

The EU Building Stock Observatory: A New Tool to Support Europe's Building Policies

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ABSTRACT

In 2016, the European Union (EU) framework legislation on buildings, including the Energy Performance of Buildings Directive (EPBD; 2010/31/EU), the Energy Efficiency Directive (EED; 2012/27/EU) and the Renewable Energy Directive (RED; 2009/28/EC) are undergoing a review process.

As part of the review process, the European Commission decided to establish Europe's Building Stock Observatory to monitor the improvement of buildings' energy performance. This public data portal, to be launched in 2016, will provide a comprehensive knowledge resource for policy makers, investors, industry stakeholders, energy utilities, local and national authorities as well as researchers to underpin decision-making, financial and long-term strategic support. The Buildings Performance Institute Europe (BPIE) is leading the work on creating the Observatory for the European Commission, in cooperation with national partners as well as a broad range of stakeholders.

The goal of the following article is to present challenges and opportunities of setting up the EU Building Stock Observatory. The paper provides an overview of the existing data sources and strategies for buildings' data collection in Europe. It also offers recommendations and strategies for future data gathering.

Introduction

EU buildings policy (2016 review)

In February 2015, the European Commission published the document "Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy" (COM/2015/080 final). This strategic document introduces the idea of an "Energy Union" indicating a development path for the energy systems in Europe by 2030. The objective "*to move further away from an economy driven by fossil fuels*" supports the EU targets agreed by the European Council in October 2014 (SN 79/14), as follows:

- A binding EU target of an at least 40% domestic reduction in greenhouse gas emissions by 2030 compared to 1990;
- A binding EU target of at least 27% is set for the share of renewable energy consumed in the EU in 2030;
- An indicative target at the EU level of at least 27% is set for improving energy efficiency in 2030 compared to projections of future energy consumption based on the current criteria. This target to be reviewed by 2020, having in mind an EU level of 30%.

In the context of the energy system transition, the European Commission pays a special attention to sectors with an important efficiency potential, in particular buildings. Europe's building stock is the largest single energy consumer, with buildings representing 40% of the energy consumption in the EU and about a quarter of non-ETS direct greenhouse gas emissions (see: Figure 1).

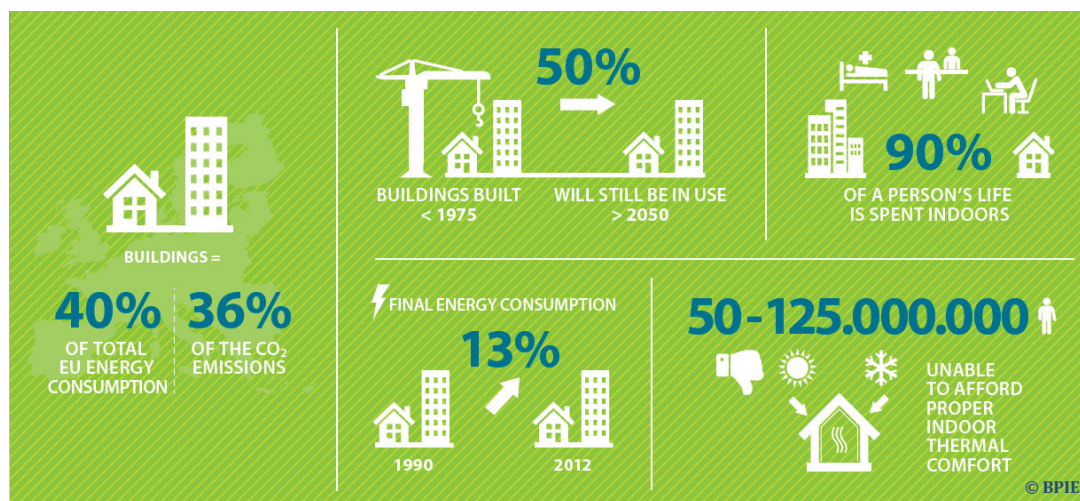


Figure 1 The EU building stock in figures (Source: BPIE)

Therefore, the Energy Union Strategy called for a 2016 review of the existing EU buildings legislation, including the Directive 2010/31/EC on the Energy Performance of Buildings (EPBD)¹ and the Directive 2012/27/EC on Energy Efficiency (EED)² and the Directive 2009/28/EC on the Promotion of Use of Energy from Renewable Sources (RED II)³.

Annex 1 presents an overview of the key EU legislation related to buildings.

The EU Building Stock Observatory

As part of the 2016 review process, the European Commission published a service tender⁴ for support in setting up the EU Building Stock Observatory to monitor the improvement of the energy performance of buildings across Europe. The Buildings Performance Institute Europe (BPIE) leads a consortium consisting of ECN, Enerdata, Ecofys, SeVen and 20 national partners developing the Observatory for the European Commission. The goal of the project is to provide the European Commission with:

¹ Directive 2010/31/EU of European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast); <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:153:0013:0035:EN:PDF>

² Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC Text with EEA relevance; <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32012L0027&from=EN>

³ Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC; <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0028&from=EN>

⁴ See also tenders specification of the service tender ENER/C3/2014-543, available at: https://ec.europa.eu/energy/sites/ener/files/documents/20140804_c3_2014_543_specifications.pdf

- A methodological framework for the monitoring of Europe’s building stock in the context of building energy efficiency policies; including a set of quantitative indicators, guidance for data collection and verification; as well as strategies to address the data gaps;
- A snapshot of the current status of the European building stock energy performance, based on the results of a data collection exercise across EU Member States;
- A publicly available portal for dissemination and communication of results.

The main focus of the Observatory is the building stock characteristics and its energy needs, including building energy performance and refurbishment, integration of renewable energy technologies and the resulting or attainable energy savings. Besides quantitative data on the building stock, the Observatory will also monitor relevant qualitative information on policies including finance, fuel poverty, other social issues, indoor air climate and so forth.

There are over 250 indicators included in the framework of the Observatory, grouped in six thematic areas (See: Annex 2). Defining the list of indicators for the EU Building Stock Observatory was achieved after a consultation with a broad range of stakeholders, including industry associations, business, building owners associations and many others, before receiving the approval of the European Commission.

The public domain of the EU Building Stock Observatory, to be launched as part of the DG ENER (Directorate General for Energy, European Commission) website in 2016, will serve as a comprehensive knowledge resource for policy-makers, investors, industry stakeholders, energy utilities, local and national authorities and researchers to underpin decision-making, financial and long-term strategic support.

EU buildings data availability

In 2013, the Global Buildings Performance Network (GBPN), published a comparative study on buildings data robustness in the EU, China, India and the US (Shnapp & Laustsen, 2013). The authors of the report investigated and compared the quality and availability of buildings data for the residential and non-residential sectors (Figure 2).

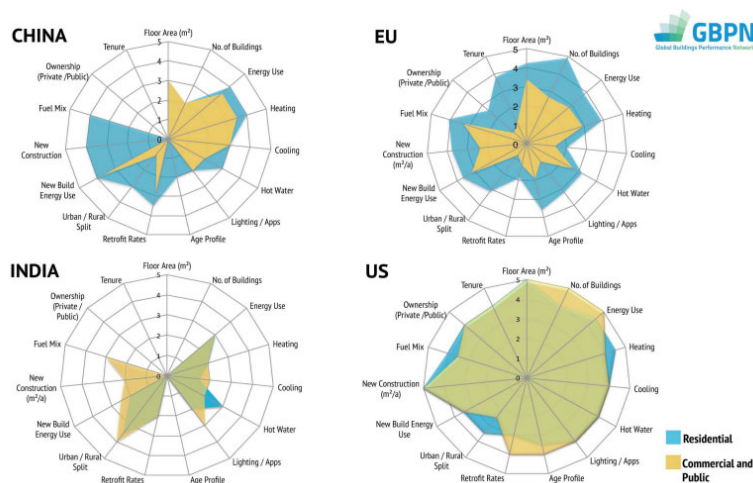


Figure 2 Buildings data availability across regions (Shnapp & Laustsen, 2013).

The results indicate that there is a room for improvement for European buildings data availability. Unlike the US, the EU does not have official data on the building sector as a whole (regional level) and the quality of data varies significantly between the different states. The findings of the analysis indicate that “the quality for both residential as well as commercial and public buildings in the EU is lower than the US”. The type of information collected and its quality vary significantly across EU Member States. Compared to other regions, in Europe there is a big difference in quality and availability of data between residential and commercial buildings.

Buildings data under the European Statistics System (ESS)

Some information on buildings in Europe is available on Eurostat, an official statistics office of the European Union. Eurostat plays a key role in the European Statistics System (ESS), and leads the way in the harmonization of statistics in close cooperation with the national statistical authorities.

Following statistics are collected in all EU Member States and reported in Eurostat⁵:

- **Information on housing stock characteristics**, based on the population and housing censuses, conducted every 10 years in every Member State on the basis of the Regulation N° 763/2008 (EC)⁶. These provide a good overview on floor area, total number of buildings/dwellings/units, owner occupancy profile, etc.
- **Energy consumption in the residential sector**, the Regulation N° 431/2014⁷ introduced a mandatory reporting of the annual national statistics on energy consumption for households as of 2016.
- **Energy statistics**, including energy balance, based on Regulation N° 1099/2008 (EC)⁸, including information on the fuel supply in households & service sectors, onsite renewable energy generation, and many others.
- **Energy poverty statistics**, based on Regulation N° 1177/2003⁹, on income and living conditions. These provide information on household’s income, poverty rate, overcrowding rate, housing deprivation, etc.

National data sources

Data on buildings in Europe is collected by different institutions at national and regional levels, such as statistical offices, energy agencies, industry, research organisations and many others. The type of data collected, the methodology (including definitions) and the frequency of data collection vary across Member States.

⁵ Eurostat database is publicly available at: <http://ec.europa.eu/eurostat/data/database>

⁶ Regulation (EC) N° 763/2008 of the European Parliament and of the Council of 9 July 2008 on population and housing censuses

⁷ Commission Regulation (EU) No 431/2014 of 24 April 2014 amending Regulation (EC) N° 1099/2008 of the European Parliament and of the Council on energy statistics, as regards the implementation of annual statistics on energy consumption in households

⁸ Regulation (EC) N° 1099/2008 of the European Parliament and of the Council of 22 October 2008 on energy statistics

⁹ Regulation (EC) N° 1177/2003 of the European Parliament and of the Council of 16 June 2003 concerning Community statistics on income and living conditions (EU-SILC)

According to Eurostat (Eurostat, 2013), over half of the available data on buildings' energy performance is based on the surveys (See: Figure 3). Surveying is a cost-effective method to obtain aggregated information; from the other hand, it doesn't necessarily provide the required level of details and consistency.

The use of administrative data, such as regional and local property registers or Energy Performance Certificate registers, is getting more popular in Europe. While it is not compulsory under EU legislation, all Member States have set up a central/regional register of the energy performance certification. These databases provide useful information on buildings envelope performance, technical system, annual energy consumption and many others.

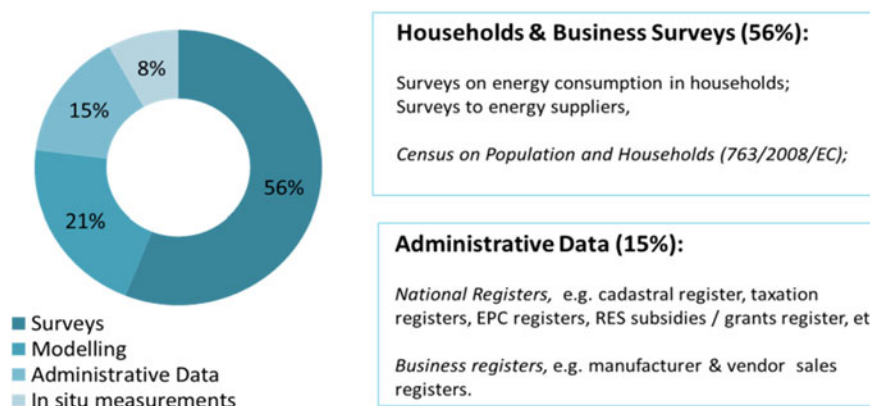


Figure 2 Energy performance data acquisition in Europe (Eurostat, 2013)

Research projects

The European Commission estimates that around 14 million euros have been spent on buildings' data collection and analysis (Ferreira 2016). This appraisal includes budgets of EU-funded projects conducted within programmes such as Intelligent Energy Europe (IEE)¹⁰, the 7th Framework Programme funded European Research and Technological Development (FP7)¹¹ and Horizon 2020 Framework Programme for Research and Innovation¹². Examples of projects that provide useful and unique data on Europe's buildings are as follows:

- **ODYSSEE-MURE project** (<http://www.odyssee-mure.eu/>). Databases of energy efficiency indicators and policies in the EU. Figures on building stock characteristics, equipment penetration rate and efficiency, existing regulations and policies and energy efficiency trends are presented for both households and service sectors. The ODYSSEE-MURE project is running since 1995.
- **ENTRANZE project** (www.entranze.eu). Database on the EU building stock, energy performance, heating energy consumption, country reports on building policies and decision

¹⁰ The Intelligent Energy Europe programme was launched in 2003 to support EU energy efficient and renewable policies; <https://ec.europa.eu/energy/intelligent/about/iee-programme/>

¹¹ <http://cordis.europa.eu/fp7/>

¹² <https://ec.europa.eu/programmes/horizon2020/>

criteria, as well as a cost-optimal and cost data tool for several energy efficient material and equipment.

- **The TABULA/ EPISCOPE projects (<http://episcope.eu/>).** Database and web data tool on building typologies in several EU countries, methodology for data collection and energy performance indicators.
- **ZEBRA2020 project (<http://zebra2020.eu/>).** Database on the EU building stock including renovation and construction activities, nearly Zero-Energy Building and renovation activities, technology sales data, value of property, etc.
- **EurObserv'ER project (<http://www.eurobserv-er.org/>).** Database on annual stock and sales for main renewable energy technologies across the EU MS.
- Another example is the **BPIE Data Hub**, an independent online portal on energy performance of buildings; launched in 2011 with private funds and today supported through EU-funding streams (namely EPISCOPE, CommONEnergy, ZEBRA2020 projects among others).

In addition to the above data sources on EU buildings, there are additional sources of information such as:

- **Industrial and commercial databases** (e.g. EuroHeat and Power database) as well as other relevant projects conducted by industry associations (e.g. REHVA, EuroAce, EHPA, EuroDoorWindows, BRSIA).
- **Other databases available in third-party countries and international organisations**, such as IEA Policy and Measures (<http://www.iea.org/policiesandmeasures/>), Buildings Rating (buildingsrating.org), Energy Star database (<http://www.eu-energystar.org/>) and many others.

Reporting obligation under the EU legislation

There is common understanding of a need for reliable facts and figures to support strategic policy-making. A good knowledge of the national building stock is a prerequisite for the development of effective building strategies and programmes, such as national renovation strategies, national plans for increasing the number of nearly Zero-Energy Buildings, setting the national goals for the public building renovation, and more.

National renovation strategies

Under Article 4 of the Directive on Energy Efficiency (EED), Member States are obliged to report on the status of their national building stock to the European Commission. The national government “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, that shall encompass:

- a) an overview of the national building stock based, as appropriate, on statistical sampling;
- b) identification of cost-effective approaches to renovations relevant to the building type and climatic zone;
- c) policies and measures to stimulate cost-effective deep renovation of buildings, including staged deep renovations;

- d) a forward-looking perspective to guide investment decisions of individuals, the construction industry and financial institutions;
- e) an evidence-based estimate of expected energy savings and wider benefits.”

In January 2016, the Joint Research Centre (JRC) published a report on the assessment of national building renovation strategies submitted by EU Member States in 2014 (JRC, 2016). The reported availability of data on the national building stock is presented in Figure 3.

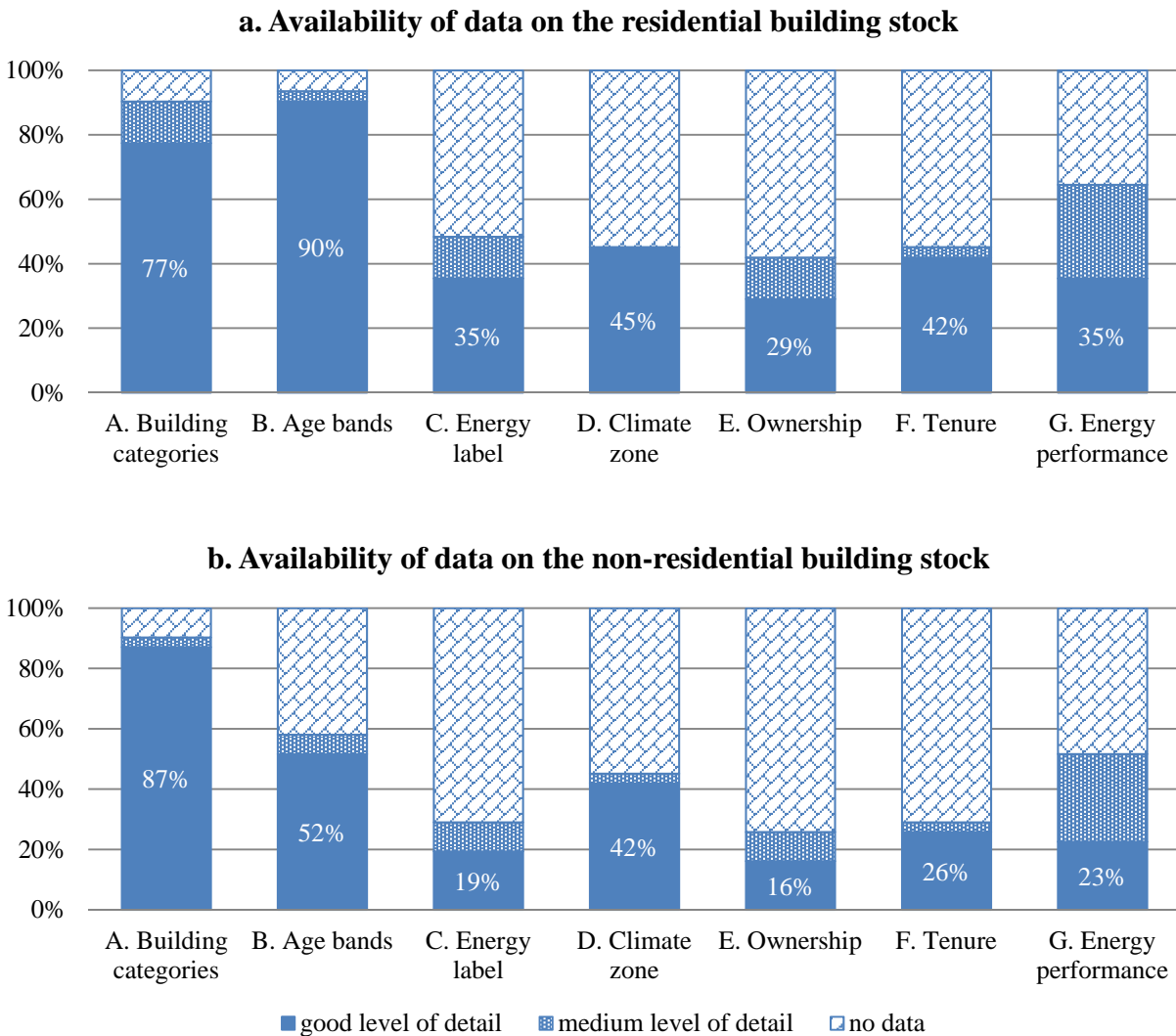


Figure 3. Information provided on the building stock in the Member States notifications on Art. 4, EED (JRC, 2016)

On average, Member States reported more comprehensive information on the residential building stock compared with the non-residential building stock. This confirms the research by Schnapp & Laustsen referred to earlier, that major data gaps are for the non-residential building stock. In general, the building stock has been well described though the different building categories and age bands, while information on climatic zone ownerships and tenure status is

missing in most cases. Data on the energy performance of buildings (including envelope performance, insulation levels, energy needs, etc.) is made available in less than 1/3 of the Member States.

Nearly Zero-Energy Building plans

Under Article 9 of the Directive on Energy Performance of Buildings (EPBD), Member States are obliged to draw national plans for increasing the number of nearly Zero-Energy Buildings (nZEB). These national plans shall include the Member State's detailed application in practice of the definition of nZEBs, targets for improving the energy performance of new buildings, as well as information on the policies and financial or other measures for the promotion of nZEBs, including details of national requirements and measures concerning the use of energy from renewable sources in new buildings and existing buildings undergoing major renovation.

Public buildings renovation

Under Article 5 of the Directive on Energy Efficiency (EED), Member States are obliged to monitor and report the 3% renovation rate to their central government buildings¹³. Information on public buildings (including floor area and energy performance) should be collected and reported to the European Commission, as a basis for calculation of the energy savings target. The directive sets ground for establishing national inventories of the central government buildings; these public buildings inventories aim at mapping the energy performance of existing buildings, showing useful floor space and actual consumption (e.g. in kWh/m² per annum, energy label). To date, public inventories of governmental buildings are available in a few Member States, including: Denmark, Lithuania, Latvia, Estonia and Cyprus (BPIE, 2014).

Conclusions and recommendations

Establishing the EU Building Stock Observatory is an important step to support policy-making processes both at the European and Member State levels. The Observatory will support monitoring of the implementation of EU directives at national and regional levels and will contribute to their review (such as the EPBD/EED/RED reviews in the coming months).

The EU Building Stock Observatory will be an important support tool for the Member States reporting to the European Commission as required under the different articles of the EPBD and EED. For example, when the time comes to update their renovation strategies in 2017 – as required under Art. 4 of the EED – Member States will be able to use the data provided in the Observatory to assess the status of their national building stock. It will provide a comprehensive overview of the building stock, including indicators such as: available statistics on envelope performance, technical systems, renovations rates and many others.

This public knowledge resource will be of use not only for decision-makers, but also investors, industry stakeholders, energy utilities, local authorities and researchers to underpin decision-making, and for long-term strategic support. Better access to data will contribute to the improvement of the way the building sector is being considered in economic modelling of energy

¹³ It applies to the heated and/or cooled buildings with a surface of more than 500m² that are owned and occupied by the central government. That threshold has to be lowered to 250 m² as of July 9, 2015.

efficiency policy options. Access to reliable information will also support effective decision-making in the financial sector, which is crucial for buildings renovation.

The experience of the EU Building Stock Observatory project shows, however, that we still have a long way to go in the process of gathering reliable information on EU's building stock. To date, the type of data collected at the national level varies between countries; Member States not only have different data collection strategies, but also different definitions and aggregation procedures. This often makes it impossible for cross-country comparison at the EU level. Data availability and quality can be improved if standardised methodologies for data collection are used, including the type of data collected and definitions. Eurostat plays in this regard a central role for the collection of harmonised statistics across Europe.

Unlike for the residential building stock, the information on non-residential buildings in Europe is not easily-accessible; which was confirmed in the Buildings Observatory project, as well as in the existing literature (JRC, 2015; Shnapp & Laustsen, 2013). New data collection strategies would need to be implemented across Europe in order to fill the data gaps.

The biggest challenge for future data collection remains the monitoring of buildings' renovation (i.e. quality and quantity) and the financial aspect of renovation. Existing data at national and European levels is not sufficient; often incomplete. Sample surveys were identified to be a transferable approach for closing the information gaps – also applicable for harmonised international activities.

Significant input of energy data can be provided by the energy utilities under Article 7 of the Directive 2012/27/EU that compels Member States to set up an energy efficiency obligation scheme. That scheme shall ensure that energy distributors and/or retail energy sales companies achieve a cumulative end-use energy savings target¹⁴. The Green Button Initiative should be inspiring for Europe's decision-makers to establish incentive mechanisms that would allow energy utilities to share energy-saving data with public authorities.

Another source of data, that hasn't yet been sufficiently exploited in Europe, is energy data collected by Transmission and Distribution System Operators (TSO and DSO). Varied schemes can and should be developed to mitigate data privacy concerns (legal agreements, limiting data dis-aggregation by defining minimum quantities of commercial entities, etc.) and allow data exchange.

¹⁴ That target shall be at least equivalent to achieving new savings each year from 1 January 2014 to 31 December 2020 of 1,5 % of the annual energy sales to final customers of all energy distributors.

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Annex 1 An overview of the EU legislation related to buildings

<p>Directive 2010/31/EC on the Energy Performance of Buildings</p>	<p>2010/31/EU Directive, recast of the 2002 version, the EPBD is the main legislative instrument at EU level to achieve energy performance in buildings.</p> <p>The Directive entails Member States to set performance standards and minimum energy performance requirements for new buildings and for existing buildings undergoing major renovations; apply energy performance certificates (EPCs) to buildings; and ensure that from 2020 only "nearly Zero-Energy Buildings" (NZEBs) are built.</p>
<p>Directive 2012/27/EC on Energy Efficiency</p>	<p>2012/27/EU Directive is an important piece of the EU legislation to achieve 20% of primary energy savings in the period 2005-2020. It covers all sectors except transport.</p> <p>Specifically, on buildings, the EED Art. 4 asks EU MS to prepare and report long-term plans for stimulating investments in deep renovation of buildings. Additionally, Art. 5 of the EED stipulates that all EU MS should undertake measures to stimulate the renovation of existing buildings owned and occupied by the central administration and to increase the renovation rate to 3% a year, or to provide equivalent energy savings.</p>
<p>Directive 2009/28/EC on the Promotion of Use of Energy for Renewable Sources</p>	<p>2009/28/EC Directive sets levels of renewable energy use within the European Union.</p> <p>Following the RED Art.12 and 13, EU MS had to set requirements for a minimum share of renewable energy to be used in buildings and take actions to stimulate the market uptake of renewable technology for heating and cooling. The targets of each individual Member State may vary depending on their renewable energy potential, the energy mix and their gross domestic product. MS should base their indicative trajectory to reach the renewable energy target based on the 2005 levels.</p>

Annex 2. Thematic areas of the Building Stock Observatory project

Topic 1: Building stock & energy needs

- T.1.1 Building stock statistics
- T.1.2 Energy Needs
- T.1.3 Fuel mix

Topic 2: Technical building systems

- T.2.1 Envelope performance
- T.2.2 On-site renewable energy generation
- T.2.3 Technical systems
 - Space heating*
 - Space cooling*
 - Domestic Hot Water supply*
 - Ventilation*
 - Lighting*
 - Cooking*
 - Electrical Appliances*
 - Metering*
 - Others*
- T.2.4 Embodied energy

Topic 3: Certification

- T.3.1. EPC distribution
- T.3.2. Voluntary certification scheme

Topic 4: Financing

- T.4.1. Average financial performance of renovation projects
- T.4.2. Tariffs
- T.4.3. Sources of Energy Efficiency financing and their financial performance
 - Debt Financing-Private debt financing for renovations (loans)*
 - Debt Financing- Dedicated credit lines*
 - Grants*
 - Fiscal Incentives*
 - Energy Performance Contracting (EPC)*
 - Energy Efficiency Supplier Obligations*

Topic 5: Fuel poverty & social aspects

- T.5.1. Fuel poverty
- T.5.2. Social issues

Topic 6 Policies and regulations

- T.6.1 Building codes
- T.6.2 National definitions