

The future of EU energy efficiency policies – a comprehensive analysis of gaps, shortcomings, and potential remedies

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Abstract

Energy efficiency activities are high on the current EU energy policy agenda. Key policy instruments like the Energy Efficiency Directive (EED), the Energy Performance of Buildings Directive (EPBD) and the Energy Labelling Directive are under revision.

In a project for the German government, we therefore analysed the effectiveness and consistency of existing sectoral policy packages anew, to open the discussion on which policy changes to the EU's energy efficiency policy packages are crucial to reach the targets.

This comprehensive review addressed the industrial, buildings, and transport sectors plus the overarching governance framework (targets and roadmaps, EED, energy taxation and EU ETS). For each of these, the first step was a gap analysis of the main deficits in the sectoral policy packages, against effective model packages.

At first glance, the combination of energy efficiency policies at EU level seems already quite comprehensive. However, their design and implementation often lack a consistent and ambitious approach to leverage their full potential.

To give some examples of the many shortcomings identified, the governance framework suffers from exceptions and the transport sector being only marginally considered in the EED; an outdated Energy Tax Directive has very low minimum rates and several exception clauses; there is a lack of commitment to implement energy management systems and investment projects in large companies; a clear EU-wide definition of nearly

zero energy buildings (nZEB) is missing; and the labelling of energy-using products is still confusing for consumers.

Subsequently, we elaborated comprehensive policy recommendations to increase the effectiveness of all these policies, and to bridge some gaps with new policies. A list of priorities was established to sort them by their relevance.

Introduction and Methodology

The aim of this paper is to present findings on policy recommendations to develop the energy efficiency policies in the European Union (EU) and its Member States (MS) further. Energy efficiency can and needs to make a significant contribution to achieve the climate protection targets and to ensure a good quality of life, among other benefits. Not the least, the European Commission has acknowledged this with the 'Efficiency First' principle.

This paper summarises findings from a 100-page report to the German government, which was prepared by the Wuppertal Institute, Ecofys Germany, and the ifeu Institute. In this paper, it is only possible to give an overview of the main shortcomings and the most substantial improvement options, due to the large number of energy efficiency policies in the EU. More detail on both the analysis and the resulting policy recommendations can be found in the comprehensive report to the German government (Thomas et al. 2017).

Due to the complexity of the market and the numerous actor-specific barriers (see e.g. Thomas 2007), policy is needed to overcome the barriers and to harness the (cost-effective) potential of energy efficiency measures. In this paper, results on possible options to develop existing energy efficiency poli-

cies at the EU level further will be presented. For the three sectors “private households”, “industry”, and “transport”, which are most important in terms of final energy consumption and potential energy savings (Ecofys 2016), policy recommendations will be presented. In addition, the “governance framework” will be analysed which builds the basis to implement sector-specific policies. The commercial and public sector is not part of this analysis. Policy recommendations for residential buildings, however, are also valid for non-residential buildings.

As a first step, the paper illustrates the sector-specific prototypical policy packages with their main policy types, as identified by the project, and the existing EU policy instruments of these types in Figures 1 to 4. The policy types that are needed to establish push and pull effects are regulation, planning, information and advice, financial incentives and financing, capacity building and networking, and research and development. These policy types addressing the demand- and supply-side should be properly combined to address all market actors with their specific barriers and incentives (cf. e.g. Thomas et al. 2016, 2015, 2013; Höfele et al. 2011; Boardman 2005; ECU 1997). Furthermore, these and other sources find that the governance framework should consist of targets and planning, infrastructure and funding, and policies to eliminate distortions, such as energy taxation.

As a second step, the project used these sector-specific policy packages as a benchmark against which to compare the existing packages of EU policy instruments, in order to identify any policy gaps in the latter. Using available literature and the project team’s expertise, existing EU policy instruments were assessed as to their effectiveness and, where possible, reasons for shortcomings. In the third step, the results of this policy gap and weaknesses analysis were used to analyse potential options for improving the EU’s energy efficiency policies. For existing policy instruments with inefficiencies, proposals for an optimised policy design were developed. If a policy gap had been identified, recommendations for new policy instruments were derived. However, the existence of a policy gap cannot automatically determine whether there is a need for action at EU level. In some cases, it may be better to complement the policy package at national level (e.g. if an agreement on EU level policies is not to be expected in the near future).

In the following, we present the results of the gap and weaknesses analysis and directly add the consequent recommendations for improved or new instruments for the most important policies in each ‘sector’ (governance framework; residential, industry, and transport). When we present a recommendation for improvement that has resulted from our analysis using the word ‘should’, it is understood that it is our recommendation, sometimes backed by other sources. Unfortunately, there is often not enough space to present details on the underlying analysis in this paper. However, we also relate our recommendations to corresponding proposals in the European Commission’s November 2016 strategy proposal “Clean Energy For All Europeans (COM(2016)860)”. The paper concludes with an overview table of the most important recommendations, sorted by their priority. Priority was determined by estimating the potential to achieve additional energy savings, relative to the other recommendations. However, priority in implementation should also consider win-

dows of opportunity that open through the currently ongoing processes for the amendment of existing EU Directives (EED, EPBD, etc).

The Governance Framework

The governance framework serves to guide and enable implementation of the sector-specific policies, which are presented in the subsequent chapters. The figure below illustrates the transposition of the governance framework in the European Union. This is only a selection of main policy instruments.

TARGETS AND CONCEPTS

In October 2014, the European Council agreed to aim for at least 27 % primary energy savings in the EU by 2030 compared to the reference scenario of 2007. This has been criticised, as it is a non-binding target and the potentials are not fully exploited; the European Parliament called for a 40 % binding target. In addition, a **clear roadmap until 2030** is not available. In its strategy proposal “Clean Energy For All Europeans”, the European Commission argues that energy efficiency is the cheapest and cleanest source of energy (“Energy Efficiency First”), and the proposal for a revised EED (COM(2016)761) includes a **binding target** at the EU level of 30 % by 2030. This is a step forward, but several studies have demonstrated that a binding target of 40 % primary energy savings by 2030 compared to the 2007 reference scenario will be needed to achieve the potential and reach the climate and energy targets (BMUB 2012; Ecofys 2016, p. 1–2). We propose that the target should also be broken down for each Member State (cf. Wuppertal Institute & Ecofys 2015) and for the main sectors to be more effective in achieving the potential.

Against this background, it is good that the 1.5 % annual energy savings targets for the MS, which have been set in **Article 7** of the Energy Efficiency Directive (EED), have been confirmed by the new strategy proposal for 2030 and beyond. However, the proposal would not remove any of the following shortcomings: It is possible to disregard the transport sector and to account early actions, which are already carried out since 2009. Companies, which are covered by the Emission Trading System (ETS), can be exempted from the target and a phasing-in of the energy savings is possible. Furthermore, the methods to calculate energy savings are often incomprehensible. According to a calculation by The Coalition for Energy Savings (2015, p. 24), the 1.5 % target is effectively reduced to 0.8 % because of these exemptions and wrong calculations.

That is why we conclude that the **target should be raised to 2 % per year** and the exemptions should be removed to achieve the cost-effective potential. The recognition of savings from EU measures could, in turn, be explicitly allowed if the target is raised to 2 % per year. This could e.g. provide an incentive to MS to strengthen the Ecodesign minimum energy performance standards. Moreover, we propose (as e.g. EEW 2016) that the calculation methods for energy savings should be clarified and the transport sector should be included without exemptions. Sectoral targets encourage MS even more to implement policies in all sectors. For instance, there could be an obligation that every major sector (household, industry, transport) has to contribute at least 20 % to the Article 7 target. The remaining 40 % could be allocated individually by the MS to energy end-use sectors.

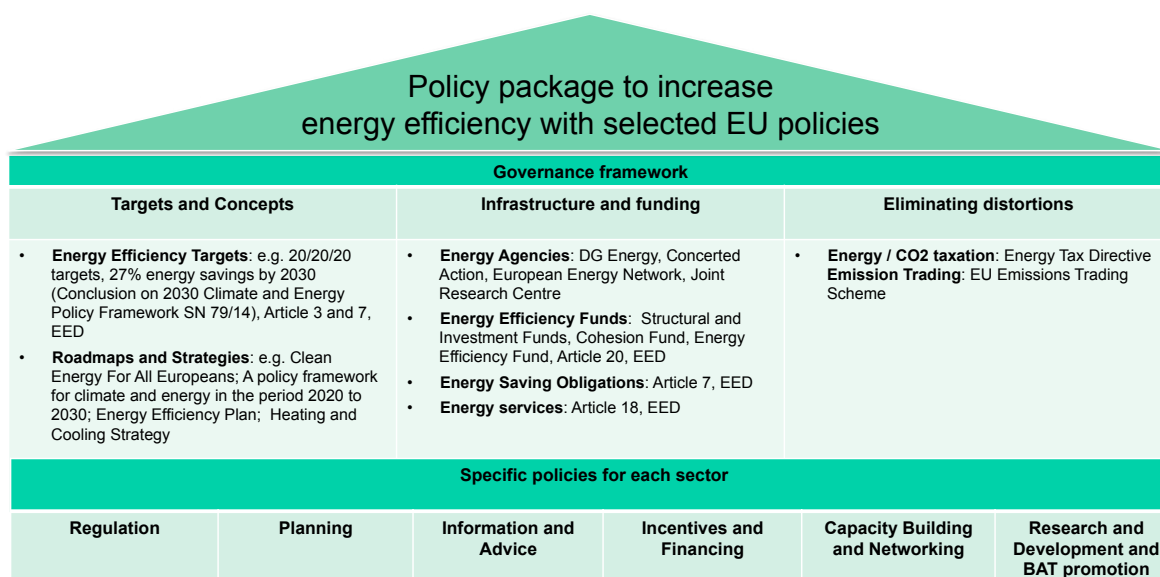


Figure 1. The EU governance framework for energy efficiency in relation to the prototypical policy package (types of instruments in bold characters). Source: own illustration based on Thomas et al. 2017.

In order to supervise the policy development in each MS, the **monitoring and enforcement** activities need to be strengthened including control and enforcement (The Coalition for Energy Savings 2015, p. 76; EEW 2016). In addition, the network activities of the enforcement authorities should be strengthened. This is connected with the need to improve the quality of the **National Energy Efficiency Action Plans (NEEAPs)** significantly. A binding and clear template should be developed to strengthen the NEEAPs as a relevant monitoring tool.

INFRASTRUCTURE AND FUNDING

Well-equipped energy agencies are an important part of the infrastructure to support policy implementation and monitoring. Staff and financial resources for implementation of the EU's energy efficiency policies should be increased, but we have no conclusion whether creation of an EU level agency with a main focus on energy efficiency is needed. Such agencies exist primarily at national and local level, even though, there is not an energy agency in every MS. A first step could be to oblige MS to operate a national energy agency via the revised EED. MS should also be obliged to provide financial support to local and regional agencies.

Several **funding programmes** are available. Key sources of funding are the **Structural and Investment Funds**, the **Cohesion Fund** and the **European Energy Efficiency Fund**. Gaps occur due to insufficient volumes of funding, unallocated funds and the short-term perspective until 2030, which does not provide planning security (Energy Efficiency Watch 2016a, EEFIG 2015, p.8). Although the strategy proposal "A Clean Energy for All Europeans" stated that e.g. the **European Fund for Strategic Investments (EFSI) 2.0** will be strengthened to unlock private financing, a sole funding of energy efficiency projects by EU funds does not seem to be appropriate, mainly because of the infrastructure needed. The majority of the infrastructure and funding should be implemented on national level. Article 20 of the EED allows the development of **National Energy Efficiency Funds (NEEFs)**. Given the need to strengthen policy

funding, this article should be revised to make it mandatory for MS to introduce such funds. These funds should have an adequate budget to invest in energy efficiency policies and measures. We estimate it should be e.g. EUR 50 per capita of the population and year, or between 0.1 and 0.6 cents per kWh of the final energy consumption, depending on the sector. Expenses of energy companies for the realisation of EEOs, cf. next paragraph, should be deducted. MS should largely be free to decide to what extent they wish to achieve the targets under Article 7 through a NEEF or through an EEO scheme. However, a minimum share of savings or costs should be required for both instruments, e.g. 10 % each.

The second important instrument to institutionalize and finance energy efficiency are **Energy Efficiency Obligation schemes (EEOs)**. Article 7 of the EED obliges all MS to implement EEOs or so called "alternative measures" (Article 7(9)). Many MS only make use of the second alternative. As EEOs are not paid from MS budgets, EEOs with a minimum size should be made mandatory for all MS, which is not the case in the proposed revision of the EED.

The market for **energy services** is also influenced by the EED. Article 18 requires all MS to support the proper functioning of the national energy service market. However, the market for energy services is still very diverse in the EU (Scharp 2011, p. 40). Medium-term targets for MS should be agreed at EU level, e.g. in the revised EED. In parallel, a clearer definition of energy services than in the current EED should be developed.

ELIMINATING DISTORTIONS

Energy taxation is another important instrument of the governance framework. At EU level, the **Energy Taxation Directive (2003/96/EC)** came into force in 2004 with minimum rates for fuels, heating and electricity. However, minimum rates set by the EU should be increased (FÖS 2012). In addition, reduced taxes should only be granted to companies that demonstrate the implementation of successful energy efficiency action and savings. Overall, the equivalence principle should be imple-

mented so that the energy content and the CO₂ emissions are taxed at the same rate. Thus, certain tax advantages for diesel compared to gasoline would no longer be possible.

The **European Emission Trading Scheme (EU-ETS)** currently comprises approximately 45 % of the GHG emissions of the EU MS. However, the ETS has been suffering from low-priced certificates and free distribution of certificates for years, reducing the incentive to reduce GHG emissions. The emissions caps need to be aligned with the energy efficiency targets in order to be effective. The ETS should be designed in such a way that there is no oversupply of certificates and free allocation is abolished. The requirements to use the revenues from the ETS and from energy taxes for the promotion of energy efficiency measures should be strengthened too, to maximise the impact for saving energy by increasing the MS' budgets to the levels needed.

Private Households

Policy instruments to increase energy efficiency in private households address new and existing buildings as well as energy using products, including appliances. The instruments in the EU policy package, their implementation gaps and recommendations to fill these gaps are described in this chapter. The current EU policy package (Figure 2) for private households includes most of the types of policies that literature finds necessary (Thomas et al. 2016, 2015, 2013). However, there are shortcomings for their effectiveness, particularly in the area of building refurbishment, which should be improved.

REGULATION

The **Energy Performance of Buildings Directive (EPBD)** sets minimum energy performance standards for the overall energy efficiency in buildings. However, some gaps still exist:

The requirements to allow only nearly zero energy new buildings (nZEBs) after 2020 are not sufficiently defined and as a consequence, MS interpret the regulation very differently (cf. ZEBRA2020 2015). That is why a harmonized and ambitious definition should be established. A roadmap for the period after 2020 should also be developed with a clear target to build only net-zero energy buildings or plus energy buildings. An even bigger gap can be found in the building stock. Although 'deep' renovations are crucial to achieve a climate-neutral building stock in 2050, there is still no trend in the EU towards a sufficient refurbishment depth and rate. According to the proposal for a revised EPBD (COM(2016) 765), MS shall set up long-term renovation strategies with clear milestones and measures to deliver on the long-term 2050 goal to decarbonise the building stock. This should be implemented but with a requirement to create deep renovation roadmaps for building types, guiding such roadmaps for each individual building in both energy performance certificates and energy audits. A next step would be to require mandatory refurbishments on certain occasions (like sales or new lettings). Energy performance certificates could be used to specify minimum requirements for buildings with poor energy efficiency classes. In addition, MS should have to address the landlord-tenant dilemma by making it possible for landlords to transfer the additional costs of the energy-efficient refurbishment to the tenants, while guaranteeing warm-rent neutrality.

Not only the EPBD but also the **Ecodesign Directive** could be improved. There are deficits in the market surveillance and enforcement (ifeu 2012, p. 7). Furthermore, the minimum requirements are too weak for some product groups (Ecofys et al. 2014, p. 4; UBA 2016). As a consequence, the minimum requirements should become more ambitious and the regulatory process should be accelerated. In addition, more products should be included to the working plan (see e.g. Van Hol-

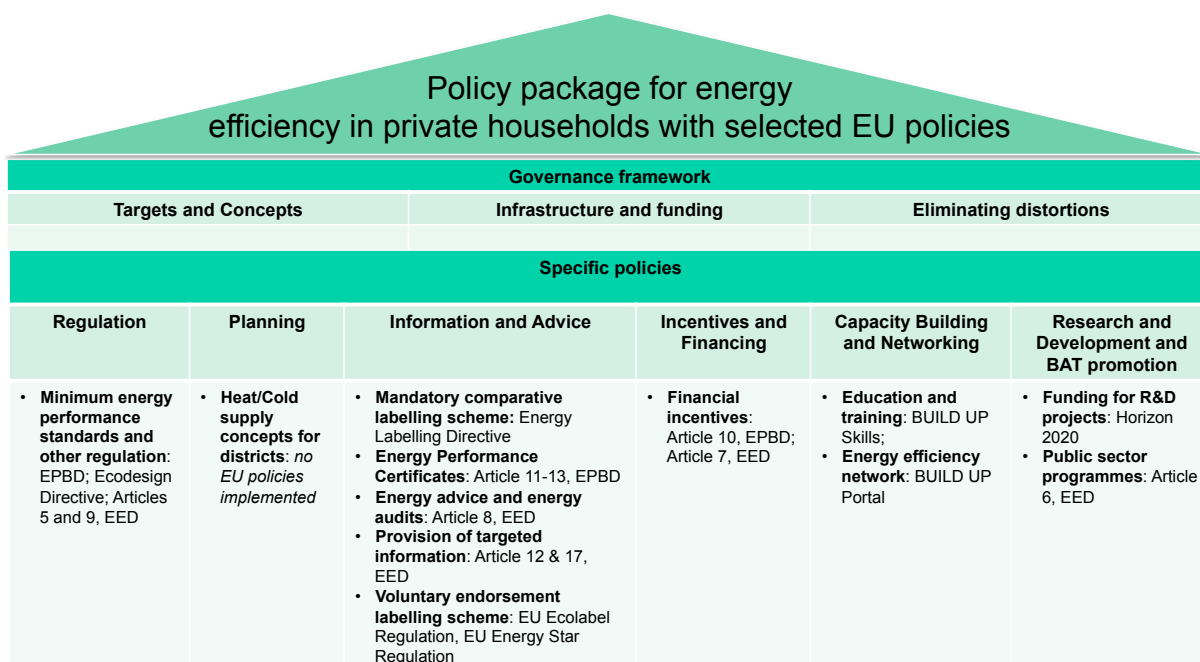


Figure 2. The EU policy package to increase energy efficiency in private households in relation to the prototypical policy package (types of instruments in bold characters). Source: own illustration based on Thomas et al. 2017.

steijn en Kemna (VHK) 2015, p. 54). Another challenge is the trend towards larger and more powerful products. Progressive instead of linear requirements should be implemented. Whenever possible, absolute limits should be set, as it was done for vacuum cleaners. Until now, resource aspects have received little attention. This should be changed as the new Ecodesign Working Plan for the period 2016-2019 promotes a transition towards a circular economy. The reparability and the lifetime of products should have greater priority (Ecofys et al. 2014, p. 5).

INFORMATION AND ADVICE

There are two main labelling schemes in the EU, the energy performance certificate of the EPBD and the EU Energy Label for products and equipment. Both have implementation gaps, which should be addressed.

With regard to the **building certificate**, the authorized person to issue the certificate is often not sufficiently qualified and the certificate itself has inconsistencies in the calculation methods. There is a need for clear rules and methods: Primary energy should be considered, the certificate should be based on calculated demand of the building, and inefficient buildings should actually be found in the worst energy classes. For existing buildings, the certificate should foster cost-effective deep renovations and support long-term roadmaps to avoid lock-in effects. A digitalisation of the energy performance criteria of all European buildings with a certificate should be mandatory in all MS, e.g. by publishing the data in an online database (BPIE 2014a, p. 54–55).

For energy related products, the **EU energy label** is already a strong instrument to inform consumers, but the label categories A+, A++ and A+++ introduced in 2010 did not prove to be useful (Ecofys et al. 2014, p. 4). The revised Energy Labelling Directive will probably see the return to the A to G classes.. The Directive should also guarantee that initially the upper classes (A and probably also B) remain empty for the top performers. In addition, the absolute energy consumption data should be given more prominence and the pictograms should be presented in a comprehensive and clear manner (Ecofys et al. 2014, p. 100). Ambition level should be increased in line with that for the Ecodesign Directive. As part of the revision, a database for all energy labelled products is being considered. It would support the market surveillance and better consumer information, and, facilitate future energy label and Ecodesign regulations. Therefore, the database should be implemented as soon as possible.

Regarding **energy audits and advice**, MS only have the obligation to take adequate measures for the inspection of heating boilers and air conditioning systems. A regulation to carry out a comprehensive and standardized high-quality energy audit does not exist (geea 2015). There is only a general requirement in the EED to promote the availability of high-quality and cost-effective energy audits for all end users. A comprehensive approach for all sectors should be established in all MS, along with standardized training units.

Information campaigns are also still insufficiently implemented in the EU. Although Article 12 of the EED requires MS to take measures to inform consumers, the revised EED should set concrete guidelines and targets.

The proposed EED revision proposes to improve information by smart meters and clear bills. This should go along with clear guidelines and monitoring mechanisms.

INCENTIVES AND FINANCING

Financial incentives to increase the energy efficiency of buildings (especially refurbishment) are available at EU level, e.g. by the different funds. However, their budget is too limited to achieve the potential.

According to Article 10 of the **EPBD**, MS shall provide financial incentives to accelerate building efficiency. Nevertheless, clear targets and obligation to introduce funding schemes are missing. Such targets (in particular to support energy efficiency investments for low-income households) should be specified in EU Directives (like Article 7 of the EED or Article 10 of the EPBD).

CAPACITY BUILDING AND NETWORKING

MS should be obliged to guarantee a **high-quality education and training** as well as a certification for building and appliance professionals. This could be included in the EPBD and/or the Labelling Directive. The EU programme BUILD UP could coordinate and support such activities.

Some measures to increase energy efficiency in buildings have a stronger impact when they are implemented in a district instead of an individual building (e.g. to establish heating grids instead of individual heat generation). Not only for this purpose, a requirement for MS to support local and regional actors' networks, as well as comprehensive heating and cooling concepts for districts as e.g., in Denmark, should be created. The actors' networks could increase the success of energy audits, financial incentives and training programmes (UBA 2016).

Industry

In the industry sector, there are some overlaps to the private household sector with respect to buildings and appliances. Hence, only new industry-specific aspects are discussed here. All in all it can be stated that large policy gaps exist in this sector. It is crucial to develop an EU-wide strategy towards a climate-neutral economy including a clear strategy for key technologies. Main elements to improve the policy package are seen in the regulatory framework (especially Article 8) and in financial incentives. These policies should be supported by quality standards for energy consultants as well as further trainings for energy managers.

REGULATION

The licensing of industrial plants is influenced by the **Industrial Emissions Directive** (IED). Although energy efficiency should, according to Annex III, be a criterion for the identification of the best available technologies (BAT), the implementation of the IED has not yet led to binding and ambitious energy efficiency requirements. The BAT BREFS should be improved by including such requirements. Moreover, Article 9(2) should be deleted so that MS have to define energy efficiency requirements also for installations subject to the EU ETS.

Industry-related products that are addressed by the **Ecodesign Directive** are cross-sectoral technologies (like motors, fans). Significantly larger savings would be possible by expanding the scope of the Directive to more complex equipment. Furthermore, the requirements almost always even fall behind the least lifecycle costs.

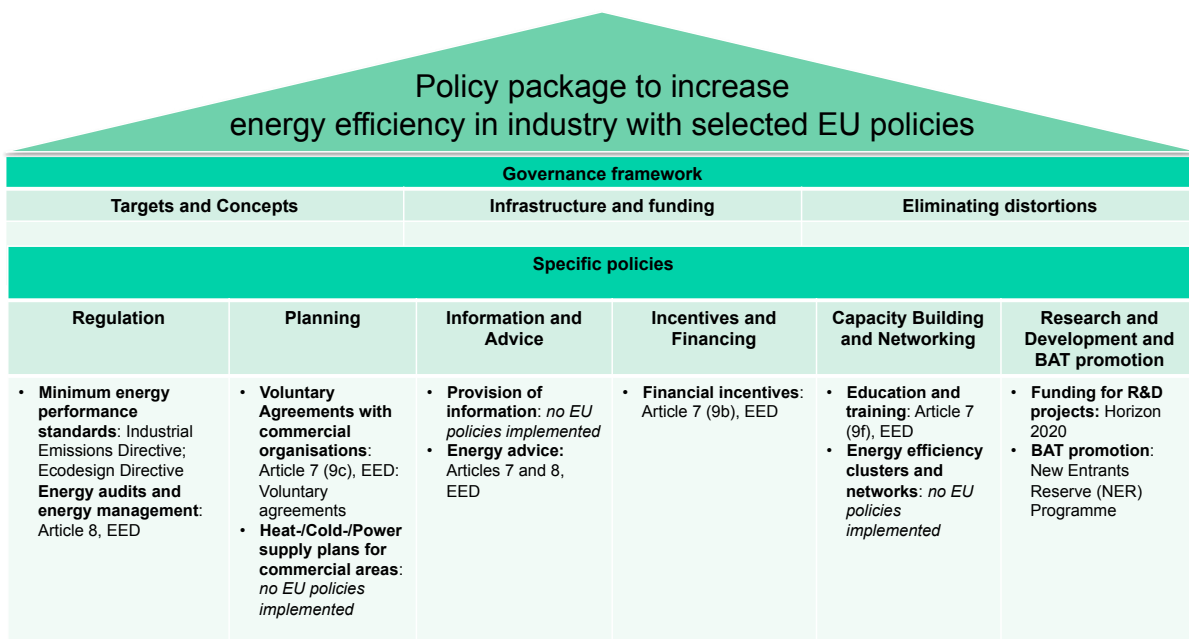


Figure 3. Policy package for energy efficiency in the industry sector at EU level in relation to the prototypical policy package (types of instruments in bold characters). Source: own illustration based on Thomas et al. 2017.

The industry sector is also addressed by **Articles 8 and 9 of the EED**. The requirements according to Article 8 should clearly define what an energy audit includes and how it should be carried out. In addition, a clear definition of companies covered should be established (not only ‘non-SMEs’ but also SMEs with a medium to high energy consumption) as well as clear requirements for multi-national and international companies (ecee & Fraunhofer ISI 2016, p. 8). The next step should be the development from energy audits towards an obligation to implement **energy management systems (EnMS)** for all companies above such an energy consumption limit.

As a result of these energy audit or energy management systems (still Article 8, EED), a roadmap should be developed for the company including a list of prioritised energy efficiency actions. Companies should be **required to implement** the prioritised actions as far as they meet specific criteria (e.g. cost-effectiveness, level of savings in %). A documentation of these actions and a comprehensive monitoring system should be implemented together with penalties for non-compliance (FH ISI & Ricardo Environment 2016, p. 10).

In **Article 9, EED**, mandatory requirements should be set for the sub-metering of equipment and installations with a high energy consumption (ICF 2015, p. 191ff.).

PLANNING

Heating-/cooling-/power-supply concepts and plans for new and existing **industrial parks** were identified as useful planning tool. However, a requirement at EU level for MS to require or promote such concepts still is lacking and should thus be created. These concepts should be based on the energy audits and energy management systems of single companies and give priority to the energy savings on the end-use side. For the remaining energy consumption, cogeneration and waste heat systems should be analysed and supported.

INFORMATION AND ADVICE

No information programme exists at EU level to address the industry sector. Energy audits are only mandatory for non-SMEs. For **SMEs** with a low or medium energy consumption, MS should be required in Article 8 of the EED to promote energy audits and EnMS, e.g. through advice, training, and financial incentives.

Overall, the EU’s guidelines and objectives to MS for **information programmes and advice** should be clarified.

For industrial processes, the elaboration of standards and benchmarks is essential for energy efficient technologies. That is why EU-wide data on worst/best performing processes are needed. There could be an obligation to transfer data and thus to set up a **database**.

INCENTIVES AND FINANCING

Although it is highly probable that the EED’s Article 7 target can only be achieved with financial incentives to increase energy efficiency in the industry sector, there is no sector-specific requirement to MS to invest in energy efficiency programmes for industry. Hence our proposal to require that at least 20 % of the Article 7 target be realised in industry. For implementation of companies’ action roadmaps (see above), financial incentives will be needed for investments which are not cost-effective. It may also be necessary to provide financing even for cost-effective investments to address the lack of capital in some MS.

The European Commission has also proposed to use the **Structural and Innovation Funds** to support the Heating and Cooling Strategy (European Commission 2016b, p. 12/13).

CAPACITY BUILDING AND NETWORKING

Structural preconditions to implement energy efficiency measures and to increase the **quality standards** should be established, i.e., minimum requirements for **education and trainings**

and **certification** of energy consultants. These requirements and certifications should be implemented in all MS and be reported to the EU. This is also of particular importance for energy managers in companies with medium to high energy consumptions.

Industrial energy efficiency networks have been proven as successful policy instruments in some MS (like Germany and Ireland). Companies can learn from each other, get advice and speed up concrete measures. SMEs can also benefit from network activities to receive relevant information. We therefore recommend to introduce an obligation for MS (in the EED) to install and promote such energy efficiency networks.

RESEARCH AND DEVELOPMENT AND BAT PROMOTION

Energy efficiency potentials can be significantly increased by the development and market launch of innovative technologies (ICF 2015, p. 8). Although in the strategy “Clean Energy For All Europeans” a budget for innovation projects until 2030 has been scheduled, it will probably not be enough to foster a real market transformation. The European research programme “**Horizon 2020**” should be further developed and the budget should be enlarged to develop, demonstrate and to introduce innovative energy-efficient solutions.

Transport

Figure 4 shows the existing EU policy package for energy efficiency in the transport sector. Although the overall governance framework of the energy efficiency policies in the EU was al-

ready described above, there are some transport-specific characteristics, which are analysed in this chapter. Furthermore, the six specific policy types are described in the same way as for the other sectors.

TARGETS AND CONCEPTS

In principle, it can be seen that policy package in the transport sector already includes the main types of policies. For instance, there are different **strategies** (e.g. COM(1999)640, COM(2010)186, COM(2016)501, COM(2016)766), **green/white books** (e.g. COM(2011)144) and **action plans** (e.g. COM(2009)490) which consist of several measures in order to improve energy efficiency and reduce GHG emissions. Nevertheless, the concrete development or revision of relevant directives and regulations is still to be expected in some cases. In addition, an overall EU **integrated strategy for sustainable mobility** should be developed. This would include targets and measures for reducing traffic, shift towards public transport, walking and cycling, as well as decarbonisation and energy efficiency.

INFRASTRUCTURE AND FUNDING

At EU level, there is still a **focus on the development of roads and motorways** (e.g. 70 % of the EU’s TEN financial resources), and less money (about 16 %) is spent on the extension of railways. **Shifting that focus** to railways is a necessary step forward. Although the funds have been significantly increased, they need further increase to match to the estimated expenditure. Fully including the transport sector into the target of

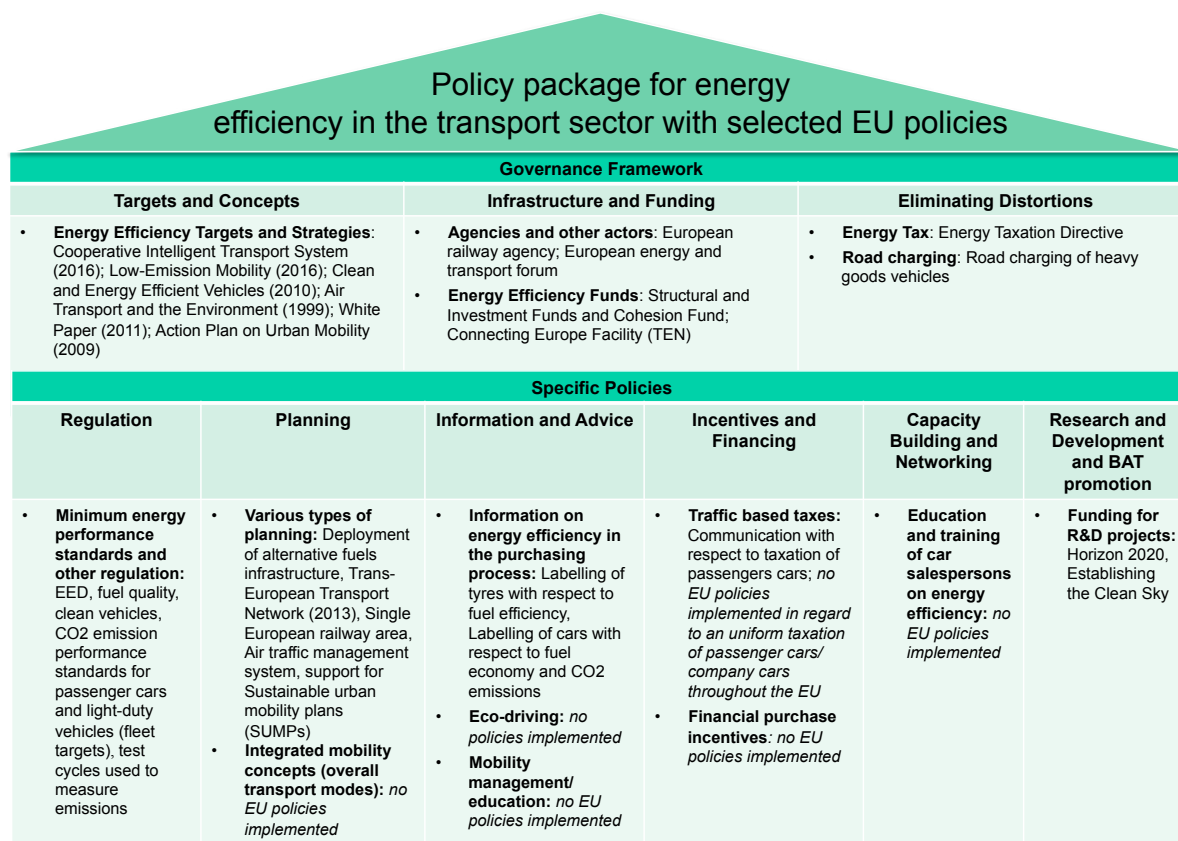


Figure 4. Policy package for energy efficiency in the transport sector on EU level in relation to the prototypical policy package (types of instruments in bold characters). Source: own illustration based on Thomas et al. 2017.

EED Article 7, as we propose, will also significantly increase MS funding for energy-efficient transport policies.

ELIMINATING DISTORTIONS

Referring to **energy/CO₂-taxation**, the minimum energy tax rate on fuels is still too low. The rate should be continuously adapted on the basis of the development of efficiency and of the inflation rate.

Directive 2011/76/EU sets common **rules on distance-related tolls and time-based user charges** (vignettes) for heavy goods vehicles for the use of certain infrastructure. However, the application of tolls and vignettes is not mandatory for Member States and external costs are insufficiently taken into account. Thus, a greater differentiation of the toll rates on basis of external costs (including CO₂ emissions) is an essential step forward to support energy efficiency in freight transport. Road pricing for buses should be added, but we have no conclusion on road pricing vs. higher fuel taxes for private vehicles.

REGULATION

In order to improve the effectiveness of the **CO₂ emission performance standards** (fleet targets), several modifications are necessary: The fleet targets should be based on vehicle basis area instead of vehicle weight in order to create an incentive to produce lighter vehicles. Secondly, a transition from an emission-based (output) assessment to an energy-based (input) assessment is essential (UBA 2013, p.3), as CO₂ emissions of alternative drive technologies (partly or completely) arise by providing energy. Moreover, more stringent fleet targets for passenger cars and light duty vehicles are crucial for the period after 2021, so as to foster technological innovations in order to continuously reduce the specific energy use and hence the CO₂ emissions. Fleet targets for heavy duty vehicles need to be implemented too. Equally, regulations are needed to continuously reduce CO₂ emissions (and pollutants) of vessels, rail vehicles, and aircraft.

Besides fleet targets which relate to the average value of a new car, the introduction of new **test cycles** determining fuel consumption, CO₂ emissions and other pollutants is crucial, as the current European type-approval procedure (NEDC) suffers from differences between official laboratory and real-world fuel consumption and CO₂ emissions. This discrepancy has increased continuously to around 40 % (ICCT 2015, p. 1). The worldwide harmonized light vehicle test procedure (WLTP) will be introduced in the EU in 2017 and is an important improvement. However, the WLTP will not close the gap on its own and thus, on-road tests should also be introduced (ICCT 2016).

PLANNING

Sustainable Urban Mobility Plans (SUMP) have a high potential in integrating transport and spatial planning and thus, support spatial structures which avoid or reduce traffic. Good examples of SUMPs already exist in several European cities. These good practices should be extensively spread, for instance by making their implementation mandatory for MS.

INFORMATION AND ADVICE

Analogous to the change of the assessment basis for fleet targets, the **energy labelling** should also be based on the vehicle area. Currently, there are many different measurement bases in

the Member States. In addition, a **public product database** is needed, with information on energy efficiency of vehicles and vehicle components.

INCENTIVES AND FINANCING

With regard to investment incentives the main deficit exists in **vehicle taxation**. Currently, the taxation of motor vehicles varies widely in the European Union. It should be based on CO₂ emissions and specific energy consumption from an energy efficiency perspective. Thus, if no unanimity is reached on European level, national initiatives will be needed: National taxation of vehicles should take their energy efficiency into account.

For the same purpose, the **taxation of company cars** should be harmonized. It is useful to set guidelines which limit tax deductibility of acquisition costs due to the fact that the more expensive vehicles are mostly the ones with higher fuel consumption and higher CO₂ emissions. The deductibility of operating costs should also be limited, to provide incentives for driving in an energy-efficient way or even driving less. It is also conceivable that company cars could not be tax-deductible at all above a certain CO₂ emission limit.

Conclusion

The EU level policy packages for the three sectors analysed in detail and for the governance framework already include (except for the industry sector) the policy instruments most important according to literature. However, a wide range of shortcomings in the design and implementation of single policies have been identified. It should, therefore, be a priority to make the existing policies more effective in order to achieve the EU's energy efficiency and climate targets and to exploit the economic potential of energy efficiency. In addition to improving EU Directives in their details, this will also require to provide the funding and the staff capacity both at EU and MS levels (cf. EEW 2016 and here above). And it will require the communication of positive narratives on the multiple benefits of energy efficiency and its policy to policy-makers at all levels, so that they are convinced why they should free the staff and funding resources needed (EEW 2016).

Apart from shortcomings in existing instruments, there are only a few complete gaps that should be filled with new instruments. In particular, new instruments should be developed in the industry sector, but also for establishing local/regional energy agencies, to address the lack of information and advice, to build up energy efficiency networks, and to further improve training activities. For these measures, the implementation should primarily take place on national level. The EU could oblige MS to implement these policies and support them in the design and implementation phase.

In the following table, the sector-specific recommendations for further policy developments are listed according to their estimated priority in achieving the energy efficiency potential.

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Table 1. Sector-specific recommendations for policy developments.

Sector	Policy recommendations
Governance Framework	<p>Highest priority</p> <ul style="list-style-type: none"> • Binding target of 40 % primary energy savings until 2030 vs. reference scenario and differentiated targets for each Member State, adding up to the 40 % overall • Extend and adapt the validity of Article 7 (EED): increase annual energy savings to 2 % for each MS, elimination of exemptions, include transport, adjustment of calculation methods, energy efficiency sub-targets for the main sectors • Securing and (if necessary) increasing of budget and human capacities for energy efficiency policies both at EU level and MS level (in ministries, agencies, etc.) • Increasing the minimum rates of energy taxes, using of tax and EU-ETS revenues for energy efficiency policies as needed • Strengthening of the monitoring activities for all energy efficiency policies and measures including control and enforcement (in addition: networking between enforcement authorities) • Compulsory implementation of the energy efficiency obligation scheme (Article 7) and an energy efficiency fund (Article 20) but freedom in the share of the Article 7 target achieved by either, except for a minimum of e.g. 10 % for each • Targets for MS to develop the energy services markets, with clearer definitions • Obligation for all MS to set up national and support regional and local energy agencies <p>Lowest priority</p>
Private Households	<p>Highest priority</p> <ul style="list-style-type: none"> • Development of a building strategy until 2050 with concrete (interim) targets, in order to achieve a climate-neutral building stock. It should also address the development of average living space and monitoring activities. • Development of ambitious Ecodesign standards and accelerated regulatory processes; stronger consideration of resource aspects; development of top runner roadmaps for every product group • For new build and existing stock: Harmonized and ambitious definition of nZEBs throughout Europe; further development of minimum requirements for net zero energy buildings or plus energy buildings towards 2030 • To reach the target of Article 7, EED: Improved conditions for standardized and high quality energy advice as well as the training and certification for energy efficiency experts. Linked to: <ul style="list-style-type: none"> – Effective financial support for 'deep' renovations – Improvement of the energy performance certificate: informative certificate with clear energy classes and recommendations that encourage deep renovations; development of a public database with key indicators for each building – Building-specific refurbishment roadmaps as a result of an energy audit to make nZEB the standard in comprehensive or partial renovation too • Return to the energy labelling classes A to G; assessment of a product should be related to the real energy consumption; establishment of a public database for all labelled products • Specific electricity consumption target for the sector private households • Further development of the heating and cooling strategy with concrete targets and transformation paths • Obligation for MS: Promotion and implementation of local/regional networks for the refurbishment of buildings and whole districts. <p>Lowest priority</p>
Industry	<p>Highest priority</p> <ul style="list-style-type: none"> • Development of an EU-wide strategy for the industry sector towards a climate-neutral economy, including a strategy for key technologies • Further development of the energy audit requirement (Art. 8 EED) to an obligation to implement energy management systems for all companies above an energy consumption threshold • Obligation to implement the proposed actions (that meet certain criteria); this also applies to actions related to an energy management system • Obligation for MS to promote energy audits and energy management systems also for SMEs below the energy consumption threshold • Obligation for MS: promotion of energy efficiency networks of companies • Obligation for companies to build up and to fill-in database with the aim to identify benchmarks (then: elaboration of standards and benchmarks) • Specification of requirements and targets to MS for information campaigns, advice programmes and the promotion of investments • Minimum standards and obligation for MS to implement capacity building programmes for energy experts; certification of energy auditors • Industrial Emissions Directive: Article 9(2) should be deleted so that requirements for emission reduction and energy efficiency must also be made for installations under the EU ETS; include binding and ambitious energy efficiency requirements into BAT BREFs • Introduction of a quota for low-carbon demonstration projects under the NER 300 innovation fund <p>Lowest priority</p>

The table continues on the next page. →

Sector	Policy recommendations
Transport	<p>Highest priority</p> <ul style="list-style-type: none"> • Implementation of transport sector White Book and 2016 strategy; advancing it to an EU integrated strategy for sustainable mobility, with targets and measures for reducing traffic, modal shift towards public transport, walking and cycling, as well as decarbonisation and energy efficiency • Mandatory inclusion of transport sector in Article 7 EED in the calculation of the saving target and saving measures • Changing the basis of assessment for fleet targets and energy labelling: use vehicle basis area • Harmonised taxation of motor vehicles and of fuels on the basis of CO₂ emissions and energy consumption/content across European Union • Development of new realistic test methods for the determination of fuel consumption, CO₂ emissions and further pollutants • Harmonisation of road charges for heavy duty vehicles and introduction for buses: based on distance driven and greenhouse gas emissions • Shifting funds from road to rail (within the framework of the TEN-financing regulation) and revival of European night trains • Introduction of fleet targets for heavy duty vehicles • Harmonized taxation of company cars: incentives for energy efficient vehicles (and no longer for expensive ones) • Consideration of mobile air conditioning systems by the Ecodesign Directive • Obligatory implementation of SUMP by MS across European Union • Development of a public product database about energy efficiency of vehicles and vehicle components <p>Lowest priority</p>

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