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1. INTRODUCTION AND POLICY CONTEXT

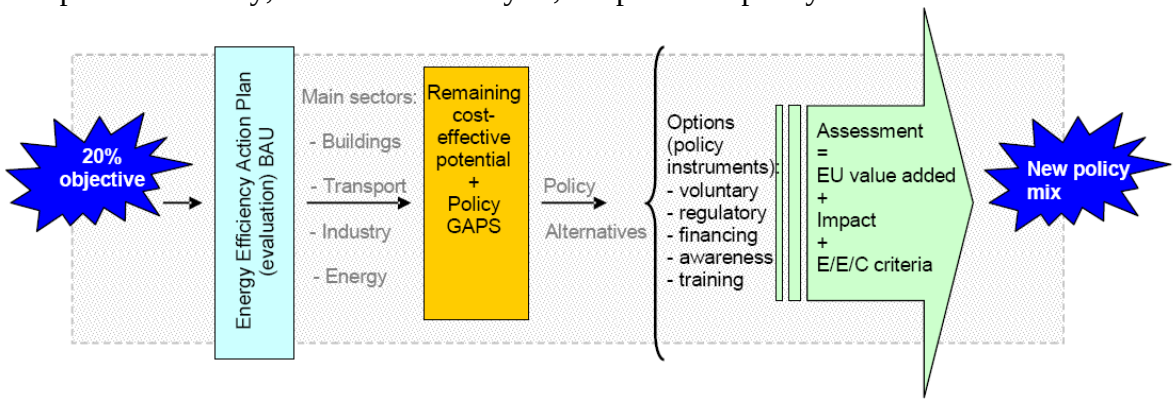
The EU leaders, realizing the important benefits of energy efficiency and savings to the EU's social, economic and environmental agendas, have committed to reach the **objective of 20% primary energy savings in 2020** compared to the PRIMES 2007 baseline[1].

The **Energy Efficiency Action Plan (EEAP) of 2006**[2]**,** endorsed at the Spring 2007 European Council, was a major step towards reaching this objective and aimed at contributing about 14% reduction in 2020[3]. In the EEAP, it was acknowledged that **further policy measures will be needed and, therefore, its mid-term evaluation and revision was envisaged for 2009**. The European Council[4] and the European Parliament[5] have also urged the Commission to adopt a new ambitious strategy.

To provide for a new impetus for energy efficiency and saving, the **Commission is developing a new Energy Efficiency Plan (EEP)** (strategic initiative in CWP 2011[6]). The EEP would set the overarching policy framework in order to put Europe on the right path not only for a 20% saving in 2020 but also for longer term efficiencies in support of the 2050 goals, by identifying the areas where future EU action is needed and outlining which policy instruments are best suited to address the challenges at EU level.

The aim of this Impact Assessment (IA) is to support EEP preparation. **The depth of analysis is proportionate to the foreseen general policy level of the EEP itself.** The concrete legislative and other initiatives following this overarching policy communication to be developed will be accompanied by detailed IAs and 'ex-ante' financial analysis, if required.

The **IA approach** is summarized in the figure below. Firstly, it is analyzed whether the cost-effective potential of at least 20% energy savings in 2020 will be met with the current EU and national policy mix. Secondly, based on this analysis, the remaining potential and policy gaps are identified for each sector. Thirdly, policy alternatives are considered. Fourthly, a number of policy options are analyzed for their EU value added also considering the resources available, their potential impact and their effectiveness, efficiency and coherence (E/E/C) with other policies. Finally, based on the analysis, the preferred policy framework is outlined.



1 7224/1/07, REV 1
2 COM(2006) 545
3 SEC(2006) 1174
4 7880/1/09, REV 1, 11018/1/08, REV 1 and 7224/1/07, REV 1
5 2010/2107(INI), 2008/2214(INI), 2006/2113(INI) and 2007/2106(INI))
6 Commission Work Programme 2011. COM(2010) 623 final, VOL. II

2. PROCEDURAL ISSUES AND CONSULTATION OF THIRD PARTIES

2.1. Organisation and timing

A broad consultation process and collection of expertise has informed the preparation of this Impact Assessment. It is based on the experience gained from the implementation of the EEAP of 2006 and a wide range of information sources and inputs from stakeholders. The process was supported by an Inter Service Steering Group, lead by DG ENER. In addition, a specially dedicated Task Force has been created within DG Energy (DG ENER) to coordinate the inputs from several units and the Executive Agency for Competitiveness and Innovation.

2.1.1. Stakeholders consultation

A very broad ranging stakeholders consultation provided valuable input to this IA. A preliminary set of possible approaches were presented to Member States on several occasions, including at the Bucharest forum (9-10 June, 2009 and 6 – 7 July 2010), the Informal Energy Council in Are (23-24 July 2009) and the meetings of Energy Director Generals on 11 September, 2009 and 7 October 2010. Member States highlighted the benefits of increased energy efficiency and were very supportive of its higher uptake. A number of good practice examples were presented. Nevertheless, some delegations highlighted that there are a number of national differences that need to be taken into account.

In addition a large number of stakeholders' inputs were collected, in particular at the EU Sustainable Energy Week 2009 (9-13 February 2009 and 22-26 March 2010), the Bucharest forum (9-10 June, 2009 and 6-7 July 2010), targeted meetings with stakeholders on financing, buildings and utilities in June 2009 and a number of bilateral discussions in 2009 and 2010. Many stakeholders called for a more ambitious and proactive approach at EU level.

To further explore policy options, the Commission carried out a broad on-line public consultation in 2009 with 239 submissions from various organizations, companies and individuals from across the EU. Whilst stakeholders did generally acknowledge that the measures in the current Energy Efficiency Action Plan should continue to be implemented, the majority argued that the time had come for a more focused and targeted approach in order to further promote energy efficiency. A detailed analysis of stakeholders' responses is provided in Annex I.

2.1.2. Studies

The analysis for this IA is also based on a large number of studies and evaluations. These include the Commission mid-term assessment of the current EEAP (see Annex III), examples of successful projects supported by the Intelligent Energy Europe programme[7], and an external study specifically tendered to provide analysis for this IA. Another important source of information and examples of various policies adopted in the EU Member States are the first National Energy Efficiency Action Plans, submitted by Member States in 2007 and 2008 within the reporting obligations of Directive 2006/32/EC and the their evaluation reports prepared by the Commission (SEC(2009)889 final and Annex IV). There are also a number of studies analysing the benefits and challenges for energy efficiency and energy savings. However, many of the data and information sources are fragmented as regards the issues discussed and countries covered and consequently various assumptions were applied to the

[7] http://ec.europa.eu/intelligentenergy

analysis. As the majority of the policies on energy efficiency are rather new very limited ex-post studies of the individual policy measures are available.

2.1.3. Opinion of the Impact Assessment Board (IAB)

This Impact Assessment was discussed at a meeting of the IAB on the 15th of December 2010. The text was well received and no resubmission was required but several recommendations were made calling for:

- Improved analysis on the general policy framework and on the justification for the need for energy efficiency targets
- Strengthened analysis of the problems to be addressed and greater use of the evaluation results of the existing action plan and national plans
- Improved description of the baseline assumptions and analysis of the rebound effect
- Inclusion of a clearer presentation of costs and benefits (incl. a clear definition of cost-effectiveness)
- Better outline the role of transport sector.

All these, but the last one, were reflected in this report and have helped its improvement. The only recommendation that could not be addressed fully was the inclusion of further details on the transport as the sector would is discussed in great detail in the IA for the forthcoming White Paper on Transport. Detailed analysis of the costs and benefits of the identified types of policy instruments and analysis of various target options and their interactions with the other targets was not prepared as the definition of the specific policy initiatives and their impact assessment is to be carried out in a consecutive IA(s) that will accompany the legal proposal(s).

3. PROBLEM DEFINITION

3.1. What is the problem?

The EU target would not be met

At the Spring Council 2007, the EU Heads of States and of Governments stressed *'the need to increase energy efficiency in the EU so as to achieve the objective of saving 20% of the EU's energy consumption compared to projections for 2020'*[8]. This 20% reduction can be reached by introducing cost-effective[9] measures which means that the investments made will be paid

[8] 7224/1/07 REV 1

[9] Cost-effective can be interpreted in different ways. In a study (Boonekamp 2006) for the Energy Efficiency Action Plan it is mentioned that the World Energy Assessment 2000 (Jochem, 2000) has been used and it refers to the term 'life cycle costs'. Therefore, in this IA a measure is considered cost-effective when the pay-back time of the investment (including the operational costs but minus cost savings) is equal or in most cases shorter than its technical lifetime. This is because of the savings on the energy bill or reduced need for maintenance. The studies that analyse the potentials (including those mentioned in footnote 10) take into account various discount rates. This means that only measures with a positive net present value are considered as cost-effective.

back from the reduced energy bills within, or often much shorter than, the lifetime of the energy savings measures realized[10]. This would make the EU's economy more competitive saving from imports about €200 bn annually in 2020[11], create jobs and new business opportunities, and EU citizens would pay less on their energy bills, reducing the number of fuel poor households and foster innovation. Energy efficiency and savings benefits the EU economy as a whole, Member States, businesses and private individuals.

Energy efficiency also means better use of energy resources and reduced import dependency. 20% less energy use also means less CO_2 (or reduction of 740 MtCO2eq annually in 2020[12]) and harmful emissions, less impact on the ecosystems, and better quality of life for people. The implementation of energy efficiency measures also creates jobs and offers possibility to retain the current ones at local level, particularly in the construction sector that has been badly affected by the economic crises. It is estimated that up to 2 million jobs can be created or retained because of energy efficiency[13].

However, the EU is not on track to fully realize this cost-effective energy savings. Whilst, the latest business-as-usual scenario (see Section 3.4) shows a break in the trend towards ever increasing energy demand, the reduction in the consumption will be only about 9% in 2020. **Therefore, if the EU does not double the efforts, it will not reach its 20% target and will not realize all the associated benefits for the economy, society and environment.**

Energy efficiency vs energy savings

Even though the terms 'energy efficiency' and 'energy savings' are often used interchangeably (including in this IA), there is a significant difference between the two. 'Energy efficiency' means that we use less energy inputs while maintaining an equivalent level of economic activity or service. 'Energy savings' is an absolute decrease of energy consumption and can be done through increased energy efficiency, behaviour changes or even decreased economic activities. Examples of energy savings without efficiency improvements are heating a room less in winter, using the car less, or enabling energy saving modes on a computer.

Gains in energy efficiency do not automatically translate into an overall reduction of energy consumption. Even though the products and processes are continuously becoming more energy efficient, our total final energy consumption continues to grow. This is due to the fact that with higher disposable incomes the level of comfort rises, the number of households increases, more appliances are bought, longer distances are travelled with bigger cars and planes and homes become bigger and are better acclimatized to the seasons.

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10 For example, European Climate Foundation. 2010. Energy Saving 2020; Fraunhofer ISI *et al.* 2009. Study on Energy Savings Potentials in EU Member States, Candidate Countries and EEA Countries; Lechtenböhmer and Thomas, Wuppertal Institute. 2005. The mid-term potential for demand-side energy efficiency in the EU.

11 COM(2006) 545. Calculated savings are 368 Mtoe in 2020; at 88$'08/oil barrel in 2008 this equals € 190 billion.

12 2 tCO2/toe (based on general CO2 intensity in 2020, PRIMES 2009 energy efficiency scenario)

13 This is rather conservative estimation of the direct energy efficiency employment effects and is based on analysis of the results of several EU and national sector specific studies, incl: Ecorys. 2010. Ex-ante evaluation of the initiative on the building workforce training and qualification in the field of energy efficiency and renewable energy within the Intelligent Energy Europe Programme; GHK Consulting, Cambridge Econometrics, Institute of European Environmental Policy. 2007. Links between the environment, economy and jobs; and Impact Assessments for Ecodesign SEC(2009) 1016, SEC(2009) 1020, and SEC(2009) 1013

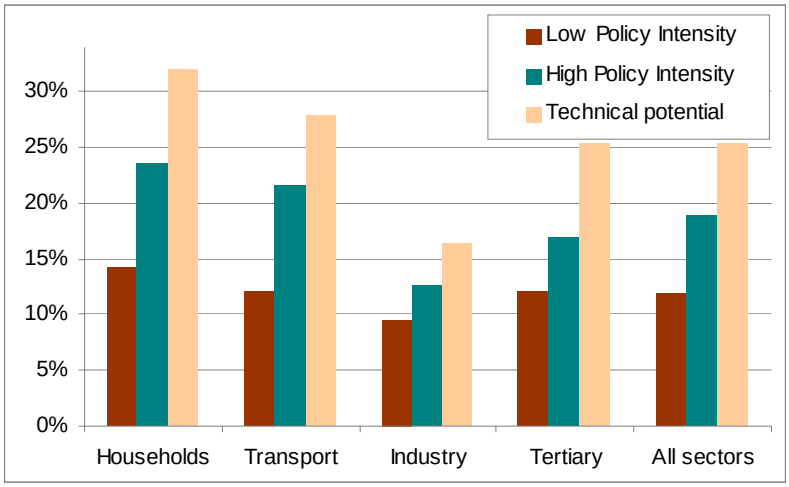
The EU value added is mainly at triggering energy efficiency improvements. However, certain measures that target behavioural change are also important and have been adopted at EU level. For example, the existing energy labelling of products, buildings and cars, various awareness campaigns, financing and fiscal stimuli or dissuasive tools have aimed at changes of consumer choices towards more rational use of energy resources. That is why in this IA also tools that are aimed at behavioural change will also be studied.

Cost-effective possibilities remain in each sector

Based on a number of studies[14], **cost-effective potential exists in all final energy demand sectors as well as in the energy transformation sector.** A difference should be made between technical potentials (best available technology irrelevant of costs) and cost-effective potential. The technical potential currently not cost-effective and thus measures for its realization will not be discussed in this IA.

The figure below illustrates that for the final energy sectors, even though some of the potential is currently being used (i.e. low policy intensity scenario, see also section 3.3.2), the cost-effective savings potential in each sector (i.e. the high policy intensity scenario) would not be fully utilized in 2020[15]. Further savings (i.e. technical potential) are possible but not cost-effective.

Figure 1. Final energy savings potential in EU 27 in 2020[16]



The rebound effect in general leads to a decrease in the expected savings. However, it has been already taken to a significant degree into account when calculating the existing potential sectors (see Box 1) and also in PRIMES model (see Box 2).

Box 1: Rebound effects in the Fraunhofer et al. (2009) study

Rebound effects can be characterised in two categories.

14 For example "Pathways to low-carbon Economy, Version 2 of the Global Greenhouse Gas Abatement Cost Curve", McKinsey&Company, 2009 and "Energy Savings 2020: How to triple the impact of energy saving policies in Europe" Ecofys and Fraunhofer ISI, 2010

15 Fraunhofer ISI *et al.* 2009. The potentials are calculated on the PRIMES 2007 baseline (pre-crisis baseline). However it is considered that the percentage savings on the new baseline could roughly the same on the post-crisis baseline; however the absolute savings would be lower.

16 Ibid footnote 35

Direct rebound effects, i.e. rebound effects which happen directly as a consequence of the energy efficiency measure. The Fraunhofer et al. (2009) study considers several such direct rebound effects, in particular:

a) increased time of use of energy savings lamps in residential and commercial applications and

b) higher heating temperatures or longer heating duration in well insulated buildings due the increase of comfort level.

c) longer driving distances due to more efficient cars

d) high speed trains were assumed to have a higher specific consumption per passenger kilometre than normal trains due to their higher speed which makes that people opt for this type of transport mode.

Generally these rebound effects happen directly in conjunction with the energy saving measures and have been modelled by reducing the effect of the efficiency improvement. For example in the case of the saving lamps, not the full theoretical impact of the savings were assumed but a reduced impact. Similar for the increased heating temperatures/increased heating periods a partial compensation of the savings was assumed. For cars, an increasing mileage was assumed. In the case of the trains a higher specific consumption expressed the rebound effect. The most commonly observed direct rebound effects are taken into account in the study.

Indirect or economic rebound effects: These are rebound effects which occur generally because people have more money available and spend it partially on more energy consuming activities. The main reason for this is that in absolute terms the budget spent on energy corrected for the inflation has become smaller and smaller compared to the development of incomes (with the exception of the very recent years). So this is not a direct impact of a specific energy saving measure but happens in a way autonomously from it in a general trend. The Fraunhofer et al. (2009) study took that into account by considering a certain development in the drivers, including:

a) A rebound effect has been implicitly taken into account by envisaging an increase of the average car size (expressed in cubic centimetres) over time.

b) The square meters living space for apartments and individual houses is increasing due to more comfort levels

c) People use more hot water for sanitary purposes due to an increased comfort

d) People use consumer electronics for a longer time due to more time available

The Odyssee database was used as an essential tool to calibrate such social drivers influenced by increased comfort factors, general rebound effects etc. by looking at their changes in past and by assuming a certain development in the future but also by considering certain limits. It is unlikely for example that people would heat rooms permanently to 30°C in winter time because this is not comfortable any more for most persons.

The current trends and remaining potential per sector are summarized in the text below.

Residential and services (or tertiary) sectors are responsible for the lion's share, about 37%, of final energy use in the EU (i.e. 25% for residential and 12% for the services sector in 2007). They will be discussed together because the energy consumption is mostly in buildings where energy is predominantly used for buildings' space and water heating, cooling and cooking (i.e. 78% of total needs for service sector and 88% for residential in 2007[17]). The rest of the energy consumption is to be attributed to the use of electric appliances and lighting. The business-as-usual scenario projects that the final energy use in the residential sector will increase with 4.4% over 2008-2020 period and in the tertiary sector with 1%.

The potential for cost-effective energy savings for the two sectors is currently estimated at 21%[18]. Some of it (or 13.4%)[19] will possibly be realized with the current policies but still the two sectors offer the biggest savings potential from the final energy sectors. In addition, most

[17] Source: DG ENER statistics. Cooking cannot be separated from the data set.

[18] Study on Energy Savings Potentials in EU Member States, Candidate Countries and EEA countries, Fraunhofer ISI from 2009, for example

[19] Ibid 18

of energy efficiency and savings technologies are cost-effective and on the market but further innovation is still possible. Therefore, is an obvious first step for reaching the EU's energy but also climate policy objectives.

Transport sector uses 32% of the EU's final energy. Since 1990, final energy consumption in the sector has been steadily increasing by 1.8% per year on average[20]. It now represents nearly one third of the final EU energy consumption[21] and relies almost exclusively on fossil fuels. More than 80% of transport final energy use is due to road transportation[22]. In 2008, cars accounted for 72% of all the kilometres travelled by passengers whilst road transport accounted for 46% of the total goods transport activities (tkm). For the period 2000-2020, freight road transport is expected to grow by 55% and passenger road transport by 36%.[23] Freight activities have until now grown faster than the economy, with road and air freight recording the largest increase between 1997 and 2007[24]. Under the business-as-usual projections the final energy use in the transport sector is expected to increase by 6% in 2020 compared to 2008.

The potential for cost-effective energy savings in transport is also significant: about 21% in 2020[25] and only a bit more than half of it (or 12%) is projected to be realized with the current policy mix. Energy efficiency measures in transport can therefore contribute significantly to the EU's energy policy target as well as to the Climate policy objectives (transport accounts for more than 20% of the total EU CO_2 emissions[26] with the highest growth rate compared to other sectors). In addition, an increased share of clean and energy-efficient transportation also reduces congestion, pollution and noise, thus improving mobility, health and well-being.

Industry sector accounts for 27% of the final energy demand in the EU. Large primary materials industries (chemical, petrochemical, iron, steel, cement, pulp and paper, etc) are energy intensive and account for 70% of industrial energy use.

Considerations for decrease of costs to improve competitiveness have prompted many industries, especially the energy intensive ones, to make energy efficiency improvements. This lead to smaller economic potential in 2020 (about 13%) than the other sectors. The majority of this potential has already been used (only 3% remaining economic one). Still the opportunities are not fully taken advantage of which is particularly true for small-size and even some medium-size industries. For example, some industry sectors, with the right technology and support, could make energy savings of around 20%. By changing certain production processes, energy savings of 30% and even up to 65% can be obtained.

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20 Europe's energy position, markets and supply. DG ENER Market Observatory for Energy, 2010. http://ec.europa.eu/energy/observatory/annual_reports/doc/2009_annual_report.pdf

21 32.6% according to 'EU energy and transport in figures – Statistical pocketbook'. European Commission 2010. http://ec.europa.eu/energy/publications/statistics/doc/2010_energy_transport_figures.pdf

22 81.9% in 2007 according to 'EU energy and transport in figures – Statistical pocketbook'. European Commission 2010.

23 ASSESS study for the mid-term review of the EC 2001 transport White Paper, *Keep Europe moving*, 2006.

24 Towards a resource-efficient transport system (TERM 2009), EEA Report No. 2/2010.

25 Study on Energy Savings Potentials in EU Member States, Candidate Countries and EEA countries, Fraunhofer ISI from 2009, for example

26 23.1% in 2007 according to 'EU energy and transport in figures – Statistical pocketbook'. European Commission 2010.

Agriculture and fisheries sectors are responsible for about 2% of the EU's final energy consumption. Energy savings are possible from the introduction of CHP for greenhouses, improved energy performance of agricultural buildings. Substantial amounts of energy are used indirectly for the production (e.g. pesticides, land cultivation, travel for fish catch) but these are not in the scope of the IA. That is why the two sectors are not looked at separately but some possibilities explored other sectors (i.e. energy generation and buildings) would have positive impact for the reduction of energy use in the sector.

Illustration of the cost-effectiveness of a number of measures at the final energy use is provided in the figure below.

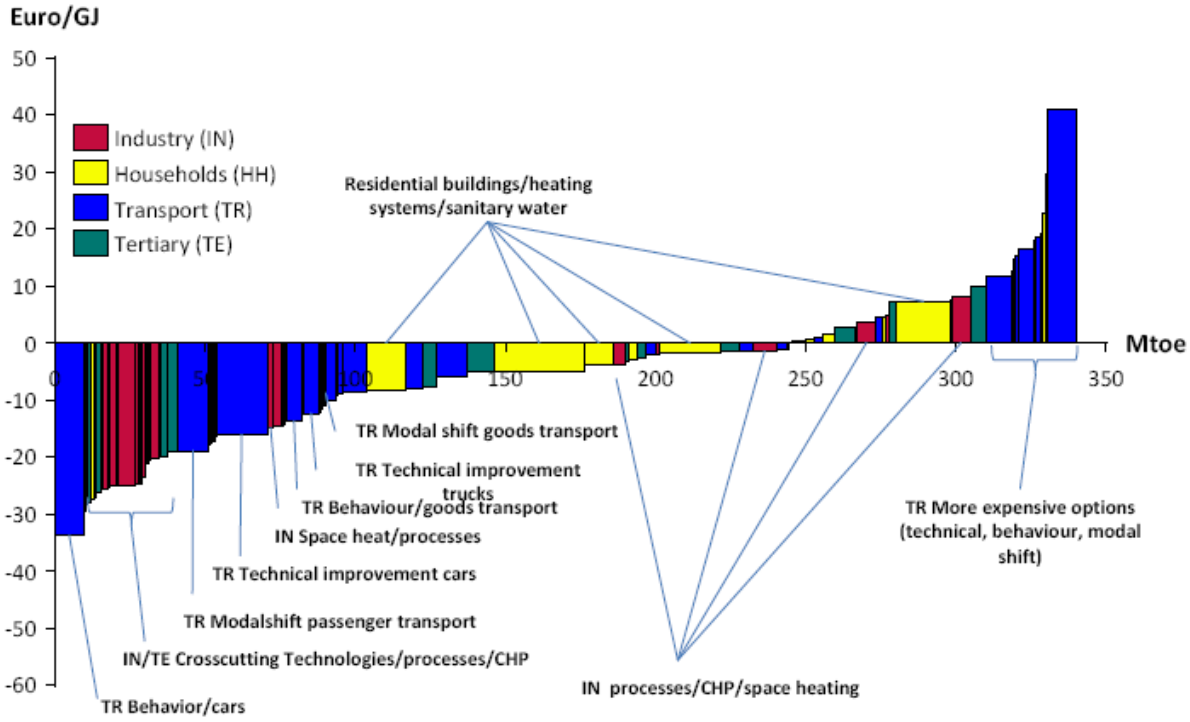

Figure 2. Overall cost-curve for energy efficiency options of end-use sectors in the EU27 in 2020. Energy savings are expressed in final energy units. Energy savings (X-axis) are relative to the baseline (source: ECF study based on Fraunhofer et al., 2009).

Energy sector also offers possibilities for energy efficiency improvements in the processes of energy transformation and also for increased utilization of recoverable energy. In addition, as energy utilities are the closest to the final energy consumers and have information on the energy use of their clients, they could be used as an interlocutor to realize energy savings potential in the demand side.

Increasing transformation efficiency can be achieved by using technologies that better transform primary energy into final useful energy. 58% of EU-27 electricity is produced in conventional thermal power plants. Around half of this electricity comes from coal-fired power plants and the rest is mainly produced based on gas combustion. Most of Europe’s coal plants operate at 36-38% of thermal efficiency while the best available technologies (BAT) deliver an average efficiency of 46%. Gas-fired plants operate at an average of 47% efficiency, while BAT are on average 59%.

Another way to increase the efficiency of electricity generation is to use the heat that is generated by using it in co/tri-generation and district heating/cooling. Cogeneration can achieve 80–90% efficiency, if all savings, including the avoided network losses are calculated. The existing economic potential is largely underused and the less than optimal utilization of combined heat and power will grow even more pronounced in the future.

As regards heat production, the overall thermal energy production efficiency of the EU is around 40%. Reference technologies in heat-only-boilers provide a range of operational efficiencies from 70% in the case of biogas to 90% for natural gas, while best available technologies can deliver even higher performances.

District heating and cooling (DHC) is particularly well placed to use the residual heat produced in industrial sources. DHC, especially in combination with cogeneration, could produce significant primary energy savings, and is a proven and cost-effective way to increase the comfort of EU citizens at a low cost.

There are also losses in the transmission and distribution of electricity, however, these losses differ widely between the different Member States from 3.2% for Cyprus to 15.7% for Latvia. Average losses in transmission and distribution for EU27 are calculated to be 6.4% in 2008[27].

3.2. Why is the savings potential not achieved?

Cost-effective energy savings potential will not be fully achieved because **the market for energy efficient products, buildings and services is not developing quickly enough** to meet the need for increased uptake of the energy savings potential. This is because of a number of market and regulatory failures.

3.2.1. Market failures

Energy market prices do not reflect all costs to society in terms of pollution, greenhouse gas emission, resources' depletion, and geopolitical dependency. Therefore, end user (and producer) choices are made on the basis of a lower energy price that does not reflect the environmental costs for the society. Due to low price elasticity of some sectors, e.g. residential one, price signals are not always a solution to the challenge.

There are many examples of **split incentives or principal-agent** market failures in the energy sector where the decision maker may be partially detached from the price signals. For example, the landlord should invest in building renovation works, but the tenant normally pays the energy bill and benefits from its reduction. Energy providers dispose of commercial information about the energy use of their client and could promote energy savings measures, but have no economic incentives to do so as it would negatively affect their turnover and profit.

Asymmetric information on the benefits (e.g. limited knowledge and information) and costs (e.g. overestimation of the investment needs) makes people reluctant to make investments even though they are cost-effective. Energy bills are also not a major expense in many companies, and therefore the possibilities for improvement are not realized. Furthermore, there is not sufficient and easy to obtain information on the possible energy efficiency solutions available on the market or the ways in which they can be carried out or supplied.

[27] Eurostat data.

Missing or incomplete markets cause another commonly recognized problem which is related to the **low number of trained professionals** (such as architects, energy auditors, builders, installers, sales assistants) and the **lack of infrastructure**. The lack of a credible and mature offering market prevents the emergence of a dynamic demand market which in turn is a barrier to the uptake of the offering market. This has a particularly negative effect on the uptake of energy services companies (ESCOs) that can provide integrated energy saving solutions together with financing schemes. The low demand keeps the prices relatively high.

Initial costs are a considerable barrier as judgements on the profitability of investment are done on short pay-back times and improvements that fail these criteria are not made even if they would bring benefits to the consumers but also society in the long-term. Proper financing instruments that take fully into account all financial benefits from energy efficiency gains are not developed because of a lack of sufficient knowledge of the financing institutions. In many cases energy efficiency projects are small scale and decentralised which **increases the transaction costs** and further slows down the uptake of financial products.

Harmful subsidies, regulated prices and negative incentives are other challenges to energy efficiency. The IEA's latest estimates indicate that fossil-fuel consumption subsidies worldwide amounted to $312 billion in 2009, down from $558 billion in 2008[28]. The decrease is mainly due to declining energy prices. This is less problematic for the OECD countries but the latest available figures from 2004 for the EU15 are still worrying: coal received €13 bn (to be phase out at the latest by 2018), oil and gas €9 bn, nuclear €2 bn, and RES were supported only by €5 bn[29]. In a number Member States energy prices, notably for gas and electricity, are still regulated which also provides distorted market signals[30]. Negative incentives are another challenge, e.g. when the value of a building is higher because of energy efficiency improvements, higher local taxes have to be paid.

3.2.2. Regulatory failures

Energy efficiency and savings are often considered too technical. It is also difficult to visualize or measure the avoided use of energy. Therefore, energy efficiency policies often **lack political visibility** and are thus not embraced by politicians.

Although there are certainly positive developments in Member States for the establishment of an enabling legislative framework to stimulate energy efficiency and savings, a lot more is needed. The **lack of a comprehensive policy framework including regulatory and support instruments, and a poor enforcement** is clearly a major problem in some countries. Too frequent changes in the legal framework make the investment climate risky. Some Member States lack administrative capacity to develop energy efficiency legislation and wait for its advancement at EU level. This has made the EU policies a key driver for energy efficiency legislation in some Member States but also reduces the national ownership of the policy instruments.

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28 http://www.worldenergyoutlook.org/subsidies.asp

29 EEA. 2004. Technical report: Energy subsidies in the European Union: A brief overview.

30 Communication from the Commission to the Council and the European Parliament - Report on progress in creating the internal gas and electricity market (SEC(2009) 287) (COM/2009/0115 final), at point B7. The Member States that have regulated prices for electricity and gas are: BG, DK, EE, FR, HU, IE, IT, LV, LT, PL, PT, RO, SK and ES. In GR, CY and MT there are regulated prices for electricity. FI has regulated prices for gas. In most Member States price regulation is not confined to household customers.

3.2.3. Other barriers

The **rebound effect** is another major challenge to energy savings. It implies that in spite of certain improvements of the efficiency of the individual products (e.g. appliances, cars and buildings), overall energy consumption linked to their use increases due to their increased volume, number or usage. This minimizes the savings from the efficiency improvements or in certain cases even leads to an absolute increase in energy consumption. For example, even though cars produced today are more efficient, the overall energy consumption of the car fleet grows because we use them more regularly and often buy bigger ones. The rebound effect is included in the assumptions of the various studies that make evaluation of the energy savings potentials and thus is not expected to hamper the possibilities for reaching the 20% energy savings target (see Box 1 for more details). The rebound effect is difficult to address it at EU level because it relates to increased living standards, freedom of choice and consumer behaviour.

The **low uptake of new and innovative technologies** in some sectors, such as buildings, is also a consequence of the long life cycles and lead times of investments.

3.3. What policies exist to address the problem?

3.3.1. EU policies: assessment of the Energy Efficiency Action Plan of 2006

The Energy Efficiency Action Plan (EEAP)[31] was adopted in October 2006 for implementation between 2006 and 2012. This Action Plan sets the current European framework for legislation, policies and measures conceived to trigger energy efficiency improvements and energy savings. It was developed because: *'even though energy efficiency has improved considerably in recent years, it is still technically and economically feasible to* ***save at least 20% of total primary energy by 2020*** *on top of what would be achieved by price effects and structural changes in the economy, natural replacement of technology and measures already in place'*[32]. In this context, the EEAP is to be seen as the major European step so far towards the realization of the 20% saving objective, as it was estimated to contribute to a 14% decline in primary energy consumption in 2020[33].

The EEAP defined six priority areas with 85 measures addressing key energy using sectors (energy transformation, buildings, services, industry and transport) and cross cutting issues (behaviour, financing and international cooperation). The portfolio of measures is very comprehensive in terms of type (e.g. voluntary, regulatory, market-based, fiscal, support and information), issues addressed (sectors and horizontal), level for implementation (EU, national, regional, city) and stakeholders involved (governments, private sector, citizens). In addition, the Commission committed to 10 priority actions to be initiated immediately and implemented as soon as possible for maximum effect. This all-encompassing approach of the Action Plan reflects the complex nature of energy efficiency.

At the end of 2010, after 4 years of implementation, a very positive balance can be drawn:

- **The majority of the 85 measures have already been completed or are in the process of being finalized.** Only a few have not been realized as intended in the Plan**.**

31 COM(2006) 545.
32 COM(2006)545, page 5
33 SEC (2006) 1174.

- **The implementation of the 10 priority actions is well advanced with the majority of them already finalized.**

- **The Plan triggered new and improved energy efficiency legislation across Europe.** With more than 20 legislative measures in its portfolio, the EEAP pushed for the implementation and revision of existing key legislation targeting efficient uses of energy. Finally it proposed also new energy efficiency legislation.

The main lessons learnt from the implementation of the EEAP are:

- **A full and ambitious application of existing energy efficiency legislation by Member States is crucial to deliver energy savings in practice**. The Commission should continue to provide further support to MS for better and faster implementation.

- **Selected supporting tools need to be strengthened or expanded** further to increase the impact of legislation, such as National Energy Efficiency Plans, monitoring systems, access to financing and training.

- **An overarching energy efficiency plan with a long term objective** is needed to trigger lasting political commitment towards energy efficiency improvements and energy savings. **It needs to be streamlined and focused on actions to be taken in key areas**.

If looked from sectoral point of view the progress is as follows:

Residential and services sectors: Substantial progress has been achieved in these sectors by moving forward with the implementation of key legislation, notably the Energy Performance of Buildings Directive (EPBD) and the Energy Services Directive (ESD). The Commission supported this process by creating Concerted Actions, BUILD UP initative and other fora (e.g. Bucharest Forum) helping Member States with their national implementation. For energy-using products, the implementation of the Ecodesign and Labelling Directives were essential, *inter alia* the adoption of ecodesign regulation for nine product groups. The EEAP also put forward the revision of the EPBD and of the Ecodesign and Labelling Directives.

Energy generation: The EEAP 2006 put forward challenging measures to improve the efficiency of power generation and distribution. Main progress has been made with the implementation of the Combined Heat and Power Directive (CHP) and with the development of a Reference Document on Best Available Techniques on Energy Efficiency. Some progress has been made with the promotion of the connection of decentralized generation with the adoption of the Third Legislative Package on the Internal Energy Markets. However, important measures have not been implemented mainly due to the complexity and the strong stringency of the required measures, that made the effort for the time being not proportionate to the foreseeable results, taken into account that this sector is already partially covered by market instruments with similar goals, e.g. to trigger energy efficiency improvements.

Transport: Main progress has been made, among others, with setting emission performance standards for new passenger cars (EC 443/2009) and light-duty vehicles (proposals COM/2009/0593), a new labelling regulation for tyres (EC 1222/2009), the promotion of clean and energy-efficient road transport vehicles through public procurement (2009/33/EC) and the integration of aviation under the EU Emissions Trading Scheme (EU ETS) as of 2012. The review of the Fuel Efficiency Labelling Directive was not put forward as intended. Despite putting forward most measures of the EEAP in the transport sector, more needs to be

done to tackle the efficient use of energy in this sector as the consumption is expected to grow further.

Industry: As industrial installations are mostly covered by the EU ETS, the EEAP did not propose direct priority measures for this sector. However a range of measures were put forward aiming at raising the awareness of industrial companies, notably SMEs.

To conclude, **the EEAP 2006 is a major step in moving towards the achievement of the 20% saving objective in 2020**. The EEAP assessment also revealed that in order to draw better political recognition, an overarching, long-term strategic vision is required. In order to capture the political attention and trigger lasting political commitment, it is essential that any future Energy Efficiency Plan is better focused on the main policy objectives, contain clear priorities and is not too technical. It is clear that energy savings are realized at national and local level. Therefore, the new Plan should aim at steering and mobilizing action at all levels of governance. Any new Plan should imperatively build upon the experiences gained with the implementation of the EEAP 2006 and propose additional policies to close the gap and realize its aspiration to mobilise the general public and policy-makers, and to provide EU citizens with energy-efficient infrastructure, buildings, appliances, processes, transport means and energy systems.

3.3.2. Current actions in MS

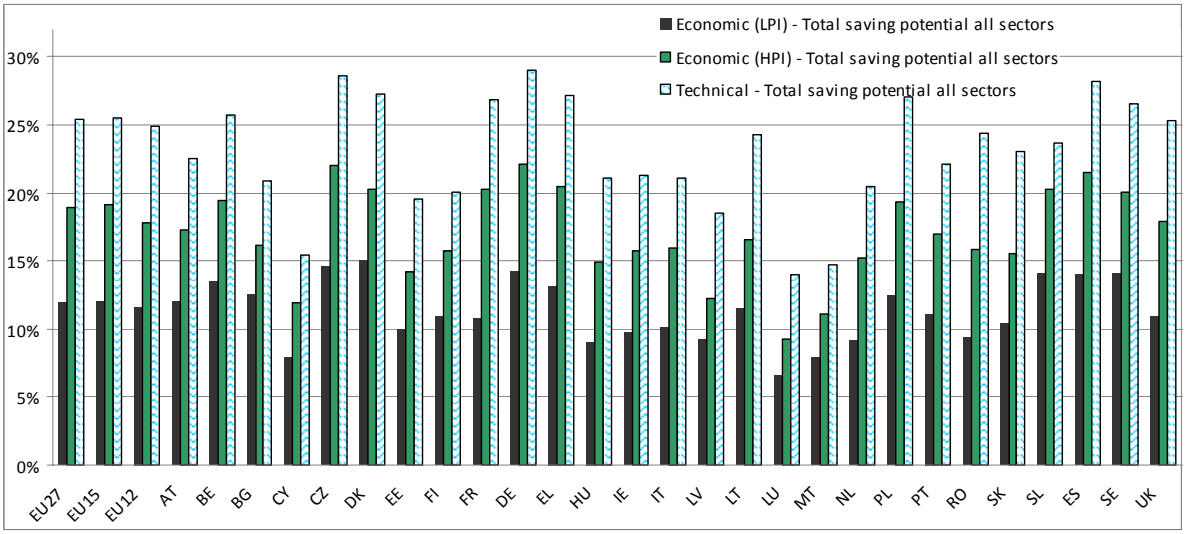
Valuable information of the progress of Member States on energy efficiency can be found in the National Energy Efficiency Actions Plans (NEEAP) developed under the Energy End-Use Efficiency and Energy Services Directive (ESD, 2006/32/EC). The first NEEAPs were due for mid-2007 but many of them were sent in 2008. Following their submission, the Commission communicated its comments and suggestions to each Member State and a number of bilateral meetings were organized. As a result, some NEEAPs were resubmitted after being remarkably strengthened. For many countries this has been first time they had to prepare comprehensive plans addressing energy savings and the feedback received from a number of Member States confirmed that the preparation of the first NEEAPs has proven to be a very useful exercise for them.

The Commission assessment[34] of the first NEEAPs and its recent update (Annex IV) showed that they propose a wide diversity of policy packages and measures targeting different end-use sectors and in some cases supply side measures. Many of them demonstrate coherent and comprehensive strategies towards the intermediate and overall targets, backed by institutional and financial provisions. A number of NEEAPs clearly identify their priority end-use sectors or policy tools. In contrast, some of them show piecemeal thinking with a scattering of fragmented energy efficiency measures. The absence, or sporadic indication of savings estimates in the majority of NEEAPs, along with the mostly limited degree of detail about assumptions made in estimating savings from different measures, have impeded the quantitative assessment of the NEEAPs and how realistic they are. In addition, for several Member States there is a considerable gap between the political commitment to energy efficiency and the measures adopted or planned, as reported in the NEEAPs, and the resources attributed to preparing it.

[34] SEC(2009) 889. Synthesis of the complete assessment of all 27 National Energy Efficiency Action Plans as required by Directive 2006/32/EC on energy end-use efficiency and energy services

Studies show that there is remaining cost-effective energy savings potential in each Member State. Indications of the remaining potential are presented in the **Figure 3** below[35]. The current efforts and future business-as-usual policies of Member States broadly fall under the Low Policy Intensity (LPI) scenario. If all proposed measures in the first National Energy Efficiency Action Plans (NEEAPs) are implemented then they represent an effort broadly in the range of this LPI scenario. The High Policy Intensity (HPI) scenario describes the additional technology diffusion of best energy saving technologies (BAT) to the maximum possible, from an economic viewpoint. The Technical Scenario considers a full technology diffusion of BAT to the technical maximum possible (without considering, however, very expensive options and still respecting investment cycles). The study concludes that under the HPI Scenario only savings of 19%, compared to an autonomous scenario, are possible with measures on the demand side.

Figure 3. Potential for end use energy savings in 2020 compared to an autonomous scenario[36]



3.4. How much of the potential will be achieved in 2020?: Baseline scenario

To project possible future development as regards energy generation and consumption, PRIMES - a market equilibrium model for energy supply and demand - was used[37]. **The PRIMES 2009 energy efficiency reference scenario** (hereafter PRIMES 2009 or baseline) **has been used as a Business as usual scenario in this IA report** (for details please see box below and Annex II). This scenario includes measures that have been implemented by **December 2009** and where the adopted legislative provisions are defined in such a way that there is almost no uncertainty on how they should be implemented in the future. The modelling gives an indication of the overall progress but not on the individual impacts of each measure. To reveal the progress towards reaching the target, results of this scenario are compared with the PRIMES 2007 which could be considered as a reference for the 20% energy savings objective.

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35 Fraunhofer ISI *et al.* 2009. Study on Energy Savings Potentials in EU Member States, Candidate Countries and EEA Countries. The potentials in this study were calculated with relatively modest assumption on energy price development.

36 Ibid footnote 35. The success of recent policies such as the recast EPBD and the mandatory CO_2-Standards for cars, which in the study was still considered uncertain and included in the potentials, was in this figure however taken for granted and included in the reference development.

37 http://147.102.23.135/e3mlab/PRIMES%20Manual/The_PRIMES_MODEL_2010.pdf

Box 2: The PRIMES model and different baselines

The PRIMES model is a modelling system that simulates a market equilibrium solution for energy supply and demand. The model is organized in sub-models (modules), each one representing the behaviour of a specific (or representative) agent, a demander and/or a supplier of energy.

The Baseline is a complete and internally consistent energy-economy-transport-environment outlook having the features of a development on the basis of current trends and implemented policies against which policy scenarios can be assessed. Several EU baselines have been established at different points in time using a framework contract with National Technical University of Athens (author and owner of the PRIMES model).

The indicative 20% target on energy savings refers to projections for 2020, as estimated by the Commission in its Green Paper on Energy Efficiency, which used the PRIMES baseline 2005. The baseline 2005 was a separate exercise that was not used for the target setting. The indicative target was set on the basis of a study on energy efficiency potentials. The baseline 2005 covers 25 MS, Bulgaria and Romania were modelled separately. The PRIMES baseline 2007 already covers EU-27 and gives similar values for primary energy consumption in 2020 for 27 Member States (1970 Mtoe in 2005 baseline and 1968 Mtoe in 2007 baseline).

The latest update - PRIMES baseline 2009 was finalized in 2009 and includes the effects of policies adopted until spring 2009. It is based on an average GDP growth of 1.7% per year for the period 2005-2030 as opposed to 2.2% in the 2007 baseline. The energy projections are based on a relatively high oil price environment compared with previous projections and similar to reference projections from other sources, with oil prices of 59 $/barrel in 2005 rising to 106 $/barrel in 2030 (in year 2008-dollars). This baseline includes only measures that have been implemented by April 2009 or where the legislative provisions are defined in such a way that there is almost no uncertainty on how they should be implemented in the future. The baseline 2009 includes the effects of measures of the current EEAP that have already been implemented, 5 Ecodesign implementing measures adopted until end April 2009 and the ETS directive. It also includes policies on energy efficiency such as implementation of the building (also the recast EPBD but limited only to measures for which the concrete implementation is provided in the Directive and not left for interpretation to MS), CHP, end-use efficiency and energy services, Ecodesign and labelling Directives as well as national policies on education, information, public procurement and CHP.

As regards other relevant fields the model takes into account the current Energy taxation directive. Some of the effects from the new Industrial Emissions Directive have been considered but those which implementation is not clear have not been modelled. Art. 10.3.b of the EU emission trading directive, which enables MS to use certain part of the revenues from auctioning allowances on measures aimed at achieving the 20% energy efficiency target has also not be included due its voluntary character and uncertainty of implementation.

A so called Efficiency scenario 2009 relies on the same macroeconomic, demographic, price and technology assumptions but in addition to all policy measures included in the Baseline 2009 takes also into account measures adopted between April and December 2009 (4 additional Eco-design implementing measures, Recast of the Energy Performance of Buildings Directive, Labelling regulation for tyres and Regulation Euro VI for heavy duty vehicles). For this scenario, unlike the Reference one (see p. 21), it is assumed that neither the RES directive targets (Member States need to establish and transmit to the Commission their national renewables action plans in 2010; these national action plans will show how Member States intend to reach their targets) nor non-ETS targets are fully achieved. However, the currently implemented national measures for both targets are reflected. In this sense, the approach for this IA as regards BAU is rather conservative one not taking achievement of adopted targets for granted.

The model does not include assumptions from the Resource Efficiency Flagship Initiative, the Climate 2050 Communication, and the Energy Decarbonisation Roadmap as these are under preparation. Nevertheless, there has been a continuous discussion between the various Commission services of the possible interactions of the various initiatives.

The model takes into account to a certain degree the effects of the rebound effect. For example, it captures peoples' desire for more comfort such as bigger cars, bigger living space, bigger appliances, etc which is reflected for instance in the gradual change in composition of car fleet, bigger spaces to be heated.

The progress towards reaching the target is evaluated by comparing PRIMES 2007 baseline and 2009 efficiency scenarios. This is done because PRIMES 2007 provides a snapshot of the existing measures (until November 2006) and their impact on energy trends before EEAP 2006 and 20% policy objective were adopted. PRIMES 2009 Efficiency scenario provides an update of the situation taking into account the policies adopted by

December 2009 and the latest economic developments. This analytical approach to measures the progress towards the 20% objective has also been applied in other studies[38].

More details on the modelling approach and the PRIMES 2009 Efficiency scenario and its assumptions can be found in Annex II a) and b).

The main assumptions, indicators and trends in energy consumption in EU 27 under this scenario are summarized in the Table below.

[38] E.g. ECF and Fraunhover Institute 2010: Energy Saving 2020; Background study for the IA. 2010.

Table 1: Evolution and projections of main energy indicators 1990-2020 (Source: ESTAT until 2008 and PRIMES 2009 projections from 2010 onwards)

Main Indicators	1990	2000	2005	2008	2010	2020	Change over 2005-2020	Difference in 2020 (PRIMES 2009 vs 2007)
Population (Million)	*470*	*481*	*489*	*498*	*499*	*514*	*5.1%*	*4%*
GDP (in 000 bn Euro'05)	*8.1*	*10.1*	*11.1*	*12.5*	*11.4*	*14.2*	*27.9%*	*-9.7%*
Gross/ primary Inland Consumption	1666	1723	1826	1799	1767	1795	*-1.7%*	*-8.8%*
Gross/ primary Inland Consumption minus non-energy uses (Mtoe)	1562	1611	1709	1685	1655	1678	*-1.8%*	*-8.9%*
Final Energy Demand (Mtoe)	1069	1113	1174	1167	1169	1214	*3.4%*	*-9.9%*
Industry	*366*	*327*	*326*	*318*	*313*	327	*0.3%*	*-11.1%*
Residential	*264*	*287*	*308*	*297*	*309*	310	*0.6%*	*-7.7%*
Tertiary	*158*	*160*	*177*	*179*	*176*	181	*2.3%*	*-11.9%*
Transport	*280*	*339*	*362*	*374*	*370*	395	*9.1%*	*-9.9%*
CO_2 Emissions (Mt CO_2, ref approach)	4031	3811	3947	3787	3743	3610	*-8.5%*	*-14.9%*
Energy intensity (GIC/GDP (toe/M€'05)	204	171	165	167	155	127	*-23.0%*	*1.3%*
Import Dependency %	45%	47%	53%	55%	55%	60%	*13.2%*	*-21.2%*
Total cost of Energy in bn €'2005		995	1161		1215	1740	*49.9%*	-
Total cost of energy as % of GDP		10%	11%		11%	12%	*9.1%*	-

The PRIMES energy efficiency scenario projections for the first time show a break in the trend of increasing energy demand. After years of growth, the **gross inland consumption**[39] **excluding the non-energy use of primary fuels (referred hereafter as primary energy)** in the EU 27 has stabilized in 2005 and 2006, slightly decreased in 2007 and 2008. The scenario projects 8.9% reduction of primary energy compared to PRIMES 2007 and 17% decrease of CO_2 emissions which shows increased decarbonisation of energy generation.

The economic crisis is included in the modelling work. The **reduction of energy use is due to the economic crisis at the beginning of the period but after 2012 is also positively influenced by the increased implementation of the recently adopted energy efficiency policies**. The economic crisis has a twofold impact on energy consumption. Firstly, it leads to its reduction because of the lower level of economic activity, but also to a reduced investment and capital turnover which slows energy efficiency progress. Secondly, the economic recovery period translates into higher economic activity and energy consumption but also a faster pace in equipment renewing, hence acceleration of energy efficiency progress takes place.

The **final energy consumption**[40] **is projected to slightly increase** (3.4%) over the period 2005-2020. While energy consumption in industry (-12%) declined considerably between 1990 and 2005, energy consumption in transport (+29%), households (+16%) and tertiary (+11%) increased over the same period. According to the projections, final energy

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39 Gross inland energy consumption represents the quantity of energy necessary to satisfy inland consumption of the geographical entity under consideration. It is calculated as follows Gross inland energy consumption = primary production + recovered products + total imports + stock change - total exports – bunkers – non-energy use. The final non energy consumption (e.g. in petrochemicals industry, lubricants, asphalt) is also subtracted as this is not relevant from the energy savings perspective.

40 Final energy consumption includes all energy delivered to the final consumer's door (in the industry, transport, households and other sectors) for all energy uses. It excludes deliveries for transformation and/or own use of the energy producing industries, as well as network losses.

consumption in all sectors will be slightly higher in 2020 than in 2008 with transport having the highest growth of almost 6% (over 2008-2020 period). In 2008, buildings (or households and tertiary sectors combined) contribute to 39% of the EU's final energy use, followed by transport (32%) and industry (27%). The relative shares are projected to stay approximately the same until 2030.

There is a positive development as regards **energy intensity** of European economies which **will decrease** by almost 23% (or 2.0% p.a.) over 2010-2020 period. This confirms that economic growth can be achieved with less energy resources, however, energy intensity does not necessarily translate into reduction of energy use, CO2 emissions and increased security of energy supply.

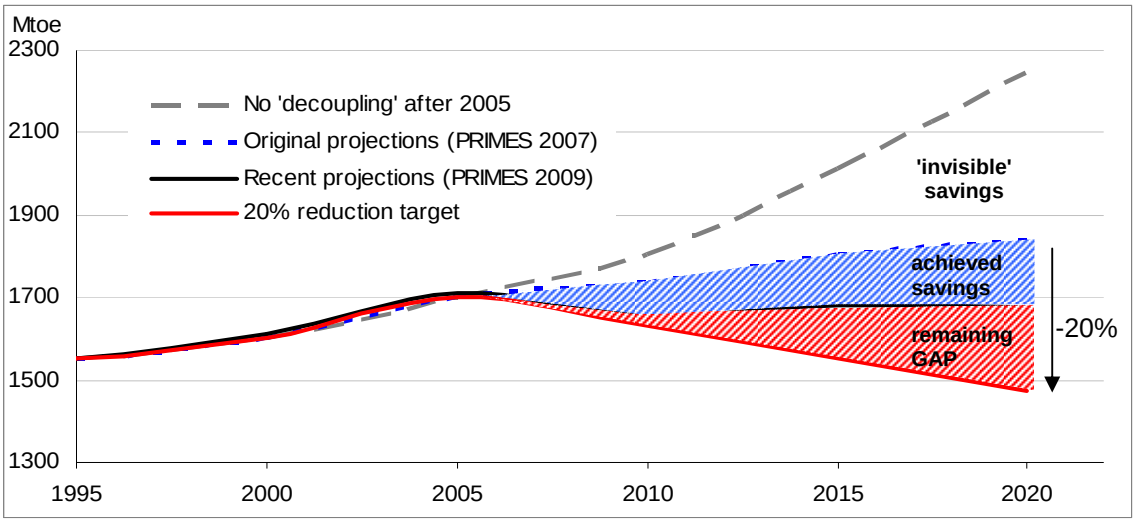
Difference to the 20% target

The 20% savings objective agreed by the European Council translates into a reduction of primary energy use by 368[41] Mtoe in 2020. According to PRIMES energy efficiency scenario the effects of the crisis and implemented policies until December 2009 will deliver 164 Mtoe of this savings objective or 8.9% reduction compared to PRIMES 2007 projections.

Therefore, the **EU needs to double its efforts in order to reap all the benefits of energy efficiency and savings in 2020.**

Another PRIMES scenario (the Reference scenario) assumes that the two binding targets on RES share and GHG emissions reductions are met. The result of the modelling shows that this would not have a significant effect on the achievement of the 20% savings objective (only by additional 0.8% or 14 Mtoe). This is because there is a range of possible measures for the realization of GHG emissions reduction, in addition to energy efficiency. These, for example, include increased use of renewables, fuel switching and use of international offsets (CDM/JI). Therefore, the objectives of energy efficiency policy would not be met by the two other targets and additional measures to fully reap its benefits are required.

Figure 4. Development and projection of primary energy use for the EU by 2020



41 Source: PRIMES baseline 2007, calculation: (Gross inland consumption in 2020 (1968Mtoe) - Non-energy uses (126 Mtoe))*0.2=368 Mtoe

In addition, there are further measures from the current policy portfolio (e.g. minimum requirements and labelling of boilers, water heaters and air conditioners) which have not yet been adopted and taken into account in the baseline scenario. Their impact could not be modelled yet but even though they will deliver additional savings, they will not be sufficient to close the remaining gap.

Gains in energy efficiency do not automatically translate into an overall reduction of energy consumption. Even though the products and processes are continuously becoming more energy efficient, our total final energy consumption continues to grow. This is due to the fact that the economy grows and with this more energy is used for production of goods. Further, with higher disposable incomes the level of comfort rises, the number of households increases, more appliances are bought, longer distances are travelled with bigger cars and planes and homes become bigger and are better acclimatized to the seasons. To illustrate these 'invisible' savings on the Figure above, it is assumed that energy consumption grows at the same rate as the GDP.

3.5. The Union's right to act, subsidiarity and proportionality

The EU's right to act as regards energy efficiency and savings is instituted in the Treaty on the Functioning of the European Union, Article 194 (1) which states that:

" In the context of the establishment and functioning of the internal market and with regard for the need to preserve and improve the environment, Union policy on energy shall aim, in a spirit of solidarity between Member States, to: … (c) promote energy efficiency and energy saving and the development of new and renewable forms of energy; "

Although much responsibility for addressing energy efficiency and savings rests with Member States, **the EU's right to act has been established because of the importance of energy efficiency and savings for realizing the EU's climate change, security of energy supply, competitiveness and environmental protection objectives**. Tackling these requires coordinated action and coherent energy efficiency and savings policy as one of the responses to these challenges. As has been demonstrated in the previous sections, the various barriers to higher uptake of energy efficiency measures and the available cost-effective potential is not sufficiently addressed at national level and thus the EU action is required to reap the remaining potential benefits. EU level action is also essential for the products that are traded in the internal market.

Energy efficiency and savings can be realized in various areas of economic activities and everyday life and thus the EU's role needs to take into account the specificities of the challenges, and respect the principles of subsidiarity and proportionality. Member States are essential for the realization of the energy efficiency policy framework and the EU intervention should be very well targeted and supportive to Member States' actions. More specifically the EU's role and level of action is in:

– **Setting minimum requirements in areas where there is a risk of internal market distortions** if MS take individual measures. This is applicable to policy areas where there is a single market with free movement (e.g. energy-using products, vehicles) where having 27 national rules, standards and regulations would distort its functioning. For these areas it is appropriate to provide a detailed regulatory framework at the European level. In addition, such EU action can be taken if the **costs of common approach are lower than the costs for 27 national ones** (e.g. the ETS, phase III).

– **Establishing a common framework** which **creates** the basis for **coherent and mutually reinforcing mechanisms** for energy efficiency improvements while leaving in being the responsibility of Member States to set, in a transparent and comparable way, concrete levels that are to be met. This has been applied in areas where there are major national differences (e.g. climate, construction traditions, fiscal policies) and there is no need for full harmonization of the approaches but only for setting of common instruments and requirements (e.g. in buildings). This is the global policy approach also in Europe 2020 Strategy.

– **Creating a platform for exchanging best practices and stimulating capacity building.** This is for the areas where the EU competences are limited but which can profit from dissemination of the experience of the more advanced Member States (e.g. awareness raising, professional and university training)

– **Using EU instruments to promote energy efficiency, e.g. through financing, and to mainstream it into the other policy areas.** The EU does not dispose of sufficient funds to match the need for funding but it can still play an important role in mobilizing, providing visibility and momentum to fill a critical gap of ongoing initiatives. For example, some of the EU funds can be used to leverage third party financing. Furthermore, it would create economies of scale and allow for more effective and efficient action. EU action also allows for the wide dissemination of information and a variety of effective implementation mechanisms.

– **Promoting the EU internationally as a forerunner in the area – an activity that is also beneficial for EU businesses.** In a time of emerging pressure for action on reduced energy consumption the activities at EU level are closely followed worldwide and some of the EU approaches (labelling, Ecodesign, EPBD) are being adopted by developed and developing countries. This will contribute to lower global CO_2 emissions and establish the EU as a recognized player on the international scene.

All the options examined in the appraisal section will once again be checked individually on whether they respect the principle of subsidiarity and proportionality.

4. POLICY OBJECTIVES

4.1. General policy objectives

The general EU policy objective, as set by EU leaders, is to increase energy efficiency in the EU so as to achieve the objective of saving 20% of the EU's energy consumption compared to projections for 2020, as estimated by the Commission in its Green Paper[42] on Energy Efficiency. This objective is consistent with the EU's overall energy policy. Increased energy efficiency is an essential element of the new European Energy Strategy 2020[43].

This objective is fully consistent with the EU overall energy policy. Increased energy efficiency is an essential element of the new European Energy 2020 Strategy which states that

[42] COM(2005) 265: Primary energy savings amounting to 370 Mtoe in 2020 compared to a baseline scenario projecting the level of primary energy consumption. The baseline was updated in 2007 to take account of two new Member States.

[43] COM(2010) 639.

"*Energy efficiency is the most cost effective and quickest way to reduce emissions, improve energy security and competitiveness, make the energy process more affordable for consumers as well as create employment, also in export industries*[44]".

More generally, energy efficiency contributes to broader initiatives to achieve climate change policy objectives and to stimulate economic recovery and smart, sustainable and inclusive growth, as outlined in *Europe 2020: A strategy for smart, sustainable and inclusive growth*[45].

4.2. Specific policy objectives

Based on the analysis of the current policies, potentials and needs the following specific policy objectives need to be addressed:

- Provide high visibility and stimulate commitment for energy efficiency at the EU and national level
- Ensure that when public funds are spent, energy efficiency considerations are taken into account
- Promote capacity building, exchange of knowledge and best practices at national and local level
- Stimulate high quality (deep) energy renovation of the existing building stock
- Ensure higher uptake of energy efficient products
- Support transformation of transport towards more efficient vehicles, modes and usages
- Encourage the uptake of energy efficiency improvements in industry (especially for SMEs)
- Intensify the uptake of energy efficiency improvements in the energy sector (i.e. energy generation and transmission)
- Commit energy companies to take an active role in energy efficiency improvement with their clients

In addition, the following specific policy objectives would contribute to the realization of the general ones but are not analyzed in this IA because their impact is studied in other policy documents. These include actions to:

- Stimulate innovation, development and demonstration of new technologies.
- Foster the international leadership of EU on energy efficiency

4.3. Consistency of the objectives with other EU policies

The above-listed general and specific policy objectives are in line with the existing EU policies because they are:

- **Enabling the reduction of greenhouse gas (GHG) emissions** and thus contribute in a cost-effective way to reaching the EU's climate objectives.

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44 COM(2010) 639.
45 COM(2010) 2020.

- **Making possible further commitments on greenhouse gas emission reduction.** Massive cuts of greenhouse gas emissions of 80 to 95% in 2050 compared to 1990[46] are needed in order to realize the EU's objective to limit the temperature increase to less than 2°C compared to pre-industrial levels[47].
- **Promoting economic recovery and enhancing the competitiveness of the EU industries in line with the Europe 2020 Strategy** and also contributing to the Resource efficiency flagship initiative and the sustainability layer of Europe 2020: The excessive use of energy brings additional costs to the price of the products and energy bills. Therefore, the implementation of cost-effective saving measures would increase the competitiveness of EU's economy. But, also know-how on energy efficient technologies and systems is a growing export field.
- **Increasing security of energy supply as called for in the Energy 2020 Strategy[48]**: less energy used in Europe means less reliance on imports. In 2007, our energy dependency meant that €332 bn of EU's wealth were exported mainly to oil and natural gas rich countries[49]. Reduction of our energy demand would lead to lower imports bill.
- **Creating jobs and fighting energy poverty in support of the EU's social agenda**: Jobs creation or (with the economic crisis) retention, especially of people employed in SMEs, is another valuable contribution that EE can bring to the EU's economy. Renovation policies would target social housing that are the lowest energy performing building and contribute to fight against energy poverty. EU citizens will also benefit from improved living conditions, improved transport infrastructure in the cities, less pollution, better buildings, and lower energy bills.

Therefore, energy efficiency policies already interact in a positive way with a number of established EU policies. The coherence of each policy option with the current policy mix considered in this IA is studied in detail in Section 6.

5. POLICY ALTERNATIVES AND OPTIONS

5.1. General policy alternatives

Current energy efficiency policy is an integral part of the overarching climate and energy policy, it is one of the headline targets of Europe 2020 Strategy and has a body of legislation addressing technical aspects for the reduction of energy efficiency.

However, unlike the targets on energy and climate, e.g. RES and GHG, the energy efficiency one is not legally binding, and thus far has not been delineated in terms of individual MS targets. This undermines the credibility of the policy[50] and endangers the achievement of the political objective of 20% reduction.

The following global questions are essential in the development of the EU energy efficiency policy:

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46 4th Assessment report by the Intergovernmental Panel on Climate Change (IPCC) http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-chapter13.pdf

47 7880/1/09 REV 1

48 COM(2010) 639.

49 COM(2008) 781.

50 2010/2107(INI)

(1) Could **binding targets** on Member States (on their own) be sufficient to reap the remaining potential?

(2) Would concrete **policy instruments** are developed at EU level be sufficient (i.e. without targets)?

(3) Should an approach of **targets and measures** be further developed?

The following considerations have to be taken into account when deciding on the general policy approach:

- **EU and national targets, Member States devise the instruments to reach them**

Energy savings take place at local level. In this respect, the targeted energy efficiency at EU level could be achieved by overall and/or sectoral targets at national level, leaving full flexibility to Member States on how to reach these targets.

This approach would result in a strong deregulation at EU level and its direct impact would be to abandon framework policies (e.g. ESD, the EPBD, the CHP Directive) that are not essential for the functioning of the internal market (e.g. Ecodesign would be retained). The energy savings which are expected to be delivered by these frameworks would need to be redeemed by national policies alone. The setting of the targets would have to take into account the interactions with the existing national greenhouse gas reductions commitments and other relevant policies. An essential element of the approach would be a robust system for the follow-up on the progress in meeting the targets. It would acknowledge the central role of the Member States in bringing about energy savings and would create a strong and visible ownership of energy savings policies.

However, this approach would require significant administrative efforts from the national authorities as they would have to develop the legislative measures themselves and it can be expected that some Member States would face difficulties in coping with the challenge alone. For example, regularly a number of Member States and many industries have asked the Commission to develop a common framework and standards (e.g. on energy performance of buildings, Eco-design) as Member States lack administrative capacity to develop this and industries do not want to comply with numerous different requirements. Such target setting would also pose compliance costs and administrative burden on the companies that operate in more than one country as they would have to comply with at least 27 national policy frameworks and regulations for each sector and the EU will move away from a single internal market for energy services.

A targets only approach could also possibly have negative impact on the development of relevant EU services markets and the mobility of workers and businesses.

- **Detailed EU policy instruments, Member States implement/supplement them, no global energy savings targets**

Targets alone do not save energy, only concrete measures do so. Focussing policy on the design of energy savings policies at EU and national level might guarantee more action than losing time and resources with target formulations.

In practical terms this approach would mean that no further targets on energy efficiency and savings are set at EU level but a number of EU individual measures on energy efficiency are

adopted following the EU competences established by the Treaty of Lisbon. New instruments would need to be designed to trigger additional energy savings so to harvest the economic energy saving potential in all sectors. Member States would still be responsible for their implementation and also, where appropriate, setting additional ones in order to establish a comprehensive policy framework.

This approach would highlight the need for concrete action to bring about savings in the different sectors. The measures could be designed to reach the full economic savings potential by 2020, that is some 368 Mtoe primary energy savings. However, the lack of general policy objectives would make the monitoring of the progress difficult. There is also a risk that this approach becomes very technical and focused on technical problems and areas and does not attract sufficient political attention. The lack of political mobilization has been one of the main political challenges and if the approach of only developing concrete measures is adopted then there is a possibility that the impact is more limited and not sufficient resources are put to address the problems.

- **Comprehensive policy framework at Member States' level (including objectives/targets), EU develops policy instruments to support Member States**

The two policy alternatives discussed above (targets only or measures only) revealed that neither of the approaches could fully address the diverse challenges of energy efficiency. Therefore, it is worth considering a combination of the two.

Establishing a national/sectoral objective and/or target for energy efficiency can be a trigger for enhanced action and creates political momentum for this policy field, which is otherwise characterised by a multitude of dispersed technical solutions. Complementing this target with concrete instruments at national and EU level would ensure that its is met.

The approach of combining compulsory national energy efficiency action plans with a set of partly indicative and partly binding target values at national and/or sectoral level leaves large room to the Member States to define the target/policy combination that fits best to the national situation. At the same time, it is safeguarded that the biggest available economic saving potentials are addressed. Clear objectives and concrete measures would create strong signals to investors in energy efficiency and thus will address the market failure of incomplete energy savings markets.

Setting policy objectives, detailed measures and coordinating national energy efficiency policies by the national action plan would incite Member States to put a stronger focus on energy savings and design more ambitious and more streamlined measures to reach the energy savings objectives. In that respect the coordination through the NEEAPs and the political commitment to objectives would reinforce the impact of the energy saving measures put in place.

The approach could include:

- A set of objectives or targets and indicators to ensure high political visibility and their commitment to energy efficiency to be developed by the EU together with Member States. These would also allow the monitoring of the progress. The targets could vary from binding to fully indicative ones or a combination of indicative and mandatory ones. The best modality (e.g. national or sectoral, linear decrease for each member State or burden sharing, primary/final or energy intensity target based on reference year or projections) and

its interaction with the other policy objectives (especially with the ETS, non-ETS and RES targets) would need to be studied in more detail. The sectoral targets could be, for example, set for the public sector or even for certain economic actors (e.g. energy companies).

- Comprehensive plans (possibly strengthened National Energy Efficiency Action Plans (NEEAPs)) where they outline the general policy objectives and the concrete comprehensive policy mix to be drawn up by Member States. These plans could serve as main policy drivers, linking the EU policies to the local reality and coordinating and streamlining fragmented policies. They should include clear analysis of the barriers to energy efficiency in each country and how to tackle them and ways to actively engage the regional and local authorities and various stakeholders. These Plans should also serve as the main reporting tool from Member States towards the EU.

- A number of well coordinated individual measures adopted at national and EU level. The EU measures could provide Member States with the needed framework based on which they could further develop their efforts. Further EU level legislation would also be developed for the products and services traded at the EU internal market, where necessary.

This approach would reinforce the level of ambition of national energy efficiency policy and guarantee a set of coordinated measures that tap synergies. This approach would require a certain increase of the administrative burden on the national authorities, EU and local stakeholders for setting this framework in place and also for NEEAPs development but these will be compensated many times by the benefits of the realized energy savings. In addition, if NEEAPs turn into a single reporting obligation for ESD, EPBD and possibly other Directives the overall impact could even be a decrease of the administrative costs.

As a conclusion, it is proposed that the third policy alternative, a policy framework for Member States with EU support, is followed. This would recognize the importance of Member States in the implementation of energy savings policies, give the EU an important supporting role, and provide for clear objectives and indicators to follow the progress in the realization of the energy savings potential.

In the next sections of the IA the additional policy measures to be put in place at EU level that would support Member States in this approach are discussed. The issues related to the nature and concrete setting of the objectives and indicators will be further analyzed when the concrete legal provisions are developed.

5.2. Options analyzed

The selection of the approach for the analysis of the individual options is based on the fact that the aim of this evaluation is to identify what type (regulatory, financial or soft-law measures) of EU intervention is needed and suggest which are the best examples or possibilities that should be further looked at. Therefore, for each sector the following policy options are analyzed:

- **No additional EU action:** implies that no additional measures beyond the existing ones are adopted.
- **Voluntary commitments:** would mean that active participation from the various industries and stakeholders is sough through voluntary agreements.
- **Regulatory instruments:** implies that additional to the existing ones command and control tools are established at EU level
- **Financial instruments:** include the provision of various forms of financial support but also means for its mobilization and also encouragement or regulation for fiscal measures. The support for RTD is excluded from the analysis as this is subject to detailed assessment in other policy documents.
- **Awareness and training:** at EU level mainly comprise initiatives that support the exchanges of best practices and support the development of training and awareness raising materials.

Fiscal instruments are not discussed in detail in this Impact Assessment as they have already been subject to a separate analysis[51] and a possible further initiative is subject to ongoing work of DG TAXUD. However, it should be noted that these could be cost-efficient instruments, implemented both at the EU and at national level. For example, tax exemptions can drive the demand for energy efficient products, buildings and services. However, because of the low energy price elasticities for final consumers (especially households/SMEs) the impacts would be more prominent at supply side. For example, the tax on the various types of fuel would be very important when an investment decision for new energy generation capacities are made (e.g. district heating company that has to choose between heavy oil and natural gas). Furthermore, there are fiscal instruments at Member States level that discourage energy efficiency (such as higher property taxes for good performing buildings) that should be carefully looked and phased out, if increased energy efficiency is sought.

The types of policy instruments are not mutually exclusive. **In energy efficiency, often, the best approach is a combination of individual instruments that complement each other and create a comprehensive policy mix.** Therefore, following the analyses of the options, a preferred policy portfolio of best options can be identified in each sector.

[51] Costs and benefits related to the use of tax incentives for energy-efficient appliances, http://ec.europa.eu/taxation_customs/common/publications/studies/index_en.htm.

The table below provides an overview of the sectors and options analyzed.

options for the residential and services sectors	
1	Option A1: No additional EU action (BAU)
2	Option A2: Voluntary commitments with commercial entities
	Option A3: Regulatory instruments:
3	Option A3a: Additional stringent legal obligations for buildings
4	Option A3b: Additional stringent legal obligations for products
	Option A4: Financial instruments
5	Option A4a: Technical assistance and risk sharing facilities
6	Option A4b: Energy efficiency conditionality on the spending of public funds
7	Option A5: Awareness
8	Option A6: Training
options for the transport sector	
	No options discussed as specific measures for the sector are discussed/analyzed in the forthcoming Transport White Paper and its IA
options for the industry sector	
1	Option C1:No additional EU action (BAU)
2	Option C2:Establish voluntary commitments with industries
3	Option C3: Regulatory measures supporting the existing climate related legal tools
4	Option C4: Financial instruments
5	Option C5: Awareness and training
options for the energy sector	
1	Option D1: No additional EU action (BAU)
2	Option D2: Voluntary commitments
	Option D3: Regulatory instruments:
3	Option D3a: Generation efficiency
4	Option D3b: Higher energy recovery from generation
5	Option D3c: Increased role of energy regulators
6	Option D3d: Energy companies' role in energy savings of their clients
7	Option D4: Financial instruments
8	Option D5: Awareness and training (focusing on the promotion of energy services companies)

6. ANALYSIS OF IMPACT AND COMPARING THE OPTIONS

The depth of the analysis is proportionate to the foreseen general political nature of the Energy Efficiency Plan itself.

For modelling purposes the business-as-usual scenario the PRIMES model was used (Section 3.4). It is a general equilibrium model and has certain limitations as regards energy efficiency (e.g. the impact of individual measures is difficult to be distinguished, only policies for which there is almost no uncertainty on how they should be implemented are taken into account which is not the case for many of the EU framework policies on energy efficiency). Due to these limitations it was also not possible to use the model for the assessment of individual policy options.

To overcome these limitations, the analysis is mainly based on case studies of similar policies that have been implemented at Member States level or on the results of various academic studies. This allowed for qualitative, and sometimes quantitative, description of the economic, social and environmental impact to be made.

Based on the description of the impact, qualitative evaluation of how the options will contribute to the realization of the policy objectives, as set in Section 4 and also described in the businesses-as-usual option for each sector, is made using the following evaluation criteria:

- **effectiveness –** the extent to which options achieve the objectives of the proposal
- **efficiency –** the extent to which objectives can be achieved for a given level of resources/at least cost (cost-effectiveness).
- **coherence –** the extent to which options are coherent with the overarching objectives of EU policy, and the extent to which they are likely to limit trade-offs across the economic, social, and environmental domain.
- **respect of subsidiarity/proportionality**

The following symbols were used to describe the results of evaluation of efficiency, effectiveness and overall assessment:

'=' **baseline or equivalent to the baseline**

'+' to '+++' **low to high improvement compared to the baseline**

'-' **worsening compared to the baseline**

For subsidiarity/proportionality principles the following symbols are used: **respected R**, **or not respected NR.**

For coherence with the other policies the following symbols used: **coherent C**, **or not coherent NC.**

As regards the business-as-usual option under each sector, only the main developments, achievements and needs are presented. Detailed analysis is available in Annex III and IV.

6.1. Residential and tertiary sectors

Option A1: No additional EU action (business as usual scenario)

Several directives and initiatives that are already part of the EEAP address the existing failures in the two sectors. The main tools used are: original and recast Energy performance of buildings Directive (2002/91/EC and 2010/31/EU), original and recast Ecodesign (2005/32/EC and 2009/125/EC) and its implementing measures; original and recast Energy labelling Directive (92/75/EEC and 2010/125/EC) and its implementing measures, Intelligent-Energy Europe Programme, and green public procurement (mostly voluntary). In addition, the Energy Services Directive (2006/32/EC), the Effort Sharing Decision, the ETS, and the draft Regulation on Construction products have indirect impact on the energy performance of buildings. Certain financial (e.g. Cohesion and social policy funds, Intelligent Energy Europe programme and European Local Energy Assistance – ELENA facility, IFIs funding), and fiscal measures (e.g. possibilities for VAT reduced rates and state aid exemptions in certain cases and conditions) are also at disposal at EU level. All these have contributed to a different extent in decreasing the existing challenges but according to PRIMES 2009 projections the final energy consumption of the sector will increase slightly in 2020 leaving the remaining potential unachieved.

However, the current policy framework does not oblige and cannot oblige property owners to renovate their buildings or consumers to change their appliances. It also cannot require a Member State to provide financial and fiscal assistance and training to buildings workforce. Therefore, the main challenge as outlined in the EEAP assessment is that renovation rates remain low (about 1.2% p.a. in 2008), and are further hampered by the crisis, and the impact of the recast EPBD cannot be fully realized. The same applies to some appliances – the products that offer the biggest energy-saving potential (e.g. boilers, air-conditioning) have the longest lifetimes (15 years and above), and hence the lowest replacement rates which reduces the impact of minimum requirements. Also although the unit efficiency of products is growing, the energy use of households is still increasing, due to purchases of more and bigger appliances. Furthermore, in order to harness the full saving potential it is important to address not only the efficiency of individual products but also ensure that these products are correctly integrated into efficient systems, be it 'smart metering/smart grids' or automatic energy management in buildings.

The final actors (e.g. EU citizens, public authorities and service companies) in both sectors face similar market and regulatory failures that limit the uptake of energy savings measures, namely: high initial costs, incomplete markets (lack of trained staff, infrastructure, information), lack of information/ knowledge/ motivation, split incentives (landlord-tenant problem), poor enforcement of legislation, and rebound effect.

A number of stakeholders have also called for more ambitious policy mix for the two sectors with measures on financing, training, awareness strongly supported. Some stakeholders also recognize that there are numerous funding opportunities in place, but that these seem confusing and difficult to access which discouraged participation. Furthermore, there has been a strong demand for more active engagement of the public sector than the one currently envisaged in the EPBD recast and the new Energy Labelling Directive.

The EEAP 2006 has already set the legal framework by pushing for the implementation and revision of key legislation in these sectors. In order to trigger the renovation process of the building sector, additional measures are needed. With respect to the resulting training needs

for the buildings workforce, the EEAP 2006 had already proposed a vocational initiative on energy efficiency, which has not been implemented yet.

Based on the PRIMES projections for the two sectors, the analysis of the potentials, and the EEAP and NEEAPs assessments (as discussed in sections 3.1 and 3.3) it is evident that further measures are needed to be developed to tackle the remaining barriers and to stimulate increased uptake of energy improvements of existing building stock (e.g. increase of renovation rates for existing buildings) and of energy efficient appliances and innovative technologies (e.g. increase of replacement rates of inefficiency appliances).

Option A2: Voluntary commitments with commercial entities

Possible approaches: Voluntary agreements combined with a support mechanism can provide a framework for stimulating an increased rate of renovation in the existing building stock or increased uptake of energy efficient appliances. These are possible, for example, between public authorities and housing associations, or commercial entities (e.g. chains of supermarkets), or organizations of specific economic activity (e.g. organization of the architects, of construction sector). The Commission can facilitate these by providing recognition, support for the preparation of agreements and for the exchange of best practice.

Impact: This option can contribute to achieving the policy objectives. The results of the 'SABO energy challenge' in Sweden[52] reveal that average energy use has dropped from 149 kWh/m2 in 2007 to 144 kWh/m2 in 2008, which amounts to an average saving of 2.3%.

As regards costs, voluntary agreements and support mechanisms are not costly processes. In financial terms, the GreenBuilding Programme[53] had a simple payback period of between 3-6 months and the initial investments triggered were between 6-7 times the programme costs. Extrapolated over the lifetime of the measures implemented, the cost to promote these savings amounts to less than 0.1 €cent/kWh of primary energy saved. The measure would be particularly cost effective even though the need for upfront investment remains. However, the voluntary approach would imply increased costs for monitoring. The social impact (besides employment) would include improved living conditions and well being for occupants: for every € 1 invested on energy efficiency, € 0.42 are saved in health expenses[54]. This will reduce the levels of fuel poverty, increase well being and strengthen the cohesion.

Option A3: Regulatory instruments

Option A3a: Additional stringent legal obligations for buildings

Possible approaches: In addition to the current legal framework for the improvement of energy performance of buildings and appliances some very stringent measures could be proposed to harness the remaining potential and ensure that major energy related renovations

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52 SABO members committed in February 2008 to reduce their energy consumption by 20% between 2007 until 2016. So far, 99 companies, owning over 370, 000 apartments have taken the challenge. SABO assists them through platform activities for provision of information and exchange of best practices.

53 The evaluation of the GreenBuilding Programme is available at the GreenBuilding website at http://re.jrc.ec.europa.eu/energyefficiency/greenbuilding/index.htm. Similar results have also been achieved with the GreenLight and Motor Challenge programmes.

54 CECODHAS figures, see the Copenhagen Offer above – this specific for well being not yet substantiated / source not identified.

and replacement of energy-using products are being carried out. These, for example, could be in the form of obligation for improvement of the energy performance of buildings when they are sold or rented out, or mapping and mandatory renovation of the poorest segment of the building stock. Another possibility is to introduce a binding target(s) on Member States, for example, to reach certain renovation rates, to renovate certain percentage of their building stock, or to renovate all poor performing public buildings.

Impact: Some quantifications of the possible implications are available for the various best practices or possibilities presented above. For example, calculations show that if there is a requirement that properties that are of the two poorest performance classes cannot be newly rented out until their performance is improved, the additional to the baseline primary energy savings in 2020 could be about 33 Mtoe with CO_2 emission reduction of 65 Mt. The CO_2 mitigation costs is in the range of -300 to 100 €/t CO_2 and 375 000 jobs will be created and maintained[55]. Similar prohibition on sale would lead to savings of 13 Mtoe in 2020, 26 Mt CO_2 emission reductions, with CO_2 mitigation costs in the range of -300 to 100 €/t CO_2 and 150 000 jobs created an maintained[56].

In the US, city of Berkley, has introduced a certain energy and water efficiency requirements to be met when residences above USD 50,000 are sold, transferred from one proprietor to another, or renovated[57]. This has reduced residential energy consumption by over 13% between 2000 and 2005 and allowed households to save up to USD 450 per year on their energy bills.

Thus it can be concluded that a strong regulatory approach will bring significant energy savings and CO_2 emission reductions.

The renovations should be cost-effective. However, the approach might require that some renovations are carried out outside of the normal refurbishment cycle which could lead to suboptimal investments. In many cases low income people live in poor energy performing buildings. Therefore, requirements on their renovation could be additional burden for their limited budgets. Similarly such obligations could be significant burden for associations owning a number of buildings, especially those offering social housing.

Option A3b: Additional stringent legal obligations for products

It is expected that by mid-2011 requirements will cover almost the entirety of electricity consumption and a large part of energy consumption in the household sector but there remains a substantial saving potential in the tertiary sector which could be addressed through mandatory minimum efficiency requirements, for e.g. in big air-conditioning and ventilation systems. It can be also considered to introduce labelling and/or minimum efficiency requirements for certain construction materials, for e.g. windows. A third element to consider is a regular tightening of requirement to ensure that the efficiency of products is constantly improving.

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55 Ecorys, Ecofys and BioIntelligence. 2010. Study to Support the Impact Assessment for the EU Energy Saving Action Plan. The calculation assumes that the measure will increase the renovation rates with 0.5% compared to the baseline (i.e. from 1.7% to 2.3%)

56 Ibid 55. The calculation assumes that the measure will increase the renovation rate with 0.2% compared to the baseline (i.e. from 1.7% to 1.9%)

57 RECO (Residential Energy Conservation Ordinance, 1979, adopted in 1987). Source: http://www.c40cities.org/docs/casestudies/buildings/berkeley_standards.pdf

Impact: Some indication of the impact can be given by the estimated effects of the Ecodesign and Energy Labelling Directives. For example, completing the current requirements limiting the power consumption of appliances in the standby mode with requirements for devices operating in networks (mainly electronic equipment) is estimated to result in additional 60 TWh saved per year in 2020 (or 11.5 Mtoe primary energy savings), leading to CO_2 emissions reduction of 24 Mt of CO_2 and €9.6 bn saved on energy bills annually by 2020[58]. The costs are considered negligible. Such approach has proved to be effective but it has certain limits related to the size and complexity of the products- for e.g. large systems such as ventilation in commercial and public buildings are often custom-made and therefore difficult to address solely through product-level requirements.

The measures proposed under this option are to be set in cost-effective manner. There are certain administrative costs but based on the experience with the already adopted implementing measures under the Ecodesign Directive they are relatively small (requirements can usually be met with readily-available technology therefore there is no incremental cost or it is minimal. The cost for assessing conformity with the requirements is in the order of 1000-2000 euro per model [not product!]. For market surveillance authorities to this cost must be added the cost of purchasing the tested product. The impacts on jobs creation are insignificant but there will be considerable reductions on the energy bill. The annual energy savings due to the 11 implementing measures adopted so far will be in the order of €50 bn. The annual energy savings in 2020 are expected to be 83 Mtoe and the CO_2 emissions will be reduced by 147 Mt annually. The administrative and other associated costs are considered negligible due to the cost-effectiveness of the measures. No problems related to affordability of consumer products were observed in the implementation of the first Ecodesign measures and thus there is no reason to expect negative impacts from further similar measures.

Option A4: Financial instruments

Most of energy efficiency investments are good business opportunities. Expected energy savings and additional benefits in terms of economic activity and social improvements are the basis of sound returns.

Nevertheless, the initial investment costs, but also lack of knowledge on the possibilities and capacity to implement the projects are considerable barriers. For example, it is calculated that the energy related investments to increase the average EU renovation rate from 1.2% pre-crises level (or 1.7% over 2010-2020) to 3% in 2020 are about €29 bn annually over the 2010-2020 period and the total cost for investments (including non-energy related investments, e.g. painting, scaffolding) are about €43 bn annually. The average annual savings over the same period are also considerable: €16 bn - and would continue to deliver over much longer periods (i.e. the lifetime of the measure implemented). The benefits of such increase of renovations would be considerable: primary energy savings of 38 to 60 Mtoe in 2020, CO_2 emission reductions of 77 Mt in 2020, and direct jobs creation of 300 000[59].

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58 For the conversion from TWh to Mtoe, the primary energy is obtained by first multiplying final electricity use by 2.82 for calculating the gross energy needed to generate that quantity of electricity (source: Eurostat 2008), and then dividing it by 11.63 to obtain the Mtoe equivalent (source: Statistical Pocketbook 2010). Monetary savings are estimated at 0.16€/kWh, CO2 savings at 0.43 kg CO2/kWh

59 Background study for this IA. The conversion factor tCO2 to ktoe is based on PRIMES EE scenario for 2020. 38 Mtoe is for increased renovation rates but at the current minimum performance levels. 60 Mtoe refers to increased renovation rates to cost-effective performance levels.

To realize these benefits it is important that funding is mobilized. The EU disposes of limited funds and they should be targeted to the sectors where the EU intervention is essential. As majority of the industrial and energy generation companies falls under ETS or are able to gain access to the capital (see sections 6.3 and 6.4) it is suggested that buildings, urban mobility and small-scale sustainable energy generation projects are tackled. The projects in these sectors are numerous, small and decentralized in nature, often responsibility of people who are not well aware of the various possibilities and ways to structure the projects financially. This results in the paradox that even if a funding is available it is not fully used.

The solution to achieve the energy efficiency objectives in the EU needs of the development and implementation of specific financial instruments. The most relevant instruments must be devised to tackle programmes rather than single projects, and be result-oriented rather than resource-oriented. The limited financial resources at EU level could be particularly targeted at providing technical support to Member States and local authorities to structure such instruments and at providing funds for the establishment of risk sharing and guarantee facilities. Providing such assistance would ensure high leverage factors for the EU funds spent. For further developing this approach, the Commission could rely on the success of ELENA facility and on the experience gained with the other technical assistance initiatives (e.g. JASPERS) or the targeted support provided in the context of the Cohesion policy instruments JESSICA and JEREMIE.

Another aspect as regards financing is the role of public authorities in stimulating the market transformation towards more efficiency products, buildings and services. Due to the large volume of public spending it could be a strong driver for higher market uptake and the development of the required skills. For example, public procurement accounts for around 17% of EU GDP, or roughly €2,000 bn and public buildings are about 12% of the EU build up area. It is also irrational from taxpayers' point of view that when public money are spent, the cost effective energy efficiency possibilities are not properly taken into account.

Another possibility for freeing up of financial resources would be the elimination of harmful subsidies for fossil fuels and their redirection towards energy efficiency improvements. Member States can also take advantage of revenues from auctioning allowances under Art. 10.3.b of the EU emission trading directive. All these could be an important source of financing of energy efficiency projects but due to their political nature will not be analyzed in this IA.

Due to the similarity of the general approaches as regards financing for buildings, urban mobility and small-scale sustainable energy generation projects, and to avoid repetition in the text the possible options are discussed under this Section and are only cross-referred in the others.

Option A4a: Technical assistance and risk sharing facilities

Possible approach: To tackle the challenges of high upfront costs and the lack of knowledge and lack of sufficient technical and financial knowledge (in project financing) in the times of economic crisis, the EU support in the form of subventions should not be a priority (except through structural funds). The focused should be on making project bankable through risk sharing mechanism that tackles the limited liquidity faced by the market so as to create leverage and attract investments (in particular from ESCOs and private sector). The creation of leverage but also allowing for public private partnerships would alleviate the deficit on national and local public authorities in time of budget crisis. Furthermore, to enable financing,

cross dissemination of best practice at EU level, and good quality of project technical assistance should also be supported.

The successful model of the ELENA technical assistance facility could be scaled up in dimension and scope, gradually involving national and regional investment banks and development agencies in its operation. Funds for this could, for instance, come from the technical assistance allocated to Member States under the Cohesion policy funds. Based upon the experience with ELENA, it can be estimated that minimum leverage factors of 20 are easily accepted by major IFIs, and make sense in the long run. This technical assistance could also be used to structure guarantee or revolving funds that would particularly work to support the energy services companies. It would allow access to financing for local authorities to carry out sustainable energy investment projects without increasing their debt volumes through leverage of financing by the private sector.

On top of ELENA-like facilities, complementary facilities such as risk-sharing facilities for innovative technologies, guarantees, debt and equity instruments for energy service companies and PPP schemes would be necessary albeit with lower leverage factors.

Furthermore, as most of the competences with energy efficiency relevance are local, new approaches creating incentives for managing authorities to allocate resources coming from EU funds in energy efficiency must be devised. The creation and operation of revolving funds in co-operation between various administrations and even private investors look a reasonable solution. Another possibility is to target part of the funds towards local authorities.

The approach of combination of technical assistance and risk-sharing facilities are currently being piloted by using the EEPR unspent funds. The relevant Regulation has been agreed but now the concrete mechanisms are being developed.

Impact: The impact would depend on the structure of the technical and risk-sharing facilities and market needs. Recently, a market study for EEPR unspent funds was initiated in order to support the setting of the concrete mechanisms but no information is available yet. Still, based on the experience with ELENA it can be concluded that each €1 public funds towards ELENA-like facilities for energy efficiency could mobilize at least € 20 in investments. A replication effect of 5 to 1 does seem realistic with a 2020 horizon. In terms of job creation, the workload-intensive nature of local energy efficiency would result in direct and induced job creation between 60 000 and 300 000 high-skill permanent non-delocalisable posts. CO_2 emission reductions would be between 24 and 120 Mt per year. As a subsequent effect, the know-how acquired by authorities and financers during the implementation phase will gradually reduce the need for technical assistance, in such a way that it will become integral part of energy efficiency programmes at lower costs. The measures can also, if properly targeted, lead to lifting households out of energy poverty (e.g. low energy demand of a building means low heating bill) and thus limiting the burden of energy subsides for the public budget.

Option A4b: Energy efficiency conditionality on the spending of public funds

Possible approaches: Various possibilities should be explored in detail upon the development of concrete proposals. For example, public procurement of efficiency products (e.g. based on their energy performance class in the Energy Label) or buildings (e.g. based on least-life cycle

cost analysis) could be obligatory above certain thresholds, to be established after careful analysis[60]. As this is a sensitive area for Member States any EU level measures would have to be flexible and cost-effective. This should be easy for central government institutions, but can probably only be voluntary for the lower levels of state. Also conditionality could be introduced on the improvement of energy performance of buildings (e.g. based on the energy performance certificate or energy audit) when public funds are spend for renovation projects.

At present, a number of national or local authorities in the EU apply some form of green public procurement. A study of seven best performing EU Member States showed that about half of the signed contract in 2006/2007 were 'green', where 'green' means compliant with endorsed common core GPP criteria for ten product groups and services[61]. Some product groups, i.e. overall electricity, office IT and furniture attain the highest scores in 2006/2007; while construction, gardening and transport the lowest.

Furthermore, some banks, including EBRD, require certain improvement of the energy performance recorded in an Energy Performance Certificate as a condition for providing public funding for construction or renovation of buildings projects.

Impact: The approach would lead to purchasing of more efficient appliances and buildings which would ultimately lead to energy savings. However, the approach would have much more profound impact. The increased orders could lead to economies of scale and would support the establishment of a market for energy efficient products, buildings and services. This would lead to further energy savings and job creation.

There are a number of examples on energy efficient procurement from across Europe. 21 Member states had already adopted the GPP National Action Plans where they set the GPP targets for central, regional or local levels as well identified the priority "green" product groups and services. Although the GPP is voluntary instrument most of the countries put it as a mandatory political obligation. Study from 2010 which compares national GPP schemes and criteria in 10 countries demonstrated that practicing of GPP in these countries is very high with their own developed GPP criteria (for example Belgium has 90 GPP criteria, Denmark 47, Netherlands 52, UK 58 etc)[62]. All of these criteria were developed with the intention of reducing the impact of public procurement on the environment. Depending on the product group, most of these criteria set requirements on energy use, among others.

Requirements on public procurement could also pose budgetary and administrative burden. The use of energy efficiency criteria in procurement procedures can lead to higher direct purchasing costs, it can result in an average decrease of overall costs for public organisations. This is because the higher purchasing prices of efficient goods are compensated by lower operating costs. Analysis of various 'green' goods and services[63] show that the cost-reduction

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60 For more information on the possible approaches refer to: Harnessing the Power of the Public Purse: Final report from the European PROST SAVE funded study on energy efficiency in the public sector

61 PricewaterhouseCoopers, Significant and Ecofys. January 2009. Collection of statistical information on Green Public Procurement in the EU: Report on data collection results. Countries studied: Austria, Denmark, Finland, Germany, the Netherlands, Sweden and the United Kingdom. Product groups and services: Cleaning products & services, construction, electricity, catering & food, gardening, office IT Equipment, paper, textiles, transport, furniture

62 DG ENV. draft. Assessment and Comparison of National Green and Sustainable Public Procurement Criteria and Underlying Schemes. The study covers Austria, Belgium, Denmark, Finland, France, Germany, the Netherlands, Sweden, and the United Kingdom and Norway.

63 Ibid. 61

(when using Life Cycle costing approach) is on average around 1% and CO_2 is on average decreased by 25% when using GPP. It is interesting that two product groups are highlighted as leading to significant cost reductions through GPP: construction and transport. However, when also taking into account the product group that have the relatively higher CO_2 emissions, construction and electricity are the proposed to be the product groups to focus on.

Option A5: Awareness

The awareness and commitment of owners/tenants, building professionals and public authorities is paramount to the success of regulatory approaches for efficient energy solutions in buildings. While awareness on the contribution of buildings and equipment to the energy and climate change challenge is increasing, there are still serious gaps in knowledge about energy efficiency measures[64], which limit their concrete implementation on the ground.

Possible approaches: most behavioural and capacity-building programmes are best developed at local, regional or national level, and not at EU level, as a careful analysis of the particular target groups and context for their behaviour, is crucial. However, the EU could play a role in increasing the effectiveness of such programmes[65] and in stimulating the adaptation and replication of successful schemes across Europe. Such action could target owners/tenants or the different actors along the building value chain. It could take the form of (i) an exchange of best practices; (ii) the dissemination of guidelines and informative tools; (iii) the reinforcement of the EU-funded BUILD UP platform[66]; (iv) the strenghtening of market surveillance activities to raise consumers' confidence; (v) requirements for the provision of improved billing and metering information; and (vi) the assistance in the design and launch of effective programmes.

Impact: Stimulating behavioural change programmes could be an effective option for the EU[67]. In the United States, changed patterns of behaviours were estimated to reduce household energy use by 22%[68], through changes in conservation, lifestyle, awareness, low-cost actions, and small investments. In Europe, a literature review[69] concluded that changing energy-related behaviour can potentially save nearly 20% of the energy consumption. In addition, on the construction side, whole-system design approaches could reduce energy use by as much as 70%, far more than what can be achieved though attention to individual design or technical solutions.

The IEE project, *Eco n'Home*[70] service advised over 850 households in six European countries. On average, the savings achieved in terms of total energy consumption were 9% per household (140 kWh electricity savings and 0.8 tonne of CO_2 reduction per household). An interesting lesson learnt was that even implementing a "small" measure (e.g. switching to

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64 World Business Council for Sustainable Development, "Energy efficiency in buildings, business realities and opportunities", October 2007 http://www.wbcsd.org/DocRoot/qUjY7w54vY1KncL32OVQ/EEB-Facts-and-trends.pdf

65 A recent analysis of 41 programme examples showed that less than 20% of these programmes used any form of market segmentation. Bruel, R. (2007) BEHAVE. Meta-evaluation of communicative programmes aimed at consumers. eceee summer study, 2007, 1827-1834.

66 www.buildup.eu

67 Allcott, H. & Mullainathan, S. (2010) Behavior and energy policy. Science, 327, 1204-1205.

68 Laitner, J. A., Ehrhardt-Martinez, K. & McKinney, V. (2009) Examining the scale of the behaviour energy efficiency continuum. eceee summer study, 2009, 217-223.

69 IEE supported BEHAVE project

70 http://www.econhome.net

low energy light bulbs) could trigger a behavioural change towards more complex and costly measures. The cost effectiveness of the *Eco n'Home* service was assessed at 0.15 € per kWh saved.

Another European initiative[71] brought together municipalities from all new Member States with support from organisations in Germany is already bearing direct fruit. For instance, municipalities are using the PassivHaus Planning Package developed in Germany for estimation of scenarios of costs versus energy savings.

Option A6: Training

The persistent lack of qualified building workforce (e.g. technicians, installers, craftsmen, energy managers, engineers, architects, auditors) is recognised as one of the main non-technological and non-financial barriers to the application of optimal energy renovations or installation of appliances in buildings. Better **initial** and **continuing** education and training in energy efficiency matters is necessary not only to support the EU energy efficiency goals, but also to provide thousands of quality jobs across Europe, especially in SMEs.

Possible approaches: The EU could facilitate continuous cross-country exchanges of best practices on how to embed energy efficiency and renewable energy systems in mainstream curricula as well as on how to establish long-term continuing education and training structure for the construction sector. The EU could support the creation of a platform for the exchange of best practices and support the development of the needed tools (e.g. framework for the voluntary agreements, monitoring tools, development of national qualification roadmaps, education and training curricula, accreditation and certification schemes)

Impact: A recent ex-ante evaluation study[72] of the skill needs showed that in 2015, about 2.5 million workers will be engaged in the improvement of energy efficiency and the integration of renewable energy for the buildings sector only. For low and medium skills groups alone, it is estimated that 1.25 million workers need to be trained over the next 10 years, or over 125, 000 annually. The figure refers to jobs being created or retained in the building sector. Therefore, meeting the training and retraining needs would be crucial. This is also in line with the conclusion of the recent CEDEFOP study[73].

According to the study, there is currently no robust assessment of the impact of qualifying the workforce on the energy savings. With a conservative estimate that 10% of the energy saving potential in the building sector is dependant on the building workforce being fully skilled, the loss of energy savings in case of an unskilled workforce would amount to 78Mt of CO_2 or €33.7 bn.

The ex-ante study estimates the costs of training needs related to energy efficiency at €1.4 bn for low and medium skills workers (compared to the €33.7 bn costs of inaction). Therefore there will be initial cost for Member States but then this will create new business opportunities and lead to social benefits in medium and long-term. The EU contribution would be much lower and would be oriented only at creating the right framework. Such an

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71 IEE supported INTENSE project, review of 2,000 references in 37 articles and books

72 Ecorys. 2010. Ex-ante evaluation of the initiative on the building workforce training and qualification in the field of energy efficiency and renewable energy within the Intelligent Energy Europe Programme (Study prepared for DG ENER)

73 CEDEFOP. 2010. Skills for green jobs. http://www.cedefop.europa.eu/EN/Files/3057_en.pdf

initiate would have positive employment aspects from the point of view that it would allow for better qualified and matching to the new legal environment workforce.

Comparing the options for the residential and services sectors

The following table summarizes the outcomes of the analysis for each policy option.

Evaluation criteria / Policy options	Subsidiarity/ proportionality	Effectiveness	Efficiency	Coherence	OVERALL
Option A1: No additional EU action (BAU)	R	=	=	C	**=**
Option A2: Voluntary commitments with commercial entities	R	+	++	C	**+**
Option A3a: Additional stringent legal obligations for buildings	NR	++	+	NC	**-**
Option A3b: Additional stringent legal obligations for products	R	++	+++	C	**+++**
Option A4a: Technical assistance and risk sharing facilities	R	+++	+++	C	**+++**
Option A4b: Energy efficiency conditionality on the spending of public funds	R	+++	++	C	**++**
Option A5: Awareness	R	+	++	C	**++**
Option A6: Training	R	++	++	C	**++**

From the point of view of **subsidiarity and proportionality** only the option to **set additional stringent legal obligations for buildings** (Option A3a) fails the test because of its strong interventionist approach into an area that is of national and even local competence. **The setting up of an additional stringent legal obligations for products** (Option B3b) is justified on the grounds that it addresses products that are traded at the internal market and intervention at MS level would create market distortions. The options **of voluntary approach, financial instruments and awareness and training** (Options A2, A4a, A4b, A5 and A6) respect the two principles because they do not aim to interact directly with the target group but to provide enabling framework and support the MS and various stakeholders. **The inclusion of energy efficiency conditionality on the spending of public funds** (Option A4b) is also in line with the principles as it would counter the proliferation of national and local approaches on public procurement that could present a barrier to competition.

Majority of the proposed options are fully **coherent** with the existing EU energy, climate and social policies. In particular, the **options on financing, awareness and training** (A4a, A4b, A5 and A6) will be an important tool to support the uptake of the current legislative measures on buildings, products and increased share of renewables. **The support for training** (Option A6) would also contribute to Copenhagen process on vocational education and training, and would complement the activities of the European Social Fund and the Lifelong Learning Programme.

However, setting of an additional stringent legal obligations for buildings (Option A3a) is **not coherent** with the recently achieved compromise for the recast EPBD and would require its amendment. Frequent changes to the legal framework would delay their implementation at Member States and local level and would increase the risk perception for investors and will be counterproductive. Furthermore, t**he inclusion of energy efficiency conditionality on the**

spending of public funds (Option A4b) is **not fully in line** with the existing voluntary approach adopted in two Public Procurement Directives[74] and applied in the Commission's Green public procurement initiative and the recast Energy Labelling Directive. However, there are already precedents of mandatory public procurement for efficiency goods at EU level such as the Clean Vehicles Directive[75] and the Energy Star Agreement which could be explored further.

As regards **effectiveness** most of the options, with the notable exception of **A1 (BAU)**, would pave the way towards reaching the objectives of increased renovation rates of buildings and higher uptake of efficient products.

Mobilizing financing (Option A4a) would bridge an important gap fro the realization of energy savings measures and thus would unlock significant energy savings, i.e. have **high effectiveness (+++)**. **Better targeting of a public spending** (Option A4b) would have considerable direct (i.e. higher uptake on efficient goods and buildings) and indirect (i.e. market transformation) impact and that is why its effectiveness is evaluated as **high (+++)**. Option A3a which implies additional very **stringent and detailed provisions on the rate** and timing of renovations at EU level that is rated as **moderately effective (++)** as it would certainly bring some energy savings, however, is not acceptable from subsidiarity point of view.

The option on training (A6) would support the realization of the current policy framework and have the potential for unleashing the remaining potential. However, the EU value added in the approach is limited and thus their effectiveness are **medium (++)**. Further **strengthening of the legal framework on products** (Option A3b) would lead to more savings due to the limitations as regards the complexity and size of products and hence its effectiveness is evaluated also as **medium (++)**.

Measures of awareness (Option A5) are ranked '**low' effective (+)** as at EU level the possibilities for making wide ranging campaigns are rather limited. Options B2 **on voluntary agreements** also scores **low (+)** as regards its effectiveness for reaching the above mentioned objectives. This is because there is a lack of sanction mechanisms at EU level and thus there is high uncertainty regarding the realization of the commitments.

As regards **efficiency**, any **voluntary commitments** (Option A2) would focus on realizing cost-effective measures but the large number of small individual entities that could be part of the commitment could bring up the costs for monitoring, i.e. also **medium efficiency (++)**.

The efficiency of **setting additional products requirements** (Option A3b) is **high (+++)** because the method implies that only cost-effective requirements are set. Also the existing experience shows that the administrative costs are insignificant compared to the resulting savings and increased volumes of sales. Similarly, highly efficient (+++) is the mobilization of **financing using technical assistance** (Option A4a) because it ensure high leverage for the public funds. Applying energy efficiency conditionality to the spending of the public funds (**Option A4b)** is marked as **medium efficient (++)** as it would require increased costs at the time of purchase and higher administrative burden but lower operation costs.

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[74] Directive 2004/18/EC and Directive 2004/17/EC which permit for certain environmental and social considerations to be taken into account in the procurement process but does not makes them a mandatory element.

[75] Directive 2009/33/EC

Measures on **awareness** (Option A5) would only focus on the improvement of programmes, the launch (not the full implementation) of new schemes, and the dissemination of knowledge. Their efficiency is therefore considered as **medium (++)**. Similarly, measures **on training** (Option A6) are also cost effective but would still require public spending that would be retuned only indirectly from increased renovation activities and tax revenues, i.e. its efficiency is **medium (++)**.

Further stringent legal requirements on buildings (Option A3a) implies high initial investments which in general should pay during the lifetime or shorter of the measures realized and hence are cost-effective but the approach could lead to some renovations being made outside of the normal renovation cycle and would also have disproportionately high impact on the poor segment of the population or the housing associations. Therefore, the efficiency of the option is evaluated as **low (+).**

6.2. Transport sector

As mentioned, the transport sector has considerable share in final energy use, is with the highest projected growth amongst all final energy use sectors, and there is considerable cost-effective savings potential untapped. Therefore, it is essential that it is addressed in any EU policy document related to energy efficiency. However, the concrete possibilities are analyzed in great detail in the Impact Assessment for the forthcoming Transport Write Paper. In order to provide consistent approach towards the sector no further discussion of individual options for the sector is provided in this IA.

6.3. Industry sector

Option C1: No additional EU action (business as usual scenario)

There are several directives and initiatives/actions which address, together with other policy instruments, the existing failures concerning energy efficiency in general and in the industry sector in particular. The ETS aims at decreasing greenhouse gas emissions of energy-intensive installations by setting a cap-and-trade system. The covered installations represent close to half of Europe's emissions of CO_2, and include the power and manufacturing (industrial) sector. In the third trading period starting in 2013 practically the entirety of the industrial sector will be covered by the ETS although a significant percentage of installations exposed to 'carbon leakage' will be receiving emission allocations for free. The sectors judged at risk of carbon leakage are estimated to account for around 77% of the total emissions from manufacturing industry[76]. Additionally due to relatively high transaction costs of the ETS combustion installations below 20MW are excluded from the system. There is more than 6000 of such installations in the EU representing about 2.5% of CO2 emissions of installations covered by the ETS.

The forthcoming Industrial Emissions Directive[77] aims at setting requirements for industrial emissions and the energy-efficiency of large industrial installations, but the requirements on the latter element are not mandatory if the installations are within the ETS.

The main barriers that prevent the full uptake of the remaining energy savings potential in the industry sector are the insufficient price signals and asymmetric information, particularly for SMEs. In addition, SMEs face challenges such as lack of financial resources and human capital to implement the projects.

Different views were given by stakeholders on which instruments should be used (ranging from very interventionist to provision of information only). However, prevailing majority asked for measures to increase the awareness for the SMEs.

It is important to address this sector as the EEAP 2006 did not put forward any direct priority measures. However it already addressed the need to raise the awareness of industrial companies *inter alia* by promoting energy management schemes, developing training toolkits; and promoting projects under the Intelligent Energy Europe Programme, notably targeting the efficient use of energy in industrial SMEs.

Based on the PRIMES projections for the sector, the analysis of the potentials, and the EEAP and NEEAPs assessments (as discussed in sections 3.1 and 3.3) it can be concluded that the full cost-effective potential would not be uptaken with the existing policy framework, even though the industry is making the biggest progress from all sectors as regards energy efficiency, and it therefore should be complemented with additional elements. Any further measures should complement the existing policy framework.

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[76] These sectors include about 100 categories, ranging from mining and manufacturing of commodities (aluminium, copper etc), food (e.g. fats, alcohol, fish), pharmaceuticals to the manufacturing of high value-added goods (machine tools, engines, domestic appliances etc). Source: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:001:0010:0018:EN:PDF and http://ec.europa.eu/environment/climat/emission/pdf/faq.pdf

[77] 2010/75/EU

Option C2: Establish voluntary commitments with industries

Possible approaches: Voluntary agreements (VA) or Corporate Agreements with specific industrial sectors could be developed at national or EU level. These should be seen as a supportive tool for the industry to comply with the targets set by the ETS, but without distorting the EU ETS.

Impact: The existing experience with VA with industry shows good results in some countries (e.g. Netherlands, Finland, Denmark, Germany). For example, Denmark and the Netherlands have met their targets, respectively 4.6% absolute emissions reduction compared to 1988 and 22.3% efficiency improvement during the period 1989-2000. Australia and Canada have considerably reduced their greenhouse gas emissions (by 14% with the Australia's Greenhouse Challenge) with completely voluntary programmes. At EU level, a voluntary agreement with the plastic converters industry (with consumption of around 14 TWh, comprised of about 50,000 SMEs) is currently being prepared in the context of an IEE project[78]. It is estimated that about 14% of the energy consumption of the subsector can be reduced over the period 2010 - 2020 in a cost-effective manner.

The majority of the agreements are limited only to several countries and so far there was no successful voluntary agreement with industry at EU level. There is also the problem of 'free riders' who profit from the benefits of the agreements but would have achieved the savings anyway.

It is difficult to determine the potential impact as it depends on many factors, including the stringency of the target and the energy consumption of the sectors included. If, for instance, it is assumed that the voluntary agreement leads to 2% efficiency improvements per year, includes all industries and is implemented from 2012 then the final energy saving will be 26 Mtoe in 2020 (or 38 Mtoe primary energy savings in 2020) and a reduction of 61 Mt CO_2 in 2020[79].

As regards the economic impact, the agreement itself is not a costly process. However, incentives that are used to draw sectors into the VA such as providing knowledge infrastructure and energy tax exemption will lead to higher costs. There are also costs of monitoring. The cost of a VA depends upon its structure and incentives. As an indication: during the period 1989-2000 the costs for public bodies that organised the VA (MJA) in the Netherlands amounted to €159m. A large share of the budget went to subsidies devoted to raising awareness and the transfer of knowledge. If this example is extrapolated to the EU the cost for saving 2% of energy consumption is approximately €1.4 bn over the total period.

78 IEE project EUPLASTVOLTAGE 'European Plastics Converting Industry Voluntary Long-Term Agreement on Energy Efficiency' www.plasticsconverters.eu

79 Ecorys, Ecofys and BioIntelligence. 2010. Study to Support the Impact Assessment for the EU Energy Saving Action Plan. This assumes that the VA are complemented by the 'threat', in case of failure, of regulatory instruments or energy/greenhouse-gas taxes and a strong negotiation position of the authorities. It is assumed that VA results in 8% savings in 2020, with foreseen final EU-27 energy demand from industry of 333 Mtoe in 2020.

Voluntary agreements in industry will also have positive impact on job creation. Using the ACEEE Energy stimulus jobs calculator the net employment effect of 2% energy consumption reduction is estimated to be 80 000 by 2020[80].

Option C3: Regulatory measures supporting the existing climate related legal tools

Possible approaches: Several regulatory measures could be adopted by the Commission that would support the existing climate change requirements (under for example ETS and IPPC, where relevant) without contradicting to the basic principles of the current framework.

Industry uses standardized and custom-made equipment. Some of the standardized one is already tackled by some implementing measures (e.g. electric motors) under the Ecodesign Directive. However, it appears that there remains a considerable cost-effective energy-saving potential for a number of products used in industrial process, such as large pumps or furnaces. This approach could not be applied to the custom-made equipment (such as machine tools) but they could be addressed with a generic energy-efficiency requirement, which would then be operationalised by the European Standardisation Organisations.

In general, it is believed, that industries are introducing energy savings measures as this is a measure to reduce the costs for production. Still, for several industries (e.g. highly-processed goods) energy is a minor cost factor therefore market failures persist. Hence, in addition to the setting of product-specific requirements another measure that could mobilize the uptake of energy savings potential could be the setting of certain requirements for energy management (mandatory independent energy audits and a mandatory energy manger) for all energy consumers above a certain threshold, notably large companies. For SMEs information (net based energy audit calculators) and assistance (audits, training) manage their energy consumption could be envisaged.

Thirdly, product-specific requirements could be complemented with requirements at system level, as the way products are fitted within larger systems has a major impact on the energy efficiency. In this case the setting specific requirements at EU level could be difficult, as local conditions matter a lot, therefore a cooperation with European Standardisation Organisation could be envisaged.

Impact: As an example it is estimated that setting minimum efficiency requirements on industrial furnaces could bring 100 TWh savings annually by 2020 (or 24 Mtoe primary energy savings) which is comparable to the annual electricity consumption of Belgium[81]. The CO_2 emissions reduction is 43 Mt. The setting of product-specific requirements is highly cost-effective as significant improvements can usually be achieved with readily-available technology (e.g. the fitting of industrial motors with variable speed drives). The forthcoming Regulation 640/2009 under the Ecodesign directive limiting the energy consumption of electric motors is expected to result by 2020 in annual electricity savings of 140 TWh (or 34 Mtoe primary energy savings), and 60 Mt CO_2 emissions reduction. The costs are negligible.

There are positive examples from the application of energy management programmes. For example, in Bulgaria, since 2004, all energy consumers with annual consumption above 3,000

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80 Ecorys, Ecofys and BioIntelligence. 2010. Study to Support the Impact Assessment for the EU Energy Saving Action Plan. Based on an energy price of €10/GJ final and a simple payback time for energy-efficiency measures of five years

81 Ibid footnote 58

MWh are subjects to obligatory energy efficiency studies/audits. The decrease of about 10% of energy intensity[82] of industry since then can be attributed partly to such policy measures, although it was primarily driven by an increase in the price of energy. In Sweden the government encouraged 100 of the most energy intensive companies to apply energy management scheme[83]. It was expected that their managers are most aware of their energy use and of cost reduction opportunities. Still, new investment opportunities, reducing annual electricity consumption by 1 TWh, were identified at a total investment of SEK 1 bn. These investments were profitable, and in total less than 20% of the initial investments necessary to get the same amount of electricity from new wind- or nuclear power plants.

The cost-effectiveness of putting in place energy-management schemes depends on the profile of the manufacturer (size, energy-intensity), and therefore any such requirements would need to be carefully calibrated. It has the benefit of creating locally-supplied jobs/services. The added value of requirements at 'system level' depends on whether they are able to provide a common framework which would assist manufacturers, while providing them with sufficient flexibility in implementing specific solutions.

Option C4: Financial instruments

Possible approaches: At present the EU ETS ensures that industrial companies with a net heat excess of 20 MW that are not subject to the Leakage Directive could profit from realizing energy savings and that the least cost possibilities are used. Investment and/or operating state aid is possible for the realization of energy savings under strict conditions and some EU funds are provided to mobilize financing. Therefore, providing further financing should not be a priority and the option is excluded from further analysis.

Option C5: Awareness and training (in particular for SMEs)

Surveys among enterprises, in particular among SMEs, confirm that important market barriers hinder the realisation of cost-effective energy saving options[84]. One important barrier remains the lack of information and expertise about cost-effective energy saving possibilities and the high transaction costs related to the gathering of information. Awareness and training measures are thus essential to ensure that the available potential is actually converted into savings, that efficient equipment is bought and used correctly, that voluntary agreements are implemented effectively.

Possible approaches: the EU could support awareness and training activities consisting of the following measures: (i) empowering multipliers across Europe, such as enterprise associations, to act as one-stop-shops for businesses[85]; (ii) disseminating tools and guidebooks tailored to the different industry sectors (e.g. online benchmarking tools to help SME's compare their energy consumption with their peers' and take appropriate actions); and (iii)

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82 DG ENER. EU energy trends to 2030, 2009 update

83 Swedish Energy Agency. 2009. Energy Management Systems – a tool for the continuous improvement of energy performance

84 lately e.g. a survey undertaken by chambers of commerce of 12 Member States in the framework of the IEE supported project CHANGE, "Energy Efficiency in SMEs: Success Factors and Obstacles", 2009, see www.eurochambres.eu/change

85 building on EU projects such as CHANGE

ensuring European-wide offer of high quality training to energy managers, building on the successful "European Energy Manager" training programme[86].

All three measures are "gate openers", enabling and empowering enterprises through targeted information and know-how to save energy and costs, often combined with improvements of quality of the product or the working conditions. The first and second measures are even more important for SMEs, where little to no internal capacity and expertise exists. The EU intervention should be limited to supporting the establishment and kicking-off of the measures. The Intelligent Energy Europe Programme (IEE) as well as the Enterprise Europe Network (EEN) could play a leading role to disseminate the measures and to maximise the outreach. The EU portal for tools and guidebooks already offers a large collection of material to be disseminated[87].)

Impact: Full-scale quantification of the impact of such measures is challenging: Voluntary by nature, based on attractive and solid experience, it could be expected that the impact would be good. There is long lasting experience with industrial energy audit programmes in some EU Member States, Finland in particular, has showed the effectiveness of energy audits[88].

For example, the evaluation of the "European Energy Manager (EUREM)" training programme started in Germany and, supported by IEE, and currently operating in 12 EU countries, shows many more saving options with short payback periods than expected and a high implementation rate. 30% of the energy saving measures identified have a payback time of less than two years and 80% of the measures are implemented[89]. EUREM also shows a snowball effect: First, certified energy managers are not stopping after the realisation of one measure, but continue. Second, the courses continue and are expanded to more regions. The EUREM.NET project, which transferred the training course to nine more countries, showed that € 0.7 million IEE-funding could trigger investments of about € 90 million in the participating companies. This demonstrates that successfully implemented the leverage effect of soft measures such as training can be very high. It is estimated that triggering the implementation of the proposed measures across the Member States would require € 80-100 million over the next years.

86 www.energymanager.eu

87 www.iee-library.eu

88 IEE supported project CHANGE
http://www.motiva.fi/en/areas_of_operation/energy_auditing/overview_of_energy_auditing_in_finland

89 IEE supported project EUREM.NET brochure (2009) "Proud to save", p. 9.

Comparing the options for the industry sector

The following table summarizes the outcomes of the analysis for each policy option.

Evaluation criteria / Policy options	Subsidiarity/ proportionality	Effectiveness	Efficiency	Coherence	OVERALL
Option C1: No additional EU action (BAU)	R	=	=	C	**=**
Option C2: Establish voluntary commitments with industries	R	+	++	C	**+**
Option C3: Regulatory measures supporting the existing climate related legal tools	R	++ or +	++ or +	C	**++**
Option C4: Financial instruments	-	-	-	-	**-**
Option C5: Awareness and training	R	++	++	C	**++**

The **principles of subsidiarity and proportionality** are respected for all options discussed. The options on **voluntary commitments, financing and awareness and training** (Options C2, and C5) provide for the EU to set a broad framework and establish supporting structures. As regards measures that relate to **products that are traded at the EU internal market** (Option C3) there is a strong case for setting product requirements at EU level in order to avoid the proliferation of national requirements. However, in the case of **energy management and system requirements** (also mentioned in Option C3) the Commission would have to propose broad frames without being too prescriptive.

All options, but Option C4, proposed are **coherent** with the current framework. These solutions proposed target the industrial sector parts of which is already covered by the ETS. However, the measures outlined are complementary to the ETS and reinforce it, leaving a lot of flexibility to manufacturers and offering assistance to them in implementing certain solutions.

As regards the **effectiveness**, for the **voluntary approach** (Option C2) there is a lack of strong dissuasive tool that would limits the effectiveness (i.e. to low, +) of the approach towards reaching the objectives. The **product-specific requirements** envisaged under Option C3 are usually highly effective but as only a part of products used in industry can be addressed in practice its effectiveness is evaluated as **medium (++)**. The effectiveness of **energy management and 'system' requirements** also discussed under **Option C3** is estimated to be lower due to the complexity of setting an effective policy framework, i.e. **low (+)**. Due to the non-binding nature of **awareness and training initiatives** (Option C5), the fact that the information needs to be regularly updated and the limited financing at EU level the efficiency of the approach is medium.

From the point of **efficiency**, the options on voluntary agreements and training and awareness (C2 and C5) are rated as **moderately efficient (++)** because the EU costs for their implementation are relatively low, the investments will be paid back and social and

environmental impact could be positive. The **product-specific requirements** (Option C3) are efficient as they do not require the setting-up of supporting administrative structures (except for market surveillance) and usually can be met with readily-available technology, i.e. **medium efficiency (++)**. Energy management and system requirements do require the setting up of often complex administrative solutions and therefore their efficiency is **low (+)**.

6.4. Energy sector

Option D1: No additional EU action (business as usual scenario)

As mentioned in Section 4.1, three important areas need to be discussed as regards the energy sector: 1) increased efficiency of energy production through increased generation efficiency and utilization of recoverable energy; 2) more efficient operation of networks; and 3) increased engagement of the sector in end-user energy efficiency.

Transformation efficiency is already incentivized by the EU internal energy market (IEM) and the EU emissions trading scheme (ETS). Both frameworks provide price signals to reward higher efficiency in energy production, via cost savings from reduced fuel and emissions expenses. They have recently been strengthened[90] and it is expected that they will in the future trigger more investment in energy efficiency. The new Industrial Emissions Directive (IED) would also have some impact, however, Member States have the possibility to choose not to apply energy efficiency requirements for units that are covered by the ETS, thus significantly limiting its importance for the efficiency of energy generation.

In spite of these policy developments, at present, price incentives coming from the energy and carbon markets are either insufficient or not suitable to overcome the barriers to improving the efficiency of the generation capacity. This is especially the case for the retrofitting or the retiring of old and inefficient generation plants. The higher operation costs stemming from higher fuel input and higher CO_2 emission of old power or heat generation plants are still lower than the needed investment cost combined with the lost operating income during the refurbishment or retiring process. **This leaves important energy saving potentials un-exploited.** As a hypothetical case, if Europe were to retrofit its coal plants aged between 20-30 years to improve their efficiency by only 3.5 percentage points, re-power its gas fired boilers of the same age and ensure that all new coal plants are constructed according to BAT by 2020, the annual power sector emissions would fall by 29 Mt, equivalent to 12% of the EU ETS emissions reduction required by 2020.

Some of the remaining potential will be tapped from 2013 onwards in phase III of the EU emissions trading scheme due to, inter alia, the tighter, gradually decreasing cap on emissions, the use of benchmarking based on the most emission efficient technologies and financing mechanisms for energy efficiency. However, because of the market based approach that it entails it is not possible to estimate how many companies will take advantage of the new energy efficiency possibilities.

The residual heat produced in energy generation, e.g. the **recoverable energy**, can be used in combined heat and power (CHP) units and district heating and/or cooling solutions (DHC). The CHP potential is addressed at EU level by the CHP-Directive and the ETS. The impact of the CHP-Directive has so far been limited and the share of CHP today is close to the levels already reached in the 1990s. This is because the Directive lacks strong instruments for the CHP promotion. Current experience shows that the ETS alone is not sufficient to overcome regulatory and market barriers encountered by cogeneration, and have created additional obstacles, especially for new and expanding cogeneration operators. There is no evidence that the ETS will provide strong market signals for an increased penetration of CHP.

[90] The third IEM package will be applied from March 2011 while the revised ETS-scheme introducing a tighter emission cap and commending higher CO2 allowance prices will start operation in 2013.

At present, there is no EU framework that specifically promotes DHC. The current EU measures are scattered in a large number of different instruments, such as the recast EPBD, the RES Directive, the ESD and State aid guidelines, but do not amount to a coherent and targeted framework. The increased deployment of this highly resource efficient energy supply solution is hindered by systemic and complex economic, as well as regulatory barriers, that needs to be tackled with a more integrated and comprehensive approach.

Energy companies' role in reducing the energy consumption of **their clients** is covered in the Energy Services Directive. However the provisions are in many respects unclear; they allow to different interpretations and so far proved to be ineffective in bringing about a more developed energy services markets throughout the EU. The split incentives market failure reduces the willingness of energy companies to realize energy savings at their clients. Energy companies dispose of important information about the energy consumption of their clients. This commercial information could make them an important actor in the energy savings market but they do not have stimuli to do so as this would mean less sales and revenues for them.

The majority of the stakeholders consulted were in favour of further measures for the energy utilities, including stricter requirement on them to invest and provide energy efficiency services. Energy utilities were also encouraged by certain stakeholders to invest in Best Available Technique (BAT) in their own installations. A lot of the stakeholders were of the opinion that cogeneration and district heating have to be further promoted.

The EEAP pushed forward with the implementation of the CHP Directive, the establishment of a legal framework to promote the connection of decentralized generation (Third legislative package) and the development of Best Available Techniques for Energy Efficiency.

Based on the PRIMES projections for the two sectors, the analysis of potentials and challenges, and the EEAP and NEEAPs assessments (as discussed in sections 3.1 and 3.3) it can be concluded that the focus should be placed on measures that lead to increased retrofit or replacement of the existing energy generation capacities, increased use of recoverable energy, via cogeneration and district heating, and ensure better engagement of energy utilities in energy savings at the demand side. Actions to prioritize increased network efficiency should also be considered. It is essential that any proposed measures are in line and support the existing policy mix.

Option D2: Voluntary commitments

Possible approaches: Energy utilities could be engaged on a voluntary basis to improve the efficiency of generation, transformation and also to support their consumers for carrying out energy savings measures. Commission could provide recognition and promotion of their efforts, support for the dissemination of best practices and also develop guidelines and voluntary standards that would support the utilities in their commitment. Member States could also offer preferential fiscal conditions and financial support, where appropriate, easier access to environmental permits and technical expertise.

Impact: Certainly some cost-effective energy efficiency improvements will be steered by such voluntary agreements. Limitation to this approach is the lack of strong incentives at EU level to encourage their participation or threat of further legal requirements if the targets are not met. However, the sector is easy to cover and engage: the number of major energy companies in the EU is small, they have high media exposure, and could gain trust in their clients and

new ones by promoting a positive image. Transparency and accountability would be essential for success of such agreements. The administrative costs would be low as the companies would have the information and resources, and the monitoring of their efforts can be done by the civil society.

Option D3: Regulatory instruments

Option D3a: Generation efficiency

Possible approaches: For new generation capacity, regulation could be proposed to ensure that only capacities that satisfy the performance requirements of at least the best available technologies (BAT) are built. This can be done by mandating the benchmarking of new electricity and heat production facilities against BAT requirements by the competent authorities. As regards existing generation capacities, the competent authorities could be made responsible to periodically check permit conditions against BAT requirements and take measures, if they find that the energy efficiency of a facility significantly lags behind certain benchmarks. Such obligations could also require that when heat load exists, the new capacities should also include co-generation units.

Impact: Such requirements could bring some energy use and CO_2 emissions reductions[91]. For example, if 50% of the total fossil-fuel capacity is to be replaced/built until 2020 assuming an average of 10% higher energy efficiency in 2020, total savings of 43 Mtoe in 2020 and 86 Mt CO_2 emissions reduction could be achieved. Due to the higher efficiency of the power plants and to rising energy prices, the extra investment in new power plants is assumed to be cost-effective. However, the time for return of the investments would depend significantly on the primary energy and CO_2 emissions permit prices and under the current conditions it may not be short enough for the energy companies. The administrative costs are estimated to be low as well as the employment impact.

Option D3b: Higher energy recovery from generation (i.e. promotion of cogeneration - CHP, and district heating and/or cooling - DHC*)*

Possible approach: Strengthened regulatory framework could support the use of residual heat produced in energy generation processes. It should be designed to increase the uptake of the potential and limit the remaining administrative barriers (e.g. preventing the access to heat and electricity networks) and supporting the investments in the infrastructure. This framework could include requirements for integrated energy demand and infrastructure planning by national, regional or local authorities, and could contain specific timelines and targets and for the development of CHP and DHC at the EU and/or national level. Furthermore, the possibility for introduction of specific support schemes and funding schemes, as well as market incentives, such as the extension of an energy saving obligations schemes on CHP and DHC could be studied.

Impact: As regards cogeneration, additional economic potential is around 350 TWh electricity output from cogeneration. Assuming that this economic potential is gradually realized by 2020, this could lead to additional 15-20 Mtoe/p.a. primary energy savings in 2020 and 35-50 Mt/p.a. avoided CO_2 emissions. Depending on the stringency of the forthcoming policy

[91] Ecorys, Ecofys and BioIntelligence. 2010. Study to Support the Impact Assessment for the EU Energy Saving Action Plan

instruments and the availability of strong price signals possibly from 20% to 80% of this potential could be tapped.

DHC provides the same comfort temperature to buildings with less primary energy consumption, and thus CO_2 emissions, than individual heating and cooling. Gas-CHP based district heating typically uses three times less primary energy than an individual building heat-only-boiler; a coal-based district heating system will save at least half of the coal needed for the same temperature level with individual coal-fired boiler. District heating with waste incineration represents almost zero primary energy consumption. The higher energy efficiency of DHC translates into lower CO_2 and other emissions than the conventional sources. For example, at present the electric heating leads to 850 g CO_2 being emitted per kWh[92]. In Helsinki, due to the district heating system, one kWh heat leads to only 272 g CO_2 emissions.

The increase of the CHP and DHC would require significant initial investments. These in general are cost-effective and justified on the grounds of the overall benefits to the society but would still be a barrier and possibilities for their leverage should be studied prior to any concrete proposal in this direction. The measures would aim at lower administrative burden for these installations than at present. The job creation impact would not be significant.

For example, the cost of installing modern energy efficient district heating and cooling systems based on cogeneration can have a relatively short pay-back time (6-8 years). A medium-sized district heating system based on a state-of-the-art biomass CHP Plant (with installed capacity of 6-7 MWth, 1-2 MWel) requires an investment of about €7-8 mln investment for the plant and €15-16 mln for the grid. However, the 8-10-year timeframe may still be considered too long for certain low-capitalized commercial operators on the liberalized markets, and may represent a barrier in the absence of appropriate regulatory framework bringing about adequate economic signals as regards the true societal value of this highly efficient and environmentally friendly end-use supply solution.

Option D3c: Increased role of energy regulators

The Third Internal Gas and Electricity Market Package provides for a general objective of the national regulatory authorities (NRAs) to promote energy efficiency as regards gas and electricity [93]. No specific tasks or powers are however given to the NRAs to implement this general objective. As regards heat network, a large portion of Europe's existing district heating system is old and in need of efficiency improving investment but there are no specific tasks conferred to NRAs in this regard.

It could be proposed that NRAs should have a clear specific legal obligation to take due regard of energy efficiency in their decisions and monitoring of the management and

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92 Average emissions calculated on the EU overall fuel mix and 40% efficiency of thermal production.

93 See Article 36(d) of Directive 2009/72/EC. In addition, concerning public service obligations, both the Gas Directive 2009/73/EC in Article 3(8) and Article 3 (11) of the Electricity Directive 2009/72/EC provide for Member States or the regulatory authority to "recommend" that electricity and gas undertakings should optimise the use of gas and electricity for example by providing energy management services, developing innovative pricing formulas or introducing intelligent metering systems or smart grids where appropriate. The provisions do not however create any legal obligation on the Member States nor the NRAs. Regarding TSOs, the Gas Directive only states in Article 13 and Article 12 in the Electricity Directive that the TSOs need to operate the network as an efficient transmission. For the distribution, Article 25 in both the Gas Directive and Electricity stipulates that each DSO shall take due regard to energy efficiency for their operation of the distribution network.

operation of the infrastructure. Energy regulator could be granted specific tasks and powers to give priority considerations to energy efficiency in their network regulations, tariffs setting, giving appropriate allowances for cost recovery and investments. This would include ensuring that all possibilities for cost-effective improvements of the grid are implemented. In addition, smart grids and intelligent metering systems that ensure peak shaping possibilities and optimize the energy demand and supply should be promoted.

Impact: With the increased role of NRAs generation and transmission losses can be reduced and smart grids promoted. In addition, higher tariffs could create price signals for energy efficiency improvements.

Losses in electricity transmission/distribution amount to 6.4% in 2008 for EU27 (corresponding to 17.6 Mtoe and 36 Mt CO_2eq). If energy regulators could reduce these losses by 5% this would lead to energy savings of only 0.9 Mtoe (1.8 Mt CO_2eq) in 2020.

However, more significantly more savings are possible through innovative, e.g. smart grid technologies and smart meters. It is estimated that Smart Grids could reduce almost 9% of the EU annual primary energy consumption of the energy sector in 2020 which equals to 37.2 Mtoe or 148 TWh of electricity[94]. Based on average prices for electricity in 2010, this amounts almost €7.5 bn/year of saving. Furthermore, the Smart 2020[95] study calculated that Smart Grids could reduce global emissions by 15%. The EPRI 2008[96] expects Smart Grids to reduce nearly 9% of the total domestic carbon emissions generated by the U.S. power sector in 2006.

This option could lead to higher transmission or distribution tariffs. The tariffs could be increased only until certain level as very high energy prices would have negative social impacts and slow down the economy. Still, depending on the level, this could incentivize energy generation, manufacturing industry and some companies in the tertiary sector to implement energy efficiency improvements. Because of the relatively low price elasticities in the residential sector small increase in energy prices would not lead to significant investments in energy savings measures. The increased role of energy regulators would also require certain increase of staff numbers but it is unlikely that this would be a significant burden to their budgets.

Option D3d: Energy companies' role in energy savings of their clients

Possible approaches: A requirement could be set on certain energy companies to realize a fixed amount of energy savings at their clients in order to encourage investment in energy efficiency solutions.

Several approaches are possible depending on the level of harmonisation and the choice of design for the main element of the scheme. The obligation could be introduced as an EU-wide

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94 Bio Intelligence Service. Impacts of Information and Communication Technologies on Energy Efficiency, Final Report. September 2008. Supported by the European Commission DG INFSO. ftp://ftp.cordis.europa.eu/pub/fp7/ict/docs/sustainable-growth/ict4ee-final-report_en.pdf.

95 GeSI and the climate Group. SMART 2020. Cited at: http://www.gesi.org/LinkClick.aspx?fileticket=tbp5WRTHUoY%3D&tabid.

96 EPRI 2008. Electric Power Research Institute (EPRI). The green grid: Energy savings and carbon emissions reductions enabled by a smart grid. Palo Alto, California, United States: EPRI, accessed November 2009. http://www.smartgridnews.com/artman/uploads/1/SGNR_2009_EPRI_Green_Grid_June_2008.pdf.

scheme or as a mandatory requirement for each Member State to set such scheme with certain minimal EU level harmonization. Some studies[97] suggest that the second approach could be more productive as nationally determined scheme could possibly better match the specific national circumstances. To ensure coherence with the EU internal energy markets certain elements would need to be harmonized. These for instance are: targeted consumption sectors and companies, common rules for counting the savings and their verification, rules for trading, if any. In addition, consistency of such a scheme with the EU emissions trading schemes is essential (e.g. it shall not be possible to meet the ETS obligations using tradable white certificates produced as a result of the schemes).

At present, such schemes already exist in five Member States, i.e. the UK, France, Italy, Denmark and the Flanders region of Belgium. Reductions of 2.3% to 5.6% of final energy consumption have been realized by the energy companies concerned (typically suppliers or distributors) over the duration of the various schemes[98]. Energy obligation schemes also exist in a number of USA States. Encouraged by the success stories, several Member States are planning the introduction of energy savings obligations or to run pilots (these include Bulgaria, Germany, the Netherlands, Portugal, Poland, and Romania).

Impact: The existing schemes proved that energy saving obligations are an effective tool for realizing energy efficiency measures. When energy consumption starts to saturate the interest of energy companies will increasingly focus on service market. The EU framework could pave the way. Savings potential at EU level estimated with a conservative savings target of 4% of final energy consumption, based on an average savings targets of the current national schemes, would yield up to 46 Mtoe of end-energy savings if all end-use is counted, or 24–34 Mtoe, if only the residential, the services and the non-energy intensive industrial sectors are included. A more ambitious, but still realistic, target of 6% of primary energy savings, based on a wider roster of eligible sectors, would yield more ambitious savings in the range of 109 Mtoe in 2020.

Evidence suggests that creating incentives to encourage energy efficiency action by energy companies is very cost-effective triggering investments in energy efficiency in the range of about €1 bn in the bigger member states such as France, Italy and UK [99,100]. The cost of compliance of the realised programs can be put in the range of 1 - 3 Eurocent per kWh for companies, while the cost for households is estimated to be only €2.5 per fuel bill per year for households.

The existing schemes create almost no extra costs for the government as they are in general completely financed by either energy prices or grid charges, or if certification and trading exist by a financial charge per certificate given[101]. The cost for the UK government is a £330,000 per year (or less than 0.3% of the budget of the authority administering the scheme[102]), in France – approx. €700,000 per year. However, in Italy, where trading of

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97 For example: JRC. 2009. Energy Savings and Tradable White Certificates

98 Ecorys, Ecofys and BioIntelligence. 2010. Study to Support the Impact Assessment for the EU Energy Saving Action Plan

99 IEA. 2009. Progress with implementing energy efficiency policies in the G8, citing Waide & Buchner, 2008

100 Lees, 2007

101 Harmelink M., Blok K. Chang M., Graus W. and S. Joosen. 2005. Mogelijkheden voor versnelling van energiebesparing in Nederland, Ecofys rapport in opdracht van Ministerie van Economische zaken

102 Based on administrative cost for EEC-1 and total expenditure on energy efficiency for EEC-2.

savings certificate is an essential part of the system, the costs are slightly higher, i.e. in the range of €1 mln per year[103]. Overall, total administrative costs of around 0.002 Eurocent per kWh can be assumed which has a negligible impact on power prices (Harmelink et al., 2005).

Such scheme(s) would also open up new opportunities for businesses in an emerging markets, creating a range of high-skilled jobs, and securing accelerated access take-up of innovations. It would incentivize the development of a market for energy efficiency services.

Some of the possible drawbacks of such scheme(s) could include negative redistribution impact, double counting, additionally. The EU has an important role in drawing the minimum design requirements that would tackle these deficiencies. Requirement to implement a given proportion of the energy efficiency improvement measures for 'energy poor' households (e.g. 50% in the UK) would ensure that there is a positive direct redistribution impact for low income households. Effective verification and monitoring mechanisms would guarantee that additional savings to business as usual are achieved and no double counting occurs. The proper selection of participating sectors would avoid possible overlaps with existing instruments, such as ETS[104], the green certificates or industrial permitting procedures.

Option D4: Financial instruments

Possible approaches: At present the EU ETS ensures that energy generation companies with a net heat excess of 20 MW could profit from realizing energy savings and that the least cost possibilities are used. Investment and/or operating state aid is possible for energy savings, renewable energy sources and for cogeneration under strict conditions. Also, in many cases, these companies could leverage funding on commercial basis. Additional EU support for companies above 20 MW would contradict the existing policies and would divert funds from the sectors that face much bigger challenges in finding the initial investments (e.g. buildings, urban mobility). However, support for small distributed generation and sustainable urban generation projects could be provided. The modalities of this support were already discussed under Option A4a (Technical assistance and risk sharing facilities, page 36) and, to avoid repetition, would not be discussed again. As a result, the option is excluded from further analysis.

Option D5: Awareness and training (in particular focusing on the promotion of energy services companies)

The practice shows that most of the energy companies are well aware and trained of the possibilities for energy efficiency improvements. Therefore, financing at EU level of such projects does not seem good investment of taxpayers' money. The situation is completely different for the final consumers who in many cases are not well aware about the possibilities but this aspect has been tackled under Sections 6.1 (Residential and services sectors) and 6.3 (Industry sector). It could also be strongly promoted by the energy companies if energy obligation (Option E3d) is imposed on them.

Specific subsector that would require additional support in terms of information, guidelines, exchange of best practices is the one of the energy services companies (ESCOs). ESCOs

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103 JRC. 2009. Energy Saving Obligations And White Certificates

104 The possible negative effects on carbon and green certificate markets of such a scheme if coupled with trading of savings certificates (white certificates) were analyzed in details in NERA Economic Consulting. 2005. Interactions of the EU ETS with Green And White Certificate Schemes

deliver energy efficiency improvement measures in a user's facility and accept some degree of financial risk by tidying part or all of their payment on the achievement of savings. These companies could serve as an important interlocutor between the energy utilities (even some utilities are developing ESCOs subsidiaries) and the end-users.

Possible approaches: Despite the potential for energy services the market development of such services is still poor. Considering the significant heterogeneity of market situation within EU-27, the EU value added is in supporting capacity building and defining clear EU energy efficiency services concept and approaches.

The EU could define clearer common definitions and possible harmonized approaches such as pan-European standard model processes for e.g. the selection, the procurement, the development or the verification and measurement of energy savings. This would ensure the delivery of higher quality services in Europe and it would avoid confusion and ease the transfer of best practices across Europe. The EU could also support the creation of specific national (or regional) business support structures in the field of energy efficiency services. In addition the EU could promote the setting up of local project support entities (e.g. "one stop shop") that could offer a wide range of services in order to assist project owners implement energy savings in their buildings.

Impact: Energy efficiency services have a great role to play in helping the market tap into the large reservoir of energy savings potential. So far, the public sector is where energy performance contracts have been the most used. For example, the city of Berlin in partnership with Berlin Energy Agency has used energy performance contracting since 1996. As a result so far over 1300 public buildings have been upgraded, delivering carbon reductions of nearly 68 kt/a and cost savings of about €10,5 millions or 26% of the baseline energy cost of the buildings involved[105]. Furthermore, the IEE project "ClearSupport" has shown that the concept of Project Support Facilities is relevant for bridging the gap that exists between building owners and financing sources. The project established facilities to assist municipal and residential building owners in 5 new MS, with more than 200 renovation projects being identified.

The European market potential for ESCOs has indeed been estimated to be at least €5-10 bn per annum and €25 bn in the long-term. The annual amount of energy savings that could be achieved through energy efficiency services is estimated to represent 10 to 30% of the overall energy savings potential in Europe[106]. As regards the distribution of the costs and benefits over time for the different parties of the contract, at the initial stage until the investment is paid back the owner of the renovated building will only profit from better comfort levels but not from reduced energy bills. The ESCO will have to make the initial investment but will have a stable profit over a number of years.

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105 C40, Best practices - Buildings - Berlin, and Good Practice Examples: Berlin, European Energy Service Initiative (EESI) project co-financed under the IEE programme, www.energy-service-initiative.net and http://www.c40cities.org/bestpractices/buildings/berlin_efficiency.jsp

106 IEE supported project ChangeBest

Comparing the options for the energy sector

The following table summarizes the outcomes of the analysis for each policy option.

Evaluation criteria / Policy options	Subsidiarity/ proportionality	Effectiveness	Efficiency	Coherence	OVERALL
Option D1: No additional EU action (BAU)	R	=	=	C	**=**
Option D2: Voluntary commitments	R	+	++	C	**+**
Option D3a: Generation efficiency	R			NC	**-**
Option D3b: Higher energy recovery from generation (cogeneration, district heating and cooling)	R	++	++	C	**++**
Option D3c: Increased role of energy regulators	R	++	++	C	**++**
Option D3d: Energy companies' role in energy savings of their clients	R	+++	+++	C	**+++**
Option D4: Financial instruments	-	-	-	-	-
Option D5: Awareness and training (in particular focusing on the promotion of energy services companies)	R	+	++	C	**++**

All options are in line with the principles of **subsidiarity and proportionality**. **Further regulatory requirements** (Options D3a, D3b, D3c, D3d) are justified on the grounds that it would create level playing field for all companies operating in the EU. Legal measures to address the potential for **energy recovery from generation** (option D3b), **increased role of energy regulators** (Option D3c) **of energy companies as regards realizing savings at their clients** (Option D3d) will set the general framework but will also provide enough flexibility to Member States to take into account the local conditions. Promoting **voluntary commitments, financial instruments, and awareness and training (Options D2 and D5)** also respect the two principles because they aim at supporting MS and various stakeholders in achieving the policy objectives.

As regards **coherency**, all options but D3a, **are fully in line** and complementary to the existing policies. Any further legal measures addressing **generation efficiency** (Option D3a) are clearly **not coherent** with the ETS and the new IED as regards capacities covered by two Directives. However, with the growing number of small generation capacities, further regulatory instruments to ensure their high efficiency could be studied. As regards **effectiveness** most of the options, with the notable exception of D1 (BAU), would pave the way towards reaching the objectives for the sector. The highest savings can be expected from the increased role of energy companies in delivering energy savings at demand side (Option D3d), i.e. high effectiveness (+++) because of the significant remaining possibilities for improvement. Still, the effectiveness would depend on the stringency of the obligation schemes. Based on the calculated impacts, the effectiveness of **options on higher energy recovery from generation and increased role of energy regulators** (Options D3b and D3c) is evaluated as **medium (++)**. The options on **voluntary commitments and awareness and training** (Option D2 and D5) would be beneficial but due to their voluntary nature and uncertainty of the results their effectiveness is measured as **low (+)**.

The efficiency of the option on **increased role of energy companies in delivering energy savings at demand side** (Option D3d) is the **highest (+++)** because small increase in the energy bills would lead to the utilization of significant cost-effective potential. The administrative burden is considered at insignificant. Measures that require significant bulky upfront investments in **energy generation capacities or networks** (Option D3b and D3c) are very capital intensive and even though the investments are cost-effective their efficiency is evaluated as **medium (++)**. The options on voluntary agreements and training and awareness (D2 and D5) are rated as **moderately efficient (++)** because the EU costs for their implementation are relatively low, the investments will be paid back and social and environmental impact could be positive.

7. CONCLUSION: OUTLINE OF THE PREFERRED NEW POLICY FRAMEWORK

The analysis discussed, first, which is the best way to approach energy efficiency at EU level and, second, what types of EU policy instruments are needed to support Member States in realizing the savings potential.

Three main policy alternatives were analyzed: (i) setting only targets and leaving it to Member States to develop the policy mix needed; (ii) no targets, but developing detailed EU policy instruments, inviting Member States to implement and/or supplement them; (iii) comprehensive policy framework at Member States' level (including objectives/targets), while EU develops policy instruments to support Member States.

Afterwards for each energy consumption sector with significant potential (i.e. residential and tertiary, transport, industry, energy sectors) various types of policy instruments were analyzed (i.e. voluntary, regulatory, financing, awareness and training) in order to identify whether their application at EU level would be needed so that the specific policy objectives for the sectors are met.

Preferred general policy approach

It is essential that a coherent policy mix is developed at Member State level with clear, simple and measurable objectives. Well coordinated measures at EU level could provide Member States with the needed framework on which to further develop their efforts. The Commission could propose individual measures for each sector that would provide for a common framework and also support Member States in developing their own tools.

This approach would lead towards the realization of the cost-effective potential and address major barriers such as policy fragmentation, lack of political commitment and policy predictability. It would ensure that the possible synergies between the various policies are explored.

The Commission could in addition study the best approach to objective setting and the interaction of such objectives with other policy instruments (especially climate targets). It could propose the establishment of NEEAPs as a key document. A strengthened and extended (to all supply and demand sectors) National Energy Efficiency Action Plan could give high political visibility to energy efficiency and drive the process. Furthermore, in order to increase the engagement of local authorities it is suggested that the successful model of the Covenant of Mayors supported by the Commission is continued to keep it growing and realising its potential.

Preferred way forward for the residential and services sectors

The analysis concluded that to address the challenge of insufficiently high renovation rates of buildings further strengthening of the current policy framework on buildings (Option A3a) is not necessary as the recent modification (especially of the EPBD) is already ambitious and the focus should be on its implementation. This is not the case for products requirement. To increase the uptake of energy efficient products, the scope of Ecodesign and Energy Labelling could be further extended to cover more product groups, especially in the tertiary sector, and also some construction materials (e.g. windows) (Option A3b). This would further support the establishment of markets for energy efficient products and materials.

Measures on financing would be essential to tackle the serious limitations on the availability of liquidity for high upfront costs and also to some extent the landlord-tenant problem. The limited financial resources at EU level could be particularly targeted at providing technical

assistance to Member States and local authorities but also provide risk-sharing and project guarantee support (Option A4a). With the economic crisis it cannot be expected that significant additional public funds would be dedicated to energy efficiency and it is therefore essential that these instruments aim at better engagement of third party financing. Measures that could further support the engagement of private investors are energy savings obligation on energy utilities (Option D3d) and support for the development of energy service companies (ESCOs) Option D5). Furthermore, the introduction of certain energy efficiency conditionalities for public funding support is considered beneficial (Option A4b).

The persistent lack of a qualified building workforce due to the undeveloped character of markets is recognised as one of the main non-technological and non-financial barriers to the deployment of optimal energy renovations or installation of appliances in buildings. It could be tackled at EU level by supporting Member States with tools (e.g. development of national qualification roadmaps, education and training curricula, accreditation and certification schemes) and creation of platforms on the exchange of best practices.

Additionally, measures on awareness raising (A5) and increased voluntary engagement of private entities (Option A2) would be beneficial and could be implemented, if there are sufficient resources as the EU has a limited role and such measures would remain mainly in the domain of Member States or local authorities. From the other sectors, Option D3d and D5 as mentioned above, will have positive impact on energy savings in the residential and tertiary sectors.

Preferred way forward for the transport sector

The projected growth in the transport sector until 2020 is the highest of any sectors. In order to realize the remaining potential support is needed for the transformation of transport towards more efficient vehicles, modes and usages. The growth in the sector is mainly driven by increase use and need of transport modes, the lack of full internalization of the environmental costs into the energy prices and low awareness. The high upfront costs are also a significant barrier which leads to the difficulty of the realization of the projects, especially on urban mobility.

The analysis of the already adopted EU policy documents revealed that a number of legislative and soft-law initiatives could be proposed, but a number of them are yet to be implemented. It could be expected that these future policies would have positive impact towards the sustainability of the sector. In addition, the forthcoming Transport White Paper (TWP) will give further impetus to the increased decarbonisation and resource efficiency of the sector. Therefore, no detailed options were analyzed for the sector but some of the measures proposed in the TWP that are relevant for EU energy efficiency and savings policy will feature also in the Energy Efficiency Plan with special focus on sustainable urban mobility and consumer behaviour.

Preferred way forward for the industry sector

Even though the industry has experienced the most significant energy efficiency improvements, still some potential remains. The EU policies have already partially addressed some of the possible environmental impact of the sector. Therefore, the objective as regards the industry sector is to support the use of this untapped potential while remaining coherent with existing policy instruments (such as the ETS and the new Industrial Emissions Directive). The barriers in the sector are mainly a lack of strong price signals, lack of awareness and training (especially for SMEs), and also lack of long-term policy planning which increases the perception of risk and deters companies from realizing investments.

The analysis of the possible approaches concluded that it is possible to propose some additional legal framework that would be in line with the above-mentioned objective and existing policy (Option C3). To this end, more implementing measures under Ecodesign Directive could be proposed that would cover commonly used products in industrial process (such as large pumps or furnaces). Custom-made equipment (such as machine tools) and systems could be addressed with generic energy-efficiency requirements, which would then be operationalised by the European Standardisation Organisations. In addition, certain energy management requirements (e.g. for energy audits or plans) could be established for all energy consumers above a certain threshold, notably large companies. For SMEs information toolkits and assistance to manage their energy consumption could be provided (Option C5).

Important mobilization of projects in the industry sector could come from energy savings obligations, if imposed on energy companies (Option D3d) and the promotion of ESCOs (Option D5).

Measures on awareness raising (Option C4) and increased voluntary engagement of private entities (Option C2) would be also beneficial and could be implemented if there are sufficient resources. Still, EU has limited role and such measures remain mainly in the domain of Member States or local authorities.

Preferred way forward for the energy sector

At present, the average efficiency of the generation capacity is considerably lower than best available technologies. The main reason for this is the lack of sufficiently strong price signals in relation to investment decisions for the construction of new capacities and the retirement of old ones. The ETS in its third phase will have a certain impact on this problem for the units it covers. Therefore, it not appropriate to propose further regulatory instruments without knowing its concrete effects (Option D3a). However, with the growing number of small generation installations, the need for further regulatory instruments to ensure their high efficiency could be studied.

The full potential for residual heat use or energy recovery is also not used. The analysis showed that further regulatory measures for the promotion of cogeneration and district heating and cooling units could be developed following further analysis and possible revision of the main policy framework in the area (i.e. the Co-generation Directive) (Option D3b).

National Regulatory Authorities (NRAs) could play an important role in steering energy efficiency improvements of the grid, promoting smart grids and promoting intelligent metering systems that ensure peak shaping possibilities and optimization of energy demand and supply. This could be done by conferring more powers on them (Option D3c).

Energy companies dispose of important information about the energy consumption of their clients but have no stimuli to use it for reducing their clients' energy consumption as this would mean fewer revenues for them. This could be overcome by the introduction of energy savings obligation schemes which would ensure that for a small short-term increase of the energy bill the most cost-effective long-term measures will be realized (Option D3d). The best methods of doing this need to be studied in further detail. In order not to have negative interactions with the ETS the certificates that prove energy reductions should not be traded within the ETS.

Usually the managers of energy companies are well aware of the possibilities for energy savings at their companies. However, the specific subsector that would require additional support in terms of information, guidelines and exchange of best practices is that of ESCOs

(Option D5). Voluntary agreements could also lead to energy savings and could be considered (Option D2).

Will the measures be sufficient to reach the 20% objective?

The preferred options provide for a wide range of supporting instruments that would intensify the uptake of the energy savings potential and the related benefits, and the maturing of the energy efficiency markets. Quantification was not possible for all options but from those that could be quantified it can be concluded that there is good chance that the remaining savings gap will be closed. However, the concrete results will depend on the level of ambition of the regulatory and non-regulatory initiatives and the pace at which they are implemented. Therefore, mid-term evaluation and possible updating of the Plan would be essential to ensure that there are continuous efforts on energy efficiency.

8. MONITORING AND EVALUATION

The Commission will monitor the progress *inter alia* via the mandatory and possibly strengthened National Energy Efficiency Action Plans and the policy objections and indicators that would be developed as a result of the new Energy Efficiency Plan. In addition, it will continue monitoring Member States progress and assisting them in implementing existing and new EU regulatory measures, and take any necessary measures at its disposal in cases of infringements.

The Commission will launch specific studies to evaluate in more details the modalities for the implementation of the various types of policy instruments proposed (e.g. the role of NEEAPs, the nature and levels of the policy objectives, the modalities for better supporting energy recovery, the approaches towards energy savings obligations on energy companies, the concrete public procurement obligations, and the requirements on companies for energy management). Ex-ante financial analysis would be carried out, where required, to study the concrete needs for financing.

The lack of detailed data on energy consumption in all end-use sectors is a major challenge. Eurostat has started efforts, following *inter alia* the requirements of the 2008 Energy statistics regulation, to get in refined data for household consumption but with the present speed it will take further years before detailed consumption statistics for all sectors will be in place. There are no good data also of how much CO_2 emission are emitted by the end-use sectors because the current statistical reporting procedure assigns the emissions from electricity and heating to the energy sector. Furthermore, additional studies to examine the job creation effect of energy efficiency measures and the composition of the EU's building stock could be carried out in order to facilitate the decision making process.