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Workshop on annual energy savings generated under Article 7 of the Energy Efficiency Directive

Summary of discussed topics

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1 Introduction

The EU Member States have submitted their fourth annual reports due by 30 April 2016 in accordance with Article 24(1) of the Energy Efficiency Directive (EED). These reports include information concerning energy savings achieved in 2014 through the national energy efficiency obligation schemes referred to in Article 7(1) or the alternative measures adopted in application of Article 7(9) in accordance with EED Annex XIV Part 1 point (e).

It is therefore possible for the first time to discuss and analyse how the measures implemented by Member States have actually allowed achieving the annual energy savings requirement under Article 7 of the EED starting from 1 January 2014 (first year of compliance). The claimed energy savings represent an opportunity to better understand how energy efficiency obligation schemes (EEOSs) and related methodologies for energy savings calculation, monitoring and verification have been actually implemented by Member States. In addition, reported energy savings can also allow better understanding of how the established methodologies for calculation and monitoring and verification of energy savings triggered by alternative measures under Article 7 work in practice. It is then now possible to analyse which measures and which economic sectors have generated most of the savings, and whether any deviations compared to ex-ante energy savings calculations have been observed in the amount of actually generated energy savings. In addition, it should also be possible now to better assess the cost-effectiveness of the measures implemented under Article 7. The experience so far by Member States and the information and data processed in their last annual reports allow better analysis of the challenges associated with the different measures implemented when the claimed energy savings have to be validated, monitored and verified ex-post.

In order to discuss the above mentioned aspects with Member States representatives, a workshop on annual energy savings generated through energy efficiency obligation schemes and alternative measures implemented under Article 7 of the EED was organised by DG JRC on behalf of DG ENER (that took place on 15-16 November 2016).
This report discusses the outcomes of this two days event almost exclusively attended by Member States representatives involved in Article 7 implementation. Two consecutive sessions of presentations and discussions have been organised during each day. The first session of the first day focused on lessons learned from measurement, verification and validation of reported savings under Article 7 and corrective actions possibly taken. The second session instead was dedicated to discussing feasibility of and indications that can be derived from cost-effectiveness assessments of implemented EEOSs and alternative measures.

The second day was specifically dedicated to discuss annual energy savings achieved under EEOSs (during the morning session) and alternative measures (during the afternoon session). Participants and speakers were invited to discuss in particular the factors that influenced selection of the policy mix implemented under Article 7, which alternative policy measures work together with an EEOS, the overall performance of the EEOSs and alternative measures (in terms of the implementation and administration in general), whether the savings were achieved as expected, how the measurement and verification worked, including the use of a representative sample, possible adjustments or corrective action needed/ taken.

This report briefly summarises the contents of each presentation by focusing on the input provided by speakers in relation to the above mentioned topics[1]. Topics discussed after each presentation, if any, are also described immediately after the summary provided for each presentation. Where deemed necessary and useful these descriptions have been

[1] More information concerning the points addressed by presenters can be found in the pdf versions of their power point presentations available at http://e3p.jrc.ec.europa.eu/events/workshop-annual-energy-savings-generated-through-energy-efficiency-obligation-schemes

detailed by the authors by including graphs and considerations that can hopefully help better understand the questions at stake and their implications for the annual energy savings to be calculated and reported by Member States in their future annual reports.

2 Overview of the energy savings achieved in 2014 as notified by EU Member States in their 4th annual reports

An overview of the energy savings achieved in 2014 as notified by EU Member States in their fourth annual reports has been presented by Ms. Lelde Kiela-Vilumsone, a representative of the Commission, DG ENER. The preliminary analysis shows that 12.3 Mtoe of final energy savings have been claimed in total by EU Member States for 2014. Ms. Lelde Kiela-Vilumsone pointed out that eight Member States have reported more savings than initially planned for 2014, whilst eleven Member States have over-achieved the average amount estimated for 2014 by totally generating 8.2 Mtoe of final energy savings during this year[2]. Concerning the energy efficiency measures implemented to achieve claimed savings under Article 7, about 37% of total savings have been generated by EEOSs, whilst energy or CO2 taxes have contributed with another 30%, and financial schemes and fiscal incentives have contributed with 12%. Regulations and voluntary agreements have provided 10% of the savings totally claimed, whilst the remaining share (11%) has been mostly generated by training and education measures, standard and norms and other measures. The amount of claimed savings for which the energy efficiency measures that have generated them is not clearly stated corresponded to just 1% of the total amount of savings. The Annual Reports also indicate that six Member States have changed their estimates of savings to be generated by policy measures, whilst eight Member States have announced changes in some of the policies they intend to use under Article 7. Ms Kiela-Vilumsone pointed out that clarifications are needed from Member States concerning energy savings from early actions and supply side actions under exemptions (c) and (d) of paragraph 2, as savings from these exemptions should be accounted separately.

Discussion after the presentation

During the question-answer session that has followed this presentation, it has been pointed out by Member States that further clarifications would be needed from the European Commission concerning the energy savings which are not additional to those generated by the EU regulations (e.g. the eco-design regulation for boilers), as it seems that in some cases (e.g. under existing EEOSs) these savings might have been counted for the achievement of national energy savings requirements.

A further point of discussion has related to how to notify possible changes in actions implemented under given policy measures. In this respect, the DG ENER representative has pointed out that some Member States have notified individual actions, and although it is not required to notify about implemented individual actions, this could be considered as good practice.

Some Member States asked whether the overachievement of the savings requirement in the current period (2014-2020) would be taken into account in view of the next obligation period (2021-2030), to which the Commission replied that the review of Article 7 considered this aspect.

[2] Each of these Member States has generated more energy savings compared to the average amount of estimated savings per 2014 (assuming the linear distribution of 1.5% savings over the obligation period, excluding exemptions).

3 Examples of lessons learned from the measurement, verification and validation of reported savings under the EEOS

Examples of lessons learned under the Austrian energy efficiency obligation scheme have been presented by Mr. Gregor Thenius from the Austrian Energy Agency. He indicated how total savings reported for 2014 by Austria (i.e. 29,898 TJ of final energy) are distributed among the various measures considered. Besides the EEOS, eight alternative policy measures are notified by Austria under Article 7. Most of the savings in 2014 have been generated by energy taxes (22,780 TJ), whilst the Austrian EEOS has generated 2,585 TJ, the Housing and Energy Support Scheme implemented for Federal Provinces and the so-called renovation vouchers have generated together other 1,940 TJ, and the Operational Domestic Environmental Support (UFI) generated other 1,469 TJ. When it comes to implemented actions, most of these savings have been generated by actions retrofitting heating and hot water systems (33%) and buildings envelopes (27%).

The Austrian representative has pointed out that the focal point of the Measurement and Verification (M&V) system in Austria is the Monitoring Agency (i.e. the Austrian Energy Agency) that implements its tasks for the Federal Ministry of Science, Research and Economy with the support of an IT service provider. This agency interacts with energy suppliers, public authorities, energy consuming enterprise and energy service providers. Its tasks consist in the definition of the data to be exchanged among all these parties, in keeping a registry of all obligated companies and administrators of alternative measures, in the assessment of the qualification of energy service providers, in the development of energy savings calculation methods, in the preparation of the energy efficiency action plans, in the control of the EEOS, in the evaluation of EED target achievement and in the monitoring of the Austrian energy service market. A major share of the estimated energy savings are based on pre-defined and standardised bottom-up calculation methods (deemed savings). More elaborated calculation methods developed by qualified experts are however also used.

Achieved savings are reported on an annual basis by obligated companies and administrators of alternative measures registered at the Monitoring Agency via an on-line database. Data to be reported include the type of measures considered, their implementation date and information on the customer where these savings have been generated. Control checks are performed by the agency on the submitted data, and they consist of:

1) automatized plausibility checks, whereby consistency among data and possible double counting is checked;

2) desk checks of representative samples based on paper files;

3) on-site checks performed for 25 days per year.

The additionality of the energy savings is established by making eligible only those measures fostering actions going beyond legal requirements set by EU and/or national law and that achieve better energy performances compared to the existing stock and the market average. In case of installation of new appliances, the energy consumption baseline is set by considering the minimum legal efficiency requirement set by the relevant national or Ecodesign regulation. If no legal requirement is in place, the market average is instead considered.

In case of replacement of existing products, the legal minimum requirement defines the baseline only if the replacement is made mandatory by a national law[3]. Otherwise, the baseline is set at the market average, or at the stock average in case of early

[3] For example, in case a hypothetical measure would *oblige* to change all installed boilers not complying with minimum energy performance requirements, these requirements would define the energy consumption baseline.

replacement stimulated by the measure[4]. Mr. Thenius has provided a series of practical examples showing how these criteria are applied in Austria.

Moreover, he pointed out that the double counting of actions under a same measure is avoided thanks to the on-line database which contains information on all actions implemented by customers as well as information on implementation sites and on the customers themselves. In order to avoid double counting among different measures a conservative approach is adopted and one action is counted under only one measure in case more measures may have fostered its implementation. Finally, he listed a series of success factors concerning the M&V system in Austria. These factors are stemming from the experience on reporting under the Energy Service Directive, also by standardisation of reporting procedures, by clear definitions of eligible measures and of evaluation requirements, by the employment of default values for energy savings generated through standardized actions, by regular updates of these values, by regular and mostly on paper checks, by the use of a database and by the definition of clear and transparent M&V rules communicated to all affected parties.

Discussion after the presentation

It was pointed out by participants that double counting is practically impossible to avoid in case of energy or CO2 taxes in conjunction with other measures. In relation to energy or CO2 taxes, it was however highlighted that double counting can be limited to a certain extent if only short term elasticities are considered for the evaluation of the impact.

Concerning energy savings calculation methods, it has been stressed by the Austrian representative that the development of these methods is particularly difficult in the industry sectors due to the complexity and specificity of the industrial installations. This is a very important issue for Austria, because one company of this country is responsible for one-third of the CO2 emissions generated by the whole nation. The Austrian Energy Agency calculates energy savings generated in this sector based on reports produced by companies where calculation methods are described. The appropriateness of these methods (correctness of the assumptions made, compliance with the rules, etc.) is also assessed by the agency. In relation to the difficulties associated with the calculation of energy savings generated in the industry sector, it has been signalled that a Horizon 2020 project named EU-MERCI is trying to build a good practices database where exemplary methods to calculate these energy savings are described[5].

Participants also discussed the aspect of how energy savings are additional to those possibly generated by EU regulations. The questions raised have pointed to the different energy consumption baselines and energy savings lifetimes that can be considered by the Member States to perform the calculations. Although not discussed during the workshop, some general considerations related to this aspect are formulated in the following box by the authors of this report.

[4] If the case of a policy measure providing substantial economic incentives for the substitution of inefficient residential refrigerators is taken as an example, it can e.g. be assumed that a) the average consumption of the installed refrigerators stock is 700 KWh/year; b) average consumption of the (new) refrigerators available on the market is 300 KWh/year; c) incentives provided through the measure stimulate the installation of new, more efficient refrigerators consuming 200 KWh/year. According to the information provided by Mr. Thenius, the energy consumption baseline considered in Austria is 700 KWh/year if it can be assumed that the measure being considered stimulates an early replacement of refrigerators.

[5] For further information on this project see http://www.eumerci.eu/objectives/

Box 1. *Calculation of energy savings generated by policy measures and energy consumption baselines*

In relation to the calculation of savings that are additional to those stemming from the application of EU legislation and by policies that would have been implemented at national level also in the absence of Article 7, *three* energy consumption baselines could generally be considered by Member States for mass market products[6]:

1) the average consumption of the installed stock;

2) the average consumption of products available on the market;

3) the maximum energy consumption allowed by EU regulations.

The installed stock can be considered as the baseline to calculate additional energy savings only in case it can be proven that the measure under evaluation has stimulated an early replacement of products[7]. This baseline however, should always be considered in conjunction with the average consumption of products available on the market for the calculation of total gross energy savings generated by the early replacement of a given product. For example, annual gross energy savings[8] generated by an energy efficient product with lifetime L should be calculated by using the baseline of the stock for a number of years N representing the amount of time by which its replacement has been anticipated because of the measure. The market average should instead be considered as baseline for the years after which the substituted product would have stopped functioning (i.e. L-N) (see Figure 1)[9] .

[6] Mass market products are mentioned here because an average market and stock consumption can be properly defined only for products sold or installed on a large scale.

[7] Notice that early replacement actions are typically just a limited fraction of the totally implemented substitution actions caused by non-regulatory policy measures. This is due to the fact that these measures typically remain anyhow in force for several years and provide economic incentives which are sufficient to convince only a limited number of participants in the measure to substitute their products well before their end of life.

[8] *Gross* energy savings are mentioned here because a series of correction factors should be considered for calculating *net* energy savings (e.g. double counting, spill over effects, free rider effects, etc.).

[9] Let's consider the case of a policy measure providing substantial incentives for the purchase of energy efficient refrigerators in a country. Let's then assume that a) the lifetime of refrigerators is 15 years; b) this measure anticipates the substitution of installed refrigerators of 8 years on average; c) the average consumption of the installed old refrigerators (i.e. the installed stock) is 700 KWh/year; d) the average consumption of the refrigerators available on the market is 300 KWh/year; e) incentives provided through the measure stimulate the installation of more efficient refrigerators consuming 200 KWh/year on average. Total energy savings generated by a single action during the first 8 years will amount to (700-200)*8=4000 kWh because the refrigerator owner benefitting from the incentive would have continued consuming 700 kWh/year in the absence of the policy measure. Total energy savings generated during the following 7 years will instead amount to (300-200)*7 = 700 kWh because in the absence of the policy measure the same owner would have bought the average product available on the market once his/her already installed refrigerator would have ended its life. The total cumulative amount of energy savings generated by each anticipated substitution caused by the policy measure is therefore 4000+700 = 4700 kWh over the 15 years lifetime. The example provided here and the associated energy saving calculation are consistent with what reported in the caption of Figure 1.

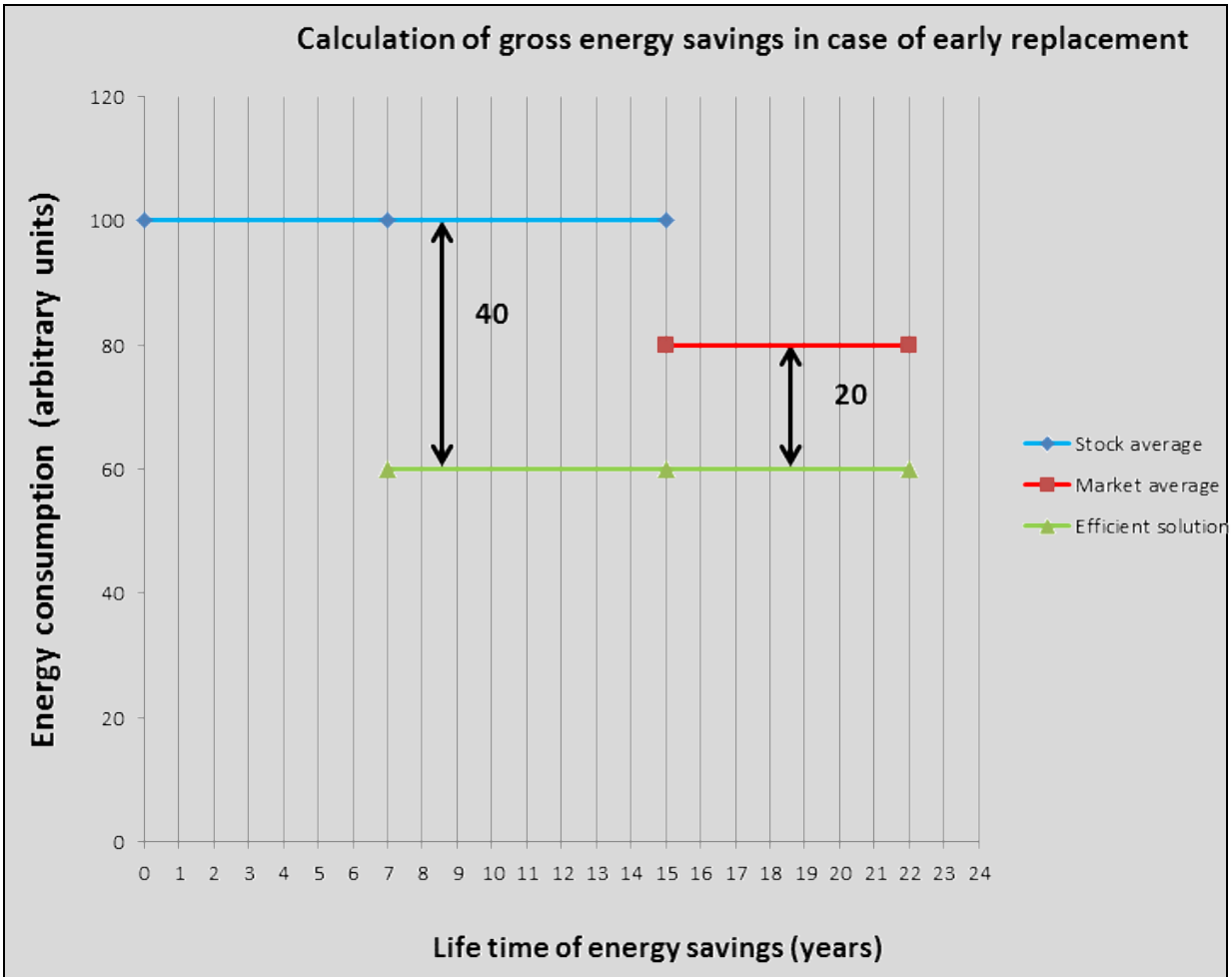

Figure 1: example of calculation of additional gross energy savings (arbitrary units) in case of early replacement of a mass market product with a lifetime of 15 years. The average product of the stock is assumed to consume 100 and to be substituted at the end of year 7 (i.e. product replacement is anticipated by 8 years). The reference consumption of the market average is assumed to be 80 and the consumption of the efficient solution is assumed to be 60. Additional gross energy savings amount therefore to (100-60)x8+(80-60)*7=460.

It goes without saying that the stock cannot be considered as the baseline in case the energy efficient product installed represents an already programmed substitution[10], or it does not substitute any product, or in case the efficient product is installed in a new building (i.e. in case the product type in question is installed for the first time)[11]. As far as the reference consumption 3) is concerned, in case of programmed substitution (i.e. in case an early replacement is *not* taking place), it may in principle either happen that the value of this reference consumption lies above or below the market average consumption (see Figure 2). In the former case the market average should be considered as baseline, whilst in the latter case the reference consumption baseline to be considered for the calculation of additional energy savings should be set at the levels defined by EU law (see Figure 2).

[10] As hinted in a previous footnote, programmed substitutions (i.e. substitutions that would have occurred anyhow and that are affected by a policy measure only in relation to the type of substituting solution that will be installed) generally represent the majority of actions addressed by non-regulatory policy measures. In case of regulatory policy measures (i.e. in case of policy measures *obliging* energy end-users to implement given types of energy efficiency improvement actions), it can be assumed that the number of programmed substitutions addressed decreases substantially in relative terms.

[11] This implies, for example, that, in countries where condensing boilers constitute the reference consumption baseline, the installation of these boilers can be assumed to generate additional energy savings only in case this installation represents an *early replacement* of an existing boiler in an existing building.

It has nevertheless to be noted that eco-design requirements are mandatory EU norms and the commercialisation of products with energy consumption values above possible related eco-design requirements is therefore forbidden when these requirements enter into force. Due to this reason, the market average consumption is generally assumed to be lower than the maximum consumption levels allowed by eco-design requirements for specific a product group. The case b) represented in Figure 2 should therefore be very rare[12] and the reference baseline consumption to be considered for the calculation of additional energy savings of programmed substitutions would be the *market average consumption* for the large majority of products for which eco-design requirements are in place.

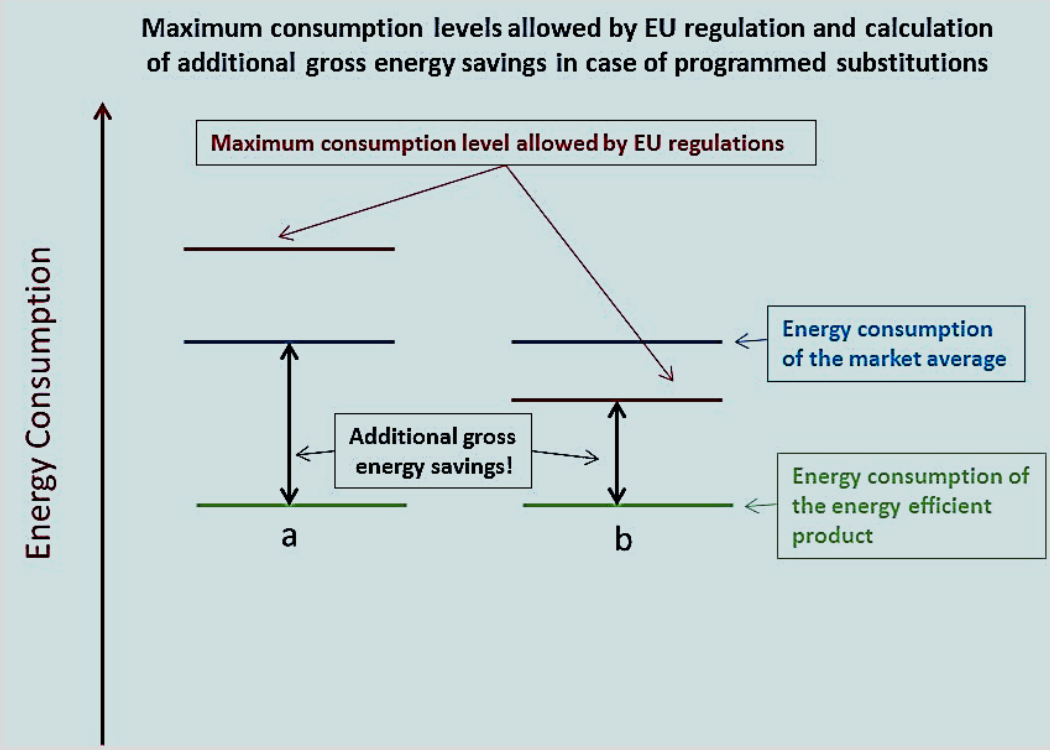

Figure 2: for programmed substitutions of mass market products for which maximum energy consumption levels are established by EU regulations, the amount of additional gross energy savings that are generated depend on the position of the national market average consumption levels with respect to the EU maximum levels. The example (a) above refers to a case where EU levels are above the national market average, whilst the example (b) refers to a case where EU levels are below the national market average.

[12] The case b) of Figure 2 may occur e.g. for programmed substitutions and given non-regulatory policy measure (e.g. an economic incentive campaign for a highly energy efficient product type for which minimum energy performance requirements are set by EU regulations) exerting such a strong push on participant energy end-users that these end-users change their minds concerning the product type they would like to purchase. It might, for example, be assumed that a given policy measure could have such a strong impact to convince (some of) the participant energy end-users to realise their programmed substitutions by installing heat pumps (for which minimum performance requirements are established in the eco-design regulation 831/2013) instead of electric space heaters. If it might be demonstrated that these substitutions are caused by the policy, the application of Article 7 additionality requirement would entail that the calculation of associated energy savings reflects the case b) of Figure 2 and less energy savings would be attributed to these programmed substitutions compared to those actually generated. Rather than by the market average consumption of *electric space heaters,* the consumption baseline to be considered would correspond in this case to the eco-design maximum consumption levels established for heat pumps. The probability that non-regulatory policies can have such a strong impact on programmed substitutions has however to be considered as very low. Referring to the previous example of policy for heat pumps, it seems much more reasonable to assume that participant energy end-users realising their programmed substitutions by installing heat pumps would install this product category also in the absence of the non-regulatory policy. If this is the case, the calculation of associated energy savings must reflect the situation depicted under case a) of Figure 2. The reference consumption baseline to be considered for programmed substitution is indeed the average consumption of *heat pumps* available on the market and this reference consumption is certainly lower than the maximum consumption levels established for heat pumps by the eco-design regulation 813/2013.

The same type of considerations applies also to early replacements caused by non-regulatory policy measures. Referring to Figure 1 above, the probability that minimum energy performance requirements should be considered (instead of the market average consumption) as the reference consumption baseline after the natural end of lifetime of the inefficient solution is very low[13], i.e. the number of actions for which eco-design requirements, instead of market average consumption, have to be considered for the calculation of annual energy savings generated after the end of life of the inefficient solution, is very low.

In conclusion, part of the above considerations have been produced to show how the additional energy savings should be calculated in case of policy measures targeting products for which eco-design minimum energy performance requirements are in force under EU law. It has been discussed that for most of the policies these savings are those resulting from calculation methods assuming that the reference consumption baseline is the average consumption of products available on the market and not the eco-design minimum energy performance requirements. Article 7 of Directive 2012/27/EU requires that Member States count those savings that exceed the minimum energy performance requirements set under the relevant eco-design regulations, while referring to the market average consumption in their respective country will reflect more accurately the national context.

Another question was raised in relation to whether electricity generated by photovoltaic panels can be claimed as energy saving in line with Article 7 requirements. One Member State representative claimed that the electricity produced from PV panels used for own consumption reduces the amount of energy sold by energy distributors and retail energy sales companies and thus can be considered as energy saving measure under article 7. This interpretation, however, does not change the amount of energy consumed by the building and thus it is not in line with the energy savings definition referred to in Article 2(5) of the EED[14] which is the main objective of Article 7(1).

A final question related to criteria used to select the actions to be verified by the Austrian Energy Agency and the staff of the agency involved in performing the monitoring and verification. The agency performs a series of plausibility checks on data provided for most of the projects submitted. Another part of verified projects is then selected randomly (about 4% of projects submitted per each measure, sector and technology is selected in this way). Other projects are then checked following indications about potential evaluation problems received from the agency. Concerning projects to be verified on-field, no distinction is made between standardised and not-standardised actions during the selection phase. It may then be worth mentioning that in case of non-compliance, the monitoring agency cannot apply penalties. It can just inform the competent authorities. It has also been pointed out that the agency employs 10 full time equivalent persons (out of the 90 persons representing the total staff of the Agency) during the peak times when on-field verifications are performed.

[13] The time period after the natural end of lifetime is given by the period starting at year 15 and ending at year 22 in Figure 1 above.

[14] 'energy savings' means an amount of saved energy determined by measuring and/or estimating consumption before and after implementation of an energy efficiency improvement measure, whilst ensuring normalisation for external conditions that affect energy consumption.

4 Assessment of cost-effectiveness of implemented EEOSs and alternative measures and factors which were detrimental to it

4.1 Examples under existing EEOSs

Mr. Tadeusz Skoczkowski from the Warsaw University of Technology presented the **energy efficiency obligations implemented in Poland** as a case for the assessment of the cost-effectiveness of EEOSs. His presentation mainly focused on the description of the design features of the Polish scheme and did not mainly address the cost-effectiveness aspects. The Polish representative showed however how the tendering system in Poland poses significant administrative costs that could probably be eliminated by possibly designing and implementing a white certificates trading system. Moreover, he provided some data whereby cost-effectiveness of the EEOS can be estimated, as he presented some estimates on the expected increases in energy prices caused by EEOSs in the years from 2016 to 2020. Concerning year 2016, the presentation showed that this increase has been estimated to amount to 1.80%, 1.33% and 0.73% respectively for gas, heat and electricity sold in the country.

4.2 Examples under Alternative Policy Measures

Mr. Vlasis Oikonomou from the Institute for European Energy and Climate Policy focused his presentation on an assessment of the **cost-effectiveness of EEOSs and alternative measures implemented under EED Article 7**. He pointed out that alternative measures are generally considered by Member States for the promotion of energy efficiency improvement actions characterised by higher investment costs by end-users (buildings comprehensive renovations, solid wall insulation, etc.). EEOSs are instead proving more effective in stimulating the installation of well known, lower cost and mass market products (e.g. energy efficient lamps, refrigerators, boilers, etc.).

He illustrated that costs generated by energy efficiency measures (either EEOSs or alternative measures) generally consist of:

1) program costs (i.e. measures costs borne by citizens and usually paid through their energy bills);
2) participant costs (i.e. capital costs made by the money spent by end-users addressed by the measures who implement related energy efficiency improvement actions);
3) transaction costs, i.e. costs not directly due to the implementation of energy efficiency improvement actions and borne by participants in the measures (either direct participants or involved third parties) to comply with administering the measures (e.g. costs associated with the document management concerning generated energy savings, contracts stipulation, identification of end-users willing to implement actions under EEOSs, etc.)[15];
4) administrative costs, i.e. costs borne by the authorities implementing the measures.

Clearly, these types of costs generally overlap (e.g. costs borne by the citizens and recovered through energy bills may overlap with costs borne by the implementing authorities or by third parties participating in carrying out the measures) and cannot be summed up to estimate the total cost of the implementation of the measures.

[15] For a description of transaction costs of associated with an EEOS and of how they can be estimated see, for example, Mundaca, L. (2007). Transaction costs of Tradable White Certificate schemes: The Energy Efficiency Commitment as a case study. Energy Policy, 35, 4340-4354.

Overall, the estimate of these total costs is a very difficult exercise, although it can be reasonably assumed that these costs are entirely borne by energy end-users for both EEOSs and alternative measures. Mr. Oikonomou warned against the misleading indications that can be derived from a comparison of measures based on their estimated cost-effectiveness. The difficulties of such a comparison (especially when performed between measures implemented in different countries) are mostly due to the fact that there is not an homogeneous way to assess the cost-effectiveness, that one measure generally interact with the other measures in a given country and that ex-posts evaluation of real costs incurred by measures are generally not performed.

Moreover, it cannot be assumed that costs estimated for a measure in a given country will be the same when this measure will be implemented in another country, due to many variables that can differentiate the measure costs generation among countries. Concerning interactions among the measures, Mr. Oikonomou pointed out that information and energy advice programmes, standards and norms and energy labelling schemes generally serve to complement (i.e. they serve to design and effectively implement) other measures[16]. EEOSs, grants, loans, on-bill finance and tax rebates could in principle be implemented as stand-alone without decreasing their cost-effectiveness. In several EU countries these measures are nevertheless implemented in combination (e.g. tax rebates can be awarded to end-users for actions eligible under EEOSs in some countries). He also stressed that the cost-effectiveness is not the only criterion to be applied to establish whether the implementation of a measure is desirable or not (for example, taxation is generally limited by its low political acceptability, measures stimulating innovative technologies may be characterised by high costs that might be recovered when these technologies become more mature and widespread, some measures may be designed to address specific social aspects, e.g. fuel poverty, which go beyond energy saving objectives).

This being said, Mr. Oikonomou presented the results of some performed cost estimates indicating that in the case of EEOSs, participant costs generally range between 1.5-3 times programme costs, while administrative costs do not usually exceed 1.5% of the overall programme costs. EEOSs seem to be particularly cost effective as their total costs (i.e. capital plus administration costs) in the EU countries where they have been implemented for the longer time period (e.g. France, Denmark, Italy, UK) range from 0.4 Eurocent/kWh to 1.7 Eurocent/kWh and these values are significantly below energy prices in those countries. Despite the huge difficulties often associated with cost-effectiveness assessments, there are some general approaches to EEOSs implementation that can contribute to reducing the associated total costs (e.g. widening the scope of the scheme either in terms of obligated and participating parties, or in terms of sectors and end-use technologies covered, in facilitating access to third parties project financing and in creating guarantee funds).

Discussion after the presentation

The discussion that has followed the presentation mostly focused on debating which types of policy measures may be more cost-effective. According to Mr. Oikonomou, when the focus is restricted only to subsidy schemes, tax rebates are considered as the most cost effective measure. He also pointed out that combining tax rebates and EEOSs can also serve to increase the cost-effectiveness of single measures. Several participants seemed to agree on the point that the most cost-effective policy solution is often represented by a combination of policy measures and that the cost-effectiveness of measures depend on the time when they are implemented (the most cost-effective solution today, may not be the most cost-effective solution tomorrow). Concerning this latter aspect, in the case of an EEOS, it is important to regularly update the scheme in

[16] For example, energy labelling schemes might be used to provide economic incentives for the purchase of given appliances, standards can be applied to define minimum energy performance requirements of products available on the market, information and energy advice programmes can serve to participate in tax deduction or tax credit schemes, etc..

order to retain its effectiveness (notably in relation to energy savings associated with single eligible actions, type and number of participating actors, sectors addressed).

Moreover, it was pointed out that EEOSs can become very cost-effective policy mechanisms in so far as:

a) they provide a stable system for financing (i.e. they are not necessarily put under discussion by the legislator every year);

b) they allow involving a lot of actors and achieve a geographical coverage that cannot be easily achieved with alternative measures;

c) they stimulate obligated parties to sell energy services instead of just selling energy.

The cost-effectiveness of EEOSs depends also on the sectors addressed and this conclusion applies also to other types of policy measures typically considered in the existing literature as a very cost-effective instrument (i.e. energy or CO2 taxes). Energy and CO2 taxes have been indicated in particular as cost-effective in the industry sector, while their cost-effectiveness in the household sector has been put under question during the discussion. A final point discussed related to the issue that the introduction of a tendering system for energy saving certificates may artificially reduce the cost-effectiveness of an EEOS. This point has been raised for the EEOS implemented in Poland. A Poland representative, Mr. Skoczkowski, has highlighted in this respect that policy makers in Poland are considering abandoning the tendering system for this reason, despite the fact that it might imply that the existing EEOS becomes less controlled from the administrative point of view (and an over or undersupply of certificates can hence be generated in the existing market) and that the costs of verification of energy savings associated with energy efficiency improvement actions become higher.

5 Energy Savings Achieved under EEOSs

Energy savings achieved under the EEOSs for the purpose of Article 7 have been discussed for the cases of Italy, France, Denmark, Ireland and Bulgaria.

5.1 EEOS in Italy

Mr. Alberto Jr. Pela from GSE[17] presented energy savings achieved under the Italian EEOS. This scheme has been implemented in 2004 and represents one of the first examples of EEOSs in force in Europe. It is expected to deliver 60% of the total amount of Italy's energy savings under Article 7 by 2020 (the two other measures considered by Italy are a tax rebate scheme on energy efficiency in private buildings and an incentive scheme for small interventions on energy efficiency improvements and thermal energy generation from renewables in private and public buildings).

Final energy savings generated by the Italian EEOS under EED Article 7 for 2014-2015 amount to 1.8 Mtoe, whilst expected final energy savings for the period 2014-2020 correspond to 16 Mtoe. These energy savings are the sum of energy savings generated by individual energy efficiency improvement actions implemented in all economy sectors and calculated by using either deemed savings, or metering savings, or scaled savings calculation methods. The additionality is ensured through the definition of reference consumption baselines representing the business as usual scenario which are regularly updated.

During the year 2015, 64% of the energy efficiency certificates[18] issued in Italy related to the actions implemented in the industry sector, 32% concerned the installation of energy efficient solutions (other than energy efficient lighting systems) in public and private buildings and the remaining 4% concerned energy efficient lighting systems installation. Overall, Mr. Pela presented the EEOS as a success story in Italy. National energy saving targets established under this scheme have always been achieved since its implementation and its associated total costs seem to be relatively low. Mr. Pela pointed out several times that the success of the scheme was thanks to a continuous adaptation to the changing market conditions. The scheme has managed to involve a large variety of participating parties (e.g. ESCOs, energy distributors, industries, etc.) and has given participating parties the possibility to choose among a large series of energy efficiency improvement options to obtain the certificates whereby gas and electricity distributors comply with their energy saving obligations. Concerning the policy mix chosen, Mr. Pela and other workshop participants pointed out that the case of Italy proved quite effective in so far as interactions among different policy measures were kept very limited and different measures were chosen for different sectors[19].

Discussion after the presentation

It has been pointed out by some participants that the fact that Italian energy distributors recover the costs borne to comply with their obligations through electricity and gas tariffs applied to energy end users and the fact that white certificates are mostly implemented in the industry sector imply that households are financing energy efficiency in industry.

[17] GSE (Gestore Servizi Energetici) is the state-owned company which promotes and supports renewable energy sources in Italy. GSE is also in charge of EEOS administration together with ENEA (Italian National Agency for New Technologies, Energy and Sustainable Economic Development), GME and the Ministries of Economic Development and the Environment.

[18] One energy efficiency certificate issued in Italy corresponds to 1 toe of primary energy saved. The number of certificates issued in one year cannot be easily converted into savings generated into that year because 1) these certificates relate to energy savings that are generated during the whole lifetime of the energy efficiency solutions installed; 2) given amounts of certificates are issued as a bonus (i.e. they are not associated to the generation of energy savings) in case of projects implemented in the industry sector and can be exchanged like all other certificates on the existing energy efficiency certificates trading market.

[19] As already mentioned, the white certificates scheme is mainly focused on industry. The tax rebate scheme targets energy efficiency improvements, and the incentive scheme implemented for private and public buildings targets small interventions on energy efficiency improvements plus the installation of systems for thermal energy generation from renewables.

In other words, the Italian white certificate scheme might be seen as a system to finance industry investments through the money paid by households.

It has been also pointed out that a similar potential problem has been observed under the Austrian EEOS and, for this reason, 40% of the energy savings obligation must be complied through projects implemented at household premises in this country. The Italian representative specified that the reasons why this aspect does not seem to represent an issue in Italy is due to the fact that households are possibly not aware of the existence of an EEOS obligation in Italy, and also of how the money paid through their electricity and gas bills are used by the government.

Other questions raised during the discussion related to costs of the Italian EEOS. Mr. Pela has mentioned that EEOS costs amount to approximately 4 Euros/year per costumer of electricity distributors and to 10 Euros/year per costumer of gas distributors. Moreover, he pointed out that the intensive monitoring and verification activities are mainly paid through fees to participating actors applied since 2015. Project implementers asking for the evaluation of their energy savings monitoring plans[20] and for the energy savings certificates to be used under the EEOS have to pay a series of fixed and variable fees. The amount of the fixed fees to be paid[21] to the GSE[22] for project certification varies from 200 Euros to 2500 Euros depending on projects size, whilst the fixed amount to be paid to the GSE for the evaluation of the energy savings monitoring plans ranges from 100 Euros to 2000 Euros. A variable fee of 1.1 Euro has then to be paid for each certificate issued only if the projects result in generating more than 100 certificates[23]. Mr. Pela also mentioned that obligated parties have paid around 600 million Euros to comply with their obligations in 2014. A final point addressed during the discussion related to the amount of staff involved in M&V activities. Mr. Pela has mentioned that the accomplishment of these activities requires around 20 GSE persons plus 10 ENEA[24] persons.

5.2 EEOS in France

Ms. Marie Pausader presented the annual energy savings achieved under the French EEOS. This scheme is in place since 2006 (the first obligation period started in July 2006) and, like the Italian EEOS, it has an energy savings certificate trading system.

Energy efficiency improvement actions eligible to white certificates can be implemented in all sectors, excluding the installations covered by the European emission trading system (ETS). The large majority of the white certificates issued relates to standardised energy efficiency improvement actions for which specific worksheets allowing the calculation of the amount of white certificates[25]to be issued have been produced. Human resources involved in activities related to administering the scheme, including the M&V, white certificates registry maintenance and provision of expertise for running the scheme range in total from 17.5 to 22.5 full time equivalent persons.

Total costs of the scheme are estimated to amount to 700 M€/year in the period between 2015 and 2018 and they are expected to cause an increase of energy prices to around 1%. The French EEOS is the main policy measure for the purposes of Article 7. Most of the savings generated under this scheme in 2014 originated from actions implemented in the residential sector (57%), whilst actions implemented in the tertiary, industry,

[20] Energy savings resulting from monitoring plans correspond to the metered savings as defined in EED Annex V.
[21] These amounts might have to be paid either by obligated parties or by the other actors eligible to participate in the EEOS (e.g. ESCOs and municipalities).
[22] GSE (Gestore Servizi Energetici) is the state-owned company which promotes and supports renewable energy sources in Italy. GSE is also in charge of EEOS administration together with ENEA (Italian National Agency for New Technologies, Energy and Sustainable Economic Development), GME (Gestore dei Mercati Energetici) and the Ministries of Economic Development and the Environment.
[23] On this point, see information included on page 6 of the GSE report available at http://www.gse.it/it/salastampa/GSE_Documenti/Tariffe%20oneri%20GSE.pdf
[24] Italian National Agency for New Technologies, Energy and Sustainable Economic Development.
[25] One Certificate corresponds to 1 KWh Cumac, which is calculated for each action by applying an annual discount rate of 4% over the total amount of savings generated by this action during its estimated lifetime.

transport and agriculture sector have respectively generated 25%, 15%, 1% and 2% of the total savings achieved in this year.

Actions implemented in the residential sector were mainly insulation of walls and roofs and installation of condensing boilers. Ms. Pausader has explained the different phases of the calculations to be performed in order to convert the energy savings from the actions implemented under the EEOS into the energy savings to prove compliance with Article 7. These phases include the identification of actions implemented in a given year, the removal of extra savings awarded as a bonus and of actions which do not fulfil the additionality requirement; then, the conversion of the units[26] used under the French scheme into the units used under the EED, the calculation of the energy savings that can be associated with each action for the period 2014-2020 by taking into account its specific lifetime, the sum of the savings associated with each implemented action.

To illustrate, Ms. Pausader showed that the amount of white certificates issued in France in 2014 corresponds to 242 TWh cumac, which represents[27] the total amount of discounted savings that will be generated during the whole lifetime of actions implemented in 2014. This amount is reduced to 184 TWh cumac when only actions and savings fulfilling Article 7 eligibility criteria are considered. Out of these 184 TWh cumac, only 86.6 TWh are then expected to be generated over the period 2014-2020 and only 15.42 TWh were generated during 2014. French representative concluded her presentation by illustrating the following main challenges associated with the calculation of energy savings under Article 7[28]:

- Only energy savings beyond eco-design requirements are eligible under Article 7. The amount of savings that can be counted under Article 7 compared to the savings counted under the French scheme is therefore lower.
- Only a limited fraction of the energy generated from renewables can generally be counted under Article 7.
- Many actions were implemented in 2013 in prevision of future objectives, whilst the number of actions implemented during 2015 and 2016 was lower than expected. Actions implemented in 2013 are however only eligible under Article 7 as early actions referred to in Article 7(2)(d)and subject to the limitations set by Article 7(3).

Discussion after the presentation

During the discussion it has been explained by the French representative that actions implemented in the residential sector are responsible for most of the savings achieved in 2014 because these actions benefit from existing tax incentives. Obligated parties are becoming aware that actions implemented in the tertiary or industry sector may be cheaper in some cases. A question was raised on the tax credits which have stimulated a lot of investments during 2014 in France[29] and it would be useful to understand which part of the savings claimed under the France EEOS are actually generated because of the presence of these tax incentives. In this respect, it has been highlighted that only savings generated under the French EEOS are reported to avoid double counting.

[26] Final energy savings considered under the French scheme are expressed in term of kWh Cumac and have therefore to be converted into kWh.

[27] The total amount of discounted energy savings generated during the whole lifetime of actions is given by the amount of associated annual energy savings times their estimated lifetime times their actualization factor. This actualization factor (AF) is calculated through the formula $AF = 1+(1/a)x(1-1/(1+a)^{n-1})$ where *a* is the discount factor and *n* the energy savings lifetime. To make a quantitative example, let's assume that one action allows saving 1 MWh per year during 10 years. Considering that the discount rate applied to generated energy savings under the French EEOS is 4%, AF = 8.44. The amount of kWh cumac assumed to be generated by this action during its lifetime is therefore $10^6 \times 10 \times 8.44 = 8.44 * 10^6$ kWh.

[28] The amount of energy savings awarded to obligated parties under the French EEOS does not equal the amount of energy savings that can be claimed under Article 7 for the list of above mentioned reasons.

[29] According to Mr. Oikonomou these sustainable development tax credits have determined 6 billion Euros investments in France during 2014.

5.3 EEOS in Denmark

Mr. Peter Bach from the Danish Energy Agency presented the achieved energy savings under the Danish scheme, which is one of the oldest schemes implemented in Europe[30]. This scheme has been designed to meet the Denmark's objective of reducing the dependence on fossil fuels by 2050. It is probably for this reason that, besides actions implemented at energy end-users, also actions related to conversion from fossil-fuel to renewables and electrification can be counted towards the national energy saving targets. The national targets established under the scheme during the 3-4 years obligation periods that have been established since 2006 have been progressively increased. Most of the claimed savings are generated in the industry sectors and claimed savings generated in the supply side have started representing a significant part of the total claimed savings (notably since 2015)[31].

The costs of the scheme for obligated parties (i.e. energy distributors) increased during 2014-2015 probably due to the significant increase in the targets and to a not as high increase in the capacity in achieving these targets by energy distributors. The annual targets set for the period 2015-2020 in Denmark amount to 3% of the final energy consumed in 2014. This target corresponds to more than the double of the EED Article 7 target but, as it can be inferred also from information so far reported, it can be achieved through actions[32] which are not eligible under Article 7. Most of the energy savings generated in 2015 have concerned a reduction in the consumption of districting heating, electricity and natural gas. Contrary to what happening in other countries, eligible savings under the Danish EEOS are only those generated during the first year of functioning of implemented actions[33]. The energy saving calculation methods considered under this scheme include deemed savings, scaled savings and surveyed savings methods. Deemed savings have been mainly employed in the household sector, whilst energy savings generated in the public, commercial and industry sectors have been almost exclusively calculated by using scaled savings methods. Surveyed savings have been used only to limited extent and only in the residential sector. This calculation method will probably disappear in the future due to its complexity and costs. Obligated energy distributors are regulated monopoly companies that do not have a direct link with energy end-users[34,35] and have to involve other actors (e.g. engineering companies, plumbers, construction companies) to comply with their obligations[36]. Obligated parties must prove to have signed a contract with their customers before the implementation of the actions and to have contributed to this implementation.

Obligated parties are also responsible for verification, documentation and reporting as well as for the application of quality control systems and the realisation of annual audits. The Danish Energy Agency plays the role of independent monitoring agency and performs annual random controls on claimed savings, whilst an independent evaluation is performed every three years[37]. As mentioned in the following paragraph, specific calculations and actions selections have to be performed in order to assess the amount of savings eligible under the Danish scheme that can be counted to prove compliance with EED Article 7. The amount of annual savings reported to the European Commission is

[30] The scheme was introduced in 2006

[31] Which are subject to the exemption of Art. 7(2)c) to comply with Article 7. For more detailed information see presentation of Mr. Bach : http://e3p.jrc.ec.europa.eu/events/workshop-annual-energy-savings-generated-through-energy-efficiency-obligation-schemes.

[32] Eligible actions can be implemented in all end-use sectors including sectors covered by the European Emission Trading System. Installation of biomass and PV panels are not eligible, but the installation of solar collectors can be counted for achievement of the national targets.

[33] Weighting factors of 0.5 or 1.5 can be applied to the calculation of these savings depending on the lifetime of the actions whereby they are generated.

[34] Energy companies having a direct link with energy end-users are typically retail energy sales companies.

[35] These actors have not the required competencies and, being regulated, are generally not allowed to make business by implementing energy efficiency services at energy end-users.

[36] It has been estimated that around 300-400 actors are involved overall in the implementation of actions.

[37] Compared to annual random controls, this independent evaluation relates to a bigger sample and is not limited to the verification of the energy savings claimed by obligated actors.

indeed calculated by excluding the weighting factors applied to the first year savings considered to prove compliance with the national targets[38]. Moreover, energy savings associated with the installation of new boilers and conversion to other heating systems also have to be corrected due to eco-design minimum requirements to be applied in order to comply with the additionality requirement. Finally, energy savings generated in the transmission and distribution system and savings associated with thermal solar plants for district heating are taken into account to the limited extent allowed by Article 7(2).

The materiality requirement is mostly fulfilled by requesting the proof of signed contracts between obligated parties and their customers before the implementation of the actions and by verification of the provision of economic subsidies[39]. Additionality requirement is then basically fulfilled by trying to ensure that eligible actions would not have been implemented within 1-3 years without the incentive provided by the EEOS. Mr. Bach highlighted the difficulties associated with the verification of this aspect and the lack of clarity in the EED concerning how the fulfilment of the materiality and additionality requirements must be proved. He also pointed out that besides additionality, spill over effects might also have to be considered in order to establish the actual amount of energy savings generated by a policy measure.

Discussion after the presentation

During the discussion it was clarified that, despite being regulated, obligated energy distributors can pass their costs on to their customers as a surplus included in the tariffs of distributed energy. Obligated parties may increase the price of distributed energy, but this increase has to be duly reported to the regulator and obligated parties have to give the money back in case they have recovered too much. It is very difficult to establish whether customers are aware of the presence of this cost-recovery mechanism. Due to its limited impact on energy prices, the possibility that customers are aware of it is deemed quite unlikely, notably in the household sector[40].

Mr. Bach mentioned that it is currently being discussed whether to move the obligation from energy distributors to suppliers. He said that this option will however be considered only after 2020. A comment was raised that a possible change in defining the obligated parties is motivated by the fact that retail energy sales companies should be more incentivised to be more cost-effective compared to the regulated energy distributors. Mr. Bach, however, pointed to a series of problems associated with this modification. In particular, he mentioned that a number of energy suppliers to be possibly put under obligation are not based in Denmark. This would create problems in the definition and application of penalties in case of non-compliance with the obligation. In the opinion of Mr. Bach, an obligation put on the suppliers would hence entail a strengthening of the control system in order to avoid the infringement of EEOS rules.

5.4 EEOS in Ireland

Annual energy savings generated under the Irish EEOS have been illustrated by Mr. Kenneth Cleary from the Irish Department of Communications, Climate Action & Environment. His presentation mostly focused on a description of the EEOS implemented in Ireland.

In relation to the annual energy savings claimed under EED Article 7, he mentioned that the Irish EEOS is supposed to deliver half of Article 7 target and that this scheme is enforced through a sectorial split mandating that 75% of the EEOS target has to be

[38] As mentioned in a previous paragraph, eligible savings under the Danish EEOS are only those generated during the first year of functioning of implemented actions and weighting factors are applied to these savings.
[39] It is estimated that subsidies typically amount to maximum 10% of total investment costs in the household sectors, whilst they can be two times higher in case of actions implemented in the industrial sector.
[40] Mr. Bach mentioned that in case of electricity this cost recovery mechanism causes a price increase which is around 1% for households. This increase can however be considerably higher in case of industrial customers.

achieved in the non-residential sector, whilst 20% of it must be achieved in the residential sector and the remainder 5% must aim to alleviate energy poverty.

The aggregation of energy savings generated during 2014 and 2015 has then been presented. 1,110 GWh have been delivered under the scheme during these two years against a target of 1,100 GWh. The distribution of these savings over the different sectors reflects the previously mentioned target sectorial split. Part of these savings has been generated thanks to the support of existing grant schemes[41]. The large majority of delivered savings in the residential sector are due to actions concerning the insulation of walls and installation of energy efficient heating and control systems. In the non-residential sectors, these savings are mostly generated by efficient lighting and heating systems and efficient industrial processes.

Monitoring and verification of energy savings are mostly under responsibility of obligated actors that should audit a statistically significant proportion of the implemented energy efficiency improvement actions. The Sustainable Energy Authority of Ireland has the responsibility of monitoring, validating and auditing the actions reported by the obligated parties.

Mr. Cleary mentioned that the EEOS appears to be more cost-effective compared to direct support actions (i.e. alternative measures) by the government. In Ireland, obligated parties may buy out part of their target from the government and this implies that the government is then supposed to incentivise the generation of these savings by using the money received from the obligated parties.

Discussion after the presentation

During the discussion that followed the presentation it has been clarified by the Irish representative that the level of the buyout price set for obligated parties corresponds to the amount estimated to be paid by the government to implement the measures needed to generate lost energy savings. Besides paying a buyout price or meeting the targets directly or through third parties, obligated parties can also trade the obligations among themselves. A trading system has been developed by a private entity. A small amount of sales has taken place so far. The reasons for this low activity have probably to be found in the fact that obligated parties are more interested in addressing their customers directly to increase customers' loyalty and are also not willing to disclose the information on the costs to comply with their obligations.

Mr. Cleary also clarified that most of the savings claimed are estimated through deemed savings methods, notably in the residential sector and that the reference consumption baseline is set by considering the average efficiency of Irish residential buildings. In the commercial sector energy savings calculation methods based on ex-ante estimates are also employed.

It has also been clarified by the Irish representative that the savings stemming from grant schemes used in combination with the Irish EEOS[42] are not reported under Article 7, and thus a risk of double counting does not exist. It was mentioned that most of the savings under the EEOS are from so-called low-hanging fruits actions (i.e. from cheap and easy to implement energy efficiency improvement actions) and that this is probably the reason why the Irish EEOS did not manage so far to stimulate the installation of innovative energy efficient solutions.

5.5 EEOS in Bulgaria

The session dedicated to energy savings achieved under EEOS for the purpose of Article 7 has concluded with the presentation by Ms. Tsvetomira Kulevska from the Sustainable Energy Development Agency (SEDA) on the energy savings generated under the

[41] These grant schemes are named Better Energy Finance, Better Energy Communities, Better Energy Communities Area Based, Better Energy Homes.

[42] These grant schemes have been incorporated into an EEOS because these latter scheme and the obligated parties involved therein are assumed to be able to more effectively foster the uptake of the former schemes.

Bulgarian EEOS. The Bulgarian EEOS is nominally in force since 2008 when a first energy saving obligation period was defined which lasted until 2016.

Besides retail energy sales companies, also owners of industrial enterprises and municipal and state administrators participate in the scheme as obligated parties. Retail energy sales companies did not however manage to achieve their target for the 2008-2016 period[43].

Generated energy savings are to be proved by energy auditors registered to a SEDA public registry or by applying action specific bottom-up calculation methodologies to be verified by the SEDA. Annual declarations related to the amount of generated energy savings have to be submitted to the SEDA by retail energy sales companies by March 1st, whilst information on energy audits performed is supposed to be annually submitted by energy auditors by January 1st.

It has then to be mentioned that energy saving certificates can be issued by SEDA to prove the contribution to the implementation of energy efficiency improvement actions. These certificates can be traded among obligated parties or between non-obligated participating parties and obligated parties. Only 29 certificates, corresponding to 170 GWh of energy savings have been issued in the period 2013-2016. Ms. Kulevska has mentioned that energy saving certificates so far have not been issued for all of the generated energy savings and that this situation will however change starting from 2017.

She also mentioned that, despite obligated retail energy sales companies did not achieve their target, the government decided to not apply penalties and is trying to stimulate their activity in the field of energy efficiency in other ways. Finally, Ms. Kulevska informed the audience that a new law was expected to enter into force by end 2016 with which Bulgaria will have a combined approach based on EEOS and alternative policy measures to comply with Article 7.

Discussion after the presentation

It has been pointed out by the Bulgarian representative that the scarcity of energy saving certificates issued so far is probably due to a lack of understanding of their meaning and of the related issuing procedures by obligated and participating parties. Ms. Kulevska stated that further information concerning the type of alternative measures that will be considered by Bulgaria under the new approach will be included in the National Energy Efficiency Action Plan to be submitted to the EU Commission by end of April 2017.

In relation to the burden represented by M&V activities to be performed by SEDA, she mentioned that the employment of an on-line database whereby obligated parties declare their savings and describe the implemented actions is certainly very useful to lighten this burden. She mentioned that at the moment the SEDA checks 100% of the implemented energy efficiency actions.

A final aspect that has been addressed relates to the recent liberalisation of the electricity market in Bulgaria. This liberalisation is expected to have generated an increase in electricity retail prices that may have caused the implementation of energy efficiency improvement actions whose energy savings could in principle be declared to prove Article 7 compliance. Ms. Kulevska mentioned that these energy savings have been neither estimated, neither reported to the European Commission.

Questions addressed at the end of the session dedicated to EEOSs

After the discussions on specific presentations, an exchange of views has taken place concerning how Member States design and accomplish their M&V activities.

The Italian representative affirmed that while not being able to provide quantitative data concerning the dimension of action samples which are verified on-field, the GSE has decided to publish statistics concerning both newly implemented projects and projects

[43] Only 2,010.8 GWh were generated in the period 2008-2015 against a target of 4,644 GWh set for the period 2008-2016 for retail energy sales companies.

that have been implemented since some years. This is assumed to have an impact on project implementers and to increase compliance with EEOS requirements.

The French representative mentioned that considerable work has been made to produce reliable information that make the control of actions easier. She also pointed out that the constitution of action samples to be checked is based on risk analyses. The outcomes of these analyses are generally not disclosed in order to avoid that obligated parties know how these activities are performed.

The Danish representative mentioned that demand by the government concerning the verification of the samples representing the implemented projects is increasing. In fact, 450 projects were subject to monitoring and verification activities during 2016. The UK representative mentioned that M&V activities are made easier in UK because the EEOSs target the residential sector only. Moreover, he pointed out that M&V and verification relies on learning processes allowing to identify which actions and obligated parties have to be monitored and verified based on the identification of given patterns having potential issues.

On the other hand, the Austrian representative stressed that the statistical representativeness of action samples depend on several factors including the type of policy measure and actions under verification, the types of obligated parties, etc.. For this reason, it does not make sense to define percentages of actions to be verified without taking this variability into account.

Other participants pointed out that the statistically representative sample can be duly established by relying on statistics and the definition of the representativeness should hence never be considered as the result of arbitrary and subjective considerations.

According to the authors of this report it should be acknowledged that in some circumstances and for some actions it can be very difficult to rigorously apply statistical laws to define action samples to be monitored and verified, given the inherent large uncertainties associated with risk estimates. Sometimes the expertise of people involved in M&V activities and the information that can be collected on the field concerning how the specific actions are being implemented can provide very useful orientations concerning how the samples to be verified should be constituted. When defining the representative sample it is therefore useful to combine criteria that can be deduced from statistics with criteria suggested by the practical knowledge of involved experts and information that can be quickly and easily collected on the field and through the analysis of existing documents.

6 Energy Savings Achieved under Alternative Measures

Energy savings achieved under alternative measures for the purpose of Article 7 have been discussed for the cases of the Czech Republic, Malta, Slovenia and The Netherlands.

Alternative measures discussed: financing schemes and other incentives for buildings retrofits (Czech Republic), measures in buildings and transport (Malta), energy efficiency national funds (Slovenia), alternative measures in the industry sector (The Netherlands).

6.1 Financing Schemes and Other Incentives for Buildings Retrofits

Financing schemes and other incentives for buildings retrofits implemented in the Czech Republic have been presented by Mr. Vladimir Sochor from the Department on Energy Efficiency and Savings of the Ministry of Industry and Trade of this country.

Mr. Sochor presented a long list of alternative measures which Czech Republic intends to implement under Article 7 target. He mentioned that a final version for the energy savings calculation methodology has been produced only in May 2016 by a Coordination Committee for Energy Efficiency made of 50 members including representatives of ministries, of the Czech Statistical Office, of the City of Prague and of eight professional associations (e.g. association of ESCOs, confederations of industry, the Economic Chamber, etc.).

During his presentation he focused on the strategies to be followed to achieve energy efficiency improvements claimed under Article 7 and in the NEEAP in general. He pointed out that policy measures should not aim to generate energy savings whatever their costs and that possible subsidies should be provided in a cost-effective way and by focusing on energy efficiency projects. He stressed that rather than targeting single technologies and actions, subsidies should be granted through policy mechanisms and market instruments allowing using them more cost-efficiently (e.g. rather than giving subsidies for insulation measures in buildings, these subsidies could be granted for the implementation of energy performance contracts aiming at reducing the operation costs of buildings by targeting different technologies and involving different market actors).

He shared his view that the large volume of subsidies available in eastern European countries may cause the destruction of national energy efficiency markets if not properly used. According to his view, subsidies may be distributed in a way that it might reduce motivation to implement complex solutions and actions with reasonably short payback time. Moreover, they can reduce the interest of market actors in supplying new types of energy services whereby energy service providers offer feasibility studies, projects implementation, financing and monitoring.

He also stressed that many energy efficiency projects targeting high quality solutions are already realised without subsidy support[44]. He underlined that it is important how the subsidy schemes are designed. It should be avoided that they create barriers to the implementation of market based and high quality solutions. For example, small subsidies can serve to finance the realisation of the feasibility studies needed to implement energy efficiency projects.

6.2 Alternative Measures in Buildings and Transport

Annual energy savings generated by measures implemented in the building and transport sector in Malta have been presented and discussed by Mr. Alan Bezzina from the Energy & Water Agency.

Alternative measures targeting the transport sector in Malta aim to encourage the diffusion of hybrid and electric vehicles and, more in general, the replacement of existing vehicles with new, smaller and more efficient ones. Measures targeting the buildings

[44] It has been mentioned in this respect that less than 50% of projects implemented in CZ receive subsidies.

sector aim at stimulating the installation of more energy efficient building envelopes as well as heat pumps and solar panels in the residential sector. In the public sector, building measures mostly support the retrofit and upgrade of public buildings, schools, hospitals and pools. Actions implemented in the public buildings sector are mainly stemming from energy audits, and associated energy savings are calculated by using deemed savings calculation methodologies. Measures implemented for residential buildings mostly consist in the provision of financial incentives for the installation of specific actions whose associated energy savings are also estimated through deemed savings. Deemed savings estimates are also used for energy savings generated in the transport sector where energy efficiency improvement actions are mostly stimulated through the provision of grants and financial incentives.

Another important alternative measure implemented in Malta consists of voluntary agreements between the government and large business organisations for the stimulation of energy efficiency improvement practices. Energy savings generated by actions implemented under these agreements are verified through the application of auditing systems based on standards ISO14001, ISO50001 and EMAS. Out of 17.1 GWh of achieved end-use savings under Article 7 for 2014, only 0.011 GWh have been achieved in public buildings, 0.718 GWh in residential buildings and 1.171 GWh in the transport sector[45].

Overall, the total amount of energy savings generated by Malta under Article 7 in 2014 exceeds the estimated energy saving target for this year[46].

Discussion after the presentation

During the discussion it has been clarified that energy savings generated by early actions (implemented before 2014) are not included in the amount of the energy savings reported for 2014. Moreover, it has been mentioned that besides the international standards ISO14001, ISO50001 and EMAS, specific templates are given to business organisations so they can calculate and claim savings generated each year under the voluntary agreements[47]. Concerning measures addressing private vehicles, it has been mentioned that the amount included in the annual reports for expected energy savings is probably an overestimation and that associated energy savings have hence to be re-estimated[48].

6.3 Energy Efficiency Funds

Annual energy savings generated under energy efficiency national funds in Slovenia have been presented by Ms. Tadeja Kovačič, Councillor for the implementation of the Slovenian Environmental Public Fund (Eco Fund).

Slovenia will achieve half of the energy saving target under Article 7 through an obligation for energy suppliers and another half through the Eco Fund. This fund is used

[45] All together, energy savings generated in residential and public buildings and in the transport sector represent a minor part of the energy savings totally generated in year 2014. The largest part of the savings comes from the EEO scheme in Malta (4.088 GWh of energy savings in 2014) and the voluntary agreements in the private sectors (11.118 GWh in 2014). These agreements can have stimulated the implementation of actions in private buildings. The amount of energy savings generated by these actions in 2014 does not however seem to have been quantified.

[46] Based on information included in the presentation given by the Commission representative, 1.5 ktoe of final energy savings were generated in 2014, whilst the target set by MT under Article 7 for this year is 1 ktoe.

[47] Mr. Bezzina mentioned that the fact that business organisations have to claim *annual* savings can represent an issue in so far as this information does not allow calculating projections concerning energy savings expected by 2020.

[48] Mr. Bezzina mentioned that the estimates included in the annual report assume that 3000 vehicles will be replaced each year thanks to available incentives. Due to a lower availability of incentives compared to expectations, the amount of replaced vehicles will probably be much lower. He also mentioned that 50% of vehicles imported by Malta are second hand vehicles and that the policy aims at reducing this percentage.

to provide financial incentives for actions mostly implemented in residential buildings and in the transport sector[49].

The Slovenian government is committed to annually provide the amount of incentives needed to achieve the established energy efficiency target under the Eco Fund. Money used to finance this fund is taken from an additional fee paid by energy end-users in their energy bills[50]. The Eco Fund is in force since 1994 when it was firstly introduced as a fund used to provide soft loans. It has been also used for distributing non-repayable grants since 2008, whilst it started being used to finance and co-ordinate also an energy efficiency advisory network[51] for household in 2014. In the 2014 it started being used to comply with Article 7 requirements thanks to the implementation of a transposition decree that served also to introduce the implementation of different awareness raising activities related to and financed through this fund.

Grants are distributed through public calls indicating the assignment criteria and grants distribution is closed only once all the money available is disbursed[52]. Applications have to be submitted by participants before making the investments and selected applications receive the grants only once they have put in place the needed investments.

Eligible applicants are households, legal entities, municipalities (only for NZEBs) and the Ministry of Defence (only for energy efficiency in buildings). Eco fund employees and independent advisors check 0.25% of the subsidised investments and the associated energy savings which are calculated according to the rules established by the Ministry of infrastructures. This measure has generated 138 GWh of final energy saving in 2014 and 102 GWh in 2015. Most of these savings come from grants for buildings and electric cars[53].

The large majority of these savings are related to buildings envelopes retrofit, installation of heat pumps for central heating and installation of wood biomass boilers[54]. The Eco Fund has nevertheless underperformed compared to expectations under Article 7 targets established for 2014 and 2015[55]. Reasons for underperformance are the late publications of calls for 2014 and 2015[56] and the fact that these calls (notably the one published in 2015) did not stimulate enough applications and investments. The main reasons for this low stimulation are probably represented by the present economic crisis, by market saturation due to high demand for grants in previous years and by the low value of grants offered for some types of energy efficiency investments. Ms. Kovačič pointed out that in order to fulfil the annual targets established from 2016 onward it will be necessary to have enough funding to ensure continuity of public calls, to extend the grants also to legal entities (e.g. municipalities investing in energy efficiency, audit and refurbishment companies, etc.), to increase the amounts of the grants and to better adapt them to the expected impact from single energy efficiency improvement actions.

Questions discussed after the presentation

During the discussion it has been clarified that grants are often offered in combination with soft loans. The proportion of people using grants in combination with soft loans is actually very high (notably in the household sector) in Slovenia.

[49] The amount distributed through single grants can be considerably high. In case of energy efficiency investments for multi-residential buildings this amount can reach up to 50% of total investment costs. In the case of electric cars for households or other legal entities, grants offered per vehicle can reach 7,500 Euros.
[50] The Eco Fund is expected to generate final energy savings amounting to 262 GWh/year. To this end, energy end-users are currently paying 0.08 Eurocent/kWh in their energy bills. This amount is expected to make 37-40 million Euro/year available to finance energy efficiency.
[51] The name of this network is ENSVET
[52] 56 public calls have been published between 1995 and 2015
[53] Energy savings were also claimed in these two years for the implementation of the advisory network ENSVET and for grants distributed in the public sector (only in 2014).
[54] The best ratio between savings generated and investment costs has been registered by the fund for the installation of wood biomass boilers.
[55] 138 GWh and 102 GWh of final energy savings have been respectively generated in 2014 and 2015, against an annual Article 7 target of 262 GWh estimated for these two years.
[56] Calls were published in April/May during these two years.

6.4 Alternative Measures in the Industry Sector

Annual energy savings generated by alternative measures in the industry sector in the Netherlands have been discussed by Mr. Antonius J.J. Bolder from the Netherlands Enterprise Agency.

His presentation focused on long terms agreements established with industry in the Netherlands. The agreements have a long history and started being established in 1991. The latest agreements are supposed to last at least until 2020 and started in 2009. Two types of agreements with industry are established depending on whether these industries are ETS companies or not. Agreements in the ETS sector involve 112 companies from 7 sectors, the chemical, the refineries and the metal sectors being responsible for most of the energy consumption by these companies.

Agreements in the non-ETS sectors involve 900 companies from 32 sectors with oil/gas, chemical, dairy and ICT sectors responsible for most of the generated energy consumption. Interestingly, a few very large companies are responsible for most of the energy consumption generated in non-ETS sectors. Every year companies should provide data through an on-line system concerning the actions implemented[57]. These data are then checked by consultants and aggregated results are published by June-July every year. Total costs generated annually by monitoring activities amount to around 500,000 Euros for the external consultants to be hired and to 100,000 Euros for the maintenance of the ICT system. Participating companies implement projects which on average reduce energy consumption by 1.3% for ETS companies and 1.9% for non-ETS companies. This policy initiative is deemed successful and policy makers aim to an annual energy consumption reduction target of 2 % to be achieved through long term agreements with industry.

Discussion after the presentation

During the discussion that has followed the presentation, Mr. Bolder clarified that companies have to submit detailed energy efficiency plans where they describe the actions they want to implement under the Long Term Agreement. In case companies do not implement the actions agreed on within the established time period, they can be excluded from the agreement.

Participants asked how the Netherlands could achieve more energy savings compared to the expected savings for 2014 which might have been due to fact that several companies had more resources during 2014 to finance energy efficiency projects.

As regards the additionality to eco-design requirements for actions promoting installation of electric drives for motors, cooling appliances, etc. by industry, Mr. Bolder explained that there is a tax deduction scheme in force for these types of actions and is therefore possible to track all of them in order to exclude those actions which might not be additional and also to avoid double counting.

Questions addressed at the end of the session dedicated to alternative measures

During the final discussion it has been asked to Member States representatives to provide further indications concerning how they perform M&V of energy savings claimed in case of alternative measures and which corrective actions are undertaken in case the achieved energy savings are lower than expected.

The Maltese representative stated that deemed savings estimates are used for actions implemented in the building sector and in the transport sector and that only desk verifications are performed. This allows to count the number of implemented actions and

[57] This data mostly relate to energy use, production, energy saving projects and adopted energy management system.

to verify whether total deemed savings being generated are as expected. For example, in case of solar thermal collectors this type of verification allowed establishing that energy savings were not sufficient. The stimulation of installation of heat pumps water heaters had therefore to be also considered by policy makers. In case of actions implemented in the transport sector, the main issue seems to be the availability of financing resources, whilst in case of actions implemented under voluntary agreements energy savings calculations are performed within reports submitted to the monitoring body and the correctness of these calculations can be checked.

The Slovenian representative mentioned that all main aspects related to the generation of energy savings are monitored on paper. Only actions for which the documentation seems to be doubtful are checked on the field, which represents only a minor part of the total actions. Slovenia is planning to introduce on site verifications for randomly selected samples representing 0.25% of total applications submitted.

The Dutch representative mentioned that on site verifications are performed for projects implemented under the long term agreements and also for those receiving subsidies. Projects to be verified on site are selected based on their size, and the larger the amount of generated energy savings, the higher the probability to be verified. For the rest, energy savings are verified on paper based on information provided in the energy efficiency actions plans by companies.

The Danish representative mentioned that on-site verifications do not always allow checking savings because these verifications do not allow knowing the situation before the implementation of the action. For some type of actions, however, this situation can be known based on possible energy audits conducted beforehand or based on information requested to project implementers.

The Belgian (Wallonia region) representative mentioned that in case of voluntary agreements with industry, preliminary audits are performed. These audits allow: a) determining the most promising energy saving investments; b) classifying projects based on associated financial revenues and payback time; c) selecting projects to be verified ex-post. Applications for grants offered to the household sector must instead be accompanied by invoices and technical data concerning the solutions installed. This information does not allow knowing the situation before the implementation, which is deducted based on an existing database on energy performance of buildings, which gives a quite reliable picture of the existing building stock. Therefore, it is possible to perform good quality monitoring and verification activities in this sector.

The Italian representative mentioned that technical sheets have to be submitted by applicants for existing tax credits, which allows performing monitoring and verification of energy savings claimed from this policy instrument.

Another part of the final discussion was dedicated to debate on an issue raised by the Czech Republic representative (Mr. Sochor) concerning the subsidies on energy efficiency which potentially could destroy an energy efficiency market. Mr. Sochor mentioned that this conclusion has to be referred to the situation of Eastern European Countries that are receiving consistent amounts of subsidies to improve their infrastructures from the European Union funding instruments. He pointed out that these amounts can be used in a way that is detrimental to the development of an energy efficiency market. Some participants in the discussion pointed out that subsidies, even if of a very small amount, can nevertheless be very important to help companies promote energy efficiency improvements. The Danish representative highlighted that the IEA energy outlook 2016[58] concluded that the market will not deliver energy efficiency improvements without suitable policies and he also pointed out that subsidies and/or energy audits are needed in order to approach energy end-users and to encourage them to implement energy efficiency improvement actions.

[58] See http://www.iea.org/newsroom/news/2016/november/world-energy-outlook-2016.html

Participants raised the question on how the calculation of the cost-effectiveness of policy measures can possibly give indications concerning the most appropriate measure(s) to be implemented. Despite the difficulties linked to cost-effectiveness estimates, the fact that some Member States have changed their policy measures initially notified to achieve the required savings under Article 7, might indicate that some evaluation based on their assumed cost-effectiveness might have driven these decisions. It was also stressed that regardless its value, the cost-effectiveness of a measure generally decreases after some time due to new developments and changed markets situation and that policy measures have hence to be regularly updated or changed in order to avoid this to happen.

In case of EEOSs, the UK representative mentioned that EEOSs are likely a cost-effective policy measure in so far as they allow targeting actions implemented by large number of energy end-users. For this reason, the United Kingdom used the EEOSs to target the residential sector. If this condition is not fulfilled, EEOSs can become a mean to transfer money from energy end-users to a few market actors, because their costs are typically recovered through energy tariffs paid by all energy end-users. According to the UK representative, despite this is happening in some EU countries, a situation where consumers are induced to pay for energy efficiency improvements in industry through an EEOS would be avoided by UK policy makers if the UK EEOSs would cover this sector. On the other hand, the Finnish representative mentioned that changes in the policy measures to comply with Article 7 obligations are the result of a natural learning process whereby Member States are learning which measures can work better to fulfil these obligations, and decisions to change policy measures are hence not necessarily based on the cost-effectiveness aspect.

7 Conclusions

Several points have been touched during the workshop discussions documented in this report.

The event was mainly conceived to allow Member States exchanging experiences on challenges faced in reporting the actual energy savings for 2014 in their 2016 annual reports, with a special focus on measurement and verification activities and on the assessment of the cost-effectiveness of implemented policy measures.

Concerning energy savings documented in the 2016 annual reports, discussions allowed highlighting a good practice adopted by several Member States and consisting in notifying every single measure implemented under Article 7 and associated energy savings. At the same time there is the need for Member States to provide clarifications in relation to the amounts of claimed energy savings that have been generated by early actions and supply side actions under exemptions (c) and (d) of the EED Article 7(2).

During the workshop it has also been possible to highlight how, particularly in case of EEOSs that were in place before EED implementation (e.g. in France, Denmark, Italy, Italy, UK), Article 7 reporting requirements might entail extensive and additional energy savings calculation activities compared to what has to be done to run policy measures at national level. Energy savings claimed by obligated actors under EEOSs are for example discounted and cumulated over the life time of actions in some Member States. Moreover, these savings have to be checked against Article 7 additionality and materiality requirements. It has to also be checked whether savings from early actions and savings attributed to final energy generation from renewables do not exceed the limits established by this Article.

It has also been highlighted that detailed verification activities are also needed to avoid double counting of energy savings and that double counting is practically impossible to avoid in case policy measures like energy or CO2 taxes are implemented in conjunction with other energy efficiency measures, due to the objective difficulties of distinguishing between energy savings generated by those taxes and energy savings generated by other energy efficiency measures.

Overall, the main challenge being faced by Member States seems to be additionality and materiality requirements. The workshop has proven in particular that it is important to correctly deal with energy consumption baselines to estimate energy savings generated by anticipated and programmed product substitutions caused by policy measures. The discussions held indicate also that the role played for the definition of energy consumption baselines by minimum energy performance requirements set by eco-design regulations for energy-related products need a particular attention. Depending, for example, on whether the stimulation by a policy measure of the installation of a highly efficient heat pump represents an anticipated or programmed substitution of a pre-existing space heater in a building, the role played by existing eco-design requirements in the definition of relevant consumption baselines and in the calculation of additional energy savings to be attributed to this action can be very different.

The event organised has also shown that, following Article 7 implementation, Member States are employing significant resources for activities related to monitoring and verification of energy savings. These activities mostly consist in on-desk verifications of information provided by participating parties claiming energy savings, whilst on site verifications, when carried out, are performed for a limited number of actions and during limited time periods. The workshop has shown that the implementation of standardized procedures and ex-ante methods for the calculation and verification of energy savings, including the creation of a database or on-line tools to collect information from participating parties, can certainly prove very helpful and cost-effective in this respect. Large and complex projects, notably those implemented in the industry sector, continue however representing the biggest challenge both in relation to how correctly defining

associated consumption baselines for calculating energy savings and in relation to how energy savings monitoring and verification should be carried out.

Another challenge for monitoring and verification activities is represented by the fact that the ex-ante situation of sites where actions have been implemented is often unknown. Nevertheless, a larger diffusion of energy audits conducted before the implementation of the actions and the requirement of relevant information to project implementers can provide important means to avoid this issue.

Discussions have also shown that the definition of statistically representative samples of actions to be monitored and verified can be somewhat challenging. Whilst some Member States seem to regularly carry out risk analyses to define these samples, others seem to be in an initial phase in the definition of proper selection procedures. Overall, agreement was expressed by several Member States in relation to the impossibility of approaching the problem of defining statistically representative samples by starting from pre-established percentages of actions to be verified. A series of variability factors, including how these percentages might depend on policy measures at stake, on the type of projects addressed, on the types of obligated and participating parties, etc. have indeed to be taken into account and make it generally very difficult to establish these percentages with the accuracy requested by statistics.

A series of aspects have been discussed during the workshop concerning policy measures cost-effectiveness and the appropriateness of deciding whether to implement a measure based on cost-effectiveness assessments. Several participants agreed that cost-effectiveness assessments are typically country specific and depend on a series of factors which are extremely difficult to take into account and impede that these assessments can be reliably used to decide which policy measure to implement in a specific country. Several participants seemed to agree in particular on the point that the most cost-effective policy solution is often represented by a combination of policy measures and that the cost-effectiveness of measures depend ultimately on the time when they are implemented (the most cost-effective solution today, may not be the most cost-effective solution tomorrow). Concerning this last point, and particularly in relation to EEOSs, it has been pointed out that policy measures need to be periodically updated/re-assessed in order to adapt them to the ever evolving market conditions and political landscape in a country.

As for subsidies, it has been pointed out that their cost-effectiveness could increase greatly if, rather than for single technologies, they could be used to foster the development of a proper energy efficiency market (e.g. they might be used to stimulate the stipulation of energy performance contracts). Moreover, it has been highlighted that subsidies can be particularly needed in so far as they can provide the justification to contact end-users and to encourage them to implement energy efficiency improvement actions. It has also been pointed out that it should be avoided that subsidies and measures like tax rebates create market distortions that might give undue advantages to given technologies while penalising the diffusion of solutions with high energy saving potential.

Some workshop participants also stressed that the cost effectiveness of EEOSs and alternative policy measures (notably energy and CO2 taxes) depend on the sectors addressed. Energy and CO2 taxes have for example been indicated as particularly cost-effective in the industry sector, while their cost-effectiveness in the household sector was questioned. Concerning EEOSs, it has been pointed out that they have so far proved particularly cost-effective in stimulating the implementation of cheaper actions (so called low hanging fruits), whilst their cost-effectiveness for large projects (e.g. projects implemented in the industry sector) has not yet been proved. Some workshop participants also questioned the appropriateness of using EEOSs to provide substantial incentives to actions implemented in the industry sector. Being financed by all energy end-users through their energy bills, these schemes could become a mean to use money of citizens to finance private industry.

On the other hand, it has also been observed that the cost-effectiveness of EEOSs stems from the fact that they can provide a stable source of financing for energy efficiency, they allow addressing several different energy efficiency market actors and they stimulate energy suppliers to sell energy services in addition to supplying the energy.

Finally, a point that has been indirectly touched during the workshop concerns interactions of an EEOS with other policy measures. Whilst some countries (e.g. Italy) tend to avoid interactions with other existing incentive schemes financing energy efficiency, other countries (e.g. France, Ireland) use the schemes in conjunction with other policy measures (e.g. tax credits and grants) to finance single energy efficiency improvement actions and to reinforce the uptake of these actions. For the above mentioned reasons concerning cost-effectiveness assessments of policy measures, it is probably difficult to establish which of the two approaches should be preferred. It can however be inferred that EEOSs, as market based mechanisms, can be very effective in fostering the diffusion of technical solutions with the highest economic energy saving potential. Whenever they are used in combination with subsidies, grants and other economic incentive measures, attention should be paid to avoid that these latter measures do not unduly penalise the diffusion of the solutions with the largest potential.

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