Implementation of the Energy Efficiency Directive: progress, challenges and lessons learned

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Keywords

Energy Efficiency Directive (EED), saving targets, policy measures, implementation

Abstract

The Energy Efficiency Directive (EED), adopted in 2012, forms a key part of the EU's overall climate and energy legislative package, laying down the foundation for actions to be taken by Member States in order to help them realise their energy efficiency potential. The European Commission tracks the progress made by Member States through the annual reports (ARs) submitted by national authorities to the European Commission. This paper reviews the information in the latest available ARs to draw a picture of the implementation status of key EED provisions and progress achieved towards the various national energy efficiency targets set by the Directive. It specifically reviews the progress made in relation to Article 3 targets for 2020, the obligations on central government building renovations (Article 5) and implementation of energy efficiency obligation schemes (Article 7). The paper examines the type of policy measures (regulations, financial/fiscal measures, information and advice etc.) used in practice to generate the energy savings in order to meet the Directive's various provisions as well as the relative contribution of the various sectors (residential, services, transport and industry). Policy recommendations are drawn based on the experience gained so far, which constitute important implementation lessons as we move forward to the revised EED and new timeline to 2030.

Introduction

The Energy Efficiency Directive (Directive 2012/27/EU, the EED or the Directive), adopted in 2012, forms a key part of the EU's overall climate and energy legislative package, laying down the foundation for actions to be taken in order to help realise the energy efficiency potential of the European economy. The Directive 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 (Commission, 2012). 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 accordance with Article 24, Member States are requested to submit National Energy Efficiency Action Plans (NEEAPs) every three years as well as report on the progress achieved towards their national energy efficiency targets by 30 April each year as from 2013 in the form of the so-called Annual Reports (ARs). For the latter, Member States are required to specifically report on their last year's consumption trends as well as report on policy updates and progress towards implementing Articles 5 and 7 of the Directive. They provide the basis for monitoring the progress towards national 2020 targets.

In compliance with the general framework for annual reports Annex in XIV Part 1, the following minimum information had to be provided by each Member State in their Annual Reports 2016 (AR2016):

a. an estimate of various energy-related indicators in year 2014

b. updates on major legislative and non-legislative measures implemented in 2015 which contribute towards the overall national energy efficiency targets for 2020;

c. the total building floor area of the buildings with a total useful floor area over 500 m² and as of 9 July 2015 over 250 m² owned and occupied by the Member States' central government that, on 1 January of the year in which the report is due, did not meet the energy performance requirements referred to in Article 5 (1);

d. the total building floor area of heated and/or cooled buildings owned and occupied by the Member States' central government that was renovated in the previous year referred to in Article 5 (1) or the amount of energy savings in eligible buildings owned and occupied by their central government as referred to in Article 5 (6);

e. energy savings achieved through the national energy efficiency obligation schemes referred to in Article 7 (1) or the alternative measures adopted in application of Article 7 (9).

This paper reviews the information in the Annual Reports 2016 to draw a picture of the implementation status of key EED provisions and progress achieved towards the various national energy efficiency targets set by the Directive. This analysis was conducted as part of the scientific and technical support provided by the Joint Research Centre to DG Energy of the European Commission for the implementation of the Energy Efficiency Directive. The paper first reviews the progress made in relation to Article 3 targets for 2020 and provides insights into the main factors behind the latest energy consumption trends. It then examines the obligations on central government building renovations (Article 5) and latest progress made in relation to that, followed by an overview of the current implementation of energy efficiency obligation schemes (EEOS) (Article 7). The paper examines the type of policy measures (regulations, financial/fiscal measures, information and advice etc.) used in practice to generate the energy savings in order to meet the Directive's various provisions.

Progress towards the 2020 targets

In the context of the EU's energy and climate package, the EU has set a target of 20 % reduction in the EU primary energy consumption by 2020. Specifically, the target corresponds to a 20 % reduction in the EU primary energy consumption by 2020 compared to the 2007 baseline primary energy consumption projections in 2020 derived by the baseline scenario results of the Primes 2007 model. In terms of primary energy, this target results in a reduction of 370 Mtoe and consumption levels of 1,483 Mtoe in 2020 compared to Primes 2007 model projections of 1,853 Mtoe in 2020. In accordance with Article 3, Member States had to set indicative energy efficiency targets – based on either primary or final energy savings, primary or final energy consumption or energy intensity – in view of the overall target of 20 % reduction in EU primary energy consumption by 2020.

Member States set their national indicative 2020 energy efficiency targets in 2013 and notified the European Commission through the reporting obligations under the EED. These targets were based on different ambition levels set by each Member State, taking into consideration, inter-alia, economic projections at national level. Following some target updates made by some Member States after 2013, the sum of national 2020 targets in terms of absolute consumption levels set by Member States is currently equal to 1,526 Mtoe in terms of primary energy; corresponding to 17.6 % savings compared to the PRIMES baseline projections (Figure 1). Despite the gap between the EU target of Article 3 of the Directive and subsequent national targets set by Member States, the energy consumption of the EU has been on a downward trend over the past decade, with the exception of a slight increase observed in 2010–2011. In particular, the EU primary energy consumption dropped by 12 % from 1,712 Mtoe in 2005 to 1,507 Mtoe in 2014 (Figure 1). The latest energy consumption figures in 2014 therefore suggest that a primary energy consumption reduction of 18.7 % compared to Primes 2007 projections is already achieved in 2014. This translates to a remaining gap of 1.3 % towards the EU 20 % primary energy target of 2020.

At Member State level, substantial progress towards the targets was made as of 2014 (Figure 2). In 18 Member States, the primary energy consumption in 2014 was below the 2020 national target levels. This was the Czech Republic, Denmark, Ireland, Greece, Spain, Croatia, Italy, Latvia, Lithuania, Luxem-

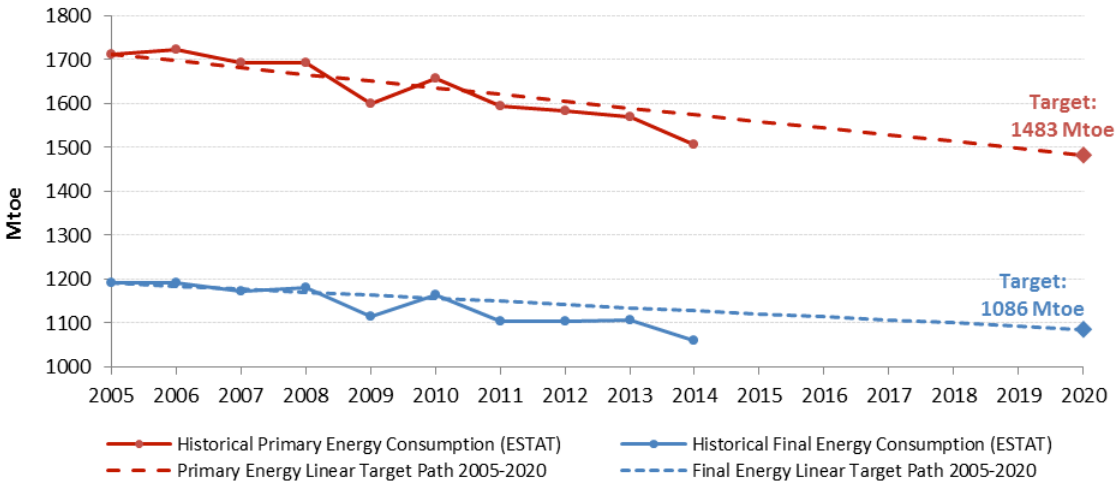


Figure 1. EU28 Energy Consumption trends (dotted lines represent a linear trajectory between EU28 2005 actual and EU28 2020 target consumption)(JRC Analysis based on EUROSTAT data).

bourg, Hungary, Austria, Poland, Portugal, Romania, Slovenia, Slovakia and Finland. All other Member States have a small remaining gap to reach the target, ranging from just over 1 % in the case Bulgaria and Estonia to over 25 % of the national target in the case of Malta. This means that efforts are necessary to further reduce the energy consumption in these countries in the remaining period up to 2020.

It should be noted that energy consumption trends are driven by several factors beyond energy efficiency improvements. Factors such as economic activity, demography and lifestyle changes can all have a profound effect on the aggregate energy consumption, irrespective of the impact of energy efficiency measures. For example, the economic crisis in recent years has been detrimental in certain Member States. Indeed, the update of the PRIMES model in 2013 (PRIMES 2013) resulted in lower baseline energy consumption projections to 2020 compared to the previous PRIMES 2007 projections. To track the real progress towards the energy efficiency targets, the separation of energy efficiency impacts from structural and activity changes of the economy as a whole is necessary through the application of decomposition analysis (Ang, 2015). This was done by using the Logarithmic Mean Divisia Index (LMDI) method to decompose changes in primary energy consumption at the EU level over the last decade (2005–2014) based on EUROSTAT data. The LMDI method is a well-proven index decomposition analysis method, which has been widely adopted in energy- and emission-related trend studies to track economy-wide energy efficiency trends since the 1990s by a number of international organizations including the International Energy Agency. The choice of LMDI as the preferred index decomposition analysis method is justified by its many desirable properties, such as perfect decomposition with no unexplained residual term in the results, ease of use (based on statistical data) and ease of interpretation of results.

The following four factors have been taken into account in our analysis:

- Activity effect: it accounts for change in energy consumption due to a change in economic activity (i.e. GDP). The activity effect is positive if GDP grows due to additional energy demand of increased economic activity.
- Structure effect: it accounts for changes in energy consumption that would have been observed due to a change in the relative importance of countries with different energy intensities. The structural effect is positive if the GDP of countries with relatively high energy intensive economies grows.
- Fuel mix effect: it accounts for changes in energy consumption due to changes in the fuel mix of the economy, i.e. the impact of the composition of fuel mix. The fuel mix effect is negative if a shift towards cleaner fuels is made. This is represented by the ratio of national primary energy consumption by each fuel to national primary energy consumption of all fuels together.
- Intensity effect: it accounts for changes in total energy consumption due to technology improvements and other factors (e.g. climate). It is represented by the ratio of national primary energy consumption to national GDP.

The results of the decomposition analysis are shown in Figure 3. These represent the cumulative results of year-on-year decomposition analysis. In the period 2005–2014, a drop of 206 Mtoe

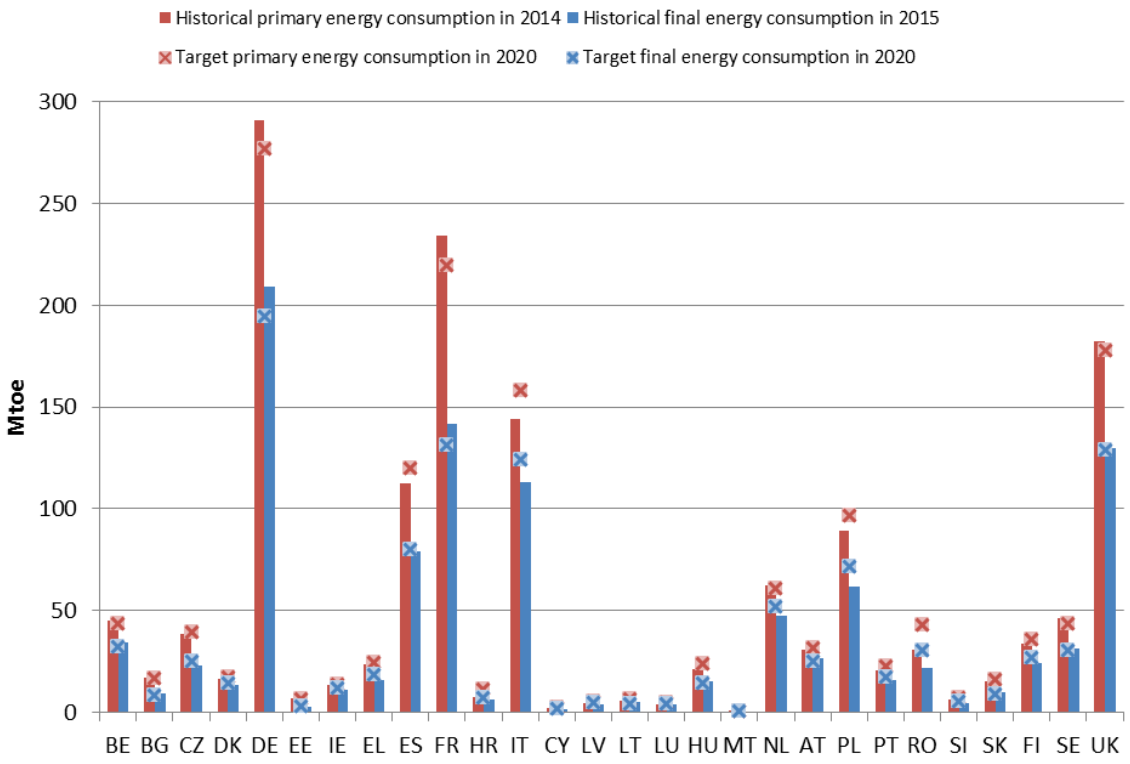


Figure 2. Progress made towards the targets by Member States in 2014 (JRC Analysis based on EUROSTAT and ENER data).

in primary energy consumption is registered, which is a result of the negative intensity effect offsetting both the positive activity and structural effects. In particular, our preliminary results show that the activity effect led to an increase in energy consumption by +123 Mtoe, however this was offset by an almost three times that margin reduction (-353 Mtoe) led by significant improvements in the energy intensity. The impacts of structural and fuel mix changes were, on the other hand, very small. Specifically, the structural effect was +25 Mtoe, which is attributed to the relative growth of more energy intensive national economies compared to less intensive ones. A very small negative fuel mix effect is noted (-0,5 Mtoe), suggesting a small shift towards cleaner fuels.

Implementation status of key directive provisions

As explained in the introduction, Member States are required to report on the progress made towards some main EED Articles on an annual basis. These annual reporting obligations include progress towards central government building renovations (Article 5) and implementation of energy efficiency obligation schemes (Article 7). The 2016 annual reports were assessed to draw a picture of the latest implementation status.

MAJOR POLICY UPDATES IN 2015

In compliance with the general framework for annual reports Annex in XIV Part 1, Member States are required to report updates on major legislative and non-legislative measures implemented in the previous year which contribute towards the overall national energy efficiency targets for 2020. An overview of policy updates based on these categories is presented in Figure 4. The majority of the new measures implemented in 2015 concerned the transposition and implementation of the provisions of the Energy Efficiency Directive. Several other measures stemmed from other directives such as the Ecodesign (Directive 2009/125/EC), Energy labelling (Directive 2010/30/EU) and Energy Performance of Buildings (Directive 2010/31/EU, EPBD) Directives. This stresses the broad range of EU policy contributing to energy efficiency improvements.

In terms of updates directly related to the Energy Efficiency Directive, the majority of the updates in 2015 were related to Article 7 (EEOSs and alternative measures), followed by policy updates in 2015 on energy audits (Article 8) and long-term renovation roadmaps (Article 4). Several updates in 2015 on the general transposition of the EED were also made. Many other updates in 2015 were reported on efficiency in heating and cooling (Article 14), energy services & energy performance contracting (Article 18), demand response (Article 15) and public procurement (Article 6). Updates in 2015 for other policies than the EED mainly concerned EPBD provisions, and in particular, requirements related to minimum energy performance requirements, nearly zero energy buildings (e.g. technical requirements to be met by these buildings in 2020) and energy performance certificates. In terms of policy types, the vast majority of policies were regulations, supporting legal & other legislative measures. This was followed by updates in funds, financial & fiscal measures. Several Member States also provided updates for various plans, roadmaps & strategies as well as measures on information, knowledge & advice. Almost half of the measure updates (around 46 %) concerned adoption of new measures, conclusion of agreements, publication of legislation, and commencement or enforcement of measures and programmes. Amendments, implementation or design changes and extension of on-going measures represented around a fifth of all updates (around 20 %). Drafts, announcements, commitments, planned measures, discussions for new measures represented around 10 % of all updates, followed by continuation of existing measures (8 %). Monitoring information, updates on progress or impact assessment results were also provided as well as notifications of completion or termination of three measures.

EXEMPLARY ROLE OF CENTRAL GOVERNMENT

In accordance with Article 5 (1) of the EED, Member States were required to ensure that, as from 1 January 2014, 3 % of the total floor area of heated and/or cooled buildings owned and occupied by their central government is renovated each year, to meet at least the minimum energy performance requirements (MEPS) that it has set in application of Article 4 of the EPBD. Alternatively, Member States may opt for an alternative approach (Article 5 (6)), and achieve by 2020, energy savings which are equivalent or greater than those which would be achieved through the application of the provisions of Article 5 (1).

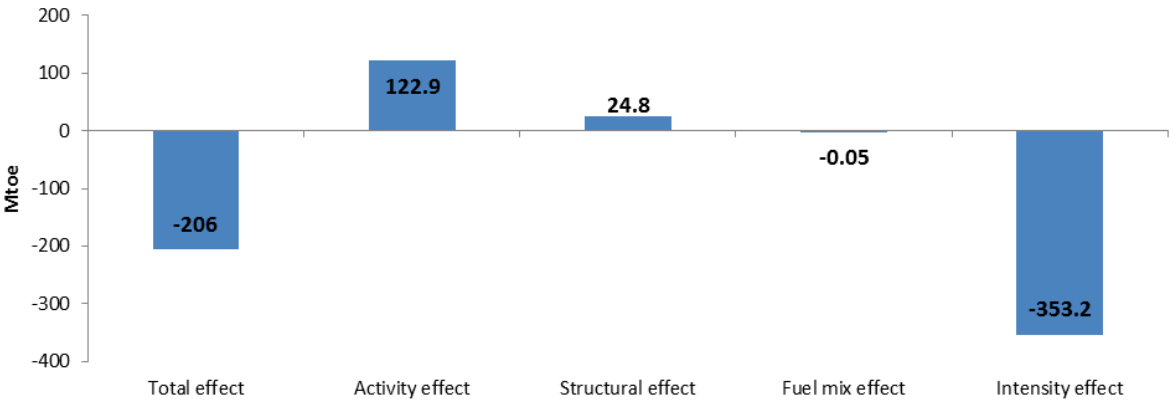


Figure 3. Decomposition of EU28 Primary Energy Consumption change (ΔE) in 2005–2014 using additive LMDI approach (JRC analysis).

A summary of the latest progress made by Member States in connection with Article 5 is presented in Table 1. This includes reported data on the central government building stock and the obligations set to comply with the Article 5 provisions in terms of annual floor area to be renovated or annual energy savings to be reached. The actual progress made in 2015 in terms of renovated floor area and energy savings achieved is also provided, together with the actual obligation achievement for the year 2015. The latter is expressed as the:

- ratio of renovated floor area in 2015 to the respective annual renovation obligation for countries opting for the default approach (Article 5 (1))
- ratio of achieved annual energy savings compared to the annual energy saving obligation for countries opting for the alternative approach (Article 5 (6)).

In terms of obligation ambition, France committed to the largest amount of energy savings in absolute terms (36 ktoe), which is equivalent to the renovation of 666,000 m^2 of central government building floor area (based on the default approach). Due to its centralized governance, France has a significantly large number of administrative departments whose competence extends over its whole territory, translating to a larger floor area of eligible buildings. Countries with a large floor area of central government buildings and thereby ambitious energy saving obligations include Italy with 377,947 m^2, the UK with 372,000 m^2 and Spain with 289,117 m^2. Germany takes only central government buildings at the federal level into account. Therefore, it has an energy saving obligation which is equivalent to the renovation of 96,000 m^2 and is on par with the obligation of Latvia which has to renovate a floor area of 77,680 m^2. The governance structure of Member States has therefore a strong influence over the floor area eligible of Article 5.

From Table 1[1], it can be concluded that the Member States which collectively met their renovation requirements under the default approach over the latest 2-year period[2] (2014–2015) are Estonia, Spain, Hungary, Italy and Latvia. On the other hand, Bulgaria, Lithuania, Luxembourg and Slovenia did not fully meet their renovation requirements. In Lithuania, central authorities submitted data to demonstrate that they did not use and had relinquished buildings with floor area of 33,447 m^2 in 2014 which were all classified in energy performance class E or lower (very inefficient buildings), while two new class D buildings with floor area of 16,364 m^2 had been acquired according to their annual report of 2016. In terms of the alternative approach, Austria, Croatia, Cyprus, Finland, Sweden and the UK have all generated the expected annual energy savings in the period 2014–2015[3]. It should be noted that the Czech Republic and Poland were very close to achieving their requirements in the period 2014–2015. At the same time, several of these countries have reported an overachievement in 2015 such as Croatia with 1,255 % achieved energy savings against the expected requirement, Finland with 463 % achieved energy savings and Sweden with 589 %.

For several countries, no conclusion can be made due to lack of sufficient data. These include Belgium, Denmark, Finland, France, Ireland (for 2014), Germany, Greece, Portugal (for 2015), Romania and Netherlands (for 2014). Missing data may include reported savings and/or expected savings (see Table 1).

ENERGY EFFICIENCY OBLIGATION SCHEMES

Table 2 provides a summary of the latest Article 7 implementation status. It provides an overview on the approach used by each Member State – the set-up of energy efficiency obligation schemes referred to in Article 7 (1) and/or the alternative measures adopted in application of Article 7 (9) – and expected annual savings for 2014 and total amount of cumulative savings required by end 2020 per each Member State. The actual progress made is presented in terms of total final energy savings achieved in 2014[4]. This progress is also expressed as a ratio of achieved savings in 2014 against the expected savings for 2014 for those Member States which have notified them and also against the national cumulative savings requirement due by end 2020.

It should be noted that four Member States (Finland, Latvia, Lithuania and Poland) have not notified the annual distribution of their expected savings, while four other Member States (Austria, Belgium, Czech Republic and Spain) notified expected savings only for some of the measures. The picture in terms of progress against expected annual savings in 2014 is therefore not complete for all EU28 (see Table 2). A number of important policy updates were reported by Member States this year. Greece initially notified to implement only alternative measures but now intends to set up an energy efficiency obligation scheme as of 1 January 2017. The EEOS will thus form part of Greece's Article 7 policy package together with alternative measures. Lithuania and Estonia recently announced that they no longer plan to adopt energy efficiency obligation schemes. Based on this latest update, energy efficiency obligation schemes are planned or are already implemented in 15 countries, while alternative measures are in place in 24 countries. Updates in the alternative measure packages were notified in the annual reports 2016 by Austria, Belgium, Estonia, Czech Republic, Malta, Spain and the UK.

As shown in Table 2, the reported generated savings in 2014 reached or exceeded the expected 2014 savings in 8 Member States[5]. This is the case for France, Italy, Hungary, Malta, Netherlands, Romania, Slovakia and the UK. On the other hand, Denmark, Estonia, Germany, Greece, Ireland, Portugal and Slovenia achieved in 2014 at least 50 % of their expected annual savings for that year. Bulgaria, Croatia, Cyprus, Luxembourg and Sweden achieved less than 50 % of the expected savings

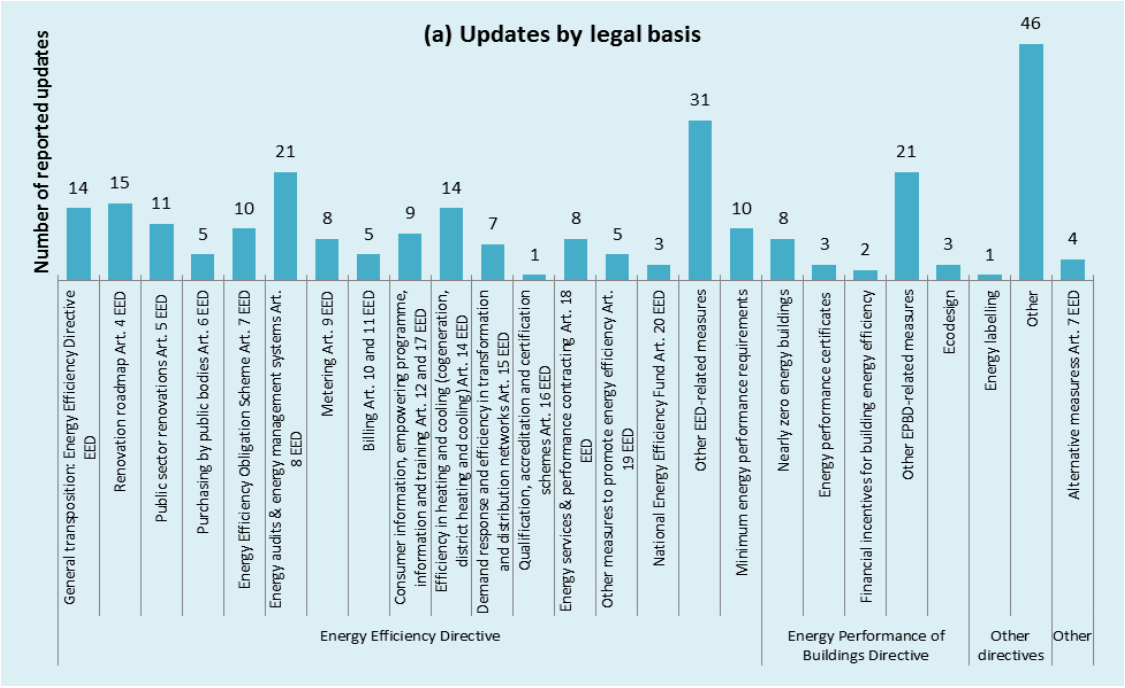
1. Progress achievement against target: This is calculated as the ratio of the savings or renovated floor area in a given year over the Article 5 requirement of that specific year.

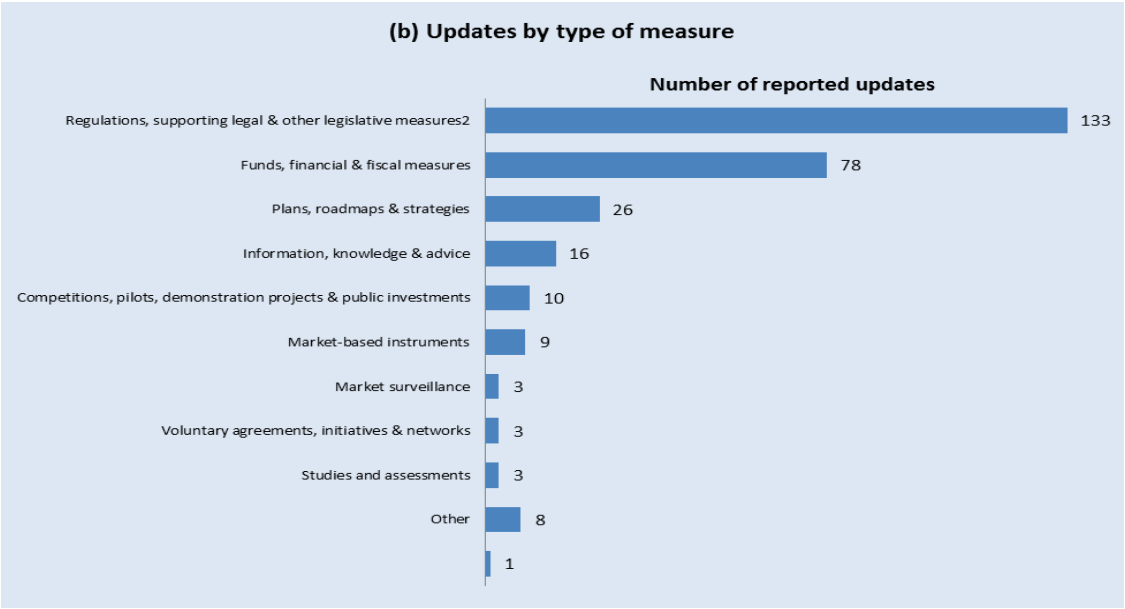
2. In other words, the sum of renovated floor area in 2014 and 2015 over the collective requirements of years 2014 and 2015 is over 100 %. According to the EED Article 5 (3), Member States may count the excess towards the annual renovation rate of any of the three previous or following years. For this reason, the achievement herein is evaluated over the entire period over which the Article 5 requirement is applied so far (i.e. 2014–2015).

3. In other words, the sum of achieved savings in 2014 and 2015 over the collective requirements of years 2014 and 2015 is over 100 %.

4. In the Annual Reports 2016, the year in which the reported energy savings are generated is 2014 (i.e. X-2, where X is the reporting year).

5. Expected savings for 2014 refer to the annual split of the cumulative savings requirement that corresponds to expected savings in the year of 2014, as reported by Member States.





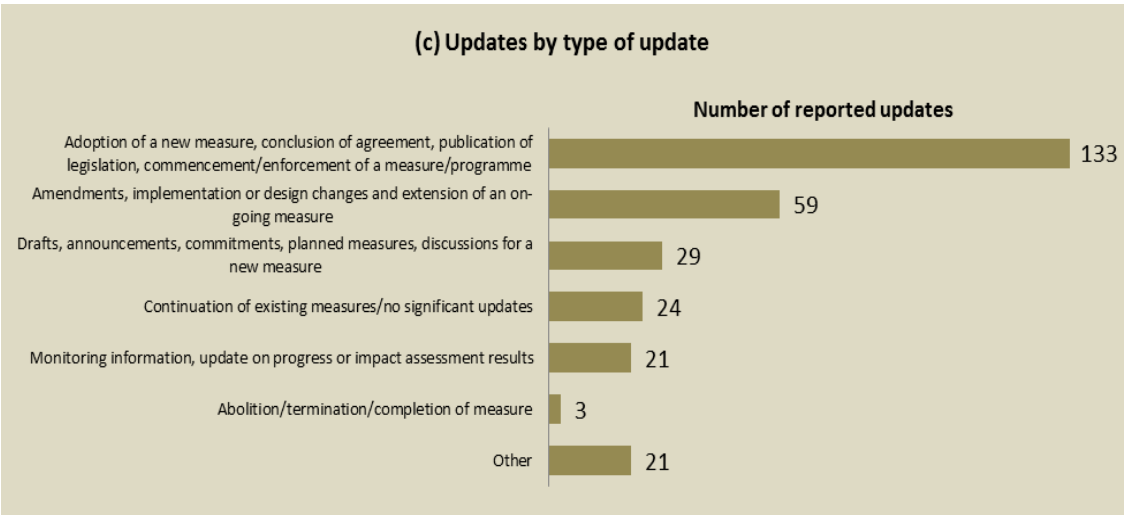


Figure 4. Summary of policy updates reported in AR2016.

Table 1. Implementation status of EED Article 5 based on reported information in AR2016 (the dash sign '–' is used to indicate missing data and empty cells indicate not applicable).

	Article 5 implementation approach		Article 5 requirement		Progress achievement		Progress achievement against target	
		Unit	2014	2015	Savings or renovated floor area in 2014	Savings or renovated floor area in 2015	2014	2015
BG	Default	m^2	225,669	155,805	59,540	72,000	26.4 %	46.2 %
EE	Default	m^2	27,432	27,432	17,022	56,321	62.1 %	205.3 %
EL	Default	m^2	9,291	9,291	–	–		
ES	Default	m^2	336,007	318,833	306,550	382,581	91.2 %	120.0 %
HU	Default	m^2	14,655	14,577	18,200	11,184	124.2 %	76.7 %
IT	Default	m^2	412,919	409,203	561,090	468,243	135.9 %	114.4 %
LT	Default	m^2	66,703	32,063	49,811	–	74.7 %	
LU	Default	m^2	4,785	4,281	0	4,281	0.0 %	100.0 %
LV	Default	m^2	77,680	77,680	232,635	0	299.5 %	0.0 %
SI	Default	m^2	21,249	21,249	0	0	0.0 %	0.0 %
AT	Alternative	MWh	1,750	1,697	4,018	6,318	229.6 %	372.3 %
BE	Alternative	MWh	665	650	–	–		
CY	Alternative	MWh	3,316	3,316	3,477	3,427	104.8 %	103.3 %
CZ	Alternative	MWh	6,168	6,168	6,367	5,535	103.2 %	89.7 %
DE	Alternative	MWh	–	–	6,500	7,116		
DK	Alternative	MWh	–	–	–	–		
FI	Alternative	MWh	1,285	1,246	9703	5772	755 %	463 %
FR	Alternative	MWh	413,500	413,500	–	–		
HR	Alternative	MWh	1,358	1,358	3,053	17,044	224.8 %	1,255.1 %
IE	Alternative	MWh	1,303	1,303	NR	470		36.1 %
MT	Alternative	MWh	793	793	0	0	0.0 %	0.0 %
NL	Alternative	MWh	60,833	60,833	–	31,667		52.1 %
PL	Alternative	MWh	4,536	4,536	4,483	4,535	98.8 %	100.0 %
PT	Alternative	MWh	634	634	0	–	0.0 %	
RO	Alternative	MWh	–	–	–	15,318		
SE	Alternative	MWh	3,219	3,123	7,220	18,400	224.3 %	589.2 %
SK	Alternative	MWh	52,170	52,170	850	54,770	1.6 %	105.0 %
UK	Alternative	MWh	63,300	66,600	272,200	116,300	430.0 %	174.6 %

in 2014. These Member States would require additional effort in the upcoming years to reach their overall cumulative saving requirements due by the end of 2020.

A variety of different measures were used to generate the Article 7 energy savings in 2014 reported by Member States (Figure 5). The breakdown of the energy savings achieved in 2014 by type of policy measure per each Member State is depicted in Figure 5. The measures have been grouped into the following policy types:

- energy efficiency obligation schemes
- regulations
- energy and CO_2 taxes
- funds, fiscal and financial incentives
- information, training and education
- other measures.

In total, 10 Member States either partially[6] or fully generated their 2014 savings through the implementation of EEOS (EED Article 7 (1)). The savings generated by the EEOSs represented just over one third of the total Article 7 savings at the EU level. Bulgaria, Denmark and Poland achieved their Article 7 savings entirely through the implementation of Energy Efficiency

6. In these cases, alternative measures were also used.

Obligation Schemes (Table 2[7, 8, 9, 10, 11]). France reported the achieved savings in 2014 solely through the implementation of the Energy Efficiency Obligation scheme[12] even though it has opted for a combination of an EEOS (EED Article 7 (1)) and alternative measures (EED Article 7 (9)). The remaining six countries: Ireland, Italy, Malta, Austria, Slovenia and the UK reached their reported 2014 savings through a combination of EEOSs and alternative measures. At MS level, the share of energy savings generated by EEOSs varied from country to country with just over 8 % (in case of Austria) to over 80 % (in case of Italy) of the total Article 7 savings in 2014. Latvia and Luxembourg reported no savings from the EEOSs in 2014, and as Croatia intends to set up the scheme only next year, no savings were reported for 2014.

Savings through alternative measures (EED Article 7 (9)) were generated in 23 Member States. These measures played an important role for generating the energy savings under Article 7 in 2014. For many countries, measures falling under the category "funds, fiscal and financial incentives" covered a substantial share of the total achieved savings, with the Czech Republic, Croatia and Greece meeting their Article 7 energy savings in 2014 entirely through financing measures or/and fiscal incentives.

All other countries generated their savings through a combination of different alternative measures. Taxation measures generated a substantial share of 2014 savings (at least 50 %) in Austria, Germany, Estonia, Lithuania and Sweden. These included energy and electricity taxes in Germany, excise duty tax and VAT for natural gas, electricity and fuels in Estonia, excise duties and taxes on fuel in Lithuania and energy taxes in Austria. Regulatory measures were used by Portugal, the UK, Ireland, Romania and Flanders region of Belgium which generated 53 %, 25 %, 23 %, 16 %, and 15 % of their achieved savings in 2014, respectively. Specific regulatory measures for the building sector included building regulations for residential and non-residential buildings in the UK, regulations for energy efficiency of space heaters in Ireland and management regulation of energy consumption in transport sector in Portugal.

Information, education and training measures were used by Germany, Ireland, Spain, Croatia and Hungary. Examples include the federal advisory programmes in Germany, behavioural change campaign in Ireland, efficient driving licence scheme for new drivers in Spain, promotion of environmentally-friendly driving in Croatia and energy efficiency awareness raising campaign in Hungary. The category "other measures" included voluntary agreements (e.g. Belgium, Ireland, the Netherlands), introduction of CLIMA scheme[13] for residential, industrial (non ETS) and transport sectors in Spain, the public transport development programme in Hungary and policies targeting households and services in the Netherlands. Slovakia and the Netherlands provided a breakdown of the achieved savings per sector and not per measure, so it is not possible to see the amount of the savings in 2014 attributed to the specific alternative measures.

A few updates in the policy measures implemented in 2014 are finally noted. In its Annual Report 2016, Austria provided savings for the following measures: (1) Renovation initiative – operational element, (2) klimaaktiv mobil climate initiative, and (3) Climate and Energy Fund. Wallonia reported a new renovation measure PIVERT targeting public housing, while in Spain a new measure Pima Land (tractors) has been notified as an alternative measure that delivered energy savings in 2014. In the UK, the Green Deal has been replaced by the Private Rented Sector Regulation (England & Wales). In Malta, voluntary Agreements were negotiated with non-SMEs that delivered savings in 2014. Estonia mentioned several new legislative measures that include support programmes for upgrading educational buildings, special care homes and increasing regional competitiveness.

Conclusions

With the implementation of the Energy Efficiency Directive, EU Member States have now set national energy efficiency targets for 2020 and put in place a number of policy measures for end-use sectors (buildings, public sector, industry, transport) as well as energy supply sector. The progress made at national level is tracked annually through the annual reports notified by Member States to the Commission in accordance with the EED Article 24. This paper focused on the assessment of the latest annual reports of 2016 with the aim to provide an overview of the implementation status of key EED provisions.

With regards to the 2020 targets, EU28 has set a collective primary energy consumption target equal to 1,526 Mtoe in terms of primary energy; corresponding to 17,6 % savings compared to the PRIMES baseline projections. Despite this, the latest energy consumption figures in 2014 suggest that a primary energy consumption reduction of 18,7 % was already achieved in 2014.

To examine the impact of different drivers on the latest energy consumption trends, a decomposition analysis was carried out using the Logarithmic Mean Divisia Index (LMDI) method for the period 2005–2014. This allowed the quantification of the impacts of structural and activity changes of the economy on the energy consumption as a whole, beyond energy efficiency improvements. Our results showed that the 206 Mtoe drop in primary energy consumption in this period is a result of the negative intensity effect offsetting both the positive activity and structural effects. This points to, inter-alia, significant improvements in the energy intensity gained in this period and is in line with similar international studies carried out, which

7. Article 7 expected savings: Based on information previously notified by Member States.

8. Share of achieved savings in 2014 against expected annual savings (%): Expected annual savings refer to the energy savings to be achieved in 2014, as reported by Member States.

9. Achieved savings in 2014 (ktoe): In total Belgium has reported 301,85 ktoe of achieved savings for 2014. These include early actions in amount of 122,03 ktoe that have been deducted.

10. Expected savings in 2014 (ktoe): Denmark has notified the energy savings requirement and expected savings inclusive of savings achieved in energy transformation, distribution and transmission sectors. Savings in these sectors accounted for 6 % of the total reported savings in 2012, in 2013 for 5 % and in 2014 for 7 %. The expected savings have therefore been lowered by 7 % for the purposes of this document.

11. Achieved savings in 2014 (ktoe): The UK notified total energy savings amounting to 27,7 TWh for all policy measures (reported as rounded amount of 28 TWh).

12. French Energy Saving Certificate Scheme.

13. Climate Projects promoting energy saving by achieving verified reductions in the emissions generated in the various sectors.

Table 2. Article 7 implementation status based on latest AR2016 information (reported values are in final energy).

	Article 7 approach		Article 7 expected savings		Article 7 achieved progress in 2014		
	Energy Efficiency Obligation scheme	Alternative measures	Expected savings in 2014 (ktoe)	Total cumulative savings notified for 2014–2020 (ktoe)	Achieved savings in 2014 (ktoe)	Share of achieved savings in 2014 against expected annual savings (%)	Share of achieved savings in 2014 against total cumulative savings requirement in 2014–2020 (%)
BE		Yes	*247 (p)*	6,911	180		3 %
BG	Yes		69	1,942	15	22 %	1 %
CZ		Yes	*173 (p)*	4,841	65		1 %
DK	Yes		238	3,841	204	86 %	5 %
DE		Yes	2,844	41,989	2,548	90 %	6 %
EE		Yes	48	610	41	87 %	7 %
IE	Yes	Yes	73	2,164	71	97 %	3 %
EL	Yes	Yes	100	3,333	74	74 %	2 %
ES	Yes	Yes	*493 (p)*	15,979	565		4 %
FR	Yes	Yes	738	31,384	1,585	215 %	5 %
HR	Yes	Yes	29	1,296	2,5	9 %	0 %
IT	Yes	Yes	850	25,502	1,232	145 %	5 %
CY		Yes	6.5	242	2,2	34 %	1 %
LV	Yes	Yes		851	5		1 %
LT		Yes		1,004	38		4 %
LU	Yes		0	515	0	0 %	0 %
HU		Yes	75	3,680	75	100 %	2 %
MT	Yes	Yes	0.62	56	1,47	238 %	3 %
NL		Yes	373	11,512	666	179 %	6 %
AT	Yes	Yes	*400 (p)*	5,200	714		14 %
PL	Yes			14,818	403		3 %
PT		Yes	53	2,532	46	88 %	2 %
RO		Yes	346	5,817	364	105 %	6 %
SI	Yes	Yes	23	945	18	76 %	2 %
SK		Yes	71	2,284	72	101 %	3 %
FI		Yes		4,213	561		13 %
SE		Yes	997	9,114	252	25 %	3 %
UK	Yes	Yes	2,347	27,859	2,382	101 %	9 %

(P) Partial – Expected savings are only reported for some of the Article 7 policy measures.

suggest that energy efficiency policies have been an important driver for the decline of the energy consumption levels (e.g. (IEA, 2016)).

Our assessment has also covered the implementation status of key Directive provisions, including the review of the exemplary role of central government and implementation of Energy Efficiency Obligation Schemes. Our analysis has shown that the Member States which met their renovation requirements in 2014 and 2015 under the default approach of Article 5 are Estonia, Spain, Hungary, Italy and Latvia. In terms of Member States which decided to implement the alternative approach, Austria, Croatia, Cyprus, Czech Republic, Poland, Sweden and the UK generated the required annual energy savings in the period 2014–2015. Several countries have reported an overachievement such as Croatia and Sweden. Good progress towards the Article 7 savings requirements is also achieved by various Member States. In particular, France, Hungary, Italy, Malta, the Netherlands, Romania, Slovakia and the United Kingdom reached or exceeded the expected annual savings for 2014. All other Member States will require additional efforts in the upcoming years to meet their saving requirements. In total, energy savings of 12 Mtoe were achieved in 2014 by EU28

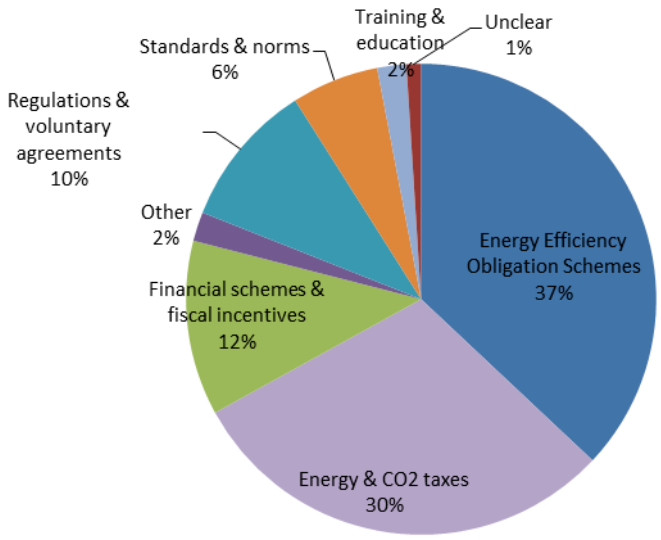


Figure 5. EU28 Energy Savings (ktoe) achieved in 2014 per measure type (JRC analysis).

which amounts to 5 % of the sum of total savings requirements notified by the Member States.

The review of the implementation of the Energy Efficiency Directive has also pointed out some important implementation lessons as we move forward to the revised EED and new timeline to 2030 (Commission, 2016/0376 (COD)). The use of decomposition analysis, in conjunction with econometric methods, is critical in assessing real energy savings and the contribution of various key factors in the progress made towards the EU targets. This is particularly important given the binding nature of the 2030 targets. To track real progress towards targets, the methodology outlined in this paper should be further developed to examine energy consumption trends of individual sectors (e.g. transport, households, industry and services) and countries. This will enable the assessment of the actual progress of energy efficiency at sectoral and country levels independently of other factors such as structural, activity, climatic and lifestyle changes.

In addition, annual reporting by Member States could be further enhanced to allow the European Commission to track more closely the implementation progress of various key articles. The reporting template developed by the European Commission has been a useful data analysis tool that has ensured a harmonised reporting approach by all Member States. This can be further developed to enable tracking of important implementation details such as breakdown of savings by policy measure, calculation methodology of energy savings, use of exceptions etc. An e-reporting platform to collect national data can further facilitate this implementation monitoring process and at the same time create a more efficient system of reporting while reducing administrative burden for national experts. The issue of data gaps in current reporting formats could also be addressed by ensuring that the platform requests a mandatory set of minimum information to be reported by each Member State. Data consistency and other checks can also be embedded in the platform to ensure sufficient data quality. In the new proposed Proposal for a Regulation on the Governance of the Energy Union published by the Commission, the establishment of such a reporting platform is indeed envisaged and is expected to streamline all reporting obligations in the area of energy and climate in an integrated way (Commission, 2016/0375 (COD)). This shall cover all five dimensions of the Energy Union: energy security; the internal energy market; energy efficiency; decarbonisation; and research, innovation and competitiveness. The new platform could therefore benefit from experience with existing reporting processes, such as those established by the Energy Efficiency Directive, and specifically the annual reports. It is therefore important to integrate lessons learned from this analysis in the development of the future reporting platform.

References

Ang, B., 2015. LMDI decomposition approach: A guide for implementation. *Energy Policy,* 86 (C), pp. 233–238.

Commission, 2012. Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32. *Official Journal,* L (315), pp. 1–56.

Commission, 2016/0375 (COD). *Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the Governance of the Energy Union, amending Directive 94/22/EC, Directive 98/70/EC, Directive 2009/31/EC, Regulation (EC) No 663/2009, Regulation (EC) No 715/2009, Directive 2009/,* Brussels: European Commission.

Commission, 2016/0376 (COD). *DIRECTIVE 2012/27/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directive 2012/27/EU on energy efficiency,* Brussels: European Commission.

IEA, 2016. *Energy Efficiency Market Report 2016,* Paris: International Energy Agency.