



Increasing the rate, quality and effectiveness of the renovation of existing buildings is the biggest challenge for the coming decades. For that reason, [the revision of the Directive<sup>4</sup>](#) introduces a requirement for Member States to establish comprehensive long-term strategies for a highly efficient and decarbonised building stock by 2050 and a cost-effective transformation of existing stock into nearly zero-energy buildings. These long-term strategies must provide a national overview of building stocks and include a roadmap with specific measures, measurable progress indicators and indicative milestones for 2030, 2040 and 2050. The revision makes stronger reference to energy poverty and includes health, safety and air quality, alongside initiatives to promote smart technologies, skills and education, and policies targeting the worst performing buildings, split-incentive dilemmas, market failures and public buildings.

More transparent information on building stocks will better inform policymakers and support the decisions of market players, in particular financial institutions, a necessary precondition to improving the depth and rate of renovation.

<sup>4</sup> [Amending Directive \(EU\) 2018/844 of the European Parliament and of the Council \(2018\) amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency](#)

<sup>5</sup> <https://ec.europa.eu/energy/en/topics/energy-efficiency/energy-performance-of-buildings/eubuildings>

Within that framework, the EC has set up the [EU Building Stock Observatory<sup>5</sup>](#), with two primary objectives: (i) to provide a snapshot of the energy performance of EU building stock with high quality and comparable data from all MSs, and (ii) to set a framework and methodology for the continuous monitoring of building stock.

A specific study has also been undertaken to define and collect data on building renovation, and on the uptake of nearly zero-energy buildings.

The European Commission is also exploring the use of big data. This is an opportunity to address data gaps and limitations, and to create value by identifying low performing buildings, along with the improvements likely to lead to significant savings.

Finally, the European Commission is looking into further actions to strengthen Energy performance certificates (EPC), including EPC databases as a tool for finance mobilisation and for monitoring the energy performance of building stocks.

# ARTICLE

## THE ROLE OF BUILDINGS IN THE HEATING SECTOR TRANSITION

In Europe, and worldwide, buildings and their related services are responsible for a large share of the total final energy consumption, therefore also for the environmental problems [which ensue<sup>1,2</sup>](#). Serrano et al. 2017<sup>3</sup> showed that while the main driver for energy consumption in residential buildings in Europe is the specific energy consumption, this is decreasing due to various technological options and [European policies<sup>4</sup>](#). Other drivers, such as the residential floor area per person and the number in each household, are increasing. This suggests that efforts to reduce energy consumption in buildings [should focus not just on the energy efficiency of household appliances<sup>5</sup>](#) heating, ventilation and air conditioning (HVAC) systems and other appliances such as refrigerators) but also on embedded energy. According to Ürge-Vorsatz et al. 2013<sup>6</sup>, when a building is constructed or retrofitted to a given energy efficiency level, it becomes extremely

uneconomic to carry out a new energy retrofit until the next construction cycle. In buildings the lock-in effect is therefore high, and should always be kept in mind.

*“ To increase the energy efficiency of buildings, the first strategy is the renovation of their envelopes ”*

The heating and cooling sector in Europe is still highly based on fossil fuels (75 % of the fuel is non-renewable), although [it is moving towards clean, low-carbon energy sources](#) (renewable energy sources)<sup>7</sup>. The heating and

<sup>1</sup> <https://iea.org/topics/energyefficiency/buildings/>

<sup>2</sup> D. Ürge-Vorsatz, L.F. Cabeza, S. Serrano, C. Barreneche, K. Petrichenko, *Heating and cooling energy trends and drivers in buildings*, Renewable and Sustainable Energy Reviews, 41, 2015, pp. 85-98.

<sup>3</sup> S. Serrano, D. Ürge-Vorsatz, C. Barreneche, A. Palacios, L.F. Cabeza, *Heating and cooling energy trends and drivers in Europe*, Energy 119, 2017, pp. 425-434.

<sup>4</sup> *Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings. The original directive is Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings*

<sup>5</sup> <https://ec.europa.eu/energy/en/topics/energy-efficiency>

<sup>6</sup> D. Ürge-Vorsatz, K. Petrichenko, M. Staniec, J. Eom, *Energy use in buildings in a long-term perspective*, Current Opinion in Environmental Sustainability 5, 2013, pp. 141-151.

<sup>7</sup> *EC Communication COM(2016) 51, An EU Strategy on Heating and Cooling*



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cooling sector spans buildings (45 %), industry (37 %) and services (18 %); the heating sector transition is therefore closely linked to the decarbonisation of buildings. This relationship is explored further in studies of specific cases in Switzerland<sup>8</sup>, Germany<sup>9</sup>, and Finland<sup>10</sup>. Various strategies can be employed to achieve decarbonisation, as outlined below.

“ After improving building envelopes, the next step in the decarbonisation of the building sector is the use of renewable energy to provide the required energy services ”

The first strategy is the renovation of building stock by increasing the energy efficiency of the building itself (walls, roof, windows, etc.). This would reduce energy demand, which, as mentioned above, is key to achieving EU targets. When this renovation is designed, the materials selection should take into account the embedded energy and their whole life cycle<sup>11</sup>; this is especially important in the case of

insulation<sup>12</sup>. Windows and doors should of course be designed to minimise infiltrations.

The next step in the decarbonisation of the building sector is the use of renewable energy to provide energy services. For heating, the renewable energies to use are solar thermal, geothermal, and biomass, but renewable electricity is also an option when using heat pumps to heat buildings<sup>13</sup>. Moreover, district heating, especially if fed with renewable sources, is a good option. Again, the lifecycle of products should be taken into account, a point included in the [circular economy strategy](#)<sup>14</sup>.

Buildings can therefore contribute strongly to the transition of the heating sector in two ways. The first is the decarbonisation of building stock through renovation, specially upgrading the building envelope using materials with low embodied energy and ensuring less energy demand. The second is the integration of renewable energy sources in buildings to provide heating and cooling.

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- 9 E. Merkel, R. McKenna, D. Fehrenbach, W. Fichtner, *A model-based assessment of climate and energy targets for the German residential heat system*, Journal of Cleaner Production 142, 2017, pp. 3151-3173.
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- 14 [https://ec.europa.eu/environment/circular-economy/index\\_en.htm](https://ec.europa.eu/environment/circular-economy/index_en.htm)

# ARTICLE

## COST-EFFECTIVE TRANSFORMATION OF ITALIAN BUILDING STOCK

The energy efficiency of buildings is currently one of the most important topics of debate at international level. The European Union has promoted programmes, projects and directives to develop harmonised instruments, criteria and solutions to increase the energy efficiency of both new and existing buildings. The main reference legislation in this field includes *Directive 2010/31/EU* on building energy performance and *Directive 2012/27/EU* on energy efficiency, along with their subsequent amendments.

Building energy efficiency is a priority objective for Italy. Relevant regulations and incentive measures include:

- Legislative Decree 192/2005, updated by Law 90/2013, transposing Directive 2010/31/EU;
- Inter-ministerial Decree 26 June 2015, enforcing Legislative Decree 192/2005, and subsequent amendments, providing minimum energy performance requirements for buildings and guidelines for building energy performance certification;
- Legislative Decree 102/2014 and subsequent amendments, transposing Directive 2012/27/EU.

According to the *Italian Energy Efficiency Action Plan (PAEE 2017)*<sup>1</sup>, the overall final energy saving achieved in 2016 by the civil sector was about 38.2 TWh/year<sup>2</sup>, equal to 67 % of the target expected in 2020. The residential sector has already reached 84 % of the final target, while the tertiary sector, at 15 %, still has far to go. The *Italian National Energy Strategy of 2017 (SEN 2017)*<sup>3</sup> recently established a programme to meet the European goals by 2030, aiming for industrial leadership to capture the great international growth of efficient technologies. For the residential and tertiary sectors, SEN 2017 set a target to reduce the final energy consumption by 58.2 TWh/year<sup>2</sup> by 2030 compared with 2015.

According to the last national census of 2011, Italian building stock comprises 14.5 million buildings, of which 84 % are residential. More than 60 % of residential buildings were built before 1976, i.e. before the introduction of the first law on energy saving. The annual final energy use of the civil sector covers about 43 % of national overall energy use. On average, the [annual thermal energy consumption](#)<sup>4</sup> is 125±142 kWh/m<sup>2</sup> for residential buildings, 170 kWh/m<sup>2</sup> for office buildings, and 130 kWh/m<sup>2</sup> for schools.

- 1 *Italian Energy Efficiency Action Plan (PAEE)*, Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA), Rome, 2017.
- 2 1 Mtoe = 11.63 TWh
- 3 *National Energy Strategy (SEN)*, Italian Ministry of the Economic Development and Ministry of the Environment, Rome, 2017.
- 4 *Italian Strategy for the Energy Refurbishment of the National Building Stock (STREPIN)*, Italian Ministry of Economic Development and Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA), Rome, 2015.

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## SETIS Magazine

SETIS launches a new magazine quarterly, each issue is dedicated to a different low-carbon energy technology or relevant aspects of the sector. It covers the latest developments in the subject in question. Relevant personalities are invited to write articles outlining the main challenges and priorities facing their sectors, and interviews are conducted with key representatives from the related topic.

The magazines also include a SET Plan news section detailing the last developments to achieve the Integrated SET Plan objectives, and European Commission services and/or relevant organizations/institutions are invited to provide a foreword that highlights the main policy developments on the subject.

## Energy efficiency in buildings

This edition of SETIS Magazine takes a closer look at the current status of the EU building stock and its future evolution. It discusses the energy transformation of Europe's buildings, along with the challenges and policy actions ahead. We bring together experts from the research and policy communities to discuss the most relevant and pressing issues on energy efficiency in buildings today. Their input sheds light on the question: What is the potential contribution of buildings in the transition to climate neutrality in 2050?

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