30] All indicators on total energy use or on heating shown in the report are temperature corrected, i.e., at normal climate. The increase in Italy is due to a revision of the biomass consumption in recent years

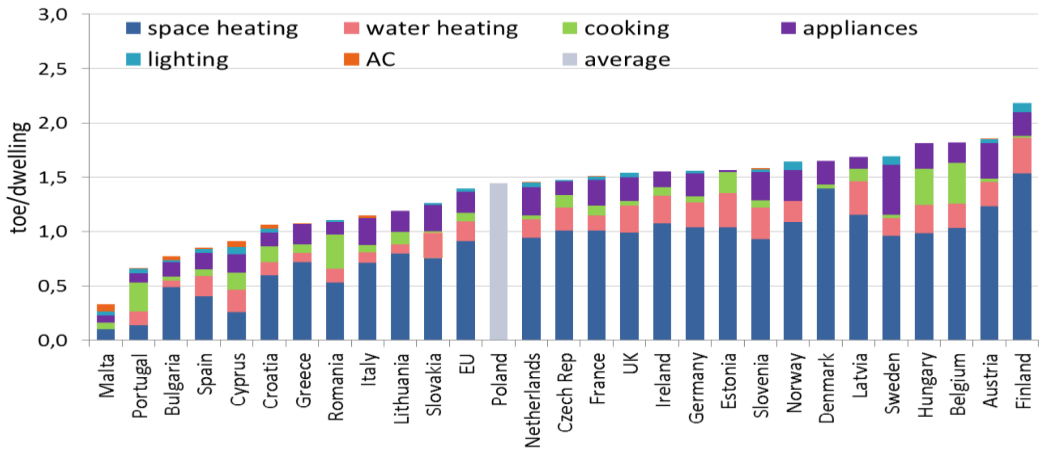
Figure 41: Trends in electricity consumption per dwelling



Source: ODYSSEE

Space heating is the most important end-use in the residential sector: in a range of 60-80% of the total household consumption, apart from the Mediterranean countries (67% for the EU average) (Figure 42)[31]. Water heating ranks second with a quite stable share (13%). Electrical appliances are having a greater importance: their share has increased from 9 to 11%. The highest share for appliances is found in Sweden (25%), then Malta, Cyprus and Spain (around 20%). Cooking represents 6% of the total and lighting 2%. Air conditioning only represents 0.5% of the consumption at EU level, but almost 20% in Malta and around 5% in Bulgaria, Cyprus and Croatia.

Figure 42: Breakdown of household energy use by end-use (2012)



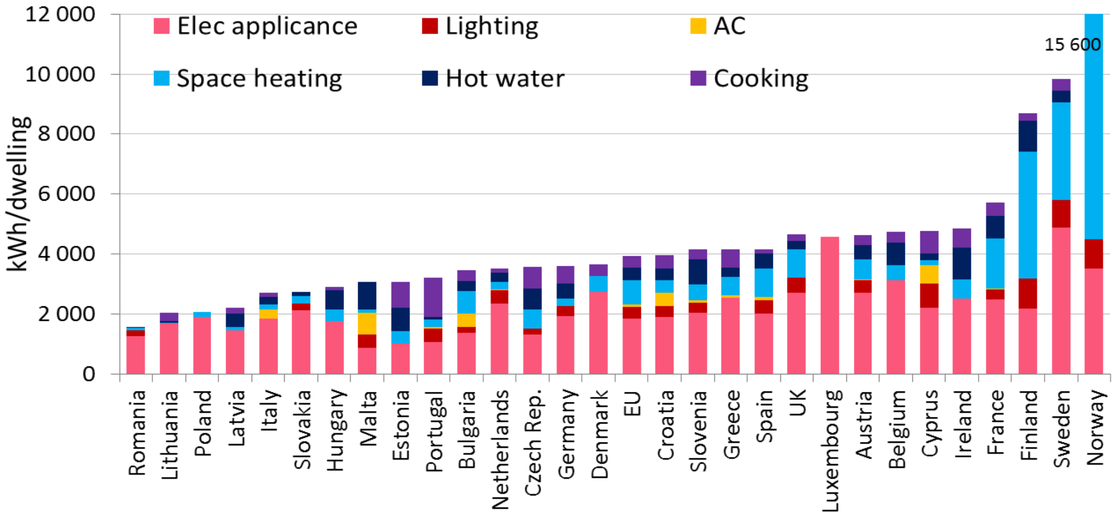
Source: ODYSSEE

[31] In Malta, Cyprus and Portugal the share of space heating is below 30% and just below 50% in Spain.

Large electricity consumption for some countries is due to space heating

EU households consume on average around 4000 kWh of electricity per dwelling (Figure 43).

Figure 43: Average electricity consumption per dwelling (2012)



Source: ODYSSEE; consumption at normal climate for space heating

Electricity uses are usually divided into two parts: thermal uses, where electricity compete with other fuels (space and water heating and cooking), and captive uses for which only electricity is used. The largest part, 2300 kWh (around 60%), concerns captive uses, i.e., electrical appliances[32], lighting and air conditioning. The consumption for captive uses varies significantly among countries, from around 1500 kWh for Romania and the Baltic countries to 3800 kWh for Cyprus, Malta, Sweden and Finland and even 4600 kWh in Norway.

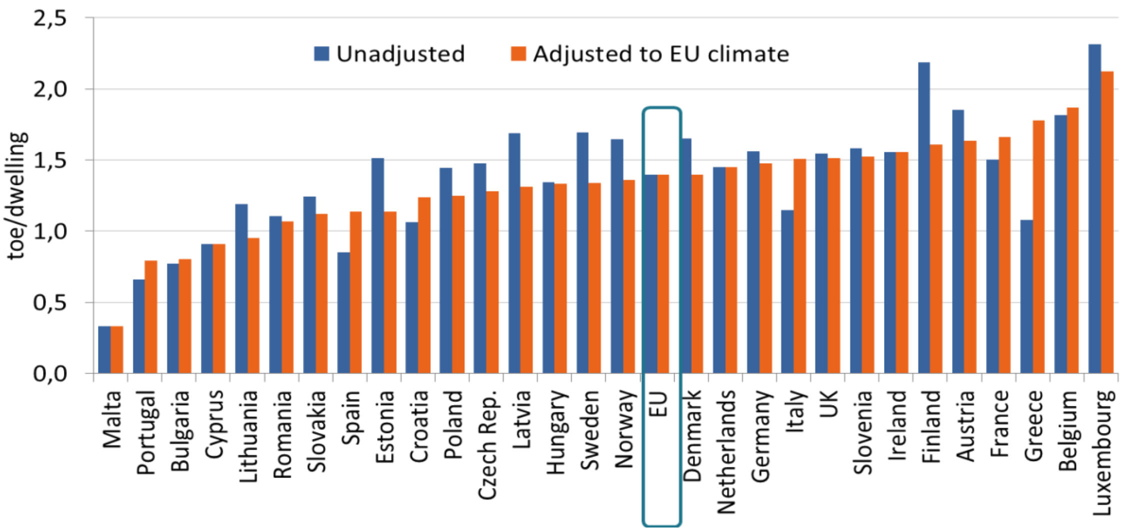
Thermal uses of electricity (space heating, cooking and water heating) are quite important in Norway, Finland, Estonia and the Czech Republic (over 60%), and to a lesser extent, in Portugal, France and Ireland (around 50%).

Large differences in the energy consumption per dwelling among countries

Given the high share of heating, the comparison between countries is more relevant if the heating consumption is adjusted to the same climate. After adjustment to the EU average climate, Luxembourg and Belgium turn out to have the highest consumption, at around 2 toe/dwelling (i.e. 23 000 kWh), compared to 0.8 toe (9 300 kWh) in Portugal and Bulgaria (Figure 44). The differences are still quite large and due to a combination of actors, among which efficiency of dwellings and appliances, lifestyles (size of dwellings, appliance ownership), etc…

[32] Electrical appliances include cold and washing appliances, IT equipment (TV, PC, etc.) and all other small appliances.

Figure 44: Household energy consumption per dwelling (2012)



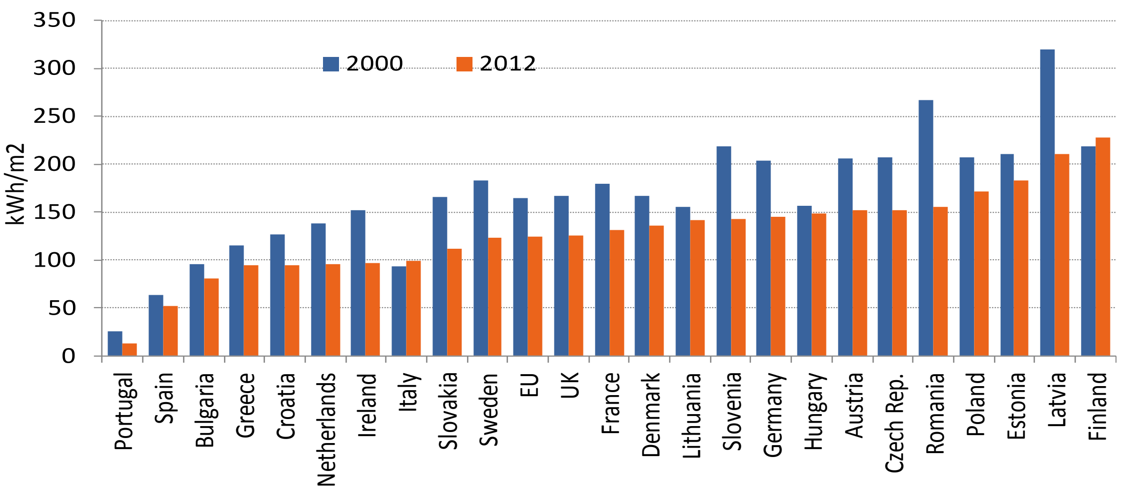
Source: ODYSSEE; Malta and Cyprus no adjustment given their low number of degree days

5.2 HOUSEHOLD SPACE HEATING AND WATER HEATING

Steady improvement in space heating efficiency since 2000

The energy used per m^2 for space heating has decreased steadily in most countries since 2000; the rate of improvement reached around 2.3%/year at the EU level (Figure 45).

Figure 45: Energy use for space heating per m^2[33]



Source: ODYSSEE

[33] Climate corrected, as all indicators related to heating and to all end-uses.

Some EU-15 countries, such as Sweden, the Netherlands and Germany, experienced very strong energy efficiency improvements (around 3%/year). In Portugal, Ireland and some new member countries, such as in Romania, Slovenia, Latvia and Slovakia, the reduction was also very significant (over 3%/year), but was also triggered by behavioural savings linked to higher prices and lower income.

There exist significant disparities among EU countries from 60-90 kWh/m^2 in southern countries with lower heating needs (Malta, Spain, Bulgaria, Greece and Croatia) to 175-235 kWh/m^2 in colder countries such as Estonia, Latvia and Finland.

The reduction in the space heating consumption per m^2 is the result of several factors: the penetration of new dwellings, which are much more efficient than the average stock, the diffusion of more efficient heating appliances and the renovation of existing dwellings.

The low volume of construction limited the impact of standards on new dwellings

According to building regulations, new dwellings consume now in theory 40% less than dwellings built before 1990, on average at EU level. The impact of these efficient new dwellings on the energy performance of the total stock is however still limited as the number of new dwellings built every year corresponds on average to 1.1% of the dwelling stock (average over 2000-2012). This ratio has even dropped to 0.8% of the dwelling stock at the EU level since the economic crisis and is even equal or below 0.5% in several countries (Baltic countries, Bulgaria, Denmark, Germany, Italy and Sweden). Dwellings built since 1990 only represent 23% of the total stock (2013).

Heating systems are getting more efficient

The efficiency of heating appliances is increasing because of the replacement of old boilers with modern boilers and the penetration of more efficient heating systems, such as gas condensing boilers and heat pumps[34]. For condensing boilers the Netherlands have the highest penetration rate (above 70% of the dwelling stock), while UK has experienced a very large penetration from 3% in 2000 to 40% now. For heat pumps, Italy is the leading country (above 60%), followed by Sweden and Finland (around 20%). The diffusion of pellet boilers or stoves instead of traditional wood heating systems also contributed to improve efficiency.

Data on the penetration of efficient equipment are still scarce and only available for a few countries. In order to gather systematicall such type of information, data are displayed in the ODYSSEE market diffusion tool at http://www.indicators.odyssee-mure.eu/market-diffusion.html. Figure 46 provides a view to the ODYSSEE facility on market diffusion (sales of condensing boilers).

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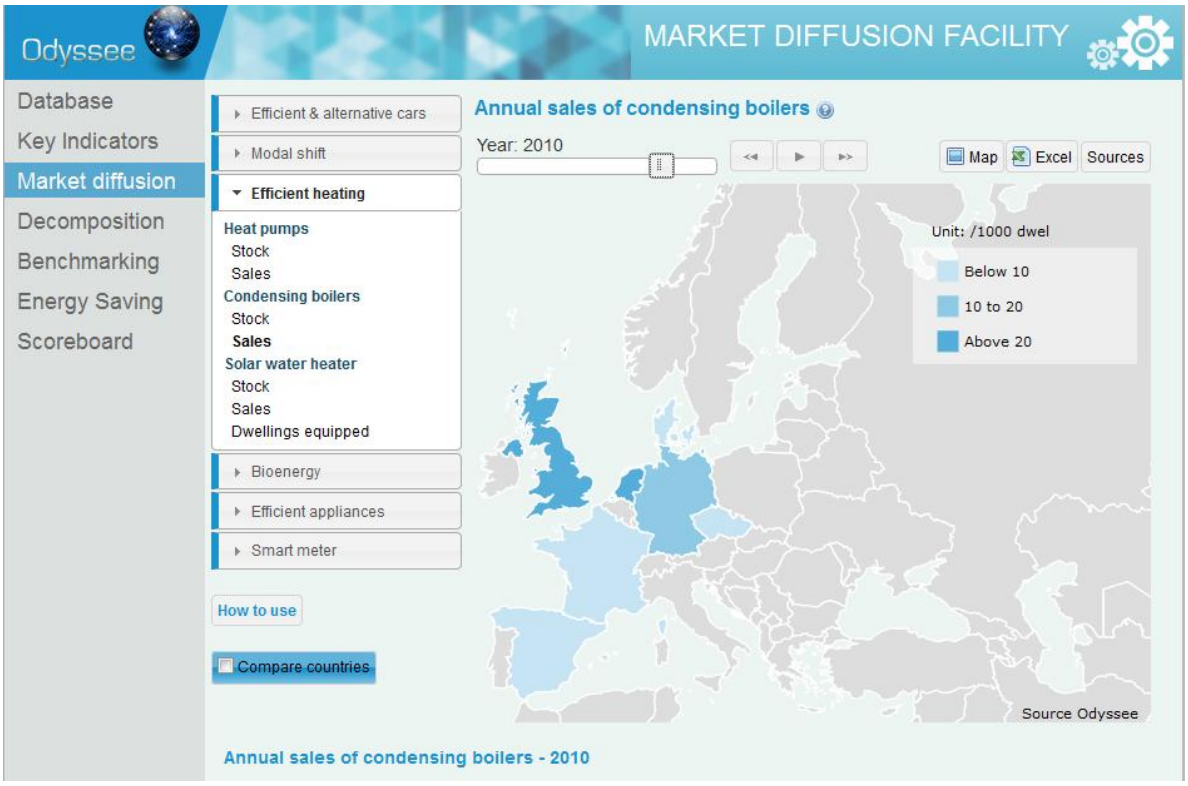
Figure 46: A view to the ODYSSEE facility on market diffusion (sales of condensing boilers)



Source: ODYSSEE, Market Diffusion Facility, http://www.indicators.odyssee-mure.eu/market-diffusion.html

The Netherlands: country with the best performance for heating

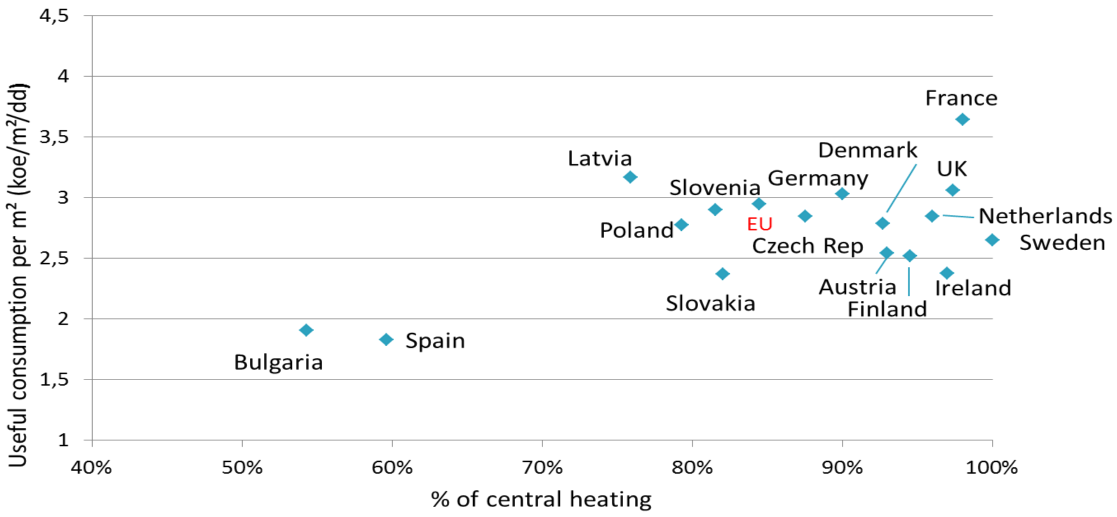
Comparison of heating energy use per m² should take into account country specificities in terms of climate and fuel mix. To do so, it is more meaningful to compare the consumption per degree-day (to account for differences in climate) and in useful energy (to account for differences in fuel mix). The comparison only makes sense for countries with similar levels of comfort, i.e. of central heating penetration. The Netherlands turns out to be the country with the best performance among countries with a large diffusion of central heating: its specific useful space heating consumption per m² and degree-day is 40% lower than for France. Compared to another group of countries with similar levels of diffusion of central heating, namely Austria, Finland, Denmark, Ireland and Sweden, France is still 30% less efficient[35].

[35] See the graph at http://www.odyssee-mure.eu/publications/efficiency-by-sector/household/Household-profile-19.pdf.

Austria, Ireland, Finland and Sweden countries with the most efficient dwellings

If we take into account the diffusion of efficient heating systems and recalculate the useful energy taking into account the average actual efficiency for electric and gas heating, we get another benchmarking graph which shows the relative position of countries in terms of dwellings' efficiency, this time Austria, Ireland, Finland and Sweden turn out to have the most efficient dwellings. The good position of The Netherlands, as indicated previously, is mainly due to the very high penetration of condensing boilers and support for energy efficiency works in existing buildings (Figure 47).

Figure 47: Energy use for space heating per m² and degree day (2012)[36]

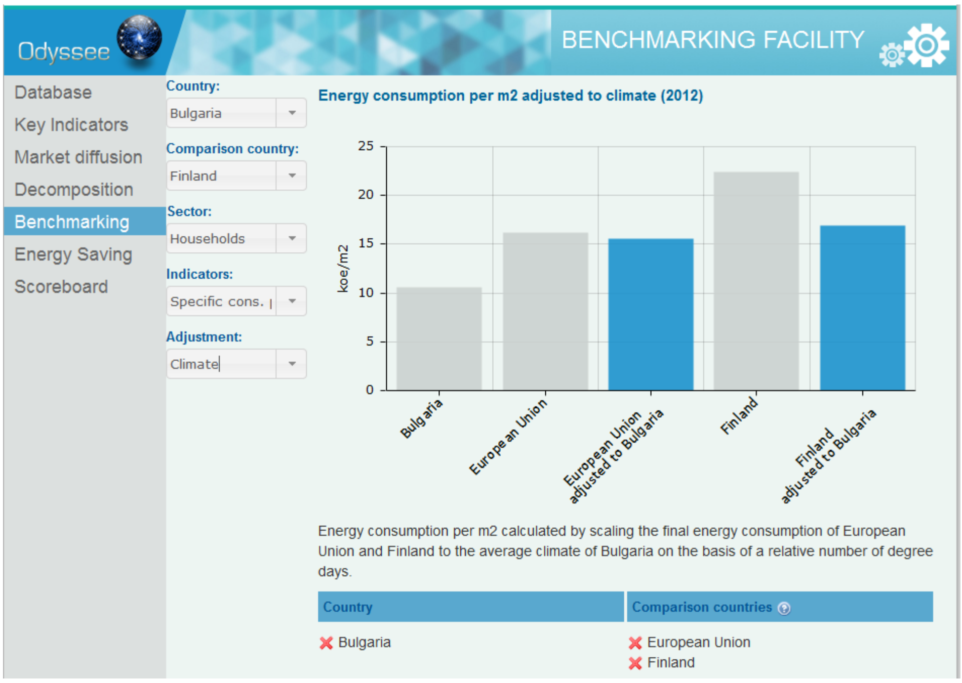


Source: ODYSSEE

For the purpose of such comparisons, the ODYSSEE database has developed a Benchmarking facility which allows comparing or adjusting a country to a comparison country. The objective of this tool is to enable any country to compare easily its energy performance with selected countries by sector and end-uses if available. First, a country is selected, then the comparison country is chosen and finally the indicators on which the comparison occurs and the adjustments to be made. Figure 48 shows that the comparisons are considerably influenced by the adjustments: Finland at the Bulgarian climate consumes considerably less that at the actual climate. Similar adjustments are possible also for other issues like differences in the fuel mix or technological differences, as far as they are not directly related to differences in energy efficiency performance.

[36] Harmonised degree days from Eurostat.

Figure 48: Comparisons among countries with the Benchmarking Facility: Bulgaria compared to Finland and the EU on the specific energy consumption per m2 (residential sector)



Source: ODYSSEE, Benchmarking Facility, http://www.indicators.odyssee-mure.eu/benchmarking.html

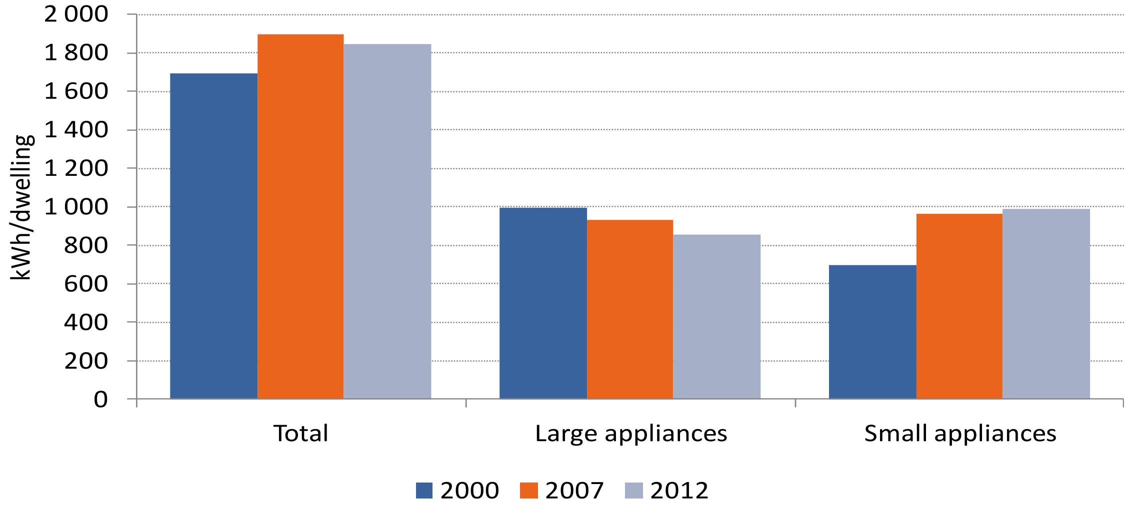
5.3 HOUSEHOLD ELECTRICAL APPLIANCES

Rapid growth of the consumption of small appliances

The average consumption of electrical appliances per dwelling has increased until 2007 and has been slightly decreasing since then, reaching around 1 850 kWh/dwelling in 2012. This trend is the result of two opposite trends: on the one hand, a regular decrease for large appliances[37] (-1.3%/year since 2000) – driven mainly by policies, such as energy labelling and eco-design regulations - and a rapid increase for small appliances until 2007 (by almost 5%/year), followed by a stabilisation since the economic crisis (Figure 49). As a result, in 2012, small appliances represent a higher share of the total consumption than large appliances (54% compared to 41% in 2000). Three large appliance groups, namely refrigerators, dish washers and freezers, represented almost 60% of electricity of the consumption of large appliances in 2012.

[37] Large appliances include cold appliances (i.e. refrigerators and freezers), washing appliances (washing machines, dish washers and dryers) and TVs.

Figure 49: Consumption trend of electrical appliances

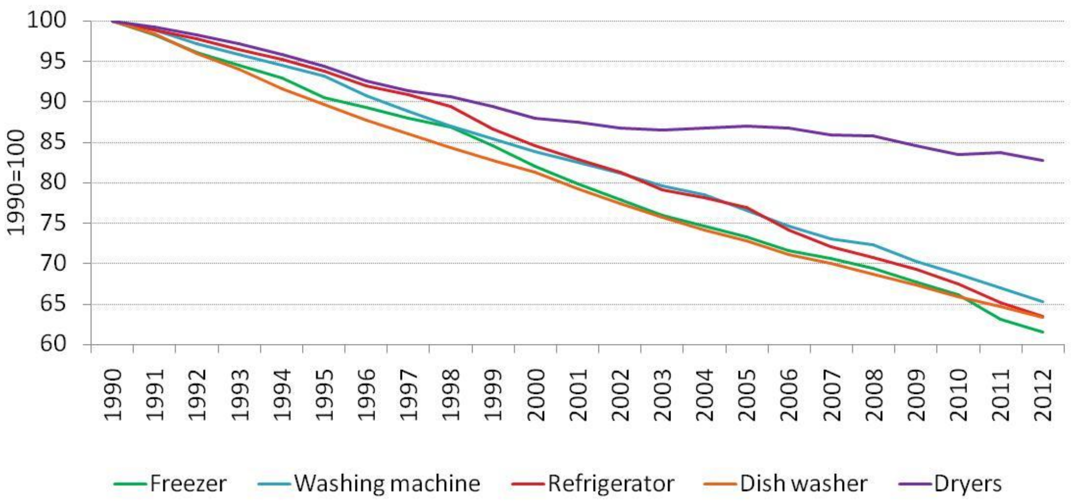


Source: ODYSSEE

More large appliances ... but more efficient

The specific consumption of large appliances (measured in kWh per appliance) has been decreasing steadily since 1990. Efficiency gains almost reached 35% for cold appliances (refrigerators and freezers), washing machines and dish washers; for dryers, gains are lower (around 15%) (Figure 50).

Figure 50: Change in specific consumption of large appliances



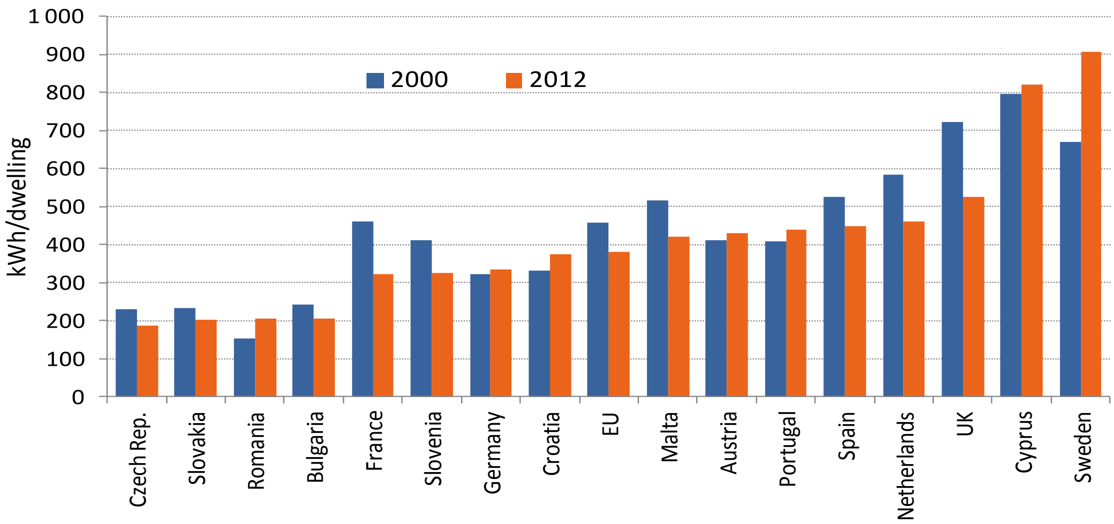
Source: ODYSSEE

The decreasing trend of the specific consumption of large appliances is linked to the diffusion of more efficient new appliances driven by labelling and eco-design regulations. For instance, on average, about 15% of new refrigerators sold in the EU in 2012 were in the highest efficiency classes (labels A++ or A+++) compared to only 2% in 2008[38].

5.4 HOUSEHOLD LIGHTING

Consumption for lighting represents around 10% of total household electricity consumption at EU level (12% in 2000). The specific consumption per dwelling for lighting has decreased since 2000 in half of the EU countries and at the EU level thanks to the diffusion of CFLs and LEDs (by 35% in Sweden, by about 30% in France and UK, by about 20% in the Netherlands and the Czech Republic, and by 17% at EU level) (Figure 51). The large differences between countries in the specific consumption for lighting are mainly explained by differences in the number of lighting points and annual usage hours: it varies from 200 kWh/year in the Czech Republic or Slovakia to 900 kWh/year in Sweden.

Figure 51: Electricity consumption per dwelling for lighting



Source: ODYSSEE

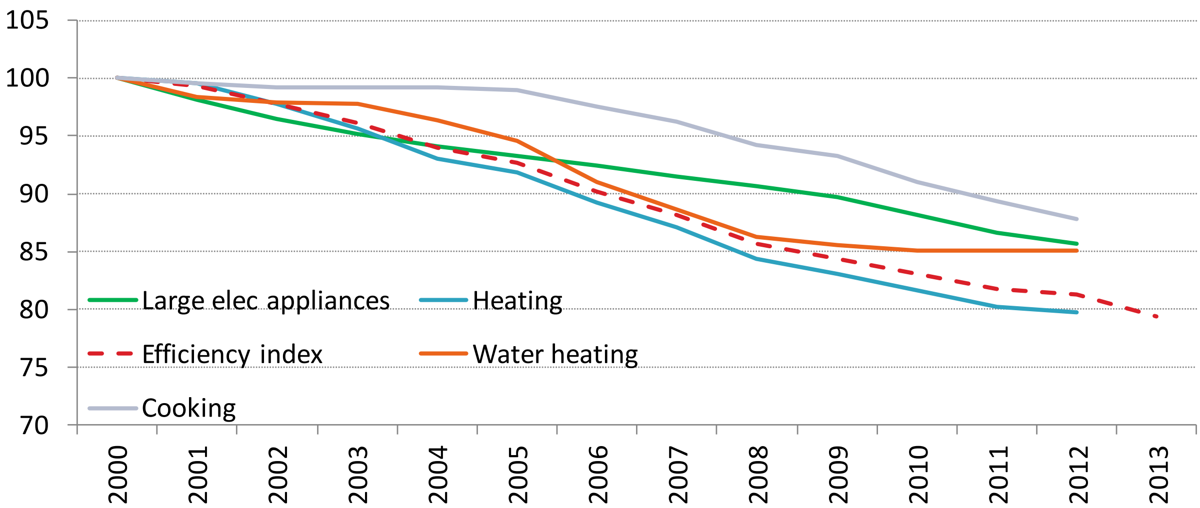
[38] An average A++ refrigerator consumes around 45% less than an A class; for energy class A+++ the saving is around 60%.

5.5 ENERGY EFFICIENCY TRENDS IN THE HOUSEHOLD SECTOR

Household energy efficiency has improved by 18% at EU level since 2000

Energy efficiency for households, as measured with the energy efficiency index ODEX[39], has improved by 21%, or 1.8%/year since 2000 (Figure 52). Most improvements have been registered for space heating (20%), followed by water heating and large appliances (15%). This energy efficiency improvement is largely due to the deployment of more efficient new buildings, new heating appliances and new large electrical appliances (e.g. labels A+ to A++).

Figure 52: Energy efficiency trends for households at EU level



Source: ODYSSEE

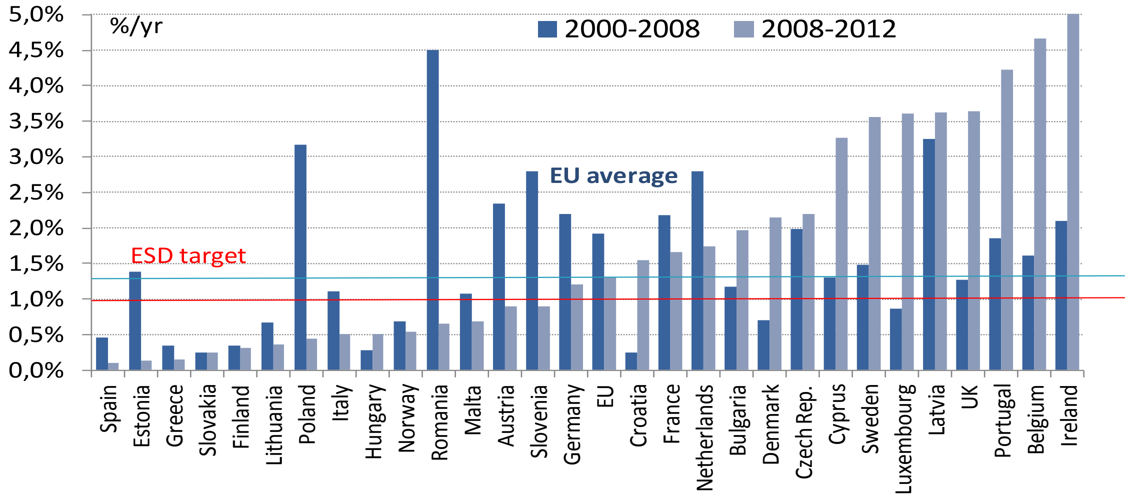
Slow-down of energy efficiency improvement for households since 2008

The pace of energy efficiency improvements has slowed down since the beginning of the economic crisis in most countries and at EU level: 1.5%/year on average at EU level since 2008, against 1.9%/year from 2000 to 2008. Large improvements, twice higher than the EU average, can be seen in Cyprus, Sweden, Luxembourg, Latvia, UK, Portugal, Belgium and Ireland. In the case of Belgium and Ireland, it is worth recalling that their energy consumption per dwelling was among the highest in the EU (Figure 53). The figure also shows the improvement requested by the Energy Service Directive (ESD) which was 1%/year.

[39] ODEX for households weights the energy efficiency progress by end-use and appliance measured, from changes in specific consumption, as follows: heating (koe/m^2), water heating, cooking (toe/dwelling), refrigerators, freezers, washing machine, dishwashers and TVs (kWh/year).

On the opposite, lower improvements are observed in southern countries[40] (Greece, Spain, Italy and Malta) because of the severe impact of the economic recession. Most new Member States also do better than the EU average improvement.

Figure 53: Energy efficiency improvements for households by country



Note: in red the target of the Energy Service Directive (ESD) from 2006 of 1%/year

Source: ODYSSEE

5.6 DRIVERS OF HOUSEHOLD ENERGY CONSUMPTION

Two main factors contributed to increase the household energy consumption:

- Increasing number of dwelling due to population growth and the growing number of one person households in some countries;
- Higher comfort (more household appliances and larger homes).

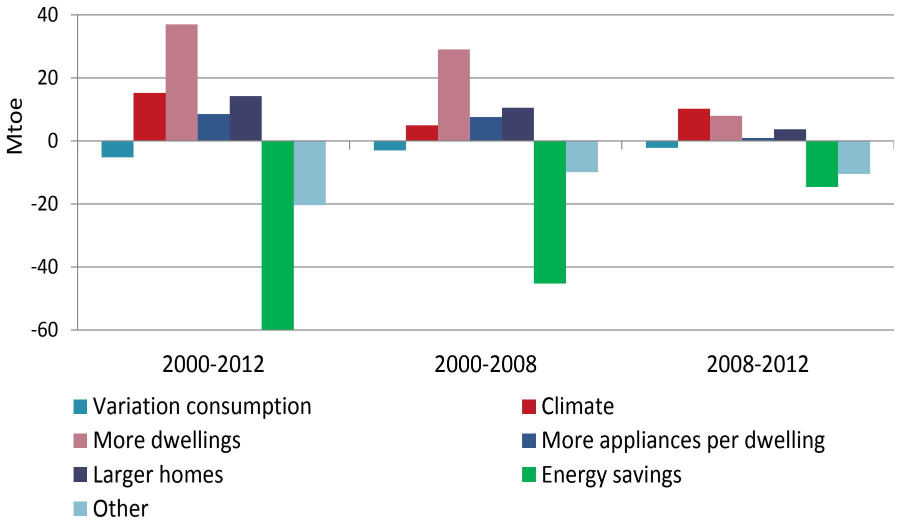
These effects have contributed to increase the household energy consumption at the EU level by 75 Mtoe between 2000 and 2012, of which 52 Mtoe between 2000 and 2008. Since 2008, the impact of these effects was lower (equivalent to 23 Mtoe) (Figure 54).

On the other hand, energy savings, resulting from energy efficiency improvements in the various end-uses, contributed to decrease the household consumption by 60 Mtoe between 2000 and 2012, i.e. by around 5 Mtoe/year. Without these savings the energy consumption of households would have been 60 Mtoe higher. The rhythm of savings has slowed down since the crisis from an average value of 5.7 Mtoe/year before 2008 to 3.6 Mtoe after 2008. In addition, changes in heating behaviour also had an impact on the energy consumption by reducing it by 20 Mtoe over

[40] Low performances may be due to the fact that it is difficult to separate out changes in lifestyle that contribute to increase consumption, from energy efficiency gains.

the same period. This behavioural effect is mainly due to the combined effect of price increases and of the economic recession as consumers paid more attention to their heating expenses and have also reduced their level of comfort. The level of this behavioural effect has doubled since 2008, to 2.6 Mtoe/year compared to 1.2 Mtoe before.

Figure 54: Drivers of the energy consumption variations for households (EU)



Source: ODYSSEE decomposition tool (http://www.indicators.odyssee-mure.eu/ decomposition.html); actual consumption

5.7 ENERGY CONSUMPTION IN SERVICES

The energy consumption of services (also called or tertiary sector) comprises the energy used in public and private buildings (e.g. public and private offices, shops, schools, hospitals). It also includes the energy used for public lighting.

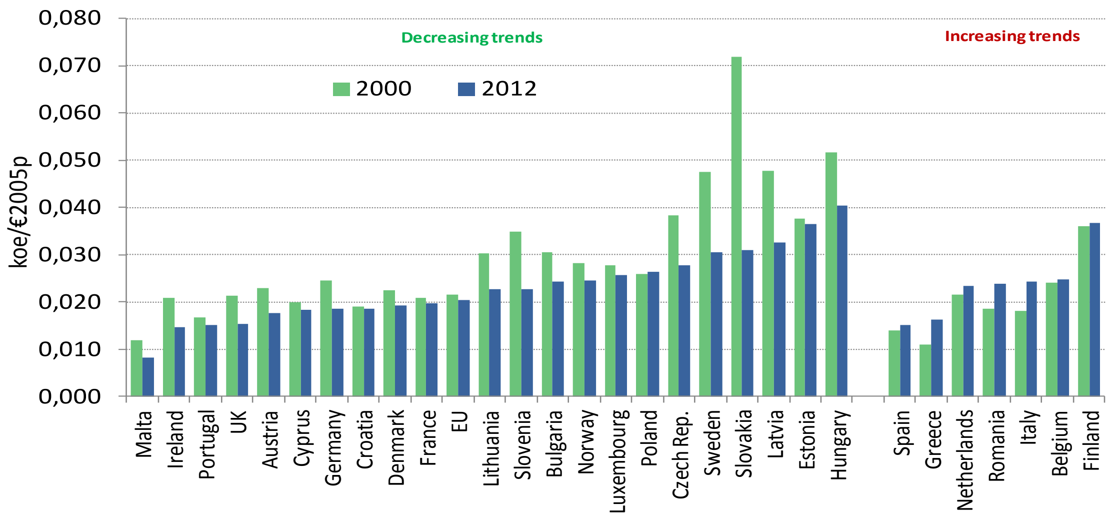
Energy consumption in services increased rather rapidly until the economic crisis, by 2.5%/year between 2000 and 2008 at the EU level; then it has been decreasing by 1.5%/year. Electricity consumption has continued growing after 2008, but at a slower pace, despite a very limited value added growth (1.1%/year, against +3%/year from 2000 to 2008.

More than half of the energy is consumed in the trade sector (wholesale and retail trade) and offices (private and public offices), both contributing 26% of the total.

Decrease in the energy intensity of services in most countries

The energy intensity, i.e. the ratio energy consumption to value added, has decreased in almost ¾ of the countries, with a larger reduction for countries with a high intensity (Figure 55). On the opposite, energy intensity has grown in Greece, Italy and Romania (by over 2%/year).

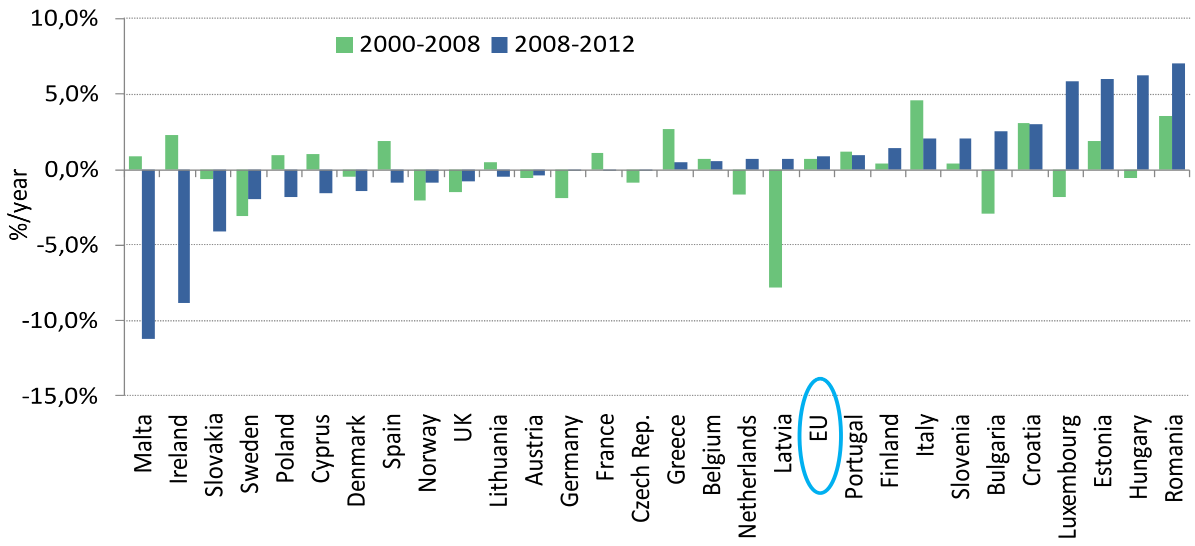
Figure 55: Energy intensity in services



Source: ODYSSEE

The electricity intensity is clearly increasing in most countries, despite the economic recession because of the growing number of new appliances, such as IT devices, linked to the development of internet and of new telecommunication types, as well as to the spread of air conditioning. At EU level, the electricity intensity has increased by 0.9%/year since 2008. In about 10 countries the electricity intensity is however decreasing (Figure 56).

Figure 56: Electricity intensity trends in services

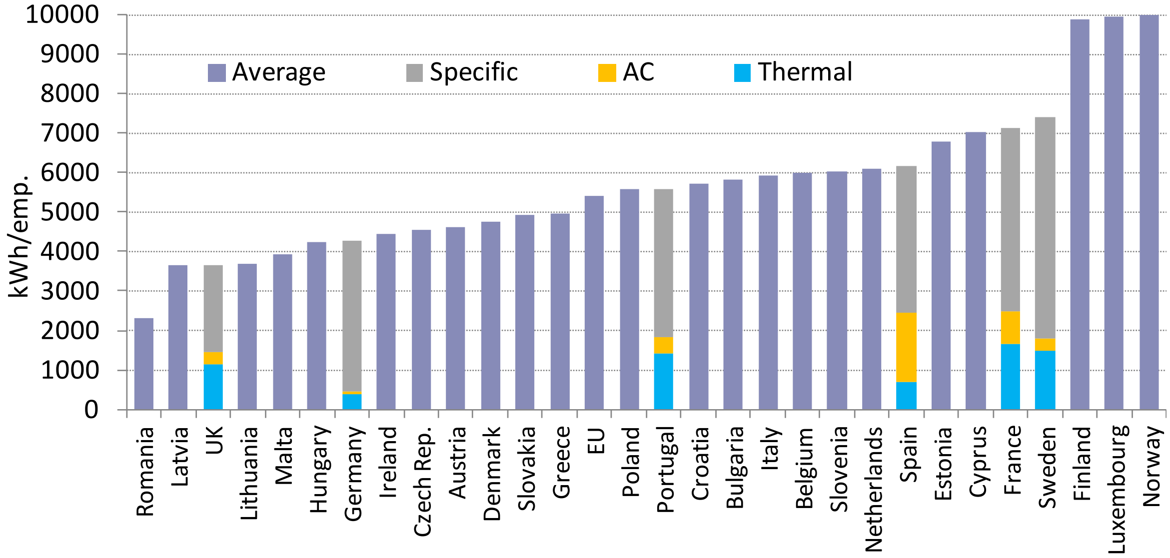


Source: ODYSSEE; space heating excluded

Large use of electricity for space heating in Nordic Countries

Norway, Sweden, Finland and Luxembourg use by far the largest amount of electricity per employee (more than twice the EU average); for Norway and Finland and, to a lesser extent, Sweden, it is has to do with electric heating (Figure 57). Most countries use between 4000 and 7000 kWh per employee. Electricity consumption per employee is increasing in most countries. Large increases can be observed for all southern countries, because of the penetration of air conditioning. The high growth for East European countries is linked to their fast economic growth, at least until the crisis. This indicator is also influenced by the number of employees to provide services that tend to reduce rapidly everywhere and faster in some countries than in others. A reduction in this indicator has an immediate impact on the productivity and the competitivity of an enterprise.

Figure 57: Electricity consumption per employee in services by end use (2012)



Source: ODYSSEE

6. OVERVIEW OF NATIONAL ENERGY EFFICIENCY POLICIES

The MURE database collects around 2350 energy efficiency measures for the 28 EU Member States, Norway and the EU as a whole. This distributes rather evenly across the sectors with the largest number of measures in the residential sector:

- Residential sector: 650 measures
- Transport sector: 523 measures
- Industry sector: 327 measures
- Tertiary sector: 523 measures
- Cross-cutting measures: 333 measures

The following sections provide some aggregate view on sectoral policies. Much more details for each sector, including detailed policy analysis and examples can be found in the three sectoral brochures on households/services, transport and industry.

6.1 PREVAILING MEASURE TYPES BY SECTOR AND COUNTRY

Are there sector- and country specific preferences for energy efficiency measures?

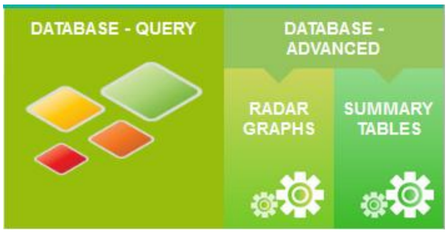
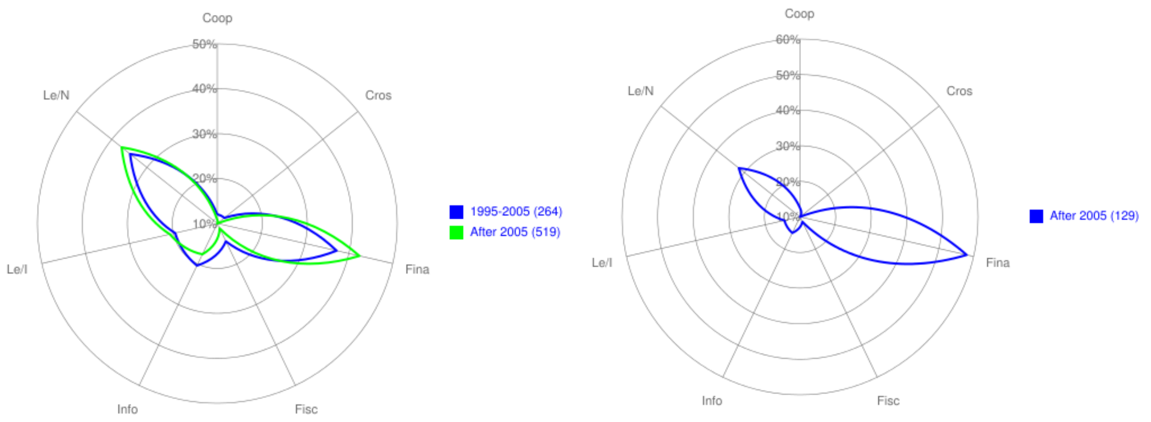


Figure 58 to Figure 61 (Source: MURE) illustrate that each sector has preferential energy efficiency measures. The left side of each graph shows the measures since 1995 (in two periods from 1995-2005 and from 2006 to today). The right hand side shows the pattern for the most recent measures from the third National Energy Efficiency Action Plans NEEAPs (from 2014) and the Art. 7 measures reported end of 2013. Article 7-measures are Energy Saving Obligations and alternative measures reported under Article 7 of the Energy Efficiency Directive 2012/27/EU.

While the residential is dominated by financial and regulatory measures (Figure 58), the transport sector (Figure 59) tackles energy efficiency mostly through a broader set of measures with a focus on infrastructure measures, the industry sector (Figure 60) preferentially uses financial and cooperative measures (such as voluntary agreements) and the tertiary sector relies – next to regulatory and financial measures like the residential sector also on informational measures (Figure 61).

Figure 58: Preferential energy efficiency measures households

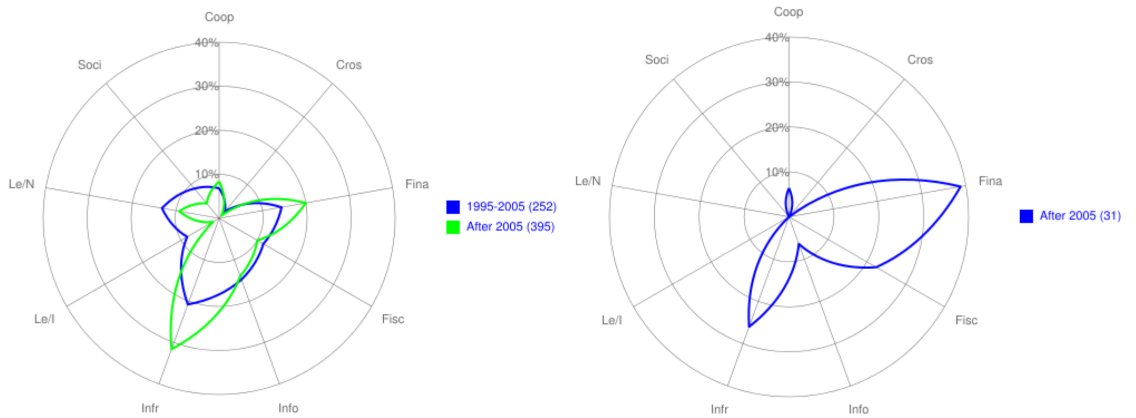
(left all measures from 1995, right NEEAP3 /Art.7 measures)



<u>Legend for both graphs:</u>
Coop: Co-operative Measures
Cros: Cross-cutting with sector-specific characteristics
Fina: Financial
Fisc: Fiscal/Tariffs
Info: Information/Education
Le/I: Legislative/Informative
Le/N: Legislative/Normative

Figure 59: Preferential energy efficiency measures transport sector

(left all measures from 1995, right NEEAP3 /Art.7 measures)



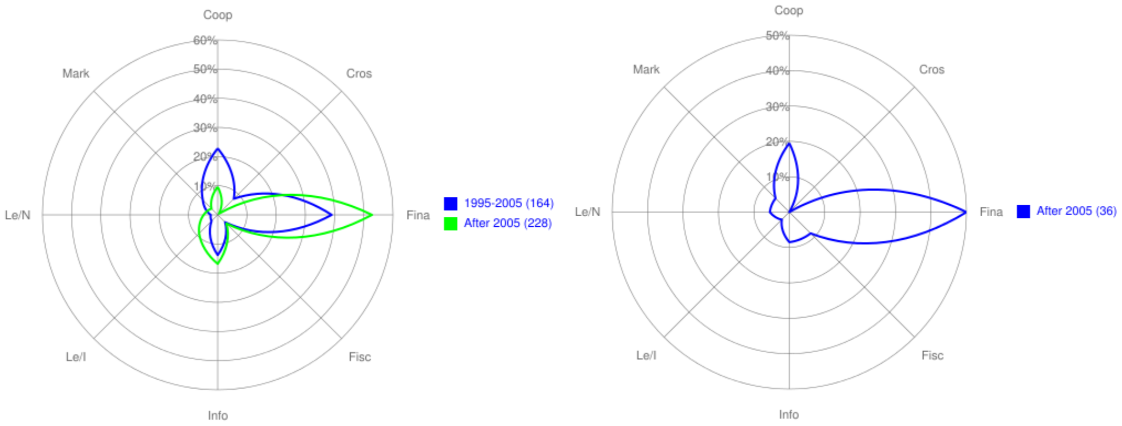
Legend for both graphs:
Coop: Co-operative Measures (voluntary agreements)
Cros: Cross-cutting with sector-specific characteristics
Fina: Financial
Fisc: Fiscal
Info: Information/Education/Training
Infr: Infrastructure
Le/I: Legislative/Informative
Le/N: Legislative/Normative
Soci: SocialPlanning/Organisational (e.g. car sharing)

Note: some measures are associated with several measure types as they may contain different components.

Source: MURE

Figure 60: Preferential energy efficiency measures industry

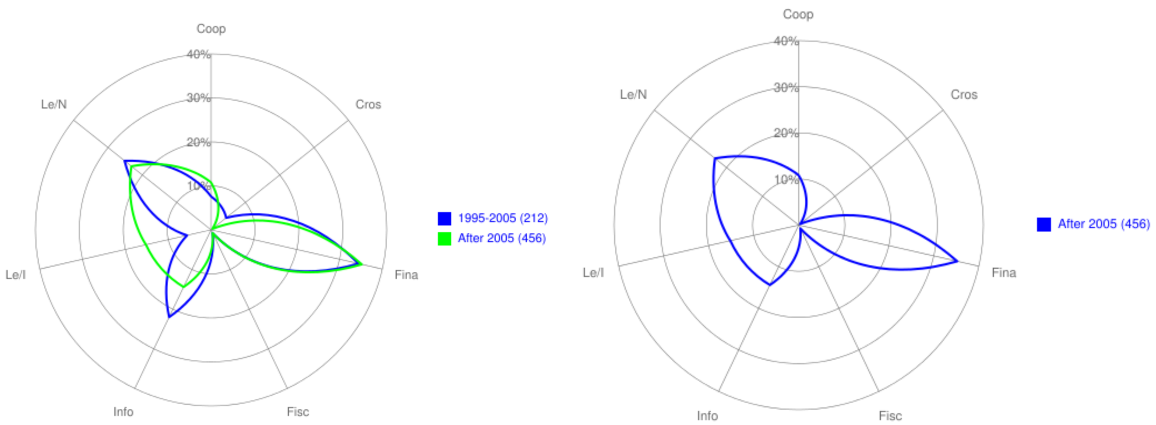
(left all measures from 1995, right NEEAP3 /Art.7 measures)



Legend for both graphs:
Coop: Co-operative Measures (voluntary agreements)
Cros: Cross-cutting with sector-specific characteristics
Fina: Financial
Fisc: Fiscal/Tariffs
Info: Information/Education/Training
Le/I: Legislative/Informative
Le/N: Legislative/Normative
Mark: New Market-based Instruments (e.g. emission trading scheme)

Figure 61: Preferential energy efficiency measures tertiary sector

(left all measures from 1995, right NEEAP3 /Art.7 measures)

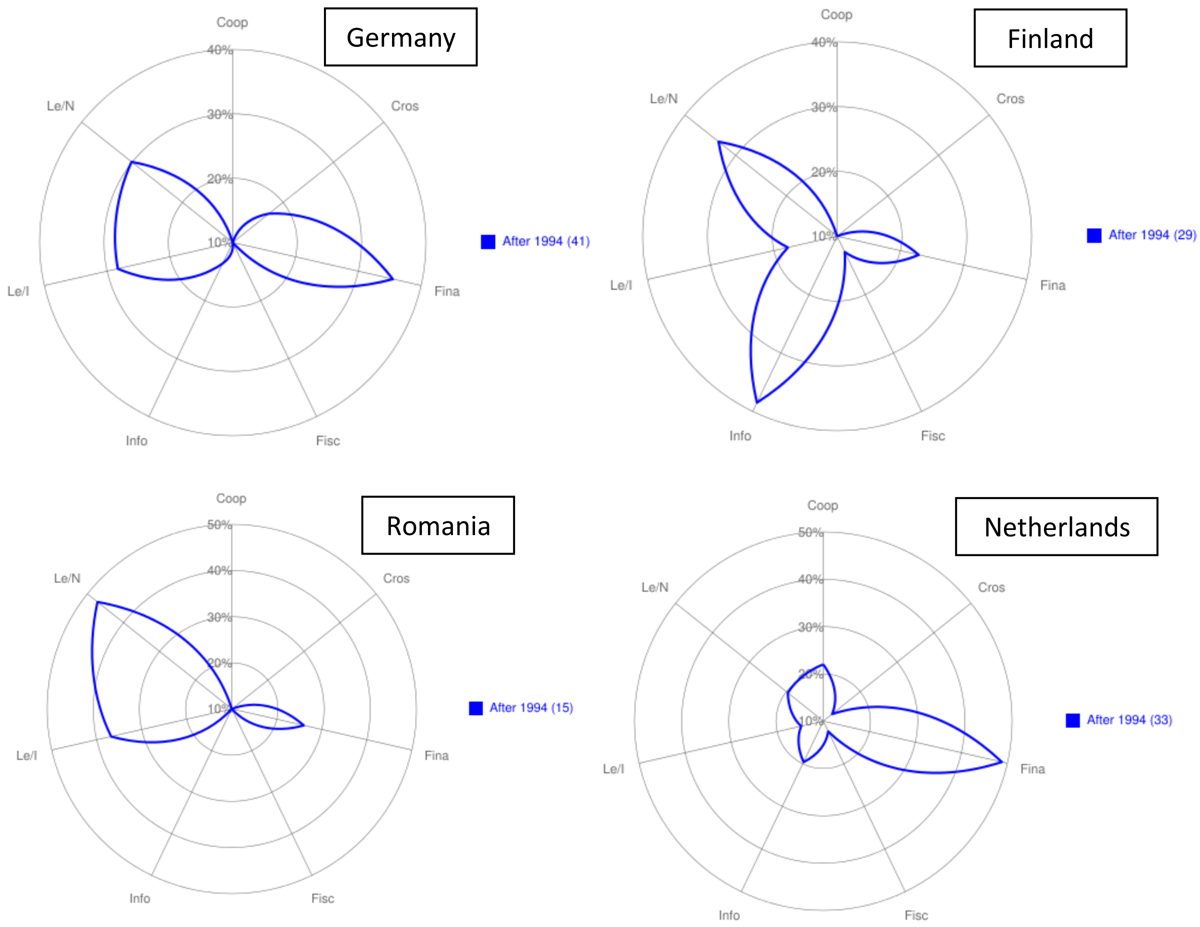


Legend for both graphs:
Coop: Co-operative Measures
Cros: Cross-cutting with sector-specific characteristics
Fina: Financial
Fisc: Fiscal/Tariffs
Info: Information/Education/Training
Le/I: Legislative/Informative
Le/N: Legislative/Normative

Source: MURE

However, across the countries and within a sector there are considerably variations in the approaches. Figure 62 shows how the countries differ in their preferences: for the residential sector (compare to Figure 58): Germany relies strongly on regulatory and financial measures, Finland has a strong focus on informational/motivational measures, Romania trusts strongly in regulatory measures and Netherlands mainly in financial measures. **The reason for this observation may be that due to cultural differences and societal habits, measures have different effectiveness according to the country context. It raises, however, also the question whether the national set of measures can be extended to include other measure types to include other measure types which have not been experienced in the past.**

Figure 62: Country-specific preferential energy efficiency measures households



Legend: see Figure 58

Source: MURE

6.2 MEASURE DYNAMICS OVER TIME

Which dynamics in the types of energy efficiency measures over time?

The focus of energy efficiencies may change over time in one sector while it remains fairly stable for a long time in other sectors:

- According to Figure 58, when comparing the two periods of ten years since 1995 and the newest measures from the third NEEAPs and Art. 7 measures, the focus in the residential sector on financial measures has even strengthened over time.
- In the transport sector (see Figure 59), financial measures have grown in importance in recent time which may be the consequence of the promotion of clean cars.
- In the industry sector financial measures also became more important while cooperative measures such as voluntary agreements lost in strength (Figure 60). New market-based instruments such as emission trading schemes have not become the dominant measure types. The fact that financial measures dominate in the industry sector is linked to the support measures provided to small and medium-sized companies (SMEs).
- In the tertiary sector informational measures seem to have lost importance compared to the period 1995-2005 (Figure 61).

All in all, though there is some dynamics in the mix of measure types, the sectoral focus remains relatively stable. Fiscal measures astonishingly play a little role in the measure mix, except for the transport sector though the NEEAPs seem to improve on this. For example in the household sector only 19 measures since 1995 are fiscal measures but out of this 15 are from the NEEAPs.

6.3 POSSIBLE IMPACT OF THE ECONOMIC CRISIS AND THE RECOVERY ON THE POLICY MIX

Are energy efficiency programmes impacted by economic crises?

The recent economic and financial crisis, from 2008 to 2012, had a profound effect on policy making in Europe[41]. Figure 63 below depicts how the energy efficiency measures for the industrial sector were packaged by the different countries during this period. Those countries hardest hit Ireland, Portugal, Italy, Spain and Greece added merely one financial measure except for Greece which despite being well engulfed by the financial crisis added a few financial measures. Overall, financial measures represent 45% of all measures started during the financial crisis. Measures implemented after the financial crisis, i.e. over 2013-2015, have been packaged by several countries in an order depicted in Figure 64, with a majority being financial measures (55%).

[41]According to Eurostat, the economic crisis started in 2008 and officially ended in the 4th quarter of 2012 http://appsso.eurostat.ec.europa.eu/. 2008 was the first year affected by the economic crisis.

Also a view on the residential sector shows that in countries most struck by the economic crisis financial programmes had been terminated while little new programmes were started, although some of these programmes may have been used to support the economy (Table 1).

Figure 63: Industrial energy efficiency measures added during the economic crisis (2008-2012) by type[42]

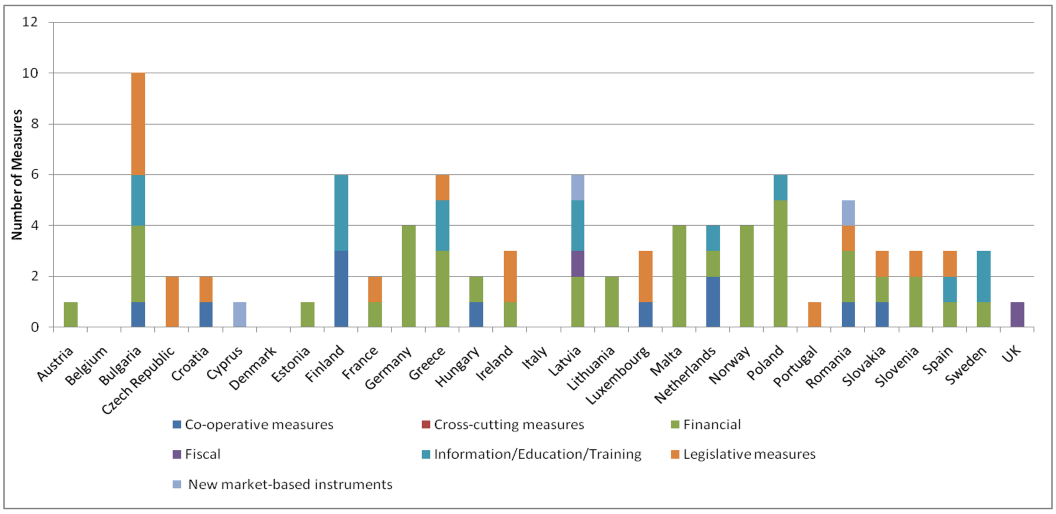
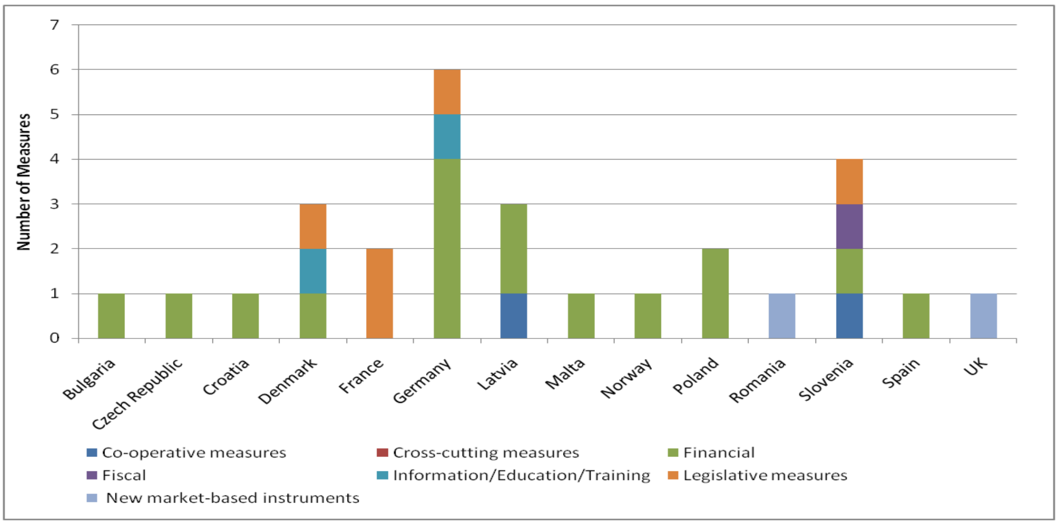


Figure 64: Energy efficiency measures added in the industrial sector since 2013 (after the financial crisis)[43]



Source : MURE database, June 2015

[42]"Unknown" measures and blanks have been excluded. Note on Portugal: In industry Portugal has also financial measure (PPEC – Plan to promote efficiency in the consumption, FEE –Energy Efficiency Fund and Portugal 2020). Partly they are described in the cross-cutting database. The measure mentioned in the figure ("POR 4 - Intensive Energy Consumption Management System (SGCIE) - Decree-Law Nº 71/2008, of 15 April 2008") has several components, notably a fiscal aspect and an information/education/training aspect and continued after 2012 though it was not described in NEEAP3.

[43]"Unknown" measures and "Blanks" have been removed.

Table 1 : Financial subsidy based energy efficiency policy measures for the residential sector in EU Member States most hit by the economic crisis

Code	Measure Title	Status 1)	Starting Year
HOU-SPA6	Aid Programme for the support of solar photovoltaic Energy	C	2000
HOU-SPA10	Aid Programme for the support of solar thermal energy	C	2000
HOU-SPA11	ICO-IDAE Financing Line for Renewable Energies and Energy Efficiency Projects	C	2000
HOU-SPA15	Plan for the Promotion of Renewable Energies in Spain 2000-2010	C	2000
HOU-IRL31	House of Tomorrow	C	2001
HOU-IRL19	Warmer Home Scheme (Low Income Housing Strategy)	C	2002
HOU-SPA18	Action Plan 2005-2007: Household Appliances Renewal Programme	C	2005
HOU-SPA20	Action Plan 2005-2007: Incorporation of efficient equipment in new homes	C	2005
HOU-SPA26	Action Plan 2005-2007: Renovation of the thermal envelope of existing buildings	C	2005
HOU-SPA27	Action Plan 2005-2007: Energy efficiency Improvement of thermal installations in existing buildings	C	2005
HOU-SPA28	Action Plan 2005-2007: Energy efficiency Improvement of indoor lighting in existing buildings	C	2005
HOU-IRL22	The Greener Homes Scheme	C	2006
HOU-IRL38	Low Carbon Homes Scheme	C	2006
HOU-CY6	Scheme for subsidising CFL lamps	O	2007
HOU-IRL32	Micro CHP	-	2008
HOU-POR16	Equipment replacement	O	2008
HOU-POR19	Renewable at the Time: Micro generation	O	2008
HOU-GRE17	"Changing Air-Condition" Program	C	2009
HOU-GRE22	Promotion of Combined heat and power (CHP) and district heating systems- Residential Sector	O	2009
HOU-IRL30	Upgrade of Older Housing Stock - Home Energy Savings Scheme & Housing Aid for Older People	C	2009
HOU-SPA38	IDAE's Financing Lines for Thermal Renewable Energies in Buildings: BIOMCASA-SOLCASA-GEOTCASA	O	2009
HOU-GRE16	"Energy Savings in households" Program	O	2010
HOU-GRE20	Installation of electronic and intelligent metering of electricity and natural gas residential consumers	O	2010
HOU-GRE18	Energy Upgrading of social housing- The "Green Neighborhoods"" Program	O	2011
HOU-IRL42	Better Energy Homes (Residential Retrofit)	O	2011
HOU-SPA22	Action Plan 2011-2020: Improvement of the energy efficiency of the electric appliances stock	C	2011
HOU-SPA30	Action Plan 2011-2020: Renewal of the thermal casing in the existing buildings	C	2011
HOU-SPA31	Action Plan 2011-2020: Energy efficiency improvement of thermal installations in existing buildings.	C	2011
HOU-SPA32	Action Plan 2011-2020: Energy efficiency improvement of indoor lighting in existing buildings	C	2011
HOU-SPA33	Action Plan 2011-2020: Energy efficient construction/rehabilitation of new/existing buildings	C	2011
HOU-SPA39	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - Action Plan 2011-2020: Construction or rehabilitation of nearly-zero energy buildings	C	2011
HOU-GRE12	Obligatory installation of central thermal solar systems in residential buildings.	O	2012
HOU-GRE21	Energy upgrading of existing buildings through Energy Service Companies	O	2012
HOU-CY11	Net metering scheme was introduced for the promotion of small residential photovoltaic systems	C	2013
HOU-SPA42	State Plan 2013-2016 for Rental Housing, Housing Rehabilitation, Urban Regeneration and Renewal	O	2013
HOU-SPA40	PAREER-CRECE Program (Aids Program for Energy Rehabilitation in Buildings in Households & Hotels)	O	2014
HOU-CY13	Program for the Energy Renovation of buildings	O	2015

Notes: 1) C = completed measure, O = ongoing measure

Source : MURE database, September 2015 (the measure codes refer to the MURE database)

7. EUROPEAN POLICY IMPACTS

7.1 INSTITUTIONAL AND ENERGY EFFICIENCY TARGETS

As established in the Europe 2020 strategy, sustainability targets are to be achieved by 2020. These targets include greenhouse gas emissions 20% lower than 1990, a share of 20% of energy from renewables and a 20% increase in energy efficiency compared to a baseline development which was set by the PRIMES 2007 projections. The latter was further specified in the Energy Efficiency Directive (EED; 2012/27/EU) that the EU-28 energy consumption for 2020 has to be no more than 1,483 Mtoe of primary energy or no more than 1,086 Mtoe of final energy. A recent evaluation on behalf of DG ENER[44], which was based on three different methods (bottom-up policy analysis, decomposition analysis and modelling analysis) found for both primary and final energy a gap of 3% to 0% points for 2020, the latter for the bottom-up policy analysis.

On 23 October 2014, the European Council decided on a new 2030 Climate and Energy Policy Framework. This includes a binding EU target of an at least 40% domestic reduction in greenhouse gas emissions by 2030 compared to 1990, and a share of at least 27% of renewable energy consumed in the EU in 2030 is binding at EU level. With regard to energy efficiency, an indicative target at the EU level of at least 27% is set for improving energy efficiency in 2030 compared to projections of future energy consumption based on the current criteria (PRIMES 2007). The energy efficiency target is planned to be reviewed before 2020, having in mind an EU target of 30%. Energy efficiency is considered the “first fuel” now – before supply options - and is an important element in the rising EU Energy Governance Scheme and the Energy Union.

Table 2 shows the main EU Directives which are currently in place for energy efficiency. The impact estimate is mainly based on the official impact assessments of the European Commission. Upcoming revisions are foreseen for the Energy Efficiency Directive (EED) and the Energy Labelling Directive, as well as the Eco-design Directive. With regard to the transport sector, an extension of CO_2-emission standards on trucks is under discussion.

[44] http://www.isi.fraunhofer.de/isi-en/x/projekte/PolicyEval_ Framework_331252.php

Table 2 : Main EU energy efficiency policy measures and their impacts

Sector	Main objectives and regulations	Impact assessment
Cross-sectoral	Energy Efficiency Directive EED (Directive 2012/27/EU)	20% reduction of primary energy consumption compared to the PRIMES2007 baseline scenario, which is equivalent to a reduction by 368 Mtoe primary energy to a level of 1,474 Mtoe in 2020.
	Taxation of energy products and electricity (Directive 2003/96/EC)	Up to 92 $MtCO_2$ reduction estimated by 2020 (depending on the chosen option).
	Promotion of the use of Energy from Renewable sources (Directive 2009/28/EC)	CO_2 savings of 600-900 Mt/year by 2020.
Industry	Amended EU Emissions Trading Scheme (Directive 2009/29/EC)	Limited impact due to over-allocation.
Buildings + Appliances	Energy Performance of Buildings Recast (Directive 2010/31/EU)	60 to 80 Mtoe/year energy savings in 2020. 160 – 210 Mt/year CO_2 savings in 2020.
	Ecodesign Recast Directive of Energy-related Products (Directive 2009/125/EC)	Estimated annual energy savings of 376 TWh (32.3 Mtoe) by 2020 (12 first implementing measures) or 150 Mt CO_2.
	Revised Directive of Labelling of Energy-related Products (Directive 2010/30/EU)	Energy savings of around 27 Mtoe by 2020. CO_2 savings of 80 Mt by 2020.
	Energy Labelling Office Equipment (Energy Star)	Emission reduction of 3.7 $MtCO_2$. Estimated energy savings of 10 TWh (0.9 Mtoe) in 2015.
Transport	Emission Performance Standards for New Passenger Cars (Directive 443/2009/EC)	Cumulative savings of 624 – 638 $MtCO_2$ for the period 2006-2020, which corresponds in average to an annual reduction of 45 Mt CO_2.

Source: MURE

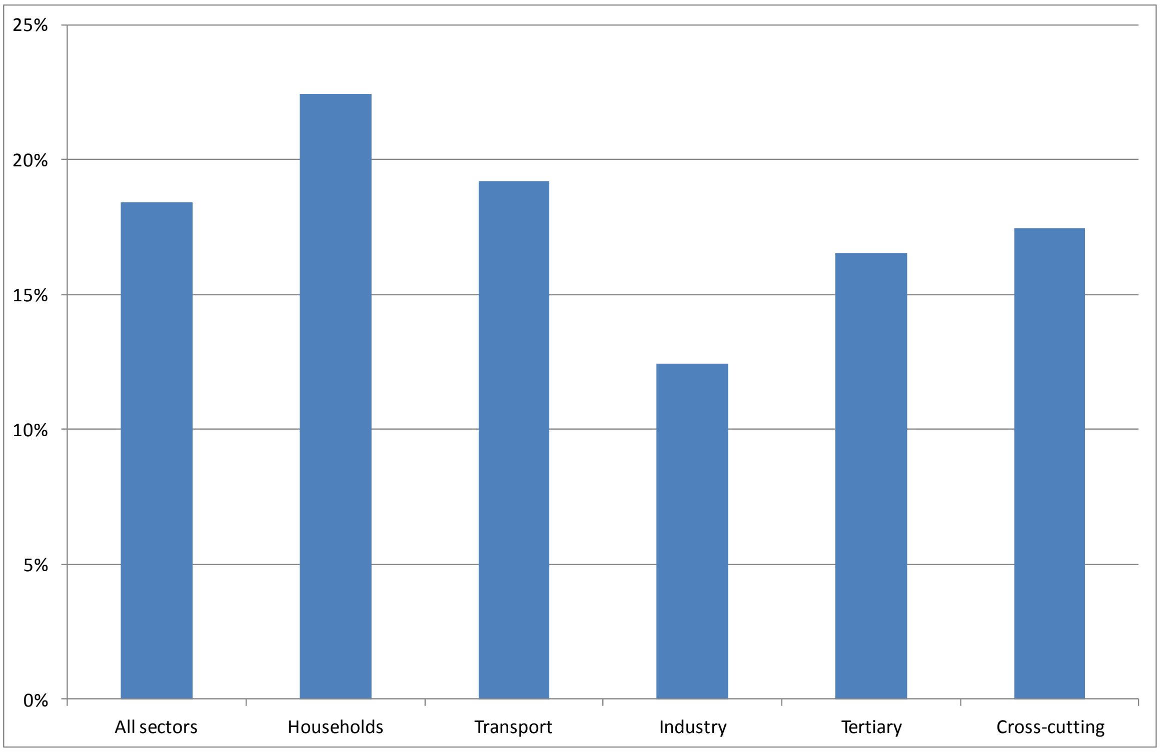
7.2 EUROPEAN POLICY MEASURES

How important was the role of European energy efficiency policies?

The MURE database contains European measures and national measures for energy efficiency. The latter are classified whether they are related to EU-wide measures. According to Figure 65, national measures which are related to EU measure represent nearly one measure out of five, most in the household sector where 22% of the measures are EU-related, and least in the industry sector where only one measure out of eight is EU-related.

Though this weight of the EU energy efficiency policy is already quite important, it is even more important, considering which of the measures have been proposed under the National Energy Efficiency Action Plans NEEAPs and the Art. 7 of the Energy Efficiency Directive EED at national level. Although these measures are not directly inspired by EU regulation and policy, they are strongly linked into a European framework.

Figure 65: Share of EU-related measures per sector (since 1995)



Source: MURE

Table 3 : Measures proposed at national level under the NEEAPs of the EU and Art. 7 of the EED

	All sectors	Households	Transport	Industry	Tertiary	Cross-cutting
All measures	2356	650	523	327	523	333
Measures since 1995	2015	575	443	257	448	292
NEEAP 1/2/3 ("or") [1)]	1039	290	209	141	258	141
NEEAP 1/2/3 ("and") [2)]	200	59	34	24	48	35
NEEAP 1 (2007)	349	107	59	50	84	49
NEEAP 2 (2011)	672	192	140	91	161	88
NEEAP 3 (2014)	753	209	142	102	187	113
Art. 7/EED (2013) [3)]	307	102	36	41	90	38

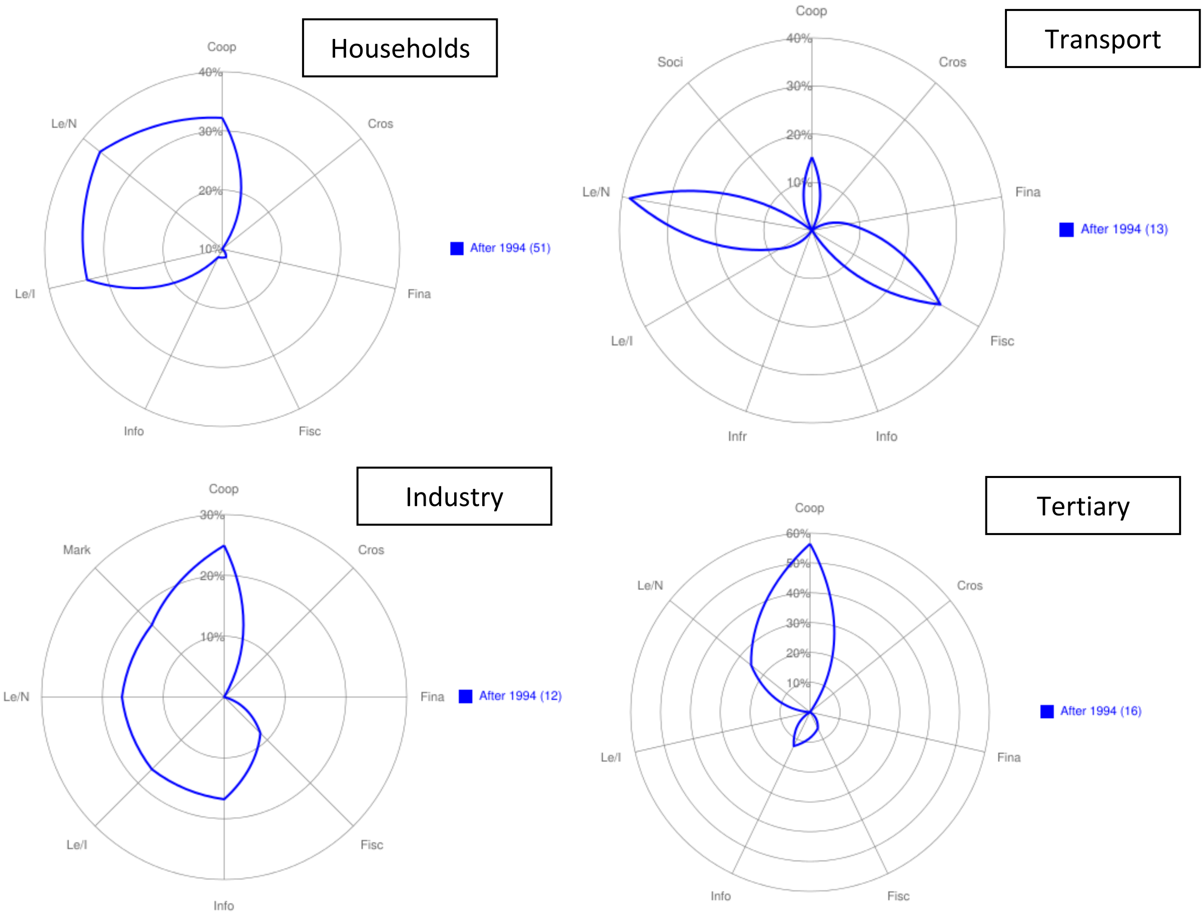
Notes:
1) Measures proposed under either of the three NEEAPS. There may be double counting, as measures may have continued in the different NEEAPs
2) Measure that have been proposed through all three NEEAPS
3) Measures proposed under the Art. 7 of the EED on Energy Saving Obligations or alternative measures

Source: MURE

Which focus of European energy efficiency policies?

European measures are mainly of legislative-normative types (e.g. minimum standards in the residential sector, CO_2 standards for cars), legislative-informative types (labelling schemes for appliances), fiscal measures (minimum taxation levels in the transport sector) or of cooperative type (code of conducts for IT appliances in the tertiary sector (Figure 66).

Figure 66: Sectoral energy efficiency measures patterns at EU level



Legend: Please refer to Figure 58 to Figure 61 for the legends of the four sectors

Source: MURE

The following tables provide an overview of the sectoral European policies. Details are discussed in the three sectoral brochures.

Table 4 : EU measures for the residential sector (since 2000)

Code	Measure Title	Status 1)	Measure Type 2)	Starting Year
HOU-EU21	Energy+ Procurement/Information Programme Cooling Appliances	O	Co-op	2000
HOU-EU34	Code of Conduct EICTA (EACEM) External Power Supplies	O	Co-op	2000
HOU-EU35	Negotiated Agreement EICTA (EACEM) Audio-Equipment (stand-by mode)	O	Co-op	2000
HOU-EU19	CECED Voluntary Commitment Stand-by Losses Electric Water Heaters	C	Co-op	2001
HOU-EU24	Promotion of Electricity Produced from Renewable Energy Sources in the Internal Electricity Market (2001/77/EC)	C		2001
HOU-EU30	Energy Labelling Office Equipment (Energy Star)	O	Co-op	2001
HOU-EU33	Code of conduct EICTA (EACEM) Digital TV Services	O	Co-op	2001
HOU-EU2	CECED Voluntary Commitment Washing Machines II (2002-2008)	C	Co-op	2002
HOU-EU3	OECED Voluntary commitment on household refrigerators, freezers and combinations	C	Co-op	2002
HOU-EU14	Minimum Energy Efficiency Standards Fluorescent Light Ballasts (2000/55/EC)	O	Leg/Nor	2002
HOU-EU17	Energy Labelling of Household Air-conditioners (2002/31/EC)	C	Leg/Inf	2002
HOU-EU18	Energy Labelling of Household Electric Ovens (2002/40/EC)	O	Leg/Inf	2002
HOU-EU45	EICTA Self-Commitment to improve the energy performance of CRT and flat LCD televisions and stand-by mode for DVD players	O	Co-op	2003
HOU-EU64	Community framework for the taxation of energy products and electricity (Directive 2003/96/EC)	O	Fis/Tar	2003
HOU-EU23	Public Awareness Campaign for an Energy Sustainable Europe	C	Inf/Edu	2004
HOU-EU27	A+, A++ labels refrigerators (2003/66/EC)	O	Leg/Inf	2004
HOU-EU28	Energy Performance of Buildings (Directive 2002/91/EC)	C	Leg/Inf, Leg/Nor	2006
HOU-EU46	Code of Conduct on Energy Consumption of Broadband Equipment	-	Co-op	2007
HOU-EU62	Ecodesign Directive for Energy-using Products (Directive 2005/32/EC)	C	Leg/Nor	2007
HOU-EU66	Ecodesign for household refrigerating appliances	O	Leg/Nor	2009
HOU-EU68	Ecodesign for Circulators	O	Leg/Nor	2009
HOU-EU69	Ecodesign for external power supplies	O	Leg/Nor	2009
HOU-EU70	Ecodesign for simple set-top-boxes	O	Leg/Nor	2009
HOU-EU71	Ecodesign for standby and off-mode losses	O	Leg/Nor	2009
HOU-EU63	Recast Ecodesign Directive for Energy-related Products (Directive 2009/125/EC)	O	Leg/Nor	2010
HOU-EU67	Ecodesign for TVs	O	Leg/Nor	2010
HOU-EU61	Labelling of Energy-related Products (revised Directive 2010/30/EU)	O	Leg/Inf	2011
HOU-EU65	Ecodesign for electric motors	O		2011
HOU-EU73	Ecodesign for washing machines	O	Leg/Nor	2011
HOU-EU74	Energy labelling of household dishwashers (“New EU Energy Label”)	O	Leg/Inf	2011
HOU-EU75	Energy labelling of household refrigerating appliances (“New EU Energy Label”)	O	Leg/Inf	2011
HOU-EU76	Energy labelling household washing machines (“New EU Energy Label”)	O	Leg/Inf	2011
HOU-EU77	Energy labelling televisions (“New EU Energy Label”)	O	Leg/Inf	2011
HOU-EU79	Ecodesign for dishwashers	O	Leg/Nor	2011
HOU-EU58	Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU)	O	Leg/Nor	2012
HOU-EU78	Energy labelling of air conditioners (“New EU Energy Label”)	O	Leg/Inf	2013

Notes:
1) C = completed measure, O = ongoing measure
2) Co-op = co-operative measures, Leg/Nor = Legislative/Normative measures, Leg/Inf = Legislative/Informative measures, Inf/Edu = Information/Education measures, Fis/Tar = Fiscal/Tariff-based measures

Source : MURE database, September 2015 (the measure codes refer to the MURE database)

Table 5 : EU measures for the Transport Sector (since 2000)

Code	Measure Title	Status 1)	Measure Type 2)	Starting Year
TRA-EU4	Scheme to monitor the average specific emissions of CO_2 from new passenger cars	C	-	2001
TRA-EU5	Passenger Car Labelling on fuel economy rating (Directive 1999/94/EC)	O	Leg/Inf	2001
TRA-EU20	Community framework for the taxation of energy products and electricity (Directive 2003/96/EC)	O	Fis	2003
TRA-EU2	Promotion of Biofuels or other Renewable Fuels for Transport (Directive 2003/30/EC)	C	Fin/Fis	2004
TRA-EU17	Promotion of Renewable Energies: Strategy for Biofuel	O	Leg/Nor	2005
TRA-EU19	Speed limitation devices for certain categories of motor vehicles (Directive 2002/85/EC)	O	Leg/Nor	2005
TRA-EU6	Fiscal Measures to Promote Car Fuel Efficiency	O	Fis	2008
TRA-EU15	Emission performance standards new passenger cars (Regulation 443/2009/EC)	O	Leg/Nor	2009
TRA-EU21	Promotion of clean and energy-efficient road transport vehicles (Directive 2009/33/EC)	O	Co-op	2010
TRA-EU16	Energy labelling of tyres (Regulation 1222/2009/EC)	O	Leg/Nor	2011
TRA-EU18	CO2 Standards for Light Duty Vehicles	O	Leg/Nor	2014

1) C = completed measure, O = ongoing measure
2) Co-op = co-operative measures, Leg/Nor = Legislative/Normative measures, Leg/Inf = Legislative/Informative measures, Inf/Edu = Information/Education measures, Fin/Fis = Financial/Fiscal measures

Table 6 : EU measures for the Industry Sector (since 2000)

Code	Measure Title	Status 1)	Measure Type 2)	Starting Year
IND-EU2	Voluntary labelling of electric motors (CEMEP/EU Agreement)	C	Co-op, Inf/Edu/Tr	2000
IND-EU1	Motor Challenge Programme	O	Inf/Edu/Tr	2002
IND-EU3	E2MAS	-	Leg/Inf	2003
IND-EU4	EU Emission Trading Scheme (2003/87/EC)	O	NMB	2003
IND-EU14	Community framework for the taxation of energy products and electricity (Directive 2003/96/EC)	O	Fis/Tar	2003
IND-EU9	Combined Heat Power (Cogeneration) (Directive 2004/8/EC)	C	Leg/Nor	2006
IND-EU10	Efficiency reference values for electricity and heat production	O	Leg/Nor	2007
IND-EU11	European Green Light Programme	O	Co-op	2007
IND-EU13	Integrated Pollution Prevention and Control IPPC (Directive 2008/1/EC)	C	Leg/Inf	2008
IND-EU12	Amended EU Emission Trading Scheme (Directive 2009/29/EC)	O	NMB	2012

1) C = completed measure, O = ongoing measure
2) Co-op = co-operative measures, Leg/Nor = Legislative/Normative measures, Leg/Inf = Legislative/Informative measures, Inf/Edu/Tr = Information/Education/Training measures, Fis/Tar = Fiscal/Tariff-based measures, NMB = New Market-based instruments

Source : MURE database, September 2015 (the measure codes refer to the MURE database)

Table 7 : EU measures for the Tertiary Sector (since 2000)

Code	Measure Title	Status 1)	Measure Type 2)	Starting Year
TER-EU1	European GreenLight Programme	O	Co-op	2000
TER-EU4	Code of Conduct EICTA (EACEM) External Power Supplies (stand-by losses)	O	Co-op	2000
TER-EU2	Energy Labelling Office Equipment (Energy Star)	O	Inf/Edu/Tr	2001
TER-EU13	Community framework for the taxation of energy products and electricity (Directive 2003/96/EC)	O	Fis/Tar	2003
TER-EU12	European Green Building Programme	O	Co-op	2005
TER-EU11	Energy Performance of Buildings (Directive 2002/91/EC)	C	Leg/Nor	2006
TER-EU5	Code of Conduct on Energy Consumption of Broadband Equipment	-	Co-op	2007
TER-EU15	Ecodesign Directive for Energy-using Products (Directive 2005/32/EC)	C	Leg/Nor	2007
TER-EU9	Code of Conduct on Data Centers	O	Co-op	2008
TER-EU10	Code of Conduct on Energy Efficiency and Quality of UPS	O	Co-op	2008
TER-EU16	Recast Ecodesign Directive for Energy-related Products (Directive 2009/125/EC)	O	Leg/Nor	2010
TER-EU18	Revised Directive for Labelling of Energy-related Products (Directive 2010/30/EU)	O	Inf/Edu/Tr	2011
TER-EU14	Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU)	O	Leg/Nor	2012

1) C = completed measure, O = ongoing measure
2) Co-op = co-operative measures, Leg/Nor = Legislative/Normative measures,
Inf/Edu/Tr = Information/Education/Training measures, Fis/Tar = Fiscal/Tariff-based measures,

Source : MURE database, September 2015 (the measure codes refer to the MURE database)

7.3 ENERGY SAVING OBLIGATIONS AND ALTERNATIVE MEASURES

Member States had to notify by 5 December 2013 their plans, proposed measures and detailed methodologies for the implementation of Article 7 and Annex V of the Energy Efficiency Directive. In the MURE database it is also possible to indicate which measures have been included in the Article 7 notification of the EED – including both energy efficiency obligation schemes as well as alternative measures. 278 such measures are reported in the database in all sectors. However, it should be noted that the measures in the notification are sometimes titled differently or may be packages of measures composed of several measures in the MURE database.

16 countries have reported to rely on energy efficiency obligation schemes, generally combined with additional policy measures[45]. The other countries will only use other policy measures as authorised by the Directive, the so called “alternative policies”.

Starting from 2014 there are in total 178 measures listed in the MURE database as being linked to Art. 7 of the Energy Efficiency Directive, quite many of them energy obligation schemes. It should be noted that also older measures may be linked to Art. 7.

[45] Only 3 countries (Denmark, Poland and Luxembourg) rely solely on an energy efficiency obligation scheme.

Table 8 : General cross-cutting measure proposed under Art. 7/EED (since 2014)

Code	Measure Title	Status 1)	Measure Type 2)	Starting Year
GEN-BG25	EU-related: Energy Efficiency Directive (EED) - Directive 2012/27/EU - Energy Efficiency Obligation Scheme	O	Leg/Nor	2014
GEN-EST21	Renovation of dilapidated and inefficient heat pipelines	O	Leg/Nor	2014
GEN-EST22	Efficient generation and transmission of heat	O	Leg/Nor	2014
GEN-GER32	Energy Efficiency Fund: Municipal networks (Energiefonds: Kommunale Netzwerke)	O	Fin	2014
GEN-LV16	EU-related: Energy Efficiency Directive (EED) - Directive 2012/27/EU - Energy Efficiency Obligation Scheme	PA	EE/CC/RES	2016
GEN-LV17	Including energy efficiency criteria into state aid programmes	PML	Non-classified	2016
GEN-LV19	Energy Efficiency National Fund	PA	Fin	2016
GEN-LUX9	EU-related: Energy Efficiency Directive (EED) - Directive 2012/27/EU - Energy Efficiency Obligation Scheme	PA	EE/CC/RES	2015
GEN-RO7	EU-related: Energy Efficiency Directive (EED) - Directive 2012/27/EU - Development of energy services / ESCO market	O	NMB	2014
GEN-RO8	EU-related: Energy Efficiency Directive (EED) - Directive 2012/27/EU - ENERGY EFFICIENCY INVESTMENT FUND	PML	Fin	2014
GEN-RO9	EU-related: Energy Efficiency Directive (EED) - Directive 2012/27/EU - Strategy for mobilising investment in the renovation of the national stock of residential and commercial buildings, both public and private	O	EE/CC/RES	2014
GEN-RO11	Development of smart mettering	-	Co-op	2017
GEN-SPA16	Energy Efficiency Obligation Scheme	PML	Leg/Nor	2015

1) C = completed measure, O = ongoing measure, PA = Proposed-advanced measure,
PML = PML
2) Co-op = co-operative measures, Leg/Nor = Legislative/Normative measures,
EE/CC/RES = General Energy Efficiency / Climate Change / Renewable Programmes, Fin = Financial measures,
NMB = New Market-based instruments

Source : MURE database, September 2015 (the measure codes refer to the MURE database)

7.4 NATIONAL ENERGY EFFICIENCY ACTION PLANS NEEAPS AND IMPACT ON EVALUATION PRACTICES

Had the National Energy Efficiency Action Plans (NEEAPs) impacts on evaluation practices?

The MURE database contains information on quantitative evaluation practices. However, not al measures are quantitatively evaluated. Figure 67 shows how the share of measures with quantitative impact evaluations has changed over time:

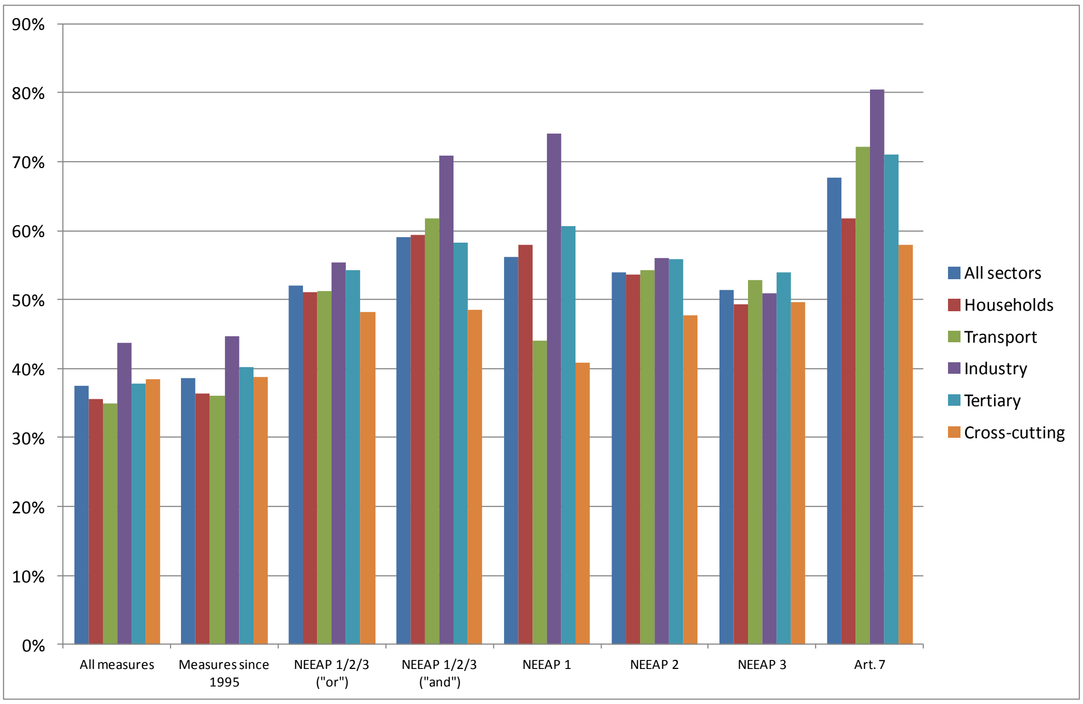
- *All measures:* for all measures in the database the share of quantitative impact evaluations is about 37% with a somewhat higher share for the industry sector (44%)
- *Measures since 1995:* Taking the measures over the past 20 years since 1995 (the earliest data when measures could be taken into account in the first National Energy Efficiency Action Plans NEEAPs) the share rises only slightly to 39%
- *NEEAP 1/2/3 ("or"):* The measures that belong to either of the three NEEAPs so far (there is some double counting of measures as some measures are similar in the different

NEEAPs!) the share of evaluated measures rises steeply to 52%, for the industry sector even to 55%.

- *NEEAP 1/2/3 ("and"):* Measures present through all three NEEAPs have been evaluated even more carefully and the share for those measures is 59% (for industry even 71%)
- *NEEAP 1:* For the first NEEAP (which dates from 2007) the share of quantitatively evaluated measures was 56%, with industry measures being evaluated to 74% while transport measures only reached 44%. This was the consequence of the fact that the transport sector was mainly neglected.
- *NEEAP 2:* In the second NEEAP from 2011 a similar share of around 54% was reached. The share of transport measures with quantitative evaluation rose to 54% compared to the 44% of the first NEEAP.
- *NEEAP 3:* The third NEEAP from 2014 reached a somewhat lower share of 51%. This was most likely due to the fact that this NEEAP was in the transition phase from the Energy Service Directive (ESD) from 2006 to the Energy Efficiency Directive (EED) from 2012.
- Art. 7: Article-7-Measures are those measures reported under the EED on Energy Saving Obligations or alternative measures. Those concern the most important measures in the NEEAPs. Consequently the evaluation share reaches 68% with the industry sector exceeding 80%. Even transport measures reached an evaluation share of 72%

In conclusion, the process of the NEEAPs was a large success with respect to evaluation practices spreading the use of quantitative evaluation methods across the Member States.

Figure 67: Share of measures with quantitative impact evaluations for the different sectors



Source: MURE

8. SUCCESSFUL ENERGY EFFICIENCY POLICIES

8.1 DEFINING SUCCESSFUL POLICIES

What characterises a successful energy efficiency policy?

In the past there was a need to identify "successful" and/or "innovative" measures, but the criteria were not homogenous and the measures could not directly be taken from the MURE database. For example, there are frequent requests from the national level for successful policy measures in other countries to learn for the national policy making process. This raises the question, how to define successful policies. For that purpose, the MURE database has introduced a new "Successful Policies" tool which allows characterising successful policies. The new policy facility aims at defining a consistent set of criteria to characterize successful policy measures and implementing an easy retrieval for successful measures in the MURE database.

The methodology approach to develop such a set of criteria occurred in two steps:

- Step 1: Pre-choice of 10-15 policy measures per country provided by the national teams (2-3 per sector) based on the following criteria
  - Only high and medium impact measures
  - Measures with some experience
  - Ongoing and not too old measures (>2000)
  - Representation of several measure types
  - Expert choice

  The pre-choice occurred to focus the efforts on around 300-400 measures instead of all 2350 measures of the MURE database.

- Step 2: Evaluation of the chosen policy measures: enables to rank the pre-chosen set of (around 300) policy measures according to their success.
  - 12 criteria have been identified to define the success level of a measure
  - Distinction between 6 "high" and 6 "low" priority criteria
  - Quantitative evaluation of each policy with a score between 1 (worst) and 5 (best) for each of the 12 criteria

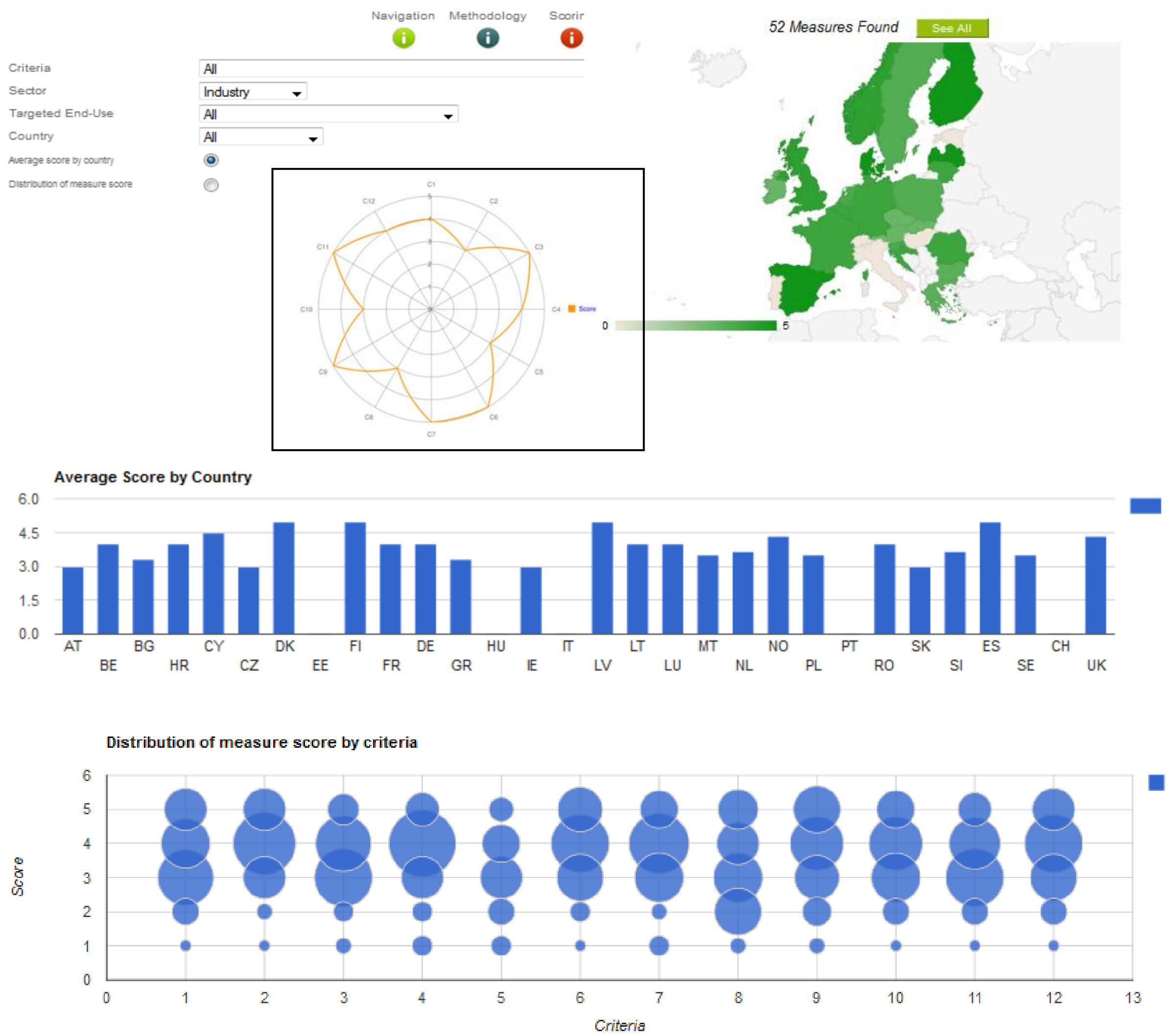
In total, the "Successful policy" tool shows around 330 successful policies (Figure 68) which are accessed by the following 12 criteria (for more details on the scoring see Box 4):

1. High impact/ high number of applicants	7. Transferability between countries
2. Cost for implementor/ administrative support	8. Link to other measures/ policy packages
3. Potential for market transformation and for promotion of energy service market	9. Previous experience with measure

4. Suitability to overcome barriers for EE	10.Avoidance of negative side-effects
5. Ease and stability of re-financing	11. Support of positive side-effects
6. Persistency of savings induced by measure	12. Ease of acceptance by stakeholders

The scores of the policies with regard to a specific criterion or the sum of all criteria can be shown by a spider graph or by bars. A darker green-shade depicts the higher score. Highest score is “5”. It should be noted that due to the pre-selection process focussing on 330 measures, the measures score already relatively high. If the process is extended to all 2350 measures in the database, some of the measures would score considerably lower than the average of the 330 measures.

Figure 68: Successful measures in industry by country



Note: The numbers in the last figure and the spider graph refer to the 12 criteria

Source: MURE database, September 2015

Box 4 : Criteria for scoring successful energy efficiency policies

For each successful measure chosen a quantitative evaluation score between 1 (worst) and 5 (best) is assigned for each of the 12 criteria. The meaning of the score by criteria is as follows:

Group 1: High priority criteria

1) High impact / high number of applicants: Amount of energy savings achieved by the measure / amount of energy saving activites which are addressed and carried out by the measure

2) Cost efficiency for the implementor / necessary administrative support: Relation of energy savings achieved and necessary costs for the implementor / amount of administrative support necessary to implement a measure, i.e. extent of the administrative barrier to implement a measure

3) Potential for market transformation and for promotion of energy service market: Suitability of the measure to enhance market transformation to energy-efficient product/systems and to strengthening markets for energy efficiency and energy services (e.g. in the form of new actors/new business models)

4) Suitability to overcome barriers for energy efficiency: This criterion refers to the fact that in reality various barriers prevent private households and companies from realizing even a profitable energy-saving potential. Usually, the following main types of barriers are distinguished: information and knowledge deficits; capital constraints both including external and internal funds; risk and uncertainties, often leading to very short pay-back times for an EE investment; or split incentives when the costs and benefits of an EE investment decision fall on different actors.

5) Ease and stability of re-financing (only relevant for financial measures): This criterion examines the extent to which the instruments differ in terms of their funding; one focus is on the aspect of budget-independence of the funding. It must only be evaluated for financial measures.

6) Persistency of the savings induced by the measure: How lasting is the impact of the measure in terms of time; usually, behavioural measures are less persistent or the persistency is less ensured as for measures inducing investments.

Group 2: Low priority criteria

7) Transferability between countries: The following questions are addressed by this criterion: Can the measure be easily transferred to another country? Makes such a transfer sense? Is it possible that the measure may not work in the same way in another political context?

8) Link other measures / policy packages: In general two or more measures interact when addressing the same targeted end use. Typical interaction, for example, is between the implementation of an EU Directive and the corresponding incentivizing (financial, fiscal, etc.) measures.

9) Some experience with measure: Experience means that the measure is already implemented for some time (refers to MURE descriptor "starting year"), and also that a measure evalu-ation or at least some information on impact, acceptance etc. is available.

10) Avoidance of negative side-effects: Side-effect are defined here as measure impacts which are not directly linked to the energy savings induced and the costs of the measure. Negative side-effects are e.g.: -Distributional effects as e.g. an ""unfair"" burdening of the measure costs or relatively high burden for low-income households -Direct rebound effects, i.e. negligent handling of energy due to cost saving induced by the measure (e.g. more lighting, higher room temperature) -Indirect rebound effects due to economic interrelations.

11) Support of positive side-effects: Positive side-effects or co-benefits of a measure are e.g.: -Higher economic growth, improved competitiveness and productivity -Creation of new jobs, improved work environment -Improvement of energy security, health etc.

12) Ease of acceptance by relevant stakeholders: The following questions are addressed by this criterion: Will the measure be easily accepted by the relevant stakeholders or is a strong opposition to be expected (e.g. by industry, consumer associations, renters etc.)?

8.2 SELECTED SUCCESSFUL POLICIES IN EU MEMBER STATES

Which energy efficiency policies are considered most successful?

Table 9 provides an overview of successful energy efficiency policies in selected EU countries. Quite some of them are linked to EU measures, in particular the Energy Performance Directive of Buildings and concern regulatory measures. However, there are also specific national measures in the list such as subsidy schemes (e.g. the KfW building programme in Germany), fiscal measures such as the Bonus/Malus scheme in France, as well as cooperative measures such as the procurement programmes in Sweden which were established already more than 20 years ago.

Table 9 : Overview of the most successful energy efficiency measures in selected countries

Code	Most successful energy efficiency measures in France	Avg Score	Measure Type 1)	Starting Year
HOU-FRA7	Sustainable Development Tax Credit	4.1	Fis/Tar	1995
HOU-FRA16	Local energy information centres (EIE)	4.0	Inf/Edu	2001
HOU-FRA31	Zero-rated eco-loan	3.5	Fin	2009
TER-FRA1	Audits subsidies in buildings	3.8	Fin	2000
TER-FRA8	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Energy performance diagnosis	3.2	Leg/Inf	2006
IND-FRA15	Loans for small and medium sized enterprises	3.6	Fin	2010
TRA-FRA22	Voluntary commitments to reduce CO_2 emissions	3.9	Co-op	2008
TRA-FRA19	Automobile bonus malus	3.6	Fis	2007
GEN-FRA1	Energy Savings Certificates (ESC)	4.2	NMB	2006
GEN-FRA2	Information and advertising campaign: why wait?	3.6	Inf/Edu	2008
GEN-FRA18	Heat Fund	3.6	EE/CC/RES	2008

Code	Most successful energy efficiency measures in Germany	Avg Score	Measure Type 1)	Starting Year
HOU-GER33	KfW Programme "Energy-efficient refurbishment" (former CO_2 Building Rehabilitation Programme)	3.9	Fin	2009
HOU-GER8	EU-related: Ecodesign Directive for Energy-using Products (Directive 2005/32/EC) - Energiebetriebene-Produkte-Gesetz - EBPG	3.7	Leg/Nor	2005
HOU-GER6	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Energy Savings Ordinance (Energieeinsparverordnung - EnEV)	3.5	Leg/Inf, Leg/Nor	2002
TER-GER35	EU-related: Recast Ecodesign Directive for Energy-related Products (Directive 2009/125/EC) - Eco-Design of Energy-using products (Energiebetriebene-Produkte-Gesetz - EBPG)	3.8	Leg/Nor	2011
TER-GER29	Special fund for energy efficiency in SME's	3.6	Fin	2008
TER-GER32	Smart Metering	3.5	Leg/Inf	2010
IND-GER36	Special fund for energy efficiency in SME´s	3.7	Fin	2008
IND-GER18	Voluntary agreement with German industry II	3.5	Co-op	2000
TRA-GER39	EU-related: Emission performance standards new passenger cars (Regulation 443/2009/EC) - Accelerating technical development / CO2 strategy for passenger cars	3.9	Leg/Nor	2009
TRA-GER32	Improving the infrastructure for using bicycles	3.8	Fin	2002
TRA-GER2	Heavy goods vehicle toll charges	3.3	Fin	2005
GEN-GER29	National Climate Initiative (NKI)	3.7	EE/CC/RES, NMB	2008
GEN-GER19	National Energy Efficiency Action Plan (NEEAP) of the Federal Republic of Germany	3.6	EE/CC/RES	2008

Code	Most successful energy efficiency measures in Greece	Avg Score	Measure Type 1)	Starting Year
HOU-GRE16	"Energy Savings in households" Program	4.3	Fin, Leg/Nor	2010
HOU-GRE15	Energy Performance of residential Buildings	4.0	Leg/Inf, Leg/Nor	2009
HOU-GRE20	Installation of electronic and intelligent metering of electricity and natural gas residential consumers	3.7	Co-op, Fin, Inf/Edu	2010
TER-GRE13	Energy upgrading of existing buildings through third-party financing arrangements (TPF), energy performance contracting and public and private joint ventures (PPJV)-Tertiary Sector	4.3	Co-op, Fin, Leg/Inf	2012
TER-GRE9	Energy savings in Local Self-Governments. - "Economize" program	4.1	Fin, Inf/Edu/Tr	2010
TER-GRE10	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Energy Performance of Buildings of Tertiary sector	4.0	Leg/Nor	2010
IND-GRE6	Incentives for obligatory implementation of Energy Management Systems	3.6	Fin, Leg/Inf	2008
IND-GRE10	Promotion of Combined heat and power (CHP) and district heating systems- Industry Sector	3.5	Fin	2009
IND-GRE7	GRE7-Promotion of voluntary agreements in industrial sector	3.4	Inf/Edu/Tr, Leg/Inf, Leg/Nor	2010
TRA-GRE3	Improvements in Public Transport Networks	4.0	Infr	1998
TRA-GRE13	Taxation of new cars according CO_2 emission	3.9	Fis	2010
TRA-GRE10	Incentives for replacement private vehicles	3.8	Fin	2008
GEN-GRE9	Program for Fin support of technological investments in energy efficiency	4.2	EE/CC/RES, Leg/Nor, NMB	2008
GEN-GRE10	Farther penetration of Natural Gas and LPG in Greek market	3.8	EE/CC/RES, Leg/Nor, NMB	2008
GEN-GRE11	Target campaigns for Tr, informing and awarding of best practice activities	3.7	EE/CC/RES, Leg/Nor	2008

Code	**Most successful energy efficiency measures in Sweden**	**Avg Score**	**Measure Type 1)**	**Starting Year**
HOU-SWE23	Technology procurement groups	4.3	Co-op	1989
HOU-SWE4	Energy and carbon dioxide tax in the household sector	3.9	Fis	1991
IND-SWE17	Energy efficiency networks for the industry	3.7	Co-op, Inf/Edu/Tr	2009
IND-SWE3	The Programme for Energy Efficiency in Industry	3.2	Co-op	2005
TRA-SWE24	Energy efficiency measures in transport Infrastructure	4.2	Infr	2011
TRA-SWE13	Value of fringe benefits for company cars	3.6	Fis	1997
TRA-SWE12	Vehicle taxation according to CO_2 emissions	3.4	Fis	2006
GEN-SWE12	Energy and carbon dioxide taxes)	3.8	EE/CC/RES	1995
GEN-SWE8	Local Energy/Climate Counsellors	3.5	EE/CC/RES	1998

1) Co-op = co-operative measures, Leg/Nor = Legislative/Normative measures, Leg/Infor = Legislative/Informative measures, Fis/Tar = Fiscal/Tariffs, Fin = Financial measures, Fis/Tar = Fiscal/Tariff-based measures, Inf/Edu/Tr = Information/Education/Training measures, NMB = New Market-based instruments, Infra = Infrastructure measures, EE/CC/RES = General Energy Efficiency / Climate Change / Renewable Programmes,

Source : MURE database, September 2015 (the measure codes refer to the MURE database)

A list of measures with the two highest average score per country is provided in Table 10. The focus is clearly on residential and tertiary sector measures while industry and transport-related measures appear less frequently in the list of most successful measures.

Table 10 : Overview of the most successful energy efficiency measures with the two highest average scores per EU Member State

Country	Code	Measure Title	Avg. Score	Measure Type 1)	Starting Year
AU	GEN-AU2	"klima:aktiv" National programme for climate protection	4.2	EE/CC/RES	2005
AU	HOU-AU13	Residential building subsidy	3.8	Fin	1989
BEL	IND-BEL4	Flanders - Energy efficiency criteria in environmental permits	3.7	Leg/Inf	2004
BEL	HOU-BEL30	Wallonia - Financial incentives for RUE investments in buildings	3.5	Fin	2005
BG	HOU-BG19	Extension of the administrative, functional and financial capacity of Bulgarian Energy Efficiency and RES Fund with authorizing it for financing projects with renewable energy sources	3.8	Fin	2011
BG	TER-BG15	Financing of energy efficiency projects in municipal buildings by Operational Program Regional Development	3.8	Fin	2010
CR	TRA-CR18	Eco-driving training for drivers of road vehicles	4.3	Inf/Edu/Tr	2011
CR	HOU-CR9	Building regulations and enforcement	4.2	Leg/Nor	2006
CY	HOU-CY11	Net metering scheme was introduced for the promotion of small residential photovoltaic systems	3.9	Fin	2013
CY	IND-CY3	EU-related: Amended EU Emission Trading Scheme (Directive 2009/29/EC) - Governmental grants/subsidies scheme for the promotion of RES, energy saving technologies and the creation of a special fund for financing or subsidising	3.9	Fin, Inf/Edu/Tr	2003
CZ	HOU-CZ17	EU-related: Energy Labelling of Household Appliances (Directive 92/75/EC) - Energy labelling of household appliances – support of implementation	3.6	Leg/Nor	2004
CZ	HOU-CZ19	Green Savings Programme	3.4	Fin	2009
DK	GEN-DK6	The Energy Companies' saving effort	4.3	Co-op	2006
DK	GEN-DK10	Danish Energy Agreement 2012	4	EE/CC/RES	2012
FIN	IND-FIN14	Energy Efficiency Agreement of Industry 2008-2016	4.5	Co-op	2008
FIN	TER-FIN3	Energy Auditing Programme in the Service Sector	4.4	Fin, Inf/Edu/Tr	1994
FRA	GEN-FRA1	Energy Savings Certificates (ESC)	4.2	NMB	2006
FRA	HOU-FRA7	Sustainable Development Tax Credit	4.1	Fis/Tar	1995
GER	HOU-GER33	KfW Programme "Energy-efficient refurbishment" (former CO2 Building Rehabilitation Programme)	3.9	Fin	2009
GER	TRA-GER39	EU-related: Emission performance standards new passenger cars (Regulation 443/2009/EC) - Accelerating technical development / CO2 strategy for passenger cars	3.9	Leg/Nor	2009

Country	Code	Measure Title	Avg. Score	Measure Type 1)	Starting Year
GRE	HOU-GRE16	“Energy Savings in households” Program	4.3	Fin, Leg/Nor	2010
GRE	TER-GRE13	Energy upgrading of existing buildings through third-party financing arrangements (TPF), energy performance contracting and public and private joint ventures (PPJV)-Tertiary Sector	4.3	Co-op, Fin, Leg/Inf	2012
IRL	HOU-IRL40	Building regulations 2011	3.9	Leg/Nor	2011
IRL	HOU-IRL42	Better Energy Homes (Residential Retrofit)	3.8	Fin	2011
ITA	GEN-ITA2	White certificates: market based instruments promoting energy efficiency	4.2	Co-op, EE/CC/RES, NMB	2004
ITA	TER-ITA13	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Energy Performace of Buildings	3.5	Leg/Inf, Leg/Nor	2006
LT	GEN-LT9	National energy efficiency improvement programme (draft)	3.9	EE/CC/RES	
LT	TER-LT11	EU Structural Funds 2007–2013	3.6	Fin	2007
LUX	HOU-LUX13	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Regulation on the energy performance of residential buildings	4.2	Leg/Inf, Leg/Nor	2008
LUX	TER-LUX3	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Regulation on the energy performance of non-residential buildings	4.1	Leg/Inf, Leg/Nor	2011
LV	HOU-LV40	EU-related: Revised Directive for Labelling of Energy-related Products (Directive 2010/30/EU) - Energy Labelling of Household Appliances	4	Leg/Inf	2004
LV	TER-LV7	Investments in Municipal Public Buildings' Energy Efficiency to Reduce GHG emissions	4	Fin	2009
MAL	HOU-MAL10	MRA PV scheme for Domestic Sector	4	Fin	2013
MAL	IND-MAL3	Energy audits for industry	4	Fin	2006
NLD	HOU-NLD3	Energy Performance Standards (Energie Prestatie Norm, EPN)	4.2	Leg/Nor	1995
NLD	IND-NLD19	Long Term Agreements with the industry, third phase; LTA3 (Meerjarenafspraken, 3e fase, MJA3)	4.2	Co-op	2008
NOR	TER-NOR17	Grants to renewable heat production and distribution - district heating and local heating plants (Program for fjernvarme og lokale energisentraler)	4	Fin	2008
NOR	TER-NOR14	Grants for energy savings in the built environment (Bygg, bolig og anlegg)	4	Fin	2005
PL	TER-PL1	Thermal Modernisation Fund	4.6	Fin	1998

Country	Code	Measure Title	Avg. Score	Measure Type 1)	Starting Year
PL	GEN-PL12	System of white certificates - Energy efficiency Act	4.4	NMB	2013
RO	TER-RO9	EU-related: Ecodesign Directive for Energy-using Products (Directive 2005/32/EC) - Promoting the development of energy service companies – ESCOs	4.5	Leg/Nor	2008
RO	GEN-RO1	EU-related: Energy End-use Efficiency and Energy Services ESD (Directive 2006/32/EC) - Law on Energy Efficiency Use	4.5	EE/CC/RES	2001
SK	TER-SK1	Thermal Insulation Standards in Buildings	4.1	Leg/Nor	2002
SK	HOU-SK8	Minimum efficiency standards for appliances	3.9	Leg/Nor	2001
SLO	HOU-SLO25	Rules on efficient use of energy in buildings	4.5	Leg/Nor	2010
SLO	IND-SLO5	Financial incentives for efficient electricity consumption	4.3	Fin	2008
SPA	HOU-SPA7	Proposal of a Municipal Ordinance for thermal uses of solar absorption	4.1	Leg/Nor	2001
SPA	TER-SPA16	Proposal of a Municipal Ordinance for thermal uses of solar absorption	4.1	Leg/Inf	2001
SWE	HOU-SWE23	Technology procurement groups	4.3	Co-op	1989
SWE	TRA-SWE24	Energy efficiency measures in transport infrastructure	4.2	Infra	2011
UK	IND-UK5	The Enhanced Capital Allowance Scheme	4.3	Fin, Fis/Tar	2001
UK	IND-UK17	EU-related: Combined Heat Power (Cogeneration) (Directive 2004/8/EC) - Combined Heat and Power (CHP)	4.3	Fis/Tar, Inf/Edu/Tr	2008

1) Co-op = co-operative measures, Leg/Nor = Legislative/Normative measures, Leg/Infor = Legislative/Informative measures, Fis/Tar = Fiscal/Tariffs, Fin = Financial measures, Fis/Tar = Fiscal/Tariff-based measures, Inf/Edu/Tr = Information/Education/Training measures, NMB = New Market-based instruments, Infra = Infrastructure measures, EE/CC/RES = General Energy Efficiency / Climate Change / Renewable Programmes,

Source : MURE database, September 2015 (the measure codes refer to the MURE database)

9. DESIGNING EFFECTIVE POLICY MIXES

9.1 BARRIERS TO ENERGY EFFICIENCY

Why do barriers to energy efficiency require integrated policy packages?

The European Union sets energy efficiency targets for 2020 and 2030 which have to be achieved by existing and new policies both at the European and the national level. The energy efficiency target for 2020 established in the Europe 2020 strategy demands for a 20% increase in energy efficiency compared to a baseline development which was set by the PRIMES 2007 projections (EU Commission 2008). The target was further specified in the Energy Efficiency Directive (EED; 2012/27/EU) that the EU-27/28 2020 energy consumption has to be no more than 1,474/1,483 Mtoe of primary energy or no more than 1,078/1,086 Mtoe of final energy. Some effort is still necessary in order to finally achieve the energy efficiency target for 2020. This is also true for the new 2030 target, which was decided by the European Council on 23 October 2014. With regard to energy efficiency, the new 2030 Climate and Energy Policy Framework provides an indicative target at the EU level of at least 27% for improving energy efficiency in 2030 compared to projections of future energy consumption based on the current criteria (PRIMES 2007). The energy efficiency target is planned to be reviewed before 2020, having in mind an EU target of 30%.

In order to achieve these targets, all energy consumption sectors have to make contributions. The energy saving potentials in order to reach these targets are already there. They are well documented in several studies. These studies also show that many of these potentials are cost-effective for a company from a social perspective, and even that of an individual private investor (see e.g. IEA 2012a, Fraunhofer ISI 2012, Eichhammer 2013, Fraunhofer ISI et al. 2014).

The cost-effectiveness of energy efficiency measures is further improved if taking into account the significant co-benefits of energy efficiency such as increases in GDP and employment, and an improvement in competitiveness (see e.g. IEA 2012b, eceee 2013, Cambridge Econometrics 2013, IEA 2014). In addition, the reduction of energy consumption through energy efficiency is one of the most effective means of reducing the dependence on imported energy and thus increasing energy security.

In reality, there is still a gap between the market potential for energy efficiency and the cost-effective potential from an individual or social point of view. Even the profitable potential is not fully exploited, primarily because of persistent barriers to the deployment of energy efficiency measures.

A suitable policy mix in the field of energy efficiency should not only be able to break down these barriers, but also make use of the driving forces which facilitate the implementation of energy saving measures. This means:

- Regulatory instruments generally define the technological baseline for the technical energy improvement measures in companies. That way they also implicitly raise the priority for energy efficiency investment.
- Financial and fiscal instruments play a crucial role for the reduction of the economic barriers, especially the lack of capital and the transaction costs.
- However, there still remain non-economic barriers which cannot be successfully tackled by regulatory and financial instruments alone. Therefore, informational and advisory instruments are an important completion of such a package since they can address barriers and driving forces which do not lie in economic reasons (as e.g. information and knowledge deficits, uncertainties or energy efficiency as an image factor).

Every policy package should therefore comprise regulatory as well as the other incentivising instruments ("stick and carrot"), where the regulatory instruments define the technological baseline. The other instruments may then either encourage the investor to undertake measures complying with this baseline or they may set incentives to even exceed the standards significantly and make use of more advanced technologies.

If this kind of policy package is designed, a specific energy use in a sector (as e.g. lighting, electric motors, electrical processes in the industry sector) will usually be targeted by several policy measures. In that case, measure interactions can occur, i.e. measures in the package may reinforce each other but they could also counteract against each other. These measure interactions have to be taken into account in order to assess the impact of the policy actions on the EU (or national) energy efficiency targets in a realistic manner.

9.2 MEASURE INTERACTION IN THE MURE DATABASE

How the MURE database tackles policy interactions?

As already stated above, measure interactions (overlap or reinforcing) can occur when designing a policy package to remove the different barriers in the companies to the deployment of energy efficiency measures. The new facility enables the user to characterize packages of measures and their interactions in a quantitative way. Methodogically, it is based on an interaction matrix which assesses the interaction between different types of policy instruments (Figure 69) and the semi-quantitative measure impact of the measures given in MURE. The semi-quantitative impact is re-calculated into a quantitative energy saving and – based on the assumptions in the interaction matrix – the interaction impact is calculated. In the example for measures addressing electric drives in Finland, which is shown in Figure 70, the calculated interaction is relatively small since there is only a slight overlap between the different policies.

The tool is set up completely interactive, so that the user can change the assessment in the interaction matrix, the measure package itself and the semi-quantitative impact evaluation.

Figure 69 : Interaction matrix for measures addressing electric drives

Measure types group interaction matrix - Finland - Electric drives

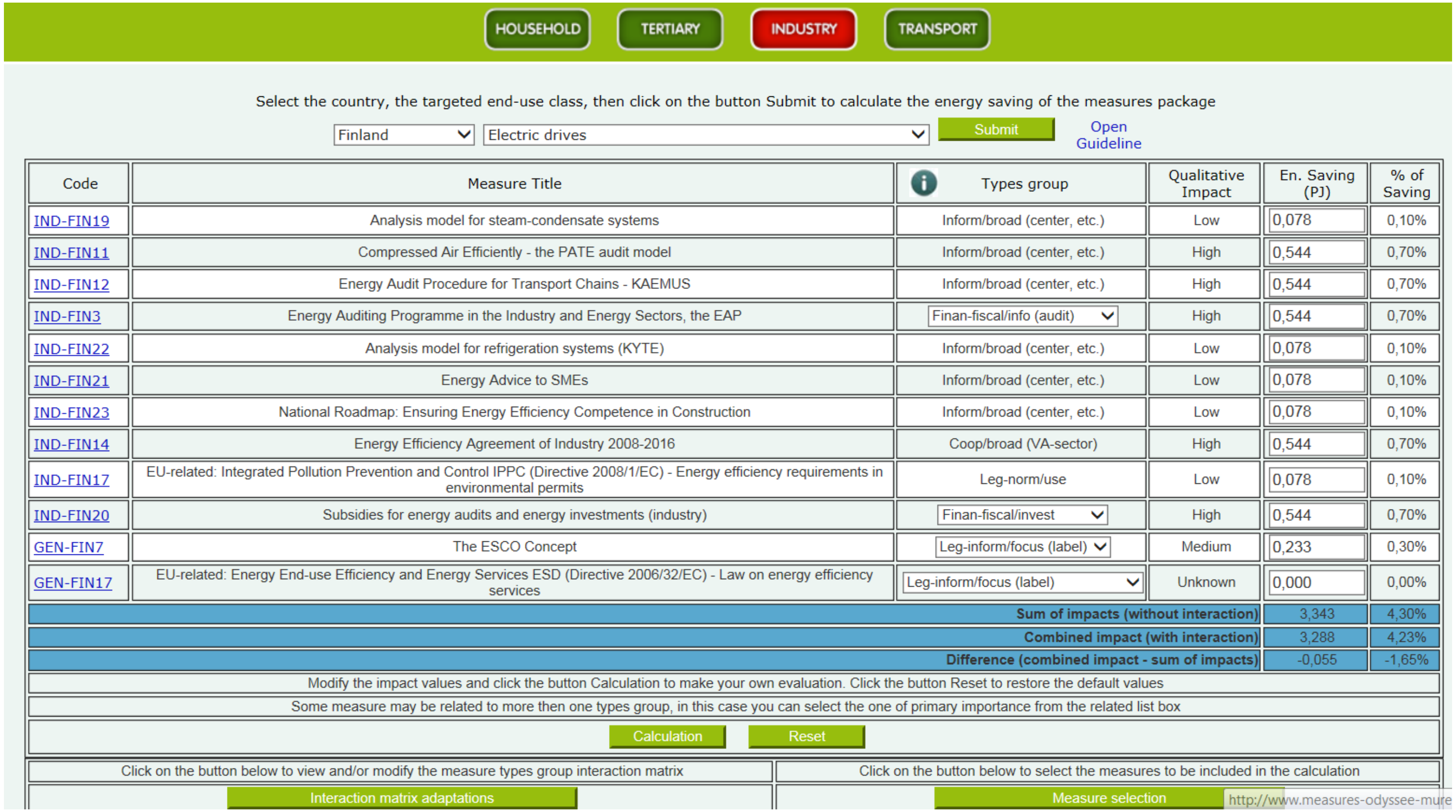
You can modify the values of the interaction matrix by choosing from the related list boxes, then click the button Confirm to make your own evaluation

	Leg-norm/invest	Leg-norm/use	Leg-inform/focus (label)	Leg-inform/focus (label)	Finan-fiscal/invest	Market-instrum/invest	Finan-fiscal/info (audit)	Inform/focused-invest	Inform/broad (center, etc.)	Coop/focused (VA-manufacturers)	Coop/broad (VA-sector)	Cross-cutting/taxes
Leg-norm/invest												
Leg-norm/use												
Leg-inform/focus (label)		Not interactin										
Leg-inform/focus (label)		Not interactin	Strong overla									
Finan-fiscal/invest		Some overlap	Strong reinfor	Reinforcing								
Market-instrum/invest												
Finan-fiscal/info (audit)		Not interactin	Strong overla	Strong overla	Some reinforc							
Inform/focused-invest		Strong overla	Not interactin	Some overlap	Not interactin		Not interactin					
Inform/broad (center, etc.)		Some overlap	Some overlap	Not interactin	Some reinforc		Some overlap	Some overlap				
Coop/focused (VA-manufacturers)		Not interactin	Reinforcing	Not interactin	Some overlap		Some reinforc	Not interactin	Not interactin			
Coop/broad (VA-sector)		Overlap	Some reinforc	Some reinforc	Overlap		Some reinforc	Strong reinfor	Some overlap	Not interactin		
Cross-cutting/taxes												

Confirm Reset

Source: MURE database (policy interaction facility)

Figure 70 : Assessment of the policy interaction– Example : measures addressing electric drives in Finland



HOUSEHOLD TERTIARY INDUSTRY TRANSPORT

Select the country, the targeted end-use class, then click on the button Submit to calculate the energy saving of the measures package

Finland | Electric drives | Submit | Open Guideline

Code	Measure Title	Types group	Qualitative Impact	En. Saving (PJ)	% of Saving
IND-FIN19	Analysis model for steam-condensate systems	Inform/broad (center, etc.)	Low	0,078	0,10%
IND-FIN11	Compressed Air Efficiently - the PATE audit model	Inform/broad (center, etc.)	High	0,544	0,70%
IND-FIN12	Energy Audit Procedure for Transport Chains - KAEMUS	Inform/broad (center, etc.)	High	0,544	0,70%
IND-FIN3	Energy Auditing Programme in the Industry and Energy Sectors, the EAP	Finan-fiscal/info (audit)	High	0,544	0,70%
IND-FIN22	Analysis model for refrigeration systems (KYTE)	Inform/broad (center, etc.)	Low	0,078	0,10%
IND-FIN21	Energy Advice to SMEs	Inform/broad (center, etc.)	Low	0,078	0,10%
IND-FIN23	National Roadmap: Ensuring Energy Efficiency Competence in Construction	Inform/broad (center, etc.)	Low	0,078	0,10%
IND-FIN14	Energy Efficiency Agreement of Industry 2008-2016	Coop/broad (VA-sector)	High	0,544	0,70%
IND-FIN17	EU-related: Integrated Pollution Prevention and Control IPPC (Directive 2008/1/EC) - Energy efficiency requirements in environmental permits	Leg-norm/use	Low	0,078	0,10%
IND-FIN20	Subsidies for energy audits and energy investments (industry)	Finan-fiscal/invest	High	0,544	0,70%
GEN-FIN7	The ESCO Concept	Leg-inform/focus (label)	Medium	0,233	0,30%
GEN-FIN17	EU-related: Energy End-use Efficiency and Energy Services ESD (Directive 2006/32/EC) - Law on energy efficiency services	Leg-inform/focus (label)	Unknown	0,000	0,00%
			Sum of impacts (without interaction)	3,343	4,30%
			Combined impact (with interaction)	3,288	4,23%
			Difference (combined impact - sum of impacts)	-0,055	-1,65%

Modify the impact values and click the button Calculation to make your own evaluation. Click the button Reset to restore the default values

Some measure may be related to more then one types group, in this case you can select the one of primary importance from the related list box

Calculation Reset

Click on the button below to view and/or modify the measure types group interaction matrix | Click on the button below to select the measures to be included in the calculation

Interaction matrix adaptations | Measure selection

http://www.measures-odyssee-mure

Source: MURE database (policy interaction facility)

9.3 MAPPING ENERGY EFFICIENCY POLICIES

How to map energy efficiency policies to specific end-uses as a pre-requisit for interaction analysis?

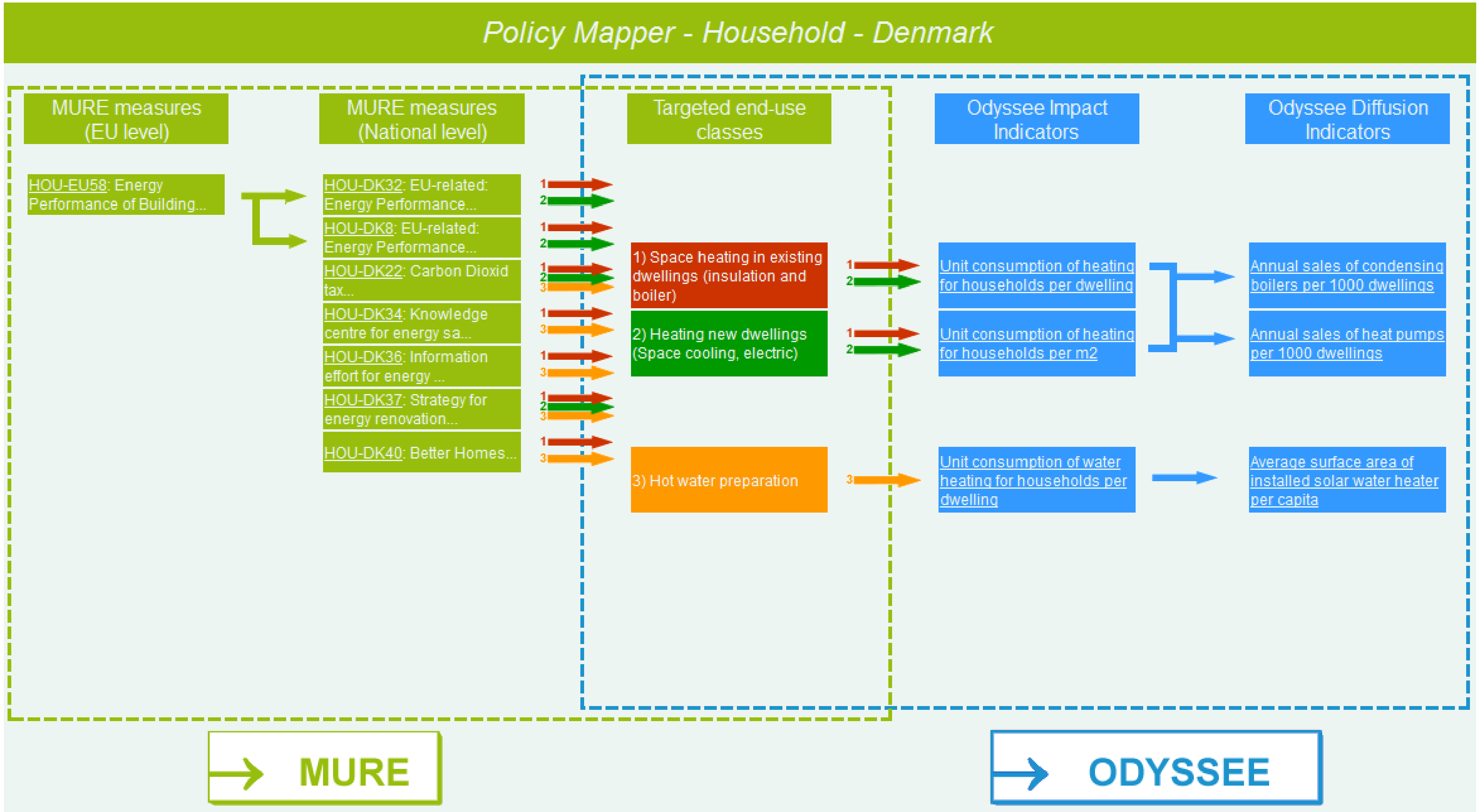
A pre-requisit for interaction analysis is mapping energy efficiency measures with end-uses. As the interaction facility, the policy mapper addresses policy mixes for a specific end-use. The policy mapper enables to identify policy packages for a given targeted end-use and relates them to the suitable energy efficiency indicators from the ODYSSEE database.

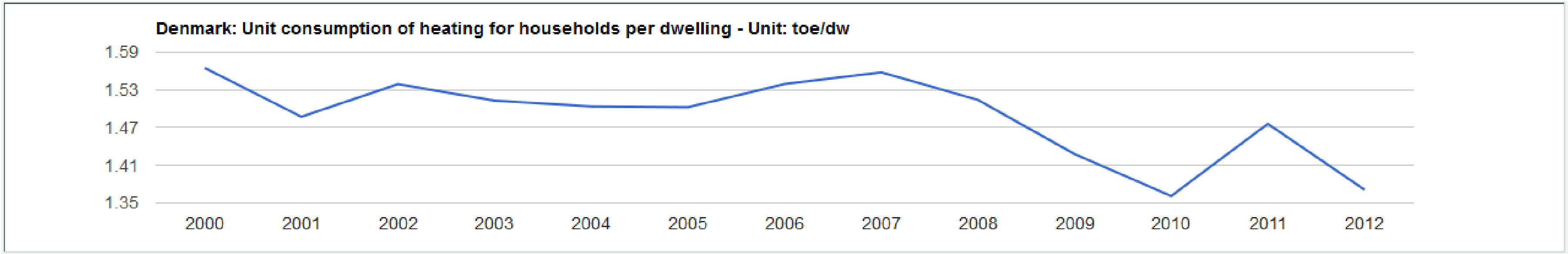
As an example, Figure 71 shows the policy measures addressing three end-uses (space heating in existing dwellings, heating of new dwellings, hot water preparation) in the residential sector in

Denmark. The figure also shows the impacts of the policy measures undertaken in Denmark on the impact indicator (unit consumption of dwellings for heating in toe/dwelling) derived from ODYSSEE. Though this indicator is not only influenced by the policy measures listed in the table and aiming at the selected end-uses, but also by autonomous developments such as world-market prices for energy carriers, it provides nevertheless some hints on the impacts of the policy measures. A full impact analysis would nevertheless include a bottom-up analysis of the policy package, including the use of the above mentioned interaction facility. Diffusion indicators such as the sales of condensing boilers complete the picture.

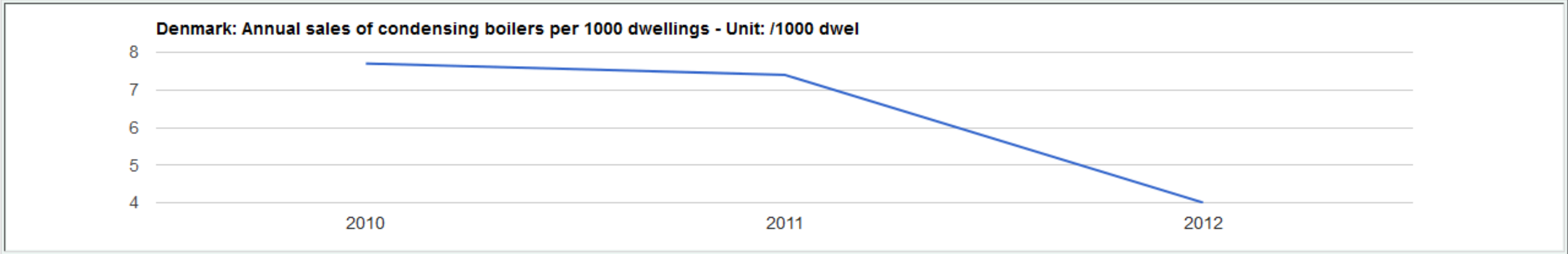
Figure 72 shows as another example for the policy mapping the case of Ireland with the policy measures addressing three end-uses in transport: Road – Passengers (cars), Modal shift - Persons (train, buses, bicycling, walking), Mobility – Persons (management, ICT). The figure further shows the impacts of the policy measures undertaken in Ireland on the impact indicator (unit consumption of cars per vehicle in toe/vehicle) derived from ODYSSEE. A typical diffusion indicator of the sales of efficient cars (less than 100g CO_2/km).

Figure 71 : Policy mapper – Example : measures addressing several targeted end-uses in the residential sector in Denmark



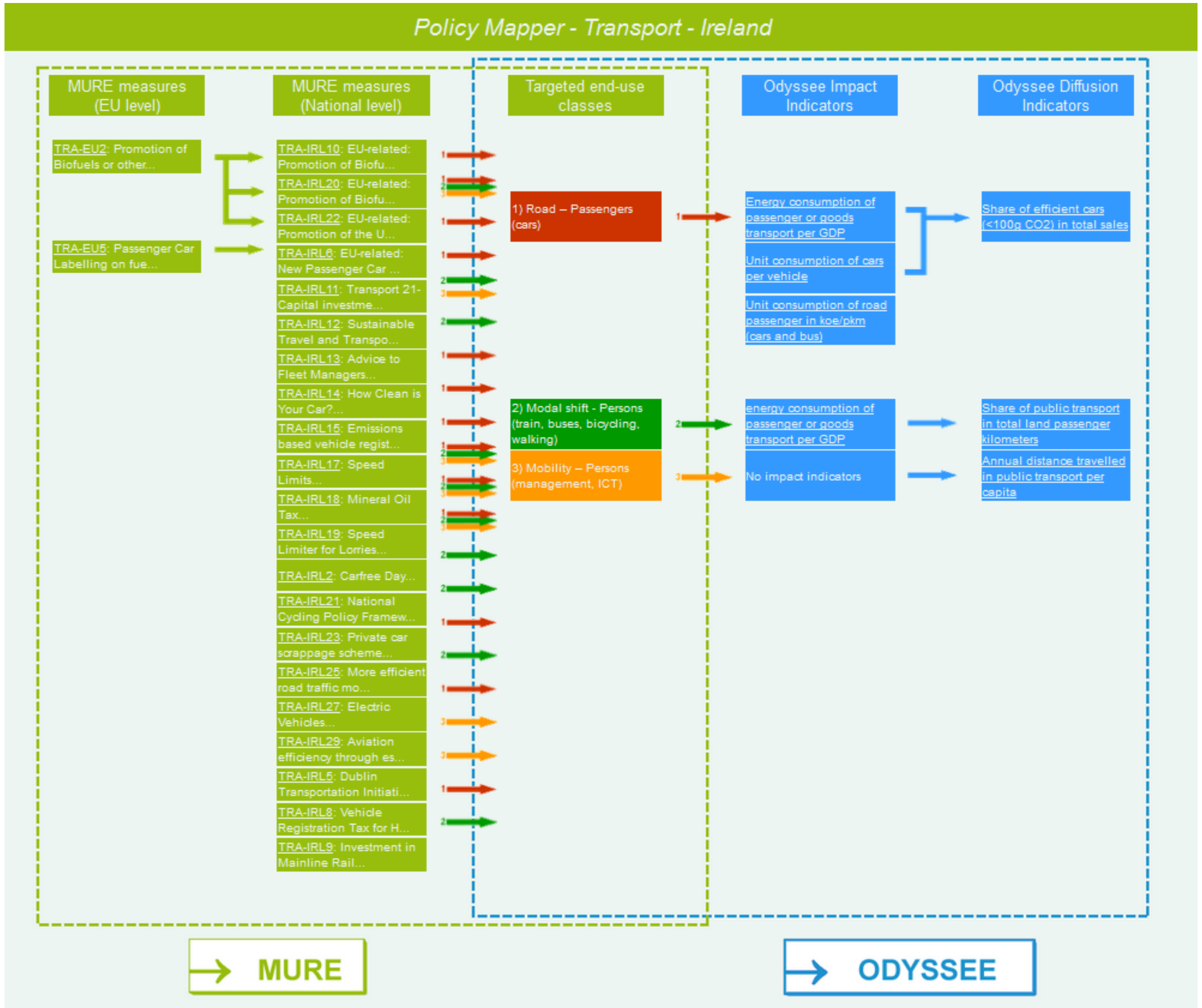


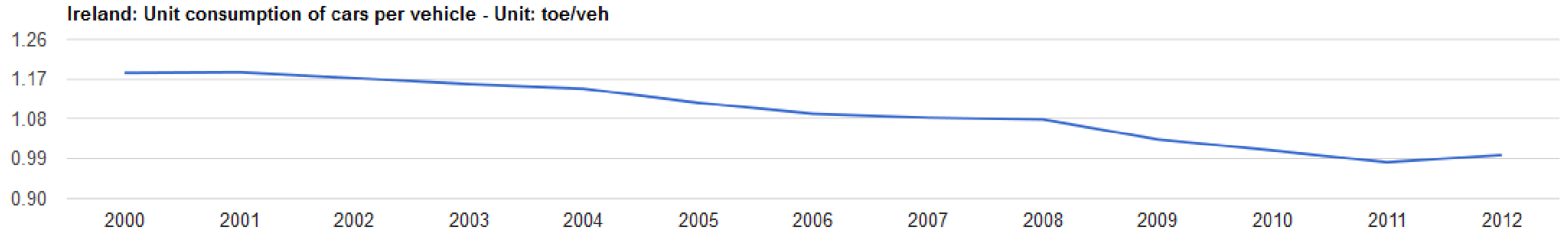
Code	Title	From	Updated
HOU-DK22	Carbon Dioxid tax	1998	2014
HOU-DK32	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - Energy Labeling of Buildings	2005	2014
HOU-DK8	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - Building regulations	2006	2014
HOU-DK34	Knowledge centre for energy savings in buildings	2008	2014
HOU-DK36	Information effort for energy efficiency regarding end-users (sparenergi.dk)	2012	2015
HOU-DK40	Better Homes	2014	2014
HOU-DK37	Strategy for energy renovation	2014	2015

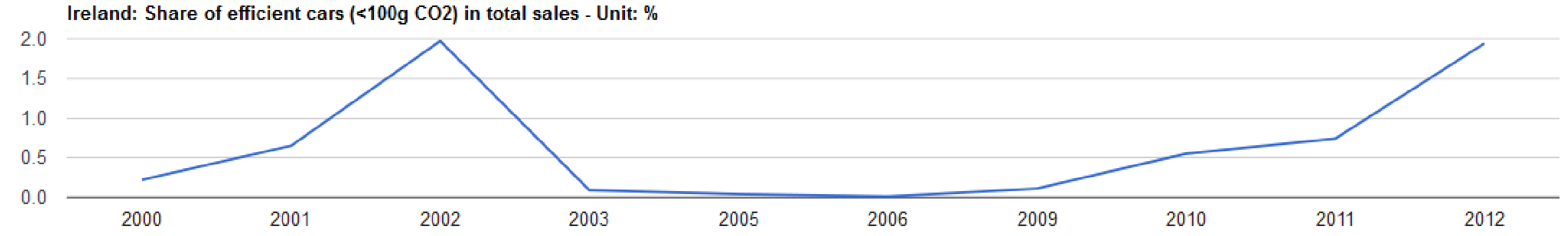


Source: MURE database (policy mapper facility)

Figure 72 : Policy mapper – Example : measures addressing several targeted end-uses in the transport sector in Ireland







Code	Title	From	Updated
TRA-IRL6	EU-related: New Passenger Car Labelling on fuel economy rating (1999/94/EC)	2001	2011
TRA-IRL8	Vehicle Registration Tax for Hybrid Vehicles	2001	2014
TRA-IRL10	EU-related: Promotion of Biofuels or other Renewable Fuels for Transport (Directive 2003/30/EC)	2005	2015
TRA-IRL19	Speed Limiter for Lorries	2005	2009
TRA-IRL17	Speed Limits	2005	2009
TRA-IRL13	Advice to Fleet Managers	2007	2011
TRA-IRL14	How Clean is Your Car?	2007	2011
TRA-IRL15	Emissions based vehicle registration tax and annual motor tax for private cars	2008	2015
TRA-IRL20	EU-related: Promotion of Biofuels or other Renewable Fuels for Transport (Directive 2003/30/EC)	2008	2014
TRA-IRL22	EU-related: Promotion of the Use of Biofuels or Other Renewable Fuels for Transport (2003/30/EC)	2008	2011
TRA-IRL18	Mineral Oil Tax	2008	2011
TRA-IRL23	Private car scrappage scheme	2010	2015
TRA-IRL27	Electric Vehicles	2011	2014

10. SPECIFIC POLICY AREAS

10.1 DEFINING SPECIFIC POLICY AREAS

The MURE database allows comparing information on specific policy areas which is otherwise spread across the database and not easily retrieved. This provides support to policy makers which are in search for specific information on special topics such as policies aiming at behaviour or SMEs. This aims in particular towards the following areas listed in Box 5. The overview in Table 11 shows that **the focus of these specific types of measures is on energy efficiency and renewable energy in buildings which comprises roughly half of the measures captured. The next important groups are measures focusing on SMEs (about a quarter of the measures) and the promotion of bioenergy for heating.**

Box 5 : Specific policy areas of the MURE database

- ***Measures on SMEs*** (by sector: tertiary, industry, transport)
- ***Energy management***, with the following subgrouping:
  - Mandatory appointment of an energy manager (Tertiary)
  - Mandatory audits in large tertiary sector buildings (Tertiary)
  - Mandatory Energy Action Plan for municipalities (Tertiary)
  - Mandatory energy efficiency certificates for buildings (Tertiary)
  - Mandatory appointment of an energy manager (Industry)
  - Mandatory audits for industrial processes / buildings (Industry)
  - Energy management in transport company (Transport)
  - Technology procurement for energy efficient or green vehicles (Transport)
- ***Consumers behaviour*** (see the subgroupings in the following sections:
- ***Promotion of energy services***, with the following subgrouping:
  - Energy services(General Cross-Cutting)
  - third party financing(General Cross-Cutting)
  - white certificates(General Cross-Cutting)
  - Incentives facilitating Third Party Financing / ESCOs(General Cross-Cutting)
  - White certificates(General Cross-Cutting)
- ***Promotion of bioenergy for heating***
- ***Reduction of the transport demand***
- ***Promotion of non-conventionally fuelled vehicles***
- ***Measures on public procurement***, with the following subgrouping:
  - Technology procurement for energy efficient appliances (Tertiary)
  - Technology procurement for energy efficient buildings / components (Tertiary)
  - Technology procurement for energy efficient or green vehicles (Transport)
- ***Measures on energy efficiency and renewable energy in buildings***

Table 11 : Overview of selected policy topics per country (number of measures per topic area)

	Measures on SMEs	Energy management	Consumers behaviour	Promotion of energy services	Promotion of bioenergy for heating	Reduction of the transport demand	Promotion of non-conventionally fuelled vehicles	Measures on public procurement	Measures on energy efficiency and renewable energy in buildings	**Total Measures**
Austria	3	0	5	0	3	6	2	0	7	**19**
Belgium	6	6	5	1	8	6	0	0	20	**40**
Bulgaria	15	9	4	2	7	6	1	1	18	**49**
Croatia	13	4	3	2	7	11	11	3	28	**65**
Cyprus	2	1	2	2	3	3	3	1	7	**17**
Czech Republic	6	1	5	1	5	3	1	1	14	**27**
Denmark	4	3	5	0	2	1	1	0	6	**17**
Estonia	17	3	9	1	3	15	1	3	20	**61**
European Union	8	3	2	4	1	1	2	4	10	**32**
Finland	18	6	18	2	5	4	1	1	16	**55**
France	5	8	11	2	9	10	5	1	36	**67**
Germany	48	5	8	2	14	4	6	0	35	**95**
Greece	3	6	3	1	2	4	2	4	14	**28**
Hungary	6	3	5	0	14	7	2	1	22	**42**
Ireland	21	1	11	0	2	9	3	1	29	**65**
Italy	6	5	2	2	10	13	3	0	19	**46**
Latvia	15	2	4	0	13	3	4	2	23	**44**
Lithuania	6	1	5	0	7	8	1	1	30	**47**
Luxembourg	8	3	0	0	2	0	2	0	14	**21**
Malta	5	5	6	0	9	7	2	5	19	**35**
Netherlands	26	1	9	0	10	7	2	2	22	**60**
Norway	23	3	9	0	9	4	2	1	23	**56**
Poland	3	0	2	1	9	5	1	0	14	**26**
Portugal	2	10	6	1	3	5	3	1	18	**36**
Romania	3	6	1	3	3	6	1	0	13	**28**
Slovakia	11	6	1	1	6	0	1	1	20	**37**
Slovenia	7	3	5	1	9	3	2	1	17	**35**
Spain	15	10	18	1	19	18	11	2	49	**105**
Sweden	6	2	3	0	5	5	3	2	11	**26**
Switzerland	0	0	0	0	0	0	0	0	0	**0**
United Kingdom	11	3	9	5	3	5	3	1	17	**41**
Total	**322**	**119**	**176**	**35**	**202**	**179**	**82**	**40**	**591**	**1322**

Source: MURE database (selected policy area facility)

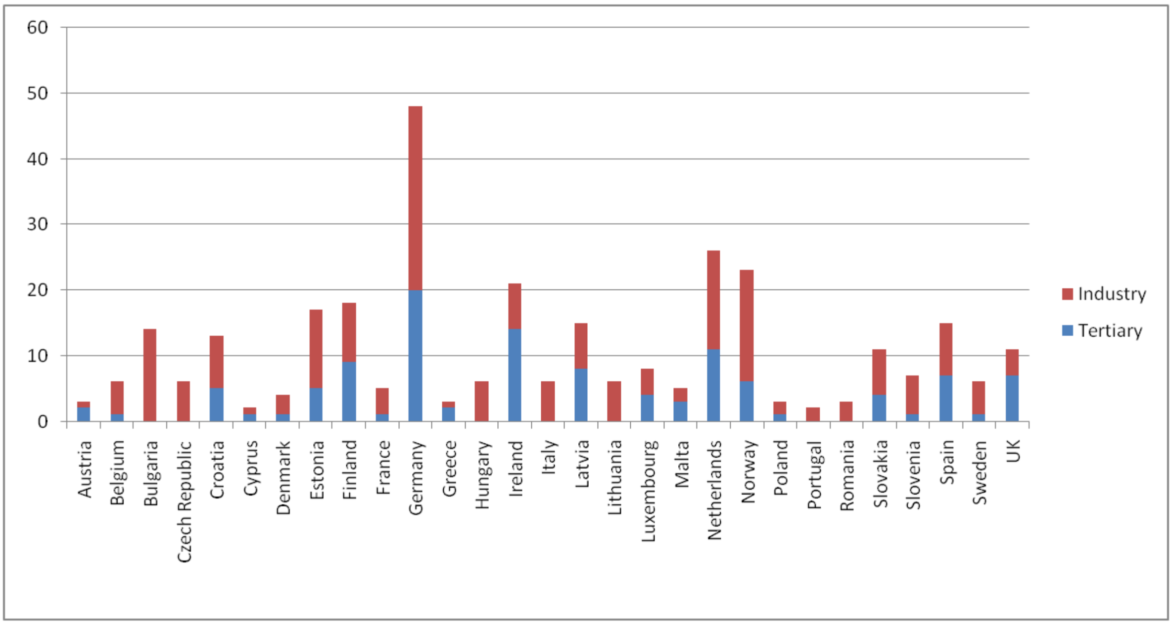
In the following sections we focus on policies for SMEs and on behavioural policies.

10.2 POLICIES FOR SPECIFIC TARGET GROUPS IN INDUSTRY – SMALL AND MEDIUM ENTERPRISES (SMES)

With the new “Policies by Topic” tool, the MURE database provides a tool to get a quick overview of policies specifically addressing target groups as e.g. small and medium enterprises (Figure 73).

This target group is both addressed by measures in industry and the tertiary sector. As Figure 73 shows, the number of measures addressing SMEs differs a lot between the countries. Whereas in Germany, the Netherlands or Norway there are a lot of measures addressing SMEs, in some other countries, such as Austria, Cyprus, Czech Republic, Greece or Romania SMEs are only targeted with very few or no measures.

Figure 73 : Policies in the MURE database addressing SMEs



Source: MURE database, July 2015

Policy measures in MURE specifically targeting SMEs can be categorized in two broad classes:

i. Financial Measures:
   Majority of the measures related to SMEs fall in this category. It includes measures dealing with funds, loans, subsidies, financial support schemes, consultations, financial incentives and aids for SMEs. Several measures provide financial support in the form of subsidies, loans and aid for Energy audits in SMEs. Such measures have been reported by Austria, Croatia, France and Spain. These measures provide technical and financial support to conduct comprehensive energy audits within SMEs. Measures related to energy-related advice and consultation have been reported by Germany, Austria, Spain and Malta.
ii. Information/Educational/Training Measures:
   These measures encompass education and training activities for SMEs on how to enhance energy efficiency, resource planning and management and the behavioral-training of the employees of the enterprise towards more responsible energy-related actions. Such measures have been reported by Finland and Ireland. UK reports a “Smart Metering” measure for the SMEs. The UK Department of Energy and Climate Change (DECC) is leading a roll-out (links below) of smart meters with support from the industry regulator, Ofgem. DECC estimates that over the next 20 years the installation of smart meters will provide £6.7 billion net benefits to the UK: the programme will cost £12.1 billion and provide £18.6 billion in benefits. Since 2009, where suppliers have replaced or newly installed a meter at a medium-

sized non-domestic site, that meter has had to be an advanced meter. Since April 2014, all supplies to these sites have to be provided through advanced meters.

In Table 12, the policies targeting SMEs are listed below under the above mentioned two categories.

Table 12 : Policy measures targeting SMEs

	Information/Education/Training	Financial
Austria		SME-Energy Cheque
Croatia		Energy audits of SMEs
Finland	Energy Advice to SMEs	
France		Loans for SMEs
Germany		a. Special fund for energy efficiency in SMEs b. KfW Energy consultations for SMEs c. Promotion of energy efficient cross-cutting technologies in SMEs
Ireland	SME Energy Efficiency	
Malta		Support schemes for Industry and SMEs
Poland		Energy efficiency investments in SMEs
Slovenia		Financial incentives for investment in energy efficiency and renewable in SMEs
Spain		a. IDEA-ERDF Programme for SMEs b. Aids to SMEs and large companies in the industrial sector
Sweden	Energy efficiency in SMEs	

Source: MURE database, June 2015

10.3 POLICIES AIMING TO INFLUENCE BEHAVIOUR

Policies aiming at consumers behaviour become increasing relevant because technical solutions to improve energy efficiency alone may not be enough to achieve large reductions in energy consumption and behavioural changes are also required. This policy category has the following subgroupings:

- behaviour (Household)
- smart meters (Household)
- Detailed energy/electrical bill aiming at EE improvement (Household)
- Information campaigns (by energy agencies, energy suppliers etc) (Household)
- Regional and local information centre on energy efficiency (Household)
- Voluntary labelling of buildings/components (existent and new) (Household)
- Information / training on energy efficient driving behaviour (Transport)
- Promotion of cycling or walking (Transport)
- Energy management in transport company (Transport)
- behaviour (Transport)

The overview in Table 13 shows that the largest focus of such type of measures is on information campaigns (roughly 40% of the behavioural measures), followed by training on energy efficiency driving behaviour and promotion of cycling/walking.

A particularly large number of behavioural measures exist in Finland (Table 14) but also in Spain. This comparison shows that two rather different cultures may have strong activities to influence behaviour though it is an open question whether the impact of these policies is similar.

Table 13 : Policy measures targeting behaviour

	behaviour (Household)	smart meters (Household)	Detailed energy/electrical bill aiming at EE improvement (Household)	Information campaigns (by energy agencies, energy suppliers etc) (Household)	Regional and local information centre on energy efficiency	Voluntary labelling of buildings/components (existent and new) (Household)	Information / training on energy efficient driving behaviour (Transport)	Promotion of cycling or walking (Transport)	Energy management in transport company (Transport)	behaviour (Transport)	**Total Measures**
Austria	0	1	1	2	0	1	2	1	0	0	**5**
Belgium	0	0	0	3	2	1	0	1	0	0	**5**
Bulgaria	0	0	0	0	0	0	2	3	0	0	**4**
Croatia	1	0	0	0	0	0	1	1	0	0	**3**
Cyprus	0	0	0	1	0	0	0	1	0	0	**2**
Czech Republic	0	0	0	2	1	1	0	1	0	0	**5**
Denmark	0	0	0	4	2	1	1	0	0	0	**5**
Estonia	1	0	0	4	1	0	3	2	0	0	**9**
European Union	1	0	0	1	0	0	0	0	0	0	**2**
Finland	0	0	0	8	1	1	3	2	4	0	**18**
France	2	0	0	3	2	2	0	4	0	0	**11**
Germany	1	1	0	3	1	1	1	0	0	0	**8**
Greece	1	0	1	2	0	0	1	0	0	0	**3**
Hungary	0	0	1	3	4	0	1	0	0	0	**5**
Ireland	2	1	1	4	1	0	4	2	0	0	**11**
Italy	0	0	0	0	0	1	0	1	0	0	**2**
Latvia	0	1	0	2	1	0	1	0	0	0	**4**
Lithuania	1	0	0	0	0	0	2	3	0	0	**5**
Luxembourg	0	0	0	0	0	0	0	0	0	0	**0**
Malta	0	0	0	5	0	0	0	1	0	0	**6**
Netherlands	3	2	1	3	1	0	2	0	0	0	**9**
Norway	0	0	1	5	2	1	1	0	0	0	**9**
Poland	0	0	0	0	0	0	1	1	0	0	**2**
Portugal	0	0	0	3	0	0	2	0	1	0	**6**
Romania	0	0	0	0	0	0	0	1	0	0	**1**
Slovakia	0	0	0	1	0	0	0	0	0	0	**1**
Slovenia	1	0	0	0	1	0	2	1	0	0	**5**
Spain	0	0	1	4	0	0	10	3	0	0	**18**
Sweden	0	0	0	1	0	1	2	0	0	0	**3**
Switzerland	0	0	0	0	0	0	0	0	0	0	**0**
United Kingdom	3	1	1	4	3	1	3	2	0	0	**9**
Total	**17**	**7**	**8**	**68**	**23**	**12**	**45**	**31**	**5**	**0**	**176**

Source: MURE database, August 2015

Table 14 : Policy measures targeting behaviour in Finland and Spain

Code	Sector	Measure Title	Status 1)	Measure Type 2)	Starting Year
HOU-FIN19	Household	Energy conservation education for inhabitants of buildings, 'the energy expert' -education	C	Inf/Edu	1996
HOU-FIN27	Household	National theme week for second grade pupils	O	Inf/Edu	1996
HOU-FIN30	Household	Promotion of heat pumps	O	Inf/Edu	2000
HOU-FIN5	Household	Programme for energy conservation in oil-heated buildings, the "Höylä II" programme	C	Inf/Edu	2002
HOU-FIN20	Household	Energy Efficient Home Campaign	O	Inf/Edu	2005
HOU-FIN1	Household	Window Energy Rating System	O	Inf/Edu	2006
HOU-FIN21	Household	Programme for energy conservation in oil-heated buildings, the Höylä III Programme	O	Inf/Edu	2007
HOU-FIN24	Household	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Periodic voluntary inspections of household boilers	O	Inf/Edu	2007
HOU-FIN28	Household	Coordinated energy advice to the consumers	O	Inf/Edu	2010
TRA-FIN20	Transport	Optimal tyre pressure in passenger car and van traffic	O	Inf/Edu/Tr	1990
TRA-FIN12	Transport	Eco-Driving Education in Driving Schools	O	Inf/Edu/Tr	1994
TRA-FIN10	Transport	Eco-driving for Professional Drivers	O	Inf/Edu/Tr	1996
TRA-FIN4	Transport	The network of Finnish cycling municipalities	O	Inf/Edu/Tr	1997
TRA-FIN15	Transport	Energy Conservation Programme for Truck and Van Transport	C	Co-op , SocP/Org	2003
TRA-FIN16	Transport	Energy Conservation Programme for Public Transport	C	Co-op , SocP/Org	2005
TRA-FIN18	Transport	Energy Efficiency Agreement for Freight Transport and Logistics 2008-2016	O	Co-op , SocP/Org	2008
TRA-FIN19	Transport	Energy Efficiency Agreement for Public Transport 2008-2016	O	Co-op , SocP/Org	2008
TRA-FIN26	Transport	Promoting walking and cycling	O	Inf/Edu/Tr, Infr, SocP/Org	2011

Code	Sector	Measure Title	Status 1)	Measure Type 2)	Starting Year
HOU-SPA2	Household	Energy Conservation and Efficiency Plan, EECP 1991-2000 (Plan de Ahorro y Eficiencia Energética, PAEE 1991-2000)	C	Fin, Inf/Edu	1991
HOU-SPA19	Household	Action Plan 2005-2007: Awareness raising and training of consumers and salespeople (Plan de Acción 2005-2007: Concienciación y formación de vendedores y compradores)	C	Inf/Edu	2005
HOU-SPA25	Household	Plan for Replacement of Electricity Meters	O	Inf/Edu	2008
HOU-SPA38	Household	IDAE's Financing Lines for Thermal Renewable Energies in Buildings: BIOMCASA-SOLCASA-GEOTCASA	O	Fin, Inf/Edu	2009
HOU-SPA22	Household	Action Plan 2011-2020: Improvement of the energy efficiency of the electric appliances stock	O	Co-op, Fin, Inf/Edu	2011
TRA-SPA3	Transport	Energy Conservation and Efficiency Plan, EECP 1991-2000 (Plan de Ahorro y Eficiencia Energética, PAEE 1991-2000)	C	Co-op , Inf/Edu/Tr	1991
TRA-SPA10	Transport	Training plan for road haulage personnel in the reduction of energy consumption	C	Inf/Edu/Tr	1994
TRA-SPA7	Transport	'ECOTEST' testing automoviles on energy efficiency (ECOTEST test de medidas de rendimiento en vehículos)	C	Inf/Edu/Tr	1997

TRA-SPA8	Transport	Ecodriving Europe Programme (Programa Europeo de Conducción Eficiente-Plan Nacional de Formación de Autoescuelas)	C	Inf/Edu/Tr	2003
TRA-SPA14	Transport	Action Plan 2005-2007: Urban Mobility Plans	C	Inf/Edu/Tr, Infr, SocP/Org	2005
TRA-SPA22	Transport	Action Plan 2005-2007:Efficient Driving of Private Vehicles	C	Inf/Edu/Tr	2005
TRA-SPA23	Transport	Action Plan 2005-2007: Efficient Driving of Lorries and Buses	C	Inf/Edu/Tr	2005
TRA-SPA24	Transport	Action Plan 2005-2007: Efficient Driving of Aircraft	C	Inf/Edu/Tr	2005
TRA-SPA30	Transport	Action Plan 2011-2020: Sustainable Urban Mobility Plans	O	Inf/Edu/Tr, Infr, SocP/Org	2011
TRA-SPA31	Transport	Action Plan 2011-2020: Transport Plans in firms and activity centres	O	Inf/Edu/Tr, Infr, SocP/Org	2011
TRA-SPA38	Transport	Action Plan 2011-2020: Eco-driving for cars and vans	O	Co-op, Inf/Edu/Tr, Leg/Inf	2011
TRA-SPA39	Transport	Action Plan 2011-2020: Eco-driving for trucks and buses	O	Inf/Edu/Tr	2011
TRA-SPA40	Transport	Action Plan 2011-2020: Eco-driving for aircrafts	O	Co-op, Inf/Edu/Tr	2011

1) C = completed measure, O = ongoing measure
2) Co-op = co-operative measures, Information/Education/Training = Inf/Edu/Tr, Infr = Infrastructure-related measures, SocP/Org = SocialPlanning/Organisational measures, Leg/Inf = Legislative/Informative measures, Fin = Financial measures

Source : MURE database, September 2015 (the measure codes refer to the MURE database)

11. SCORING ENERGY EFFICIENCY EFFORTS

11.1 WHY SCORING ENERGY EFFICIENCY POLICIES AND TRENDS?

Scoring energy efficiency policies and trends aims to provide comparison indicators and comparable characteristics which help countries to understand whether their policies are comparable or better than in other countries or whether they can learn from other countries to improve their policies. For that purpose, scoreboards are useful instruments which gather in general multiple aspects which are, as far as possible, quantitatively evaluated and compared among countries. Outside the energy efficiency field scoring is used in many areas and famous score boards are for example:

- the World University Rankings 2014-15[46]
- the Programme for International Student Assessment PISA[47]
- the Innovation Indicator of the Telekom Stiftung, developed by Fraunhofer ISI, which compares the innovative strength of Germany with other countries[48], A similar tool is the European Innovation Scoreboard[49] which provides a comparative assessment of research and innovation performance in Europe.
- the macro-economic imbalance procedure (MIP) scoreboard of EU Member countries[50] which serves as an early warning system
- the EU Single Market Scoreboard[51]

Hence, the notion of scoring efforts is present in nearly all areas of life.

On a worldwide basis a variety of countries/organisations have started to organise scoreboards for energy efficiency with widely differing. Examples for Energy Efficiency Score Boards are

- the IEA Energy Efficiency Score Boards 2009 and 2011[52]
- the ACEEE 2012 and 2014 International Energy Efficiency Score Boards[53]
- the ACEEE US 2006 to 2014 State Energy Efficiency Scorecards[54]
- RCREEE Arab FutureTM Energy Index AFEX[55]
- CO2 Score Card[56]

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[46] https://www.timeshighereducation.com/world-university-rankings/2015/world-ranking
[47] http://www.oecd.org/pisa/pisaproducts/
[48] http://www.telekom-stiftung.de/dts-cms/en/innovation-indicator
[49] http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards/index_en.htm
[50] http://ec.europa.eu/economy_finance/economic_governance/macroeconomic_imbalance_procedure/mip_scoreboard/index_en.htm
[51] http://ec.europa.eu/internal_market/scoreboard/index_en.htm
[52] https://www.iea.org/publications/freepublications/publication/IEA_Scoreboard2011.pdf
[53] http://aceee.org/research-report/e1402
[54] http://aceee.org/state-policy/scorecard
[55] http://www.rcreee.org/projects/arab-future-energy-index%E2%84%A2-afex
[56] http://www.co2scorecard.org/

- the Climate Change Performance Index 2015[57]
- the Climate Action Tracker[58]
- the Climate Scoreboard[59]

These examples show that it is the time to investigate more in detail the feasibility of a detailed European Energy Efficiency Scoreboard (EEES). Though the above mentioned examples provide excellent information to design such a scoreboard for Europe, each region has to design its own methodology which fits its purposes and data availability. Therefore, the efforts of the present ODYSSEE-MURE project and of this section are focussed on methodological development rather than on presenting a fully elaborated energy efficiency scoreboard. The score board should have three basic elements:

- Scoring of the state of energy efficiency
- Scoring energy efficiency trends
- Scoring energy efficiency policies

The following sections are devoted to these three aspects. The first two aspects are covered through the ODYSSEE database, the third aspect by the MURE database.

11.2 HOW TO SCORE ENERGY EFFICIENCY STATUS AND TRENDS?

How to develop a scoreboard facility on energy efficiency indicators?

The objective of the Scoreboard facility on energy efficiency indicators is to assess and score the level and progress of countries in energy efficiency, globally and by end-use sector.

The scoring is done for a list of selected indicators representative of end-uses, transport mode or sub-sector. The calculation of the score for each indicator is based on the OECD Composite Indicators methodology[60], which gives normalized scores across the countries within a range of 0-1.

To get the average score by sector, each indicator is weighted with the same weight for all countries, taking into account a typical share of the end-use or subsector. For each type of indicator both the level and the trend is considered separate, as well as combined with an equal weight. For instance, in transport, the indicator for ar (l/100 km) has a weight of 50%, of which 25% for the level and 25% for the trend.

[57] https://germanwatch.org/en/9472
[58] http://www.climateactiontracker.org/
[59] https://www.climateinteractive.org/tools/scoreboard/
[60] http://www.oecd.org/els/soc/handbookonconstructingcompositeindicatorsmethodologyanduserguide.htm

The scoring is shown in two ways:

- Positioning: to show the position of any country by sector for all indicators vis à vis a reference to be selected by the user: the best country, the EU average or any country;
- Scoring to show the ranking of all countries by quartile and for the first quartile by score, with an option to show the ranking indicator by indicator.

Table 15 shows from the residential sector indicator scoreboard some selected indicators and indicators weighting. Figure 74 presents a radar graph to visualize the position of one country, Figure 75 exhibits sector results in the form of quartiles and finally Figure 76 is a ranking by indicator.

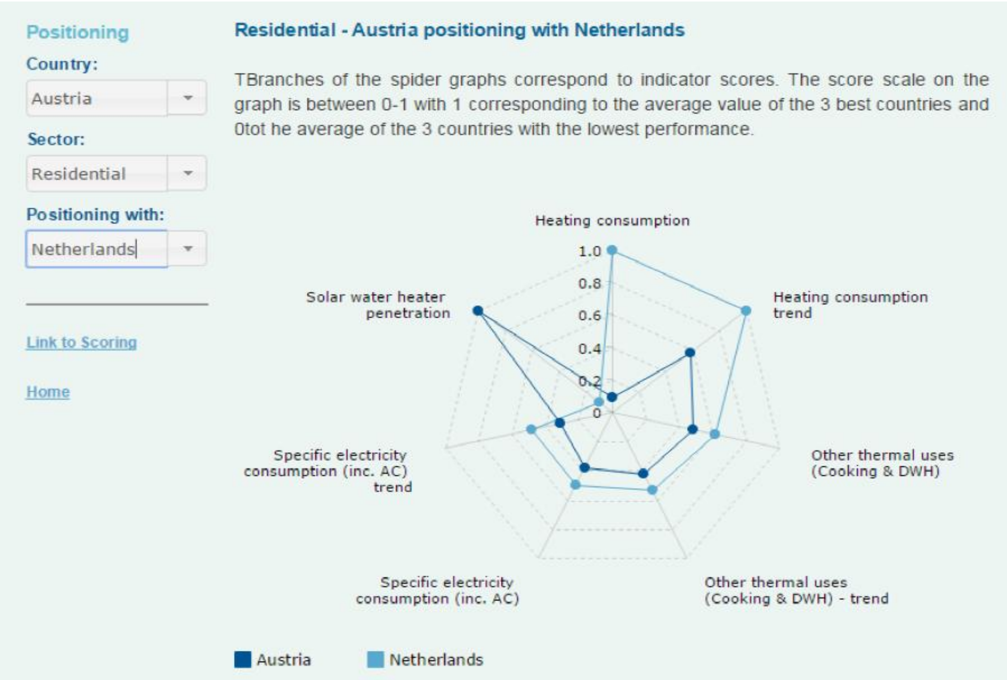
Table 15 : Residential sector indicator scoreboard - selected indicators and indicators weighting

End-use	Indicator	Weight	Weight
		Countries with low heating needs*	All other countries
Heating	Consumption for heating adjusted at EU climate per dwelling	25%	65%
Other thermal uses	Cons. per dwelling for cooking and water heating	35%	15%
Appliance	Specific consumption of electricity per dwelling for appliances (incl. Air-conditioning)	30%	15%
Solar penetration	% of dwellings with solar water heaters	10%	5%

•Malta, Cyprus and Portugal

Source: ODYSSEE

Figure 74 : Radar graph to visualize one country position



Source: ODYSSEE

Figure 75 : Ranking by sector with horizontal bars

Source: ODYSSEE

Figure 76 : Ranking by indicator

Hide details

The numbers in the table correspond to the indicator rankings among all countries; where shows the top ranking country for a particular indicator. Only the first quartile countries are listed for detailed ranking.

		1 Netherlands	2 Malta	3 Portugal	4 Spain	5 Romania	6 Bulgaria	7 Italy
Heating consumption	Level	3	4	2	5	7	6	10
	Trend	2	26	10	6	7	15	5
Other thermal uses (Cooking & DWH)	Level	8	2	13	11	18	1	5
	Trend	8	1	3	15	2	11	6
Specific electricity consumption (inc. AC)	Level	20	9	5	15	2	8	10
	Trend	12	3	14	21	25	6	10
Solar water heater penetration	Level	11	4	6	9	24	22	13

Source: ODYSSEE

These options and methodologies are still under development and will be further elaborated after more expert discussions.

11.3 HOW TO SCORE ENERGY EFFICIENCY POLICIES?

What is output or input-based scoring of energy efficiency policies?

For the scoring of energy efficiency policies two different ways of scoring have can be envisaged:

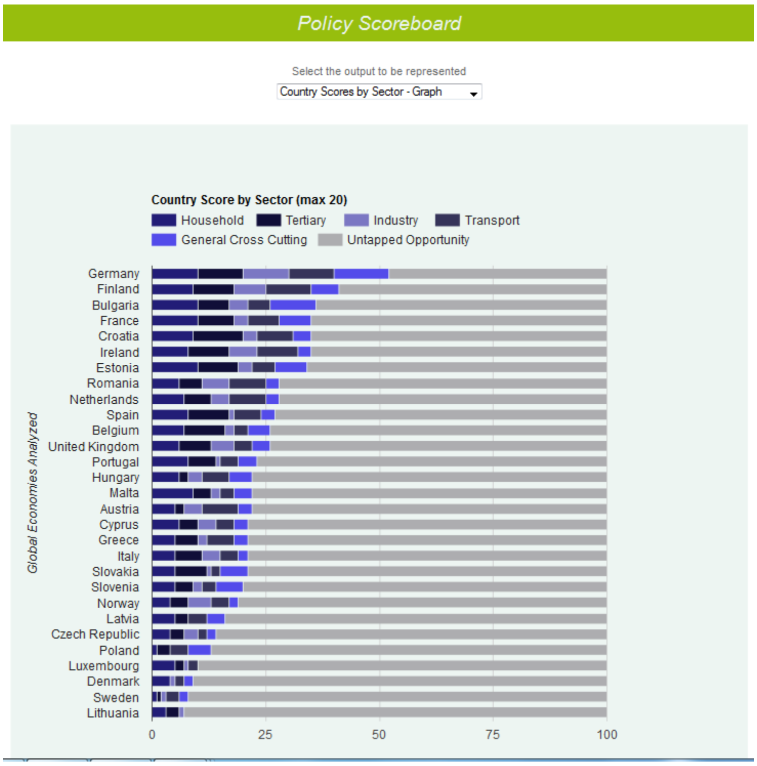
- ***Output-based scoring (scoring based on policy impacts)***: This approach is based on the savings that are achieved. The more a country is able to save in a given time frame compared to the overall or sectoral energy use, the higher score of the country. Therefore, this scoring approach is based on the percentage savings achieved in a given sector with the policy measures (or a proxy of the savings). Due to the fact that not all measures are fully quantitatively evaluated though with the National Energy Efficiency Action Plans NEEAPs this practice is largely improving (see section 7.4) two approaches were investigated, for the scoring of energy efficiency policies including in combination.
    - ***Approach 1 is based on the semi-quantitative impacts*** which are contained in the MURE database and which have been provided by the different experts from the

National Teams of ODYSSEE-MURE. Nearly 90% of all the measures in the database have such a semi-quantitative estimate of the impacts in terms of low, medium and high impact. For an example of results, see Figure 77.

- ***Approach 2 is fully based on the quantitative impact evaluations*** gathered in the MURE database (on average around 40% of all the measures have such an evaluation; measures under the NEEAPS are evaluated to up to 70%, depending on the sector. As in general, larger measures are more frequently evaluated, the coverage of savings is higher than the coverage of number of measures.
- ***In a combined approach, quantitative estimates were taken when available; otherwise they were completed with the semi-quantitative estimates.*** This approach takes the advantages from both approaches: the high impact measures tend to be underestimated by the semi-quantitative approach and are better represented with the quantitative approach when available. On the other hand the completeness of evaluations available is much higher with the semi-quantitative impact estimates.

Both approaches to output-based scoring can be standardised in the MURE database in an automatic manner and have been investigated, including through discussions with experts in workshops.

Figure 77 : Illustrative results from the output-based scoring of energy efficiency policies (based on the semi-quantitative impact estimates from the MURE database)



Source : MURE database, September 2015

- Further, a second approach to the scoring of energy efficiency policies was ***input-based scoring (that is: budgets for energy efficiency subsidies, existence or level of energy efficiency standards etc.).*** This is the approach for example ACEEE for the scoring of US States or the ACEEE worldwide Energy Efficiency Scoreboard. In principle such type of information is more readily available than impacts. The main difficulty with this approach is that the information is at present not automatically extracted from the database but need to be collected manually from the detailed measure descriptions available in the MURE database. Also, in difference to the approach for example by ACEEE to simply count the energy efficiency standards in a country/a state does not work out in Europe as the main standards, for example from the eco-design process, are similar in the different countries. Also all countries have thermal building regulation. So the main difference comes from the differences in the level of the regulation which is more difficult to describe. For an example of the indicators and the metrics discussed in the residential sector for the European Energy Efficiency Scoreboard, see Box 6.

Box 6 : Examples of how describe residential policies for the Input-based Scoring

The following are important energy efficiency measures for the residential sector and some indication on how the inputs to the policies could be normalized to take into account the size of the country:

- *Ecodesign standards*: common policies for all EU Member States. Metric could
- *Financial/fiscal measures:* metric are total budgets related for example to the GDP of a country or to the value of energy consumed in buildings (though the latter is influenced by energy prices)
- *Informational measures:* Metric for example total budgets related to value of energy consumed in buildings
- *Appliance labels:* share of labels better than A, average of labels (but not all countries have such type of information), ODEX for consumption of appliances (output based in that case!).
- *Energy taxes:* metric for example similar to financial measures: fiscal income generated, related to GDP or value of energy consumed
- *Energy saving obligations:* metric could be budgets spent on saving measures under the obligations related to GDP or value of energy consumed (in the output-based scoring one would use the savings achieved)

An item to be discussed is how the different policies could be weighted among each other. They could be weighted equally, some measure types could be given higher weights (e.g. financial subsidies) compared to other measure types, or lower weights (e.g informational measures due to the uncertain impacts-

Source : MURE

11.4 OPEN QUESTIONS FOR THE ENERGY EFFICIENCY SCOREBOARD?

How can I understand my position in the scoreboard?

From the discussions with experts inside and outside the ODYSSEE-MURE project it is rather evident that there is a lot of interest in the results of such scoring and that the results spur a lot of discussion, both with respect to the methodology as well as with respect to the results.

For example, on a German national workshop for the ODYSSEE-MURE projects preliminary results of a simplified scoreboard for energy efficiency state, trends and policies was presented and discussed (Figure 78). The event was presented under the title “World Champion of Energy Efficiency? How good is Germany really?”. Background to this question was the ACEEE 2014 Scorecard which ranked Germany first from a selected group of countries worldwide (Figure 79).

Figure 78 : Simplified Energy Efficiency Scoreboard presented in Germany (status: left, trend: middle, energy efficiency policies: right)

Tabelle 1

Deutschland steht beim Niveau der Energieeffizienz noch auf vorderen Plätzen…

Country	2012 Final Energy Intensity *	Rank
Malta	0,0717	1
United Kingdom	0,0746	2
Lithuania	0,0851	3
Germany	0,0884	4
Slovakia	0,0888	5
Hungary	0,0909	6
Spain	0,0925	7
Portugal	0,0930	8
European Union	0,0947	
Austria	0,0950	9
Poland	0,0964	10
Italy	0,1010	11
Netherlands	0,1021	12
Denmark	0,1027	13
France	0,1051	14
Czech Rep.	0,1053	15
Croatia	0,1060	16
Cyprus	0,1076	17
Ireland	0,1076	18
Greece	0,1096	19
Slovenia	0,1108	20
Romania	0,1135	21
Norway	0,1168	22
Latvia	0,1205	23
Bulgaria	0,1288	24
Belgium	0,1326	25
Estonia	0,1369	26
Finland	0,1488	27
Luxembourg	0,1584	28
Sweden	n.a.	

* Final energy intensity (koe/€2005p) adjusted for differences in industry and economic structure, as well as for climate differences (ppp, 2005)

Tabelle 2

…erzielte aber seit 2000 nur vergleichsweise bescheidene Fortschritte

Country	ODEX 2000-2012 *	Rank
Latvia	3,11%	1
Poland	2,79%	2
Romania	2,53%	3
Bulgaria	2,47%	4
Lithuania	2,02%	5
United Kingdom	1,89%	6
Netherlands	1,84%	7
Norway	1,81%	8
Slovenia	1,77%	9
Hungary	1,60%	10
Slovakia	1,54%	11
European Union	1,34%	
Denmark	1,24%	12
France	1,19%	13
Portugal	1,15%	14
Sweden	1,12%	15
Croatia	1,07%	16
Ireland	1,06%	17
Germany	1,04%	18
Cyprus	1,04%	19
Czech Rep.	1,01%	20
Austria	0,99%	21
Belgium	0,87%	22
Italy	0,83%	23
Estonia	0,75%	24
Greece	0,71%	25
Luxembourg	0,39%	26
Finland	0,34%	27
Spain	0,22%	28
Malta	0,10%	29

* Jährliche Energieeffizienzgewinne 2000-2012 (gemessen mit ODEX)

Tabelle 3

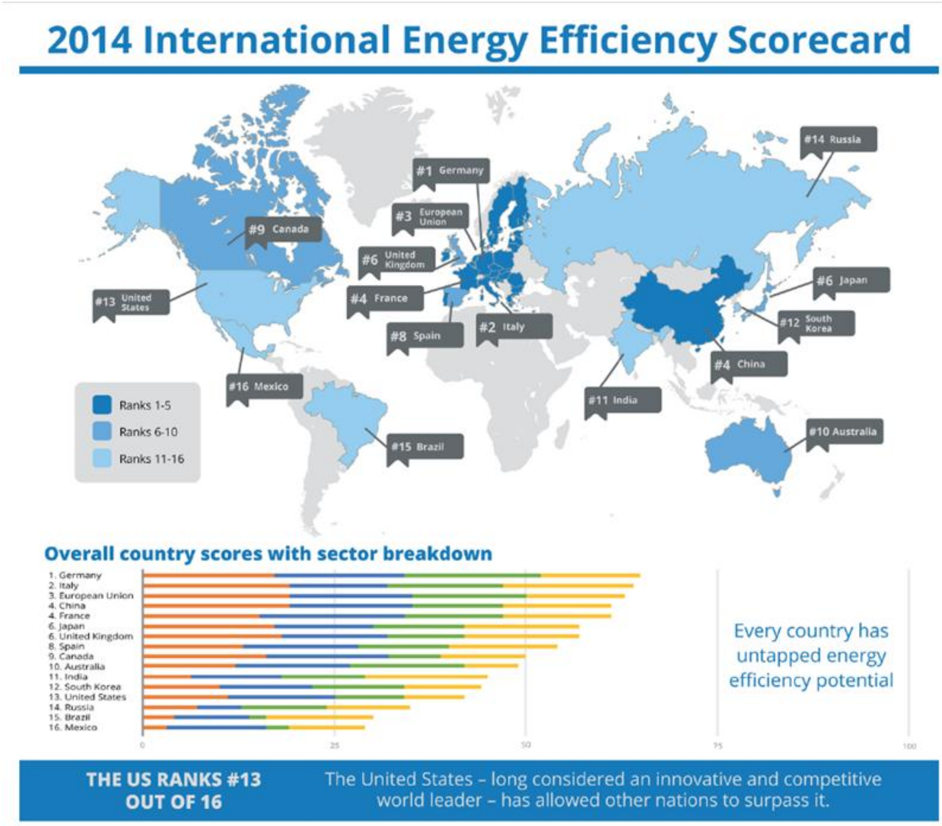
Ein guter Platz bei der Energieeff.politik könnte bei konsequenter Umsetzung erlauben, die Energiewendeziele zu erreichen

Country	Policy impact*	Rank
Bulgaria	56	1
Croatia	54	2
Germany	53	3
Ireland	48	4
Spain	48	5
France	46	6
Estonia	40	7
Finland	36	8
Latvia	36	9
Romania	34	10
Portugal	29	11
UK	27	12
Hungary	26	13
Belgum	25	14
Slovakia	25	15
Malta	25	16
Netherlands	23	17
Norway	21	18
Slovenia	21	19
Cyprus	20	20
Greece	20	21
Italy	20	22
Poland	15	23
Luxembourg	12	24
Czech Republic	12	25
Lithuania	11	26
Denmark	11	27
Austria	10	28
Sweden	10	29

* in energy efficiency base points (1 point = 0.1% of final energy consumption), based on impact assessments provided in the MURE database on energy efficiency policies 2000-2014

Source : ODYSSEE, MURE

Figure 79 : Results from the ACEEE 2014 International Energy Efficiency Scorecard



Source : ACEEE

The analysis prepared for the European Scoreboard showed that this picture should be nuanced, in particular as the ACEEE Scoreboard did not consider all European countries:

- Germany is with respect to the state of energy efficiency still on one of the top-level places in Europe, though not on the first place.
- However, progress as measured by the energy efficiency trends are modest. If this continues, Germany will also fall back with respect to the state of energyefficiency
- There is also an excellent position of Germany with respect to energy efficiency policy which may provide a good basis for the future. However, this implies that German energy policy is translated to practice as it is intended in the “Energiewende” (transformation of the energy system)

These discussions have shown that there is a lot of interest in such scoreboard activities. However, still a variety of questions remain to debate.

One important question is in particular whether the ranking principle should be “hard”, by quartile or weak. Depending how the performance is aggregated across the different criteria one could establish a Scoreboard based on:

- ***A "strong ranking principle":*** Weights are established for the different criteria and the "score" across the different criteria is added to allow establishing a ranked list. The underlying methodology for the ranking is generally a more or less transparent (in principle: multi-criteria analysis). A weaker version is ranking by classes (e.g. quartile ranking).
- ***A "medium strong ranking principle"***: The overall result for each criterion is shown in the form of spider or flower graphs.
- ***A "weak ranking principle":*** the performance of each criterion is merely reported without any summary view.

Such types of open questions need to be further debated and explored to come to an accepted European Scoreboard. **Establishing such a Scoreboard is a learning process and different options should be explored and discussed.**

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