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Measuring and increasing impact: The next challenge for EU energy efficiency policy measures

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Summary

This paper recommends improvements in evaluation, measurement and verification practices as a way of increasing the impact of the Energy Efficiency Directive (EED) and enabling the Energy Efficiency First principle to be implemented.

Delivering energy savings has never been more important as the EU enters a crucial decade in its energy transition. The 55% climate goal represents a step change in ambition, and energy efficiency is expected to play a major role. The renovation wave aims to double energy savings from building fabric improvements. Energy consumption reductions will be needed across buildings, transport and industry. Enacting the Energy Efficiency First principle will require reliable data on the costs and benefits of energy efficiency actions. To drive efficiency gains and reduce energy consumption, effective energy efficiency policy measures are required, owing to the significant barriers to action and market failures across all sectors.[2] The European Commission's proposed revisions to the EED energy savings obligation would almost double the annual energy savings required by Member State policy measures. Legislators are now starting discussions on a final version of the law.

To ensure policy effectiveness, policymakers need to have reliable data on energy savings and other variables affecting policy design and implementation. This is the role of evaluation, measurement and verification. Yet as we move into this key period for energy transition policymaking, we are faced with a lack of reliable and timely

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[2] Gillingham, K., Newell, R. & Palmer, K. (2009). Energy efficiency economics and policy. *Annual Review of Resource Economics* 2009 1:1, 597-620. https://www.annualreviews.org/doi/pdf/10.1146/annurev.resource.102308.124234

information on the key performance indicator for energy efficiency policy measures: energy savings. The 2014-20 EED energy savings obligation period was the first time that Member States had to achieve and report energy savings from their policy measures. The reporting requirements have led to significant advances in the monitoring and verification of energy efficiency actions. Nevertheless, there is both room for improvement in Member States' compliance with their existing reporting obligations and scope for changes to the Directive itself to foster better policymaking and more energy savings.

Compliance with the EED energy savings obligation has been patchy. Many Member States are likely to miss their energy savings targets based on their reported energy savings alone.[3] Issues related to the additionality and materiality of reported energy savings persist, in that they could be attributed to other overlapping EU or national policy measures, or to broader trends in technology, prices or market developments.

More significant issues, however, relate to what is missing from the EED energy savings obligation: a focus on the evaluation, measurement and verification of energy savings. The EED allows energy savings to be calculated through a range of methods, but only the metered savings approach uses *ex post* data – that is, information collected after the energy efficiency action has taken place. The vast majority of reported energy savings are calculated using *ex ante* estimates of the impacts of policy measures – that is, what the impact is likely to be, without timely *ex post* evaluations to verify whether the *ex ante* estimates were accurate.

This has led to a focus on the measurement of installations or actions, as opposed to the estimation of the primary objective of energy efficiency policy – energy savings. The lack of information about how well energy efficiency policy measures have been performing is problematic on many levels. With more accurate information on energy savings:

- The Commission would have a better understanding of how energy efficiency policy measures are affecting energy efficiency target achievement.
- National policymakers would have the evidence to draw upon as they design their next set of policy measures.
- The application of the Energy Efficiency First principle would be supported, enabling policymakers to compare demand- and supply-side energy policy measures.

To drive efficiency gains and reduce energy consumption, effective policy measures are required, owing to significant barriers to action and market failures across all sectors.[4] To ensure effectiveness, policymakers need to have reliable data on energy savings and other variables affecting policy design and implementation. This is the role of evaluation, measurement and verification.

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[3] European Commission. (2020a). *2020 assessment of the progress made by Member States towards the implementation of the Energy Efficiency Directive 2012/27/EU and towards the deployment of nearly zero-energy buildings and cost-optimal minimum energy performance requirements in the EU in accordance with the Energy Performance of Buildings Directive 2010/31/EU*. COM(2020) 954 final. https://ec.europa.eu/energy/sites/ener/files/progress_report_towards_the_implementation_of_the_energy_efficiency_directive_com2020954.pdf

[4] Gillingham et al., 2009.

To improve the accountability of energy efficiency policy measures and enable them to play a fuller role in the energy transition, we propose the following policy recommendations.

Recommendation 1: The Commission should mandate the independent evaluation of energy savings reported under the EED energy savings obligation.

- Under the current EED, Member States focus on counting installations, not on testing the accuracy of the associated energy savings.
- The EED could require Member States to commission independent evaluations of policy measures covering all reported energy savings every five years.
- Future *ex ante* deemed energy savings estimates could be made more accurate based on the results.
- The Commission could produce guidance on the design of evaluations and the resources required to carry them out, by policy measure type and size.

Recommendation 2: EU Member States should focus impact evaluation efforts on assessing the costs and benefits of meeting policy goals.

- Evaluating energy savings is essential for monitoring compliance with the goals of the EED and the entire climate and energy package.
- Identifying the time and location of energy savings will become increasingly important in assessing energy system resource investment strategies and the implementation of the Energy Efficiency First principle.
- Evaluating impacts relevant to energy poverty alleviation strategies – such as bill savings, indoor temperatures and indoor air quality – will be important in some cases.
- Other impacts may also be significant enough to warrant evaluation effort. For example, building energy efficiency measures may have impacts on public health and labour markets.

Recommendation 3: The Commission should mandate the piloting of pay-for-performance using metered savings in the buildings sector.

- Member States could institute pay-for-performance for buildings as part of energy efficiency obligation schemes, energy efficiency auctions or tenders, or regular subsidy programmes.
- The Commission could mandate that a small proportion of Member States' EED energy savings obligations be delivered using metered savings in the buildings sector.
- Energy savings delivered through metered savings approaches would help Member States meet their evaluation requirements (Recommendation 2).

Recommendation 4: Member States should provide clear pathways for accessing individual dwellings' smart meter data.

- Smart meter data have huge potential for targeting energy-saving and flexibility interventions, but privacy concerns prevent the data from being analysed this way.
- Clear pathways for accessing individual dwellings' data would make it easier to use actual energy usage in project design and to evaluate the performance of renovation projects.
- Access to large, anonymised sets of smart meter data would enable the development of advanced evaluation, measurement and verification methods and innovative approaches to the implementation of the Energy Efficiency First principle.

Recommendation 5: The Commission should mandate the publication of verification reports by Member States every two years, alongside the reporting of energy savings.

- Member States are already required to independently verify a statistically significant proportion of the energy savings from each of their policy measures.
- A Member State verification report could include verification procedures, results from verification activities, and any corrective action taken (e.g., to modify the energy savings submitted by obligated parties or to apply penalties to scheme participants).
- The scrutiny board could assess Member States' verification reports and provide guidance on improving verification processes.

Recommendation 6: The Commission should facilitate knowledge and expertise sharing on evaluation, measurement and verification across Member States.

- The Commission should help bring together Member State officials responsible for evaluation, measurement and verification with experts to support consistency and transparency in approaches, the adoption of best practices and the tackling of emerging issues such as the piloting of metered savings policy measures.
- An EU knowledge-sharing forum could produce detailed guidance on evaluation, measurement and verification that could be used across Member States, building on the work of the ENSMOV[5] and streamSAVE[6] Horizon 2020 projects.
- The Regional Technical Forum in the United States could act as a model in this respect. The forum establishes a venue where people can propose the creation of new evaluation, measurement and verification protocols. It has committees that focus on specific sectors or energy efficiency action types, and programme administrators throughout the region use its products.[7]

[5] ENSMOV. (n.d.). https://ensmov.eu

[6] streamSAVE. (n.d.). *Streamlining energy savings calculations*. https://streamsave.eu

[7] Regional Technical Forum. (n.d.). https://rtf.nwcouncil.org/

Recommendation 7: The Commission should regularly assess the accuracy and consistency of energy savings estimates across EU Member States.

- Inconsistencies in measuring energy savings across Member States call into question the validity of the energy savings reported under the EED energy savings obligation.
- The Commission could review Member States' evaluation, measurement and verification efforts, identify issues and best practices, and publish credibility assessments of the reported energy savings.

With the EED being renegotiated, now is the time to make the changes that will enable energy efficiency to play its full role in the energy transition.

Introduction

This paper recommends improvements in evaluation, measurement and verification practices as a way of increasing the impact of the Energy Efficiency Directive (EED) and enabling the implementation of the Energy Efficiency First principle.

In its proposals for a recast of the EED, the European Commission has proposed a near doubling of the annual energy savings that Member States' energy efficiency policy measures must deliver.[8] These energy savings will be crucial in achieving the EU's ambitious new 2030 climate goal and Member States' emissions reduction targets.[9]

To meet their energy savings obligations, Member States will have to drive new energy efficiency investments through more ambitious and effective policy measures. To ensure effectiveness in meeting their obligations, Member States need to understand what their policy measures deliver and why, so they can adapt policy measure design and implementation. For that to happen, Member States need reliable and timely data on energy savings delivery, as well as broader evidence on the costs, benefits and wider impacts of their policy measures.

Unfortunately, this is not current practice in most of the EU. Energy savings are most often assumed *ex ante* – through 'deemed' or 'scaled' calculation methods – and very rarely evaluated *ex post*. Evaluations are undertaken infrequently and often do not focus on energy savings. Energy saved is the key performance indicator for the EED energy savings obligation, and yet very few resources are devoted to understanding whether energy savings are being achieved. Without a greater focus on delivery, we risk a continuation of the recent trend, which has seen a slowdown in the rate of energy efficiency improvement[10] despite the energy savings reported by Member States.[11] Beyond energy savings, as the focus of building renovation efforts shifts towards whole-house refurbishments and as the need to embed climate resilience measures in renovation projects grows, it is important to recognise the value of measuring other indicators. This could drive higher renovation performance and protect building occupants by encouraging improvement on indicators such as indoor temperature, carbon dioxide concentrations and humidity.

In this paper, we make the case for a stronger focus on the evaluation, measurement and verification of energy efficiency policy measures. We conclude that the independent *ex post* evaluation of energy savings should be built into the design of all energy efficiency policy measures, to provide greater certainty over policy impacts and enable their continuous improvement. Furthermore, we recommend the widespread piloting of pay-for-performance programmes that link rewards to measured outcomes, aligning the incentives of programme participants with policy objectives. To drive these changes and to give the Commission a clearer view of whether policy measures are

[8] European Commission. (2021a). *Proposal for a Directive of the European Parliament and of the Council on energy efficiency (recast).* COM(2021) 558 final. https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/delivering-european-green-deal_en

[9] Graichen, J., Scheuer, S., & Thomas, S. (2021). *Strengthening synergies between climate effort sharing & energy savings obligations, an input to the "Fit for 55" package.* Stefan Scheuer SPRL. https://www.stefanscheuer.eu/wp-content/uploads/2021/01/20210201-Synergies-between-ESR-EED.pdf

[10] Thomas, S., & Rosenow, J. (2020, February). Drivers of increasing energy consumption in Europe and policy implications. *Energy Policy*, 137, 111108. https://doi.org/10.1016/j.enpol.2019.111108

[11] European Commission, 2020a.

helping to meet energy efficiency and climate targets, we recommend changes to the Energy Efficiency Directive.

New climate targets require stepping up energy savings delivery

In light of pressing climate challenges, legislators have set a target for the EU to be climate neutral by 2050.[12] They have also stepped up the climate target for 2030, requiring a net greenhouse gas emissions cut of 55% compared with 1990 levels.[13]

To succeed, the EU must have the ability to manage and reduce its energy consumption. In 2018, EU legislators targeted a reduction of energy consumption by 2030 of at least 32.5% compared with projections made in 2007.[14] In 2020, the Commission decided that the EU should reduce energy consumption further to reach more stringent climate targets[15] and proposed a revision of the 2030 energy efficiency target in the EED.[16] The EU will need to further increase its energy efficiency ambition by at least 9 percentage points in 2030 on top of the level of efforts foreseen under a 2020 reference scenario. This corresponds to a reduction of 36% for final and 39% for primary energy consumption, when compared with the 2007 projections for 2030.

Figure 1[17] on the next page compares the EU's current and proposed final energy consumption targets for 2030 with an extrapolation of the linear trend since 2005.[18] It shows that reaching such a target requires an acceleration of energy consumption cuts in the coming years.

[12] European Union. (2021). *Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law').* https://eur-lex.europa.eu/eli/reg/2021/1119/oj

[13] The EU 2030 target was previously set at a 40% greenhouse gas emissions cut compared with 1990. European Union, 2021.

[14] European Union. (2018a). *Directive (EU) 2018/2002 of the European Parliament and of the Council of 11 December 2018 amending directive 2012/27/EU on energy efficiency.* Official Journal of the European Union, L 328/210, 21 December 2018; and European Union. (2019). *Decision amending directive 2012/27/EU on energy efficiency for the withdrawal of the United Kingdom from the EU*. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CONSIL%3APE_19_2019_REV_1

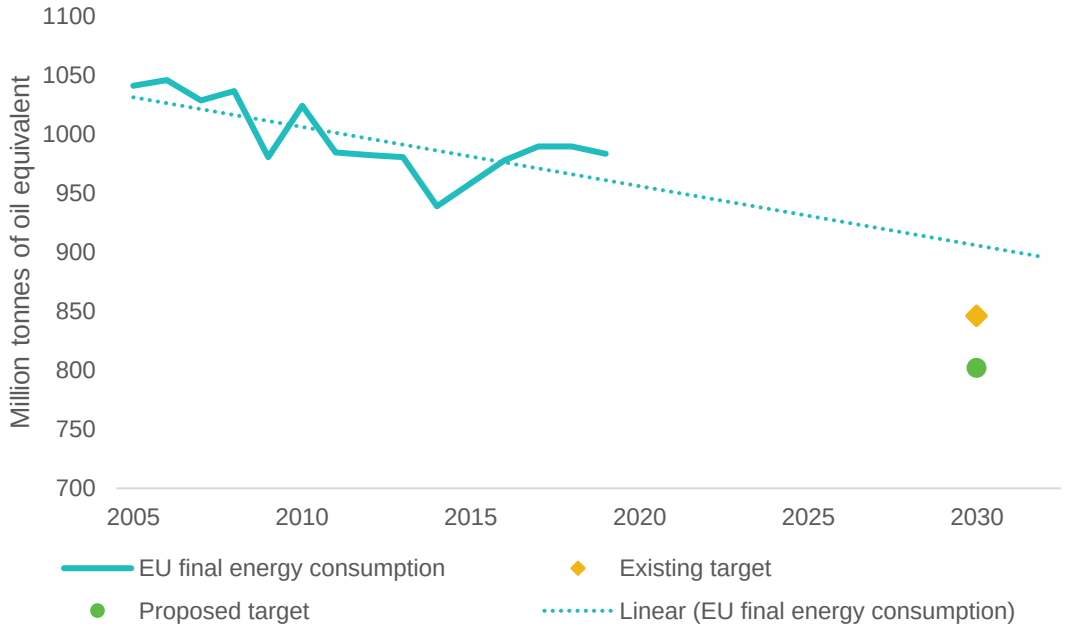
[15] European Commission. (2020b, September). *Stepping up Europe's 2030 climate ambition – Investing in a climate-neutral future for the benefit of our people.* COM(2020) 562 final. https://knowledge4policy.ec.europa.eu/publication/communication-com2020562-stepping-europe's-2030-climate-ambition-investing-climate_en

[16] European Commission, 2021a.

[17] Data sources: Eurostat. (2021, 8 February). *Final energy consumption (Europe 2020-2030).* http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=t2020_34&lang=en; European Union, 2018a; European Commission, 2021a.

[18] The absolute numbers in million tonnes of oil equivalent are not directly comparable with those in the Commission's proposal, because of changes in the Eurostat accounting methodology.

Figure 1. Final energy consumption trends and 2030 energy efficiency targets



Data sources: Eurostat. (2021). *Final energy consumption (Europe 2020-2030)*; European Union. (2018). *Directive (EU) 2018/2002 of the European Parliament and of the Council of 11 December 2018 amending directive 2012/27/EU on energy efficiency*; European Commission. (2021). *Proposal for a Directive of the European Parliament and of the Council on energy efficiency (recast)*

To drive efficiency gains and reduce energy consumption, effective policy measures are required, owing to significant barriers to action and market failures across all sectors.[19] The EED energy savings obligation requires Member States to establish policy measures that deliver reductions in final energy consumption. The policy measures that Member States report are diverse. Energy efficiency obligation schemes on utilities deliver the highest proportion of energy savings across the EU as a whole, but other policy measures include subsidy programmes for building renovation, voluntary agreements with industry sectors, energy taxation measures, and behaviour change campaigns.

To ensure policy measure effectiveness, policymakers need to have reliable data on energy savings and other variables affecting policy design and implementation. This is the role of evaluation, measurement and verification.

The role of evaluation, measurement and verification in energy efficiency

Supply-side energy generation policy measures, such as feed-in tariffs for rooftop solar photovoltaics, can use metering to measure and verify the key indicator of policy success – the production of renewable electricity – in a straightforward manner. Evaluation is still needed to estimate the full range of impacts, but the most important performance data are easily captured. Demand-side measures do not share this advantage. Estimates must be made of the energy consumption avoided as a result of

[19] Gillingham et al., 2009.

the intervention. To do this accurately, policymakers need reliable measurement and verification processes. Policy evaluation is then required in order to understand the full impacts of energy efficiency measures. This section defines these terms and presents the multiple benefits of evaluation, measurement and verification systems.

Definitions

Energy savings are the difference between two states of the world: one that you can observe (energy consumption after the energy efficiency action) and another that you cannot (consumption in a counterfactual scenario without the action). The challenge for evaluation, measurement and verification is to calculate that difference most cost-effectively, by either:

- Estimating counterfactual energy consumption and comparing that with observed energy consumption.
- Estimating the difference between the two states of the world without observing consumption, for example by using data from past interventions or engineering calculations.

Monitoring and reporting

The word 'monitoring' is sometimes used instead of 'measurement'. In the EED energy savings obligation, 'measurement' is used only to refer to the methods by which energy savings are estimated, while 'monitoring' is used to denote the process by which measurements are made.

The term 'monitoring and reporting' is often used to refer to the regime by which key variables are measured and documented, particularly in the field of carbon dioxide emissions policy. 'Monitoring, reporting and verification' is sometimes used to refer to the regime through which key variables are measured, documented and checked.

In some reports, the term 'M&V' is used to refer to the combination of monitoring and verification.

The following definitions are used in this report.

Policy measures are programmes, schemes, regulations, or fiscal or voluntary instruments established to encourage or require market actors to undertake energy efficiency improvements.

Actions are installations, projects or interventions that lead to verifiable and measurable or estimable energy efficiency improvements undertaken as a result of a policy measure.

Measurement comprises activities that document the variables that enable impacts to be estimated and policy measure requirements to be met.

Verification comprises activities by programme administrators, or parties independent of project developers, that check the accuracy of reported measurements and adherence to other programme requirements, such as the quality of installations or the materiality of policy measures in the investment decisions of final consumers. Verification can be undertaken for a sample of individual energy efficiency actions or for all of them, depending on their characteristics.

Evaluation takes place at the policy measure level and should be carried out by a party independent of both the programme administrator and the project developers. Evaluations draw upon measurement and verification activities, as well as other

evidence, and can provide information on both the effectiveness of policies and their impacts. Although measurement and verification activities are undertaken on an ongoing basis, evaluations are undertaken periodically and fall into two broad categories: process evaluations and impact evaluations.

- **Process evaluations** examine policy measure design and implementation to improve effectiveness. Process evaluations would likely include interviews with participants, project developers, administrators and other stakeholders to assess ways in which the design and implementation of the policy measure could be made more efficient and key performance indicator scores improved. Best practice from other policy measures could also be brought to bear in assessing performance.
- **Impact evaluations** estimate energy savings and other benefits and costs attributable to the policy measure. The scope of an impact evaluation will depend on the policy measure's aims and objectives. For example, an evaluation might focus on emissions savings, market and supply chain effects, macroeconomic impacts or the distribution of costs and benefits. To understand policy impacts, evaluators can apply a variety of methods to differentiate between the gross impacts resulting from the energy efficiency actions that participants undertake and the net impacts of the policy measure itself.

Gross and net impacts[20]

Gross impacts, such as gross energy savings, result directly from actions that policy measure participants undertake, regardless of why they participated.

Net impacts, such as net energy savings, can be attributed to the energy efficiency policy measure.

Estimates of gross impacts should factor in existing policy measures, such as energy efficiency performance standards.

To calculate net impacts, gross impacts need to be adjusted for free riders and spillover effects.

Free riders are participants that would have taken the energy efficiency actions supported by the policy measures either fully or partially, or in the future. Accounting for free riders reduces net impacts.

Spillovers tend to increase net impacts. The term refers to additional impacts beyond those directly related to the energy efficiency actions that participants undertake — for example, through the uptake of energy efficiency actions by nonparticipants exposed to the policy measure, or through additional actions by participants themselves.

Additional spillovers may arise through changes in market structures and market participants as a result of an energy efficiency policy measure. For example, installers and other professionals may change their practices in a way that encourages consumers to undertake energy efficiency actions.

[20] Based on Northeast Energy Efficiency Partnerships. (2016). *Gross savings and net savings: Principles and guidance*. https://neep.org/sites/default/files/FINAL%20GS%20and%20NS%20Principles%20and%20Guidance%20Document_2016May17.pdf

How evaluation, measurement and verification support policy goals

Solid evaluation, measurement and verification frameworks for energy efficiency policy measures support several objectives.

Documenting policy impacts

Evaluation, measurement and verification frameworks document the impacts of policy measures to determine whether they have met their goals.[21]

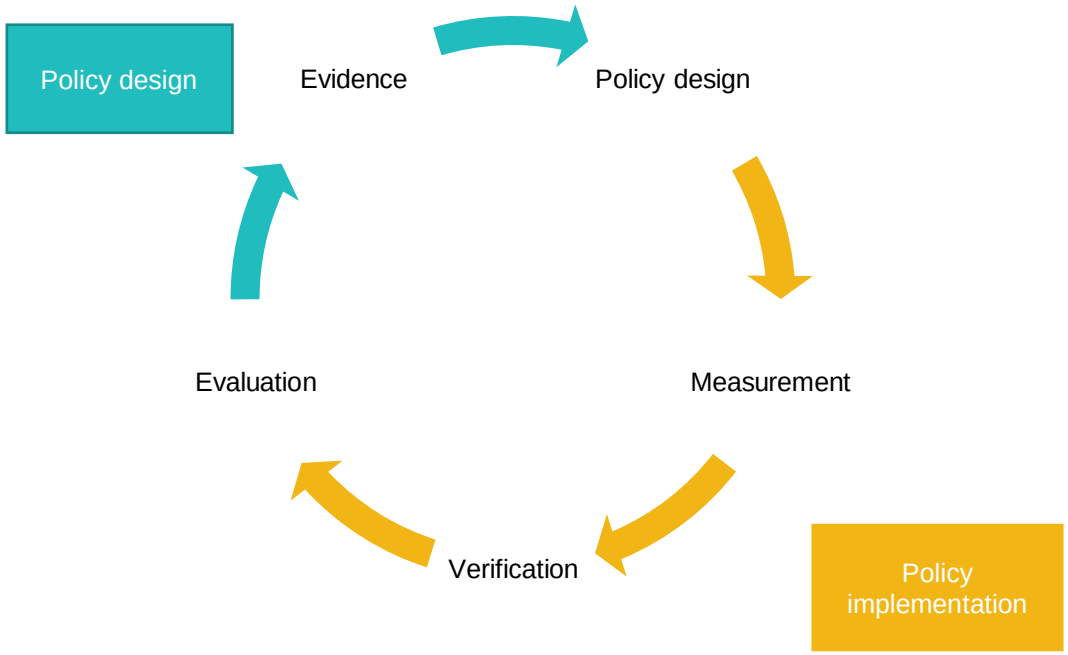
Understanding the effectiveness of energy efficiency policy measures will help speed up the energy transition and deliver better value for money for taxpayers and bill payers.

Implementing continuous policy improvement

Evaluation, measurement and verification frameworks are needed to identify ways to improve current and future policy measures.[22]

Without the evidence such frameworks provide, valuable resources may be wasted on ineffective measures and actions, undermining energy efficiency policy. With the right evidence, policy measures can be designed and implemented to achieve their objectives more cost-effectively. The information gathered through evaluation, measurement and verification can be fed into future policy design, creating a positive policy cycle of continuous improvement, as shown in Figure 2.

Figure 2. The energy efficiency policy cycle



[21] Slote, S., Sherman, M., & Crossley, D. (2014). *Energy efficiency evaluation, measurement, and verification.* Regulatory Assistance Project. https://www.raponline.org/knowledge-center/energy-efficiency-evaluation-measurement-and-verification/

[22] Slote et al., 2014.

Aligning incentives with policy objectives

Better measurement and verification enables public authorities to pay a more accurate price for the results they aim to achieve. The use of meter data enables performance-based payments to be made to beneficiaries or contractors, including energy efficiency aggregators. In the energy efficiency pay-for-performance policy programmes rolled out in the United States, *ex post* meter-based estimates of energy savings are used as the indicator for project performance.[23] The progress of advanced measurement and verification methods, using smart meter data, enables public authorities to make timely payments to aggregators, as the measurement of energy savings is made as the savings occur.[24]

Enacting the Energy Efficiency First principle

The Energy Efficiency First principle requires that energy supply and demand solutions be treated on an equal footing, considering their respective costs and benefits.[25] EU legislators have adopted this guiding principle to ensure that energy efficiency solutions are not overlooked.[26] The Commission has proposed reinforcing the application of the principle by creating an obligation on Member States in the revision of the EED.

Energy Efficiency First in the EED revision proposals

Since 2018, the Governance Regulation[27] has provided a definition of the Energy Efficiency First principle. 'Energy Efficiency First' means taking primary account of alternative measures to make energy demand and supply more efficient in energy planning, and in policy and investment decisions, while still achieving the objectives of those decisions. This is primarily achieved by means of cost-effective end-use energy savings, demand response initiatives, and more efficient conversion, transmission and distribution of energy.

With the EED recast, the Commission proposes to further operationalise the principle by requiring Member States (Article 3), national regulatory authorities, and transmission and distribution network operators (Article 25) to ensure that energy efficiency solutions are considered in planning, policy and investment decisions related to energy systems, and in non-energy sectors affecting energy consumption and energy efficiency. After the proposed recast of the EED, the Commission published new guidelines on how to implement the Energy Efficiency First principle in decision-making.[28]

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[23] Santini, M., Tzani, D., Thomas, S., Stavrakas, V., Rosenow, J., & Celestino, A. (2020). *Experience and lessons learned from P4P pilots for energy efficiency*. Report from the SENSEI project, funded by the European Union's Horizon 2020 programme. https://zenodo.org/record/3887823#.Ybd-XS-cZt-

[24] Franconi, E., Gee, M., Goldberg, M., Granderson, J., Guiterman, T., Li, M., & Smith, B. A. (2017). *The status and promise of advanced M&V: An overview of "M&V 2.0" methods, tools, and applications.* Rocky Mountain Institute and Lawrence Berkeley National Laboratory. https://www.osti.gov/servlets/purl/1350974

[25] Pató, Z., Boza-Kiss, B., Broc, J.-S., Schmatzberger, S., & Mandel, T. (2020). *Defining and contextualizing the E1st principle.* Report from the ENEFIRST project, funded by the European Union's Horizon 2020 programme. https://enefirst.eu/wp-content/uploads/D2-1-defining-and-contextualizing-the-E1st-principle-FINAL-CLEAN.pdf

[26] European Union. (2018b). *Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action.* Official Journal of the European Union, L 328/1, 21 December 2018. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018R1999

[27] European Union, 2018b.

[28] European Commission. (2021b). *Annex to the Commission recommendation on Energy Efficiency First: From principles to practice*. COM(2021) 7014 final. https://ec.europa.eu/energy/sites/default/files/eef_guidelines_ref_tbc.pdf

As an energy system resource, energy efficiency actions can help avoid the need to invest in more costly supply-side alternatives. To ensure that solutions are not overlooked or undervalued, decision-makers need to be confident in the savings that energy efficiency measures will deliver. By providing information on the historical and future resource contributions of energy efficiency compared with other energy resources, evaluation, measurement and verification can support energy demand forecasting and resource planning,[29] in line with the Energy Efficiency First principle. New York's Reforming the Energy Vision initiative is an ongoing example of the application of the principle in the United States. Consisting of many policies, regulations and other tools, it has prioritised investment in distributed energy resources, including energy efficiency, as a cost-effective means of meeting energy system goals.[30]

As the combination of grid decarbonisation, end-use electrification and digitalisation transforms energy systems, the value of applying the Energy Efficiency First principle will increase, while the costs should fall. The electrification of transportation and most end uses in buildings is increasing electricity baseload. The rising penetration of intermittent renewables at the grid edge is making energy savings more valuable at different times and in different places. Meanwhile, the digitalisation of the electricity system and the application of smart technologies in buildings enables the value of energy savings to be differentiated more accurately. California is at the forefront of these developments. In 2021, the target metric for Californian energy efficiency programmes was changed from energy savings to 'total system benefit.' The metric requires programmes to optimise across energy saving, peak demand reduction and greenhouse gas benefits. The metric must also be used in identifying energy efficiency potential and setting programme goals.[31]

The rollout of smart meters and access to smart meter data enables decision-makers to both accurately estimate the benefits of energy efficiency and reward programme participants for the delivery of those benefits in a timely manner. In 2020, the penetration of smart electricity meters had reached 43% of households and small and medium-sized enterprises, with wide variations between Member States in part because of delays relating to consumer acceptance. Nevertheless, the European Commission projects that the penetration rate will rise to 77% by 2024.[32]

To realise the benefits of smart meters for grid optimisation, regulatory frameworks that provide for data access need to allay privacy concerns and ensure that energy users' consent is always necessary. Access to large, anonymised sets of smart meter data would help in the development of advanced evaluation, measurement and verification methods and other innovative approaches to demand-side measures in the buildings sector. Smart meter data have huge potential for targeting energy-saving and flexibility interventions, but privacy concerns can prevent them from being analysed to

[29] Slote et al., 2014.

[30] Sedano, R. (2015). *Power sector transformation: The case of New York REV*. Regulatory Assistance Project. https://www.raponline.org/knowledge-center/power-sector-transformation-the-case-of-new-york-rev/

[31] California Public Utilities Commission. (2021). *Decision 21-05-031: Assessment of energy efficiency potential and goals and modification of portfolio approval and oversight process.* https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M385/K864/385864616.PDF

[32] EU Commission. (2020). *Benchmarking smart metering deployment in the EU-28.* https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M385/K864/385864616.PDF

support cost-effective energy efficiency measures, particularly in the residential buildings sector. Clear pathways for accessing individual dwellings' data would make it easier to use actual energy usage in project design and to evaluate renovation projects.

Overall, solid evaluation, measurement and verification systems can establish the contribution of energy efficiency policies to the achievement of the EU energy consumption target, support the continuous improvement of policy measures, help align incentives with policy objectives, and support the implementation of the Energy Efficiency First principle. Nevertheless, estimating energy savings from a policy measure requires balancing the desire for precision against the cost of the evaluation, measurement and verification system.[33] The costs depend on several parameters, including the number of participants and their characteristics, the variety of the energy efficiency actions, the energy savings measurement method, the metering infrastructure, and the range of impacts to be evaluated. The next section looks at current practices under the EED.

Evaluation, measurement and verification practice under the Energy Efficiency Directive

The EED places an energy savings obligation on Member States. This section introduces the obligation, as well as the provisions related to evaluation, measurement and verification. It then presents lessons learnt during the first phase of the EED implementation.

The energy savings obligation

The EED requires Member States to achieve a certain amount of energy savings among energy end users. These savings must be the result of national policy measures, defined as energy efficiency obligations schemes or alternative measures, which complement and go beyond EU measures such as product standards.

The obligation's first period ran from 2014 to 2020. Member States had to achieve cumulative end-use energy savings that were at least equivalent to new annual savings of 1.5% of baseline final energy sales.[34] The directive allowed several exemptions that effectively lowered the target to 0.7%.[35] For the 2021-2030 period, Member States must achieve cumulative end-use energy savings at least equivalent to new annual savings of 0.8% of baseline annual final energy consumption.[36] There are no exemptions, although Malta and Cyprus have a smaller target of 0.24%, calculated in the same way.

[33] Neme, C., & Cowart, R. (2013). *Energy efficiency feed-in-tariffs: Key policy and design considerations.* Energy Futures Group and Regulatory Assistance Project. eceee 2013 Summer Study Proceedings. https://www.raponline.org/knowledge-center/energy-efficiency-feed-in-tariffs-key-policy-and-design-considerations-2/

[34] Baseline annual final energy sales averaged over the period 2010-2012.

[35] Rosenow, J., Leguijt, C., Pató, Z., Fawcett, T., & Eyre, N. (2016). An ex-ante evaluation of the EU Energy Efficiency Directive – Article 7. *Economics of Energy & Environmental Policy* 5(2), pp. 45-63. https://www.researchgate.net/publication/304940496_An_ex-ante_evaluation_of_the_EU_Energy_Efficiency_Directive_-_Article_7

[36] Baseline annual final energy consumption averaged over the period 2016-2018.

As part of the EED recast proposals, the Commission proposed increasing the annual savings rate to 1.5% for all Member States from 2024 onward. In addition, the EED proposal includes a requirement to deliver a share of these savings among people affected by energy poverty, vulnerable customers and, where applicable, people living in social housing. Table 1 shows how the EED energy savings obligation has evolved.

Table 1. Comparison between adopted EED texts and Commission proposals

	2012 EED	2018 EED	2021 proposals
Savings period	2014-2020	2021-2030	2021-2030
Annual savings	1.5%	0.8%	1.5% from 2024
Possible exemptions	Reduced impact by half	Only for Malta and Cyprus	None from 2024
Energy poverty	No requirement	Requirement to consider	Required share of savings from 2024
Eligibility	No restrictions	No restrictions	Fossil-fuel combusting technologies ineligible from 2024

The Commission expects the EED energy savings obligation to deliver more than half of the energy savings required to reach the 2020 and the existing 2030 energy efficiency headline target.[37] This contribution will only be delivered if the energy savings reported by Member States represent real reductions in energy consumption. Recent trends in energy efficiency progress suggest that this is not the case. The EED sets out rules on the materiality and additionality of energy savings, which aim to ensure that the energy savings Member States report come on top of business-as-usual savings – that is, that they are net savings, going beyond those brought about by natural market developments and existing policy efforts (see the 'Materiality and additionality' box on the next page).

[37] European Commission. (2016, November). *Impact assessment accompanying the document proposal for a directive of the European Parliament and of the Council amending directive 2012/27/EU on energy efficiency*. SWD/2016/0405 final. Part 1, p.17. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52016SC0405

Materiality and additionality

To qualify for the EED energy savings obligations, the activities of national public authorities in implementing the policy measure must be **'material'** to the achievement of the energy savings claimed, for example by providing a financial contribution to an energy efficiency investment. Establishing materiality requires setting policy measure requirements, collecting evidence and verifying that the requirements are met.

The savings must also be shown to be **additional** to those that would have occurred in any event without the activity of the obligated, participating or entrusted parties, or implementing public authorities. Member States must examine how energy use and demand would evolve in the absence of the policy measure in question (baseline or counterfactual scenario). They need to do this by considering at least the following factors: energy consumption trends, changes in consumer behaviour, technological progress, and changes caused by other measures implemented at EU and national level. Savings resulting from the implementation of mandatory EU law shall be considered as savings that would have occurred in any event, and thus cannot be claimed as energy savings.

To establish a baseline scenario, Member States need a good knowledge of market developments. According to the European Commission, this is particularly important to avoid counting 'free riders' that are common in the context of supplier obligations and financial support schemes. The Commission provides an example in its guidance note.[38] If a national support scheme for building renovation supports 100 individual actions each year, some of those actions would have happened anyway (without the scheme) and must be deducted.

Evaluation, measurement and verification in the EED

The EED requires Member States to put in place measurement, control and verification systems for all policy measures except taxation. The measurement, control and verification must be carried out independently of the obligated parties (for energy efficiency obligation schemes) and of the participating or entrusted parties (for other measures).

Verification

Member States are required to provide information about the independence of the monitoring and verification systems. The Commission provides a non-exhaustive list of criteria to establish independence (including statutory or financial independence).[39]

[38] European Commission. (2019, September). *Commission recommendation on transposing the energy savings obligations under the EED.* (EU) 2019/1658. https://ec.europa.eu/energy/sites/ener/files/documents/c_2019_6621_-_act_com_recom_energy_savings.pdf

[39] European Commission, 2019.

Verification in the EED

The EED requires Member States to check a statistically representative sample of measures. This involves establishing a subset of a statistical population of energy-saving actions within each measure that accurately reflects the entire population of all energy-saving actions. This allows for reasonably reliable conclusions to be drawn regarding the totality of the measures.

The monitoring and verification system can be organised in different steps or levels. On-site inspections can be part of the approach, as a second stage of verification on subsamples of individual actions identified as being at risk of noncompliance with the requirements of the measures. Where these are not technically or economically feasible, this can be explained in the compliance documentation the Member States provide to the Commission.[40]

Evaluation

Member States are required to give the Commission information on the energy efficiency policy measures put in place in the context of their energy savings obligations, including the savings expected from the different measures. This requirement means that Member States must anticipate the impact of the policy. An *ex post* evaluation is not mandated but would be required in order to validate the energy savings identified through the measurement and verification processes. This is especially important where *ex ante* calculation methods are used to estimate energy savings based on monitoring data – for example, on the number, type and size of heating system installations. Examples of approaches taken to the *ex post* evaluation of energy savings have been aggregated by the EPATEE Horizon 2020 project.[41]

Measurement

The EED is flexible on the measurement techniques and the assumptions made by Member States to calculate energy savings.

The EED refers to five calculation methods. The three methods usually used for energy efficiency obligation schemes and nontaxation measures are the metered, deemed and scaled approaches, with deemed savings being the most common. Metered savings is the only method to use *ex post* energy consumption data. The other two methods make assumptions about *ex post* energy consumption based on experience or the technical specifications of equipment.

- Metered savings – where energy consumption after the energy efficiency action is compared with a counterfactual scenario in which the action is assumed to have not taken place. The model of counterfactual energy consumption may need to take account of other factors affecting energy consumption, such as building occupancy, the weather and economic conditions.
- Deemed savings – where the results of previous studies are used to estimate energy savings scores for energy efficiency actions. Previous studies will often have used the metered savings approach on a sample of actions.

[40] European Commission, 2019.

[41] Sipma, J., Broc, J.-S., & Skema, R. (2019). *Comparing estimated versus measured energy savings*. EPATEE project. https://epatee.eu/sites/default/files/files/epatee_topical_case_study_comparing_estimated_vs_measured_energy_savings.pdf

- Scaled savings – where engineering estimates of energy savings are used to calculate the difference in energy consumption for bespoke technical energy efficiency actions on which there is not enough evidence from previous studies to inform a deemed savings score. *Ex post* data on variables affecting energy consumption (e.g., production or floor space heated) may be needed to scale the savings estimates.

The EED provides for a separate evaluation-based method that may be used for behaviour change measures.

- Surveyed savings – where surveys of participants in energy efficiency programmes are used to estimate the energy savings from behavioural energy efficiency actions.

The EED also specifies a method for estimating energy savings from taxation measures that increase the price of energy.

- Elasticity-based savings – where previous evidence on the responsiveness of energy consumption to changes in energy prices is used to estimate counterfactual energy consumption without the taxation measure in place.

Lessons learned from the first phase of the EED energy savings obligation

The 2014-2020 period was the first phase of the energy savings obligation. Member States notified the Commission of qualifying policy measures and provided details on compliance with the technical aspects of the Directive in their national energy efficiency action plans in 2014 and 2017. Until 2020, Member States reported annually on progress towards meeting their obligations; final reports are due in 2022. An analysis of Member States' reporting thus far reveals the following lessons.

A delivery gap in reported energy savings in some Member States

Reported energy savings for the period 2014-2018 suggest that as many as half of the countries involved are unlikely to meet their targets. Bulgaria, Czechia, Luxembourg, Portugal and Romania are rated by the Commission as very unlikely to meet their targets.[42] Furthermore, around half of Member States' reported savings are from policy measures for which either insufficient information on the approach to calculation, monitoring or verification has been provided, or the information given suggests that the energy savings reported are likely to be overestimated.[43, 44] We unpick some of the key concerns below.

[42] European Commission, 2020a.

[43] Forster, D., Kaar, A. L., Rosenow, J., Leguijt, C., and Pató, Z. (2016). *Study evaluating progress in the implementation of Article 7 of the Energy Efficiency Directive.* Ricardo Energy & Environment. https://ec.europa.eu/energy/sites/ener/files/documents/final_report_evaluation_on_implementation_art._7_eed.pdf

[44] Schlomann, B., Rohde, C., Denishchenkova, A., Broc, J.-S., Dragovic, M., Oikonomou, V., Thomas, S., & Rosenow, J. (2021). *Technical assistance on assessing progress in implementing Article 7 of the Energy Efficiency Directive and preparing the policy implementation in view of the new obligation period 2021-2030* [Manuscript submitted for publication]. Fraunhofer ISI; Institute for European Energy and Climate Policy; Regulatory Assistance Project.

An increasing focus on monitoring, reporting and verification of actions

The monitoring, reporting and verification requirements in the EED have led Member States to collect and verify more information related to their energy efficiency policy measures.[45] Member States' 2017 national energy efficiency action plans contain significantly more and better-quality information on policy measures and monitoring and verification regimes than the 2014 editions. There is still, however, considerable room for improvement in the information reported to the Commission on monitoring and verification. According to an assessment of Member States' submissions, no supporting information is provided at all for 7% of cumulative energy savings reported for the period 2014-2018. A further 27% of reported energy savings give rise to concerns related to either the type of measurement method used or the independence of the verification regime.[46]

Uncertainty about reported energy savings

The EED's reporting requirements mean that there is now an inventory of energy efficiency policy measures across EU Member States. However, while energy savings have been attributed to policy measures, there is very little verification undertaken of the energy savings themselves. Most verification is related to checking that paperwork has been completed and, when on-site checks are undertaken, that equipment or insulation products have been installed.

The focus on the measurement and verification of installations, as opposed to energy savings, is driven in part by the EED, which allows energy savings to be calculated through the *ex ante* deemed and scaled methods (see the 'Measurement' section above), without a requirement to evaluate their accuracy and make continuous improvements. This inattention to the evaluation of energy savings in the EED's reporting requirements undermines efforts to improve knowledge about the effectiveness of energy efficiency policy. Although it is in the interests of Member States to understand more about the impacts of their policy measures, to improve outcomes for their citizens, they will understandably be nervous about finding out that their policy measures have underperformed. Without independent evaluation evidence, the Commission has very little ability to hold Member States accountable for their reported energy savings. A meta-analysis of engineering estimates and deemed savings adopted by different countries shows that savings estimates for similar individual actions vary greatly between countries.[47] Notwithstanding differences in national circumstances, this suggests that some of the energy savings that Member States report are likely to be inaccurate. Some attempts have been made to harmonise energy savings methodologies in the past, but no common practice has been established.[48]

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[45] Schlomann et al., 2021.

[46] Schlomann et al., 2021.

[47] Labanca, N., & Bertoldi, P. (2016). *Energy savings calculation methods under Article 7 of the Energy Efficiency Directive.* EUR 27663 EN. https://doi.org/10.2790/855880

[48] Broc, J.-S., Thenius, G., Di Santo, D., Schlomann, B., van der Meulen, J., van den Oosterkamp, P., Marić, L., & Matosović, M. (2018). *What can we learn from sharing experience about evaluation practices?* [Conference paper]. International Energy Policy & Programme Evaluation Conference 2018. https://hal.archives-ouvertes.fr/hal-02425109/document

The use of *ex post* measurement techniques in policy design, using energy consumption meter data, has been limited in Europe to a small number of industry sector actions, where deemed or scaled energy savings estimates are inappropriate owing to the complex or bespoke nature of the interventions. This is, for example, the case for some of the industry sector savings in the Italian White Certificate programme[49] and the energy efficiency obligation schemes in Austria, Greece, Ireland, Luxembourg and Latvia. The metered savings method helps to evaluate energy savings as part of the measurement and verification process, reducing the costs of more extensive evaluation studies. The broader use of metered savings would also allow incentives to be aligned with policy goals, by linking subsidies or regulatory compliance to the achievement of energy savings, through 'pay-for-performance.'[50] The SENSEI Horizon 2020 project reviewed the use of pay-for-performance and metered savings in buildings sector energy efficiency pilot programmes, mostly in the United States, where providing better value for money for bill payers was often a key consideration.[51]

Even if the metered savings measurement method is not incorporated into policy design, the use of meter data should be a central element of *ex post* policy evaluation. This can help to ensure that *ex ante* deemed and scaled energy savings estimates are more realistic. In Great Britain, the National Energy Efficiency Data-Framework (NEED) is used to analyse panels of energy consumption data.[52] This enables a comparison of the energy consumption patterns of treated and untreated dwellings with otherwise similar characteristics across virtually the entire building stock. NEED analysis supported a reduction in the *ex ante* deemed savings that could be claimed for many actions undertaken by parties obligated under the country's energy efficiency obligation scheme in 2013.

Energy taxation measures, which account for 15% of reported energy savings, have particularly uncertain impacts. Traditional energy efficiency policy measures, such as utility obligations and financing programmes, specify actions that can be undertaken to qualify for subsidies or regulatory compliance, the effects of which can be measured, verified and evaluated. Energy taxation measures, on the other hand, change the incentives facing all consumers, making energy consumption more expensive and improving the attractiveness of energy efficiency investments in general.

The EED allows the energy savings from taxation measures to be calculated by applying *ex ante* (deemed) estimates of the own price elasticity of demand[53] for the taxed energy products to the percentage increase in prices attributable to the taxes. This leads to significant uncertainty over the energy savings from taxation measures, since elasticity estimates are, by their very nature, specific to the context in which they

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[49] Di Santo, D., De Chicchis, L., & Biele, E. (2018). *White certificates in Italy: Lessons learnt over 12 years of evaluation* [Conference paper]. International Energy Policy & Programme Evaluation Conference 2018. https://www.dariodisanto.com/wp-content/uploads/2018/07/2018-DiSanto_paper_vienna-IEPPEC.pdf

[50] Santini, M. (2021). *Energy Efficiency Directive 3.0: Can "metered savings" approaches support EU's Renovation Wave objectives?* eceee Summer Study 2021. https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2021/4-monitoring-and-evaluation-for-a-wise-just-and-inclusive-transition/energy-efficiency-directive-30-can-metered-savings-approaches-support-eus-renovation-wave-objectives/

[51] Santini et al., 2020.

[52] UK Department for Business, Energy & Industrial Strategy. (2021). *National Energy Efficiency Data-Framework (NEED).* https://www.gov.uk/government/collections/national-energy-efficiency-data-need-framework

[53] The own price elasticity of demand of a good is an empirical measure of the percentage change in demand for the good if its price changes by 1%.

are calculated. As technologies evolve, the availability of substitutes changes and social parameters shift, as do the likely responses of end users to energy price changes. Furthermore, price elasticities vary, depending on the underlying price level at which the estimates are made. Elasticities are calculated in percentage terms. A percentage increase has a greater quantitative effect at higher price levels. This also means that elasticity estimates become less reliable as higher percentage increases are assessed, as is often the case with taxation measures. These issues make reported energy savings from taxation measures less likely to be reliable than those from other policy measures.

The broad coverage of taxation measures also presents complications in terms of their overlap with other policy measures (see the section on 'Accounting for policy overlap at the Member State level' below). This means that most Member States use only short-run elasticity estimates to calculate energy savings. Broadly speaking, short-run elasticities represent the behavioural responses of consumers to higher prices, whereas long-run elasticities also capture the effects of investments by consumers, which play out over a longer period. The extent to which all behavioural responses constitute energy efficiency actions is debatable, since only some reductions in energy consumption will be to reduce energy waste (unneeded energy consumption caused by low prices), while others will be accompanied by reductions in energy services, particularly among those least able to pay for energy. These latter energy consumption reductions count towards Member States' energy efficiency obligation targets but run counter to the just transition objectives of the Green Deal.

Concerns about the additionality of some energy efficiency policy measures

Beyond the fundamental issues around the measurement of energy savings, there is further uncertainty around the attribution of savings to Member States' policy measures. To isolate the impact of policy measures, estimates of the energy savings resulting from the actions participants take need to be adjusted to take account of what would have happened in their absence. This turns *gross savings* – the energy savings that occur when, for example, old heating systems are replaced by more efficient ones – into *net savings*, which is the proportion of those savings that can be attributed to the policy measures.

Annex V EED requires Member States to do this by addressing the additionality and materiality requirements. To meet the additionality requirement, Member States must take into account other trends and the impact of other policy measures when reporting their net energy savings. To meet the materiality requirement, Member States' policy measures must have more than a minimal impact on end users' decisions to undertake investments or change behaviour in some other way.

Additionality to EU law

The EED places significant emphasis on the need for Member States' policy measures to be additional to EU law. This is important for planning strategies to meet EU climate and energy targets. The EED energy savings obligation should generate energy savings that can be added to those brought about by other EU legislation. An exception to this rule is that energy savings from building fabric renovations can be counted in full, given the very low rate of energy renovations that would be expected in the absence

of Member State policy measures and the need to increase that rate to meet climate and energy targets.[54]

More than a third of Member States' reported energy savings over the 2014-2018 period are from policy measures where additionality to EU law has not been fully accounted for, or for which Member States have provided no information.[55] Concerns relate to:

- Reporting savings from new building codes (which are mandated by the Energy Performance of Buildings Directive).
- Reporting savings from energy audits by large enterprises (which are mandated by the EED) without additional policy measures to drive energy efficiency actions.
- The assumption, in some programmes, that not all heating systems, products and lighting (which are subject to minimum ecodesign standards) would have been replaced before the end of the energy savings obligation period.
- Absence of accounting for new vehicle carbon dioxide legislation (which effectively means that energy savings can only be derived from policy measures that bring forward vehicle replacements).[56]

If Member States do not fully account for the impact of EU law when reporting for their EED energy savings obligations, the impact of the EU's energy efficiency policy framework will be overestimated.

Accounting for policy overlap at the Member State level

Additionality concerns can also arise with the way in which overlaps between Member State policy measures are accounted for. Subsidy regimes, information campaigns, utility programmes and energy pricing instruments may form part of an effective policy framework for driving energy efficiency actions, but the impact of one policy measure cannot be easily isolated from the other elements of the policy mix. The issue for policymakers is not necessarily to attribute energy savings accurately to each policy measure, but rather to ensure that the combined impact of the set of policy measures is not overstated.

To account for policy overlaps and to avoid double counting, some Member States with economywide quantity-based policy instruments, such as energy efficiency obligation schemes, have chosen only to report savings from this measure, despite the presence of other policy measures. This was the case in the 2014-2020 obligation period in Denmark, France, Luxembourg and Poland. Similarly, Sweden, which has an economywide carbon tax, chose only to report savings from this policy measure, even though many other energy efficiency policy measures are in place. The same principle of attributing energy savings to a primary policy instrument can be applied at the sector or end-use level too. Alternatively, overlapping policy measures can be assessed collectively, as is the case in the Netherlands, where energy savings are reported at the sectoral level.

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[54] European Commission. (2020c, October). *A Renovation Wave for Europe – greening our buildings, creating jobs, improving lives.* COM(2020) 662 final. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0662

[55] Schlomann et al., 2021.

[56] European Commission, 2019.

Where overlapping policy measures are reported to the Commission individually, each policy measure should be assessed in sequence, taking account of the impact of all previously assessed measures. An assessment of the extent to which policy overlaps have been considered[57] reveals that 15% of the energy savings Member States report are from policy measures where this is a concern, or no information has been provided on how potential issues have been dealt with.

Materiality of policy measures

The other broad area to watch out for when assessing the impacts of policy measures is their materiality. Policy measures that subsidise energy-efficient products with a significant market share will most likely lead to purchases that would have been made without the government intervention. For some participants, subsidies would be immaterial to their purchasing decision. In evaluation parlance this is known as 'free riding.' Technological progress, energy prices and other consumption trends can all affect the extent to which a policy measure will lead to free riding.

Taking account of materiality is important in policy design. Policymakers wishing to ensure that scarce subsidies are directed to where they will have most impact need evidence on which to base their decisions: on which technologies to make eligible for support, the level of support to provide, and the conditions for participation.

Understanding the impact of materiality on the energy savings attributable to policy measures is important in the context of the EU's climate plan, which demands energy consumption reductions in addition to a baseline that should take account of known trends. To improve the likelihood that energy savings will be additional to the baseline, the EED requires that policy measures make a meaningful contribution to individual actions and have more than a minimal effect on end users' decisions. An assessment of Member States' compliance with the materiality requirement found that 12% of reported energy savings were associated with policy measures with concerns or for which no information was provided.[58]

Narrow focus on annual energy savings

As we have seen, the reporting requirements of the EED energy savings obligation have led to a focus on counting installations and making assumptions about the annual energy they save, while taking account of the impacts of other policy measures, particularly EU law. Although this approach would be defensible in assessing annual energy savings, if backed up by reliable evaluation evidence, it fails to capture the range of information needed to assess the role of energy efficiency in meeting broader policy objectives.

- To allow the Energy Efficiency First principle to be put into practice, in many cases data on the pattern of energy savings across hours, days and seasons will be needed, so energy efficiency resources can be compared with supply-side alternatives delivering similar services to the energy system. Understanding the geographical location of savings will also be important in improving planning and allowing the Energy Efficiency First principle to be implemented.

[57] Schlomann et al., 2021.

[58] Schlomann et al., 2021.

- A focus only on energy savings will fail to capture the benefits of tackling energy poverty through energy efficiency actions, as some of the benefits will likely be taken through more comfortable indoor temperatures.
- The benefits of energy efficiency actions for public health through improvements in indoor and outdoor air quality also affect the overall cost-benefit analysis comparing energy efficiency and supply-side resources.

A narrow focus on annual energy savings in reporting means that neither the costs nor the full range of energy efficiency benefits[59] is available to policymakers.

Policy recommendations

Currently, European governments are undervaluing knowledge of what their energy efficiency policy measures are delivering. The following policy recommendations would help to rectify this situation, providing better monetary value for Europe's taxpayers and energy bill payers, and allowing energy efficiency to play a bigger role as an energy system resource. They are grouped under three headings: bolstering policy evaluation, aligning incentives and fostering culture change.

Improving policy outcomes through evaluation

Evaluation is a fundamental part of policymaking. It helps in the design and adaptation of policy measures and enables comparisons across policy measures when considering strategies for meeting strategic policy goals. If designed into the policy measures from the start, evaluation can provide the evidence needed to make better policy decisions in the future at the time that it is needed. In the United States, typically 3% to 5% of energy efficiency policy portfolio budgets is devoted to evaluation, measurement and verification.[60] This enables policymakers and civil society to have a greater understanding about what policy measures are delivering, and provides the information needed for energy efficiency to play a role as an energy system resource.

In the EU, evaluation evidence is needed to help understand how energy efficiency policy measures are contributing to policy goals including meeting carbon targets, managing the energy transition, alleviating energy poverty and improving health outcomes.

Recommendation 1: The Commission should mandate the independent evaluation of energy savings reported under the EED energy savings obligation.

- Under the current EED, Member States focus on counting installations, not on testing the accuracy of the associated energy savings.
- The EED could require Member States to commission independent evaluations of policy measures covering all reported energy savings every five years.

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[59] Lazar, J., & Colburn, K. (2013). *Recognizing the full value of energy efficiency (What's under the feel-good frosting of the world's most valuable layer cake of benefits).* Regulatory Assistance Project. https://www.raponline.org/knowledge-center/recognizing-the-full-value-of-energy-efficiency/

[60] American Council for an Energy-Efficient Economy. (2017, 12 June). *Evaluation, measurement, & verification.* https://www.aceee.org/toolkit/2017/06/evaluation-measurement-verification.

- Future *ex ante* deemed energy savings estimates could be made more accurate based on the results.
- The Commission could produce guidance on the design of evaluations and the resources required to carry them out, by policy measure type and size.

Recommendation 2: EU Member States should focus impact evaluation efforts on assessing the costs and benefits of meeting policy goals.

- Evaluating energy savings is essential for monitoring compliance with the goals of the EED and the entire climate and energy package.
- Identifying the time and location of energy savings will become increasingly important in assessing energy system resource investment strategies and the implementation of the Energy Efficiency First principle.
- Evaluating impacts relevant to energy poverty alleviation strategies – such as bill savings, indoor temperatures and indoor air quality – will be important in some cases.
- Other impacts may also be significant enough to warrant evaluation effort. For example, building energy efficiency measures may have impacts on public health and labour markets.

Aligning incentives with policy goals

Among the energy savings measurement methods allowed under the EED energy savings obligation, only the metered savings approach allows alignment of the incentives of programme participants with policy objectives. This is because the *ex post* use of meter data enables remuneration – subsidies or regulatory compliance – to be linked to the energy savings delivered at the individual project level. Payments can be linked to performance, rather than the delivery of installations that may or may not lead to the energy savings policymakers require. Programme participants – subsidy recipients or third parties tasked with delivering energy savings – will find it in their interests to seek out the most cost-effective energy savings opportunities and support end users in the efficient operation and maintenance of energy-saving equipment after it has been installed. Participants will not fare as well if equipment is improperly installed, defective, or poorly operated or maintained. Governments would have greater certainty more quickly over gross energy savings outcomes if relevant evaluation outputs were provided in real time.

In the U.S., a number of pay-for-performance pilot programmes have been set up in the buildings sector, including programmes in California and New York focused on aggregating energy savings from household energy efficiency actions. In Europe, metered savings are rarely used in policy measures in the buildings sector, although there are some small-scale examples of performance metering beginning to take off.[61] The residential pay-for-performance utility pilot programme in California came about as a result of mandates by two authorities: The California State Legislature requires that real-time energy usage data be made available to consumers and that weather-normalised, meter-based savings be prioritised; and the California Public Utilities

[61] See, for example, a 28-home project in the UK. Knauf Insulation. (n.d.). *Home comfort*. https://www.knaufinsulation.com/home-comfort

Commission requires that energy utilities procure third-party designed and implemented energy efficiency programmes.[62] The EU could provide a similar mandate for its Member States.

Recommendation 3: The Commission should mandate the piloting of pay-for-performance using metered savings in the buildings sector.

- Member States could institute pay-for-performance for buildings as part of energy efficiency obligation schemes, energy efficiency auctions or tenders, or regular subsidy programmes.
- The Commission could mandate that a small proportion of Member States' EED energy savings obligations be delivered using metered savings in the buildings sector.
- Energy savings delivered through metered savings approaches would help Member States meet their evaluation requirements (Recommendation 2).

Recommendation 4: Member States should provide clear pathways for accessing individual dwellings' smart meter data.

- Smart meter data have huge potential for targeting energy-saving and flexibility interventions, but privacy concerns prevent the data from being analysed this way.
- Clear pathways for accessing individual dwellings' data would make it easier to use actual energy usage in project design and to evaluate the performance of renovation projects.
- Access to large, anonymised sets of smart meter data would enable the development of advanced evaluation, measurement and verification methods and innovative approaches to the implementation of the Energy Efficiency First principle.

Fostering a culture change towards evaluation, measurement and verification

The move towards better evaluation, measurement and verification of energy savings – energy efficiency's key performance indicator – will require a shift in policymaking culture. The EU can play a role in both scrutinising Member States' evaluation, measurement and verification efforts and facilitating the sharing of knowledge and expertise across Member States.

Recommendation 5: The Commission should mandate the publication of verification reports by Member States every two years, alongside the reporting of energy savings.

- Member States are already required to independently verify a statistically significant proportion of the energy savings from each of their policy measures.
- A Member State verification report could include verification procedures, results from verification activities, and any corrective action taken (e.g., to modify the

[62] Santini et al., 2020.

energy savings submitted by obligated parties or to apply penalties to scheme participants).

- The scrutiny board could assess Member States' verification reports and provide guidance on improving verification processes.

Recommendation 6: The Commission should facilitate knowledge and expertise sharing on evaluation, measurement and verification across Member States.

- The Commission should help bring together Member State officials responsible for evaluation, measurement and verification with experts to support consistency and transparency in approaches, the adoption of best practices and the tackling of emerging issues such as the piloting of metered savings policy measures.
- An EU knowledge-sharing forum could produce detailed guidance on evaluation, measurement and verification that could be used across Member States, building on the work of the ENSMOV[63] and streamSAVE[64] Horizon 2020 projects.
- The Regional Technical Forum in the United States could act as a model in this respect. The forum establishes a venue where people can propose the creation of new evaluation, measurement and verification protocols. It has committees that focus on specific sectors or energy efficiency action types, and programme administrators throughout the region use its products.[65]

Recommendation 7: The Commission should regularly assess the accuracy and consistency of energy savings estimates across EU Member States.

- Inconsistencies in measuring energy savings across Member States call into question the validity of the energy savings reported under the EED energy savings obligation.
- The Commission could review Member States' evaluation, measurement and verification efforts, identify issues and best practices, and publish credibility assessments of the reported energy savings.

[63] ENSMOV, n.d.

[64] streamSAVE, n.d.

[65] Regional Technical Forum, n.d.

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