This document states the views of the Commission services, does not alter the legal effects of the Directive and is without prejudice to the binding interpretation of the amended EED as provided by the Court of Justice.

Discussion paper on lifetimes of measures and decline of savings over time in the context of Article 7 of the EED

This paper is prepared for the purposes of the Energy Efficiency Expert Group meeting on 15 March 2019 to frame the discussion on the possibility to develop indicative (non-binding) lifetime values for calculating energy savings and to discuss if and how to take into account the declining rate of savings in the context of the energy savings obligation under Article 7 together with Annex V(2) point (i) of the EED.

The aim of this paper is to support the discussion how lifetimes of measures could be calculated by Member States in the energy savings they claim under Article 7 of Directive 2012/27/EU ("the EED" or "the Directive") as amended by Directive (EU) 2018/2002 and complements the 2013 Guidance note on Article 7[1].

I. Introduction - the purpose and use of lifetimes of measures under Article 7 of the EED

The EED requires Member States to take into account the lifetime of savings when calculating energy savings for the purposes of Article 7 (Annex V(2) point (e)[2], **and the rate at which the savings decline over time**. Member States should count the end-use energy savings (cumulative savings) that each individual action would achieve between its implementation date and the end of the respective obligation period, i. e. by 31 December 2020 or 31 December 2030– according to the so called "straightforward" approach or alternative calculation methods are also allowed as long as the estimated total energy savings does not exceed what would have been achieved under the straightforward (default) approach.

According to the evaluation carried out by the Commission in the context of the review of implementation of the energy savings obligation for the current period 2014-2020, a majority of Member States have used the straightforward approach while some Member States also used other methods (e.g. Denmark and France, due to the established monitoring systems under their energy efficiency obligation schemes).[3]

In practice, the calculation of energy savings should take into account **three key aspects** (in relation to lifetimes):

1) The year the measure was installed or first implemented.
2) The mix of measure (distribution per action type).

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[1] https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52013SC0451

[2] The provision was amended by Directive 2018/2002 and is now Annex V(2) point (i).

[3] SWD/2016/0402 final - 2016/0376 (COD).

3) The lifetimes of the measure (usually defined per type of measure).

The first point is usually handled directly by the monitoring and verification systems in the Member States (as the achieved savings should be reported annually to the Commission).

The second point can be challenging, depending on the type of a policy measure. Some policy measures focus on a limited number of action types (e.g. grants for renovation of buildings). Other policy measures cover a broad range of action types and deal with large numbers of actions (e.g. EEOs). Some policy measures can promote a broader set of energy efficiency improvements, based on specific energy efficiency or economic criteria, and without a specific list of eligible actions, but rather be. This is the case for some policy measures targeting industry, for which energy savings projects can be very specific to the industrial processes being made more efficient.

Keeping track of the mix of actions can thus require particular efforts, for example through a detailed monitoring system (with records of action types implemented) or through periodical surveys. To facilitate monitoring of the reported savings, several Member States developed specific ICT platforms (e.g. Austria, Croatia). This paper will focus on the third aspect (how to calculate the lifetimes of measures).

A new provision introduced in Annex V(2) point (i) of the amending Directive 2018/2002 provides that *'the calculation of energy savings shall take into account the lifetime of the measures* ***and the rate at which the savings decline over time***[4]*. That calculation shall count the savings each individual action will achieve during the period from its date of implementation to 31 December 2020 or 31 December 2030 as appropriate.'*

Lifetimes of measures are also used for lifecycle cost analysis of energy efficiency investments (and included in the preparatory studies for ecodesign regulations under the Directive 2009/125/EC). The lifetime of the product is for example a key parameter when defining the basis to compare several technological options. In this case, the relevant **Ecodesign studies** provide estimates of product lifetimes.

Likewise, lifecycle cost analysis can be useful to assess business cases for investments in energy efficiency. Initiatives like DEEP (De-risking Energy Efficiency Platform)[5] intends to gather data from energy savings projects to improve the knowledge and reliability of data for such assessments.

II. Indicative lifetime values for calculating energy savings

The analysis of the implementation of Article 7 of the EED during the first period 2014-2020 shows that Member States have notified the lifetimes of their measures with varying degrees of completeness. In many cases lifetimes varied considerably in terms of the duration attributed to the same type of action (e.g. from 10 to 22 years for boiler

4 Text highlighted in bold only for the purpose of this discussion paper.

5 https://deep.eefig.eu/

replacement in commercial buildings). Ricardo et al.[6] used a **simplified approach** by defining **four main categories of lifetimes** to overcome the heterogeneity of data available from Member States' notification. This approach helped in particular to overcome missing data in a systematic way when assessing the expected energy savings impact of the first obligation period (2014-2020) up to 2030.

Based on available studies on values of lifetimes could be categorised per each type of measure as illustrated in **Error! Reference source not found.** below.

Table 1. Example of categories of lifetimes (simplified approach).

Lifetime category	Range (years)	Category of type of measure
A] Long lifetimes	23-30	Insulation of building envelope
B] Medium long lifetimes	10-23	Heating, ventilation and air conditioning systems
C] Medium lifetimes	3-10	Draught proofing
D] Short lifetimes	1-3	Behavioural changes

Source: (Ricardo et al. 2016, table 6)[6],

This simplified approach could represent an alternative to defining indicative values of lifetimes per action type, taking into account the specificities related to the **eligible** savings period for the purposes of Article 7. In practice, the maximum duration to consider for Article 7 is usually the duration of the obligation period, i.e. **7 and 10 years** respectively for 2014-2020 and 2021-2030.

In parallel, the Joint Research Centre raised a question of a possibility of harmonising and establishing a set of **European default values** of savings lifetimes, for example starting from available European standards (e.g. EN 15495 for building components).[7] The availability of indicative lifetime values could help to improve consistency of Member States' calculation methodologies under Article 7, and possibly even beyond the frame of Article 7 EED. These values are an important input parameter for other purposes, particularly for lifecycle cost analysis (e.g. for Ecodesign studies or business cases) or long-term planning.

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[6] Ricardo et al. 2016. Study evaluating progress in the implementation of Article 7 of the Energy Efficiency Directive. Final Report for DG Energy. ENER.C3.dir(2014)3156530. https://ec.europa.eu/energy/en/studies/study-evaluating-implementation-article-7-directive-201227eu-energy-efficiency

[7] Labanca, N., and P. Bertoldi, 2016. Energy Savings Calculation Methods under Article 7 of the Energy Efficiency Directive. Report of the Joint Research Centre for the European Commission. https://e3p.jrc.ec.europa.eu/publications/energy-savings-calculation-methods-under-article-7-energy-efficiency-directive, p. 8.

The JRC also highlighted that particular attention needs to be paid to behavioural actions (due to lack of evidence), as well as actions in industry (due to technology turn-over and reorganisation within industries).

The effective lifetime of a measure (i.e. duration over which the measure continues to achieve energy savings) can indeed be shorter than its technical lifetime, due to non-retention effects (e.g. products removed due to obsolescence).

Discussion questions:

1) Would it be useful to have indicative values of lifetime for some categories of actions? If yes, for which ones?

2) What sources of data/values (or process) should be considered to prepare such indicative values?

3) Are there particular action types whose lifetime can vary significantly depending on the conditions of implementation (or other factors of variations)?

III. Declining rate of lifetime for the proposes of energy savings obligation in Article 7

A new provision introduced in Annex V(2) point (i) of the amending Directive 2018/2002 provides that the calculation of energy savings shall take into account the lifetime of the measures ***and the rate at which the savings decline over time***. *That calculation shall count the savings each individual action will achieve during the period from its date of implementation to 31 December 2020 or 31 December 2030 as appropriate.*

The requirement to take into account the rate at which savings decline over time is a new concept in relation to Article 7 which may require Member States to adapt their calculation methodologies, either by including new factors to reflect year-to-year declines in savings (similar to discount factors in economic calculations) or by conducting further analysis (e.g. surveys of metered energy consumption in different years after the installation of the actions). This increases the complexity of savings calculations and possibly monitoring processes with associated administrative costs. It would eventually mean claiming a lower amount of savings, assuming that a positive rate of decline is observed or deemed to be appropriate given the existence of relevant indicative values.

There is not much evidence on the size of the declining rate or how it would be applied - no EU Member States use it when calculating energy savings for Article 7 EED (apart from the alternative approaches which result in the same amount of savings when using the so called “straightforward” approach).

More generally, the available literature about how energy savings would evolve over time is limited. The largest source of publicly available studies can be found in the US, and more specifically in California. The main finding from these studies is that in most cases there was no significant difference in energy performance over time between the

high-efficiency option and the base case. As a result of these studies, the issue of savings persistence has usually been taken into account by adjusting either the lifetime or the deemed savings per action type, and only for a limited number of action types (e.g. LED).

In order to apply the new provision on declining rate in practice, there are two main aspects which could be considered in the calculation of energy savings: **performance degradation** and **changes in the condition of use**. In literature these two aspects are referred to as **savings persistence.**

Based on the literature, the main points for consideration in relation to savings persistence are:

- These issues are difficult to investigate, and the limited number of studies available show limited (or even no) decline of energy savings over time due to performance degradation.
- Savings persistence can be significantly affected by the lack of, or poor, maintenance, or due to poor product quality or installation. In principle this should be tackled in Article 7 by the requirement on ensuring quality and maintenance (see for example in Annex V(2) point (g)).
- Savings persistence can also be affected by changes in non-technical factors, such as occupancy or economic cycles. Most often, these changes cannot be anticipated. So taking them into account would require further analysis or surveys.

This would require further studies and investigation to develop a robust and cost-effective methodology to apply the concept into the calculation methodologies for the purposes of Article 7.

Discussion questions:

1) Is it appropriate to calculate the declining rate of energy savings within each of the obligation periods?

2) In case it is appropriate – would it be relevant to distinguish specific groups of policy measure types (which ones)?

3) Which approach should be used to account for decline of the savings over time, e.g. a default rate, are there any studies or evidence that could be used to develop such method for Article 7 EED purposes?