

The assessment of the Member States National Energy Efficiency Action plans: will the EU reach the 2020 target?

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Abstract

In the European Union (EU) there is a target to reduce energy consumption by 20% by 2020. The target has been introduced in EU legislation through the so-called Energy Efficiency Directive (EED), which calls for Member States to set energy efficiency targets at national level. The national targets are of indicative (rather than legally binding) nature due to the complexity of defining them (e.g. apportioning the EU target to individual MSs, based on possible criteria such as energy efficiency potential, economic capabilities, etc.). The best way to ensure that MSs achieve their targets and contribute to the achievement of the EU target is therefore through careful monitoring of the energy savings achieved by MSs and implementation of national energy efficiency policies. The EED introduces a number of policies and measures MSs have to adopt such as Energy Efficiency Obligation Schemes (EEOSs), mandatory energy audits, renovation roadmaps, metering and billing, etc. Under the EED MSs have to present a National Energy Efficiency Action Plan (NEEAP) every three years (the first NEEAPs were introduced in 2007 under the previous Energy Services Directive). The paper presents the analysis of the 2014 NEEAPs. It shows the importance of good and complete NEEAPs and argues that a strategic NEEAP, with detailed assessment of the energy savings, is an important contribution to meeting the MS' target and to predict the energy consumption trajectory towards the achievement of the EU 2020 target. The paper shows the main conclusions from the NEEAP 2014 assessment, identifying best practice policies and gaps. The European experience with energy saving targets, NEEAPs, evaluation of energy savings induced policies is a useful experience also for countries outside Europe.

Introduction

The need to increase energy efficiency progress in the EU was reinforced in the Conclusions of the European Council meeting of 8-9 March 2007, and based on agreements made in June 2010, the EU set a target of 20 % reduction in the EU primary energy consumption by 2020. This target results in a reduction of 368 Mtoe and consumption levels of 1474 Moe in 2020 compared to 2007 primary energy consumption projections of 1842 Mtoe in 2020¹. Reiterating the importance of energy efficiency in the overall EU economy, the European Council in 2011 concluded that present trends were not on track and more efforts were needed to deliver its target. Following Croatia's accession in the Union in 2013, the baseline primary energy consumption was revised to 1853 Moe and primary energy savings to 370 Mtoe, leading to EU28 consumption of 1483 Mtoe in 2020. The Energy Efficiency Directive (the EED or the Directive) [8], adopted in 2012, laid down the foundation for more actions to be taken in order to put the EU on track. The Directive, which is a key part of the EU's overall climate and energy legislative package, requires EU Member States to set indicative national energy efficiency targets and legally binding measures to help the EU reach its 20% energy efficiency target by 2020. In particular, all EU Member States are required to implement policy measures that improve energy efficiency at all stages of the energy chain from production to final consumption.

In compliance with the Directive's requirements, Member States have to present the progress

¹ The projections are based on EU27 energy baseline scenario results of the Primes 2007 model

and efforts made in the so-called National Energy Efficiency Action Plans (NEEAPs), which are due every three years starting from 2014. The NEEAPs are regarded as strategic national policy documents placing energy efficiency at the heart of energy policy [3][5]. They outline national energy efficiency targets and detail actions put in place to ensure that energy savings are generated in all sectors of the economy. The previous experience gained through the submission of NEEAPs under the Energy Services Directive 2006/32/EC (ESD)² [7] has provided a strong foundation upon which Member States have continued to develop and strengthen their energy efficiency policy strategies. While only a few Member States have had experience with preparing energy efficiency policy strategies prior to the ESD adoption, the ESD experience has helped Member States move from a simple list of measures to comprehensive strategies that plan, monitor and report the efforts made in energy efficiency in the various sectors of the economy. Improvements especially for New Member States (EU13) are now noted due to this experience built up over the years with the ESD implementation.

The EED is more ambitious than its predecessor ESD and its scope has been expanded. In addition to energy efficiency measures at the end-use level, Member States are obliged to report measures taken to improve the efficiency of the supply sector (e.g. cogeneration), which also count towards the EED energy efficiency targets. Energy Saving Obligations (officially Energy Efficiency Obligation Schemes, EEOs) on energy companies to achieve 1.5% energy savings among their customers every year have been introduced, giving the option to MSs to use also alternative measures resulting in equal savings. Other measures introduced are: requirement for the public sector to renovate annually 3% of central government building stock; mandatory energy audits for large enterprises; measure on metering and billing; and long-term strategies for the renovation of the national building stock. As the final round of the NEEAPs under the ESD coincided with the submission of the first NEEAPs³ under the EED, these were replaced by the first EED NEEAP.

As per the Directive's requirements, the European Commission's responsibilities include evaluating the plans and assessing the extent to which Member States have made progress towards the achievement of the national indicative energy efficiency targets and towards the implementation of the Energy Efficiency Directive in general. As with the analysis of previous NEEAPs under the ESD, the Joint Research Centre has undertaken the task of evaluating the first National Energy Efficiency Action Plans of the EED and the results of this work are presented in this paper.

Methodology

The JRC was assigned the task of evaluating the NEEAPS through a 2-step review approach: the first step focused on checking if all compulsory elements listed in the template adopted by the European Commission were sufficiently addressed. To facilitate the comparison of the results of the first step, the following scoring system was used: 0 points were allocated for missing information, 0.5 points for partly addressed/unclear information and 1 for adequately sufficient information.

The second step entailed a more detailed analysis, focusing on the quality of the information given for each measure and sector, and the implementation status of various articles under the EED. The quality of the single policies and policy packages, the overall strategy, gaps and likelihood to deliver savings have been investigated. The results were presented in the form of country reports, providing an overview of the main measures, assessment of compulsory elements addressed in the NEEAP, implementation strengths and weaknesses and conclusions.

NEEAP template and completeness of the NEEAPs

As requested by Article 24(2) of the EED, the European Commission published a NEEAP

² In compliance with the ESD, the first and second ESD NEEAP were due in 2007 (a year after the entry into force of the ESD) and 2011

³ also requests information on the progress of the ESD targets.

Template⁴ to support Member States with the NEEAP reporting requirements. While the NEEAPs were legally required to report on the information specified in the EED Annex XIV Part 2, the template encouraged Member States to adopt a common structure by listing compulsory elements⁵ together with explanatory notes. The existence of the template was overall positively perceived and resulted in more homogeneous reporting among Member States compared to past NEEAPs submitted under the ESD.

In compliance with the template and Article 24(2), implementation details of horizontal measures such as EEOs had to be outlined followed by measures targeting each end-use sector (buildings, public sector, industry, transport) and energy supply sector. To complement the template published by the European Commission, additional guidelines were published in the Commission Staff Working Document "Guidance for National Energy Efficiency Action Plans"[1].

Energy efficiency targets and their impact in 2020

In accordance with Article 3, MSs had to set indicative energy efficiency targets, based on either primary or final energy savings, primary or final energy consumption or energy intensity. The 2020 target expressed in primary energy consumption was notified by all MSs. Collectively, the combined primary consumption at the EU level based on the reported values sums to 1542 Mtoe, corresponding to a target of 16.8% of savings vs. the PRIMES 2007 baseline projections for 2020. Following several target updates communicated by MSs in 2015, the collective target has now been revised to 1527 Mtoe of EU28 primary consumption (corresponding to 17.6% of savings). In terms of final energy, all countries except Lithuania and Portugal provided their 2020 target values. The collective final energy consumption target excluding Lithuania and Portugal amounts to 20.2% of savings. The least used indicator reported was energy intensity where only Greece, Spain and Sweden reported energy intensity targets for 2020.

Given that the EU target has been set using the PRIMES 2007 baseline scenario projections, a comparative analysis of the primary energy consumption targets set by the Member States and the national projected 2020 baseline consumption as set by the PRIMES 2007 model was made (Fig. 1)). The graph shows the national targets set according to the NEEAPs, the PRIMES 2007 projections for 2020 and the corresponding consumption if a 20% reduction in the PRIMES 2007 projections is applied. This analysis shows that only a few MSs (Bulgaria, Greece, Spain, Ireland, Italy, Lithuania, Latvia, Portugal and Sweden) will achieve savings equal or above the savings prescribed by the 20% vs. PRIMES 2007 baseline projections. The targets of all remaining countries correspond to energy savings which are below the 20% of PRIMES 2007 values.

Information on the baseline scenario considered by the Member States and the connection with the PRIMES model was also examined. In general, only a handful of MSs provided explicit information on the baseline consumption levels in 2020. A comparison between the absolute energy savings with respect to the reported baseline consumption levels was made for the countries with the necessary data availability. The results (Fig. 2) indicate that percentage reduction in primary energy consumption is generally lower than the 20% target set at the EU level. Exceptions include Malta, Spain and the UK which reported primary energy savings equivalent to 27%, 26% and 20%, respectively.

The discussion of the energy efficiency targets needs to take into consideration the impact of the economic crisis in Europe in recent years. An update of the PRIMES model in 2013 reveals lower projections for the baseline energy consumption until 2020. The significant difference in the trajectory between PRIMES 2007 baseline projection and latest PRIMES update in 2013 in terms of primary energy is illustrated in Fig. 3. This can be largely attributed to the impact of the crisis and to additional energy efficiency policies introduced after 2007. The actual EU27 primary energy consumption dropped below the PRIMES 2007 and 2013 projections after 2006 and after 2010, respectively. While the latest available historical data for 2014 (1507 Mtoe of primary energy) show

⁴ Implementing decision 2013/242/EU of 22 May 2013

⁵ The elements of the template are listed in Annex D of the EED

that there is only an additional 1.5% energy savings needed to reach the 2020 target, in terms of final energy consumption, the 2014 official Eurostat figure (1061 Mtoe) shows that we are already below the 2020 target (1086 Mtoe). Therefore, despite the fact that the NEEAP targets set by MSs correspond to 17.6% and not 20% of primary energy savings compared to the PRIMES 2007 baseline projection, the current situation, in part due to the impact of the crisis and new energy efficiency policies, shows that the EU is likely to reach overall the 2020 target at the EU level.

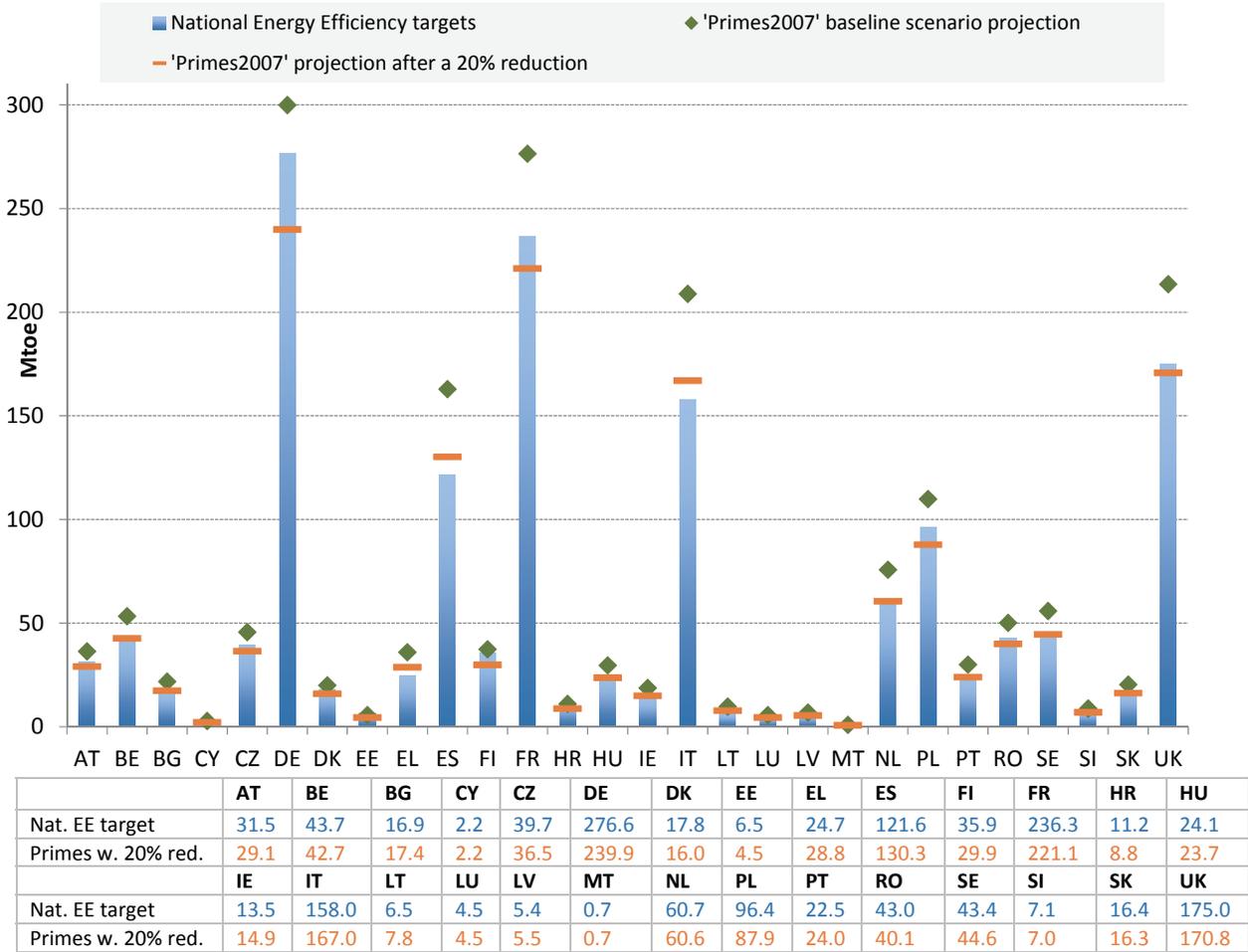


Figure 1 Comparison of 2020 National Primary Energy Consumption Targets and PRIMES 2007 model projections (all table values are expressed in Mtoe)

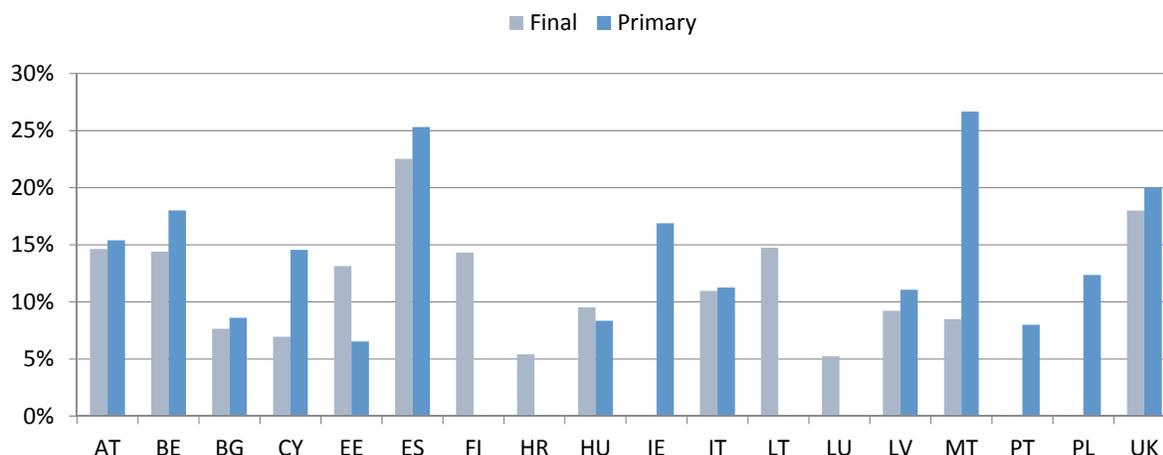


Figure 2 Share of NEEAP energy savings against projected baseline consumption levels in 2020 as reported in NEEAPs

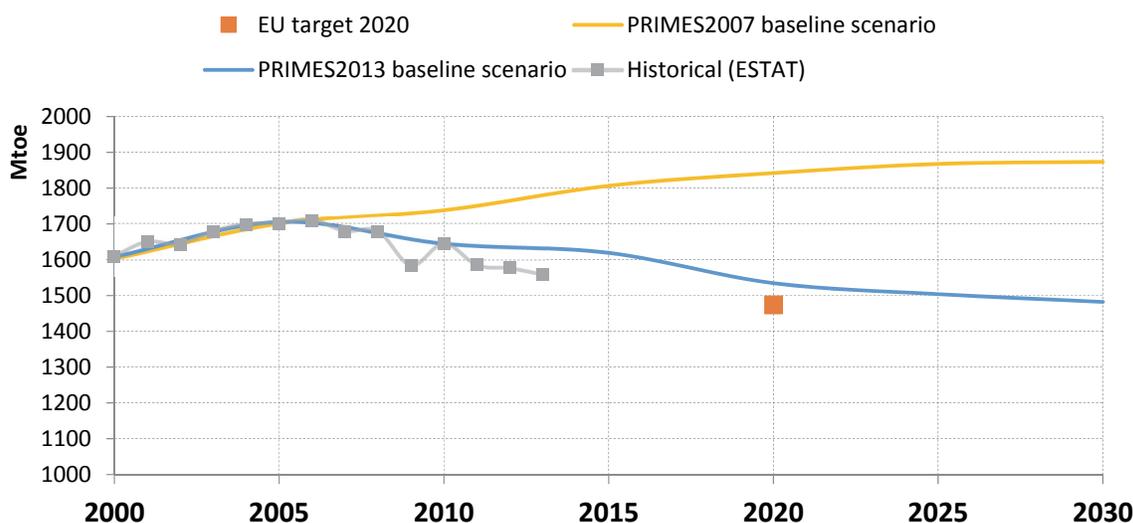


Figure 3. Comparison between PRIMES projections and historical primary energy consumption

Policy measures under the National Energy Efficiency Action Plans

Various policy measures are reported in the NEEAPs targeting each sector of the economy, individually or in a horizontal manner. The distribution of policy measures by starting year is shown in Figure 4. It can be noted that a number of countries have had a long tradition in promoting energy efficiency before action at the EU level was taken, with some measures starting well before the ESD adoption in 2006. Specifically, Austria, Denmark, France, Finland, Germany, Italy, the Netherlands, Sweden, and the UK have implemented energy efficiency policy measures since the 1990s. Following the ESD adoption, a sharp increase of measures starting in the period 2007-2009 can be observed, while the subsequent second peak in 2014 can be largely attributed to the introduction of the NEEAPs under the EED.

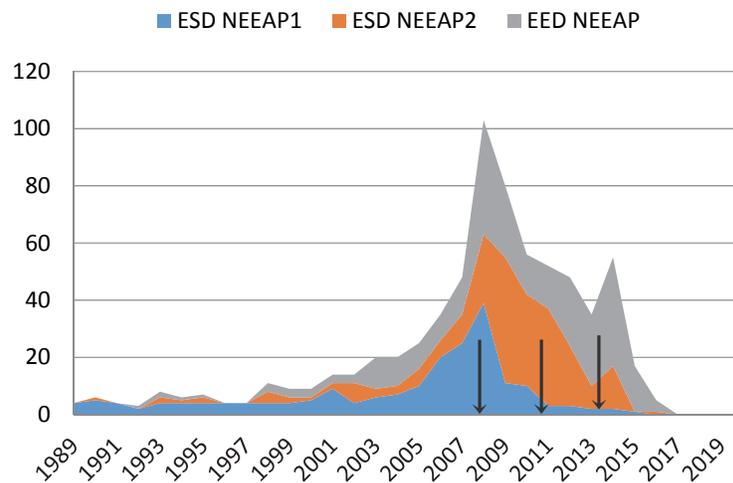


Figure 4. Distribution of EED NEEAP policy measures by starting year, where the blue area indicates the share of measures which were first reported in the 1st NEEAPs under the ESD, the orange area shows measures first reported in the 2nd NEEAPs under ESD and grey area shows new measures presented in the EED NEEAPs for the first time (*based on information extracted from MURE database*); arrows indicate the years, in which the NEEAPs had to be presented

The EED NEEAPs include a mixture of "old" measures already reported in the previous NEEAPs (2008 and 2011) under the ESD as well as new measures, introduced in 2014 or planned to be introduced in the following years. Around 60% of the measures mentioned in the EED NEEAPs are measures previously notified in the last two NEEAPs under the ESD [9] [10]. Half of these measures were mentioned in both ESD NEEAPs, while the other half in the second ESD NEEAP only. In addition, both the ESD and the EED allow counting the impact of previously existing and continuing measures for meeting energy savings targets, which explains the large number of measures starting before the years of preparing the NEEAPs. All of this is indicating a general continuation of energy efficiency policy at national level (Figure 4). Member States with long tradition in energy efficiency policy (such as Finland, Germany, France etc.) typically have no space for many new measures and instead largely rely on existing measures, which are periodically reinforced and aligned with the new requirements of the EU directives. It is also noted that the area under the graphs typically continues beyond the NEEAP submission year, indicating that the implementation of several measures reported in NEEAPs may start several years after the NEEAP submission. This is especially true for measures under the first ESD NEEAP. This can be partly explained by the challenge related to the set-up of new policy platforms faced under the ESD by Member States with no previous experience in energy efficiency policy. Measures which are associated with a longer time span were mainly of regulatory nature (e.g. measures related to Energy Performance of Buildings) or constituted long-established financial or fiscal measures in certain countries. For these countries, the need to introduce new measures beyond the obligatory measures of the EED is somewhat of lesser importance, given that the pre-existing measures are periodically updated and remain effective in terms of delivering the estimated savings of the target.

The description of policy measures was provided with varying degree of detail. Typical policy information included the policy type, implementation timeframe, sectors targeted and short descriptions. There are some good examples with information categorised according to general information (e.g. Category; Duration; Target groups; Measure description; relevant webpage), implementation details (e.g. Geographical scope; Budget and financial resources, Implementing authority), achieved/expected impact, calculation methodology, assumptions as well as monitoring & verification. Austria, Croatia, Ireland and Finland followed this general structure, addressing all main elements of the measures, while other good examples include Croatia and Malta which also outlined information on monitoring and verification protocols, as well as France, Cyprus, Greece and the

Netherlands.

New measures reported in NEEAPs

While the majority of the measures presented in the NEEAPs are existing measures, the EED has been instrumental for the implementation of new measures in Member States. In addition to the establishment of Energy Efficiency Obligation Schemes, new or updated policy measures in the area of financing, information dissemination and other regulations have been identified. These are briefly discussed below.

Energy Efficiency Obligation Schemes. With the exceptions of Italy, France, Denmark, Belgium, Poland and the UK, where EEOSs existed before the EED, Energy Efficiency Obligation Schemes represent an important new measure for 12 Member States.

Of the 18 countries with an EEOS in their territory, Ireland, Slovenia, Austria, Bulgaria, Spain, Lithuania, Malta, Latvia, Estonia, Hungary, Luxembourg and Croatia plan to put obligations for their energy suppliers for the first time [2].

With regards to Article 7, all Member States have provided the targets⁶ to be reached including information on aspects of the calculation of the target (e.g. options considered for Article 7(2)). Most countries have chosen to apply the 25% reduction to their target calculations – an option offered by Article 7(3) – with the exceptions of Denmark, Portugal, Romania and Sweden which have applied less than 25% reduction. Transport was excluded in the 2010-2012 energy sales for all countries except Sweden. Four MSs are planning to rely on EEOSs alone, 14 will use a mixture of EEOSs plus alternative measures and 10 MS will use only alternative measures.

Most Member States notified the savings to be achieved by the EEOSs and alternative measures. In certain cases, the sum of the expected savings is found to be larger than the savings required by the targets (Austria⁷, Cyprus, Denmark, Finland, Ireland, Malta, and the UK), while for others (Greece and Germany), the reported savings of the measures are not enough to reach the target.

Mandatory energy audits. Mandatory energy audit in large enterprises is an obligation for all Member States. As an example, Denmark has specified that the obligation covers enterprises in all sectors (at least 250 employees and an annual turnover of more than EUR 50 million) [6].

Financial measures. Various new financial schemes are identified in the NEEAPs. In some MSs updates of existing financial measures are noted. As example in Latvia, an existing public building renovation scheme will be refinanced for a new period (2014-2020). Specifically, a grant scheme, financed through EU structural funds will target renovations of central government buildings and improvements in the energy performance of municipal buildings. In addition, a revolving fund is established for the implementation of profitable investment projects by providing their financing with low interest rates. Equity capital of such funds consists of co-financing from the respective State and its local governments, funds of donor institutions, as well as, in certain cases, financing from the European Union support financing. The set-up of National Energy Efficiency Funds (NEEF) is also in the plans of some Member States.

Information and advice. A number of new information and advice schemes are identified. Specifically Denmark introduced *BedreBolig* (Better Homes) scheme on 1 January 2014 to make it easier and clearer for home owners to renovate their homes by offering comprehensive, expert advice as well as by strengthening cooperation between home owners and financial institutions advisers, banks and mortgages institutions to facilitate the interaction between home owners throughout the energy renovation process. A renovation Information Services based on the concept of one-stop approach is set up in France with the aim of helping owners to make decisions through the implementation for the energy renovation of private dwellings. This is a new local public service with 450 Renovation Information Service Points (PRIS), present on the whole territory and has a

⁶ Art.7 target is mandatory for all MSs. The energy saving target is defined as 1.5% per year of energy sold in the past year to be achieved through additional energy efficiency projects (policies) till 2020. The target is cumulative.

⁷ This was notified after the submission of the NEEAP

mission of guiding property owners based on their profile and their location and suggest local information centres, local advice centres and provide basic information. A new awareness campaign for the existence of these PRIS was launched in September 2013.

Transport-related measures. Various new transport measures are presented in the NEEAPs. As example in the Flanders Region of Belgium, a feasibility study of a road taxation system based on kilometres travelled for passengers and freight transport is currently being examined. Preparatory studies and initiatives stimulating the employment of alternative energy carriers (biofuels, electricity for passenger cars and ships while in harbours, natural gas for freight transport) are under way. In the future, the Flemish NEEAP also states the introduction of electric vehicles in the Flemish government fleet. In Italy, a new package with a long list of energy efficiency measures in the transport sector is presented. While it is not possible to establish whether all these measures can be considered as new measures, the measures range from incentives for cars' substitution, to measures for the local public transportation including substitution of buses, to improvement of railroad infrastructures, to the creation of a national logistics platform. (Bertoldi d 2015)

Voluntary agreements. As an example of this policy instrument, the second generation agreement has recently been concluded for the period 2014-2020 in Wallonia, which originally started in the 1990s involving industry federations, single enterprises and the government. This agreement consisted in a contract established between the Wallonia government and the most energy intensive industries via their federation. It has been reinforced and now includes the possibility of industries exploiting renewable energies and implementing an accounting system related to the CO₂ emissions associated with their products and services. Industries participating in this agreement are also invited to present a roadmap to 2050 whereby they outline their strategy to achieve specific energy efficiency and emissions reduction targets. In the Flanders Region of Belgium, a new agreement with companies operating under and outside the ETS system and consuming more than 0.1 PJ/year of primary energy has been established for the period 2014-2020. Participating companies undertake an energy audit every four years and implement periodic energy plans based on the audit outcomes. In exchange for this commitment the Flemish Region does not impose further energy efficiency or CO₂ reduction obligations (unless they are imposed by the EU).

The combination of policy types and sectors responsible for the largest energy savings vary from country to country. Savings realised by the residential sector are particularly important for all Member States, followed by transport, industry and services. In addition, it can be noted that Energy Efficiency Obligation scheme is an important measure for several Member States (Belgium, Bulgaria, Denmark, Estonia, France and Italy). Financial and fiscal measures are the most common measures, followed by regulations, market-based instruments, voluntary agreements and information/advice programmes. The energy taxation measures in Sweden, Austria, France, Estonia and Germany have also an important role.

Sectors targeted by the NEEAPs

In order to consolidate the information provided in the NEEAPs, policy matrices classifying measures according to sectors targeted and policy types have been developed for each Member State. The sectors considered are residential, services, industry, transport, public and energy supply. The policy measures were divided in the following categories: regulatory, financial and fiscal, information & awareness, qualification, training and quality assurance, market-based, voluntary agreements, infrastructure investments and other measures.

Table 1 provides a detailed breakdown of the types of policy measures considered.

Table 1. Categorisation of policy measures

Regulatory	Building codes; Minimum energy performance standards (MEPS) for new and existing buildings; Energy efficiency standards for appliances & equipment; refurbishment obligations; Procurement regulations;
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	Phase-out of inefficient equipment
Financial and fiscal	Grants/subsidies; Preferential loans; Tax incentives; Energy taxation
Information and awareness	General Information; Information campaigns; Information Centres; Energy Audits; Energy labelling schemes; Governing by Example; Information exchange; Awareness campaigns; Demonstration programmes;
Qualification, training and quality assurance	Professional training; Training courses; Vocational education, quality standards
Market-based	Incentives facilitating Third Party Financing / ESCOs; Energy Efficiency Obligation Schemes (EEOSs); White certificates ⁸ ; Incentives for the producers of innovative technologies; Technology deployment schemes
Voluntary action	Voluntary certification and labelling programs; Voluntary and negotiated agreements;
Infrastructure investments	Investments in transportation infrastructure (e.g. railways, road networks), energy infrastructure (e.g. generation plants, electrical grid, substations, and local distribution); Smart meter roll-out;
Other	Other measures that do not fall under one of the above categories

Residential & service sectors

The residential and service sectors benefit from a wide coverage of policy action. Most Member States presented a number of measures mainly in the form of regulatory, financial/fiscal measures as well as information & awareness raising measures, voluntary agreements, infrastructure investments (e.g. smart-meter roll outs), market-based instruments and other measures for these sectors.

Regulatory measures were mostly composed of requirements related to Energy Performance of Buildings Directive and Eco-design Directives. Examples include minimum energy performance requirements for new/existing buildings in their NEEAPs, inspections of water boilers and air conditioning systems (e.g. Bulgaria, Cyprus, Italy, Croatia and France) and energy efficiency standards for appliances & equipment (e.g. Cyprus, Denmark, France and Finland). Other regulatory measures included in the German NEEAP are Renewable Thermal Energy Act (EEWärmeG) and Renewable Energy Act (EEG), which promote the use of renewable energies in various sectors including residential buildings⁹.

Most of the regulatory measures discussed in the residential sector also apply to the services sector. For example, minimum energy performance requirements for buildings, inspections and minimum requirements for water boilers and air conditioning systems, as outlined in the EPBD, are also applicable for non-residential buildings. Furthermore, energy labels and energy efficiency standards for products and equipment also target equipment for the services and industry sectors.

All Member States have reported financial and fiscal measures supporting energy efficiency improvements in the residential and service sectors. These are typically offered in the form of grants and subsidies. Tax relief on energy efficiency upgrades for households are available in Greece, France, Denmark, Finland, Italy, the Netherlands and Portugal. In Italy, the tax credit scheme for building renovations constitutes one of the 3 biggest measures in terms of expected energy savings in 2020. Loan programmes are offered by a few Member States (France, Greece, Germany, the

⁸ Energy efficiency obligations coupled with a trading system for energy efficiency measures resulting in certified energy savings (tradable white certificates). Obligations can be coupled with various trading options: trading of certified energy savings, trading of eligible measures without formal certification, or trading of obligations.

⁹ Although the focus of these measures is on renewable energy (rather than energy efficiency), they are mentioned here, because they are included in the list of measures generating primary energy savings in the German NEEAP.

Netherlands and Portugal). Germany has had a long successful tradition with grants and loans through its KfW scheme, which provide support for renovations achieving various "KfW Efficiency House" levels; the most ambitious one being the KfW Efficiency House 55 representing 55% of the maximum primary energy requirement set for a new building.

Six Member States (Austria, Denmark, Estonia, Germany, the Netherlands and Sweden) have put in place energy taxes above the EU minimum required level, which aim to improve the cost-effectiveness of measures aimed at energy efficiency and promote more efficient use of energy (including households) through behavioural change and investments in energy efficiency.

Market-based instruments in the residential and services sectors are mainly in the form of EEOs. Austria, Flanders region of Belgium, Bulgaria, Denmark, France, Italy, Ireland, Latvia, Luxembourg, Malta and the UK have energy efficiency obligation schemes which target these sectors.

Industry

Various financial incentives are offered to industry actors. Fiscal measures are also available. As example through the Energy Investment Allowance programme, Dutch companies are allowed to deduct 41.5% of energy efficiency investment costs from their taxable profits. Taxation on energy is a measure used by some Member States. In Austria taxation also covers industry. Higher taxes on electricity and natural gas for non-ETS industry apply in the Netherlands. In Germany, while energy taxes apply to all sectors, the manufacturing industry can benefit from "peak equalisation" if they can show that they have a certified energy management system or environmental management. This scheme allows enterprises in manufacturing industry to claim relief on up to 90 % of their energy and electricity tax, to safeguard their international competitiveness.

Voluntary agreements are a common policy instrument for the industry sector. The assessment of the NEEAPs shows that 9 Member States have established such agreements with industry actors, with the aim to engage various enterprises in energy efficiency measures. Specifically, Belgium (Flanders), Denmark, Finland, Ireland, Luxembourg, the Netherlands, Portugal, Sweden and the UK have mentioned voluntary agreements as a measure targeting the industrial sector. In Denmark, the main policy instrument for industry has been a 3-year voluntary agreement scheme which obliges companies to implement energy management and improve energy efficiency in their production in exchange of energy saving tax and as a rebate. This successful scheme ended at the end of December 2013 and a new voluntary agreement is under way. In Finland, medium-sized industrial companies and energy intensive industries can enter into an agreement, which allows them to receive subsidies of up to 25% of the investment costs of energy-efficient measures.

In addition to the obligation of energy audits for large enterprises stipulated in Article 8 of the Directive, support for energy audits in industry is provided in various countries. In Finland, the Energy Audits programme, launched in 1992, is one of the most consolidated energy policies for the industry sector of the country. Subsidies are available for the realization of energy audits and cover 40% of the eligible costs for all organizations and 50% of the costs of SMEs that have signed an energy efficiency agreement. Subsidies for energy audits have also been mentioned for France (on-going), Wallonia (on-going), Greece (to start in 2015), Lithuania (completed). In Portugal, the on-going SGCIE - Management System of Intensive Energy Consumption – programme has the objective to promote energy efficiency and monitor energy consumption for intensive consuming installations (>500toe).

Energy savings in the industry sector are also achieved through market-based instruments. In Italy, the white certificate scheme plays an important role for improving the energy efficiency of industry. In particular, all the energy savings claimed in the NEEAP for energy efficiency improvement measures in the industry sector are generated by actions implemented under Italy's existing white certificate scheme. The UK has the CRC Energy Efficiency Scheme (CRC), which is a mandatory scheme aimed at improving energy efficiency and cutting emissions in large, but non-

energy intensive, public and private sector energy users. The Danish EEOS includes energy savings in enterprises covered by the emissions trading system (ETS). The newly-established EEOSs of Austria, Bulgaria, Denmark, Ireland, Luxemburg and Malta also plan to cover the industry sector.

The European Union Emission Trading Scheme, EU ETS (Directive 2003/87/EC) is another market instrument mentioned in some NEEAPs. For example, the most important measure for the industry sector in France is the national implementation of the EU ETS. France plans to use the revenues of the allowances auctioning for building renovation. In Germany, the EU ETS is expected to generate 2.5 Mtoe of primary energy savings in the period.

Transport

Various transport-related measures are included in the NEEAPs, either reported as individual measures or as part of an overall transport package or a strategy plan [4]. Most of the NEEAPs analysed include the following elements as part of the strategy to reduce energy consumption in the transport sector: improvement of vehicles efficiency, shift towards more environmental friendly means of transport (e.g. rail or public transport), consumer information and behaviour. Austria described an Overall Transport Plan¹⁰, which aims to achieve the goal of 19% reduction of CO₂ emissions by 2025 compared to 2010 as well as a reduction of energy consumption from 240 petajoule to 210 petajoule by 2025. Germany has adopted the so-called Mobility and Fuel Strategy (MKS), which constitutes the strategy of the transport sector towards implementing the targets laid down in the German Government's Energy Concept. Other countries with a comprehensive strategy for the transport sector include Estonia with its Transport Development Plan 2014-2020. The reported measures in the NEEAPs concern both private and public transport. For the public transport, Bulgaria, Czech Republic, Denmark, France, Italy, Latvia, Portugal, Sweden and the UK reported measures which target the rail transport through improvements in the rail infrastructure, electrification of railways and increasing the patronage of passenger railway systems. The promotion of modal shift and the encouragement to use public transport have also been mentioned by some Member States (e.g. Portugal). In Wallonia (Belgium) single persons and families renouncing their use of cars by returning the related number plates are eligible to free bus passes for three years. About 70% of the total primary energy savings expected from the transport sector in 2020 in Wallonia are supposed to be generated by incentives to transport through waterways.

The private transport measures include improvements in car fleet efficiency, measures supporting the use of electric, hydrogen or more fuel efficient cars, development of bicycle lanes etc. Financial incentives for purchase of energy efficient vehicles are provided by Croatia, Spain, Luxemburg (for purchasing of electric cars) and the Netherlands, while Denmark offers tax incentives for electric and hydrogen car owners and car owners who change to lower fuel consumption vehicles. Behaviour measures are also mentioned in the UK, Finnish and Dutch (driver training) NEEAPs. With the *Mobil.e* programme, Portugal promotes the acquisition of electric vehicles by adjusting the already existing electric charging infrastructure and by giving a total exemption of the environmental component of the road tax. The purchase of new lower emission vehicles is also incentivised in Ireland and Italy. France relies on the EU Regulation on CO₂ emissions of light vehicles. The Regulation is further promoted through the annual road tax for company vehicles and the bonus/malus scheme for new vehicles. The strong financial support for energy efficiency improvements in the transport sector in Denmark is highlighted by the numerous funds currently available: the Train Fund (Togfonden) EUR 7 Billion for the electrification and improvement of railways; the Accessibility Fund to improve the access to the stations and parking; the Transport Fund for the modernization of stations and for building new energy efficient stations; the Cycle Fund to establish new cycle path ways; the Fund for energy efficiency transport solutions and the Infrastructure Fund for electric, hydrogen vehicles and gas (although gas does not improve energy efficiency). Other measures in Austria in transport sector include: the *klimaaktiv mobile* – promotion of energy efficiency measures in the transport sector. This programme focuses on supporting

10 <http://www.bmvit.gv.at/verkehr/gesamtverkehr/gvp/index.html>

efficient, environmentally friendly mobility through mobility management, the conversion of vehicle fleets to alternative propulsion systems, electro mobility and encouraging cycling, innovative public transport services and a fuel-saving. Finland is giving attention to heavy load transport by promoting fuel economy among lorry drivers and also with a measure to increase the mass and dimensions of heavy goods vehicles with the goal to increase the cost-effectiveness of transport and to improve energy efficiency.

Public Sector

Various measures have been reported for the public sector, supporting energy efficiency improvements in public buildings, infrastructure, transport etc. Improvements in the energy performance of the central government building stock are a key provision of the EED. A total of 10 countries plan to renovate 3% of their central government stock every year in line with Article 5's default approach. The remaining countries plan to meet Article 5's requirements using the alternative approach (Article 5(6)), through a mixture of renovation, behavioural change and other measures.

Several NEEAPs present financial instruments for the public sector. For example, Croatia has an energy renovation programme for public buildings which runs until 2020 with investments with an estimated value of HKR 400 million (about EUR 52 millions) for the period 2014-2015. This programme will be financed through the Croatian Fund for Environmental protection and energy efficiency. Bulgaria has various measures on public buildings. Its EE fund finances renovations of municipal and central government buildings, while the Operational Programme 'Regions in Growth 2014-2020' support the transition to a low-carbon economy by implementing EE projects in municipal buildings in the period 2014–2020 with overall investments amounting to BGN 218 million.

In Greece, Portugal and Cyprus, energy saving officers/energy managers are appointed in public buildings. In Croatia, the Information System for Energy Management (ISGE) is in place; this has been used for monitoring and analysing of the energy and water consumption of the public buildings owned by the local government (municipalities, counties and cities). Ireland plans to run a behavioural change campaign in naturally ventilated central government buildings, comprising 96% of the total floor area of the central government inventory. In Luxembourg, energy audits are mandatory for all municipalities which participate in the Klimapakt initiative.

Several actions are taken to promote the use of ESCOs in the public sector. A significant measure in Portugal is the ECO.AP programme, aiming for the improvement of energy efficiency in the public administration. The overall objective of this programme is to achieve 30% energy savings in buildings owned or managed by the public administration. These savings will be achieved by the realization of energy audits in public buildings. ECO.AP has also the objective to stimulate the ESCO market, by giving qualified ESCO companies a chance to participate in the programme. A study carried out in Denmark in December 2013 has found that around 30 out of 98 Danish municipalities use ESCOs. In Belgium, ESCOs are promoted in federal buildings and in particular, for the implementation of alternative measures under Article 5.

Energy Supply, Distribution and Transformation

Several MSs have provided information on policy measures supporting cogeneration and district heating/cooling and other systems. As an example, Wallonia has a series of measures already in place to provide financial support for micro-cogeneration, small distribution grids for heating from biomasses, co-generation and collective heating systems. In Flanders, a CHP certificate scheme is in place since 2004 and has been updated in 2012. Certificates have a financial value based on the amount of electricity generated by highly efficient CHP. Electricity suppliers have to buy these certificates from CHP owners. In Germany, the Combined Heat and Power Act was mentioned as the main incentive programme for extending the use of CHP in the country. Demand response measures have been reported only by a few MSs. In Austria, it is stated that all producers and consumers are entitled to take advantage of all supply-side and demand-side possibilities in electricity sector, ranging from time-dependent tariffs for customers (who already have smart metering systems) to the ability of producers to participate in the energy balancing and regulation markets. Denmark has reported various

demand response measures.

Discussion and conclusions

The NEEAPs have provided a strategic platform for Member States to set energy efficiency targets, outline planned or implemented end-use and supply level measures and evaluate the energy savings resulting from the implementation of these measures. With the introduction of the EED, the scope of the NEEAPs has been enhanced as MSs are now obliged to also cover measures taken to improve the efficiency of the supply sector and take into account the ETS sector. These measures may also count towards the EED energy efficiency targets, thereby moving from end-use ESD targets to more holistic targets considering all sectors of the economy. The previous experience with the ESD NEEAPs and the guidance provided by the European Commission's template has also allowed MSs to create more comprehensive and coherent strategies.

All MSs have now set indicative energy efficiency targets for the year 2020. A comparison between the reduction of primary and final energy consumption and reported baseline for the year 2020 has revealed that in general several MSs have considered energy consumption reductions lower than the 20% set at the EU level. Some MSs have not notified the impact of their target in terms of energy savings vs. baseline projections for the year 2020 and the calculation of the percentage savings has therefore not been possible. A comparison between the PRIMES 2007 baseline scenario projections and target consumption levels set by MSs shows that Bulgaria, Greece, Spain, Ireland, Italia, Lithuania, Latvia, Portugal and Sweden will achieve savings equal or above the equivalent 20% savings relative to the Primes 2007 projections. The combined primary consumption at the EU level based on the reported values sums to 1542 Mtoe¹¹, instead of the EU target of 1483 Mtoe. The collective 2020 energy consumption target compared to the PRIMES 2007 projections in 2020 amount to 17.6% in terms of primary and 20.2%¹² in terms of final energy. However, the latest available primary energy consumption data show that we are likely to reach overall the 2020 target at the EU, in part both to of the economic crisis as well as to the energy efficiency policies introduced after 2007. A large heterogeneity has also been observed in the assumptions made by MSs concerning the baseline (notably the baseline reference year) considered for the calculation of the Article 3 target. Whilst some MSs have considered 2007 as reference year for the forecasting model, others have considered 2009 or subsequent years. Given these differences, an estimation of the ambition of the national targets in relation to the overall 2020 EU target in terms of energy savings becomes very difficult for this reason. On the other hand, it has to be acknowledged that the EED does not provide detailed indications on how MSs are supposed to set their reference baseline for 2020.

The legal requirements outlined in EED Annex XIV to be addressed in the NEEAPs were met with a varying level of detail. Our evaluation has shown that the reporting requirements for some articles were not satisfactorily addressed. In particular, Articles 14 and 15 were in general not covered adequately in the NEEAPs, with limited information on procedure and methodology for carrying out a cost benefit analysis to satisfy EED Annex IX criteria of the comprehensive assessment, demand response measures and progress made as part of the on-going assessment of EE potential of national gas and electricity infrastructure. Figures of energy audits carried out in compliance with Article 8 requirements were generally scarce.

Several NEEAP measures reported by the MSs stem from the implementation and enforcement of other EU directives or regulations. These include measures implemented in compliance with the Energy Performance of Buildings Directive (Directives 2010/31/EU, 2002/91/EC), Ecodesign and Energy Labelling Directives (Directives 2009/125/EC, 2005/32/EC,

¹¹ Following several target updates communicated by Member States in 2015, the collective target has now been revised to 1527 Mtoe of EU28 primary consumption

¹² Lithuania and Portugal were excluded from the calculation of the percentage target as no final energy consumption values with regards to Article 3 implementation were identified in their NEEAPs.

2010/30/EU), Regulation (EU) No 333/2014 on CO₂ emissions from new passenger cars, Internal Market for Electricity (2009/72/EC) and Gas (2009/73/EC) Directives and the Emission Trading Scheme.

While the majority of the measures presented in the NEEAPs are existing measures (expected for MSs with successful long lasting measures), the EED has also been a driver for new measures in MSs. In addition to the establishment of EEOs, new or updated policy measures in the area of financing, information exchange, regulations as well as transport-related measures have been identified. Major measures in terms of energy savings generated have also been identified. While all sectors and policy types were identified in the list of biggest measures, savings realised by the residential sector were found to be particularly important for all MSs, as well as measures of financial or fiscal nature.

It should be noted that in most cases the impact of the policies has been expressed in terms of energy savings, and rarely in other indicators such as job creation, greenhouse gas emissions reduction, improved air quality. Moreover, the energy savings generated by each measure has not always been quantified in the NEEAPs. The evaluation of the ambition of the overall national policy framework against the national targets is therefore not possible in a quantitative way for all MSs. For certain countries, the share of the savings to be achieved in 2020 by each sector is presented, demonstrating how each sector contributes towards the achievement of the target. A more systematic approach towards reporting of measures is generally recommended for future NEEAP submissions in order to ensure that a set of minimum information is reported across all MSs.

In conclusion, the EEDs offer a good frame that complements other EU directives (e.g. Eco-design and Energy Labelling, EPBD) and helps MSs to adopt targets and a structured and strategic plan based on national policies meeting the target. The NEEAP is a key tool for the presentation of the plan and for the monitoring of the energy savings already achieved and expected in the future. The quality of NEEAPs has progressed over time, also thanks to the template provided. A key role in the EED is played by Art. 7, which imposes mandatory targets. The positive experience gained in the EU through the NEEAPs and the associated energy saving reporting could be used also by other jurisdictions outside Europe to help prepare national energy efficiency strategies.

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