EUFORIE
European Futures for Energy Efficiency

# European Futures for Energy Efficiency

# 649342 EUFORIE

# Report from public hearings in the EUFORIE project

## WP9 Deliverable D9.6

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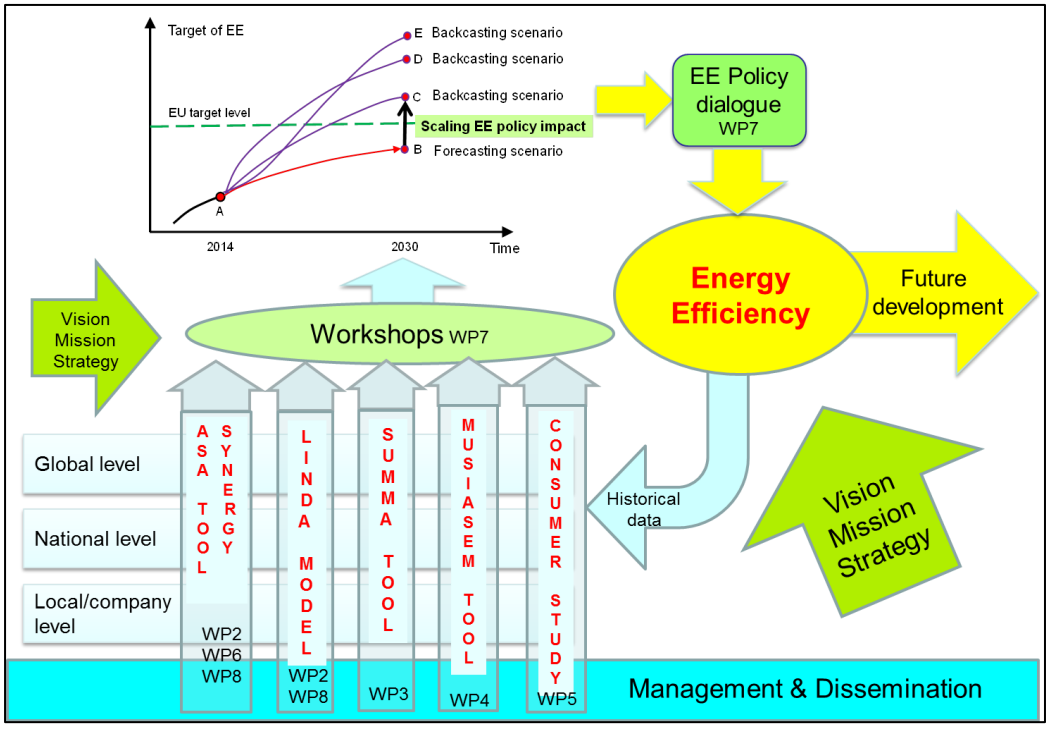
# The EUFORIE project

The strategic goal of the EUFORIE project is to provide useful and accurate information and knowledge in the field of energy efficiency for the EU Commission and stakeholders in the Member States. The tangible objectives are the following:

1. To provide energy and energy efficiency trends and their drivers, synergies and trade-offs between energy efficiency related policies, as well as energy efficiency scenarios (WP2).
2. To provide data about implementation of energy efficiency in specific processes, sectors and entire systems, in order to understand bottlenecks/efficiency drops and suggest improvements (WP3).
3. To carry out analyses of efficiency of provision, from making useful energy carriers from primary energy sources, and from conversion of energy carriers to end uses across macro-economic sectors (WP4).
4. To identify policy instruments and other measures leading to significant reduction in the energy consumption of households (WP5).
5. To analyse the relationship between investments and change in energy efficiency, and to develop indicators to describe changing energy efficiency at the company level (WP6).
6. To carry out participatory foresight for European stakeholders of energy efficiency with a target of providing ideas for the energy efficiency vision and strategy in the European Union (WP7).
7. To compare energy efficiency policy instruments and measures and their impacts in China and the European Union (WP8).

The EUFORIE Work Packages relate to each other. The project applies different quantitative and qualitative analysis methods to energy efficiency in the EU and its Member States at different levels and from different perspectives. These analyses provide input for foresight activities, which serve European energy efficiency vision and strategy process by generating useful information. Management (WP1) and dissemination (WP9) run in parallel with the research and innovation activities.



## Tasks of this deliverable related to WP9 and WP7

This deliverable D9.6 disseminates results from the EUFORIE project (WP9).

The results included in this deliverable are taken from EUFORIE WP7 deliverable D7.1 reporting the results from Tasks 7.1-7.4 (participatory workshops on energy efficiency policy and implementation in Finland, Germany, Spain and Italy) which are considered as public hearings.

EUFORIE WP7 Task 7.5 (roundtable of a European energy efficiency vision and strategy) is also considered as a public hearing, but it is not reported in this deliverable. Results from Task 7.5 will be reported in deliverable D7.2.

# Executive summary

The purpose of this deliverable is to give an insight to the key findings from the EUFORIE public hearings, which include three national workshops organised in Italy, Spain and Germany, one set of national interviews made in Finland, and one roundtable discussion held in Belgium:

| **Title of the public hearing** | International workshop on costs and benefits of energy efficiency – Scenarios for Italy and Europe | Workshop: Lessons learned from a critical analysis of Euro-pean energy di-rectives: Policy implications for Pla de l'Energia i Canvi Climàtic de Catalunya 2012-2020 | Workshop: Beyond energy efficiency | Thematic interviews on energy efficiency and technology | Roundtable: "From physics to policy: Overcoming misperceptions in energy policy" |
|---|---|---|---|---|---|
| **Location** | Rome, Italy | Barcelona, Catalonia/Spain | Frankfurt a.M., Germany | Finland | Brussels, Belgium |
| **Date** | 18 November, 201 | 13 April, 2017 | 2 June, 2017 | May-June 2017 | 27 September 2018 |
| **Number of partici-pants** | 32 | 43 | 26 | 11 | 10 |
| **Survey on energy efficiency** | Yes | Yes | No | No | No |
| **Respon-sible EUFORIE partner** | Parthenope University of Naples, Italy | Autonomous University of Barcelona, Spain | Sustainable Europe Research Institute, Germany | University of Turku, Finland | University of Turku, Finland |
| **Notes** | In collaborat-ion with the Federation of energy service companies (FEDERESCO) | In collaboration with Associació i Col·legi d'Enginyers Industrials de Catalunya (CEIC) | In collaborat-ion with Friends of the Earth Germany | | Back-to-back event with the EMP-E conference "Modelling Clean Energy Pathways" |

The key findings from the workshops and interviews include the following:

- Energy efficiency should be dealt with at the level of relevant stakeholders and at the level where it can be monitored
- Energy efficient targets set at macro level do not necessarily lead to real improvements in energy efficiency.
- EU targets and policies dealing with energy efficiency are not clear for all stakeholders.
- Material/resource efficiency should be taken into account in addition to energy efficiency.
- There is a large potential for energy efficiency in many sectors of the society.
- Best technologies for improving energy efficiency include smart, automated heating/cooling, ventilation and lighting management systems for buildings, heat pumps, waste heat recovery technologies, and insulation.
- Institutional, organizational, economic and political issues, in addition to behavioral aspects of different energy consumers, are more important challenges of energy efficiency than technology.
- Lack or unawareness of financial incentives and short payback time with low energy price hinder implementation of energy efficient investments in practice.
- There is no superior policy instrument for promoting energy efficiency, and the opinions of instruments vary widely between EU Member States and stakeholder groups.

Results from the three workshops and the interviews only are included in this deliverable. The roundtable results are presented in a separate WP7 deliverable.

The results presented in this deliverable are useful for policy makers in the European Union and in the EU Member States. They are also of interest to all other stakeholders such as researchers, NGOs, and energy industry/companies, who are interested in energy performance of systems at various spatial, temporal and functional scales, energy and environmental policies, and the role of energy efficiency in policy target setting and implementation of policies and measures to improve energy efficiency.

# Content

# Public hearings in the EUFORIE project

A public hearing may be a formal or informal meeting about a specific issue. A formal public hearing can be arranged in order to receive a testimony from the public on a specific issue with an impact to the public, typically a proposed action by public authorities. Formal public hearings are sometimes mandated by law. Good examples of this include national legislation on environmental impact assessment (EIA). Formal public hearings can also be arranged for gathering information which will help the public authorities in decision-making, or drafting legislation. (Community toolbox 2018.)

A public hearing may also be an informal one, and arranged by other actors as the public authorities. The public hearings related to the EUFORIE project are informal ones. The public hearings selected for this report include stakeholder workshops organised within the project during the years 2016 and 2017. The following three workshops were organised:

- “Methods of measurement and rating of energy efficiency", afternoon session in the "International Workshop on costs and benefits of energy efficiency. The scenarios in Italy and Europe” in Rome, Italy on 19th November 2016
- “Lessons learned from a critical analysis of European energy directives: Policy implications for Pla de l’Energia i Canvi Climàtic de Catalunya 2012-2020” in Barcelona, Spain on 24th of March 2017
- “Beyond energy efficiency” in Frankfurt am Main, Germany on 2nd of June 2017.

In addition to these workshops, a set of interviews on energy efficient technologies carried out in Finland during May-June 2017 (instead of a cancelled workshop) can be considered as informal public hearings too.

These events are called as public hearings in this report. Opinions on event-specific topics were collected from relevant stakeholders following the “quartet Helix” approach, where stakeholders are grouped into four categories: (1) public administration and politicians, (2) economic actors such as industry, (3) academia, and (4) citizens (Table 1).

**Table 1.** The share of Quartet Helix stakeholder representatives in the national EUFORIE workshops and interviews. Source: Vehmas et al (2017).

| Quartet Helix stakeholder group | Italian workshop | Spanish/Catalan workshop | Finnish interviews | German workshop |
|---|---|---|---|---|
| Government/public sector | 12 % | 9 % | 23 % | 15 % |
| Industry/companies | 25 % | 47 % | 31 % | 15 % |
| Academia | 47 % | 35 % | 31 % | 27 % |
| Citizens/NGOs | 16 % | 9 % | 15 % | 43 % |

The original idea was to include also the forthcoming EUFORIE roundtable on energy efficiency vision and strategy in the public hearings. Because the roundtable was postponed from the original schedule, it had to be excluded from this report. However, the roundtable will have a report of its own.

The content of this report at hand is a slightly shortened version of major outcomes from the report from EUFORIE workshops and interviews (Vehmas et al 2017).

# Energy efficiency as a policy target

Improving energy efficiency is good, but targets set for macro level of a society may not necessarily lead to real efficiency improvements in practice. Energy efficiency should be considered more at the levels where the stakeholders operate. On the other hand, energy efficiency can be considered also as a means to reach other targets such as energy saving, decreasing fossil or non-renewable energy consumption, or mitigation of global climate change by decreasing $CO_2$ emissions from fuel combustion. Because the concept of energy efficiency is very context-dependent, a general energy efficiency target is always a risky one.

The meaning of energy efficiency in European energy policy and in the energy efficiency directive is not clear for the stakeholders who look at it from their own perspectives. This is because the national targets have to be presented in terms of primary energy consumption and final energy consumption. These are, however, different things. Moreover, the national target can be set also in other terms such as primary energy savings, final energy savings or energy intensity, but also in these cases, the targets have to be transferred into primary energy consumption and final energy consumption, with all calculations they are based on (EC 2012). Because some industrial branches are energy-intensive by nature, it is not easy to reduce the amount of energy used in certain industrial processes such as chemical industry. Thus, generic limitations of energy consumption in industry could severely harm economic competitiveness.

In the political discussion, energy efficiency is even more unclear, because it means different things to different stakeholders in different contexts – energy use per unit of production is a practical meaning of energy efficiency in the industrial context, and decreasing fossil or non-renewable energy is a usual context of energy efficiency in environmental NGOs. In households, a typical example of context is electric appliances, their electricity consumption and related energy labels. For academia, energy efficiency is a challenge because natural sciences, technical sciences and social sciences all offer useful perspectives to it. In general, “more from less” type of thinking is the starting point of energy efficiency. There is no shared definition or view of energy efficiency. Thus, energy efficiency can be considered as a strongly context-dependent concept, and its significance lies in its attractiveness as a political catchword. This is not necessarily a good thing: in the U.S., discussion on energy efficiency has been polarized into skeptics and advocates (Brown & Wang 2017), and the same can be expected to happen in Europe, too.

In the EU and practically in all Member States, energy efficiency is a key policy objective addressing climate change, energy, and sustainability. However, many stakeholders see related EU legislation as abstract causing misinterpretations. In addition, EU directives contain significant overlap and incoherence in the objectives set for energy efficiency, renewable energy, reduction of greenhouse gas emissions, and creating an energy efficiency (service) market.

To solve these problems, a clearer and more flexible framework than the current one is needed for promoting energy efficiency in the EU and the Member States. According to many stakeholders, a legislative framework with more freedom to Member States, especially in the ways to achieve the common objectives, is a better solution. Indicative targets instead of legally binding ones are preferred by many economic actors, possibly combined with economic incentives as a tool to promote investments in energy efficiency. A more flexible framework would be beneficial for the energy efficiency market, and thus support other important EU policy targets such as employment and job creation (cf. Bukarica & Tomsic, 2017). Moreover, lack of monitoring is a generic problem recognized in the literature a long time ago (see Harmelink et al 2008).

# Challenges of energy efficiency

Energy efficiency as a means to reach targets of energy saving (primary energy and final energy consumption), and reducing $CO_2$ emissions and other harmful emissions of energy use, are the most common energy and environmental policy targets where energy efficiency can contribute. In the EU directive on energy efficiency (EC 2012), energy efficiency appears as a means to reduce energy consumption, but in public discussion, energy efficiency is often treated like a political target *per se*. This may reflect a hidden overlapping between climate, energy, and economic policies, as some stakeholders pointed out in the EUFORIE public hearings. Updating the national energy efficiency target for the year 2030 is a major challenge for many EU Member States.

Economic profitability of energy efficiency improvements is a major challenge. The length of the payback period should be short enough that investments will be made, but low energy price makes the payback period often too long for companies. The development of energy efficiency market based on both demand-side management (DSM) and supply-side options, is strongly dependent on the valuation of the payback time. Energy price is the most important driver here. On the other and, in the case of investments for energy production, acceptable payback periods are much longer. In the economic context, another challenge that may arise is lack of resources to invest, combined with lack of updated knowledge about investment opportunities. Information about available incentives to improve energy efficiency does not always reach the potential stakeholders. This is especially relevant in SMEs, where time and resources are limited to update knowledge on such opportunities, and SMEs may therefore be unaware of their eligibility for investment support.

Technology is no longer a challenge in improving energy efficiency. Much more important are the institutional, organizational, economic and political issues, in addition to behavioural aspects of different energy consumers. Moreover, change in the structure of energy production is a challenge.

Due to growing decentralization and increasing electricity production from intermittent energy sources, energy supply and demand systems have to constantly readapt to changes, which creates organizational and management-related challenges. Traditional roles of energy producers and consumers are disappearing especially in the electricity market, while more players adapt to dual roles and are either net producers or net consumers of electricity, depending on e.g. weather, season, time, market conditions, etc.

In addition, energy efficiency-related legislation is already too complex and detailed, both at the EU and Member State levels. This complexity is increasing due to e.g. the reasons mentioned above, and can potentially be an obstacle to the improvement of energy efficiency in practice – policies are enforced despite the existence of better options for improvement in specific situations.

A significant challenge is the influence of consumer behaviour on energy efficiency. When not strictly an obstacle, it is nonetheless seen as an important factor that can greatly effect energy efficiency on a large scale. Personal comfort and the willingness to pursue a different lifestyle with reduced comfort is a major challenge to fulfil objectives that really lead to reduced energy consumption.

# Indicators of energy efficiency

Aggregated energy concepts such as total primary energy supply, gross inland energy consumption, and final energy consumption, are mixing “apples and oranges”, because summing up different forms of energy is problematic. Especially calculating electricity produced by nuclear, hydro, solar and wind are problematic in this sense. The treatment of electricity produced by these primary energy sources is different in the energy statistics collected by International Energy Agency (IEA) and Eurostat: nuclear electricity is multiplied by a coefficient 3, while for hydro, wind, and solar electricity the coefficient is 1, when calculated as primary energy. In British Petroleum (BP) energy statistics, which are also widely used, primary energy is calculated by assuming a thermal efficiency of 38 % for electricity produced by nuclear, hydro, wind and solar power.

Moreover, mixing aggregated energy concepts and economic data into a single indicator (such as energy intensity, or its inverse, energy productivity) is problematic. From a scientific point of view, the whole life cycle of the biophysical aspects including imports and exports related to energy production and consumption should be taken into account. Moreover, energy intensity, for example, can change for many reasons and often without any change in efficiency defined in biophysical terms. Thus, the use of these indicators in formulating policy objectives can be considered as risky. Different stakeholders benefit from different policies, so assessment of social parameters is also important in formulating the objectives in energy policy.

# Cost effectiveness of energy production

Energy efficiency can be approached also from the perspective of cost effectiveness of energy production, including both technological choices and policy instruments such as subsidies. Reaching a cost effective solution requires a careful analysis of available alternatives. For this kind of analysis, there are various methods available, one of them is life-cycle analysis. The intermittent nature of wind and solar energy is a challenge for cost effectiveness. Dependence of renewable energies on fossil fuels is a major reason to the fact that despite of substantial investments in renewable energy, and the increase of their share in the energy mix, no significant reduction in harmful substances into the atmosphere, such as carbon dioxide emissions, has not taken place. For example, the German "Energiewende" has focused on replacing nuclear power by renewables in electricity production, without affecting the coal industry. At the same time, specific effort has not been put on energy savings e.g. in the housing sector.

Energy production and consumption is an essential aspect of circular economy. However, focusing on energy efficiency only is not enough. Material or resource efficiency should also be taken into account. Re-use and recycling of materials in an efficient way requires interpretation of the society's complex metabolism, and careful strategic planning. Moreover, different stakeholders benefit from different choices of materials and energy, so it is important to take into account social parameters too in decision-making. Integrative approaches are thus needed at many levels.

# Energy efficiency potential

It seems that nowadays there is an abundance of available technologies to improve energy efficiency in all economic sectors. Typically, a new technology is more efficient than an old one. From this perspective, improving efficiency (doing more from less) is the most important, even dominant driver of technology development. However, availability of financial resources strongly correlates with initiatives in energy efficiency-related improvement. Potential sectors for improvement include transport, industry, buildings, the service sector and SMEs (Knoop & Lechtenböhmer 2017).

In addition to technological advances in decreasing energy consumption, digitalization is a key driver of energy efficiency. Moreover, consumer behaviour can help significantly shaping the trends in energy consumption at the Member State level. Individual behaviour needs to be directed towards a decrease in energy consumption.

Another key area with large potential is the development of flexible supply and demand of electricity and heat. As energy production is shifting towards a more decentralized production with intermittent production capacity, it is important to have a system in place that can utilize the excess energy produced at peak times as efficiently as possible, thus matching supply and demand and minimizing unnecessary production. An important area is demand side management (DSM), e.g. electricity peak

cutting during high demand periods. In many EU Member States, there are institutional and legal barriers to improve DSM activities.

New buildings are often already energy-efficient, which makes further improvements difficult to realize cost-efficiently. Public buildings such as schools, hospitals and office buildings, have large potential for improvement in terms of reduction of energy consumption. Energy efficiency in buildings is now looked at from a more systemic point of view: smart control mechanisms can be used for real-time monitoring and regulation of indoor temperature, ventilation and lighting. Often installation of such control systems does not require a large investment, and its benefits clearly outweigh the costs.

In industry, companies actively invest in improvements that enhance the energy efficiency of plants and processes because such investments are cost-effective. Large improvements only occur through large innovations, whereas energy efficiency can be improved continually but in smaller steps through constant ameliorations. Some potential ways to improve energy efficiency in the industrial sector are waste and excess heat recovery (Viklund 2015), automation and control of the origin of the energy supply. Finally, there is a large potential for indirect improvement of energy efficiency through product development. For instance, chemical industry can indirectly improve energy efficiency of production by developing better, energy-efficient materials that minimize energy use throughout the product's lifetime. The large future potential of energy efficiency has been recently acknowledged also in the literature, see e.g. Fais et al (2016).

# Energy efficient technologies

A plethora of technologies was mentioned in the EUFORIE public hearings. Many stakeholders found it difficult to identify "superior" technologies that would be the most important ones in order to improve energy efficiency. They rather emphasized the need for hybrid systems, where a combination of complementary technologies brings the best results.

The most often mentioned technologies for improving energy efficiency were smart, automated heating/cooling, ventilation, lighting management systems for buildings, heat pumps, waste heat recovery technologies, and insulation. Additional Insulation needs improved heating/cooling and ventilation management in order to avoid moisture, mold and indoor air problems.

Another area that the stakeholders sought important to develop is energy storage technologies. Improving energy storage capacity can greatly minimize energy losses during production and ensure a steady, uninterrupted availability of electricity, a critical requirement for many industrial processes.

In addition to the above-mentioned technologies, the stakeholders also cited renewable energy technologies, LED lighting, new know-how for carbon sequestration, frequency changers for electric motors (for both transport and industry), electric vehicles, hydrogen technologies, and passive energy management systems.

# Policies and measures to improve energy efficiency

On the basis of the EUFORIE public hearings, there is no superior policy instrument to promote energy efficiency. National differences in the popularity seem to be significant (Table 2).

**Table 2.** Top-5* policy instruments promoting energy efficiency based on the opinions of stakeholder participants in Finland, Italy, Spain/Catalonia, and Germany. Source: Vehmas et al (2017).

| Top-5 ranking | Finland | Italy | Spain/Catalonia | Germany |
|---|---|---|---|---|
| 1 | Voluntary agreements | Information offices for energy efficiency solutions | Energy taxes | Standards |
| 2 | Research and education | Subsidies for energy production | Energy audits | Subsidies for investments |
| 3 | Standards | Government's help to reduce energy consumption | Smart meters and billing information | Information provision |
| 4 | Energy audits | Energy audits | Tax deductions | Regulation |
| 5 | Information and campaigns | Energy labels and certificates | Subsidies | |

*The policy instruments presented to the stakeholders were not necessarily similar in all countries. The table is generated from the results of the public hearings.

In Finland, the most popular policy instruments were voluntary energy efficiency agreements based on the results of stakeholder interviews. Voluntary agreements between the State administration and energy-consuming industrial and other branches are very largely used in in Finland. Their popularity and good coverage of companies in many braches is based on positive attitude, non-binding nature and lack of legal obligations on either side, which makes the structure of the agreement light. The companies have a freedom to progress towards energy efficiency goals on their own terms and pace. In addition, subsidies to investments are available.

In Italy, the most popular policy instrument, based on the answers by stakeholders to a questionnaire, appears to be information provision. In Catalonia, energy taxes, was the most popular instrument. In Germany, standards are seen as the most effective policy instrument to reduce energy consumption in households.

Table 2 reflects at least three things in relation to policy instruments for promotion of energy efficiency in the EU: (1) differences between the Member States, (2) the complexity and problems of energy efficiency as a concept at the macro level, and (3) the methodological differences in the EUFORIE WP7 work carried out by the beneficiaries. Thus, it is not surprising that no policy instrument belongs to all

Top-5's of the four EU Member States. The most shared views seem to be on energy audits, subsidies and information provision, each of them is included in all national "rankings" in Table 2.

Finally, the EUFORIE public hearings showed that no single policy instrument was perceived as effective on its own. A good solution seems to be a combination of complementary instruments that promote both economic flexibility and cost-effective solutions.

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