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National Building Energy Performance Strategy

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Commissioned by the Ministry of National Development and drawn up by ÉMI Építésügyi Minőségellenőrző és Innovációs Nonprofit Kft. (ÉMI Non-Profit Limited Liability Company for Quality Control and Innovation in Building).
The study ‘A typology of buildings for modelling the energy performance of the domestic residential building stock’ was carried out by Dr Tamás Csoknyai (2013).
The preparatory task of establishing ‘A typology of buildings for modelling the energy performance of the domestic public building stock’ was delegated to Dr Zoltán Magyar, the associate of Comfort Consulting Kft. (2013).
The calculation of renovation costs was made by ÉTMV Építési Termék Minőségvédelmi és Vállalkozásfejlesztési Nonprofit Kft. (ÉTMV Non-Profit Limited Liability Company for Construction Products Quality Protection and Enterprise Development).

Introduction

‘Implementation of the “European energy-efficient buildings” initiative must be promoted in Hungary to support green technologies and the development of energy-efficient systems and materials in new and renovated buildings.’
(Quoted from the Programme of National Cooperation)

The use of energy, energy efficiency and security of energy supply have become key to the competitiveness of nations and sustainable economic development. Today, energy is not simply a resource but also a prerequisite for economic development and growth, and a chance to achieve a real breakthrough.

One of the priorities identified in Hungary’s ‘National Energy Strategy 2030’, adopted in 2011, is to increase energy efficiency by reducing the energy consumption of buildings. Since 40 % of the total primary energy consumed in Hungary is used for supplying buildings with energy, achievement of this goal would result in a radical improvement in the financial position of both households and undertakings. The most important benefit for the population would be a further sustainable decrease in utility costs which, in turn, would unlock further potential for growth due to the extra purchasing power made available this way. In this context, undertakings may profit from both new market opportunities opening up in sectors engaged in rationalising energy use, and more predictable and stable energy costs.

Pursuant to Article XXII(1) of the Fourth Amendment to the Fundamental Law

‘Hungary shall strive to ensure decent housing conditions and access to public services for everyone.’

It is a sad legacy of our national past that the majority of the public building and housing stock of Hungary lag far behind the current technical and thermal design standards, with a considerably greater heat and cooling energy consumption than is attainable by modern technologies. It is obvious that the current situation is unsustainable in the long term from the point of view of both national economy and social policy. The European Union also imposes a number of obligations on Member States to improve the energy efficiency of buildings. In order to achieve the Union’s 2020 targets for energy efficiency and climate change, several EU directives have been drawn up, which are to be transposed by the Member States with the national characteristics taken into account.

The main focus of the National Building Energy Performance Strategy (the ‘NABEPS’) is on the possibilities, main criteria and conditions of implementing the energy modernisation of the domestic building stock.

The NAPEBS – drafted by the Ministry of National Development in cooperation with a group of experts coordinated by ÉMI Non-Profit Limited Liability Company for Quality Control and Innovation in Building (the ‘ÉMI’) – pinpoints the targets and main directions for modernising the domestic building stock and achieving a significant decrease in the energy demand of buildings over the period until 2020, with projections until 2030, by defining a conceptual framework for the building energy action plans as well as the specific programmes and actions to be devised at a later date.

Executive Summary

In the 2010–2013 period, the Government of Hungary prepared the essential documents in which the domestic energy policy, the set of conditions for establishing sustainable energy supply systems, the main tasks for improving energy efficiency and increasing the share of renewable energy as well as energy-related environmental targets are defined for the long term. These documents put the task of improving building energy performance into a wider energy policy, economic and social context.

Buildings account for approx. 40 % of total national primary energy consumption, using energy for heating, cooling and hot water production. This share is similar to those recorded in Member States of comparable natural endowments. A considerable part of the domestic building stock is characterised by obsolete technical and thermal design features. Accordingly, reducing the energy consumption of buildings would give rise to substantial energy savings. As more than 50 % of the energy used by buildings comes from natural gas, the savings achieved by improving the energy performance of buildings would significantly affect natural gas imports. Since a major part of the energy consumed by buildings is used for heating, energy use shows a highly seasonal pattern. This is a circumstance of central importance for both the storage of natural gas and capacity management.

Compared to developed Member States, the domestic energy consumption of households per capita is low. Still, many Hungarian households struggle with paying their energy bills. Therefore, the Government of Hungary set the goal to curb utility costs. The utility cost reduction programme launched in 2013 and the improvement of the energy performance of buildings will jointly allow for a dramatic decrease in the utility costs payable by Hungarian households. The implementation of the NABEPS is a significant step towards this aim.

In drafting the NABEPS, for the purpose of modelling and defining the number of residential building types, the database created during the 2011 census has been used to be able to extrapolate the results to the entire country. The individual search conducted by the HCSO allowed for defining further subclasses within the group of buildings classified as 'mixed-wall' and for removing non-residential buildings from the data set.

In addition to the data of the census, a detailed energy performance survey was also conducted, involving a significant number of residential buildings. ÉMI inspected the energy performance of 2 230 buildings previously filtered by quality using the databases of the Green Investment Scheme (the 'ZBR') and the Environment and Energy Operational Programme (the 'EEOP') as well as the energy performance certificates collected by VÁTI Hungarian Public Nonprofit Company for Regional Development and Town Planning ('VÁTI'). Furthermore, an on-spite energy performance inspection of over 100 buildings was carried out in each Hungarian region. Finally, ÉMI conducted an additional survey with the aim of investigating the ratio of renovated buildings per building type in addition to carrying out detailed energy performance inspections. Altogether 20 842 buildings were involved, with an equal number of buildings inspected in the different regions of the country, located in Budapest, and in major cities, smaller towns and villages in the countryside. The survey covered family houses, traditional multi-apartment buildings and multi-apartment buildings constructed of prefabricated panels alike. A detailed building energy performance survey was carried out for public buildings in State or municipality ownership as well.

The NAPEBS touches upon the requirements applicable to new buildings, incentives for the construction of new buildings and novel building structures only to the extent they are relevant for the modernisation of the existing building stock. Housing policy measures targeted at new buildings and subsidies for building new homes fall outside its scope. Based on the surveys and the analyses conducted, a typology of buildings has been developed, the energy performance characteristics of the respective building types have been defined and calculations were made for the energy savings and the investments costs entailed by the renovation scenarios resulting in a cost-optimal energy efficiency level and a nearly zero-energy level, respectively. These detailed calculations were used for elaborating different renovation scenarios in order to set targets for the renovation of residential and public buildings with a view to improving their energy performance.

Within the category of residential buildings, priority should be given to the modernisation of family houses, in particular to single-family houses built between 1946 and 1980, which are the most common based on the typology. Property owners should be supported by advisers in making their renovation choices.
The NAPEBS makes proposals primarily for the renovation of low-efficiency buildings, which are found all over the country, regardless of geographical region. Accordingly, the NAPES does not propose specific regional measures for improving energy performance. Eliminating disparities in the development levels of the various regions is an objective to be achieved with the help of support programmes. Objectives are formulated within the NABEPS at three different levels:

Overarching strategic objectives

- Harmonisation with the energy and environmental objectives of the EU
- Modernisation of buildings as a means to reduce the utility costs of the population
- Cutting back on budgetary expenses
- Reducing energy poverty
- Creating jobs
- Reducing greenhouse gas (‘GHG’) emissions

Specific objectives

- The energy savings to be achieved by 2030 should be in line with the relevant energy efficiency requirements set in the National Energy Strategy 2030.
- 2020 targets for energy savings from improved building energy performance should be defined on the basis of calculations made with the current condition of the building stock, the requirements applicable to the different building types, the technical modernisation tasks needed to meet these requirements as well as the costs this involves and the available Government and other resources taken into account.
- Having regard to Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings, Decree No 20/2014 of 7 March 2014 of the Minister for the Interior amending Decree No 7/2006 of 24 May 2006 of the Minister without Portfolio determining the energy performance characteristics of buildings (the ‘Energy Performance Characteristics Decree’) provides that, from 1 January 2015, the values corresponding to cost-optimal energy efficiency levels are applicable in the case of support granted under domestic or EU tenders or from the central budget for the improvement of the energy performance of buildings falling within the scope of the Energy Performance Characteristics Decree.
- Pursuant to the Energy Performance of Buildings Directive, it will be binding upon Member States to meet nearly zero-energy building (‘NZEB’) standards for new buildings as from 1 January 2021 and for new public buildings as from 1 January 2019. This means that NZEB requirements will apply whenever a new building is constructed instead of renovating existing buildings.
- For public buildings, the obligation laid down in Article 5 of Directive 2012/27/EU, pursuant to which 3 % of the total useful floor area of heated and/or cooled buildings over 500 m^2 owned and occupied by the central government of Member States should be renovated each year, must also be observed. That threshold shall be lowered to 250 m^2 as of 9 July 2015.

While the total consumption of the buildings of economic operators is lower than that of residential and public buildings, there is untapped potential for achieving energy savings in this area, too. The renovation of buildings in the business sector is an efficient means to reduce energy costs and promote competitiveness at the same time.

The modernisation of buildings is a labour-intensive activity allowing limited room for mechanisation and pursued mainly by small and medium-sized enterprises. Due to these characteristics, it offers ample opportunity for creating new workplaces and securing jobs for small and medium size enterprises. Furthermore, the resulting investment projects may contribute to lower costs of living, in keeping with the Government's political programme for utility cost reduction.

Energy performance targets

Having regard to the objectives formulated in the National Energy Strategy 2030, the **targets for savings to be achieved in the primary energy consumption of buildings** were set in the NAPEBS at **49 PJ/year for 2020 and 111 PJ/year for 2030.** The savings targets to be achieved by 2020 by improving the energy performance of buildings are outlined in the table below.

		Primary energy savings target for 2020 (PJ)
1	Renovation of residential and public buildings (including commercial buildings)	40
3	Renovation of the buildings of businesses	4
4	Other savings in the energy consumption of buildings	5
5	TOTAL	49

Table 1: Targets laid down in the NABEPS for savings to be achieved by 2020 by improving the energy performance of buildings

Targets for the renovation of residential and public buildings
Under the NABEPS, an opportunity is provided for the renovation of all building types.
Drawing on the renovation scenarios developed on the basis of the in-depth surveys and calculations performed, the energy savings targets to be achieved by 2020 by the renovation of residential and public buildings were specified as follows:

	2020 energy savings targets (PJ)	**Number of residential and public buildings to be renovated by 2020 (number)**	**Estimated expense by 2020 (HUF bn)**
Family houses	17.6	130 000	743
Industrialised multi-apartment buildings (prefabricated panels)	12.8	380 000	536
Traditional multi-apartment buildings	8.0	190 000	329
Residential buildings total	**38.4**	**700 000**	**1 608**
Public buildings	1.6	2 400	152
Total	**40.0**		**1 760**

Table 2: Primary energy savings targets to be achieved by 2020 through the renovation of residential and public buildings

Apart from renovating residential and public buildings, the NABEPS identifies targets in other areas as well. Additional primary energy savings of at least 9 PJ should be achieved by 2020 from the construction of new buildings and the exchange of the building stock, by renovating the buildings of businesses, improving the energy efficiency of buildings supplied with district heat, using renewable energy for supplying buildings, introducing building energy management systems, raising awareness, disseminating information, giving advice and exchanging information.

Achieving the targets laid down in the NAPEBS would have a significant effect on both budget and employment figures. The analyses performed for the 2014–2020 period show a budget surplus of HUF 290 700 million (calculated as the balance of State support and revenues from taxes and contributions). The extra demand for labour directly generated by building renovations (investment projects) would create workplaces for 41 000 to 42 000 people under contracts concluded for the entire 2014–2020 period or renewed annually. As an indirect effect of the increase in consumer demand, which is to be expected due to the extra savings on residential and public energy costs, employment in various sectors of the economy would increase by almost 3 000 at an annual level.

Meeting the targets of the NABEPS is facilitated by several actions. Some of these are already under way but the majority of them are new initiatives. The actions will be presented in detail in the national building energy action plan to be developed as part of the Third Energy Efficiency Action Plan of Hungary.

Number	**Title of action**
I.	***Energy savings on the existing building stock***
1.	Drafting the National Building Energy Action Plan
2.	Drawing up new support and financing schemes for energy efficiency projects for residential and public buildings
3.	Promoting the use of renewable energy sources (solar collectors, biomass, heat pumps) for supplying buildings with energy for heating and cooling
4.	Providing for the electricity supply of buildings from renewable sources, using photovoltaic applications
II.	***Requirements for new buildings and building renovations***
5.	Reviewing the energy performance requirements for new buildings and building renovations and laying down specific requirements and conditions for the energy performance certification of buildings, the renovation of building elements and the modernisation of buildings for improved energy performance as well as defining specific energy performance target values and indicators
6.	Revising the requirements laid down for the replacement or renovation of technical building systems and building envelopes within the category of building elements
7.	Drawing lessons from the experience gained of the building energy performance certification scheme and further improving the scheme
8.	Drawing up energy performance requirements for buildings owned and occupied by the State or the municipalities
III.	***Research, development, demonstration, innovation, knowledge, training, information***
9.	Research, development and demonstration of new technologies for the improvement of building energy performance and promoting the widespread use of such technologies
10.	Developing public awareness raising and information campaigns in the field of responsible energy use
11.	Promoting knowledge sharing and information exchange between building manager companies, owners, energy advisers and the energy experts of municipalities
12.	Training building energy performance professionals, improving training in tertiary and vocational education

13.	Further development of the system for reporting building energy performance data, harmonised reporting of project-level data and energy performance data
14.	Establishing and operating a National Building Energy Performance Information System

Table 3: Actions under the NABEPS

The NABEPS sets out the national plan for increasing the number of nearly zero-energy buildings, which is to be drawn up in accordance with Article 9 of Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings. The plan envisages gradual introduction of the requirement ensuring that all new buildings are nearly zero-energy buildings. In the first phase, compliance with cost-optimal levels of minimum energy performance requirements will be implemented in two stages. The interim introduction of cost-optimal requirements allows for sufficient lead time to prepare for the even more stringent nearly zero-energy requirements applicable as of 2019 and 2021. New public buildings will have to meet nearly zero-energy requirements as of 2019 and as of 2021, all newly constructed buildings will have to be nearly zero-energy buildings.

1. EU and international context

1.1. EU energy policy

1.1.1. Framework of the EU policy on the energy performance of buildings

In 2007, the Council of the European Union laid the foundations for an integrated European climate and environmental policy in the Energy Policy for Europe. In addition to the objectives to reduce greenhouse gas emissions and increasing the proportion of renewable energies in the European energy mix, an energy efficiency target was also laid down in this document according to which the EU should reduce its energy consumption by 20 % by 2020.

Among the headline targets of the Europe 2020 Strategy published by the European Commission in March 2010, the objectives were set to reduce greenhouse gas emissions by at least 20 % compared to 1990 levels or by 30 %, if the conditions are right, to increase the share of renewable energy sources in final energy consumption to 20 % and to achieve a 20 % increase in energy efficiency.

In its 2050 roadmap for a low-carbon economy, the European Commission analysed several possible scenarios for establishing a carbon-free energy system. The targets set include an 80 % reduction in greenhouse gas emissions and an 85 % reduction in energy-related CO_2 emissions – in particular in the transport sector – by 2050. Full implementation of the European Union's Energy 2020 Strategy is a precondition and, therefore, a main priority for achieving the targets set in the 2050 roadmap.

To support these efforts, a number of European Directives have been adopted, which are to be transposed by the Member States in their national legislation. These Directives are the following:

- Directive 2006/32/EC of 5 April 2006 on energy end-use efficiency and energy services
- Directive 2009/125/EC of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products
- Directive 2010/30/EU of 19 May 2010 on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products
- Directive 2010/31/EU of 19 May 2010 on the energy performance of buildings (the 'Energy Performance of Buildings Directive')
- Directive 2012/27/EU of 25 October 2012 on energy efficiency (the 'Energy Efficiency Directive')

The Europe 2020 Strategy defines the tasks of Member States in the field of employment, education, energy consumption and innovation based on specific objectives. The detailed measures for implementing the Strategy are specified in the national reform programmes. The respective national targets for reducing energy consumption and CO_2 emissions and increasing the share of renewable energy by 2020 are reported in the national reform programmes submitted by the Member States.

In line with the energy and climate change targets of the Europe 2020 Strategy, taking the national characteristics into account, Hungary has undertaken to increase the share of renewable energy sources to 14.65 %, to achieve an overall 18 % increase in energy efficiency compared to the energy consumption forecast for 2020 in the National Energy Strategy 2030 according to the BAU (Business as Usual) scenario and to limit the increase in greenhouse gas emissions compared to 2005 levels to not more than 10 % in sectors not covered by the EU Emissions Trading System by 2020. Reducing the energy consumption of buildings and promoting the use of renewable energy sources for supplying buildings with energy are indispensable for meeting these targets.

1.1.2. The requirements under the Energy Performance of Buildings Directive

The main objective of the Energy Performance of Buildings Directive is to promote the improvement of the energy performance of buildings within the Union. This Directive lays down, among others, a common general framework for calculating the integrated energy performance of buildings, and provides for Member States to calculate cost-optimal levels of minimum energy performance requirements and compare the results of these calculations with the minimum energy performance requirements in force. Pursuant to the Directive, by 31 December 2020, all new buildings must be nearly zero-energy buildings and Member States must draw up national plans in order to achieve this target. The Directive provides that the minimum requirements for the energy performance of buildings should be set with a view to achieving a cost-optimal balance between the investments required and the savings achieved on energy costs throughout the lifecycle of the building. At the same time, the Directive advocates measures for increasing the number of buildings that do not merely fulfil current minimum energy performance requirements but are even more energy efficient. Member States must draw up national action plans for increasing the number of nearly zero-energy buildings. The provision having the greatest impact in the Directive is the obligation imposed on Member States to establish minimum requirements for energy performance and technical building systems in the case of all building renovation projects, thereby improving the energy efficiency of the existing building stock. Despite the introduction of the Energy Performance of Buildings Directive and the other Directives preceding it, the Commission estimated that only half of the 20 % energy efficiency target would be met by 2020. Consequently, a comprehensive Energy Efficiency Plan was published in March 2011, underlining that the greatest energy saving potential lies in buildings. It calls for the establishment of binding targets in order to secure progress. Therefore, the plan focuses on instruments to trigger the renovation process in public and private buildings and to improve the energy performance of the components and equipment used in them. It is established in the Plan that publicly owned or occupied buildings represent about 12 % by area of the EU building stock and that public spending accounts for 17 % of EU GDP. Accordingly, the renovation of public buildings and upgrading the energy efficiency level of the public infrastructure is crucial. The Plan discusses the definition of low-energy buildings as well as the minimum requirements to be established in order to increase the number of such buildings, stressing that nearly 40 % of final energy consumption arises in houses, public and private offices, shops and other buildings and that two thirds of the energy consumed in residential buildings is used for space heating.

1.1.3. The requirements under the Energy Efficiency Directive

The Energy Efficiency Directive establishes a common framework of measures for the promotion of energy efficiency within the European Union in order to ensure the achievement of the Union’s 20 % energy efficiency headline target for 2020 and to pave the way for further energy efficiency improvements beyond that date.

Member States should set an indicative national energy efficiency target, based on either primary or final energy consumption, primary or final energy savings, or energy intensity. When setting those targets, Member States must take into account, among others, that the Union’s 2020 energy consumption has to be no more than 1 474 Mtoe of primary energy or no more than 1 078 Mtoe of final energy and that the national energy savings targets previously adopted in accordance with Directive 2006/32/EC should also be met. Pursuant to Article 5 of the Energy Efficiency Directive, without prejudice to Article 7 of the Energy Performance of Buildings Directive, each Member State must ensure that, as from 1 January 2014, 3 % of the total floor area of heated and/or cooled buildings owned and occupied by its central government is renovated each year to meet at least the minimum energy performance requirements that it has set in application of Article 4 of the Energy Performance of Buildings Directive. The 3 % rate must be calculated on the total floor area of buildings with a total useful floor area over 500 m^2 owned and occupied by the central government of the Member State concerned that, on 1 January of each year, do not meet the national minimum energy performance requirements set in application of Article 4 of the Energy Performance of Buildings Directive. That threshold must be lowered to 250 m^2 as of 9 July 2015.

Pursuant to the Energy Efficiency Directive, Member States must establish and make publicly available an inventory of heated and/or cooled central government buildings with a total useful floor area over 500 m^2 and, as of 9 July 2015, over 250 m^2, excluding exempted buildings.
Since May 2013, the energy performance requirements of central government buildings are surveyed and kept record of in the database entitled the National Building Energy Performance Information System. This System may also be suitable for checking compliance with the obligation to renovate buildings.

1.2. International outlook

As buildings account for a substantial part of primary energy consumption within the European Union, priority is given to measures for improving the energy performance of buildings in all Member States. In the majority of Member States, residential buildings represent 75 to 85 % of the total floor area of the existing building stock. Accordingly, while the programmes launched in the respective Member States for improving the energy performance of buildings focus primarily on residential buildings, reducing the energy consumption of public buildings remains a priority.
The national energy efficiency targets and programmes of a number of countries having a climate comparable to that of Hungary are presented in Annex 1 to the NABEPS.

2. Domestic energy policy

2.1. Cornerstones of domestic energy policy

In the 2010–2013 period, the Government of Hungary prepared the essential documents in which the domestic energy policy, the set of conditions for establishing sustainable energy supply systems, the main tasks for improving energy efficiency and increasing the share of renewable energy as well as energy-related environmental targets are defined for the long term. These documents put the task of improving building energy performance into a wider energy policy, economic and social context. Discussion of these strategic Government documents will be limited in this Chapter to a summary of the main propositions and tasks formulated in them, which have relevance for the energy performance of buildings, without presenting the documents themselves in detail.

2.1.1. Link with the National Energy Strategy

The main focus of the 'National Energy Strategy 2030 and Outlook for 2050' (Ministry of National Development, 2011) (the 'Energy Strategy') is on sustainability, ensuring domestic security of supply and enhancing economic competitiveness. These are regarded as a guarantee for securing energy services at competitive prices for economic operators and the population in the long term in the face of increased environmental regulation and diminishing hydrocarbon resources. In order to achieve the objectives specified in the Energy Strategy, the document identifies a number of instruments, including the increase of energy efficiency and energy savings.
As part of restructuring domestic energy supply, with a view also to achieving the objectives set and increasing energy efficiency, the following measures should be implemented:

- comprehensive energy efficiency measures affecting the whole supply and consumption chain;
- increasing the share of low carbon intensity electric power generation;
- promoting the spread of heat generation from renewable and alternative sources;
- increasing the share of low-carbon modes of transport.

Achieving these four points would represent a significant step towards the establishment of sustainable and safe energy systems which, at the same time, would contribute greatly to enhanced economic competitiveness.

It is established in the Energy Strategy that, on the basis of the specific communal energy consumption calculated for a floor area of 1 m^2 and adjusted for climatic differences, Hungary ranks among the ten highest consumers among the EU-27: compared to the European average of 220 kWh/m^2/year between 2000 and 2007, the Hungarian average figure for retail consumption is 247 kWh/m^2/year.

Furthermore, it is highlighted that the fairly high ratio of natural gas consumption in winter, mainly for heating purposes, presents particular challenges to the Hungarian energy industry and economic diplomacy in terms of regulation, reserves, capacity commitment and, consequently, security of supply. The current situation could be considerably improved by an efficient and comprehensive building insulation and efficiency improvement programme for energy saving purposes, combined with sufficient incentives for a transition to renewable energy sources.

The Energy Strategy provides that the detailed steps to be taken for improving the energy performance of buildings, which is one of the objectives specified in the Strategy, should be defined in a separate building energy performance strategy.

Energy consumption patterns changed in the aftermath of the economic crisis which, in turn, called for the revision of the National Energy Strategy. The National Building Energy Performance Strategy has been aligned with the targets set in the revised National Energy Strategy, already completed and pending approval.

2.1.2. Link with Hungary's National Energy Efficiency Action Plans

The 'Second National Energy Efficiency Action Plan of Hungary until 2016 with an Outlook to 2020' (Ministry of National Development, May 2011) (the 'NEEAP II') outlines the ongoing and planned energy efficiency measures that will make it possible to reduce Hungary's final energy use in sectors and industries not covered by the EU Emissions Trading System by at least 1 % per annum in the period between 2008 and 2016. Like other Member States, Hungary must meet this energy savings objective by 2016. Measurement of the achievement of indicative target values – apart from interim assessments – must be performed after the ninth year of introduction of the Directive.

The Third National Energy Efficiency Action Plan of Hungary (the 'NEEAP III') is developed in parallel with the National Building Energy Performance Strategy. The NEEAP III builds on the energy performance profile analysis provided in the NABEPS and is in line with other strategic documents currently under review, the proposed target for energy savings in buildings as well as the support programmes envisaged for the 2014–2020 period. The NEEAP III lists the institutional and structural measures required for the implementation of the NABEPS as well as the relevant monitoring tasks in detail.

2.1.3. Link with the New Széchenyi Plan

Government Decree No 1163/2010 of 4 August 2010 made provision for the preparation of the economic development programme of the Hungarian Government, the 'New Széchenyi Plan' (the 'NSZP'), as well as for the corresponding tasks. The programme was launched on 14 January 2011. The main objectives set under the NSZP are to increase the employment rate, maintain financial stability, create the conditions for economic development and enhance Hungary's competitiveness. On the basis of the growth potentials identified in the Hungarian economy, the NSZP identifies seven different programmes, of which the 'Renewal of Hungary – Green Economic Development' programme is aimed at improving the energy performance of buildings.

In addition to renewable energy and energy efficiency, the Green Economic Development programme also covers environmental technologies and the environmental industry. Accordingly, it encompasses sub-programmes for green energy, energy efficiency, green education, green employment, environmental industry as well as green research, development and innovation.

The priority objective of the Green Economic Development programme of the New Széchenyi Plan is to foster the establishment of a more energy- and cost-effective, viable institutional and economic structure by increasing the diversity of resources and developing the environmental industry, whereby new jobs can be created in line with the domestic conditions, and balanced and sustainable rural development can be secured.

The energy efficiency measures under the Green Economic Development programme are key to meeting climate change and energy policy objectives at the lowest possible cost, in particular those concerning the energy consumption of buildings and transport. To this end, several measures and sub-programmes are targeted under the programme at the residential, public and municipal, industrial, business and transport sectors.

2.1.4. Link with Hungary's National Renewable Energy Action Plan

The specific tasks associated with Hungary's National Renewable Energy Action Plan (the 'HUNREAP') are defined by Government Resolution No 1002/2011 of 14 January 2011. In the Renewable Energy Road Map 2020, developed as a follow-up to the EU's Energy and Climate Package, a mandatory target of 20 % is set for the share of renewable energy in energy consumption in the EU by 2020; within that, 10 % in the field of transport, as well as a 20 % increase in energy efficiency and a 20 % cut in GHG emissions (compared to the 1990 level). The HUNREAP was drawn up in order to meet these targets. In the HUNREAP, a separate sub-chapter is dedicated to the application of renewable energy sources in the energy supply of buildings.

2.1.5. Link with the Fourth Environmental Programme of Hungary

The successive National Environmental Programmes (the 'NEP'), drawn up since 1997, provide a comprehensive framework for Hungary's environmental policy objectives and measures. Provision is made for the development, purpose, content and implementation of such Programmes in Act LIII of 1995 on the general rules of environmental protection. The Fourth Environmental Programme of Hungary (the 'NEP IV') defines the environmental objectives for the 2014–2019 period. The improvement of energy efficiency is addressed in Chapter 5.3.3 of the NEP IV. In addition to foregrounding environmental considerations, the NEP IV stresses the importance of meeting the 2020 EU and national targets for energy efficiency and the use of renewable energy sources.

2.1.6. Link with the National Climate Change Strategy

Section 3 of Act LX of 2007 on the framework for implementation of the United Nations Framework Convention on Climate Change and its Kyoto Protocol (the 'Climate Change Act'), adopted on 28 May 2007, provides for the preparation of a National Climate Change Strategy (the 'NCCS'). In accordance with Hungary's international commitments, a National Climate Change Strategy must first be prepared for the 2008–2025 period. The objectives defined in the NCCS are to be implemented pursuant to the National Climate Change Programmes drawn up every two years. The NCCS delineates the following three main lines of action for Hungary's medium-term climate policy:

- Measures to reduce and to limit the emission of gases causing climate change in keeping with EU and national requirements. GHG emissions and total energy consumption should be mitigated in conjunction so as to prompt a move towards less labour- and energy-intensive production and consumption patterns.

- The most important measures to cope with the adverse ecological and social effects of climate change, which is now inevitable, and to improve our resilience to the consequences.

- Raising public awareness of climate change and enhancing climate-consciousness.

The aim set under the National Building Energy Performance Strategy is to reduce the energy consumption of buildings in the coming years to the greatest possible extent from the funds available whereby a decrease can be achieved in GHG emissions levels as well. In the course of renovations, special attention should be paid to provide for the protection of buildings against weather conditions, especially summer heat, preferably using architectural and horticultural solutions and avoiding additional electricity consumption. At the same time, the awareness-raising campaigns aimed at increasing energy efficiency contribute to strengthening the climate-consciousness of society. As such, the National Building Energy Performance Strategy supports all three lines of actions under the NCCS. The NABEPS does not propose disparate regional actions, as improving the energy performance of buildings is a concern for the whole country. Priority is given to less developed regions at the level of operational programmes.

2.2. Requirements laid down in domestic energy policy documents, as signposts for the objectives of the NABEPS

2.2.1. National Energy Strategy 2030 and outlook for 2050

The overarching strategic objectives of security of supply, competitiveness and sustainability form the three main pillars of the Energy Strategy. All of these three strategic objectives were regarded as governing principles in formulating the objectives of the NABEPS.

In the Energy Strategy, cost-efficiency is identified as a decisive factor in planning for building energy performance programmes; however, it should also be taken into account that the funds made available for renovations improving energy performance are limited. Furthermore, it should be borne in mind that the depth of such renovations may define the energy consumption of the renovated buildings and the sector concerned for decades. Accordingly, the requirements set for renovations should be based on a well-informed economic policy decision and the depth of renovations should be continuously increased.

Efforts to eradicate energy poverty are a priority concern under the Energy Strategy. Such efforts are closely linked with the tasks to be performed for improving the energy performance of buildings. The Energy Strategy calls for support schemes which, instead of price supports, help reduce the energy costs of households by the energy savings secured through increased energy efficiency.

The Energy Strategy also sets a savings target for primary energy consumption pursuant to which 189 PJ total primary energy savings should be achieved by 2030, of which 111 PJ is expected from programmes for improving the energy performance of buildings. These figures were taken into account when the savings targets were specified under the NABEPS.

2.2.2. The Second National Energy Efficiency Action Plan of Hungary (the 'NEEAP II')

The NEEAP II identifies a quantifiable energy savings target having relevance for the energy performance of buildings for 2016 but not for 2020 and 2030. At the same time, it has integrated a number of sub-programmes affecting building energy renovations in the residential, public and business sectors.

The following sub-programmes, designed to improve the energy performance of buildings, have been implemented under the NEEAP II in recent years or are currently under way:

'Liveable Panel Homes' Renovation Sub-programme – Mitigation of the district heat demand of residential buildings built using industrialised technologies Complex investments in existing buildings (mainly built using industrialised technologies) supplied with district heat, including insulation, replacement of doors and windows, metering-based billing, enabling the regulation of heating in every apartment (room) separately, operation of ventilation systems by solar panels, modernisation of heat sources, installation of heat pumps and solar collectors.

'Our Home' Renovation Sub-Programme – Mitigation of the heat demand of residential buildings (family homes and multi-apartment buildings) with individual or central heating Complex investments in existing buildings (mainly built using traditional technologies) with individual or central heating, including insulation, replacement of doors and windows, modernisation of heat generators (boilers), application of renewable energy production (heat pumps or solar collectors).

Electricity-Efficient Households Programme – Mitigation of the electricity demand of households Lighting, household appliances, stand-by consumption, smart metering – smart grid systems.

Renewed Public Institutions Sub-Programme – Mitigation of the heat demand of public buildings through complex energy efficiency investments Complex investments in existing buildings (mainly built using traditional technologies) supplied with district heat and buildings with individual or central heating, including insulation, replacement of doors and windows, metering-based billing, modernisation of heat centres, installation of heat pumps and solar collectors.

Mitigation of the electricity demand of public institutions Lighting, office equipment, stand-by consumption, smart metering – smart grid systems.

Apart from the measures outlined above there are further sub-programmes indirectly contributing to the reduction of energy consumption in buildings, including the ‘District Heating Efficiency Sub-Programme’ and the sub-programme for the ‘Mitigation of the energy use of businesses’.

2.2.3. Government Decree No 1246/2013 of 30 April 2013 on the energy performance requirements applicable to buildings and establishing cost-optimal levels of minimum energy performance requirements in accordance with Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings

Pursuant to Article 5(2) of the Energy Performance of Buildings Directive, Member States must calculate cost-optimal levels of minimum energy performance requirements using the compulsory comparative methodology framework established at European level and taking into account their climatic conditions, and economic figures and forecasts. Member States must report the results of those calculations to the Commission. In accordance with Article 5(3) of the Directive, if the comparison of the calculated cost-optimal levels of minimum energy performance requirements and the minimum energy performance requirements in force reveal a significant gap (more than 15 %) and this gap cannot be justified, the report must be accompanied by a plan outlining appropriate steps to attain cost-optimal levels of minimum energy performance requirements.

‘Cost-optimal level’ means the energy performance level that leads to the lowest cost of operating the building during the reference period (30 years), where the lowest cost is determined taking into account energy-related investment costs, maintenance and operating costs (including energy costs and savings, the category of building concerned, earnings from the energy produced, where applicable) and disposal costs, where applicable.

The comparative methodology framework was established by Commission Delegated Regulation (EU) No 244/2012. The calculated cost-optimal levels of minimum energy performance requirements and the steps needed to attain these levels were laid down in Government Resolution No 1246/2013 of 30 April 2013.

To implement Government Resolution No 1246/2013, an amendment was introduced to the provisions in force on the energy performance requirements for buildings which established cost-optimal levels of minimum energy performance requirements and made their application compulsory from 1 January 2015 in all energy efficiency projects funded from support granted under domestic or EU tenders or from the central budget, and as from 1 January 2018 in all other cases. This amendment was introduced by Decree No 20/2014 of 7 March 2014 of the Minister for the Interior.

In the context of cost-optimal levels of minimum energy performance requirements, Decree No 20/2014 establishes the required values for the thermal transmittance of building envelopes, heat loss and overall energy performance in residential buildings, accommodation facilities, educational buildings and buildings used for other purposes.

The requirements laid down in Government Resolution No 1246/2013 were taken into account in setting the 2020 and 2030 targets of the NABEPS, and the corresponding measures as well as the depth, scope and cost of renovations to be carried out were defined accordingly.

As there are no significant regional differences in climactic conditions in Hungary, these requirements are applicable uniformly throughout the country.

3. Analysis of the energy performance profile of the domestic building stock

3.1. Methodology

Familiarity with the baseline, i.e. the energy consumption of the existing building stock and main energy consumption patterns is a prerequisite to improving the energy efficiency of buildings. Therefore, a large-scale in-depth survey has been conducted in preparation for the NABEPS, involving the analysis of data in statistical databases on buildings and existing project and certification databases as well as the on-site inspection of a great number of buildings.

The inventory of domestic residential buildings and public buildings in State or municipal ownership was compiled, with specific building types identified based on the energy performance characteristics of the buildings, and the energy performance and energy consumption characteristics of each type quantified.

- A number of earlier surveys have been available for reference in identifying the types of residential buildings, which have been established based on diverse criteria relying on these surveys. As the next step, the type and the energy performance characteristics of each building in the domestic residential building stock was established.
- The types of public buildings owned and occupied by the State or the municipalities were identified based on a comprehensive survey covering the entire stock. These buildings were also allocated to types based on their energy performance characteristics.

The aggregate energy consumption of buildings was calculated using national systems for energy data reporting and buildings statistics. The objective of the survey was to explore the share of buildings in total domestic energy consumption and the specific energy consumption of certain key sectors and industries.

3.1.1. Description of the building stock inventory

Prior to establishing building models a group of experts coordinated by ÉMI studied the energy performance data available for the respective building types in the databases of the ZBR and the EEOP as well as in the certificates collected by VÁTI. The database of the ZBR was the largest accessible source from which the energy performance data of 2 230 buildings, previously filtered by quality, were examined. Where the volume of data available in the tendering databases on specific building types was not sufficient for analysis, the engineers of ÉMI conducted an on-site inspection of the energy performance of more than 100 buildings in each region.

ÉMI conducted a further survey with the aim – in addition to carrying out detailed energy performance inspections – of investigating the ratio of renovated buildings per building type. In the survey, data were recorded in Budapest, and in major cities, smaller towns and villages in the countryside. This building energy performance survey was unprecedented in sample size: a total of 20 842 buildings were involved in equal numbers across the different regions of Hungary, covering family houses, traditional multi-apartment buildings and multi-apartment buildings constructed of prefabricated panels alike. During the on-site inspections carried out as part of the survey, the experts of ÉMI recorded the building energy renovations performed earlier on the buildings inspected.

To facilitate planning for future renovation scenarios, it was essential to take inventory of and determine the energy performance characteristics of the domestic buildings stock, with special regard to residential and public buildings. It is common knowledge that no two buildings are identical; however, certain building types may be identified based on common features.

For this purpose, the residential and public building stock was analysed in the following three steps:

- Inventory was taken of the existing residential and public building stock, specific building types were identified based on the energy performance characteristics of the buildings and the buildings were classified according to the building types identified.
- Calculations were made for the expected effect of renovations in terms of energy efficiency in the sector of both residential and public buildings.
- Finally, calculations were made also for the costs involved in the different renovation scenarios.

3.1.2. The typological model of residential buildings

In creating the typology of residential buildings, it was a primary consideration to obtain information on the number of domestic buildings belonging to each building type. Accordingly, the typology was developed on the basis of the statistical data at hand. After the typology had been established, model buildings were designed, which reflect the representative characteristics of each building type defined based on the statistics as well as the technical parameters typical to the period of construction and to typological criteria. For modelling, information and surveys extracted from previous tenders for the improvement of building energy performance were also made use of. As a result of multi-step modelling performed for the existing building stock, altogether 15 building types were specified, using construction technology, structure and year of construction as the main classification criteria. It was a requirement to extrapolate the data obtained for each building type to the whole of the country, which obviously entailed generalisations.

Modelling was required to be able to develop 'renovation packages' based on the models established, determine the achievable energy savings and estimate the cost of renovations to be performed later. The 15 building types identified cover the total Hungarian residential building stock and provide a firm basis for analyses of the energy performance of residential buildings. In addition to existing buildings, buildings currently classified as new buildings were also involved in modelling under the category of new family houses and new multi-apartment buildings (see *4.1.3 Models of new buildings).*

The main characteristics of the 15 residential building types are summarised in the table below.

No	Building type	Year of construction	Walls	Floor area (m^2)	Number of buildings	Number of apartments	Proportion (%)	Total floor area (m^2)	Floor area / building (m^2)	Number of apartments / building
Type 1	family houses below 80 m^2	-1945		below 80 m^2	274 097	275 559	6.3 %	15 918 875	58	1.0
Type 2	family houses above 80 m^2	-1945		80 m^2 or more	272 150	310 990	7.1 %	29 610 378	109	1.1
Type 3	family houses below 80 m^2	1946–1980		below 80 m^2	422 421	423 211	9.7 %	25 746 455	61	1.0
Type 4	family houses above 80 m^2	1946–1980		80 m^2 or more	807 792	844 137	19.3 %	83 997 263	104	1.0
Type 5	family houses	1981–1990			379 810	387 822	8.9 %	39 914 396	105	1.0
Type 6	family houses	1991–2000			213 527	219 188	5.0 %	23 667 465	111	1.0
Type 7	family or terraced houses (1 to 3 apartments)	After 2001			215 755	227 648	5.2 %	24 466 147	113	1.1
Type 8	multi-apartment buildings (4 to 9 apartments)	-2000			46 843	279 143	6.4 %	17 471 243	373	6.0
Type 9	multi-apartment buildings (4 to 9 apartments)	After 2001			7 763	43 249	1.0 %	2 929 898	377	5.6
Type 10	multi-apartment buildings (10 or more apartments)	-1945			10 226	242 287	5.6 %	14 066 410	1 376	23.7
Type 11	multi-apartment buildings (10 or more apartments)	1946–2000	brick, other		12 596	191 179	4.4 %	10 260 214	815	15.2

No	Building type	Year of construc-tion	Walls	Floor area (m^2)	Number of buildings	Number of apartments	Proportion (%)	Total floor area (m^2)	Floor area / building (m^2)	Number of apartments / building
Type 1 2	multi-apartment buildings (10 or more apartments)		mid-size or large blocks, cast concrete		8 345	185 256	4.2 %	11 346 937	1 360	22.2
Type 1 3	multi-apartment buildings (10 or more apartments)	1946–1980	panels		14 881	330 094	7.6 %	16 174 606	1 087	22.2
Type 1 4	multi-apartment buildings (10 or more apartments)	1981–	panels		7 271	187 428	4.3 %	9 877 417	1 358	25.7
Type 1 5	multi-apartment buildings (10 or more apartments)	After 2001			8 706	216 563	5.0 %	11 392 046	1 309	24.9

Source: A typology of buildings for modelling the energy performance of the domestic residential building stock (Study for the National Building Energy Performance Strategy, Dr Tamás Csoknyai, 2013)

Table 4: Main statistical data of residential building types

3.1.3. The typological model of public buildings

In analysing the public building stock, the purpose and the year of construction of buildings were the main classification criteria, while building types were identified based on energy consumption and prevalence. The survey is based on the data of the HCSO and ÉMI on public buildings owned and occupied by the municipalities and the State, respectively.
Based on the available data, buildings were categorised according to their purpose as follows:

- Health and social care facilities
- Office buildings
- Commercial buildings
- Cultural facilities
- Educational buildings

Buildings dedicated to a specific purpose were grouped into subcategories according to their year of construction as follows:

- Before 1900
- 1901–1945
- 1946–1979
- 1980–1989
- After 1990

In the case of commercial buildings, the periods of construction were restricted to a before and an after 1980 category, while in the case of cultural facilities, the pre-1900 and the 1901–1945 periods were consolidated.

Buildings dedicated to a specific purpose were grouped into sub-categories according to their year of construction and structural features. Based on the available data, model buildings (sub-types) were defined based on purpose, the structural features characteristic of the period of construction and the number of storeys. These were then used as a standard for energy performance analyses. 10 public building sub-types were identified within the category of health and social care facilities, 10 within office buildings, 4 within commercial buildings, 8 within cultural facilities and 10 within educational buildings.

The altogether 42 public building sub-types identified are outlined in the table below.

No	Type	Year of construction	Sub-type		No of sub-type
1	Health and social care facilities	Before 1900	Building 1	3-storey U-shaped building with a basement (hospital), retrofitting with thermal façade insulation is prohibited	1
			Building 2	2-storey regular-shaped building with a basement (social care facility), retrofitting with thermal façade insulation is permitted	2
		1901–1945	Building 1	3-storey L-shaped hospital building with a basement, retrofitting with thermal façade insulation is prohibited	3
			Building 2	2-storey regular-shaped building with a basement (social care home), retrofitting with thermal façade insulation is permitted	4
		1946–1979	Building 1	4-storey U-shaped hospital building with a basement, traditional construction method (hospital)	5
			Building 2	Single-storey doctor's office building with a solid ground floor (built using the lightweight CLASP system)	6
		1980–1989	Building 1	9-storey regular-shaped building with a basement (hospital)	7
			Building 2	3-storey regular-shaped building with a solid ground floor (social care home, doctor's office)	8
		After 1990	Building 1	8-storey regular-shaped building with a basement (hospital)	9
			Building 2	3-storey regular-shaped building with a solid ground floor (social care home, doctor's office)	10
2	Office buildings	Before 1900	Building 1	3-storey regular-shaped building with a basement	11
			Building 2	2-storey L-shaped building with a basement	12
		1901–1945	Building 1	3-storey regular-shaped building with a basement	13
			Building 2	2-storey L-shaped building with a basement	14
		1946–1979	Building 1	3-storey U-shaped building with a solid ground floor, traditional construction method	15
			Building 2	10-storey building with a curtain wall and a solid ground floor	16
		1980-1989	Building 1	6-storey regular-shaped building with a solid ground floor	17
			Building 2	6-storey U-shaped building with an underground car park	18
		After 1990	Building 1	5-storey regular-shaped building with a solid ground floor	19
			Building 2	7-storey U-shaped building with a curtain wall and an underground car park	20
3	Commercial buildings	Before 1980	Building 1	2-storey regular-shaped building with a solid ground floor (warehouse)	21
			Building 2	3-storey almost regular-shaped building with an inner courtyard and a solid ground floor (store)	22
		After 1980	Building 1	Single or 2-storey regular-shaped building with a solid ground floor, light partition walls (shopping centre)	23
			Building 2	Single to 4-storey regular-shaped building with	24

No	Type	Year of construction	Sub-type		No of sub-type
				an inner courtyard and a solid ground floor, traditional and prefabricated panel structures (department store)	
4	Cultural facilities	Before 1945	Building 1	2-storey regular-shaped building with 2 inner courtyards and a basement (museum)	25
			Building 2	1+2-storey almost regular-shaped building with a basement (theatre)	26
		1946–1979	Building 1	Single-storey regular-shaped building with a solid ground floor, light partition walls (community centre)	27
			Building 2	2-storey U-shaped building with a basement, traditional construction method (library)	28
		1980–1989	Building 1	3-storey regular-shaped building with 2 inner courtyards and a solid ground floor (cultural centre and library)	29
			Building 2	Single-storey regular-shaped building with an inner courtyard and a solid ground floor (cultural centre)	30
		After 1990	Building 1	7-storey regular-shaped building with 2 inner courtyards and a solid ground floor (cultural centre and library)	31
			Building 2	Single-storey regular-shaped building with 2 inner courtyards and a solid ground floor (community centre)	32
5	Educational buildings	Before 1900	Building 1	3-storey regular-shaped school building	33
			Building 2	2-storey U-shaped school building	34
		1901–1945	Building 1	3-storey regular-shaped school building	35
			Building 2	2-storey U-shaped school building	36
		1946–1979	Building 1	School building from the 1950s built in the socialist realist style	37
			Building 2	School building from the 1970s built from self-supporting prefabricated panels	38
		1980–1989	Building 1	3-storey regular-shaped building	39
			Building 2	2-storey U-shaped building	40
		After 1990	Building 1	3-storey regular-shaped building	41
			Building 2	2-storey U-shaped building	42

Source: Establishing a typology for modelling the domestic public building stock (Delegated preparatory task for the National Building Energy Performance Strategy, Comfort Consulting Kft., Dr Zoltán Magyar, 2013)

Table 5: Characteristics of public building types

3.2. Overview of the energy performance profile of the domestic building stock

3.2.1. The share of buildings out of total domestic energy consumption

In Hungary, primary energy consumption decreased by 17 % between 1990 and 1992 while the GDP continued to increase, followed by an average annual growth of 0.5 % between 1992 and 2007. From 2006 onwards, primary energy consumption showed a downward trend, with 2009 seeing a 6 % decrease in the aftermath of the economic crisis. In subsequent years and up until the present day, energy consumption has been on the decline.

Primary energy intensity, i.e. the primary energy demand of the total domestic output (the nominal GDP) is approximately 2.5 times the average of the European Union. However, converted to purchasing power parity, this ratio is only half the afore-mentioned figure. This means that, while both per capita energy consumption and per capita electricity consumption is significantly lower than the EU average, Hungary is characterised by relatively high energy intensity in international comparison.

Primary energy consumption is heavily influenced by economic performance through the development of technology-related energy demand but the current energy consumption of buildings also has a significant share in it. Buildings accounted for 403 PJ of the total domestic energy consumption of 1 044 PJ in 2011, which corresponds to 40 %. This share is similar to those recorded in Member States of comparable natural endowments.

A sectoral breakdown of the primary energy consumption of buildings in 2011 is presented below:

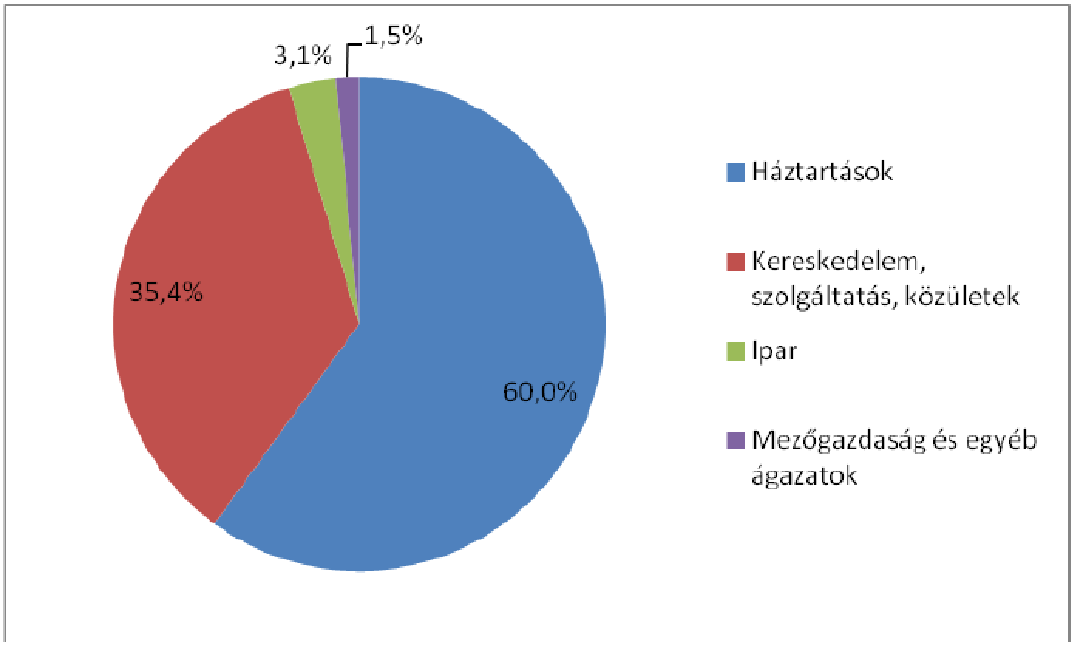
Primary energy consumption in buildings in 2011 (PJ)	
Households	242
Commerce, services, public bodies	143
Industry	12
Agriculture and other sectors	6
Buildings total	**403**

Source: Calculated on the basis of the data in the national energy balance and the Statistical Yearbook of Electricity, Natural Gas and District Heating 2011 (published by HEPURA)

Table 6: The primary energy consumption of buildings in 2011, broken down by key sectors (PJ)

With a share of almost 60 %, residential buildings are the greatest contributors to the energy consumption of buildings. The energy consumption of buildings within the industrial and agricultural sector is relatively low. Accordingly, these sectors have a negligible role in the development of energy consumption in buildings at national level and are, therefore, not covered by the National Building Energy Performance Strategy.

The figure below shows sectoral contributions to the primary energy consumption of buildings.



Source: Calculated on the basis of the data in the national energy balance and the Statistical Yearbook of Electricity, Natural Gas and District Heating 2011 (published by HEPURA).

■ Háztartások	■ Households
■ Kereskedelem, szolgáltatás, közületek	■ Commerce, services, public bodies
■ Ipar	■ Industry
■ Mezőgazdaság és egyéb ágazatok	■ Agriculture and other sectors

Figure 1: Sectoral contributions to the primary energy consumption of buildings (%)

The primary energy consumption of buildings in 2011 broken down by main energy carriers is presented in the table below. The data in the table refer to the primary energy component of energy carriers.

Primary energy consumed in buildings in 2011 (PJ)	
Natural gas	210
Other fuels (firewood, coals etc.)	56
District heat	39
Electricity	98
Buildings total	**403**

Source: Calculated on the basis of the data in the national energy balance and the Statistical Yearbook of Electricity, Natural Gas and District Heating 2011 (published by HEPURA)

Table 7: Primary energy consumed in buildings in 2011, broken down by main energy carriers (PJ)

Of the main energy carriers, national natural gas consumption is profoundly influenced by the energy demand of buildings: of the approx. 243 PJ final natural gas consumption (excluding use as a basic material of the chemical industry), 210 PJ is needed to meet the natural gas demand of buildings, a major part of which is used for heating. This also means that a considerable portion of the natural gas consumption of buildings emerges in the heating season which has implications for energy management and also for natural gas capacity management. Within the energy consumption of buildings, households have the biggest share of approx. 60 %.

The electricity consumed by buildings is basically used for lighting, heating, cooling and hot water production. The spread of air-conditioning in buildings is a significant factor in trends in the electricity consumption of buildings. Its effect is conspicuous in growing peak demand on the national electricity system in the summer season.

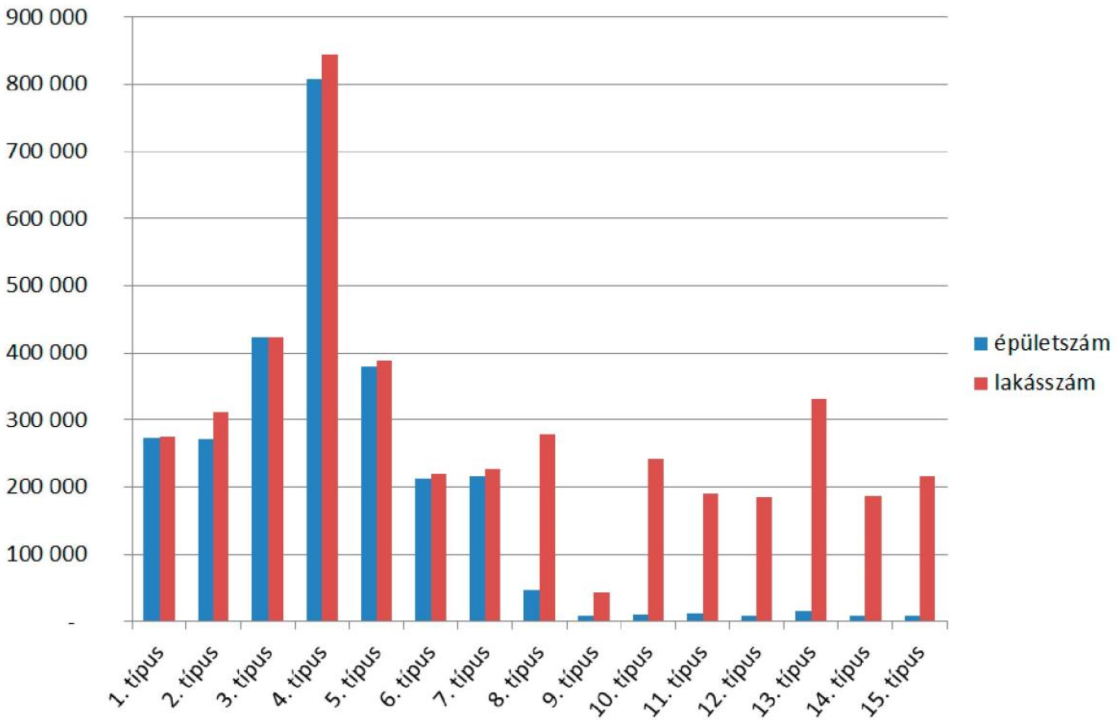
The amount of district heat consumed has been decreasing since 2003. This is attributable mainly to a sharp decline in the district heat demand of industrial consumers (to close to a quarter of the 2003 figure) and a 30 % decrease in household demand for heating purposes. The latter is the result of the building energy performance programmes implemented in recent years which had the reduction of the energy consumption of homes supplied with district heat as one of their main objectives.

3.2.2. The energy performance profile of residential buildings

In defining the building types to be used for the analysis of the domestic residential building stock, due consideration was given to the characteristics which are decisive for building energy performance. Buildings were filtered based on the HCSO's database of the 2011 census. The criteria used for identifying building types are as follows:

- *Size of the building (number of apartments):* discrete categories were specified in the census questionnaire for recording data on size, with buildings of 1 to 3, 4 to 9 or more than 10 apartments as the available options, which was also adopted in the NABEPS.
- *Year of construction:* data were requested according to year and the periods were determined in the course of drawing up the NABEPS, based on major changes in construction technology.
- *Construction technology:* in accordance with census data, according to the typical construction technology used to build their walls buildings were categorised as adobe, masonry, prefabricated panels and other industrialised buildings.
- *Floor area of the building (for family houses and houses of 2 or 3 apartments)* Based on typical occurrence, houses below 80 m^2 are regarded in general as single-storey buildings while those above 80m^2 as multi-storey buildings. The number of storeys is significant from the point of view of energy performance.

The distribution of the building and housing stock across the different types is illustrated in Figure 2. As regards the number of buildings, family houses (types 1 to 7) substantially outnumber multi-apartment buildings (types 8 to 15). However, the opposite is true for the number of apartments in a given building.

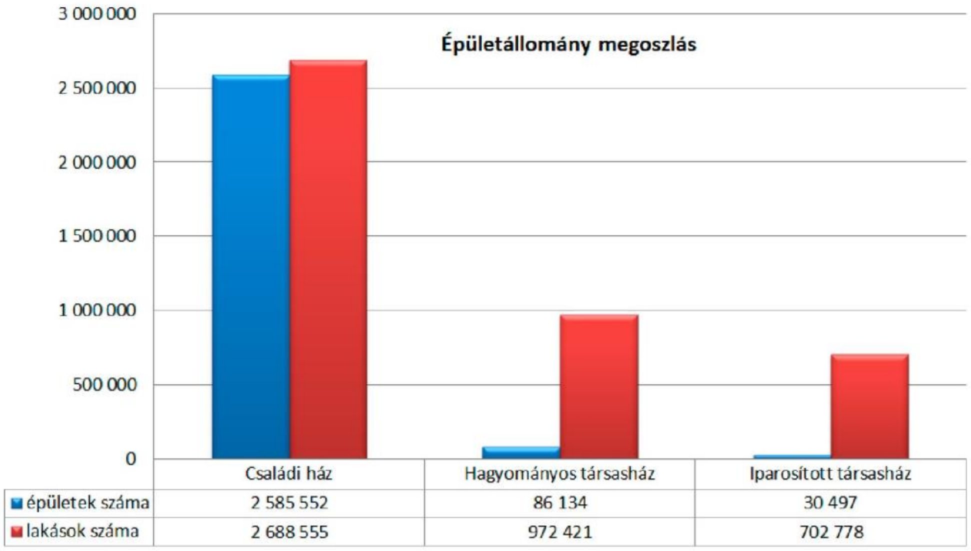


1. típus	Type 1
épületszám	number of buildings
lakásszám	number of apartments

Source: A typology of buildings for modelling the energy performance of the domestic residential building stock (Study for the National Building Energy Performance Strategy, Dr Tamás Csoknyai, 2013)

Figure 2: Distribution of the building and housing stock by building type

The statistical data of the respective building types and the number of apartments and buildings are presented in Figures 3 to 8 according to different criteria.

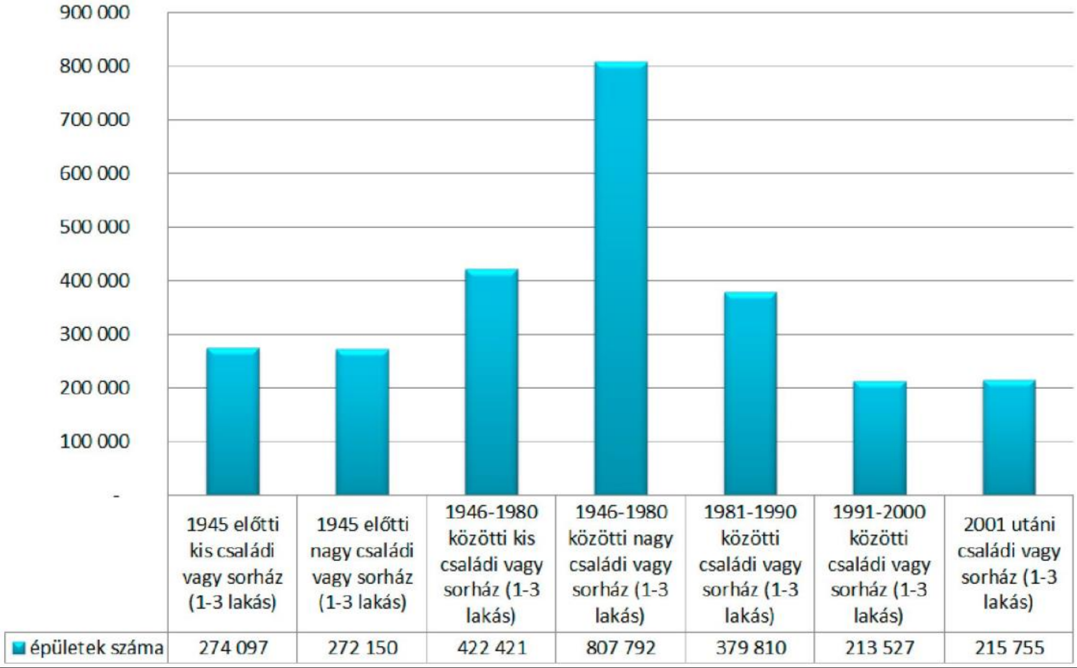


Épületállomány megoszlás	Share in the building stock
Épületek száma	Number of buildings
lakások száma	Number of apartments
Családi ház	Family houses
Hagyományos társasház	Traditional multi-apartment buildings
Iparosított társasház	Industrialised multi-apartment buildings

Source: A typology of buildings for modelling the energy performance of the domestic residential building stock (Study for the National Building Energy Performance Strategy, Dr Tamás Csoknyai, 2013)

Figure 3: Distribution of the existing building and housing stock by construction method

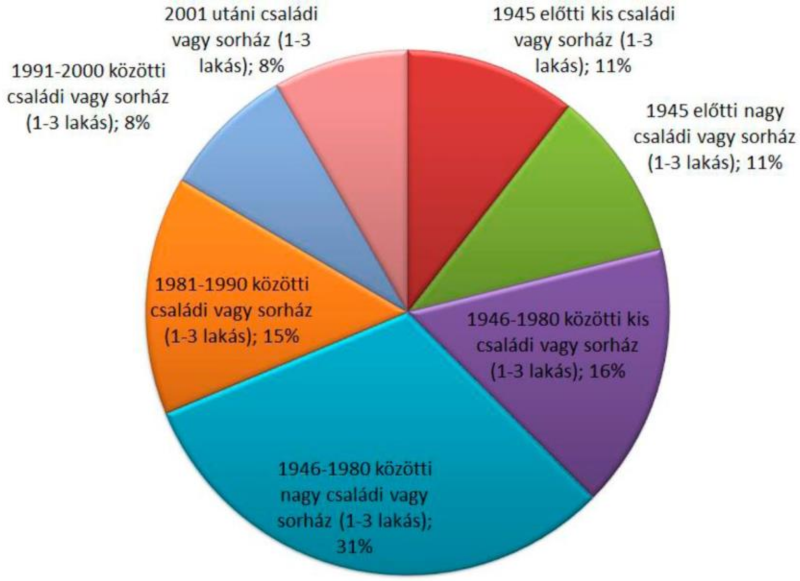
The figure above shows that the overwhelming majority (approx. 95 %) of residential buildings are family houses. Family houses predominate also in terms of the number of apartments, with a share of approx. 60 %.



Épületek száma	Number of buildings
1945 előtti kis családi vagy sorház (1-3 lakás)	Small family or terraced houses built before 1945 (1 to 3 apartments)
1945 előtti nagy családi vagy sorház (1-3 lakás)	Large family or terraced houses built before 1945 (1 to 3 apartments)
1946-1980 közötti kis családi vagy sorház (1-3 lakás)	Small family or terraced houses built between 1946 and 1980 (1 to 3 apartments)
1946-1980 közötti nagy családi vagy sorház (1-3 lakás)	Large family or terraced houses built between 1946 and 1980 (1 to 3 apartments)
1981-1990 közötti családi vagy sorház (1-3 lakás)	Family or terraced houses built between 1981 and 1990 (1 to 3 apartments)
1991-2000 közötti családi vagy sorház (1-3 lakás)	Family or terraced houses built between 1991 and 2000 (1 to 3 apartments)
2001 utáni családi vagy sorház (1-3 lakás)	Large family or terraced houses built after 2001 (1 to 3 apartments)

Source: A typology of buildings for modelling the energy performance of the domestic residential building stock (Study for the National Building Energy Performance Strategy, Dr Tamás Csoknyai, 2013)

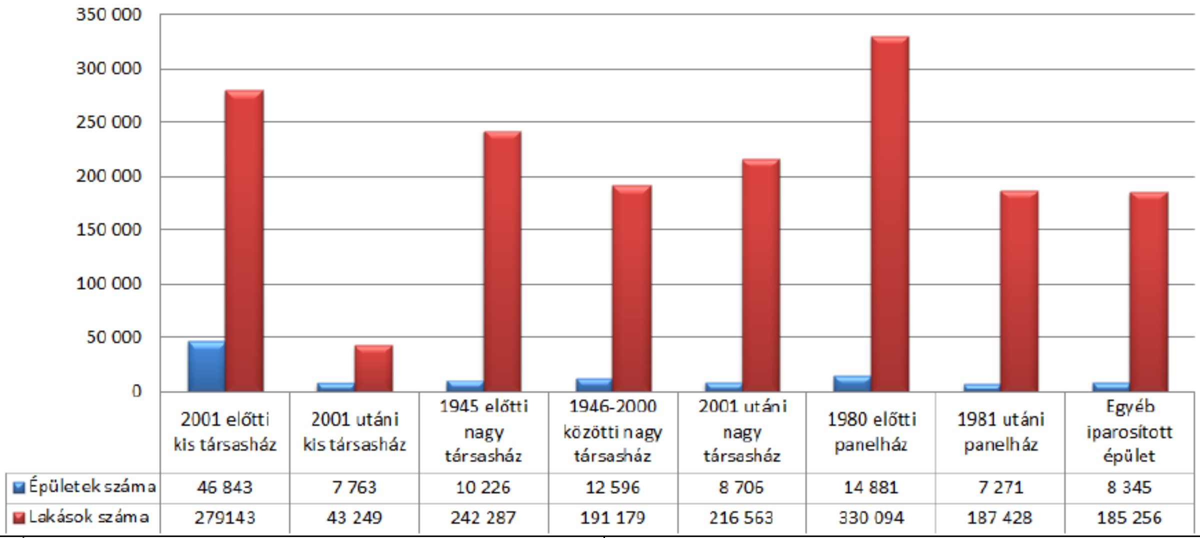
Figure 4: Number of domestic buildings belonging to the 7 family house types



Source: A typology of buildings for modelling the energy performance of the domestic residential building stock (Study for the National Building Energy Performance Strategy, Dr Tamás Csoknyai, 2013)

Figure 5: Relative share of domestic buildings belonging to the 7 family house types

Almost 25 % of the family houses were constructed before 1945. The share of houses built between 1946 and 1980 is close to 50 %. Consequently, almost 75 % of all family houses were put up before 1980, in accordance with the thermal design requirements in force at the time. At the same time, only 8 % of the total family house stock was constructed after 2001.

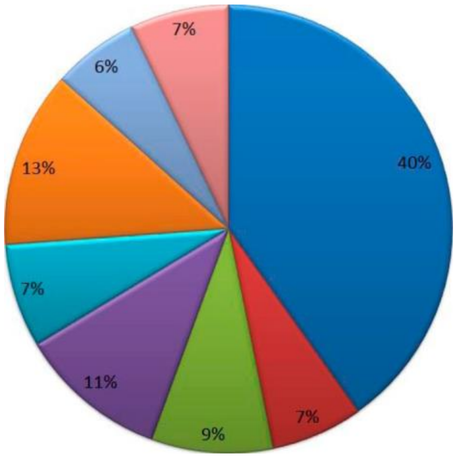


■ Épületek száma	■ Number of buildings
■ Lakások száma	■ Number of apartments
2001 előtti kis társasház	Small multi-apartment buildings built before 2001
2001 utáni kis társasház	Small multi-apartment buildings built after 2001
1945 előtti nagy társasház	Large multi-apartment buildings built before 1945
1946-2000 közötti nagy társasház	Large multi-apartment buildings built between 1946 and 2000
2001 utáni nagy társasház	Large multi-apartment buildings built after 2001
1980 előtti panelház	Buildings constructed of prefabricated panels before 1980
1981 utáni panelház	Buildings constructed of prefabricated panels after 1981
Egyéb iparosított épület	Other industrialised buildings

Source: A typology of buildings for modelling the energy performance of the domestic residential building stock (Study for the National Building Energy Performance Strategy, Dr Tamás Csoknyai, 2013)

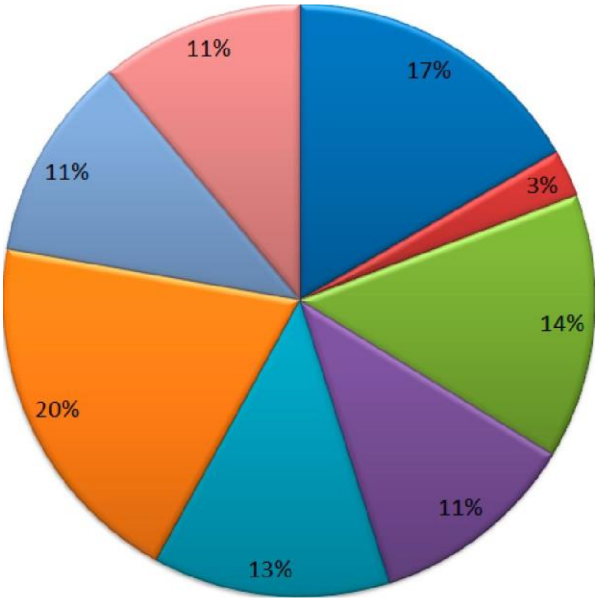
Figure 6: Number of domestic buildings belonging to the 8 multi-apartment building types (number of buildings and number of apartments)

Small multi-apartment buildings built using a traditional method before 2001 make up approx. 40 % of the domestic stock of multi-apartment buildings. The share of buildings constructed of prefabricated panels or using other industrialised system building methods is slightly over 25 %. Around 10 % of multi-apartment buildings were built before 1945.



Source: A typology of buildings for modelling the energy performance of the domestic residential building stock (Study for the National Building Energy Performance Strategy, Dr Tamás Csoknyai, 2013)

Figure 7: Number of buildings by multi-apartment building type (see the legend in Figure 8)



[For key to chart, see Figure 6 above]

Source: A typology of buildings for modelling the energy performance of the domestic residential building stock (Study for the National Building Energy Performance Strategy, Dr Tamás Csoknyai, 2013)

Figure 8: Number of apartments by multi-apartment building type

Only some 16 % of apartments are found in traditional small and large multi-apartment buildings built after 2001. Buildings constructed of prefabricated panels or using other industrialised system building methods make up 42 % of the stock of multi-apartment buildings. The share of multi-apartment buildings built before 1945 is around 14 %. Apartments in buildings constructed of prefabricated panels before 1980 represent the largest portion (20 %) of homes found in multi-apartment buildings; however, the number of apartments in large multi-apartment buildings built after 2001 and between 1946 and 2000, respectively, is close to this figure.

The table below provides an overview of the heating systems used in residential buildings.

Family houses		**Multi-apartment buildings of less than 10 apartments**		**Residential buildings constructed of prefabricated panels**		**Residential buildings of more than 10 apartments other than buildings constructed of prefabricated panels**	
gas boiler	36.60%	district heating	6.70%	district heating	99.00%	district heating	14.60%
gas convection heater	21.60%	central gas boiler	3.40%	other	1.00%	central gas boiler	7.80%
wood-fired stove or furnace	30.30%	gas boiler	35.20%			gas boiler	19.80%
other	11.50%	gas convection heater	18.00%			gas convection heater	27.40%
		mixed	30.40%			mixed	26.70%
		other	6.30%			other	3.70%

Source: Based on the data of the HCSO

Table 8: The distribution of heating systems used in residential buildings

The distribution of heating systems reveals that, except for buildings constructed of prefabricated panels practically all of which are supplied with district heat, 55 to 60 % of apartments in all other building types are heated by gas, however, the number of those heated by a central boiler, a gas boiler or a gas convention heater differs greatly across the building types. In addition to heating by gas, mixed and wood heating are also significant, while district heating is relatively rare in residential buildings other than buildings constructed of prefabricated panels.

Several sources were used simultaneously in determining the energy performance characteristics of buildings. For residential buildings, information is available electronically in the tenders submitted under the ZBR, calculated based on a uniform methodology defined in the Energy Performance Characteristics Decree. The 2 230 buildings assessed in the tendering database could be classified according to the established typology. The database included mostly family houses and industrialised buildings. For traditional multi-apartment buildings, ÉMI conducted a survey in which 100 residential buildings (27 of Type 8, 15 of Type 9, 22 of Type 10, 21 of Type 11, 15 of Type 15) were inspected in equal numbers across the different regions of Hungary. Based on the results of the survey, an energy performance certificate was prepared for the inspected buildings in accordance with the legislation in force, which were then used to determine their specific primary energy consumption.

Drawing on these sources, the main energy performance characteristics of the 15 residential building types were quantified as shown in the table below. The data refer to specific primary energy consumption at construction, excluding any renovations carried out later.

	Building type	**Year of construction**	**Walls**	**Surface to volume ratio (m^2/m^3)**	**Specific primary energy consumption kWh/m^2a**
Type 1	family houses below 80 m^2	-1945		1.52	551
Type 2	family houses above 80 m^2	-1945		1.18	408
Type 3	family houses below 80 m^2	1946–1980		1.26	517
Type 4	family houses above 80 m^2	1946–1980		1.14	405
Type 5	family houses	1981–1990		0.96	336
Type 6	family houses	1991-2000		0.92	227
Type 7	family or terraced houses (1 to 3 apartments)	After 2001		1.1	173
Type 8	multi-apartment buildings (4 to 9 apartments)	-2000		0.53	312
Type 9	multi-apartment buildings (4 to 9 apartments)	After 2001		0.64	125
Type 10	multi-apartment buildings (10 or more apartments)	-1945		0.61	344
Type 11	multi-apartment buildings (10 or more apartments)	1946-2000	brick, other	0.51	299
Type 12	multi-apartment buildings (10 or more apartments)		mid-size or large blocks, cast concrete	0.46	244
Type 13	multi-apartment buildings (10 or more apartments)	1946–1980	prefabricated panels	0.36	218
Type 14	multi-apartment buildings (10 or more apartments)	1981-	prefabricated panels	0.39	200
Type 15	multi-apartment buildings (10 or more apartments)	After 2001		0.41	100

Source: A typology of buildings for modelling the energy performance of the domestic residential building stock (Study for the National Building Energy Performance Strategy, Dr Tamás Csoknyai, 2013)

Table 9: The main energy performance characteristics of residential buildings

ÉMI conducted another survey giving an insight into the technical specifications, heating and extent of renovation of the building stock which also served as a useful reference in modelling. In terms of the number of buildings examined, this survey was unprecedented in scale: a total of 20 842 buildings were involved in equal numbers across the different regions of Hungary. Data were recorded in Budapest, and in major cities, smaller towns and villages in the countryside. A questionnaire was completed by the experts of ÉMI during the on-site inspections carried out as part of the survey.

The survey provided the following results:

- Unbroken rows of buildings and semi-detached houses are quite common. Depending on the size of the given settlement, 9 to 40 % of family houses and more than 50 % of multi apartment-buildings are characterised by this development pattern.

- Depending on settlement type, 5 to 30 % of family houses have façade insulation; however, this figure is below 16 % in the case of houses built before 1980. The ratio of insulated larger multi-apartment buildings built before 1945 is meagre while it is around 20 % in the case of buildings constructed of prefabricated panels. With partial insulation also taken into account, the corresponding figures are 5 to 60 % for family houses and approx. 50 % for buildings constructed of prefabricated panels.

- Concerning doors and windows, the situation is somewhat better. The doors and windows in 27 to 75 % of family houses from before 2001, 40 to 50 % of older multi-apartment buildings and 20 to 50 % of industrialised buildings are originals in good condition or already replaced.

- The first four types of family houses and the two types of multi-apartment buildings built before World War II typically have an unheated high-pitched roof. This roof type is also common to family houses built after 2001, which is probably due to the popularity of Mediterranean single-storey houses. In other family house types and multi-apartment buildings put up after 2001 the attic tends to be converted into a living space while industrialised buildings mostly have a flat roof.

- As to heating systems, gas convention heaters are used in 11 to 20 % of the first four family house types while they rarely occur in the other family house types. At the same time, they are the typical heating appliance of older traditional multi-apartment buildings constructed after 1945 (46 %) and other industrialised buildings (43 %), and are also common in small and large pre-1945 multi-apartment buildings (26 %). In multi-apartment buildings, central and individual heating units occur equally, however, individual heating units are more frequent in those built after 2001. District heating predominates in buildings constructed of prefabricated panels but is also found in older multi-apartment buildings in a proportion varying from settlement to settlement (4 to 28 %).

3.2.3. Building energy performance sub-programmes implemented under the ZBR providing information on the energy performance data of residential buildings

Pursuant to the Climate Change Act, the owners' rights and obligations over emission allowances are exercised by the Minister competent in matters of public finances in agreement with the Minister responsible for energy policy. In accordance with Section 90(2) of Government Decree No 152/2014 of 6 June 2014, the Member of the Government responsible for public finances is the Minister for National Economy, while based on Section 109(7) of the same Decree, the Minister for National Development is the Member of the Government responsible for energy policy. Under the international emissions trading regime, the Minister for National Economy may buy and sell emission allowances on behalf of the Hungarian State and Kyoto units may be used to offset GHG emissions occurring in the territory of Hungary. The conditions and rules of selling Kyoto units, the operation of the ZBR and the rules of carrying out joint implementation projects are regulated by Government Decree No 323/2007 of 11 December 2007 on certain rules of implementation of the Climate Change Act.

In the first commitment period, revenues from the assignment of the Kyoto units must be spent on supporting activities and measures aiming at the reduction of domestic emissions of greenhouse gases, on increasing the removal thereof by sinks and on adaptation to the impacts of climate change, in line with the NCCS and the National Climate Change Programme.

The building energy performance data obtained under the following ZBR sub-programmes were taken into account in developing the NAPEBS.

Climate Friendly Home Panel Sub-Programme (ZBR-Panel I, 2008; ZBR-Panel II, 2009)
The ZBR Climate Friendly Home Panel Sub-Programme was launched in July 2009 with the aim to support the refurbishment and renovation of residential buildings constructed using industrialized system building methods, resulting in energy savings and lower carbon-dioxide emission levels. In implementing the sub-programme, it was the first time for the Ministry responsible for environmental affairs to introduce a special climate protection element with strictly quantified carbon dioxide emission calculations for the energy-efficient renovation of homes in prefabricated buildings. The Sub-programme was implemented in two phases. Supported activities included the renovation or replacement of windows/doors, the thermal insulation of façades and roofs, the modernization or overhaul of technical building systems, increase of the use of renewable energy, the replacement of traditional energy sources with renewable energy sources, the improvement of the thermal protection of buildings during the summer and the covering of the loggias of buildings with glass.

ZBR Climate Friendly Home Energy Efficiency Sub-Programme (ZBR-EH-2009)
The Climate Friendly Home Energy Efficiency Sub-Programme was launched in December 2009 as second under the ZBR, with the aim to support the energy renovation of residential buildings built with traditional technologies with a view to climate protection as well as the use of renewable energy sources in equipment connected to the buildings and the construction of new energy-efficient residential buildings. Supported activities included the renovation or replacement of windows/doors, the thermal insulation of façades and roofs, the modernization or overhaul of technical building systems, increase of the use of renewable energy (solar collector and solar panel systems, biomass-fired boilers, geothermal heat pumps, use of wind energy), the replacement of traditional energy sources with renewable energy sources, the improvement of the thermal protection of buildings during the summer, covering of the loggias of buildings with glass and the construction of new energy-efficient buildings.

ZBR Energy-Efficient Light Bulb Replacement Sub-Programme (ZBR-ICS)
The primary aim of the Sub-programme was climate protection. A substantial amount of electricity can be saved in households by promoting the spread of more efficient devices that consume less electricity. The consumer price of long-life, energy-efficient light bulbs is significantly higher than the price of traditional light bulbs; therefore, it is an investment that the most vulnerable groups of society, particularly the elderly, large families and the disabled cannot afford without State support. The Energy-Efficient Light Bulb Replacement Sub-Programme provides an opportunity for these groups of society to reduce their energy consumption by replacing their energy wasting traditional light bulbs. By doing so, they also contribute to achieving the country’s climate protection targets. The measure supported under the sub-programme was the replacement of traditional light bulbs with energy efficient ones.

ZBR ‘Our Home’ Renovation Sub-Programme and ‘New Home Building’ Sub-Programme under the New Széchenyi Plan (ÚSZT-ZBR-MO-2011)
The purpose of the sub-programme launched in 2011 under the ZBR was the complex energy renovation and modernisation of residential buildings to reduce carbon dioxide emissions as well as the promotion of the use of renewable energy sources and the construction of new energy-efficient residential buildings. Supported activities included the renovation or replacement of windows/doors, the thermal insulation of façades and roofs, the modernization or overhaul of technical building systems, increase of the use of renewable energy (solar collector and solar panel systems, biomass-fired boilers, geothermal heat pumps, use of wind energy), the replacement of traditional energy sources with renewable energy

sources, the improvement of the thermal protection of buildings during the summer, covering of the loggias of buildings with glass and the construction of new energy-efficient family houses and multi-apartment buildings.

ZBR Sub-programme for the establishment of solar collector systems facilitating the use of renewable energy carriers, producing residential hot water and providing complementary space heating under the New Széchenyi Plan (ÚSZT-ZBR-NAP-2011)
The sub-programme for the establishment of solar collector systems was launched under the ZBR on 12 October 2011 with the aim to provide support for the procurement and installation of systems using solar energy (producing hot water, heating buildings or multi-purpose solar collector systems used for both or eventually for other purposes requiring heat), resulting in reduced carbon dioxide emissions from, and increased energy efficiency in, existing residential buildings. The installation of solar collector systems was eligible for support under the Sub-programme.

The table below provides a summary of the ZBR sub-programmes taken into account in calculations for the NAPEBS.

Name of sub-programme	**ZBR Panel I**	**ZBR Panel II**	**ZBR EH**	**ZBR ICS**	**ÚSZT-ZBR-MO-2011**	**ÚSZT-ZBR-NAP-2011**
Aid intensity	33.33 %	33.33 % + Climate Bonus grant	30 % + Climate Bonus grant	100 %	40 % to 50 %	50 %
Beneficiaries	Housing cooperatives, multi-apartment buildings, residential buildings owned and let by municipalities		Private persons, housing cooperatives and multi-apartment buildings	Foundations/ associations caring for, assisting and representing the interests of large families, the elderly and the disabled	Private persons, housing cooperatives and multi-apartment buildings	Private persons and multi-apartment buildings
Eligible activities	Renovation or replacement of windows/doors; thermal insulation of façades and roofs; modernization or overhaul of technical building systems; increasing the use of renewable energy, replacement of traditional energy sources with renewable energy sources; improvement of the thermal protection of buildings during the summer; covering of the loggias of buildings with glass.		Renovation or replacement of windows/doors; thermal insulation of façades and roofs; modernization or overhaul of technical building systems; increasing the use of renewable energy, replacement of traditional energy sources with renewable energy sources; improvement of the thermal protection of buildings during the summer; covering of the loggias of buildings with glass; construction of new energy-efficient residential buildings.	Replacement of traditional light bulbs with energy-efficient ones.	Renovation or replacement of windows/doors; thermal insulation of façades and roofs; modernization or overhaul of technical building systems; increasing the use of renewable energy; replacement of traditional energy sources with renewable energy sources; improvement of the thermal protection of buildings during the summer; covering of the loggias of buildings with glass; construction of new energy-efficient family houses and multi-apartment buildings.	Installation of solar collector systems.

Source: ÉMI

Table 10: Main data of the ZBR sub-programmes taken into account in calculations for the NAPEBS

The planned results of the ZBR sub-programmes taken into account in calculations for the NAPEBS based on applications having a valid grant decision are outlined in the table below.

	Households receiving support (number)	Planned energy savings (KWh/year)	Total investment cost (HUF bn)	Total amount granted (HUF bn)
ZBR-PANEL I	43 698	138 359 946	41.97	13.19
ZBR-PANEL II	17 169	106 249 850	19.73	8.76
ÚSZT-ZBR-NAP-2011	3 546	11 754 473	5.43	2.49
ÚSZT-ZBR-MO-11	417	9 613 724	3.13	1.37
ZBR-EH-09	1 547	19 631 151	4.39	1.60
ZBR-ICS	18 962	22 579 934	0.44	0.44
Total	**85 339**	**308 189 078**	**75.10**	**27.84**

Source: ÉMI Nonprofit Kft., data as at 18.07.2013

Table 11: Results of the ZBR building energy performance sub-programmes taken into account in calculations for the NAPEBS

3.2.4. Sociological background to the typology of residential buildings

In 2014, 115 000 apartments were owned by the municipalities. This is a small fraction of the total housing stock comprising 4 400 000 apartments and is continuously decreasing. Accordingly, apartments owned by the municipalities are not distinguished within the Strategy which investigates primarily the privately owned housing stock. The number of residential buildings owned and leased by private persons or institutions is also low; it is typically the owners who inhabit the properties.
Apart from the technical characteristics and condition of the building stock, the scope of renovations to residential buildings and consequently the energy savings and the success of implementation of building renovation programmes and projects are strongly defined by the social situation of the owners or occupants of apartments, the social composition of the inhabitants of the affected apartments and the financial standing of households. In order to explore these circumstances, and provide a sound basis for the NAPEBS, the ÉMI requested the foundation Századvég to carry out a detailed survey and analysis which relies on and keeps most of the residential building types presented earlier. The 2010 Household Budget and Living Conditions Survey of the HCSO was also consulted for the purpose of the analysis.

The following characteristics were examined in the case of each building type:

- Technical characteristics – condition, depth of renovation and characteristics of the apartment, public utilities
- Value and rent of the apartment – estimated market value or (in the case of rented apartments) rental fee
- Energy performance characteristics – type of heating and hot water supply, availability or absence of electricity, gas and district heating supply, gas consumption, heating temperature
- Regional and settlement-specific characteristics – typical occurrence of the residential building type in certain regions and settlements
- Demographic characteristics and employment status – number of people living the household, number of employed, long-term unemployed, retired and disabled people in the household
- Income – earned income and social benefits

- Expenses – utilities, housing and property acquisition costs, burden imposed on occupants by utility bills
- Loans, debt service – residential real estate loans, personal loans, difficulties with paying utility bills
- Savings – the extent to which savings cover unexpected costs

The findings of the survey for each residential building type are as follows:

Type 1 (family houses below 80 m^2 built of bricks, stone or adobe before 1945)
There are very few in good or excellent condition. Dwellings of this type typically lack modern amenities and almost a quarter (23.8 %) of their occupants cannot afford sufficient heating. Such buildings are more common in smaller settlements (at lower levels of the urban hierarchy) and in rural areas. Senior residents are over-represented among occupants. The value and rent of these apartments/houses are also far lower than average. A mere 14.9 % of occupants would be able to cover a larger unexpected expense from their own resources. Their reserves, however, are lower than the average amount available for this purpose at all respondents. The income and expenses of occupants are also below average.

Type 2 (family houses above 80 m^2 built of bricks, stone or adobe before 1945)
Half of the buildings were found in good and 8.9 % in excellent condition. Every fifth building (19.5 %) was fitted with a secondary heating appliance; however, in another one fifth, the occupants were not in a position to afford adequate heating. More than 50 % of buildings of this type are found in villages – they are less frequent in larger cities – and mostly in rural or in residential areas with single-family houses. The value and rent of apartments in these buildings are close to the national average and 29.4 % of their occupants claim to have resources for unexpected expenses.

Type 3 (family houses below 80 m^2 built of bricks, stone or adobe between 1946 and 1980)
In this category, the number of buildings in a poor condition is higher than average and one fifth of the occupants (19.5 %) reported that having sufficient heating in their dwelling is not an option. Two fifths (39.4 %) of buildings of this type are found in villages and one tenth (10.4 %) in Budapest. 35.4 % are located in rural and 47.8 % in residential areas with single-family houses. Both the value and rent of such houses/apartments are lower than average. About one fifth (21.4 %) of occupants could cover unexpected expenses, though from amounts falling short of the average. Their income and utility bills are also lower than average.

Type 4 (family houses above 80 m^2 built of bricks, stone or adobe between 1946 and 1980)
Buildings in a poor condition are scarce in this category (2.4 %), almost four fifth are in good or excellent condition and two kinds of heating systems are available in 28.3 %. 12.7 % of households have reported that they lack the resources to provide for sufficient heating in their dwelling. Half (50.5 %) of the buildings of this type are found in villages and 4.4 % in Budapest. The majority is found in rural (31.7 %) or residential areas with single-family houses (54.3 %). The rent and value of houses/apartments of this type are below the national average. 36.7 % of the occupants could cover unexpected expenses of around HUF 357 000 on average.

Type 5 (family houses built of bricks, stone or manually placed blocks between 1981 and 1990)
Most buildings of this type are of good or excellent condition (87.2 %) and typically have all amenities. 31.6 % also have a secondary heating system. Only 4.9 % are in Budapest while half of them are found in villages and close to one third in towns other than towns with county rank. 53.6 % are located in residential areas with single-family houses (53.6 %) and 38.5 % in rural areas. Only one fifth of these buildings are jobless households and few are inhabited by elderly people. The value and rent of houses/apartments of this type are higher than average and one third of their occupants could meet unexpected expenses from higher than average amounts. Earned incomes in these households are also above the national average.

Type 6 (family houses built of bricks, stone or manually placed blocks between 1991 and 2000)
The majority of buildings of this type are in good condition and only one tenth of them in satisfactory or poor condition. They predominate in the North Great Plain region (23.2 %) but are also common in the Central Hungary region (27.5 %). 46.4 % are found in villages, and just over one fifth in Budapest or towns with county rank. While the estimated value of these houses/apartments exceeds the national average, their rent is lower. One third of the occupants could cover any unexpected expenses incurred, in fact, from higher than average amounts. The total average cost of utilities specific to this building type is higher than the national average. The earned income of occupants is also higher than the national average while they receive less social benefits.

Type 7 (family or terraced houses of 1 to 3 apartments built of bricks, stone or manually placed blocks after 2001)
More than half of the buildings of this type are in excellent and only 13.5 % of them in satisfactory or poor condition. They typically have all amenities and some one fifth (20.7 %) is also furnished with a secondary heating system. A mere 4.2 % of these buildings are located in Budapest and 47.5 % in villages. Half (50.6 %) of them are situated in residential areas of single-family houses and 37.5 % in a rural environment. The average value and rent of properties in this category is well above the national average; however, more than half of the corresponding households (56.7 %) have a residential real estate loan to repay.

Type 8 (multi-apartment buildings of 4 to 9 apartments built of bricks, stone or manually placed blocks before 2000)
Buildings of a satisfactory (36.3 %) or poor condition (9.7 %) are found in higher numbers in this category. A secondary heating system is available in only 3.8 % of them. They typically occur in metropolitan areas (43.5 % in cities and 36.1 % in the capital). The share of occupants having sufficient – though more limited – resources to cover unexpected expenses (39.2 %) is slightly above the national average. The earned income of occupants is higher but the average social benefits received by them is below the national average.

Type 9 (multi-apartment buildings of 4 to 9 apartments built of bricks, stone or manually placed blocks after 2001)
The condition of sampled buildings of this type was rated in all cases as good or excellent. In particular, 51.9 % of them were rated as excellent. All sampled households in this category are supplied with mains gas. 10.3 % of the households are supplied with individual space heating and 89.7 % with central heating. No households in the sample were fitted with a secondary heating system. All respondents in the sample claimed to be able to heat their dwelling as they pleased. Their average earned income is considerably higher than the national average, with all building types considered. On the other hand, the social benefits received in this category were far below the national average, with all building types considered.
(Due to fewer sampling units, the data recorded for this building type are on average less robust.)

Type 10 (multi-apartment buildings of more than 10 apartments built of bricks, stone or manually placed blocks before 1945)
15.3 % of buildings of this type are in a poor and 50.1 % in a satisfactory condition. They are typically heated by gas (94.4 %) and, with a few exceptions, do not have a secondary heating system. Houses/apartments of this type are prevalent in urban areas, mainly in Central Hungary (88.5 %), in particular in Budapest (88.3 %). The value of these buildings is above the national average. The incomes earned and the social benefits received by households in these buildings are also above the national average.

Type 11 (multi-apartment buildings of more than 10 apartments built of bricks, stone or manually placed blocks between 1946 and 2000)
68 % of buildings of this type were found in good condition but the condition of 20.9 % was assessed as only satisfactory. The number of those having a secondary heating system is negligible. 30.8 % is located in Central Hungary (of which over 25 % in Budapest) and 41.8 % in towns with county rank.

More than half of these buildings (51.1 %) are found in housing estates. The value and rent of these apartments/buildings is in keeping with the national average. 38.6 % of their occupants have funds for unexpected expenses.

Type 12 (multi-apartment buildings of more than 10 apartments built of mid-size or large blocks and concrete cast on-site)
Buildings of this type are mostly in good condition (68.3 %). However, the condition of 23.3 % is only satisfactory and 13.8 % are not connected to the gas network. 16.1 % of them are located in Central Transdanubia, 15.6 % in West Transdanubia, 31.2 % in Budapest and 44.4 % in towns with county rank. 76.6 % of the buildings are found in housing estates. Average earned incomes in the affected households are higher than the national average. The average amount of social benefits received is close to the national average.

Type 13 (multi-apartment buildings constructed of prefabricated panels between 1946 and 1980)
The majority of buildings of this type were found to be in good condition (65.9 %). The condition of 22.1 % was characterised as satisfactory. 14.8 % are not connected to the gas network and none has a secondary heating system installed. 91.6 % are located in housing estates, with an average value below that of all other building types. The financial position and cost of utilities of their occupants does not show a significant difference from the national average.

Type 14 (multi-apartment buildings constructed of prefabricated panels after 1981)
Just under 75 % (73.5 %) of buildings in this category are in good condition, although 43.5 % are not connected to the gas network. There are no options available for secondary heating in any of these buildings. They are absent from villages, with the majority (60.9 %) found in towns with county rank and 27.6 % in Budapest. Almost all of them (95.6 %) are located in housing estates. 40.6 % of their occupants reported to have sufficient funds for unexpected expenses. Furthermore, their average earned income is higher than the average calculated for the entire population in employment.

Type 15 (multi-apartment buildings of 30 apartments on average built of bricks or other materials after 2001)
The buildings hosting the sampled households are all in excellent (59.4 %) or good condition. All households have mains water. All sampled households are heated by gas and none has a secondary heating system. 27.8 % has individual space heating, 37.1 % central heating and 35.1 % by a boiler supplying several households in the same building. 4.9 % of the households in buildings of this type have responded that they are not in a position to afford comfortable heating in their dwelling. In 58.7 % of the sampled households having an earned income, two people were in employment. Of all sampled buildings of this type, only 12.5 % were jobless households. The average earned income of occupants is considerably higher than the national average, including all building types. On the other hand, the social benefits they received were far below the national average, including all building types. (Due to fewer sampling units, the data recorded for this building type are on average less robust.)

On the whole, the survey shows that the share of buildings in a poor or satisfactory condition is higher among pre-1945 residential buildings (family houses and multi-apartment buildings alike) than among buildings of a later construction date. Occupants of older family houses reported the most frequently and in numbers higher than the average that they had financial difficulties with heating the entire house. The average income and expenses of such occupants are also lower. The condition of most multi-apartment buildings built after 1945 and the overwhelming majority of those built after 2001 were assessed by their occupants as good. The earned income of the occupants of multi-apartment buildings built after 2001 is higher than the national average but the social benefits received by them are lower. The condition of buildings constructed of prefabricated panels is similar to other multi-apartment buildings and, based on the sample, the earned income of their occupants does not differ significantly from the national average either.

40 % of households in the survey claimed that utilities are a significant burden for them while 53 % reported to have only periodic difficulties in this respect. Payment of the cost of utilities places a higher

than average burden on occupants of family houses and buildings constructed of prefabricated panels from before 1980.
It is most common to family houses and urban multi-apartment buildings built before 2001 that owners have to repay a loan from their income; however, the same problem occurs in other building types as well.

3.2.5. The energy performance profile of public buildings

In order to examine the energy performance of model buildings, the structure as well as heating, hot water supply, cooling, ventilation and lighting systems were identified for each building type. For structure, the materials typically used in the period of construction were taken into account, assuming that no modernisation has taken place since construction. For identifying the technical building systems of model buildings, the most commonly occurring present-day mechanical appliances were considered. For example, in the case of buildings built before 1900 a gas boiler providing for a constant temperature was reckoned with instead of a coal or wood-fired furnace typical of the period.

Based on the Energy Performance Characteristics Decree, the thermal transmittance of the building envelope (U, W/m^2K), the specific heat loss of the building (q, W/m^3K), permitted specific heat loss (q_m, W/m^3K) and the ratio of actual and permitted specific heat loss (q/q_m) were calculated for each model building. Specific heat loss depends on the structure and the geometrical layout of the building (the relation of surfaces adjoining unconditioned spaces to building volume).

As the next step, taking account of technical building systems, the primary energy consumed for heating (EH), cooling (EC), hot water supply (EHW) and ventilation (EVent) were also calculated. For lighting, the specific values provided in the Energy Performance Characteristics Decree were used for the calculations while for functionalities not mentioned in the Decree, an average value was considered.

The overall energy performance of buildings (EP, kWh/m^2a) was calculated as the sum of the primary energy consumed for heating, cooling, hot water supply, ventilation and lighting. In addition, an energy performance rating from A+ to I was assigned to each building in accordance with Government Decree No 176/2008 of 30 June 2008.

The most important results of the calculations made for public buildings are outlined under the following subheadings (building identifications are the same used in Table 16 of Chapter 3.1.3).

Health and social care facilities

In the health and social care facilities surveyed, the specific heat loss of the building envelope was 0.16-0.51 W/m^3K, primary energy consumption for heating was 151-308 kWh/m^2a and total primary energy consumption was within the range of 196-354 kWh/m^2a. The highest specific heat loss value was 0.51 W/m^3K, calculated for a doctor’s office built using the lightweight CLASP system between 1946 and 1979. The table below lists the surveyed buildings according to specific primary energy consumption in a descending order.

Health and social care facilities		
Building identification	**Specific primary energy consumption (kWh/m^{2}a)**	**Rating**
H_1900_2	**354**	E
H_1946-1979_2	**350**	E
H_1901-1945_2	**313**	E
H_1900_1	**298**	E
H_1946-1979_1	**293**	E
H_1901-1945_1	**270**	E
H_1980-1989_2	**237**	D
H_1990_2	**196**	D
H_1990_1	**194**	D
H_1980-1989_1	**189**	D

Source: Establishing a typology for modelling the domestic public building stock (Delegated preparatory task for the National Building Energy Performance Strategy, Comfort Consulting Kft., Dr Zoltán Magyar, 2013)

Table 12: Characteristics of health and social care facilities

The highest primary energy consumption was measured in a 2-storey regular-shaped social care facility with a basement (354 kWh/m^{2}a), built before 1900, followed by social care homes built between 1946 and 1979 (350 kWh/m^{2}a), and 1901 and 1945 (313 kWh/m^{2}a), respectively.

Office buildings

In the office buildings surveyed, the values calculated for the specific heat loss of the building envelope were between 0.16-0.6 W/m^{3}K, primary energy consumption for heating was 86–240 kWh/m^{2}a while total primary energy consumption ranged from 138 to 292 kWh/m^{2}a. The highest specific heat loss value was 0.6 W/m^{3}K, calculated for a 2-storey L-shaped building with a basement built before 1900. The table below lists the surveyed buildings according to specific primary energy consumption in a descending order.

Office buildings		
Building identification	**Specific primary energy consumption (kWh/m^{2}a)**	**Rating**
O_1900_2	**292**	F
O_1901-1945_2	**264**	F
O_1900_1	**251**	F
O_1946-1979_1	**234**	F
O_1901-1945_1	**218**	F
O_1946-1979_2	**187**	E
O_1980-1989_2	**171**	E
O_1980-1989_1	**163**	E
O_1990_1	**154**	D
O_1990_2	**138**	D

Source: Establishing a typology for modelling the domestic public building stock (Delegated preparatory task for the National Building Energy Performance Strategy, Comfort Consulting Kft., Dr Zoltán Magyar, 2013)

Table 13: Characteristics of office buildings

The highest primary energy consumption was measured in a 2-storey L-shaped building with a basement (292 kWh/m^{2}a) built before 1900, followed by 3-storey regular-shaped buildings with a basement built between 1901 and 1945 (264 kWh/m^{2}a), and before 1900 (251 kWh/m^{2}a), respectively.

Commercial buildings

In the case of the commercial buildings surveyed, the specific heat loss of the building envelope of model buildings constructed after 1980 was 0.12 to 0.13 W/m^{3}K, while it was between 0.4 and 0.44 W/m^{3}K in those built before 1980. The primary energy used for heating was 146–258 kWh/m^{2}a and total primary energy consumption was within the range of 198–291 kWh/m^{2}a. By way of explanation for these results, it should be noted that a heating/cooling ventilation system without a heat recovery unit was considered for buildings constructed after 1980. Accordingly, the amount of primary energy used for heating was significantly lower, which, however, was counterbalanced by the primary energy needed for ventilation and cooling. As a result, on the whole, the primary energy consumption of these buildings is similar to those built earlier.

The table below lists the surveyed buildings according to specific primary energy consumption in a descending order.

Commercial buildings		
Building identification	**Specific primary energy consumption (kWh/m^{2}a)**	**Rating**
COM_1979_1	291	E
COM_1980_2	232	C
COM_1980_1	227	D
COM_1979_1	198	E

Source: Establishing a typology for modelling the domestic public building stock (Delegated preparatory task for the National Building Energy Performance Strategy, Comfort Consulting Kft., Dr Zoltán Magyar, 2013)

Table 14: Characteristics of commercial buildings

The primary energy demand of a 3-storey almost regular-shaped store building with an inner courtyard and a solid ground floor from before 1890 was the highest (291 kWh/m^{2}a). The second largest primary energy consumer was a single to 4-storey regular-shaped department store with an inner courtyard and a solid ground floor constructed after 1980 (232 kWh/m^{2}a) and the third largest a single or 2-storey regular-shaped lightweight shopping centre with a solid ground floor, also built after 1980 (227 kWh/m^{2}a).

Cultural facilities

The specific heat loss of the building envelope in the cultural facilities surveyed was in the range of 0.13-0.47 W/m^{3}K, primary energy used for heating was between 70 and 198 kWh/m^{2}a, total primary energy consumption was between 106 and 234 kWh/m^{2}a. The highest specific heat loss value of 0.47 W/m^{3}K was calculated for a traditional 2-storey U-shaped library building with a basement built between 1946 and 1979. The table below lists the surveyed buildings according to specific primary energy consumption in a descending order.

Cultural facilities		
Building identification	**Specific primary energy consumption (kWh/m^{2}a)**	**Rating**
CUL_1946-1979_2	**234**	F
CUL_1946-1979_1	**216**	E
CUL_1980-1989_2	**188**	D
CUL_1990_2	**168**	D
CUL_1945_2	**166**	E
CUL_1945_1	**161**	E
CUL_1980-1989_1	**134**	E
CUL_1990_1	**106**	D

Source: Establishing a typology for modelling the domestic public building stock (Delegated preparatory task for the National Building Energy Performance Strategy, Comfort Consulting Kft., Dr Zoltán Magyar, 2013)

Table 15: Characteristics of cultural facilities

The highest primary energy consumption was recorded for a traditional 2-storey U-shaped library building with a basement, constructed between 1946 and 1979 (234 kWh/m^{2}a). The second and third highest value was calculated for a single-storey regular-shaped lightweight community centre with a solid ground floor constructed between 1946 and 1979 (216 kWh/m^{2}a) and a single-storey regular-shaped cultural centre having an inner courtyard and a solid ground floor (188 kWh/m^{2}a) constructed between 1980 and 1989, respectively.

Educational buildings

In the educational buildings surveyed, the specific heat loss of the building envelope was 0.23-0.61 W/m^{3}K, primary energy consumption for heating was between 113 and 238 kWh/m^{2}a and total primary energy consumption was within the range of 139 and 267 kWh/m^{2}a. The highest specific heat loss value was 0.61 W/m^{3}K, calculated for a 2-storey U-shaped building constructed between 1901 and 1945. The table below lists the surveyed buildings according to specific primary energy consumption in a descending order.

Educational buildings		
Building identification	**Specific primary energy consumption (kWh/m²a)**	**Rating**
EDU_1946-1979_1	**267**	G
EDU_1901-1945_2	**247**	G
EDU_1946-1979_2	**236**	F
EDU_1900_1	**235**	G
EDU_1901-1945_1	**234**	G
EDU_1900_2	**233**	F
EDU_1980-1989_2	**189**	F
EDU_1980-1989_1	**166**	F
EDU_1900_2	**159**	E
EDU_1900_1	**139**	E

Source: Establishing a typology for modelling the domestic public building stock (Delegated preparatory task for the National Building Energy Performance Strategy, Comfort Consulting Kft., Dr Zoltán Magyar, 2013)

Table 16: Characteristics of educational buildings

The highest primary energy consumption value (267 kWh/m^{2}a) was calculated for a school building built in the socialist realist style in the 1950s, followed by a 2-storey U-shaped building constructed between 1901 and 1945 (247 kWh/m^{2}a). According to the calculations, almost the same amount of primary energy is consumed by a school building from the 1970s built from self-supporting prefabricated panels (236 kWh/m^{2}a), 3-storey regular-shaped school buildings constructed before 1900 and in the period between 1901 and 1945 (235 kWh/m^{2}a) as well as a 2-storey U-shaped school building constructed before 1900 (233 kWh/m^{2}a).

Summary of results for the public buildings surveyed

The following paragraphs set out the total primary energy consumption determined for each model building and a comparison of the results. The table below lists the surveyed buildings according to specific primary energy consumption in a descending order.

Order	Building identification	Specific primary energy consumption (kWh/m²a)
1	H_1990_2	**354**
2	H_1946-1979_2	**350**
3	H_1901-1945_2	**313**
4	H_1990_1	**298**
5	H_1946-1979_1	**293**
6	O_1900_2	**292**
7	COM_1979_2	**291**
8	H_1901-1945_1	**270**
9	EDU_1946-1979_1	**267**

Order	Building identification	Specific primary energy consumption (kWh/m^{2}a)
10	O_1901-1945_2	**264**
11	O_1900_1	**251**
12	EDU_1901-1945_2	**247**
13	H_1980-1989_2	**237**
14	EDU_1946-1979_2	**236**
15	EDU_1900_1	**235**
16	O_1946-1979_1	**234**
17	EDU_1901-1945_1	**234**
18	CUL_1946-1979_2	**234**
19	EDU_1900_2	**233**
20	COM_1980_2	**232**
21	COM_1980_1	**227**
22	O_1901-1945_1	**218**
23	CUL_1946-1979_1	**216**
24	COM_1979_1	**198**
25	H_1990_2	**196**
26	H_1990_1	**194**
27	H_1980-1989_1	**189**
28	EDU_1980-1989_2	**189**
29	CUL_1980-1989_2	**188**
30	O_1946-1979_2	**187**
31	O_1980-1989_2	**171**
32	CUL_1990_2	**168**
33	CUL_1945_2	**166**
34	EDU_1980-1989_1	**166**
35	O_1980-1989_1	**163**
36	CUL_1945_1	**161**
37	EDU_1900_2	**159**
38	O_1990_1	**154**
39	EDU_1900_1	**139**
40	O_1990_2	**138**
41	CUL_1980-1989_1	**134**
42	CUL_1990_1	**106**

Source: Establishing a typology for modelling the domestic public building stock (Delegated preparatory task for the National Building Energy Performance Strategy, Comfort Consulting Kft., Dr Zoltán Magyar, 2013)

Table 17: The list of public buildings ranked in order of specific primary energy consumption

Five of the ten highest ranking primary energy consumers in the list of the surveyed model buildings are health care facilities. These are, in descending order, a 2-storey regular-shaped social care facility with a basement, a single-storey doctor's office built between 1946 and 1979 using the lightweight CLASP system, a 2-storey regular-shaped social care home with a basement built between 1901 and 1945, a 3-storey U-shaped hospital building with a basement built before 1900, and a 4-storey U-shaped hospital building with a basement, constructed between 1946 and 1979. The amount of primary energy consumed by these buildings is in the order of 300 kWh/m^{2}a or, in the case of the first three buildings, even more.

The next five positions in the list are occupied by office, commercial and educational buildings or health and social care facilities with a primary energy consumption ranging between 260 and 300 kWh/m^{2}a. Of these, the largest consumer of primary energy is an L-shaped office building built before 1900, followed by an almost regular-shaped store building with an inner courtyard and a solid ground floor constructed before 1980, a 3-storey L-shaped hospital building with a basement built between 1901 and 1945, a school building built in the socialist realist style in the 1950s and finally a 2-storey L-shaped office building with a basement built between 1901 and 1945.

Buildings ranking 11 to 20 in the list show no significant difference in primary energy consumption, which is within the range of 232–251 kWh/m^{2}a. Educational facilities are overrepresented in these ten positions, taking five of them. These are, ranked in order of consumption, are a 2-storey U-shaped school building constructed between 1901 and 1945, a school building from the 1970s built from self-supporting prefabricated panels, a 3-storey regular-shaped school building constructed before 1900, a 3-storey regular-shaped school building constructed between 1901 and 1945 and a 2-storey U-shaped school building constructed before 1900.
The primary energy consumption of the rest of the buildings (21 to 42) is typically between 130 and 230 kWh/m^{2}a.

3.2.6. Summary of findings of the energy performance profile analysis

While in Hungary both per capita energy consumption and per capita electricity consumption is significantly lower than the EU average, our country is characterised by relatively high energy intensity in international comparison.

Primary energy consumption in Hungary has shown a decreasing trend since 2006. This is due partly to the economic crisis which resulted in a reduced energy demand in production technology and falling production. In addition, no increase was observable in the overall energy consumption of buildings. The implementation of Government programmes for improved energy efficiency play a significant role in reducing primary energy consumption.

The share of households in the total energy consumption of buildings is approx. 60 % while the public, service and commercial sectors account jointly for 35 %. The energy consumption of buildings in the industrial and agricultural sector is meagre. In the energy consumption of households, a decreasing trend is observable in the use of natural gas and district heat while the popularity of firewood is on the rise. The amount of electricity used by households has not changed significantly over the last decade.

To be able to carry out an analysis of the energy performance profile of buildings in the residential and public sector, a separate typology allowing for modelling of the domestic building stock and planning for future renovation scenarios had been established for each sector.

A detailed energy performance survey has been carried out, involving a great number of residential buildings. ÉMI inspected the energy performance of 2 230 buildings previously filtered by quality using the databases of the ZBR and the EEOP as well as the certificates collected by VÁTI. Where the volume of data available in the tendering databases on specific building types was not sufficient for analysis, the engineers of ÉMI conducted an on-site inspection of the energy performance of more than 100 buildings in each region. ÉMI conducted an additional survey with the aim of investigating the ratio of renovated buildings per building type in addition to carrying out detailed energy performance inspections. Altogether 20 842 buildings were involved, with an equal number of buildings inspected in the different regions of the country, located in Budapest, and in major cities, smaller towns and villages in the countryside, including family houses as well as traditional multi-apartment buildings and multi-apartment buildings constructed of prefabricated panels.

Family houses are prevalent, not only in terms of the number of buildings but also in terms of the number of apartments: 95 % of residential buildings are family houses and their share in the housing stock is around 60 %. Almost 75 % of family houses were put up before 1980, in accordance with the thermal design requirements in force at the time.

Small multi-apartment buildings built using a traditional method before 2001 make up approx. 40 % of the domestic stock of multi-apartment buildings. The share of buildings constructed of prefabricated panels or using other industrialised system building methods is slightly over 25 %. The share of multi-apartment buildings built before 1945 is only around 10 %. 42 % of homes in multi-apartment buildings are found in buildings constructed of prefabricated panels or using other industrialised system building methods.

The distribution of heating systems reveals that, except for buildings constructed of prefabricated panels practically all of which are supplied with district heat, 55 to 60 % of apartments in other building types are heated by gas. In addition to heating by gas, the share of mixed and wood heating is also significant. The specific primary energy consumption of residential buildings varies greatly within a range of 100 to 550 kWh/m^2a. In particular, the majority of older buildings are characterised by higher specific primary energy consumption while that of multi-apartment buildings and family houses built after 2001 is below 200 kWh/m^2a.

Based on the surveys conducted, 5 to 30 % of the family houses have façade insulation; however, this figure is below 16 % in the case of houses built before 1980. The number of fully insulated larger multi-apartment buildings built before 1945 is meagre while it is around 20 % in the case of buildings constructed of prefabricated panels. With partial insulation also taken into account, the corresponding figures are 5 to 60 % for family houses and approx. 50 % for buildings constructed of prefabricated panels. Fortunately, the ratio of replaced or renovated doors and windows is higher.

The surveys show that the share of buildings in a satisfactory or poor condition is higher among pre-1945 residential buildings (family houses and multi-apartment buildings alike) than among buildings of a later construction date. Many of the occupants of older family houses have financial difficulties with heating the entire house. The average income and expenses of these occupants are also lower. The condition of most multi-apartment buildings built after 1945 and the overwhelming majority of those built after 2001 were assessed by their occupants as good. The earned income of the occupants of multi-apartment buildings built after 2001 is higher than the national average but the social benefits received by them are lower. The condition of buildings constructed of prefabricated panels is similar to other multi-apartment buildings and the earned income of their occupants does not differ significantly from the national average either. 40 % of the households claimed that utilities are a significant burden for them while 53 % reported to have only periodic difficulties in this respect. Payment of the cost of utilities places a higher than average burden on occupants of family houses and buildings constructed of prefabricated panels from before 1980.

The detailed survey of public buildings was based on the data on public buildings in municipality and State ownership of the HCSO and ÉMI, respectively. Based on the available data, the following five building types were identified according to their purpose: health and social care facilities, office buildings, commercial buildings, cultural facilities and educational buildings. Model buildings (sub-types) were defined based on purpose, the structural features characteristic of the period of construction and the number of storeys. These model buildings were used as a standard for energy performance analyses. In order to examine the energy performance of model buildings, the structure as well as heating, hot water supply, cooling, ventilation and lighting systems were identified for each building type.

Of the model buildings surveyed, five of the ten highest ranking primary energy consumers are health care facilities with values between 300 and 350 kWh/m^{2}a. Moving down the list, we find office, commercial and educational buildings or health and social care facilities alike with a primary energy consumption ranging between 260 and 300 kWh/m^{2}a. There is no significant difference in the primary energy consumption of educational buildings, which is in the range of 232–251 kWh/m^{2}a. The primary energy consumption of the most energy-efficient buildings is between 130 and 230 kWh/m^{2}a.

3.2.7. Energy efficiency programmes in the sector of non-residential buildings

‘The majority of funds for energy efficiency improvement are available to enterprises, municipalities and institutions.

Between 2004 and 2006, 28 applicants were granted funds under the Environmental Protection and Infrastructure Operational Programme (EIOP), mostly for the modernisation of institutions (mainly schools and hospitals). Applications were submitted for various projects, including the replacement of doors and windows and/or modernisation of lighting and insulation, however, heating modernisation was a priority purpose. In addition, funds were granted to several district heat suppliers as well as for a transport project (modernisation of the power supply system of the tramline on Nagykörút in Budapest) and a project for the modernisation of street lighting in Budapest. From 2007, funds were granted under priority 5 of the EEOP to 739 applicants in a total amount of HUF 57 249 544 000. (Source: emir.nfu.hu) Funds were also available for similar projects or project components under the Economic Development Operational Programme (EDOP) and Regional Operational Programmes (ROP).’

(Source: Overview of the experience and assessment results in the field of energy efficiency and low-carbon economy, commissioned by the Ministry of National Development and drawn up by the consortium leader HÉTFA Research Institute and Centre for Economic and Social Analysis, 31 October 2013)

4. Renovation scenarios

The Energy Performance Characteristics Decree was amended with a view to establishing the cost-optimal levels of minimum energy performance requirements under the Energy Performance of Buildings Directive. The new cost-optimal levels of minimum energy performance requirements are applicable since 1 January 2015 to support granted under domestic or EU tenders or from the central budget for energy efficiency projects. For new buildings, the provisions of the Energy Performance of Buildings Directive should be taken into account which require Member States to ensure that, after 31 December 2020, all new buildings are nearly zero-energy buildings and, after 31 December 2018, that new buildings owned and occupied by public authorities are nearly zero-energy buildings.

- *Cost-optimal scenario:* Renovation in accordance with the cost-optimal levels of minimum energy performance requirements applicable from 2015, having regard to the requirements under the amendment of the Energy Performance Characteristics Decree entered into force on 1 January 2015.
- *Nearly zero scenario:* Buildings completed at a cost-optimal level in accordance with the Energy Performance Characteristics Decree or at a more energy-efficient level, with at least 25 % of the annual energy requirement expressed in primary energy being met using renewable energy sources occurring in the building, originating from the property or produced in the vicinity. The requirements for new buildings currently in force apply to major renovations as well.

The required heat loss values are outlined in the table below.

Building envelope	Required heat loss value, U (W/m^2K)	
	Until 31 December 2014	From 1 January 2015
Façade wall	0.45	0.24
Flat roof	0.25	0.17
Boundary structures of heated attics	0.25	0.17
Floor of attics	0.3	0.17
Ceiling above arcades and passages	0.25	0.17
Lower closing ceiling above non-heated spaces	0.5	0.26
Glazing	-	1
Special glazing	-	1.2
Glazed door or window on façade with a frame structure made from wood or PVC (> 0.5 m^2)	1.6	1.15
Glazed door or window on façade with a metal frame structure	2	1.4
Glazed door or window on façade of a nominal surface of < 0.5 m^2	2.5	-
Glass wall or curtain wall on façade	1.5	1.4
Glass roof	-	1.45
Skylight, smoke vent	2.5	1.7
Roof window	1.7	1.25
Industrial and fire door and gate (bounding heated spaces)	-	2
Door on façade or between heated and unheated spaces	1.8	1.45
Gate on façade or between heated and unheated spaces	3	1.8

Building envelope	Required heat loss value, U (W/m^2K)	
	Until 31 December 2014	From 1 January 2015
Wall between heated and unheated spaces	0.5	0.26
Wall between adjacent heated buildings and parts of buildings	1.5	1.5
Foundation wall, wall in contact with the soil up to a depth of 1 m below ground level (the part below ground level only for new buildings)	0.45	0.3
Floor laid directly onto soil (for new buildings)	0.5	0.3
Traditional solar-energy collecting walls (e.g. mass walls and Trombe walls)	-	1

Source: Establishing a typology for modelling the domestic public building stock (Delegated preparatory task for the National Building Energy Performance Strategy, Comfort Consulting Kft., Dr Zoltán Magyar, 2013)

Table 18: Required heat loss values used for the calculations

The cost of renovation measures in residential buildings were determined in collaboration with the Hungarian Association for Building Engineering Contractors (MÉGSZ) and the Hungarian Window & Door Manufacturers Association (MATA), using the budget planning software VIKING of Terc Kft., based on the unit costs calculated upon assessment of the submitted applications and the cost estimation manual. For public buildings, the resources required for the investment were calculated based on the unit costs established by analysing the applications submitted under the EEOP.

4.1. Renovation scenarios for residential buildings

The renovation of residential buildings was examined based on the building types introduced earlier and cost-optimal renovation requirements.

4.1.1. Cost-optimal requirements: renovation in accordance with the cost-optimal levels of energy performance requirements applicable from 2015

The cost-optimal renovation scenario involves renovation in accordance with the requirements for major renovations introduced by the Energy Performance Characteristics Decree. Pursuant to the Decree, the requirements applicable to new buildings should be met in the case of major renovations as well. Similar to its predecessor, the Energy Performance Characteristics Decree provides for requirements to be applied from 2015 at three levels, defining the upper limit of the thermal transmittance of building envelopes (U), specific heat loss and overall energy performance (total specific primary energy consumption). The U value is a uniform quantified requirement to be met by all buildings (e.g. for exterior walls U_{max}=0.24 W/m^2K, for roofs U_{max}=0.17 W/m^2K and for attic floors U_{max}=0.17 W/m^2K). However, specific heat loss and overall energy performance values vary according to the relation of surfaces adjoining unconditioned spaces to heated building volume and are therefore set for each building type separately. Moreover, overall energy performance fundamentally defines the applicable technical building system.

Proof must also be provided of the protection of buildings against excessive summer heat.

Consequently, the technical solutions which ensure compliance with the requirements outlined above differ across the building types, since not only the original structure and systems of each building but also the required values applicable to them are diverse. In modelling the buildings, our basic principles were to meet the minimum requirements for structure, while in the case of technical building systems, to choose the technology which is deemed the most cost-efficient and ensures compliance with the overall energy performance requirement as well. Meeting the requirements for major renovations was already a basic condition for applications submitted under the ZBR.

4.1.2. Models of new buildings

In addition to modelling existing building types, two new model buildings were also defined:

- new family houses with up to date structures and technical building systems;
- new multi-apartment buildings with up to date structures and technical building systems.

For defining these model buildings, the statistical data and average floor area of new buildings were taken into account. The information available in the statistics and therefore also the number of building types established on their basis were limited.

In the case of new buildings, the requirements currently in force are identical with those applicable to major renovations. In order to ensure an appropriate standard of comfort, installing an artificial ventilation system with a heat recovery unit is an option to consider in residential buildings, too.

4.1.3. Results of calculations for the renovation of residential buildings

The results of the calculations are outlined in the table below. The energy data in the table refer to the overall energy performance and the total primary energy consumption for the net heated floor area of the buildings. Apart from heating, the latter also includes the energy required for producing hot water. The two new model buildings, also included in the table, meet the cost-optimal level even without renovation.

No	Building type	Year of construction	Walls	Primary energy consumption in current state (kWh/m^2a)	Primary energy consumption after cost-optimal renovation (kWh/m^2a)
Type 1	family houses below 80 m^2	-1945		551	140
Type 2	family houses above 80 m^2	-1945		408	128
Type 3	family houses below 80 m^2	1946–1980		517	139
Type 4	family houses above 80 m^2	1946–1980		405	135
Type 5	family houses	1981–1990		336	109
Type 6	family houses	1991–2000		227	114
Type 7	family or terraced houses (1 to 3 apartments)	After 2001		173	123
Type 8	multi-apartment buildings (4 to 9 apartments)	-2000		312	111
Type 9	multi-apartment buildings (4 to 9 apartments)	After 2001		125	99
Type 10	multi-apartment buildings (10 or more apartments)	-1945		344	99
Type 11	multi-apartment buildings (10 or more apartments)	1946–2000	brick, other	299	95
Type 12	multi-apartment buildings (10 or more apartments)		mid-size or large blocks, cast concrete	244	85
Type 13	multi-apartment buildings (10 or more apartments)	1946–1980	prefabricated panels	218	84
Type 14	multi-apartment buildings (10 or more apartments)	From 1981	prefabricated panels	200	80
Type 15	multi-apartment buildings (10 or more apartments)	After 2001		100	80

Type 16	NEW BUILDING (1 or 2 apartments)	From 2013	category C/B	143	no renovation
Type 17	NEW BUILDING (12 apartments on average)	From 2013	category C/B	112	no renovation

Source: A typology of buildings for modelling the energy performance of the domestic residential building stock (Study for the National Building Energy Performance Strategy, Dr Tamás Csoknyai, 2013)

Table 19: Results of calculations for the renovation of residential buildings

4.1.4. Cost of renovation of residential buildings in the different renovation scenarios

A package containing technical renovation measures was also put together under the renovation scenario outlined above. The package was produced in the light of the relevant renovation requirements with the assistance of technical experts. The costs involved in the package were determined mainly on the basis of the calculations made by the experts but tendering databases were also used. The resource estimates established using tendering databases warrant careful interpretation.
The cost of renovation measures in residential buildings described in an itemised manner was determined in collaboration with the Hungarian Association for Building Engineering Contractors and the Hungarian Window & Door Manufacturers Association, using the budget planning software VIKING of Terc Kft. and the cost estimation manual. When the cost of primary energy savings could be established from data in the tendering databases, calculations were made using these data as well.

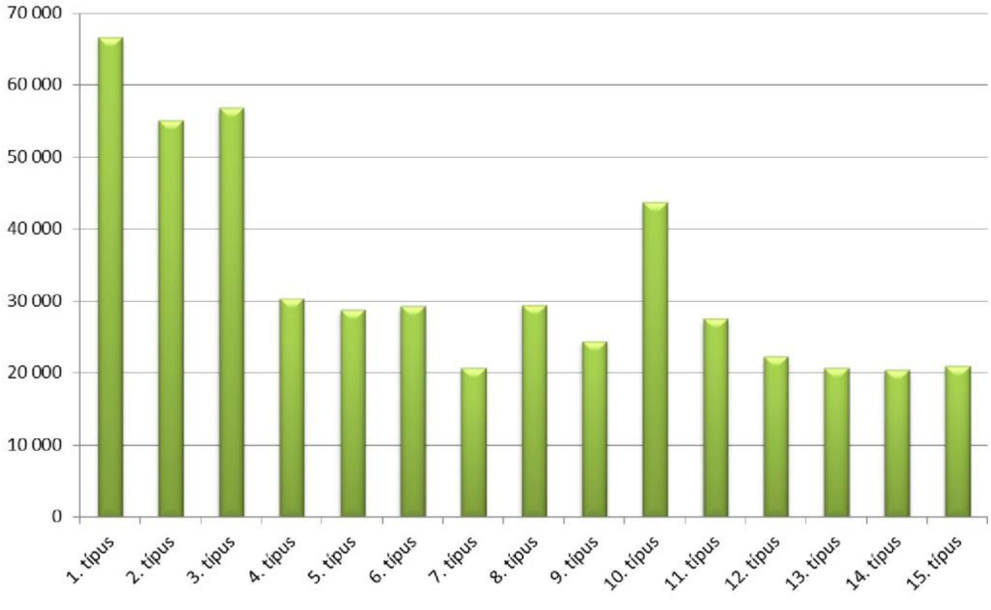
The calculated renovation costs obtained with these methods for each residential building type are presented in the table below.

No	Building type	Year of construction	Walls	Primary energy savings (kWh/m^{2}a)	Estimated cost of modernisation for heated floor area (HUF thousand/m^2)
Type 1	family houses below 80 m^2	-1945		**411**	**66**
Type 2	family houses above 80 m^2	-1945		**280**	**55**
Type 3	family houses below 80 m^2	1946-1980		**378**	**56**
Type 4	family houses above 80 m^2	1946-1980		**270**	**30**
Type 5	family houses	1981-1990		**227**	**28**
Type 6	family houses	1991-2000		**113**	**29**
Type 7	family or terraced houses (1 to 3 apartments)	After 2001		**50**	**20**
Type 8	multi-apartment buildings (4 to 9 apartments)	-2000		**201**	**29**
Type 9	multi-apartment buildings (4 to 9 apartments)	After 2001		**26**	**24**
Type 10	multi-apartment buildings (10 or more apartments)	-1945		**245**	**43**
Type 11	multi-apartment buildings (10 or more apartments)	1946-2000	brick, other	**204**	**27**
Type 12	multi-apartment buildings (10 or more apartments)		mid-size or large blocks, cast concrete	**159**	**22**
Type 13	multi-apartment buildings (10 or more apartments)	1946-1980	Panel 1	**134**	**20**
Type 14	multi-apartment buildings (10 or more apartments)	1981-	prefabricated panels	**120**	**20**
Type 15	multi-apartment buildings (10 or more apartments)	After 2001		**20**	**20**

Source: Calculations of ÉTMV Építési Termék Minőségvédelmi és Vállalkozásfejlesztési Nonprofit Kft.

Table 20: Cost of renovation of residential buildings

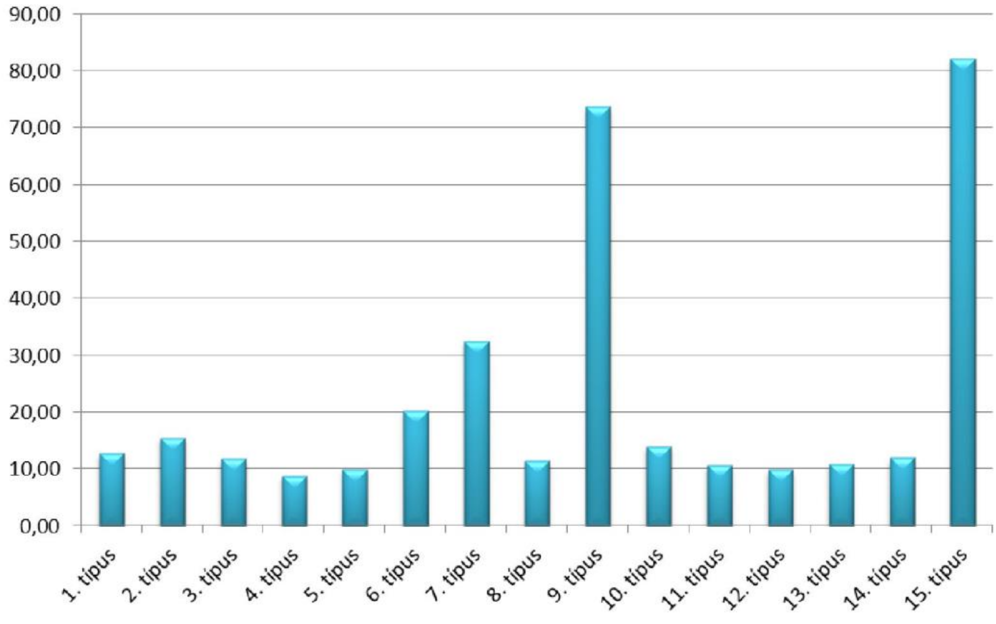
The following figures illustrate the results of the calculations.



[Key: 1. típus = Type 1, etc.]

Source: Calculations of ÉTMV Építési Termék Minőségvédelmi és Vállalkozásfejlesztési Nonprofit Kft.

Figure 9: Estimated cost of modernisation for heated floor area (HUF/m^2)



Source: Calculations of ÉTMV Építési Termék Minőségvédelmi és Vállalkozásfejlesztési Nonprofit Kft.

Figure 10: Ratio of investment costs (vertical axis): initial cost of investment / cost of annual savings in energy for heating purposes based on 2013 prices

Within the residential building stock, priority should be given to the modernisation of family houses, in particular to single-family houses of Type 3 and 4 which are the most common according to the typology. Property owners should be supported by advisers in making their renovation choices.

The NABEPS does not propose disparate regional actions, as improving the energy performance of buildings is a concern for the whole country. Priority is given to less developed regions at the level of operational programmes, especially in the form of support for the energy efficiency projects of enterprises.

4.2. Renovation scenarios for public buildings

Two renovation scenarios were examined for the model buildings in this case as well.

The first involves renovation to ensure compliance with the energy performance requirements applicable from 1 January 2015 in accordance with the amendment of the Energy Performance Characteristics Decree. The second meets the nearly zero-energy requirements defined in the same Decree.

4.2.1. Cost-optimal scenario: renovation in accordance with the cost-optimal levels of energy performance requirements applicable from 2015

The first renovation scenario meets the cost-optimal requirements introduced by the amendment to the Energy Performance Characteristics Decree, which represent a more stringent set of requirements than those laid down by the provisions replaced by the amendment.
Restrictions were also considered, including the prohibition to retrofit valuable historic buildings with thermal façade insulation or to provide the ceiling of their basement with additional insulation. The grounds for the latter prohibition are that reducing the clear height of the basement is in general not permissible for functional reasons and is frequently infeasible also because of the cables and pipes of technical building systems running below the ceiling. Accordingly, in the case of such buildings retrofitting with thermal insulation was not involved in the calculations.
For technical building systems, the effects of the following characteristics were considered:

- in the case of heating by gas boiler, the heating unit is a condensing boiler;
- a double duct heating system is installed;
- the designed temperature difference of the heating system is 65/50 °C;
- heat emitters are provided with a thermostatic valve;
- a pump with controlled speed (r.p.m) is installed in the heating system;
- in systems where hot water is produced by a boiler, the original boiler will be replaced by a condensing gas boiler during modernisation.

The possibility of installing solar collector systems was also added to the considerations above so that the additional energy savings achievable by such systems could be quantified, too.

Solar collectors bring the most benefit in places where hot water demand is high throughout the year. Educational institutions are closed during the summer holiday with practically no hot water used in this period. Cultural facilities are characterised by low hot water consumption in general. Therefore, in these institutions, installing a solar collector system for hot water production is not recommended. In contrast, such a system is highly advantageous in healthcare facilities where large quantities of hot water are used all year round. Although hot water consumption is lower in office and commercial buildings than in healthcare facilities, at an annual level, it tends to be largely consistent and therefore the effect on primary energy consumption of installing a solar collector system for hot water production was examined also in these buildings. Since 50 to 60 % of the annual heating energy required for hot water production may be produced economically by solar collectors, we have assumed 60 % in our calculations.

For larger investment projects, it is particularly recommended to install monocrystalline solar collectors which have the highest efficiency (16 to 18 %) and an expected lifetime of over 30 years. In terms of power supply, it is advised to connect the solar collector system directly to the electricity grid by inverters approved by the electricity provider so that batteries are avoided and the collectors shut down in the event of a failure of the supply system. The system operates at close to peak power at maximum insolation. Having regard to Hungary's natural endowments in terms of sunshine duration, the annual amount of electricity which may be produced with a solar collector of 1 kW is 1 063 kWh/year. For the purpose of application on buildings, it was assumed that solar collectors are placed on 20 to 25 % of the surface area of the roof. In practice, probably more solar collectors could be installed; however, the unit cost of such investments currently stands at HUF 400 000 to 600 000/kW which adds up to a significant amount in the case of systems of a higher capacity. Funds available under the different tenders are essential for the economical use of solar systems.

For calculating overall energy performance, the electricity generated by solar collectors was converted to primary energy by a conversion factor of e = 2.5, as specified in the Energy Performance Characteristics Decree. Finally, the amount of primary energy obtained this way was deducted from the total primary energy consumption of the building.

The total primary energy consumption of buildings in comparison to the current state is as follows:

Building identification	**Current state**		**Renovation scenario 1 Heat transmission values meeting cost-optimal requirements + solar energy**		
	Primary energy consumption E_p (kWh/m^2a)	**Rating**	**Primary energy consumption E_p (kWh/m^2a)**	**Rating**	**Primary energy savings (%)**
H_1990_2	354	E	147	A	58 %
H_1946-1979_2	350	E	169	A	52 %
H_1901-1945_2	313	E	130	A	59 %
H_1990_1	298	E	185	B	38 %
H_1946-1979_1	293	E	160	B	46 %
O_1900_2	292	F	88	A+	70 %
COM_1979_2	291	E	124	A	57 %
H_1901-1945_1	270	E	173	B	36 %
EDU_1946-1979_1	267	G	96	B	64 %
O_1901-1945_2	264	F	88	A	67 %
O_1900_1	251	F	152	D	39%
EDU_1901-1945_2	247	G	65	A+	74 %
H_1980-1989_2	237	D	112	A	53 %
EDU_1946-1979_2	236	F	71	A	70 %
EDU_1900_1	235	G	138	E	41 %
O_1946-1979_1	234	F	76	A+	67 %
EDU_1901-1945_1	234	G	138	E	41 %
CUL_1946-1979_2	234	F	60	A+	74 %
EDU_1900_2	233	F	65	A+	72 %
COM_1980_2	232	C	153	A	34 %
COM_1980_1	227	D	148	A	35 %

Building identification	Current state		Renovation scenario 1 Heat transmission values meeting cost-optimal requirements + solar energy		
	Primary energy consumption E_p (kWh/m^{2}a)	**Rating**	**Primary energy consumption E_p (kWh/m^{2}a)**	**Rating**	**Primary energy savings (%)**
O_1901-1945_1	218	F	130	B	41 %
CUL_1946-1979_1	216	E	47	A+	78 %
COM_1979_1	198	E	79	A	60 %
H_1990_2	196	D	102	A	48 %
H_1990_1	194	D	114	A	41 %
H_1980-1989_1	189	D	101	A	47 %
EDU_1980-1989_2	189	F	68	A	64 %
CUL_1980-1989_2	188	D	40	A+	79 %
O_1946-1979_2	187	E	141	D	25 %
O_1980-1989_2	171	E	77	A	55 %
CUL_1990_2	168	D	36	A+	79 %
CUL_1945_2	166	E	59	A	65 %
EDU_1980-1989_1	166	F	66	A	60 %
O_1980-1989_1	163	E	77	A	53 %
CUL_1945_1	161	E	70	A	57 %
EDU_1900_2	159	E	54	A+	66 %
O_1990_1	154	D	81	A	47 %
EDU_1900_1	139	E	55	A	60 %
O_1990_2	138	D	91	A	34 %
CUL_1980-1989_1	134	E	44	A+	67 %
CUL_1990_1	106	D	70	A	34 %
Average	***219***		***99***		***55 %***

Source: Establishing a typology for modelling the domestic public building stock (Delegated preparatory task for the National Building Energy Performance Strategy, Comfort Consulting Kft., Dr Zoltán Magyar, 2013)

Table 21: Total primary energy consumption after renovation meeting cost-optimal requirements and with the use of solar energy

Implementing this renovation scenario would result in primary energy savings of 55 % on average in the inspected model buildings. Of the inspected buildings, higher than average savings of around 70 % are achievable in the buildings where a higher share of solar energy in total primary energy consumption can be ensured. Such higher share of electricity generated by solar collectors may be obtained in buildings where the available surface area of the roof is greater in proportion to the heated floor area. This applies mostly in the case of single- or two-storey buildings. Once the modernisations in the structure and technical systems of the buildings described under the target state are fully implemented and assuming that solar collectors are installed on 20 % of the surface area of the roof, almost all of the model buildings concerned will have an upgraded energy performance rating of ‘A+’ or ‘A’.

The greatest primary energy savings – almost 80 % – may be achieved in the case of a single-storey regular-shaped cultural centre having one inner courtyard and a solid ground floor.

4.2.2. Nearly zero-energy scenario: renovation in accordance with nearly zero-energy requirements

The nearly zero-energy scenario, complementing the renovation package meeting cost-optimal requirements, incorporates the requirement under the Energy Performance Characteristics Decree for a 25 % share of renewable energy. As the use of renewable energy was already part of the renovation package outlined above, in the case of certain model buildings, there is no need to install additional components. For the rest of the buildings, in addition to increasing the share of solar energy, the possibility to apply air-to-water heat pumps was also considered. As a result, such appliances were involved in the calculations in the nearly zero-energy scenario in the case of several buildings. For example, heat pumps are a viable solution in public buildings not having sufficient surface area on the roof to ensure a 25 % share of renewable energy. Technical building systems of this type also allow for recovering heat from used air in buildings having an air treatment system. When designing the energy supply system, it was a priority to produce the largest possible part of the energy needed for operating the heat pump with the solar collectors also to be installed. The installed capacity of the solar collector system to be applied in most building types will not exceed 50 kVA. In the current regulatory context, this allows for the possibility to connect a small-size power plant for domestic purposes to the public distribution network together with a bidirectional meter. This in turn makes it possible to sell the electricity exported to the grid to energy traders.

The total primary energy consumption of buildings in comparison to the current state is as follows:

Building identification	**Primary energy consumption in current state (kWh/m^2a)**	**Primary energy consumption in nearly zero-energy state after renovation (kWh/m^2a)**	**Primary energy savings (%)**
H_1990_2	354	**123**	**65 %**
H_1946-1979_2	350	**160**	**54 %**
H_1901-1945_2	313	**106**	***66 %***
H_1990_1	298	**155**	**48 %**
H_1946-1979_1	293	**97**	**67 %**
O_1900_2	292	**66**	**77 %**
COM_1979_2	291	**107**	**63 %**
H_1901-1945_1	270	**145**	**46 %**
EDU_1946-1979_1	267	**84**	**68 %**
O_1901-1945_2	264	**67**	**75 %**
O_1900_1	251	**130**	**48 %**
EDU_1901-1945_2	247	**59**	**76 %**
H_1980-1989_2	237	**93**	**61 %**
EDU_1946-1979_2	236	**71**	**70 %**
EDU_1900_1	235	**114**	**51 %**
O_1946-1979_1	234	**53**	**77 %**
EDU_1901-1945_1	234	**114**	**51 %**
CUL_1946-1979_2	234	**54**	**77 %**
EDU_1900_2	233	**59**	**75 %**
COM_1980_2	232	**95**	**59 %**

Building identification	Primary energy consumption in current state (kWh/m^2a)	Primary energy consumption in nearly zero-energy state after renovation (kWh/m^2a)	Primary energy savings (%)
COM_1980_1	227	**100**	**56 %**
O_1901-1945_1	218	**109**	**50 %**
CUL_1946-1979_1	216	**47**	**78 %**
COM_1979_1	198	**74**	**63 %**
H_1990_2	196	**84**	**57 %**
H_1990_1	194	**94**	**52 %**
H_1980-1989_1	189	**84**	**56 %**
EDU_1980-1989_2	189	**61**	**68 %**
CUL_1980-1989_2	188	**40**	**79 %**
O_1946-1979_2	187	**70**	**63 %**
O_1980-1989_2	171	**63**	**63 %**
CUL_1990_2	168	**36**	**79 %**
CUL_1945_2	166	**53**	**68 %**
EDU_1980-1989_1	166	**53**	**68 %**
O_1980-1989_1	163	**71**	**57 %**
CUL_1945_1	161	**65**	**60 %**
EDU_1900_2	159	**54**	**66 %**
O_1990_1	154	**74**	**52 %**
EDU_1900_1	139	**52**	**62 %**
O_1990_2	138	**76**	**45 %**
CUL_1980-1989_1	134	**31**	**77 %**
CUL_1990_1	106	**60**	**43 %**
Average	***219***	**81**	**63 %**

Source: Establishing a typology for modelling the domestic public building stock (Delegated preparatory task for the National Building Energy Performance Strategy, Comfort Consulting Kft., Dr Zoltán Magyar, 2013)

Table 22: Total primary energy consumption after renovation meeting nearly zero-energy requirements

Implementing this renovation scenario would result in primary energy savings of 63 % on average in the inspected model buildings.

The possibility of establishing (extensive) green roofs and façades during renovation is an option to consider especially in the case of public buildings with a flat or low-slope roof, subject to the technical properties and the load-bearing capacity of the structure of the existing building.

The application of intelligent building energy management systems, lighting, heating/cooling, shading and ventilation control systems, building integration and/or fire detection systems and the benefits obtainable by such systems should also be considered during renovation in order to curb the energy demand of building operation.

In the case of locally listed or historic buildings, it should also be taken into account that the features of the building serving as the basis of its protection, i.e. its specificities and protected architectural merits must be left intact in the course of energy renovation works.

4.2.3. Cost of renovation of public buildings in the different renovation scenarios

Just like in the sector of residential buildings, a package of technical renovation measures was put together also for the public building renovation scenarios outlined above. The corresponding renovation cost calculations were made for the individual public building types and renovation scenarios. The results are presented in the table below.

No		Building identification	q	Overall energy performance (EP, kWh/m²a)			Primary energy savings (kWh/m²a)		Cost of modernisation (HUF/m²)	
			W/m³K	Current condition	In accordance with cost-optimal requirements	In accordance with nearly zero-energy requirements	In accordance with cost-optimal requirements	In accordance with nearly zero-energy requirements	In accordance with cost-optimal requirements	In accordance with nearly zero-energy requirements
		Health and social care facilities								
1.	a	H_1900_1	0.34	297.67	185.00	154.68	112.67	142.99	40 955	52 100
	b	H_1900_2	0.46	353.92	147.10	122.52	206.82	231.40	50 056	55 483
2.	a	H_1901-1945 1	0.36	269.62	173.40	144.59	96.22	125.03	33 121	43 505
	b	H_1901-1945_2	0.47	313.35	129.70	105.57	183.65	207.78	40 481	45 815
3.	a	H_1946-1979_1	0.34	293.10	159.50	97.47	133.60	195.63	38 882	40 786
	b	H_1946-1979_2	0.51	349.77	168.90	160.46	180.87	189.31	47 523	49 426
4.	a	H_1980-1989_1	0.21	189.24	101.10	84.11	88.14	105.13	32 107	40 594
	b	H_1980-	0.28	236.77	112.00	92.70	124.77	144.07	39 242	43 497
5.	a	H_1990_1	0.16	193.83	113.90	93.86	79.93	99.97	29 486	38 967
	b	H_1990_2	0.22	196.40	101.50	84.18	94.90	112.22	36 038	40 055
		Office buildings								
1.	a	O_1900_1	0.39	250.52	151.60	130.21	98.92	120.31	38 751	44 230
	b	O_1900_2	0.60	291.72	88.00	65.65	203.72	226.07	47 363	52 600
2.	a	O_1901-1945_1	0.41	218.41	129.50	109.20	88.91	109.21	43 514	48 889
	b	O_1901-1945_2	0.53	263.63	88.30	66.80	175.33	196.84	53 184	58 525
3.	a	O_1946-1979_1	0.47	234.19	76.30	53.23	157.89	180.96	30 086	35 682
	b	O_1946-1979_2	0.28	187.44	140.80	70.22	46.64	117.22	24 616	33 052
4.	a	O_1980-1989_1	0.22	163.18	76.90	70.52	86.28	92.66	21 958	24 706
	b	O_1980-1989_2	0.26	170.75	77.40	62.51	93.35	108.24	26 838	31 034
5.	a	O_1990_1	0.18	153.94	81.10	74.50	72.84	79.44	16 231	18 965
	b	O_1990_2	0.16	137.75	91.40	76.20	46.35	61.55	13 280	21 221
		Commercial buildings								
1.	a	COM_1979_1	0.40	197.74	79.20	74.08	118.54	123.67	45 896	48 111
	b	COM_1979 2	0.44	291.10	124.00	107.23	167.10	183.87	56 096	63 831
2.	a	COM_1980_1	0.13	226.57	148.10	100.45	78.47	126.12	23 663	32 553

No		Building identification	q	Overall energy performance (EP, kWh/m^2a)			Primary energy savings (kWh/m^2a)		Cost of modernisation (HUF/m^2)	
			W/m^3K	Current condition	In accordance with cost-optimal requirements	In accordance with nearly zero-energy requirements	In accordance with cost-optimal requirements	In accordance with nearly zero-energy requirements	In accordance with cost-optimal requirements	In accordance with nearly zero-energy requirements
	b	COM_1980_2	0.12	231.98	153.30	95.01	78.68	136.97	28 922	37 928
		Cultural facilities								
1.	a	CUL_1945_1	0.28	160.50	69.50	64.60	91.00	95.90	28 389	31 033
	b	CUL_1945_2	0.24	165.56	58.70	53.47	106.86	112.09	34 698	37 365
2.	a	CUL_1946- 1979 1	0.40	216.33	46.70	46.70	169.63	169.63	56 451	56 451
	b	CUL_1946- 1979 2	0.47	233.69	60.40	54.24	173.29	179.45	68 995	71 592
3.	a	CUL_1980- 1989 1	0.22	133.79	44.40	30.93	89.39	102.86	38 374	42 151
	b	CUL_1980- 1989 2	0.33	187.69	39.80	39.80	147.89	147.89	46 901	46 901
4.	a	CUL_1990_1	0.13	105.77	70.00	60.44	35.77	45.33	26 272	32 785
	b	CUL_1990_2	0.27	167.79	35.80	35.80	131.99	131.99	32 111	32 111
		Educational buildings								
1.	a	ED_1900_1	0.39	234.91	138.10	113.93	96.81	120.98	38 348	43 747
	b	ED_1900_2	0.56	233.29	64.60	58.98	168.69	174.31	46 870	48 979
2.	a	EDU_1901-1945_1	0.39	233.91	138.10	113.64	95.81	120.27	46 631	52 030
	b	ED_1901- 1945 2	0.61	247.46	64.60	59.14	182.86	188.32	56 994	59 102
3.	a	EDU_1946-1979_1	0.60	266.53	95.90	84.01	170.63	182.52	69 364	71 688
	b	ED_1946- 1979 2	0.45	235.55	71.30	71.30	164.25	164.25	56 752	56 752
4.	a	ED_1980- 1989 1	0.29	165.53	66.30	53.05	99.23	112.48	29 469	32 798
	b	ED_1980- 1989 2	0.37	188.69	68.40	60.85	120.29	127.84	36 017	38 228
5.	a	OKT_1900_1	0.23	138.99	55.00	52.26	83.99	86.73	24 518	25 079
	b	OKT_1900_2	0.30	158.59	53.70	53.70	104.89	104.89	29 967	29 967

Source: Calculations of ÉTMV Építési Termék Minőségvédelmi és Vállalkozásfejlesztési Nonprofit Kft.

Table 23: Cost of renovation of public buildings

5. Vision, priorities and objectives of the Strategy

5.1. Vision and priorities

5.1.1. Vision for the Hungarian construction sector

In addition to its significance for the GDP and the job market, the construction sector also has a relevant spill-over effect in other areas of the economy since new construction projects and large-scale renovations generate further investment in infrastructure (such as the development of the transport infrastructure, procurement of furniture and equipment, the development of ICT equipment etc.).

Achieving the objectives of the NAPEBS contributes significantly to ensuring that the domestic building sector has the appropriate capabilities and is well-suited for successfully completing the tasks envisaged as well as the specific construction activities set forth in the action plans to be developed later. To accomplish this, the current state of the sector has to be reviewed within the NABEPS and the actions for the necessary developments have to be outlined.

The European Construction Technology Platform created under the auspices of the EU articulates development objectives along three main lines: better meeting client/user satisfaction, increasing social sustainability and modernising the construction industry. The Hungarian Construction Technology Platform, in whose work the authors of this Strategy are also involved, has added the need to catch up and to exploit national energy assets to the three lines of development listed above. Another line of development of European dimensions is an increasing desire and certain initial steps taken to shift the focus from the level of buildings to the level of communities/cities in construction, which is best exemplified by the Smart Cities and Communities Initiative.

The development of the construction industry is fundamentally determined by competition. An aspiration within the industry to move towards quality building is observable in a domestic context as well. This means that many clients are looking for quality solutions while also taking cost-effectiveness into account.

For environmental considerations, it is important to minimise transport distances during renovation works. Therefore, the availability and use of local construction materials and products has to be supported.

States play a significant role in the advancement of the industry since in developed countries every second construction project is commissioned by the public sector. The State support provided for the residential building projects of private persons, by virtue of its nature and magnitude, significantly affects the volume and quality of production in construction.

The current state of the domestic construction industry has been fundamentally defined by the recent economic crisis. Between 2000 and 2008, approximately 20–25 000 residential buildings were completed on a total floor area of 4–5 million m^2, a period that has been followed by a decline from 2010. In 2013, 7 293 new homes were built, a number that stands in contrast to the 28 054 homes constructed twelve years earlier in 2001.

The crisis has taken its toll on investment in non-residential buildings; however, its effect was more marked in the housing market. Prospects for the construction of new public buildings are limited. Positive developments are anticipated in the field of newly built office buildings and investments in the commercial and service sectors as a result of the forecasted strong economic recovery. In the industrial sector, construction projects for new buildings are expected under greenfield and brownfield developments; however, the volume of such investments is currently hard to estimate. Construction projects linked to agricultural modernisation are implemented on several hundred square meters annually. It is projected that new non-residential buildings will be constructed on 2.5 million m^2 annually, accounting for up to 80 000 new non-residential buildings until 2030 on a total floor area of approx. 40 million m^2.

The construction sector is dominated by domestic players. Some of the domestic enterprises have recently started to work also for clients abroad as technological developments provided them with the means to satisfy export demand. There is constant demand for the improvement of skilled workforce, in terms of both quality and quantity. The tendering programmes launched in recent years for improving building energy performance have translated into a marked professional improvement in the field of developing energy efficiency technologies. Several enterprises having extensive experience in the renovation of windows/doors or retrofitting façades and roofs with thermal insulation have emerged while others have gained the required expertise also for installing solar collector and photovoltaic systems.

The sector of construction materials is well-developed, with domestic, international and jointly owned enterprises being active in the market. A number of construction materials manufacturers have been hit hard by the crisis. Nevertheless, the market remains open and competition is strong, which even fosters the use of quality materials.

The required capacities have been established and, owing to better working conditions and a greater degree of mechanisation, the lack of skilled workforce is less acute in this sector than in the construction industry. High-quality energy efficiency solutions are available for doors/windows, thermal insulation and finishes. The volume of domestic production in the renewable energy sector is not significant at present; however, improving market conditions allow the domestic pool of manufacturers of systems and appliances generating thermal energy from solar energy or biomass to grow stronger. Therefore, in order to better exploit the benefits the use of renewable energy and investments improving energy efficiency hold in store for the national economy these sectors should be further supported and reinforced.

At the same time, increasingly stringent construction requirements pose additional obstacles for the domestic construction and construction materials industry. It is not feasible to comply with the requirements for nearly zero-energy buildings laid down in Article 9 of the Energy Performance of Buildings Directive and to be met by 2019 without an interim stage, as this would impose a disproportionate burden on construction clients, construction materials manufacturers, architects and contractors alike.

Innovation in the construction and construction materials industry may have a major contribution to ensuring that future programmes and projects for improving building energy performance are implemented to a high technical standard of quality and at competitive prices. The main focus areas of innovation and R+D in building energy performance are defined as follows:

- developing integrated design systems and simulation models based on sustainability, life-cycle assessment and respect for bioclimatic characteristics;
- widespread introduction of complex building energy performance rating systems taking the entire life-cycle of the building into account in Hungary to pave the way for providing preferential support for construction technologies and materials which are environmentally-friendly, resource-efficient and sustainable in terms of the entire life-cycle of the building;
- efficient thermal bridge free buildings designs to improve the thermal insulation properties of the building envelope;
- recycled materials and structures for construction;
- applied research for developing thermal insulating materials obtained from local natural sources;
- smart metering and smart integrated grid systems at the level of both buildings and communities to ensure the efficient and integrated use of renewable energies;
- solar systems integrated, in particular, into the façades and roofs of buildings;

- developing cost-effective seasonal thermal energy storage systems;
- further development of heat recovery systems offered at an affordable price in retail sale and drawing up an appropriate support scheme promoting the purchase of such systems;
- developing short-term energy storage systems if the reserve balancing capacity required for newly emerging renewable electricity generation and the use of electricity for transport purposes (the Green Cars PPP initiative) can be provided;
- promoting the use of micro-cogeneration systems (gas engines, fuel cells) for meeting the own energy needs of buildings;
- online monitoring systems.

The construction and construction materials industry is reasonably well-prepared for the implementation of the NAPEBS, although some developments will be needed in certain areas. These include high-quality vocational education in a dual system, the development and application of IT systems assisting integrated design and construction, and active participation in international energy efficiency demonstration projects. It is an important task at hand to get prepared for the programmes under HORIZON 2020 of the EU, to efficiently monitor the ongoing national energy efficiency programmes and ensure that the experience obtained feeds back into new tendering schemes as well as to implement domestic pilot projects and widely disseminate the emerging results.

5.1.2. Priorities in the field of building energy performance

The policy objectives formulated under the NAPEBS derive directly from the National Energy Strategy adopted by the Hungarian Parliament. Accordingly, the purpose of implementing the NAPEBS is to achieve the objectives set in the National Energy Strategy with the maximum benefits for the national economy and society.

Contribution to the security of energy supply

With a share of 40 % in total primary energy consumption, the energy consumption of buildings account for a significant portion of the national energy balance. Therefore, improving the energy efficiency of buildings would in the long run decrease the national energy consumption of Hungary in absolute terms. Reduced energy demand in the building sector would contribute primarily to decreased natural gas consumption since the direct source of heat supply to the majority of buildings is natural gas and it is also a prominent supply source for district heating. Improved building energy performance would have benefits not only for energy management but also for natural gas and electricity generation capacity management. This would directly reduce Hungary’s energy import dependency and lead in turn to increased security of supply.

Fostering economic competitiveness

Orders for construction projects generate further orders in other sectors, fostering economic development. In the context of businesses, boosting the competitiveness of Hungarian enterprises is conditional on providing them with the energy they need for operation to a high degree of safety and at an affordable price. Their costs may be further mitigated by energy efficiency improvement. The proportion of energy costs in the expenses of enterprises varies greatly according to sector-specific characteristics. Of their total energy consumption, the amount of energy used for technological purposes and for meeting the energy needs of buildings shows further differences. Only a minor share of the domestic SMEs apply energy-intensive technologies and use the most energy for heating, cooling, lighting and producing hot water at their premises. In light of this, modernisations resulting in improved building energy performance are an efficient tool to reduce production costs for these businesses.

Ensuring a sustainable domestic energy system

As supplies of fossil fuels are diminishing, long-term sustainability becomes a decisive factor in economic policy. The two major prerequisites for sustainability are to save energy by reducing the amount of energy consumed and to cover an increasing proportion of the remaining energy need from renewable energy carriers. Due to the considerable energy consumption of buildings, reducing the use of energy and increasing the share of renewable energy in this field is key to a sustainable energy economy as well as to keeping the ecological footprint of the measures aimed at these objectives at a minimum (e.g. by selecting the materials and technologies used for renovations or new investment projects and their subsequent operation based on a life-cycle analysis for minimum environmental impact).

5.2. Objectives of the NABEPS

5.1.2. Overall strategic objectives

Harmonisation with the energy and environmental objectives of the EU
In recent years, the EU has devoted considerable effort to reduce the rate of growth of energy consumption, to curb energy demand and to mitigate GHG emissions in the Union. As the action taken by the Union and Hungary's national interests converge, it is crucial to promptly transpose the directives promoting EU objectives into Hungarian legislation, and for Hungary to contribute to joint EU initiatives in the field of building energy performance in which Member States must participate on a mandatory basis. By doing so, Hungary will also be able to secure important sources of funding from the EU's support funds for its objectives relating to building energy performance.

The modernisation of buildings as a tool to reduce the utility costs of the population
Compared to developed Member States, the domestic energy consumption of households per capita is low. Still, many Hungarian households struggle with paying their energy bills. The Government of Hungary set the goal to curb utility costs. The utility cost reduction programme launched in 2013 and the improvement of the energy performance of buildings will jointly allow for a dramatic decrease in the utility costs payable by Hungarian households. The implementation of the NABEPS is a significant step towards this aim.

Cutting back on budgetary expenses
The maintenance costs of public buildings account for a significant part of the spending of the central and local governments. The renovation of public buildings for improved energy efficiency would reduce the expenses of the Government and municipalities in the long term, which in turn would strengthen Hungary's budgetary position.

Reducing energy poverty
There is a significant number of Hungarian families whose access to basic services and in particular energy supply is greatly impaired due to their social situation. Users in need (vulnerable users) may try to find alternative ways to get access to basic energy services, which is not an ideal situation for either the families or for society. Energy poverty falls within the scope of social policy rather than energy policy. However, solutions fostering its mitigation may be proposed within the framework of energy policy. One such solution is to extend the scope of renovation programmes for improving building energy performance to include families affected by energy poverty.

Job creation
Improving the rate of employment and creating jobs is key to Hungary's economic development. Low-skilled workers are in the most disadvantaged position in the labour market. The thermal insulation of buildings within the framework of a large-scale programme creates numerous jobs not only for low-skilled but also unskilled workers who otherwise have quite limited employment opportunities. Such works for the modernisation of buildings also offer positions for skilled and highly-qualified workforce. Projects for the improvement of building energy performance represent an especially labour-intensive segment within the construction industry as compared to other activities characterised by a higher degree of mechanisation.

Reducing GHG emissions
Almost all countries in the world and in particular EU Member States channel considerable effort into preventing climate change. Hungary is no exception. The use of fossil fuels is a major source of GHG emissions. In addition to their direct effects (such as reduced energy costs or a higher degree of comfort), renovations resulting in improved building energy performance also contribute to reducing GHG emissions. Thermal insulation projects combined with applications using renewable energy help to deliver even better results in the field of reducing GHG emissions.

5.2.2. Specific objectives

The objectives set in the NABEPS for building energy performance are defined taking into account the requirements of the EU outlined above and those laid down in the relevant national energy policy documents, building on the following basic conditions:

- The energy savings to be achieved by 2030 should be in line with the relevant energy efficiency requirements set in the National Energy Strategy. Having regard to the objectives formulated in the National Energy Strategy, the targets for savings to be achieved in the primary energy consumption of buildings were set in the NAPEBS at 49 PJ/year for 2020 and 111 PJ/year for 2030.

- 2020 targets for energy savings from improved building energy performance had to be defined on the basis of calculations made with the current condition of the building stock, taking into account the requirements applicable to the different building types, the technical modernisation tasks needed to meet these requirements, the costs this involves as well as the available Government and other resources. The necessary calculations and analyses were made by the experts of the REKK.

- Specific targets for building types should be set on a balanced footing, with the proportion of individual building types, the savings achievable per unit investment cost, and the environmental and social effects all factored in. In the same vein, as far as possible, the renovations should involve residential buildings constructed using industrialised technologies (of prefabricated panels), multi-apartment buildings and family houses alike. Within the limits of programmable funds, it is important to launch as many renovation programmes for improving building energy performance as possible already in the 2014–2020 period.

- In the context of the cost-optimal levels of minimum energy performance requirements under the Energy Performance of Buildings Directive, the amendment to the Energy Performance Characteristics Decree provides that, from 1 January 2015, the values corresponding to the cost-optimal energy performance level are applicable in the case of support granted under domestic or EU tenders or from the central budget for the improvement of the energy performance of buildings falling within the scope of the Energy Performance Characteristics Decree. Pursuant to the Energy Performance of Buildings Directive, it will be binding upon Member States to meet nearly zero-energy building standards for new public buildings as from 1 January 2019 and for all other new buildings as from 1 January 2021.

- For public buildings, the obligation laid down in Article 5 of the Energy Efficiency Directive should also be observed, pursuant to which at least 3 % of the total useful floor area of heated and/or cooled buildings of public sector bodies having national competence, owned and occupied by the central government should be renovated each year during the period covered by the NABEPS.

- While the total consumption of the buildings of economic operators is lower than that of residential and public buildings, there is untapped potential for achieving energy savings in this area, too, especially in shopping centres, commercial and catering establishments and office buildings. The potential for saving energy at industrial manufacturers and agricultural producers should also be examined, in particular in the buildings of domestic SMEs. The renovation of buildings in the business sector is an efficient means to promote competitiveness by reducing energy costs.

As regards newly constructed buildings and buildings to be renovated, the potential of using efficient heating and cooling systems, in particular those using high-efficiency co-generation should be duly taken into account in accordance with Article 14(2) of the Energy Efficiency Directive.

5.2.3. Building energy performance targets under the NABEPS

The primary energy savings targets of the NABEPS to be achieved by 2020 by improving the energy performance of buildings are outlined in the table below.

		Primary energy savings target for 2020 (PJ)
1.	Renovation of the residential and public building stock	40
2.	Renovation of the buildings of businesses	4
3.	Other energy savings in buildings	5
4.	TOTAL	49

Table 24: Targets laid down in the NABEPS for savings to be achieved by 2020 by improving the energy performance of buildings

Within the sector of buildings, energy savings of the greatest volume may be secured by improving the energy performance of the existing stock through renovations (thermal insulation, replacement of doors/windows, modernisation of heating systems). The effect of renovations is reinforced by a number of supplementary measures which, although less significant in terms of the volume of savings achieved, contribute greatly to the efficiency and sustainability of the result of such renovations.

Targets for the renovation of existing buildings
On the basis of these considerations, detailed calculations were made and different renovation scenarios were elaborated by the experts of the REKK in order to set quantifiable targets for 2020, to be achieved by renovating residential and public buildings for improved energy performance. The specific quantifiable targets for 2020 for residential and public buildings set in the NAPEBS are as follows:

	Building energy performance target for 2020 (PJ)	**Number of residential and public buildings to be renovated by 2020 (number)**	**Estimated amount of funds needed until 2020 (HUF bn)**
Family houses	17.6	130 000	743
Industrialised multi-apartment buildings (prefabricated panels)	12.8	380 000	536
Traditional multi-apartment buildings	8.0	190 000	329
Residential buildings Total	**38.4**	**700 000**	**1 608**
Public buildings	1.6	2 400	152
Total	**40.0**		**1 760**

Table 25: Primary energy savings targets to be achieved by 2020 by renovating residential and public buildings

Targets are indicated in primary energy savings over the reference year, with no rebound effect assumed.

Construction of new buildings and exchange of the building stock (autonomous change of the building stock)
The share of new residential buildings out of the total housing stock currently stands at 0.5 %; however, a constant increase is to be expected in the period up to 2020. Such increase will not lead to an increase in the housing stock. Instead, it emerges from part of the existing building stock being replaced by buildings of much greater energy efficiency (autonomous change of the building stock). The public building stock is expected to undergo a similar process. The building energy performance targets in the table above are inclusive of the effect of the autonomous change of the building stock on energy demand.

Renovation of the buildings of businesses
The expected energy savings in buildings in the industrial, agricultural, hospitality, service and commercial sector are added to the energy savings target specified for residential and public buildings. In these sectors, the continuous improvement of building energy performance is driven by consumers' commercial interests and efforts to increase competitiveness. Yet the volume of potential energy savings is smaller than in the sector of residential and public buildings. Among these consumers, potential primary energy savings of at least 4 PJ/year may be reached in the period up to 2020.

Increasing energy efficiency and using renewable energy in buildings supplied with district heat
In buildings supplied with district heat, apart from renovations, several other measures resulting in improved building energy performance will be implemented, including metered billing, separate regulation of the heating system by apartment (room), heat source modernisation, and renewable energy applications. These actions will lead to additional energy savings in buildings supplied with district heat on top of the effects of building renovations.

Using renewable energy for supplying buildings
By drawing up an appropriate support scheme for residential and public buildings as well as for the buildings of businesses, renovations for improved building energy performance should be encouraged which not only reduce the energy demand of the building but employ renewable energy to satisfy the largest possible share of the remaining energy demand. In this context, it is a strategic aim to promote the widespread use of solar collectors in public, industrial and agricultural buildings with high hot water consumption as well as to replace fossil fuels by biomass and heat pumps in the heating and hot water systems of buildings whenever the circumstances allow. An objective defined for the electricity supply of buildings is to widely promote the use of solar applications, including systems connected to the electricity network and isolated appliances operating in island mode. As a result of technological progress, it is to be expected – especially after 2020 – that autonomous micro-cogeneration (CHP) systems (of a capacity of 1 to 50 kW) are coming into widespread use at households, while mid-range (50 to 500 kW) systems are likely to gain ground in the energy supply of public, industrial, commercial, catering and agricultural facilities. Active houses, producing energy themselves, are also expected to become common. It should be studied what measures are required to address fluctuations in the production of electricity from renewable energy sources in order to provide for a well-regulated national energy network. Further consideration should be given to the application of bottom-up and top-down regulatory instruments by transmission system operators which would allow for more optimal load profiles.

Saving energy by introducing building energy management systems
Wider application of intelligent building energy management systems and techniques would ensure optimum energy consumption in buildings under the conditions defined by their existing energy performance characteristics. Such systems may be installed and used in both residential and public buildings as well as in the buildings of businesses, enhancing the energy savings achieved by the renovations carried out to improve energy performance.

Saving energy by awareness-raising, disseminating information, giving advice and exchanging information
Apart from the technical characteristics of buildings and the standards of the technical building systems built into them, it is crucial that their operators run them in an energy-efficient way. There are a number of tools to contribute to this in as many buildings as possible. One of them are awareness-raising campaigns promoting an energy- and eco-conscious lifestyle which should be targeted mainly at the wider population but should also reach out to all actors playing a part in the operation of buildings (owners, managers etc.) Energy efficiency considerations should also be made an integral part of school curricula so that engineers, architects, skilled workers in the construction industry, plumbers and heating engineers receive thorough knowledge of energy-conscious building as part of their training. The energy-efficient operation of buildings owned and occupied by the State or the municipalities also calls for training and further education. Active involvement of the settlements in the implementation of these actions is of utmost importance.

Most of the actions listed above, supplementing renovations for improved building energy performance – such as awareness raising, training etc. – have and indirect effect perceptible only with a certain delay. Some actions (e.g. introduction of an energy management system, renewable energy applications, modernisation of heat sources) are implemented simultaneously with building renovations under the different projects and, therefore, their effect cannot be distinguished from that of the entire project. As a result, the energy savings achieved by such actions cannot be quantified individually, but their accumulated effect by the end of the programming period until 2020 is estimated at not less than 5 PJ.

Outlook to 2030
In line with the objectives formulated in the National Energy Strategy, the 2030 target for savings to be achieved in the primary energy consumption of buildings was set in the NAPEBS on the basis of the calculations at 111 PJ. The basis for the calculations to determine the targets more specifically and in more detail will be provided by the experience gained during the 2014–2020 period. Such experience will be collected as part of the monitoring and evaluation of the NABEPS within the framework of the periodic review of the Strategy and the Action Plan.

6. Dedicated instruments

6.1. Necessary actions for achieving the objectives

This chapter provides a summary of the actions promoting the achievement of objectives set under the NABEPS. Details regarding the substance, expected result, means of implementation and costs of the actions will be set forth in the National Building Energy Performance Action Plan to be developed after the NABEPS has been adopted.

Due to the scarcity of available funds, the order of priority of building types to be included in the energy performance actions is laid down in the annual framework programmes of the support schemes. Priority is given to administrative buildings owned by the State or used by public sector bodies having national competence to be renovated to comply with EU legislation as well as to residential buildings falling within the scope of residential renovation programmes. Support should be granted in proportion to the expected and verified energy savings achieved.

In the case of locally listed or historic buildings, the features of such buildings serving as the basis of their protection, i.e. their specificities and protected architectural merits must be left intact in the course of energy renovation works.
In accordance with Section 5 of Government Decree No 348/2006 of 23 December 2006, special attention should be paid during renovations for improved energy performance to the protection of natural assets and the habitat of protected flora and fauna.

	Title of the action	*Objective of the action*	*Content of the action*	*Relevant legal and strategic background*	*Deadline*	*Responsible authority*
I.	***Energy savings on the existing building stock***					
1.	Drafting the National Building Energy Performance Action Plan	Coordinating the necessary activities for achieving the objectives under the NAPEBS	The Action Plan identifies the tasks to be carried out, their schedule, responsibilities, technical content, the expected results and the means of follow-up (monitoring and evaluation).	- National Energy Strategy - Third National Energy Efficiency Action Plan	30.06.2015	MND PMO
2.	Drawing up new support and financing schemes for energy efficiency projects for residential and public buildings	Achieving energy savings by implementing building renovation programmes and projects.	Drawing up and publishing support and financing schemes promoting the renovation of residential and public buildings for improved energy performance which enable the efficient implementation of a great number of projects using private capital in addition to State and Community funds.	- Energy Efficiency Directive - Action Plan for the Development of District Heating - Planning for the EEOP, TOP, CCHOP and HRDOP	30.06.2015	MND MNE PMO
3.	Promoting the use of renewable energy sources (solar panels, biomass, heat pumps) for supplying buildings with energy for heating and cooling	Reducing the use of fossil fuels, energy import dependency and GHG emissions	A significant amount of fossil fuels may be replaced in certain types of residential and public buildings by making use of solar panels and heat pumps for heating and cooling. The use of these technologies should be promoted as part of building renovation programmes. The potential of biomass-based heating should also be explored.	- National Renewable Energy Action Plan - Action Plan for the Development of District Heating	30.06.2015	MND
4.	Providing for the electricity supply of buildings from renewable sources, using photovoltaic applications	Reducing the use of fossil fuels, energy import dependency and GHG emissions	The prerequisites of achieving and the means of promoting more widespread application of solar systems in the electricity supply of residential and public buildings, including systems connected to the electricity network and isolated appliances operating in island mode, should be identified.	- National Renewable Energy Action Plan	30.06.2015	MND

II.	***Requirements for new buildings and building renovations***					
5.	Reviewing the energy performance requirements for new buildings and building renovations	Curbing the energy consumption of new and existing buildings to a low level	As new buildings may stay intact for even a century, low energy-consumption must be a target already during their design and construction. When renovating existing buildings, the works performed should as far as possible result in substantial energy savings. The objective of this action should be met by introducing and continuously monitoring the achievement of ambitious levels of energy performance requirements. Reviewing and publishing the nearly zero-energy performance requirements under Article 9 of the Energy Performance of Buildings Directive in the Energy Performance Characteristics Decree.	- Decree No 7/2006 of 24 May 2006 of the Minister without Portfolio establishing the energy performance characteristics of buildings - Third National Energy Efficiency Action Plan	31.12.2017 30.06.2015	PMO MND
6.	Revising the requirements laid down for the replacement or renovation of technical building systems and building envelopes within the category of building elements	Applying up to date energy performance solutions when replacing, converting or maintaining building elements.	The applicable building regulations for new buildings and renovations contain provisions concerning building elements as well. Furthermore, energy savings should be given priority also in the case of renovation works of a smaller-scale (e.g. replacement of only one or a few door(s)/window(s), 'cosmetic' renovation etc.) To this end, the regulation should be reviewed on a continuous basis.	- Decree No 7/2006 of 24 May 2006 of the Minister without Portfolio establishing the energy performance characteristics of buildings - Third National Energy Efficiency Action Plan	31.12.2017 30.06.2015	PMO MND
7.	Drawing lessons from the experience gained from the energy performance rating of buildings and the certification scheme and further improving the scheme, if necessary	Achieving energy savings by reviewing the building energy performance certification scheme.	Developing the legislative provisions on rating buildings according to energy performance and the certification scheme further in view of the increasingly stringent construction requirements and the expected rise in the number of nearly zero-energy buildings (introduction of a new rating) in order to simplify access to the benefits of renovations for improved energy performance.	- Government Decree No 176/2008 of 30 June 2008 on the energy performance certification of buildings - Third National Energy Efficiency Action Plan	30.06.2015	PMO MND

8.	Drawing up energy performance requirements for buildings owned and occupied by the State or the municipalities (pursuant to Article 6 of the Energy Efficiency Directive)	Cutting back on the energy consumption of buildings owned and occupied by the State or the municipalities thereby strengthening their budgetary position.	Developing and introducing a set of requirements and the corresponding legislative framework for the energy-efficient operation of buildings owned and occupied by the State or the municipalities. A uniform set of eco-conscious quality requirements should be established for renovations of public buildings implemented from public funds.	- Energy Efficiency Directive - Third National Energy Efficiency Action Plan	30.06.2015	MND

III.	***Research, development, demonstration, innovation, knowledge, training, information***					
9.	Research, development and demonstration of new technologies for the improvement of building energy performance and promoting the use of such technologies	Opening up new opportunities for energy savings by introducing new technologies in the market, implementing independent combined electricity/heat production in buildings and promoting the take-up of buildings actively producing energy themselves. Offering the possibility to apply intelligent building energy management systems and building integration systems and developing the appropriate regulations.	Developing new technologies for the improvement of building energy performance and introducing them in the Hungarian market, drawing on domestic research and entrepreneurs. Applying technologies reducing the heat loss of buildings and fuel cell systems at households and for supplying energy to public, industrial, commercial, catering and agricultural facilities. Developing and marketing new technologies for the use of renewable energy for building energy purposes. Conducting studies with a combined focus on the implications for public health, building energy performance and energy poverty of building energy performance developments.	- Planning for the EDIOP - Energy, Industry Development and R&D Action Plan - Third National Energy Efficiency Action Plan	ongoing	MNE MND PMO NCTI
10.	Developing public awareness raising and information campaigns in the field of responsible energy use	Securing energy savings in households by fostering energy-awareness.	Developing the system and content of public awareness raising and information campaigns in the field of responsible energy use, establishing information and knowledge centres. A monitoring system should also be put in place to follow up on the efficiency of the campaigns.	- Planning for the EDIOP - Energy Awareness Raising Action Plan - Action Plan for the Development of District Heating - Third National Energy Efficiency Action Plan	ongoing	MND PMO

11.	Promoting knowledge sharing and information exchange between building manager companies, owners, energy advisors and the energy experts of municipalities	Encouraging energy savings by collecting and disseminating knowledge about the energy saving achievable in buildings as well as information about the relevant legislation and energy saving opportunities within the framework of a well-functioning system.	The target groups for knowledge sharing and information exchange include small-size enterprises, advisors and the managers and occupants of buildings. The experience gained in reducing the energy consumption of buildings should be collected and made accessible to all stakeholders. Energy saving efforts in the public sector should be underpinned by more active knowledge sharing between the public bodies commissioning construction projects. The structure and mechanism of this knowledge sharing and information exchange system should be developed.	- Planning for the EDIOP - Energy Awareness Raising Action Plan - Action Plan for the Development of District Heating - Third National Energy Efficiency Action Plan	ongoing	MND PMO
12.	Training building energy performance professionals, improving training in tertiary and vocational education	Engineers, energy advisers, architects and small enterprises as contractors should contribute to energy savings by promoting energy-conscious building.	Further training for engineers, advisers and contractors should be enhanced, placing the focus on low energy consumption in buildings. The action should be developed in close cooperation with construction sector operators. The engineers, architects, skilled workers in the construction industry, plumbers and heating engineers should acquire thorough knowledge of energy-conscious building as part of their training. Energy efficiency should be a major priority in training; it is important to provide each participant a comprehensive view of the construction process.	- Planning for the EDIOP - Energy Awareness Raising Action Plan - Action Plan for the Development of District Heating - Third National Energy Efficiency Action Plan	ongoing	MND MHR PMO
13.	Further development of the system for collecting energy performance data from buildings, harmonised collection of project-level data and energy performance data	Harmonising the systems for collecting energy performance data from buildings and project-level data to obtain a faithful picture of the energy savings achieved.	Ensuring reliable and efficient retrieval of information on the energy consumption and energy performance characteristics of buildings by further developing the national system for energy data reporting. To be able to follow up on the results of renovations programmes for improved building energy performance, a single administrative system of projects should be established which may be harmonised with the upgraded systems storing energy performance data.	- National Energy Strategy - Third National Energy Efficiency Action Plan - National Renewable Energy Action Plan - Introduction of the Energy Efficiency Directive	30.06.2015	MND

14.	Establishing and operating a National Building Energy Performance Information System	The objective of the action is to fulfil the exemplary role of public bodies' buildings under Article 5 of the Energy Efficiency Directive and to achieve energy savings in public institutions. Each Member State must ensure that, as from 1 January 2014, 3 % of the total floor area of heated and/or cooled buildings owned and occupied by its central government is renovated each year to meet at least the minimum energy performance requirements that it has set in application of Article 4 of the Energy Performance of Buildings Directive.	For this purpose, Member States must establish and make publicly available an inventory of heated and/or cooled central government buildings with a total useful floor area over 500 m^2 and, as of 9 July 2015, over 250 m^2, excluding exempted buildings. Pursuant to the Directive, the inventory must contain the floor area in m^2 and the energy performance of each building or relevant energy data. In addition to meeting the obligation imposed by the Directive, the Information System will also serve as useful reference in planning for future tenders for improving building energy performance and making other decisions of strategic importance.	- National Energy Strategy - Third National Energy Efficiency Action Plan - Planning for the EDIOP	30.06.2015	MND

Table 26: Actions under the NABEPS

6.2. The organisation of implementation

It is a basic requirement for the successful implementation of the NAPES to assign clear and transparent roles and responsibilities to the bodies taking part in implementation. In this context, the following Government functions and areas of competence can be identified:

Management of the NABEPS by the Government – This includes the policy co-ordination and monitoring of the Strategy's implementation as well as management of the process of independent evaluation of the administration of instruments dedicated to the implementation of the Strategy. Independent experts may also be involved to assist in these tasks. Management of the NABEPS at the level of the central Government is coordinated by the Ministry responsible for energy efficiency.

Development of an action plan for achieving the objectives laid down in the NABEPS – In order to accomplish the objectives set in this Strategy, a comprehensive action plan should be drawn up, setting out the programmes required to achieve energy savings, their target group as well as the substantive elements, sources of financing, the professional, institutional and other conditions for, and the expected results of, the projects to be implemented under these programmes.

Review of the system for energy performance data reporting on domestic buildings and its enhancement to provide for the monitoring and the regular evaluation of the implementation of the NABEPS – The current regime of national data reporting is not suitable to supply the information required for the planning, implementation and monitoring of either programmes for the improvement of building energy performance or other energy efficiency programmes carried out at a national level. The requirements for the optimal functioning of the related institutional structure should be revised. Monitoring should be an integral part of the management of tenders which, at the same time, ensures audit of the efficient use of the tender funds for the purpose they have been granted for. The database and register of building energy performance certificates provides general information about the current technical condition and energy performance characteristics of the domestic buildings stock. Energy performance certificates have been collected in the database since 2013. As a result, the register currently contains the energy performance rating and characteristics of almost 200 000 real estate. The introduction of Commission Regulation (EU) No 431/2014 amending Regulation (EC) No 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 as of 2016 will enable cross-checking of the recorded building data and will probably provide further useful experience in this field.

Coherent and sensible alignment of building energy performance matters within the Government's competence with governance structures – Establishing a system of allocating tasks and coordination between the Ministries as well as adapting them to the changing economic environment are central to this aim. In order to increase the effectiveness of the Government's work, it has to be examined how the building energy performance tasks performed by the different Ministries within the governmental structure could be coordinated.

Establishing and operating a building energy performance and energy efficiency service system – Developing uniform building energy performance services which, at the same time, take local requirements into account and advisory networks are a key component in this process. The means should be found to involve energy service providers, businesses providing services aimed at increasing building energy efficiency, the relevant professional and scientific organisations as well as civil society organisations and professional associations. Developing such a service infrastructure has institutional financing and training implications as well, which should be addressed in detail in the action plans to be drawn up as a follow-up to the Strategy.

Building energy performance legislation – The coming into effect of legislation should be scrutinised and rationalised, domestic legislation should be harmonised with the relevant EU Directives and other documents, and the Hungarian legislative system should also be internally harmonised and made consistent.

Management and monitoring of building energy performance tendering programmes – The management experience of the different building energy performance tendering programmes suggests that the management and monitoring activities of building energy performance tendering programmes should be performed in a harmonised manner, preferably by a single central body. This independent tender management body should oversee central building energy performance related tendering systems, the register of tendering programmes, the monitoring and checking of results, and should also participate in the development and preparation of the implementation of tendering schemes. In order to ensure efficient monitoring of building energy performance programmes, the central body should cooperate closely with the body responsible for collecting building energy performance data at a national level. As a priority task, it will manage and supervise the implementation of long-term renovation programmes for buildings owned and occupied by the Government. Since May 2013, the energy performance requirements of central government buildings are surveyed and kept record of in the database entitled the National Building Energy Performance Information System. This System will be used also for checking compliance with the obligation to renovate buildings.

Development of efficient building energy performance tendering schemes – The objectives laid down in the NABEPS may be met through comprehensive building energy performance programmes, with a great number of projects implemented to achieve the planned savings. For this purpose, appropriate support schemes should be developed to mobilise a considerable volume of private capital through the funds granted by the Government for financing projects for improved building energy performance. Such support schemes should be made appealing to potential investors through an efficient system of tendering. The essential features of such a system are eligibility criteria which are easy to meet, focus on the tenderers in order to reach out to as many tenderers as possible and to provide them useful assistance, a broad tendering portfolio ensuring that projects are implemented in great numbers, transparency, predictability and stable project financing. Efficient operation of the programme as well as appropriate PR and quality assurance for the projects are additional crucial requirements.

Overview of the potential financing schemes and identification of sources of funding

In recent years, building energy performance programmes have been funded from grants provided by the State to supplement own contribution. During the development of the action plans connected to the NAPEBS, the possibility should be considered to introduce other funding arrangements in addition to the financing model followed so far. Such alternative schemes include credit agreements with commercial banks linked to the State support, credits with interest subsidies which already proved successful in the business sector, tax benefits or ESCO financing. In parallel with establishing other forms of funding, ways to fine-tune the system of grants should also be considered.

To address the financing difficulties of the population and to be able to implement renovations at a depth which releases their full economic potential, investment projects for improved building energy performance may be divided into phases (in accordance with a set of technical requirements) and those phases implemented one after the other, with the funds disbursed in appropriate instalments. However, for genuine deep renovations to be carried out, the granting of funds should be made conditional already in the first phase of implementation to the last phase which should be set down in a legally binding statement. This means that, in exchange for the grants, beneficiaries must undertake a commitment to achieve the building energy performance standard for which the funds were granted through a series of investments implemented in line with on a long-term (multiannual) plan.

The main source of funding for building energy performance programmes will be the EU financial framework for the period starting in 2014. However, it is important to find additional sources of funding. The selling of GHG emission allowances and eliminating certain energy sector supports may be such sources in the future. The latter are responsible for a massive loss of efficiency and distortion of market mechanisms in the current energy system. Eliminating these supports would not only release funds but would also help overcoming such inefficiency affecting the entire society. However, social needs should be borne in mind when engaging in the introduction of such changes.

The European Investment Bank (EIB) and the Council of Europe Development Bank (CEB) offers loans for investment projects improving the energy performance of buildings with favourable conditions (long maturity, low interest rates). On the one part, the EIB and the CEB provide funds to the Hungarian State to refinance central expenditure on investment projects, and on the other part, loans through the system of financial intermediaries (the Hungarian Development Bank, commercial banks) to cover private expenditure.

6.3. National plan for increasing the number of nearly zero-energy buildings

Lowering the energy consumption of buildings is important for national strategy because it reduces Hungary's dependence on imported energy resources, mitigates the external account deficit, improves competitiveness and lowers the energy bills of families and public institutions, thereby relieving the national budget, creating jobs, facilitating the strengthening of SMEs in the domestic construction sector and contributing to the fulfilment of international obligations undertaken in the field of climate protection. The introduction of EU regulations aiming at the reduction of the energy consumption of buildings, including both cost-optimal and nearly zero-energy requirements for buildings, facilitates progress towards this national objective.

The Energy Performance of Buildings Directive lays down for Member States to obligation to draw up national plans for increasing the number of nearly zero-energy buildings.

6.3.1. Practical steps of application of the definition of nearly zero-energy buildings

The Energy Performance Characteristics Decree has been amended in order to accommodate cost-optimal and NZEB requirements. For cost-optimal levels of energy performance requirements, stricter values have been established for thermal transmittance, specific heat loss and overall energy performance. Cost-optimal levels of building energy performance requirements are in the economic interest of consumers as the overall expenditure of clients (over a 30 year period) is the lowest at this performance level. The interests of consumers and the national economy coincide as renovations not only reduce energy demand but also increase output in the construction industry.

Pursuant to the Energy Performance Characteristics Decree nearly zero-energy buildings are buildings completed at a cost-optimal or at a more energy-efficient level, in which at least 25 % of the annual energy requirement expressed in primary energy is met using renewable energy sources occurring in the building, originating from the property or produced in the vicinity. It follows from the occurrence of cost-optimal requirements in the wording that the tripartite system of requirements outlined in the Energy Performance Characteristics Decree is applicable also to nearly zero-energy buildings. In order to comply with the high energy efficiency of such buildings, all three requirements must be fulfilled.

6.3.2. Mid-term targets for improving the energy efficiency of buildings by 2015

The amendment to the Energy Performance Characteristics Decree defines and makes the meeting of cost-optimal levels of building energy performance requirements compulsory from 1 January 2015 whenever support granted under domestic or EU tenders or from the central budget is used for the improvement of the energy performance of buildings.

The amendment to the Decree was a first, preparatory step towards the introduction of NZEB requirements, setting the required values of the thermal transmittance of building envelopes, and the specific heat loss and overall energy performance of buildings to achieve cost-optimal levels.

Introduction of cost-optimal levels of energy performance requirements

The mandatory application of cost-optimal levels of minimum energy performance requirements is implemented in two stages, as follows:

From 1 January 2015

- for the renovated structures in the case of small-scale renovations of existing buildings from tender funds or from State support;

- for new buildings or major renovations of existing buildings from tender funds or from State support.

From 1 January 2018

- for the renovated structures in the case of small-scale renovations of existing buildings;

- for new buildings or major renovations of existing buildings.

The interim introduction of cost-optimal requirements allows for sufficient lead time to prepare for the even more stringent nearly zero-energy requirements applicable as of 2019 and 2021.

Introduction of NZEB requirements

In line with the Energy Performance of Buildings Directive, NZEB requirements will be introduced in two stages:

- for new public buildings after 31 December 2018;
- for all other newly constructed buildings after 31 December 2020.

6.3.3. Planned measures to encourage the construction of nearly zero-energy buildings Policy measures

The above-mentioned deadlines of introduction of NZEB requirements will be reckoned with in developing the Third National Energy Efficiency Action Plan as well as in planning for its sub-programmes concerning building energy performance.

NZEB requirements and the relevant obligations will be taken into account also in the upcoming review of Hungary's National Renewable Energy Action Plan.

Support scheme

Full compliance with NZEB requirements may be achieved gradually over a period covering several years. During the transitional period leading up to their introduction, the application of NZEB requirements which are stricter than the current requirements would impose additional financial burden on construction clients commissioning new buildings. The support scheme for constructing new residential buildings should be drawn up and developed further in a manner to cover these costs. Provision should be made for gradual transition and the required sources of funding also in the case of newly constructed public buildings.

The support scheme for the construction of new residential buildings should put emphasis on encouraging the use of local renewable energy sources for building energy purposes subject to local conditions. Depending on the technical conditions at, and the location of ,the construction site, preference should be given to heat supply and cooling systems making use of solar collectors and heat pumps, photovoltaic solutions for electricity supply, the installation of micro-cogeneration units for heat and electricity supply, and if local conditions permit, also biomass-based energy supply. These solutions should also take priority in the case of newly constructed public buildings.

Demonstration, information, awareness-raising

A higher rate of construction of new buildings meeting NZEB requirements should be encouraged by demonstration projects making construction clients familiar with the benefits of meeting these requirements as well as the technical requirements and solutions of construction, including technologies to make use of locally available renewable energy sources. In addition to technical solutions, such demonstration projects should also provide information on potential sources of funding for construction. It is especially important to meet NZEB requirements in the case of new schools and educational institutions even before the mandatory deadline of introduction which would facilitate the integration of knowledge in this area into school curricula.

A knowledge sharing, information exchange and information system concerning the construction and operation of nearly zero-energy buildings should be developed, having clients, owners, occupants, SMEs and building energy advisers as its target group. More active knowledge sharing between the public bodies commissioning construction projects is also crucial.

The expertise required to comply with NZEB requirements should be broadly disseminated in tertiary education and further training to engineers, advisers and contractors. Such knowledge should not only be acquired by engineers and architects but also by skilled workers in the construction industry, plumbers and heating engineers as part of their vocational and further training. In the longer term, NZEB requirements and the related insights in the field of physics, economics and environmental protection should also be made part of the curriculum at secondary level.

It is essential to provide information to the public on a large scale about the timetable of introducing NZEB requirements and the corresponding substantial and technical regulations, as well as about the economic and environmental benefits constructing nearly zero-energy buildings. Therefore, public awareness raising and information campaigns should be launched to prepare the public in respect of all important elements of the requirements applicable to new residential buildings in the transitional period.

7. Budget and employment impact of implementing the NABEPS

The implementation of the NABEPS will have significant long-term effects on employment and the budget. The scale and development of these effects are described in the macro-economic impact assessment of REKK based on the balance of intersectoral relations.

Basic assumptions underlying the analysis

The analysis is based on the savings targets to be achieved by renovations by 2020 defined for individual building types in Chapter 5.2.3, assuming a linear course of progress towards the targets and also for the development of costs. All calculations were made with a grant rate of 30 % and 55 % for residential buildings and public buildings, respectively. These rates include grants and interest subsidies, showing State support in a single measure. Assuming total investment costs of HUF 1 751 billion over seven years, the support provided by the State amount to HUF 80.2 billion annually.

Investment in building renovations stimulates demand for the goods of the affected economic sectors. The investment vector used for the analysis shows which sectors are affected and to what extent. The final vector was calculated from the respective packages of technical measures necessary to renovate a family house type, a prefabricated building type and a traditional multi-apartment building type selected from the typology of buildings established under the NABEPS and used as the basis of modelling to 2015 standards. The vector was defined in proportion to the value of investment planned for each building type, taking into account the rate of import and the products typically used for renovations by relevant NACE Divisions. For the purpose of the calculations, renovation to 2015 standards means renovation to the cost-optimal levels under Article 4 of the Energy Performance of Buildings Directive.

The renovation packages put together under the NABEPS generally involve no change of fuel, i.e. transition to a gas boiler of higher energy efficiency is the typical scenario. In addition, the calculated amounts of primary energy used also pertain solely to heat supply. Therefore, energy savings are expressed in a simplified manner as a reduction in the volume of gas consumed. The income released by energy savings was calculated on the basis of the (residential and institutional) gas tariffs applicable from 1 November 2013. Accordingly, a residential tariff of 2.46 Ft/MJ and an institutional tariff of 2.34 Ft/MJ were used for the calculations. The residential tariff applies to retail consumers with a meter capacity below 1 200 m^3/year and 20 m^3/h and the institutional tariff to non-retail consumers with a mater capacity below 20 m^3/h.

Results of the calculations for budgetary impact

Several of the budgetary effects of building renovation programmes may be estimated based on the BIR. Components increasing tax revenues include the VAT, personal income tax and contributions payable on the investment, which are referred to as direct tax-increasing effects. Further VAT revenues can be expected from additional consumption (due to lower energy costs) which in turn results in additional central budget revenues from personal income tax and contributions through the jobs it creates. Revenue-decreasing components of the building modernisation programmes include the loss of VAT on the energy saved and the interest rate revenue on residential savings which are used up for the own contribution of investments. A 22 % tax on savings (savings tax and healthcare contribution), a 4.25 % deposit rate, a 27 % social contribution and a 1.5 % vocational training contribution were assumed for the calculations. Consumption-related components accumulate and occur first in the second year (2015). The HUF 80.2 billion State support specified among the basic assumptions of analysis ensures a positive budget balance over the entire period. The final balance of the period is HUF 290.7 billion. The HUF 561.4 billion State support specified in total for the period until 2020 includes European Union funds as well.

	Tax revenue decreasing components		Tax revenue increasing components						
			direct		indirect				
	Tax on the energy saved	Tax revenues on the savings used up	VAT payable on the investment	Additional VAT and personal income tax from the investment	VAT from additional consumption	Additional personal income tax from the jobs created by the savings spent	Total change in tax revenues	State support	Balance of State support and tax revenues
2014		1.6	37.9	71.2			107.6	80.2	27.4
2015	3.9	1.6	37.9	71.2	4.0	4.6	112.3	80.2	32.1
2016	7.9	1.6	37.9	71.2	8.0	9.3	117.0	80.2	36.8
2017	11.8	1.6	37.9	71.2	12.0	13.9	121.7	80.2	41.5
2018	15.8	1.6	37.9	71.2	16.1	18.6	126.4	80.2	46.2
2019	19.7	1.6	37.9	71.2	20.1	23.2	131.1	80.2	50.9
2020	23.6	1.6	37.9	71.2	24.1	27.8	135.9	80.2	55.7
Total	**82.7**	**11.1**	**265.6**	**498.6**	**84.3**	**97.4**	**852.1**	**561.4**	**290.7**

Source: Regional Centre for Energy Policy Research: Assessment of the macroeconomic effects of energy efficiency investments based on the balance of intersectoral relations

Table 27: Budgetary impact of the NABEPS until 2020 (HUF 1 000 million)

Results of the calculations for employment impact

Buildings renovation programmes have a dual effect on employment. On the one part, additional hiring for the renovation works (direct effect), and on the other part, surplus income at households and institutions part of which they consume thereby creating new jobs due to the increased demand (indirect effect).

The employment impact may be calculated in two ways. The effect of the investments for employment may be quantified by dividing the extra wages generated by the investments by the average wages calculated for the entire national economy. A more nuanced picture may be obtained by dividing the wages generated in each sector by the average wages in the corresponding sector of national economy.

The extra demand for labour directly generated by building renovations (investment projects) would create workplaces for 41 000 to 42 000 people under contracts concluded for the entire period or renewed annually. As an indirect effect of the increase in consumer demand which is to be expected due to the extra savings on residential and public energy costs, employment would increase by almost 3 000 at an annual level in various sectors of the economy.

8. Monitoring

8.1. Main tasks and milestones of implementing the Strategy

A schedule of the main tasks and the corresponding milestones of the implementation and management of the NABEPS is provided below.

2014:

- social consultation on the NABEPS
- adoption of the NAPEBS by the Government
- developing building energy performance support programmes, elaboration of the tendering programmes available from 2014
- laying the technical foundations (e.g. indicators) of the tender monitoring system for all direct support instruments, carrying out the necessary IT developments
- creating the institutional framework of the management of building energy performance tendering programmes to be introduced from 2014
- establishing a tender monitoring system for direct support instruments
- developing the Building Energy Performance Action Plan for the 2014-2020 period

2017:

- mid-term assessment of the Strategy and the action plans
- mid-term assessment of the instruments of direct support schemes

2018:

- preparing the strategy of the next programming period

2021:

- final evaluation of the Strategy and the Action Plan

8.2. Evaluation of the result of the Strategy and the Action Plan

The comprehensive evaluation of the NAPEBS will take place in the first half of 2017. In addition, the achievement of the targets will be promoted by the regular review and evaluation of the Action Plan and the dedicated instruments.

Evaluation will be based on the comparison of the targets and results achieved. As a prerequisite for this, the data reporting systems required for evaluation and the system of indicators for monitoring and evaluation should be developed.

To be able to make well-founded calculations, the national system for energy data reporting and information should be upgraded to provide for reliable and accurate data on the energy consumption and energy performance characteristics of buildings as well as for the monitoring of the results of the implemented renovations for improved building energy performance within the data reporting system. An administrative and monitoring system of projects which is able to provide a picture of the outcome of building energy performance projects launched under the action plans should also be developed and put in place. The systems for reporting national energy performance data and project-level data should be harmonised.

It is essential for the successful implementation of the NAPEBS to monitor and evaluate action plans and projects both individually and in a comprehensive manner.

The government body responsible for and the professional organisation actually carrying out monitoring and evaluation should be appointed and the corresponding monitoring rules, including the description of processes, responsible persons/bodies, provisions on scheduling and the responsibilities and powers of participants should be established.

Energy efficiency actions in other EU Member States

Directive 2006/32/EC sets the aim to achieve a 9 % reduction on average in the annual average final energy consumption of energy users within the scope of the Directive from the beginning of 2008 until 2016. Average annual final consumption is calculated from the data of the five-year period previous to the implementation of the Directive. Energy savings are calculated, using a combination of the harmonised top-down and bottom-up methods defined in the Directive and official statistical data, based on the total energy savings achieved over the total duration of the Directive (2008-2016). The calculated targets and the energy efficiency improvement measures planned to reach these targets must be reported by the Member States in their national energy efficiency action plans on three occasions during the nine-year period. The energy consumption of buildings is part of the energy consumption falling within the scope of the Directive. Accordingly, all Member states have set ambitious energy savings targets for buildings in their national energy efficiency action plans as well as number of corresponding actions.

Most national energy efficiency action plan includes actions for improving the energy performance of buildings and also reveal how much of the total planned reduction in energy demand Member States wish to achieve by energy savings in buildings. The summary below outlines the energy efficiency improvement actions introduced in the respective Member States for residential and public buildings, not including any associated horizontal measures.

1.2.1. Austria

According to the Energy Strategy of Austria, final energy consumption in 2020 may not exceed the 2005 level. In its Second National Energy Efficiency Action Plan, Austria has foreseen an energy savings target of 80.4 PJ/annual for 2016 (a savings target of 9 % in accordance with Directive 2006/32/EC. Approx. 75 % of the savings are planned to be achieved by the actions for residential and public buildings listed below (without horizontal measures).

Action	*Savings in relation to total savings (%)*	*Amount of energy saved (PJ/year)*
Support scheme for the improvement of the building envelopes of new and renovated buildings, support scheme for the renovation of the building envelopes of other buildings (also for businesses)	28	22.51
Support scheme for the improvement of the heating systems of new and renovated buildings, support scheme for the renovation of buildings supplied with district heat (residential and non-residential buildings)	23	18.49
Increasingly stringent building energy performance requirements	23	18.49
energy efficiency advisory service for the population	0.2	0.16
Renovation of public buildings for improved energy performance	0.5	0.40
Total savings from improving the energy performance of buildings	74.7	60.05

Source: The Second National Energy Efficiency Action Plan of Austria

Table 28: Planned energy savings in buildings in Austria

Main characteristics of the actions taken in Austria to improve the energy performance of buildings:

Actions	*Strategic objective*	*Main impact areas of the actions*	*Instruments to be used for the actions*
National Renovation Plan (2009)	renovation of residential and public buildings for improved energy performance	residential and public buildings constructed before 1 January 1999 or at least 20 years ago	grant
Renovation Programme (2011)	renovation of residential and public buildings for improved energy performance and the use of renewable energy sources	residential and business sector buildings	grant
Extension of district heating systems (2006-2012)	extension of district heating systems, use of biomass	district heat sector	grant
Strengthening building energy performance requirements (2011)	reducing energy consumption	residential and non-residential buildings	application of regulatory provisions

Source: The Second National Energy Efficiency Action Plan of Austria

Table 29: Planned actions for improving the energy performance of buildings in Austria

From 1982, improvement of the thermal insulation of buildings and the efficiency of heating systems has been supported under different funds in the federal provinces of Austria. Under the 2011 Renovation Programme, a 20 % support was granted for renovations involving the thermal insulation of residential buildings and/or at least EUR 5 000, with an additional EUR 1 500 provided if the existing heating system was converted into a system using renewable energy sources. There are also support schemes to promote the extension of district heating system, in particular the extension of district heating systems using biomass. In accordance with the 2008 Act on Co-generation (KWK-Gesetz), funds of EUR 55 million were granted for this purpose in the 2006-2012 period, while the Act on district heating and cooling pipelines (WKLG) allocated a budget of EUR 10 million in 2010 and EUR 20 million in 2011.

The thermal design requirements for buildings are regulated in Austria by the federal legislation on construction as well as by the construction regulations of the individual federal provinces which may vary from province to province. In order to promote the use of renewable energy sources, under certain schemes, eligibility for support was made conditional on the use of renewable energy sources (solar collectors and panels, biomass, biogas). For example, EUR 1 500 to 3 000 was granted for the installation of solar collectors on a 15 m^2 area, considered as average by size. The grant rate in the case of district heating systems using biomass was 30 %.

According to the National Energy Efficiency Action Plan adopted in 2014, final energy consumption should be 1 100 PJ by 2020 while the savings achieved in comparison with a BAU scenario should be 200 PJ. A primary energy consumption of 1 320 PJ is proposed for 2020.

The ‘Renovation Check’ programme launched in 2014 is focussed on the renovation of buildings over 20 years of age. The grant rate is 30 % and at least EUR 6 000 for improvements of thermal insulation and EUR 200 for renovation of the heating system. On top of this, EUR 500 is granted for projects involving the installation of eco-labelled products or, in the case of window replacement, windows with a wooden frame. The maximum grant rate for the renovation projects of businesses is 35 %.

1.2.2. Czech Republic

In its Second National Energy Efficiency Action Plan, the Czech republic has set an energy savings target of 71.0 PJ/year for 2016 (a savings target of 9 % in accordance with Directive 2006/32/EC. Approx. 39 % of the savings are planned to be achieved by the actions for residential and public buildings listed below (without horizontal measures).

Action	*Savings in relation to total savings (%)*	*Amount of energy saved (PJ/year)*
Supporting the modernisation of the building stock through savings programmes for residential communities	5.8	4.12
Renovation programme for high-rise buildings	2.7	1.92
Development fund for the renovation of multi-apartment buildings	1.3	0.92
Loans extended to municipalities for improving the condition of the building stock	0.04	0.03
State support for energy efficiency advice for households	0.4	0.28
Energy performance rating of household appliances	5.6	3.98
Savings on lighting at households	0.3	0.21
Green Savings Programme	11.9	8.45
Introduction of new technologies in the public sector	2.4	1.70
Electricity savings on public lighting	1.0	0.71
Application of the Energy Star Agreement to office equipment	7.3	5.18
Total savings from improving the energy performance of buildings	38.7	27.50

Source: The Second National Energy Efficiency Action Plan of the Czech Republic

Table 30: Planned energy savings in buildings in the Czech Republic

Main characteristics of the actions taken in the Czech Republic to improve the energy performance of buildings:

Actions	*Strategic objective*	*Main impact areas of the actions*	*Instruments to be used for the actions*
Green Savings Programme (2009-2012)	modernisation for improved energy performance	family houses and multi-apartment buildings	grant
Support for nearly zero-energy buildings	increasing energy efficiency	family houses and multi-apartment buildings	grant
Support for renewable energy sources (biomass, heat pumps, solar collectors)	using renewable energy sources	family houses and multi-apartment buildings	grant
Planned introduction of increasingly stringent building energy performance requirements	reducing energy consumption	residential and non-residential buildings	application of regulatory provisions

Source: The Second National Energy Efficiency Action Plan of the Czech Republic

Table 31: Planned actions for improving the energy performance of buildings in the Czech Republic

In the Czech Republic, a considerable proportion of the savings are to be achieved under the Green Savings Programme. Funds for the Programme are raised from the sale of CO_2 quotas, which amount to CZK 20 billion. The Programme ran from 2009 to 2012, with approx. 79 000 applications submitted. Funds were granted under the programme for the total or partial insulation of family houses and multi-apartment buildings and the reduction of the energy demand of heating. The grant rate depends on the scale of the planned energy savings (higher grant rate for greater specific energy savings). The use of renewable energy sources in buildings is also supported under the Programme with a grant rate depending on the technology applied (biomass-firing, heat pumps, solar collectors).

Thermal design requirements for buildings were last strengthened in the Czech Republic in 2007. However, the Second National Energy Efficiency Action Plan proposes even stricter requirements of which savings of 4.2 PJ/year are expected by 2016. This would account for 6 % of the planned energy savings.

1.2.3. Germany

Germany has set the following national energy efficiency targets in its Second National Energy Efficiency Action Plan:

- a 20 % and a 50 % reduction in primary energy savings by 2020 and 2050, respectively, compared to the 2008 level;
- an annual increase of 2.1 % in the productivity of energy generation in relation to primary energy consumption by 2050;
- a 20 % and a 50 % reduction in electricity consumption by 2020 and 2050, respectively (compared to the 2008 level);

- a 20 % decline in the heating energy demand and a 50 % reduction in the primary energy consumption of buildings by 2020 and 2050, respectively, with a view to creating a nearly climate neutral building stock by 2050.
- as a prerequisite for reducing heating energy demand, the annual rate of renovation should be increased to 2 % as compared to the current rate of less than 1 %;
- compared to 2005 levels, energy consumption in the transport sector should drop by 10 % by 2020 and by 40 % by 2050.

In its Second National Energy Efficiency Action Plan, Germany has foreseen an energy savings target of 462.6 PJ/year for 2016 (a savings target of 9 % in accordance with Directive 2006/32/EC). Approx. 45 % of the savings are planned to be achieved by the actions for residential and public buildings listed below (without horizontal measures).

Action	*Savings in relation to total savings (%)*	*Amount of energy saved (PJ/year)*
Strengthening the decree on building energy performance – non-residential buildings	7.6	35.16
Strengthening the decree on building energy performance – residential buildings	23	106.40
German Development Bank (KfW), 'CO_2 building rehabilitation programme' – low-interest loans	1.5	6.94
German Development Bank (KfW), 'CO_2 energy-efficient refurbishment programme'	11	50.89
German Development Bank (KfW), 'Housing modernisation – Eco-Plus variant' – low-interest long-maturity loans	1.0	4.63
German Development Bank (KfW), 'Energy-efficient construction programme' – grants for new buildings that outperform the applicable energy requirements and passive house standards	1.5	6.94
German Development Bank (KfW), 'Ecological construction programme' – grants for new buildings that outperform the applicable energy requirements and passive house standards	0.2	0.93
On site consultancy – Federal Office for Economic Affairs and Export Control (BAFA)	0.4	1.85
Market promotion programme for the use of renewable energy sources (BAFA and KfW)	6.5	30.07
The energy efficiency actions of certain provinces in the construction sector	1.1	5.09
Total savings from improving the energy performance of buildings	53.8	248.9

Source: The Second National Energy Efficiency Action Plan of Germany

Table 32: Planned energy savings from improving the energy performance of buildings in Germany

Main characteristics of the actions taken in Germany to improve the energy performance of buildings:

Actions	*Strategic objective*	*Main impact areas of the actions*	*Instruments to be used for the actions*
Energy Saving Ordinance (2009)	reducing energy demand	residential and non-residential buildings	application of regulatory provisions
Development programme of the German Development Bank (KfW)	modernisation for improved energy performance	residential and non-residential buildings	grants and low-interest bank loans
Promoting the use of renewable energy sources	use of renewable energy sources	residential and non-residential buildings	grant

Source: The Second National Energy Efficiency Action Plan of Germany

Table 33: Planned actions for improving the energy performance of buildings in Germany

Germany expects to achieve the largest savings by introducing increasingly stringent thermal design requirements for buildings.

The German Energy Saving Ordinance (EnEV) lays down minimum requirements for the thermal design of the building envelope and technical building systems of new buildings and buildings undergoing a major renovation. New buildings may not exceed a certain annual amount of primary energy consumption calculated for a reference building while in the case of existing buildings undergoing renovation, the elements affected by renovation should meet the minimum requirements. During the last amendment in 2009, the minimum requirements for thermal design were made more stringent by 30 %.

Funds may be applied for under the energy efficiency renovation programme managed by the German Development Bank (KfW) if the relevant minimum energy performance requirements are met. Funds are available in the form of direct investment grants or low-interest loans. As a precondition to eligibility for aid, all actions should be carried out by specialized professionals exclusively.

The objective of the market promotion programme is to strengthen the base of users of renewable energy sources by encouraging investment projects. Direct support may be requested for the installation of heat pumps and solar collectors. An additional bonus may be secured if the two systems are applied in combination.

1.2.4. Poland

In its Second National Energy Efficiency Action Plan, Poland has foreseen an energy savings target of 192.4 PJ/year for 2016 (a savings target of 9 % in accordance with Directive 2006/32/EC). Approx. 19 % of the savings are planned to be achieved by the actions for residential and public buildings listed below (without horizontal measures).

Action	*Savings in relation to total savings (%)*	*Amount of energy saved (PJ/year)*
A bonus system of energy modernisation and a renovation fund for new buildings and building renovations	15	28.86
Green Investment Programme – actions for reducing the energy consumption of public buildings	3.6	6.93
Infrastructure and Environment Operational Programme – actions for reducing the energy consumption of public buildings	0.6	1.15
Total savings from improving the energy performance of buildings	19.2	36.94

Source: The Second National Energy Efficiency Action Plan of Poland

Table 34: Planned energy savings from improving the energy performance of buildings in Poland

Main characteristics of the actions taken in Poland to improve the energy performance of buildings:

Actions	*Strategic objective*	*Main impact areas of the actions*	*Instruments to be used for the actions*
Modernisation and renovation programme for residential buildings	modernisation for improved energy performance	residential buildings	grants and bank loans
Green Investment Scheme	modernisation for improved energy performance	public buildings	grant
National support scheme under the Environmental Protection and Water Management Fund	modernisation for improved energy performance	State-owned cultural and budgetary institutions	grant
Support for solar collector systems	use of renewable energy sources	existing buildings	grant

Source: The Second National Energy Efficiency Action Plan of Poland

Table 35: Planned actions for improving the energy performance of buildings in Poland

Under the modernisation and renovation programme for residential buildings, Poland grants funds for improving the energy performance of and renovating residential buildings at a maximum of 20 % of the bank loan extended for this purposes which, however, may not exceed 16 % of the cost of the investment or double the annual amount of the energy savings expected. Funds may only be granted if the energy demand for heating and hot water generation of the dwelling is reduced by at least 10 % and the requirements set for the financial indicators of the project are also fulfilled. Under the programme, support is granted for the thermal insulation and the modernisation of the heating system of residential buildings as well as for facilitating their connection to district heating systems, the reduction of primary energy loss and the use of renewable energy sources for supplying buildings with energy.

The Green Investment Programme provides support for the modernisation of public buildings for improved energy performance, including thermal insulation, the replacement of doors and windows, the modernisation of heating systems, the replacement of ventilation and air-conditioning systems, preparation of the technical documentation of the investment project, the installation of building energy management systems and energy-efficient lighting.
A new support scheme was launched in 2010 which provides a 40 % grant for the installation of solar collectors for hot water production.

1.2.5. Slovakia

In its Second National Energy Efficiency Action Plan, Slovakia has foreseen an energy savings target of 8.36 PJ/year for the 2011-2013 period (in accordance with Directive 2006/32/EC). Approx. 46 % of savings are planned to be achieved by the actions for residential and public buildings listed below (without horizontal measures).

Action	*Savings in relation to total savings (%)*	*Amount of energy saved (PJ/year)*
Improving the energy performance of family houses	10	0.84
Improving the energy performance of multi-apartment buildings	7.5	0.63
Improving the energy performance of office buildings, hotels, restaurants and commercial buildings	1.5	0.13
Building low-energy buildings and passive houses	0.6	0.05
Application of the legislative provision on construction – optimising heating and hot water systems, insulation of hot water systems	1.2	0.10
Improving the energy performance of public buildings (hospitals, educational facilities, social facilities, cultural facilities, offices)	25	2.09
Total savings from improving the energy performance of buildings	45.8	3.84

Source: The Second National Energy Efficiency Action Plan of Slovakia

Table 36: Planned energy savings from improving the energy performance of buildings in Slovakia

Main characteristics of the actions taken in Slovakia to improve the energy performance of buildings:

Actions	*Strategic objective*	*Main impact areas of the actions*	*Instruments to be used for the actions*
Government Thermal Insulation Programme	modernisation for improved energy performance	family houses and multi-apartment buildings	bank loans
Building Development Programme	modernisation for improved energy performance	multi-apartment buildings	grant
The Sustainable Efficiency Programme of Slovakia (SLOVSEFF II)	modernisation for improved energy performance	multi-apartment buildings	grant
Support for installing thermostatic valves (2011-2013)	modernisation for improved energy performance and improving energy efficiency	multi-apartment building above 1 000 m^2	grant
Renovation of public buildings from EU funds for improved energy performance	modernisation for improved energy performance	hospitals, schools, social care facilities, cultural facilities, office buildings	grant

Source: The Second National Energy Efficiency Action Plan of Slovakia

Table 37: Planned actions for improving the energy performance of buildings in Slovakia

In the 2011-2013 period, Slovakia continued to support the renovation of family houses from own funds with the help of commercial loans. According to the plans, 50 family houses will be renovated, with assumed energy savings of 20 % on average. A special assessment and monitoring system has been put in place to verify savings. The Second Government Thermal Insulation Programme continued in the 2011-2013 period, providing funds for the renovation of family houses. Loans of a maturity of 15 years are extended under the Programme, which, when repaid to the fund, may be used for extending new loans. A budget of approx. EUR 3 million is allocated to the Programme.

In the 2011-2013 period, the renovation of multi-apartment buildings was supported under the State Housing Development Fund (SHDF), and repairs of the construction defects of multi-apartment buildings under the Building Development Programme and the Second Sustainable Efficiency Programme of Slovakia (SLOVSEFF II). Government programmes place special emphasis on the fulfilment of minimum energy performance requirements and the ex post monitoring of renovations. Around 150 buildings will be renovated under the SHDF yearly, assuming energy savings of at least 20 %. The State support granted for this period is EUR 63.9 million. An additional 100 buildings are renovated yearly under the Building Development Programme. A 10 % improvement is expected in the thermal design features of the renovated buildings as well as a 20 % reduction in their energy demand for heating. The fund allocated to this programme amount to EUR 15 million. The renovation of another 320 multi-apartment building is foreseen under the SLOVSEFF II Programme in the 2011-2013 period from EU funds of EUR 12 million. The Second Government Thermal Insulation Programme is also available for multi-apartment buildings. The allocated budget is EUR 27 million which is sufficient for the renovation of 150 multi-apartment buildings yearly.

Public buildings were renovated primarily from EU funds in the 2011-2013 period. The funds made available for the renovation of hospitals, schools, social care facilities, cultural facilities and office buildings were estimated at EUR 504 million. EUR 7 million State support was dedicated to the renovation of healthcare facilities.

1.2.6. Slovenia

In its Second National Energy Efficiency Action Plan, Slovenia has foreseen an energy savings target of 24.7 PJ/year for 2016 (a savings target of 9 % in accordance with Directive 2006/32/EC). Approx. 51 % of the savings are planned to be achieved by the actions for residential and public buildings listed below (without horizontal measures).

Action	*Savings in relation to total savings (%)*	*Amount of energy saved (PJ/year)*
Economic incentives for the energy-efficient renovation and sustainable construction of residential buildings	6.4	1.58
Economic incentives for establishing energy-efficient heating systems	9.2	2.27
Programme for improving the energy efficiency of low-income households	0.9	0.22
Compulsory division and calculation of heating costs in multi-apartment buildings and other buildings	1.3	0.32
Consultancy network for energy-efficient operation	4.9	1.21
Co-financing measures for the efficient use of electricity in the service sector	0.5	0.12
Economic incentive for the use of renewable energy sources and co-generation installations in the service sector	3.9	0.96
Economic incentive for the energy-efficient renovation and sustainable construction of public buildings	1.7	0.42
Introduction of energy management systems in the public sector	3.2	0.79
Economic incentives for the efficient use of electricity in the public sector	1.1	0.27
Regulations on the energy performance of buildings	4.1	1.01
Energy performance rating of household appliances	7.5	1.85
General support programmes for the use of renewable energy sources and co-generation in electricity production	6.5	1.61
Total savings from improving the energy performance of buildings	51.2	12.63

Source: The Second National Energy Efficiency Action Plan of Slovenia

Table 38: Planned energy savings from improving the energy performance of buildings in Slovenia

Main characteristics of the actions taken in Slovenia to improve the energy performance of buildings:

Actions	*Strategic objective*	*Main impact areas of the actions*	*Instruments to be used for the actions*
Eco Fund environmental protection fund	increasing energy efficiency, renovations improving energy performance	residential buildings	grant
Energy-efficient renovation of residential buildings and support for sustainable new buildings (2011-2016)	increasing energy efficiency, renovations improving energy performance	residential buildings	grant
Support for reducing the heating energy demand of residential buildings (2011-2016)	increasing energy efficiency, renovations improving energy performance, using renewable energy	residential buildings	grant
Establishing advisory networks	increasing energy efficiency, using renewable energy	occupants of residential buildings	consultancy (State support)
Economic incentives for the service and industrial sector	use of renewable energy sources and co-generation installations	Service and industrial sector	grant
Support for the energy-efficient renovation of public buildings	renovations improving energy performance	public buildings	grant
Strengthening building energy performance requirements (PURES, 2010)	reducing energy demand	residential and non-residential buildings	application of regulatory provisions

Source: The Second National Energy Efficiency Action Plan of Slovenia

Table 39: Planned actions for improving the energy performance of buildings in Slovenia

In Slovenia, the majority of support is provided from the State's facility for environmental protection 'Eco Fund'.

Economic incentives for the energy-efficient renovation and sustainable construction of residential buildings encourage the large-scale improvement of the thermal insulation of building envelopes, the replacement of windows and, when new buildings are concerned, the construction of low-energy buildings and passive houses. The funds allocated for this purpose in the 2011-2016 period are estimated at EUR 113 million.
Other economic incentives for residential buildings aim at reducing the energy consumed in buildings for heating. Such incentives cover, among others, the replacement of heating equipment, the optimisation of heating systems and the use of renewable energy sources. The funds allocated for this purpose in the 2011-2016 period are estimated at EUR 164 million.

Low-income households are provided special assistance under the energy efficiency programme. In this area, primarily simple low-cost energy efficiency measures are supported such as the insulation of attics, doors and windows and the use of energy-efficient bulbs. The funds allocated for this purpose in the 2011-2016 period are estimated at EUR 47 million.

To add impetus to the introduction of energy efficiency measures, the State has established a consultancy network with the involvement of municipalities which provides information, advice and assistance to citizens concerning their energy efficiency tenders free of charge. This helps increasing the number of investment projects for the reduction of energy consumption and the use of renewable energy sources. The funds allocated for this purpose in the 2011-2016 period are estimated at EUR 6 million.

There are a number of energy efficiency incentive programmes in the service and industrial sectors as well with the primary aim to encourage the use of renewable energy sources and co-generation installations. The funds allocated for this purpose in the 2011-2016 period are estimated at EUR 54 million.

Under programmes for the energy-efficient renovation of public buildings and the construction of low-energy buildings the grant rate is higher in the case of comprehensive renovations than partial renovations, which compels applicants to carry out full building rehabilitation. The funds allocated for this purpose in the 2011-2016 period are estimated at EUR 127 million.

The most recent Slovenian regulation on building energy performance requirements (PURES) was published in 2010, establishing more stringent requirements than the former regulation. The regulation lays down requirements for building envelopes, heating, cooling, ventilation, lighting and hot water systems and provides that at least 25 % of the energy demand must be met using renewable energy sources.

1.2.7. Summary of findings on the national energy savings targets from improved building energy performance

The overwhelming majority of EU Member States undertook commitments that fall short of the 2020 target of reducing primary energy consumption by 20 %.

In most Member States, buildings account for a substantial part of total energy consumption. Accordingly, they wish to achieve a large portion – generally 40 to 60 % – of the planned savings by implementing programmes and actions for improving the energy performance of buildings.

There are no uniform building energy performance requirements applicable to the Member States, which has resulted in practice in highly divergent Member State requirements.

There are significant differences in the country-specific energy performance profile of Member States which they have took into account when establishing the instruments dedicated to achieving the set building energy performance targets in their respective national energy efficiency action plans. Most Member States plan to introduce more stringent building energy performance requirements and actions facilitating the renovation of residential and public buildings for improved energy performance. Furthermore, depending on Member State specificities, several other actions are proposed to reduce the energy consumption of buildings.

Literature

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Directive 2009/125/EC of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products

Directive 2010/30/EU of 19 May 2010 on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products

Directive 2010/31/EU of 19 May 2010 on the energy performance of buildings (the ‘Energy Performance of Buildings Directive’)

Directive 2012/27/EU of 25 October 2012 on energy efficiency (the ‘Energy Efficiency Directive’)

National Energy Strategy 2030 and Outlook for 2050 (Ministry of National Development, October 2011)

Second National Energy Efficiency Action Plan of Hungary until 2016 with an Outlook to 2020 (Ministry of National Development, May 2011)

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Government Decree No 1002/2011 of 14 January 2011 on Hungary’s National Renewable Energy Action Plan

Government Decree No 1246/2013 of 30 April 2013 on the energy performance requirements applicable to buildings and establishing cost-optimal levels of minimum energy performance requirements in accordance with Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings

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Assessment of the macroeconomic effects of energy efficiency investments based on the balance of intersectoral relations (Regional Centre for Energy Policy Research, 2013)

Abbreviations

BIR	Balance of intersectoral relations
CECED	Conseil Européen de la Construction d'appareils Domestiques (European Committee of Manufacturers of Electrical Domestic Equipment)
EED	Energy Efficiency Directive
EEOP	Environment and Energy Operational Programme
ÉMI	ÉMI Non-Profit Limited Liability Company for Quality Control and Innovation in Building
EPBD	Energy Performance of Buildings Directive
ESCO	Energy Service Company
EU	European Union
GDP	Gross Domestic Product
GHG	Greenhouse gas
HCSO	Hungarian Central Statistical Office
HEPURA	Hungarian Energy and Public Utility Regulatory Authority
HNEEAP	Hungary's National Energy Efficiency Action Plan
MND	Ministry of National Development
Mtoe	million tonne oil equivalent
NABEPS	National Building Energy Performance Strategy
NEEAP	National Energy Efficiency Action Plan
NREAP	Hungary's National Renewable Energy Action Plan
NSZP	New Széchenyi Plan
NZEB	nearly zero-energy building
REKK	Regional Centre for Energy Policy Research
VÁTI	VÁTI Hungarian Public Nonprofit Company for Regional Development and Town Planning
ZBR	Zöld Beruházási Rendszer (Green Investment Scheme)