EERAdata

DATA-DRIVEN DECISION-SUPPORT TO INCREASE ENERGY EFFICIENCY THROUGH RENOVATION IN EUROPEAN BUILDING STOCK

D7.3 – Policy Recommendation Guidelines for Transnational and National Legislation Amendment

[WP7 – Practical Integration in Governance and Local Policies]

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Disclaimer

About the project

The EERAdata project will develop and test a decision-support tool to help local administrations in the collection and processing of their building and demographic data towards an assessment and prioritisation of Energy Efficiency measures in planning, renovating and constructing buildings.

While EU policy assigns a primary role to Energy Efficiency (EE), the lack of a holistic understanding of the impact of EE investments has hindered its integration in the policy-making process. Coordination between demand and supply side of energy policy is not targeted, and there is need to gather the evidence on the benefits of EE in ecological and socio-economic terms as well as on its interactions with the broader policy context and energy market.

Project's goals

The project aims to develop:

- Guidelines and roadmaps for the advancement of the clean energy transition
- Joint thematic studies and analyses reports on territorial needs and decarbonisation pathways
- A fully developed and tested decision-support tool to help local administrations in the collection and processing of their building and demographic data towards an assessment and prioritization of EE measures in planning, renovating and constructing buildings

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Executive summary

This deliverable, *D7.3 – Policy Recommendation Guidelines for Transnational and National Legislation Amendment,* presents an overview of recommendations for policy improvements as a result of the lessons learned from the EERAdata project. It brings together the expertise of all project partners to draw insights and lessons from different stages of the project.

This report presents eight recommendations addressing established energy efficiency-based policy instruments such as energy performance certificates (EPCs), long term renovation strategies, building renovation passports, and energy audits. It also proposes new policies which will help improve the implementation of energy efficiency measures and help alleviate energy poverty in the EU. The recommendations proposed are as follows:

- Recommendation to track Indoor environmental conditions in buildings
- Recommendation to ensure utility companies provide energy consumption data
- Recommendation to include minimum data requirements as part of energy audits
- Recommendation to ensure the provision of energy performance certificates to relevant public administrations
- Recommendation to track and store data on changes/renovations made to buildings over time
- Recommendation to include the wider benefits of building renovation in energy audits
- Recommendation to include socio-economic assessment databases into long term renovation strategies
- Recommendation to include solar resource use through PV and Solar thermal systems as mandatory in residential sector in renovation of buildings

Evidence for the recommendations developed have been obtained from the initial case studies, data collection and cleaning, and pilot phases of the EERAdata project. For each recommendation, the context and shortfalls in current policy are first defined, after which the recommendation is proposed. Evidence for each recommendation in the EERAdata project is then presented and finally a short explanation for how it will create positive impact is given.

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1. Introduction

This deliverable provides an overview of the key policy recommendations drawn from the EERAdata project by bringing together the expertise of the project partners to draw insights from different stages of the project. It is based on Task 7.5 of the EERAdata grant agreement – *Policy Governance Recommendations* within Work Package 7 – *Practical Integration in Governance and Local Policies*. The EERAdata project has formulated key recommendations (i.e., suggested courses of action to be followed based on the results of both the theoretical and empirical work carried out) which together can serve to help European policymakers to prioritise energy efficiency measures in buildings through the application of the DST developed by EERAdata.

Decisions made on implementing building renovation measures are often made without considering data on existing building stock, wider socioeconomic, and environmental conditions. This is seen as especially true in understaffed public authorities. As a result of this, there is a lack of understanding of the impacts of investments in energy efficiency-based building renovation measures on mitigating the effects of climate change. The EERAdata project is therefore conducting research and developing a decision support tool (DST) for calculating and communicating the impact of energy efficiency-based renovations.

There are currently existing policies such as the Energy Performance for Buildings Directive (EPBD)[1], Energy Efficiency Directive (EED)[2], and Ecodesign Directive[3] which help to address the energy challenges in the EU and promote the EU's "Energy Efficiency first Principle (EEfP)"[4]. However, these policies and others are lacking in that they do not take into account the wider benefits of energy efficiency as well as data availability for accurate impact assessments. Therefore, six policy recommendations have been developed based on the work carried out over the project's duration so far (M1-M29). This includes work conducted on the initial case studies, data collection, DST development, and scalability assessment. For each recommendation, the context and shortfalls in current policy are first defined, followed by the proposed recommendation, the evidence for it in EERAdata and then how it will create positive impact.

The remainder of this report is structured as follows: Section 2 contains the different policy recommendations based on the work done in the EERAdata project. Section 3 concludes the deliverable.

[1] Energy Performance for Buildings Directive (https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L0844&from=EN)

[2] Energy Efficiency Directive (https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:315:0001:0056:EN:PDF)

[3] Ecodesign Directive (https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32009L0125)

[4] Energy Efficiency first Principle (https://ec.europa.eu/energy/topics/energy-efficiency/targets-directive-and-rules/energy-efficiency-first_en)

2. Key Recommendations of the EERAdata Project

2.1. Recommendation to track indoor environment in buildings

The indoor environment in buildings affects the comfort, well-being and performance of the occupants. Currently, all buildings track their use of electricity, gas, oil and other potential energy sources for payment purposes. However, measurement of indoor environment conditions is most often used for instantaneous control of heating, cooling, and ventilation systems, but measurements are rarely saved and used to evaluate occupant exposures. This is a serious flaw, as the cost of employees in commercial buildings dominates expenses incurred in running and maintaining the building by almost an order of magnitude. Substandard indoor environment that deteriorate occupant performance may thus have serious economic consequences.

Currently, in both the most recent version of the Energy Performance for Buildings Directive (EPBD) and the Energy Efficiency Directive (EED), there is no requirement to track and report the indoor environment in buildings. This is an issue because of the importance of the indoor environment on comfort, health and productivity (Fisk and Rosenfeld 1997, Seppänen *et al*., 2006; Seppänen and Fisk 2006; Akimono *et al*., 2010; Tanabe *et al*., 2013).

A comprehensive survey containing 129 questions was conducted in task 2.1 (*Policy Review and User Requirement Definition*) of the EERAdata project to obtain information on the existing situation in each of the partner municipalities. From the survey conducted, thermal comfort, one of the indoor environment domains, was identified by all implementing partners as one of the main challenges likely to be improved by performing energy efficiency-based renovations, along with improved wellbeing and productivity, and economic growth and poverty alleviation. Additionally, in a workshop conducted as part of this deliverable, one of the project's implementing partners (the Andalusian Energy Agency), highlighted the lack of clear criteria for identifying which buildings are in the most need for energy efficiency-based renovations which can potentially alleviate energy poverty. This criterion can be used to develop a ranking system which will contribute to building a systematic and needs-based allocation of the limited resources designated for building renovation by public authorities. This is an issue also highlighted in Carlucci (2013) which indicated that simply comparing energy consumption of buildings is not a satisfactory enough method for ranking building performance.

It is therefore recommended that indoor environment descriptors be used as a metric through which buildings can be ranked and prioritised for receipt of generally limited renovation budgets in municipalities around the EU. Given that the level of thermal comfort in a building has been described as an indicator of energy poverty (Papada and Kaliampakos, 2016), this ranking can also help to identify households which are energy poor and help relevant entities allocate appropriate funding and attention to addressing this. Entities which could greatly benefit from having this ranking include:

- "Social housing agencies managing thousands of public households"
- "Communities which have a large section of the population living in energy poverty"

2.2. Recommendation to ensure utility companies provide energy consumption data

Building energy consumption is simply the amount of energy used for a building to fulfil its basic functions and the ones of its residents i.e., lighting, heating, cooling, appliances, and cooking. While energy consumption should not constitute the only piece of data used to determine the energy performance of a building, it is still a significant part of the assessment and is recommended as the variable to be quantified first (Wang *et al.*, 2012).

In the Energy Efficiency Directive (Directive 2012/27/EU), point 1 of Article 11 states that "*member States shall ensure that final customers receive all their bills and billing information for energy consumption free of charge and that final customer also have access to their consumption data in an appropriate way and free of charge*". Although utility companies are required by EU directive to provide final consumption data to consumers, there is currently no requirement for these organisations to provide energy consumption load curves to public entities and administrations managing renovations, energy social housing and public buildings.

The EERAdata project required that basic building stock data such as energy consumption be available to conduct impact assessments of energy efficiency-based renovations. During the data collection process however, two of the three partner municipalities encountered difficulties in accessing and collecting building energy consumption data. This was due to this data not being made available to the public authorities in charge of building management.

It is therefore recommended that utility companies be required to provide energy consumption information to municipalities and public authorities. This information, provided in the right format and with privacy and data protection taken into account, can help public authorities in allocating renovation funds and renovation scheduling. It can also help with activities such as regulation/negotiation of energy prices with suppliers, supervision of trends in energy consumption to identify deviations, and the proposal of corrective steps to mitigate severe energy poverty.

2.3. Recommendation to include minimum data requirements as part of energy audits

Energy audits are required by the EU according to article 8 of the Energy Efficiency Directive 2012/27/EU. An energy audit is defined as a procedure performed with the purpose of obtaining adequate knowledge of the existing energy consumption of a building. It focuses mainly on diagnosing the fragile points of a building's energy usage system, access latent power and develop energy-saving responsibility (Wang et al., 2010). The main steps of the audit process include conducting a complete energy

analysis of the building system, identification of areas which contain waste, development of a plan for reducing energy consumption, implementation of the defined plan, and monitoring of results (Dongellini *et al.*, 2014).

According to the energy efficiency directive, energy audits should be based on "up to date, measured, traceable operational data on energy consumption and for electricity (load) profiles". The directive, however, does not specify or provide detail on the basic variables required to be collected in order to perform quality energy audits.

As part of the EERAdata project (in deliverables 4.1, 4.2 and 4.3), databases which contain building-specific, and default (regional) data have been created to help municipalities and public authorities assess the impact of energy efficiency-based renovations in buildings through the creation of a digital decision-support tool (DST). The most basic of these databases, consisting of the minimum data required for the DST to function, can be incorporated into the energy audit. The data dictionary for this database can be seen in table 1 below.

Table 1 Minimum Required Data in EERAdata

Variables	Data Type	Description
Building ID	Integer	Building identification number
Building Use	String	Building category (administrative, educational, healthcare, cultural and sport)
Building Age	Datetime	Year in which building was constructed
Floor Area	Integer	Used area of the building
Building Width	Float	Width of the building
Building Length	Float	Length of the building
Number of Storeys	Integer	Number of storeys in the building
Room or Building Height	Float	Room height or building height
Ground Surface Area	Integer	Surface area of the base plate

It is recommended that the variables listed in the data table above be tracked and collected during energy audits. The collection of the variables in the data table above will help energy auditors perform detailed and validated calculations for proposed energy-saving measures. This in turn will contribute to the development and proposal of clear recommendations for potential energy and cost savings.

2.4. Recommendation to ensure the provision of energy performance certificates to relevant public administrations

The Energy Performance Certificate, according to the Energy Performance for Buildings directive (EPBD) is "an instrument aimed at informing building owners, tenants and users about the cost of heating and cooling, savings that investments would bring and offer benchmarks to compare similar buildings". It is the main instrument used by the EU to promote energy efficiency. The energy performance rating in most EU countries is represented by a letter scale, i.e., from A to G – A being the most efficient and G being the least efficient (Olaussen *et al.*, 2017).

Under the existing EU regulatory framework, these certificates are currently required for buildings being built, sold, or rented. They are required to be provided to prospective tenants or buyers. There is, however, currently no requirement to provide these certificates to public administrations that lead building renovation efforts and allocate resources. Due to the data requirements for energy efficiency impact assessment in the EERAdata project, the energy performance certificates are a necessary part of providing a robust assessment of the state of a building energy-wise.

It is therefore recommended that it becomes mandatory for building managers and landlords to provide energy performance certificates to public building administrations to help with renovation planning and resource allocation efforts. This information would go a long way to establishing a baseline in terms of energy performance for each building assessed and will help to determine an accurate measure of how much renovations have improved the energy performance of the building.

2.5. Recommendation to track and store data on changes/renovations made to buildings over time

Buildings can go through several renovation activities over time. This can include both cosmetic and structural renovations. In large cities, such as those of EERAdata's implementing partners, Copenhagen and Andalusia, the number of buildings which undergo renovation on a yearly basis could reach the hundreds. Therefore, it is important that data on renovation activities be tracked and stored.

Renovation of building stock in the EU has been deemed a top priority (Pombo *et al*., 2016). Through the EPBD, EU Member States are required to keep a Building Renovation Passport (BRP), which contains a digital logbook with information about the property, it's operational performance and historic renovations. The passport, which is complementary to the energy performance certificates, also includes a long-term renovation roadmap that identifies future retrofit measures, along with links to contractors and finance options.

However, this passport is only optional and complementary to the energy performance certificates. This, in essence, downplays the importance of having a record of renovations which have been performed on a building. Additionally, there is no provision in the directive for where the information on historic renovations should be stored. This is a problem as one of the challenges to the data collection efforts in the EERAdata project was the lack of centralised repositories from which data on historical renovation actions could be obtained. Data necessary for impact assessment was scattered with access rights, data owners, and data format varying significantly. This led to the use of a more scattershot approach which involved manual data gathering, sourcing for data from different government agencies, extrapolating from existing data, and incorporating default data (i.e., data representative of the country/continent). For example, in the City of Copenhagen, five different databases were found to contain

the data required for impact assessment: BBR, KASA, Timesafe, Sparenergie and Statistics Denmark.

It is therefore recommended first that the building renovation passports be made mandatory rather than optional for EU Member States and **that each member state develops a central repository in which information from the passports can be stored and retrieved by the appropriate authorities**. This can help with impact assessment for energy efficiency-based renovations as well as building-stock planning and resource allocation.

2.6. Recommendation to include wider benefits of renovation in energy audits

The impacts of energy efficiency-based renovations go beyond the standard benefit of energy consumption reduction. There are wider benefits to be taken into account which fall into the macroeconomic, fiscal, and wellbeing categories (Payne *et al.*, 2015).

Current energy audits, according to the Energy Efficiency Directive, should comprise a detailed review of the energy consumption profile of buildings or group of buildings, industrial operations or installations and build wherever possible on life-cycle cost analysis (LCCA) instead of Simple Payback Periods (SPP). This should be done to take account of long-term savings, residual values of long-term investments and discount rates. There are, however, wider benefits of energy efficiency-based renovations such as indoor well-being, comfort, energy generation, environmental well-being, health, and economic productivity which can also be taken into account in the energy audit process.

The EERAdata project is aiming to accelerate the incorporation of wider benefits of building renovations in national, regional, and municipal laws and regulations. From the survey conducted in task 2.1, questions were asked to assess the existing renovation frameworks regarding the incorporation of wider benefits and social costs. The partner municipalities indicated the need to include the wider benefits as part of their assessment process in the future.

It is therefore recommended that the wider benefits of energy efficiency-based renovation be incorporated into the results of energy audits. This can significantly help energy auditors provide additional justifications for energy saving recommendations provided as part of the audits. This in turn provides avenues for energy poverty alleviation which might otherwise go unexplored. The Andalusian Energy Agency, being an energy auditor, as well as building-stock manager, can greatly benefit from this.

2.7. Recommendation to include socio-economic assessment databases into long term renovation strategies

With the upcoming renewal of the European Energy Efficiency Directive (Directive 2018/2002/EU,) and the potential integration of the Energy Efficiency First Principle, the EERAdata results also stress the extension of article 4 of the EED in the future. Article 4 specifically states that: “Member States shall establish a long-term strategy for mobilising investment in the renovation of the national stock of residential and commercial buildings, both public and private. This strategy shall encompass:

- an overview of the national building stock based, as appropriate, on statistical sampling;
- identification of cost-effective approaches to renovations relevant to the building type and climatic zone;
- policies and measures to stimulate cost-effective deep renovations of buildings, including staged deep renovations;
- a forward-looking perspective to guide investment decisions of individuals, the construction industry and financial institutions;
- an evidence-based estimate of expected energy savings and wider benefits.”

These points are clearly part of the municipal decision-making mechanisms which, based on the right facts and balancing schemes, should lead to a sustainable development of the public building stock.

Within the EERAdata project, it became clear that the integration of wider, socio-economic benefits into balancing and planning schemes have a significant influence when integrated into long-term scenarios. **It is therefore recommended that the time-domain be added into the baselines and furthermore that the socio-economic benefits be integrated into long-term renovation strategies**. This encourages the decision makers to take facts and numbers into account which lie beyond energy cost savings, which can be calculated yearly but have a reduced impact compared to economic or social impact assessment.

Public building owners should be motivated to create a socio-economic database, observing the effects of their own building renovation projects in economic, environmental, and social terms. “How many jobs have been created?” “Have particulate matter concentration been reduced?”, “How much revenue has the municipality created over time and related to renovation projects?”. These findings can be shared and help to create an evidence base for more complex and legally binding quantification methods for wider benefits in the future.

2.8. Recommendation to include solar resource use through PV and Solar thermal systems as mandatory in residential sector in renovation of buildings

Nearly Zero Energy Buildings (NZEB) according to D’Agostino (2015), are buildings that possesses very high energy performance while requiring only minimal amount of energy which should be covered significantly by renewable sources. In the EU recommendations for Nearly Zero Energy Building (NZEB), point 2.1.3 states that the most frequently applied renewable energy systems in NZEB are on-building solar thermal and PV systems. Despite this, the majority of techcnical codes of construction

in the EU do not make the use of this solar resource mandatory. An example of this is the National Regulation in Spain (where the Region of Andalusia is located) with regards to the use of PV systems for electricity in households. This is a problem because it does not afford low income residents the opportunity to take advantage of the most freely available renewable energy source, which would help to reduce energy poverty. This issue has to also been refereced inside the COAMá publication in Greencities 2020.

It is therefore recommended that solar resources such as PV cells or solar thermal systems be made mandatory in EU directives related with building renovation and new design. This can significantly help to increase the use of the free solar resource, thereby helping to reduce energy poverty.

3. Conclusion

This deliverable has presented an overview of policy recommendations drawn from the EERAdata project by bringing together the expertise of the project partners to draw insights from different stages of the project. In total, six recommendations were put forth addressing established policy instruments such as energy performance certificates (EPCs), long term renovation strategies, and energy audits and proposing new policies which will help improve the implementation of energy efficiency measures and help alleviate energy poverty in the EU. In summary, the recommendations proposed are seen in table 2.

Table 2 Policy Recommendation Summary

S/N	Recommendation
R1	Recommendation to track “thermal comfort” in buildings. There are usually limited budgets allocated for renovations and it would be good to know which building occupants have it worst in terms of comfort and prioritize them. This ranking can also help to identify households which are energy poor and help relevant entities allocate appropriate funding to addressing this.
R2	Recommendation to make it mandatory for utility companies to provide data on energy consumption of buildings to public authorities and housing agencies which manage renovation of building stock. This can help with activities such as regulation/negotiation of energy prices with suppliers, supervision of trends in energy consumption to identify deviations, and the proposal of corrective steps to mitigate severe energy poverty.
R3	Recommendation to include the EERAdata minimum requirements as part of the data to be collected in energy audits which are required to be performed according to Article 8 of the Energy Efficiency

	Directive 2012/27/EU. This will help auditors perform detailed and validated calculations for proposed energy-saving measures.
R4	Recommendation to ensure provision of energy performance certificates to relevant public administrations. This information will help to establish a baseline of energy performance for each building assessed and determine an accurate measure of how much renovations have improved the energy performance of the building.
R5	Recommendation to track and store data on changes/renovations made to buildings over time. Based on the experience of EERAdata's implementing partners, this information is not collected and stored in a central database. Policy developed as a result of this recommendation can help with impact assessment for energy efficiency-based renovations as well as building-stock planning and resource allocation.
R6	Recommendation to incorporate the wider benefits of energy efficiency in energy audits. This can significantly help energy auditors provide additional justifications for energy saving recommendations provided as part of the audits.
R7	Recommendation to include socio-economic assessment databases into long term renovation strategies. This can significantly help to create evidence on socio-economic effects of energy efficiency and helps to develop complex quantification mechanisms and regulations for long-term renovation strategies.
R8	Recommendation to include solar resource use through PV cells and solar thermal systems as mandatory in residential sector in renovation of buildings. This can significantly help to increase the use of the free solar resource, thereby helping to reduce energy poverty.

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