MINISTRY OF ECONOMIC AFFAIRS AND COMMUNICATIONS

Notification on the energy efficiency of buildings to be submitted to the European Commission on the basis of Article 4 of Chapter II of Directive 2012/27/EU of the European Parliament and of the Council

2014

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Notification on the energy efficiency of buildings to be submitted to the European Commission on the basis of Article 4 of Chapter II of Directive 2012/27/EU of the European Parliament and of the Council

INTRODUCTION

This document describes Estonia's trends and principles for achieving energy savings in buildings. The notification encompassing sectoral activities has been elaborated by the Construction and Housing Department of the Ministry of Economic Affairs and Communications and proceeds from the necessity to meet the objectives provided in Directive 2012/27/EU of the European Parliament and of the Council. The notification prepared by the Member State provides a description of the activities and documents that can be used as the basis for making investments in the renovations of residential and commercial buildings of the public and the private sectors in order to achieve energy efficiency to the relevant extent. Nationally elaborated cost-effective, feasible and justified measures are described in the notification.
The preparation of more detailed plans is conducted in accordance with other sectoral development plans and strategies.

The plan on the activities relating to the renovation of buildings encompasses the following:

a) an overview of the national building stock;
b) identification of cost-effective approaches to renovations relevant to the building type and climatic zone;
c) policy and measures to stimulate cost-effective deep renovations of buildings, including staged deep renovations;
d) a forward-looking perspective to guide the investment decisions of individuals, the construction industry and financial institutions; and
e) an evidence-based estimate of expected energy savings and wider benefits.

Overview of the national building stock

The data on the buildings situated in Estonia is presented pursuant to an extract from the State Register of Construction Works (as of 30.06.2013). Only data on buildings that are being used pursuant to the data of the Register has been presented. The classification provided in Regulation no. 78 'List of Usage Purposes of Construction Works' of the Minister of Economic Affairs and Communications has been used for the classification of buildings.

Net area and number of buildings pursuant to purpose of use:

1.	Small residential buildings (one apartment)	23,667 thousand m^2	198,857 pcs
2.	Apartment buildings (several apartments)	33,745 thousand m^2	3,576 pcs
3.	Accommodation buildings	1,314 thousand m^2	2,853 pcs
4.	Food service buildings	384 thousand m^2	908 pcs
5.	Office buildings	4,693 thousand m^2	4,093 pcs
6.	Commercial and service buildings	10,225 thousand m^2	5,441 pcs
7.	Transport buildings (terminals and garages)	4,247 thousand m^2	13,009 pcs
8.	Industrial buildings and warehouses	14,841 thousand m^2	16,088 pcs
9.	Recreational buildings	813 thousand m^2	1,006 pcs
10.	Museum and library buildings	295 thousand m^2	361 pcs
11.	Educational and research buildings	4,240 thousand m^2	2,123 pcs
12.	Hospitals and other medical buildings	1,150 thousand m^2	537 pcs
13.	Sports buildings	748 thousand m^2	629 pcs
14.	Agricultural, forestry, hunting and fisheries buildings	12,790 thousand m^2	18,306 pcs
15.	Miscellaneous buildings (including buildings of worship, historic buildings and special-purpose buildings)	17,782 thousand m^2	312,777 pcs

Number of building heating systems by type:

1.	district heating	22,147 pcs
2.	local central heating	38,429 pcs
3.	electric heating	15,922 pcs
4.	ground source heating	1,566 pcs
5.	air source heating	1,050 pcs
6.	stove or fireplace heating	244,121 pcs
7.	other	9,491 pcs
8.	no heating system	292,476 pcs

As every building may be equipped with more than one heating system and it is not possible to identify the main type of heating system of a building due to the characteristics of data collection in the State Register of Construction Works, the numbers of heating systems and buildings are not equivalent in value.

Number of buildings by date of construction:

1.	Buildings constructed before 2003	557,665 pcs
2.	Buildings constructed in 2003-2013	23,777 pcs

Identification of cost-effective approaches to renovations relevant to the building type and climatic zone

The survey ‘Improvement of the Energy Efficiency of the Building Stock – Energy Savings, Unit Costs and Volumes’ was conducted in the course of the amendment of the Estonian Development Plan for the Energy Sector (ENMAK).

The main objective of the survey was to evaluate the economic and technical potential of the energy savings to be achieved by means of comprehensive renovation of the existing building stock and the unit costs and volumes of the package solutions to be used for the implementation thereof. The results were calculated by volume on the basis of the most important package solutions and standard buildings for major reconstruction and generalised such as to be able to also evaluate the total savings potential of the construction sector on the basis thereof. The most cost-effective package solutions therefore characterise the economic potential and the package solutions for thorough and major reconstruction characterise the technical potential.

When describing the existing building stock, it was taken into consideration that the majority of the building stock constitutes an object of improvement of energy efficiency as regards the technical potential as the energy efficiency of buildings has greatly improved during the last decade. The standard buildings used in the calculations covered approximately 70% of the building stock volume of buildings with indoor climate control:

1. Small residential buildings in which only the technical building systems need to be renovated
2. Small residential buildings in which the building envelope must also be renovated
3. Apartment buildings
4. Office buildings
5. Educational buildings
6. Commercial and service buildings
7. Industrial buildings (no processes)

The improvement of energy efficiency was calculated on several levels in all the standard buildings in order to determine the package solutions that can be implemented in order to achieve the most feasible unit cost (how many euros must be spent to achieve savings of 1 Wh/y). A more ambitious improvement of energy efficiency provides an approximate evaluation of the technical savings potential. Improvement of energy efficiency on a lower level characterises the economic potential of energy savings, i.e. the package solutions that are the most economically feasible to implement for the owner.

The package solutions used were chosen on the basis of earlier surveys and experience; they may be treated as general guidelines as regards the complete and justified reconstruction solutions.

Energy savings were calculated with the help of simulation models of standard buildings that were prepared on the basis of the actual measured energy consumption of the standard buildings. The evaluation of the cost of package solutions was mainly based on the data of the implemented projects and the established unit costs; budgeting was also conducted for a portion of the solutions due to a lack of data.

All the used construction costs describe the cost of the complete construction work, i.e. upon insulation, the cost of the accompanying general construction and finishing work was also considered. The package solutions therefore also include the reinforcement of the main structures, which lengthens the service life of the building and raises the level of quality as regards the work performed. The work does not include the cost of other work (electrical work, water and sewerage systems, etc.) that is generally performed in the course of renovation of apartment buildings and is not related to the improvement of energy efficiency; such work would increase the cost of the packages by up to approximately 25%. The cost of the package solutions that improve energy efficiency and the technical condition of the building is therefore somewhat smaller than repairs and renovation performed where other work that is not related to energy efficiency is also included. The base level, i.e. the existing situation in the calculations (on the condition that nothing is performed) only proceeds from the energy costs. In fact, the technical condition of numerous buildings is bad insofar as to bring about the necessity of the performance of certain work (dilapidated roofs/facades) at any rate, and in reality the cost of such work would be added to the costs of the existing situation, which is important to take into consideration when interpreting the results.

The energy costs corresponding to the existing situation were calculated for every building type along with the energy savings and costs that accompany 3-4 package solutions on differentiated levels of renovation. The change in the supplied heat and electricity and the monetary energy savings were calculated separately (whereas, e.g. any additional electricity consumption arising from the construction of a ventilation system was expressed in negative numbers). The cost of the implementation was also calculated in total for the entire net area of the building type (€M), and the total change in heat and electricity consumption (GWh/y) was also calculated. On the basis of the aforesaid, the unit cost of energy savings was calculated, i.e. how many euros must be invested to achieve energy savings of 1 MWh per year. The net present value for 20 years, consisting of the construction cost and the discounted energy costs, has been used for drawing the overall conclusions.

Apartment buildings

The energy efficient renovation packages have been prepared for five energy efficiency levels from the standard-usage existing situation (energy performance class F) to the level of a low-energy building (energy performance class B).
As additional insulation has been applied to the building envelopes of apartment buildings as of now, an additional insulation of 50 mm was used for the side walls in the calculation model for the existing situation; this represents a situation where additional insulation has already been applied to a certain number of apartment buildings to a smaller or greater extent. It was additionally considered that approximately 2/3 of the windows in apartments have been replaced as of now. Upon the preparation of the energy efficiency packages, it was considered that the chosen individual actions are optimal. For example, a thickness of 100 mm for additional insulation was not used for the packages as this solution is no longer reasonable. The packages also include the insulation of the ceiling of the basement, which is not always required for achieving an energy efficiency level; however, it is necessary to ensure the thermal comfort of the inhabitants of the apartments on the first storey. Several solutions have been provided in the packages as regards the technical building systems as the desired energy efficiency level can be achieved by means of using various systems depending on the size of the reference building.

Renovation packages analysed for apartment buildings:

Energy performance class E

- Exterior wall additional insulation +200 mm
- Windows replaced U-1.1 W/m^2*K

Substantially reconstructed building level (energy performance class D)

- Exterior wall additional insulation +200 mm
- Roofing deck additional insulation +300 mm
- Basement ceiling additional insulation +150 mm
- Windows replaced U-1.1 W/m^2*K

- Reconstruction of a single-pipe heating system or a new double-pipe system
- Exhaust ventilation without heat recovery or an exhaust air heat pump

New building level (energy performance class C)

- Exterior wall additional insulation +200 mm
- Roofing deck additional insulation +300 mm
- Basement ceiling additional insulation +150 mm
- Windows replaced U-1.1 W/m^2*K
- New double-pipe heating system
- Room-based or apartment-based ventilation unit

Low-energy building level (energy performance class B)

- Exterior wall additional insulation +200 mm
- Roofing deck additional insulation +300 mm
- Basement ceiling additional insulation +150 mm
- Windows replaced U-0.6 W/m^2*K
- New double-pipe heating system
- Apartment-based ventilation unit
- Solar thermal collectors for making domestic hot water

The costs of the measure have been calculated on the basis of the budgets of the reconstruction work of apartment buildings that have applied for a renovation grant from SA KredEx.

Conclusions:

For apartment buildings, the current situation (with inadequate ventilation and dilapidated structures) is marginally cheaper than the package solutions: net present value €280/m^2 vs. €300/m^2. Reconstruction to the level of a new building (C) or a low-energy building (B) may be considered to be a justified objective due to the small difference in the net present values. However, the slightly higher net present value that accompanies class B indicates that this package is not economically feasible even with a 20 years' perspective. As the major packages (C and B) also entail a significantly higher initial investment, it is extremely likely that the energy savings potential of the major packages will not be realised under market conditions as the investments will rather be limited to packages E and D based on the construction cost. If packages E or D are chosen, the opportunity for energy savings corresponding to the major packages is essentially lost for the next 10-20 years.

However, the differences between the net present values are relatively small between energy performance classes E, D and C, permitting the conclusion that it is possible to renovate apartment buildings to a new level of energy efficiency without increasing the costs.

To realise the energy savings potential corresponding to levels C and B, a relatively small grant would therefore be needed in order to shift the results of investment calculations so they become economically feasible for these packages. As there is no difference between levels C and B in terms of the performance of the reconstruction – in both instances, the technical solutions are slightly different than deep or major reconstruction – it may be expected that the technical potential of energy savings of apartment buildings could be implemented in practice with relatively small grants. The realisation of the technical potential for apartment buildings would convey impressive energy savings of approximately 2 TWh/y compared to the packages that are most likely practicable in market conditions.

Small residential buildings

Options for improving the energy efficiency of small residential buildings have been researched on the basis of two types of sample buildings:

1. Small residential buildings in which only the technical building systems need to be renovated
2. Small residential buildings in which the building envelope must also be renovated

When choosing the sample buildings, the typical solutions for the stock of small residential buildings pertaining to structures and heat sources were considered. The efficiency of various measures for improving energy efficiency (insulation of the floor, exterior wall and roofing deck, replacement of doors and windows, replacement of the ventilation system, replacement of the heating system, usage of solar panels) were calculated in terms of energy savings and their estimated unit costs were found. The results with the lowest net present values are presented in the currently applicable energy efficiency classes of small residential buildings along with the list of the work required to achieve the respective levels.

The considered renovation measures of technical building systems are the installation of a ventilation system with heat recovery (a plate heat exchanger system with a temperature ratio of 0.8), the replacement of the initial heat source (new heat sources: air-to-water heat pump, pellet boiler, geothermal heat pump) and the usage of solar thermal collectors for heating water (up to 50% of the energy used for heating domestic water).

The considered renovation measures of structures are the insulation of the floor (with an insulation layer of 100, 200 and 300 mm), insulation of the exterior wall (with an insulation layer of 50/100, 150/200 and 250/300 mm), insulation of the attic dropped ceiling or roofing deck (with an insulation layer of 50/100, 150/200 and 250/300 mm), replacement of the windows (with a thermal transmittance of 0.7 W/(m^{2}K), 1.1 W/(m^{2}K) and 1.5 W/(m^{2}K) for the entire window) and the replacement of doors (with a thermal transmittance of 1.0 W/(m^{2}K) and 1.5 W/(m^{2}K) for the entire door). The note '50/100' for the thickness of the insulation layer of the exterior wall and the roofing deck refers to a situation where 50 mm of additional insulation has been used for a newer sample building and 100 mm of additional insulation has been used for an older building in order to equalise the thermal transmittance of the structures in post-renovation conditions.

Upon the evaluation of the cost of the measures, the cost assessments provided by general contracting companies in the field of construction were used. When combining the different measures, the options corresponding to the various energy efficiency classes with the smallest net present value were considered.

Renovation packages analysed for small residential buildings:

Building in which only the technical building systems need to be renovated

Energy efficiency class E:

- Installation of a ventilation system with heat recovery

Energy efficiency class D:

- Installation of a ventilation system with heat recovery
- Replacement of the heat source (pellet boiler)

Energy efficiency class C:

- Installation of a ventilation system with heat recovery
- Replacement of the heat source (geothermal heat pump)
- Attic dropped ceiling additional insulation (50 mm of bulk insulation)
- Replacement of windows (thermal conductivity 0.7 W/(m^{2}K))
- Replacement of doors (thermal conductivity 1.0 W/(m^{2}K))

Energy efficiency class B:

- Installation of a ventilation system with heat recovery
- Replacement of the heat source (geothermal heat pump)
- Solar thermal collectors for making hot water
- Roofing deck additional insulation (250 mm of bulk insulation)
- Exterior wall additional insulation (250 mm of mineral wool)
- Floor insulation (300 mm of expanded polystyrene)
- Replacement of windows (thermal conductivity 0.7 W/(m^2K))
- Replacement of doors (thermal conductivity 1.0 W/(m^2K))

Building in which the building envelope must also be renovated

Energy efficiency class E:

- Installation of a ventilation system with heat recovery
- Replacement of the heat source (pellet boiler), heating system based on radiator heating
- Roofing deck additional insulation (250 mm of mineral wool)
- Replacement of doors (thermal conductivity 1.0 W/(m^2K))

Energy efficiency class D:

- Installation of a ventilation system with heat recovery
- Replacement of the heat source (pellet boiler), heating system based on radiator heating
- Roofing deck additional insulation (250 mm of mineral wool)
- Exterior wall additional insulation (200 mm of mineral wool)
- Replacement of windows (thermal conductivity 0.7 W/(m^2K))
- Replacement of doors (thermal conductivity 1.0 W/(m^2K))

Energy efficiency class C:

- Installation of a ventilation system with heat recovery
- Replacement of the heat source (geothermal heat pump), heating system based on radiator heating
- Roofing deck additional insulation (250 mm of mineral wool)
- Exterior wall additional insulation (300 mm of mineral wool)
- Replacement of windows (thermal conductivity 0.7 W/(m^2K))
- Replacement of doors (thermal conductivity 1.0 W/(m^2K))

Maximum achievable energy savings potential (energy performance value 136 kWh/(m^2y)):

- Installation of a ventilation system with heat recovery
- Replacement of the heat source (geothermal heat pump), heating system based on radiator heating
- Solar thermal collectors for making hot water
- Roofing deck additional insulation (300 mm of mineral wool)
- Exterior wall additional insulation (300 mm of mineral wool)
- Floor insulation (300 mm of expanded polystyrene)
- Replacement of windows (thermal conductivity 0.7 W/(m^2K))
- Replacement of doors (thermal conductivity 1.0 W/(m^2K))

Conclusions:

For newer small residential buildings, only smaller repairs (the installation of a ventilation system with heat recovery or the replacement of the heat source) are feasible; in such case, the improvement in energy efficiency is also relatively modest.

In older small residential buildings, major reconstruction solutions (with the smallest unit cost) are feasible, in the course of which the building envelope is insulated and the technical building systems are replaced. This results in achieving the new building level (C) and energy consumption is significantly reduced. Regardless of feasibility assessed both in terms of the unit cost and net present value, a construction cost of €300/m^2 must be considered, which is 2 times higher than for apartment buildings. The realisation of major repairs is therefore unlikely. As repairs are carried out in stages in practice and generally without much regard for the complete solution and the final result, the realisation of the potential can only be ensured with supportive measures requiring complete reconstruction to the economically feasible level C.

Educational buildings

Data from the 29 educational buildings at the disposal of the consultants was used as the basis for assessing the energy consumption of the existing educational buildings. The average heat energy supplied to the existing educational buildings is estimated to remain between 130-140 kWh/m^2. It must thereat be emphasised that the air circulation (ventilation) is inadequate in the existing educational buildings and does not meet the modern requirements. In case of air circulation based on the minimum requirements, the consumption of thermal energy would significantly increase.

The methodology and usage profiles provided in the energy efficiency minimum requirements regulations (Regulation no. 68 of the Government of the Republic and Regulation no. 63 of the Minister of Economic Affairs and Communications) were used as the basis for preparing the models. The building envelopes and air circulation of the existing buildings were characterised by the following main indicators:

Thermal conductivity of exterior walls U=1.1 W/(m^2K)

Thermal conductivity of roofs U=1 W/(m^2K)

Thermal conductivity of windows U=1.8 W/(m^2K)

Air circulation: 30% of the minimum requirements.

In order to eliminate energy savings on account of the interior climate, the air circulation was increased to comply with the minimum requirements (e.g. mechanical outflow and compensating for the intake by means of the building envelope or conditional increase of air circulation by means of ventilation). The energy savings have been calculated for educational buildings with the current thermal performance and an air circulation that meets the minimum requirements.

Mechanical intake/outflow ventilation must be installed in the building in order to ensure an air circulation that meets the minimum requirements.

Renovation packages analysed for educational buildings:

Package I (energy performance class C):

- Exterior wall additional insulation +200 mm
- Roof additional insulation +250 mm
- Thermal conductivity of windows U=1.2 W/(m^2K)
- Ventilation system with heat recovery

Package II (energy performance class C):

- Exterior wall additional insulation +250 mm
- Roof additional insulation +300 mm
- Thermal conductivity of windows U=0.9 W/(m^2K)
- Ventilation system with heat recovery
- Lighting management

Package III (energy performance class B):

- Exterior wall additional insulation +250 mm

- Roof additional insulation +300 mm
- Thermal conductivity of windows U=0.9 W/(m^2K)
- VAV ventilation system with heat recovery
- Lighting management

Conclusions:

Class C can be achieved with relative ease. Class B entails significant insulation of the building, efficient lighting and a demand-based ventilation system or local production of renewable energy.

The NPV does not depend on the thickness of the additional insulation to a great extent. The optimal thickness of additional insulation is 15-20 cm for walls and 20-25 cm for roofs. Efficient lighting and a demand-based ventilation system increase the NPV. It was found that major reconstruction corresponding to the level of a new building (C) is economically feasible in educational buildings. However, regardless of the economic feasibility, the packages require such a big initial investment that the implementation thereof is unlikely to come about without other reasons such as the necessity for repairs of the facade or roof of the building.

The necessity of state measures may only be considered for school and nursery school buildings in order to aid the local governments in preparing the terms of reference to ensure a good interior climate and energy efficiency and upon the conduct of well-organised construction procurements which could turn out to be too daunting a task in smaller local governments without state aid. As the economic feasibility is good, the need for aid is mainly manifested in know-how.

Office buildings

The data of 15 office buildings at the disposal of the consultants was used as the basis for assessing the energy consumption of the existing office buildings. The models of the existing situation were calibrated such as to ensure energy consumption somewhere between 140-150 kWh/(m^2y) for the buildings. Energy consumption was calculated on the basis of the standard usage provided in Regulations. It must therefore be considered that the actual present energy consumption is approximately 45 kWh/(m^2y) higher. The building envelopes and air circulation of the existing buildings were characterised by the following main indicators:

Thermal conductivity of exterior walls U=1.1 W/(m^2K)
Thermal conductivity of roofs U=1 W/(m^2K)
Thermal conductivity of windows U=1.8 W/(m^2K)
Air circulation: 30% of the minimum requirements.

In order to eliminate energy savings on account of the interior climate, the air circulation was increased to meet the minimum requirements. If the air circulation of an office building were to be brought into conformity with the minimum requirements, the consumption of thermal energy would increase by approximately 100 kWh/(m^2y). Mechanical intake/outflow ventilation must be installed in the building in order to ensure an air circulation that meets the minimum requirements. The usage of ventilation heat recovery reduces the consumption of thermal energy by approximately 100 kWh/(m^2y), provided that ventilation with air circulation corresponding to the minimum requirements is used. Efficient lighting would reduce electricity consumption by 7 kWh/(m^2y) and increase the consumption of thermal energy by 4 kWh/(m^2y). Insulating the building envelope would allow reducing the consumption of thermal energy by 75-90 kWh/(m^2y).

Renovation packages analysed for office buildings:

Package I (energy performance class D):

- Exterior wall additional insulation +200 mm
- Roof additional insulation +250 mm
- Thermal conductivity of windows U=1.2 W/(m^2K)
- Ventilation system with heat recovery

Package II (energy performance class C):

- Exterior wall additional insulation +150 mm
- Roof additional insulation +200 mm
- Thermal conductivity of windows U=0.9 W/(m^2K)
- Ventilation system with heat recovery
- Lighting management

Package III (energy performance class C):

- Exterior wall additional insulation +250 mm
- Roof additional insulation +300 mm
- Thermal conductivity of windows U=0.9 W/(m^2K)
- Ventilation system with heat recovery

Package IV (energy performance class C):

- Exterior wall additional insulation +250 mm
- Roof additional insulation +300 mm
- Thermal conductivity of windows U=0.9 W/(m^2K)
- Ventilation system with heat recovery
- Lighting management

Conclusions:

Class D can be achieved with relative ease. Class C entails significant insulation of the building and efficient lighting or the local production of renewable energy.

The NPV (net present value) does not depend on the thickness of the additional insulation to a great extent. The optimal thickness of additional insulation is 15-20 cm for walls and 20-25 cm for roofs. Efficient lighting increases the NPV.

It was found that major reconstruction corresponding to the level of a new building (C) is economically feasible in office buildings; however, such a reconstruction would require a large initial investment.

Commercial and service buildings

This part of the building stock consists of buildings of various sizes and of varying construction quality, of which many have not been initially planned for commercial premises, yet are used for this purpose as of now. The sample also includes buildings that are related to commercial activities according to their purpose of use, but the actual current usage thereof is difficult to determine. Depending on the time of construction and the size of the buildings, any matters related to energy consumption and the possible solutions vary in a broad scale. It is not possible to reach a clear conclusion that would indicate the exact energy consumption and the impact of the size of the building. A big share of the energy consumption of commercial buildings is formed by technical equipment, including refrigerators, refrigerated display cabinets and other various display cases. Depending on the nature of the commercial building, the electricity consumption of refrigeration equipment may extend to 45% of the total consumption, as in the case of supermarkets. In the case of industrial products, this share is completely non-existent.

There are numerous different possibilities for improving the energy efficiency of commercial buildings. However, some of them are very specific and only suitable for certain building types. When assessing the packages for certain buildings, the general condition of the existing system or a part of the structure has also been taken into consideration.

The following general measures for improving energy efficiency were analysed for buildings related to commerce and trade:

Package I:

- Renovation of lighting fittings

Package II:

- Renovation of lighting fittings
- Renovation of the ventilation and heating systems
- Improvement of automated equipment

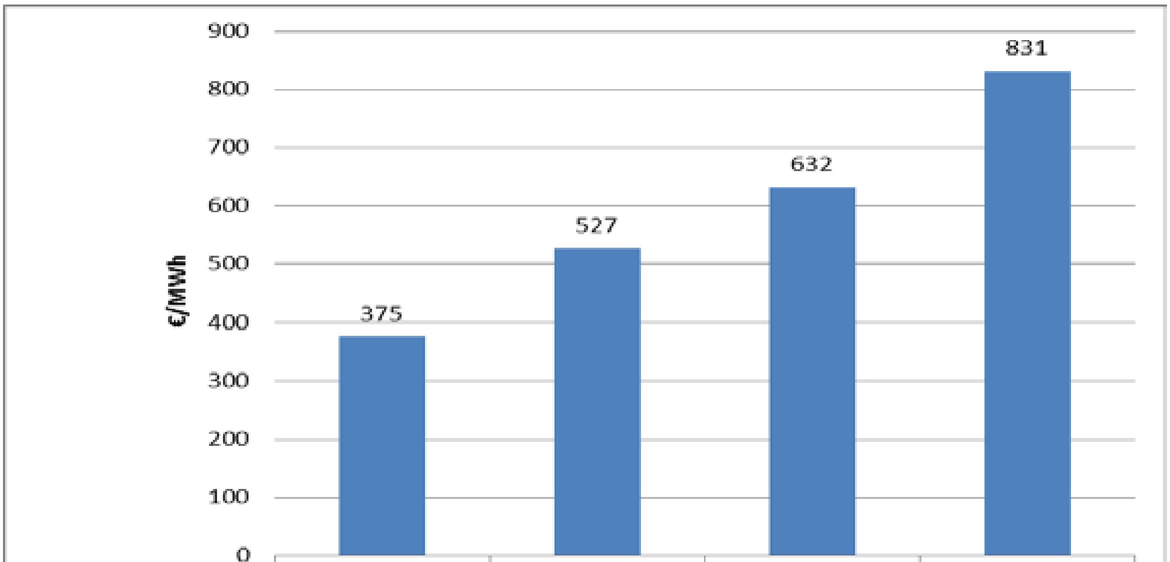
Package III:

- Renovation of lighting fittings
- Renovation of the ventilation and heating systems
- Improvement of automated equipment
- Improvement of technical equipment

Package IV:

- Renovation of lighting fittings
- Renovation of the ventilation and heating systems
- Improvement of automated equipment
- Improvement of technical equipment
- Insulation and renovation of the building envelope

The following figure provides the cost of the renovation packages, indicating the amount of the investment for energy savings of 1 MWh/y.



	Package I	Package II	Package III	Package IV
COMMERCIAL AND SERVICE BUILDINGS	375	527	632	831

Costs of the renovation packages of commercial buildings

Conclusions:

For commercial buildings, the latter solutions (insulating the building envelope in addition to renovating the technical building systems) are feasible based on the net present value as compared to the existing situation (current air circulation). However, regardless of the economic feasibility, the latter packages require a very big initial investment. Good market economy prerequisites exist for these buildings as regards the improvement of energy efficiency.

Industrial buildings (no production or processes)

Selection of packages

The possibilities of and necessity for improving the energy efficiency of warehouses and industrial buildings mainly depend on the year of construction of the building and thereby the structural solutions used in the building. The exact purposes of use and usage modes of the buildings have a big impact. The processes conducted in the building and the related possibilities for using the residual heat also impact the energy savings potential. The values provided in the tables are indicative; for every specific building, the major consumers must be examined separately.

Renovation packages analysed for industrial buildings:

Package I:

– Renovation of lighting fittings

Package II:

– Renovation of lighting fittings

– Renovation of the heating, heat supply and ventilation systems

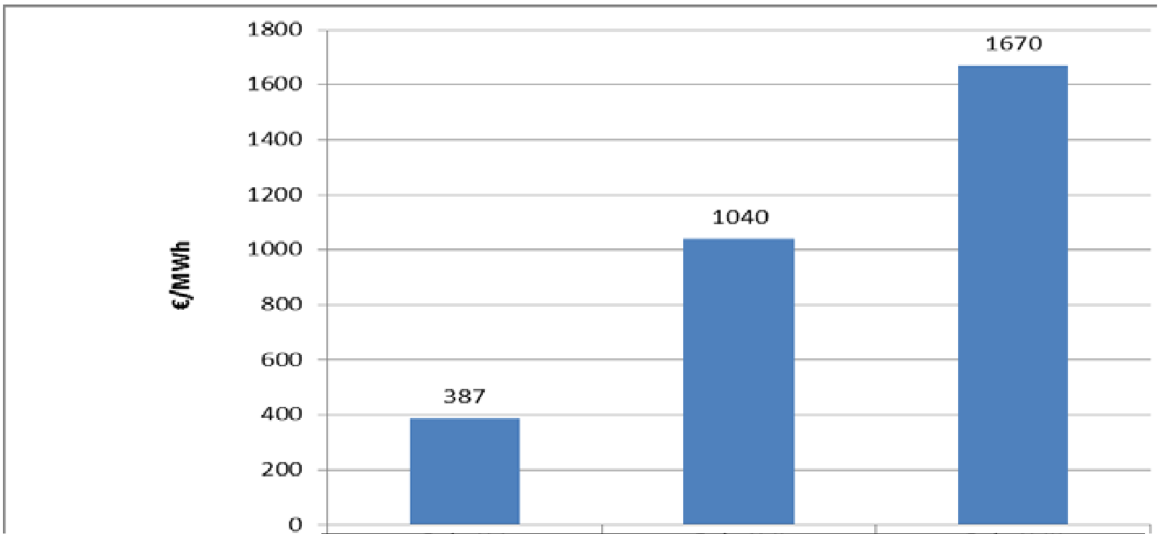
Package III:

– Renovation of lighting fittings

– Renovation of the heating, heat supply and ventilation systems

– Insulation and renovation of the building envelope

The following figure provides the cost of the renovation packages, indicating the amount of the investment for energy savings of 1 MWh/y.



	Package I	Package II	Package III
INDUSTRIAL BUILDINGS (NO PROCESS)	387	1040	1670

Costs of the renovation packages of industrial buildings

Conclusions:

With a 20-year perspective, reconstruction is economically feasible for industrial buildings. For industrial buildings, the latter solutions (insulating the building envelope in addition to renovating the technical building systems) are feasible based on the net present value as compared to the existing situation. Regardless of the economic feasibility, these packages require a very big initial investment. It can be stated that good market economy prerequisites exist for these buildings as regards the improvement of energy efficiency.

Necessity for further research

When interpreting the results of the survey, the methodology used and the objectives of the survey must be taken into consideration – the survey has ultimately been conducted in order to determine the unit costs of the energy efficiency measures of the building stock. The results of the survey indicate the levels at which the package solutions of energy efficiency measures are expedient for the analysed building types. In order to implement the package solutions in practice, they must be optimised beforehand; the technical standard solutions must be described with a sufficient level of detail, also taking into consideration the division of the building types by age in smaller increments.

Policy and measures to stimulate cost-effective deep renovations of buildings, including staged deep renovations

The objective of the national energy savings policy is to ensure the efficient usage of energy resources, the long-term accessibility thereof at optimal prices, and to mitigate the environmental damage and risks arising from the consumption of energy. Programmes for promoting the Estonian energy sector have been consistently implemented since the restoration of the independence of Estonia. The Energy Efficiency Division of the Energy Department of the Ministry of Economic Affairs and Communications is responsible for the implementation of the energy savings policy.

Measures to support implementation of the directive on energy performance of buildings:

Support scheme for reconstruction of apartment buildings

Supporting the reconstruction of apartment buildings is conducted pursuant to Regulation no. 52 ‘Conditions of and procedure for the usage of the Green Investment Scheme "Support for the reconstruction of apartment buildings"’ of the Minister of Economic Affairs and Communications.

This is an investment support that is granted to apartment associations, building associations and communities of apartment owners. The measures are mainly used to support the insulation of the building envelope, replacement of exterior windows and doors, replacement or reconstruction of the heating system, reconstruction of the ventilation system or the installation of a ventilation system with heat recovery, installation of equipment required for the usage of renewable energy, reconstruction of the control system or actuator of lifts, planning, project management and exercising owner supervision.

The support can be applied for in the extent of 15%, 25% and 35% of the total cost of the construction work depending on the level of complexity of the reconstruction of the apartment building and the estimated achievable energy savings.

As the support measure is mainly aimed at achieving better energy efficiency, only activities that have been set out as recommended work in the energy audit of the apartment building are supported within the framework of the measure and it is observed that the principle of a comprehensive solution has been observed upon the preparation of the energy audit.

In order to be granted support in the extent of 15%, an apartment building must comply with the following requirements upon reconstruction:

- comply with the requirements set out for the granting of the renovation loan and the recommendations of the energy audit and achieve energy savings on the consumption of thermal energy by at least 20% for an apartment building with a net covered area of less than 2,000 m^2 and energy savings of at least 30% for an apartment building with a net covered area of more than 2,000 m^2. The performance of the reconstruction work must result in the conformity of the interior climate of the building to Standard EVS-EN 15251 and compliance with energy performance class E (energy performance value <250 kWh/(m^2y));

In order to be granted support in the extent of 25%, an applicant must comply with the following requirements in addition to compliance with all the aforesaid conditions:

- achieve energy savings of at least 40% relating to the consumption of thermal energy resulting from the reconstruction of the apartment building. The performance of the reconstruction work must result in the conformity of the interior climate of the building to Standard EVS-EN 15251 and compliance with energy performance class D (energy performance value <200 kWh/(m^2y));
- reconstruct the heating system of the apartment building to be able to be regulated at least in an apartment-based system and install heat cost allocators for radiators or equipment that would allow for the division of energy consumption of heat by apartments. Thermostatic devices must be equipped with limiters that do not permit persons to intentionally lower the temperature in the apartment below 16 degrees.
- replace any windows that have not yet been replaced as of the initiation of the project for energy efficient windows whereas the total thermal conductivity of the installed windows will be U≤1.10 W/(m^2K) and, on a recommended basis, install the windows at the level of insulation or replace all the windows of the apartment buildings for windows with higher energy efficiency in advance. It is permitted to not replace the windows for new windows if the local government has not issued a permit for the replacement of the windows on grounds of protection of cultural property or protection of cultural and environmental value. In this case, the required energy efficiency rate must be ensured by means of renovation of the windows (e.g. replacing the window panes or the installation and thickening of insulated glass units) or other reconstruction work. It is permitted to not replace any windows that do not affect the energy consumption of the building.
- insulate and reconstruct the exterior walls of the apartment building in part or in full to achieve a thermal conductivity of U≤0.22 W/(m^2K) whereas the final thermal conductivity level depends on the required energy savings and the sought energy performance value. It is permitted to not insulate the facade or insulate the facade to a lesser degree if the local government has, with good reason, prohibited the additional insulation of exterior walls on grounds of protection of cultural property or protection of cultural and environmental value. In this case, the required energy efficiency rate must be ensured with other reconstruction work.
- insulate and reconstruct the roof of the apartment building to achieve a thermal conductivity of U≤0.15 W/(m^2K) whereas the final thickness of the insulation depends on the required energy savings and the sought energy performance value.

In order to be granted support in the extent of 35%, an applicant must comply with the following requirements in addition to compliance with all the aforesaid conditions:

- achieve energy savings of at least 50% on the consumption of thermal energy resulting from the reconstruction of the apartment building. The performance of the reconstruction work must result in the conformity of the interior climate of the building to Standard EVS-EN 15251 and compliance with energy performance class C (energy performance value <150 kWh/(m^2y));
- install a ventilation system with heat recovery in the apartment building to service all the residential rooms.

Upon determining the amount of the support, any reconstruction work performed before the entry into force of the Regulation referred to above will also be considered when calculating the energy efficiency rate on the condition that such reconstruction work allows for compliance with the energy savings requirements provided in the Regulation. Any performed work will be taken into consideration if an energy auditor verifies that the reconstruction work performed earlier allows for the achievement of the energy efficiency rate provided in the Regulation. The energy consumption of initial entry into service will be proceeded from when calculating energy savings.

Support for performance of energy audits and expert assessment of buildings and drawing up of building design documentation for apartment buildings

The support is granted to apartment associations, building associations and communities of apartment owners in order to aid the preparatory professional activities for the renovation of apartment buildings, thereby achieving the best result of the investment. The support is suitable for associations who wish to apply for support for the performance of energy audits and the drawing up of building design documentation required for the work to be performed on the basis of the recommendations of the energy audit. Energy audits and building design documentations required for the reconstruction work in compliance with the energy audit drawn up since 17.01.2008 are supported. The maximum rate of the support is 50% of the cost of the building design documentation or the energy audit. As of the moment of applying for the support, the document must be completed and paid for.

Programme: Renovation loan for apartment buildings

The soft loan developed within the framework of the Operational Programme for the Development of the Living Environment may receive applications from apartment associations, building associations and communities of apartment owners. The supported activities are the insulation of apartment buildings, reconstruction of utility systems (e.g. heating system and ventilation system), replacement of windows, etc. The soft loans are granted through AS Swedbank and AS SEB Pank and financed from the structural funds of the EU.

The long-term low interest rate renovation loan is suitable for apartment associations who wish to renovate their apartment buildings and thereby improve the energy efficiency of the buildings and improve the physical and social environment.

The renovation loan is aimed at the reconstruction of apartment buildings constructed before 1993 and improving the energy efficiency thereof. Apartment associations, building associations and communities of apartment owners with at least 3 apartments can apply for the renovation loan.

Ordinary bank loans have too short a repayment term and too high an interest rate for apartment buildings. The renovation loan allows for a more feasible interest rate and a longer repayment term for apartment buildings. When applying for the loan, the self-financing of the apartment building must be at least 15%. Other loans taken or support received for the reconstruction work are also considered to constitute self-financing for the comprehensive solution of the reconstruction work. The costs of the preparation of the projects of the comprehensive solution may be considered to constitute self-financing to the extent to which the support for the performance of energy audits and expert assessment of buildings and drawing up of building design documentation has not been granted.

The expected impact of the measure lies in the fact that the prerequisite of being granted a renovation loan under favourable conditions is an energy audit which provides the high-priority renovation work. Only the renovation work provided in the energy audit is financed with the loan.

The prerequisite of being granted the soft loan is the achievement of at least 20% energy savings in apartment buildings of up to 2,000 m^2 (net covered area) and at least 30% energy savings in apartment buildings bigger than 2,000 m^2. The loan period is up to 20 years.

In order to later assess the actual impact of the support measure, the conditions of the measure include an obligation pursuant to which an applicant for the loan will, after the performance of the work financed with the loan, communicate the energy consumption reports of the renovated building to the state during the next three years.

A programme for reconstruction of public sector buildings

The programme for the reconstruction of public sector buildings has been launched on the basis and in the course of the implementation of the Energy Efficiency Plan. One of the objectives of the national programmes and measures is to modernise existing public sector buildings or to construct new public sector buildings.

The programme for the reconstruction of public sector buildings constitutes investment support that can be applied for by state authorities and local governments. Implementation of the measure is managed by Riigi Kinnisvara AS. In the course of the programme, a total of 540 buildings with an aggregate usable area of 1.3 million m^2 have been reconstructed.

The selection criteria for the objects approved by the Government of the Republic of Estonia were as follows:

- CO_2 savings – the objects were divided into three groups (A, B and C) equal by volume pursuant to the expected CO_2 volume to be saved per investment. The criterion is in accordance with the objective of the emissions trading scheme to ensure the maximum possible CO_2 savings as the result of the investments. The final estimate of Riigi Kinnisvara AS (hereinafter RKAS) based on the data communicated by the local governments is used as regards the costs and CO_2 savings. The estimates are conservative and given on the basis of general indicators, taking into consideration the nature of the performed work and the CO_2 emissions of the energy used. Upon the calculation of CO_2 emissions, the specific CO_2 emissions created upon the burning of fuels depending on the type of fuel calculated by the Department of Electrical Engineering of the Faculty of Power Engineering of the Tallinn University of Technology were used. Utility line losses of 20% have been considered for district heating.

- The number of beneficiaries – educational and cultural objects were divided into three groups (A, B and C) equal by volume pursuant to the number of beneficiaries per investment. Various levels were used for educational objects, cultural objects and social objects. The objective of the criterion is to direct the resources to as many beneficiaries as possible and thereby ensure the maximum potential increase in the quality of the provision of public services. The data communicated by local governments was used as the basis for the number of beneficiaries. The estimates of RKAS were used as regards the costs.

- Regional limits – 50% was divided equally between 5 regions (NUTS III level pursuant to the Eurostat nomenclature of territorial units for statistics) and the basis for the division of the other 50% was the number of residents per region (result rounded to an integer). Based on the aforesaid, the calculated limits were as follows: Northern Estonia 30%, Southern Estonia 23%, Northeastern Estonia 16%, Western Estonia 16%, Central Estonia 15%.

- Ranking – the objects were ranked on the basis of the aforesaid criteria pursuant to the reductions in CO_2 emissions per invested financial resources.

If required, the criteria will be adjusted pursuant to the wishes or necessities of the buyer of emissions units. The sequence of groups of objects to be presented to the buyer grouped on the basis of the aforesaid criteria is as follows (no objects will be chosen from the subsequent group unless the objects of the previous group have been presented):

1) AA objects (A CO_2 savings, A beneficiaries);
2) BA objects (B CO_2 savings, A beneficiaries);
3) AB objects (A CO_2 savings, B beneficiaries);
4) BB objects (B CO_2 savings, B beneficiaries);
5) AC objects (A CO_2 savings, C beneficiaries);
6) BC objects (B CO_2 savings, C beneficiaries).

The later clarification of the total cost of eligible work in relation to the chosen object and the achieved CO_2 savings does not affect the choices made. Instances in which CO_2 savings cannot be achieved by performing the work within the limits of the estimated resources serve as exceptions to the aforesaid rule.

A forward-looking perspective to guide investment decisions of individuals, the construction industry and financial institutions

The courses of action to be put in place at national level for the upcoming period are set out in the Estonian Development Plan for the Energy Sector 2030+ (hereinafter "the Development Plan" or "ENMAK 2030+").
The part pertaining to buildings is covered in the section of the Development Plan entitled "Buildings Development Plan 2030+".
ENMAK 2030+ is a strategic source document for developing the housing sector over the next few years. It lays down the guidelines and principles for resolving individual matters in the field. The Development Plan was drafted jointly by the Ministry of Economic Affairs and Communications and the KredEx Fund (hereinafter "SA KredEx"). The objectives and measures set out in the Development Plan serve as a basis for planning state budget resources and funding from the structural instruments of the European Union and the Cohesion Fund for 2014-2020. A more detailed implementation plan will be prepared in accordance with the budget strategy.

The Buildings Development Plan included in the Estonian Development Plan for the Energy Sector 2030+ also covers the energy consumption of buildings. Activities aimed at energy savings in buildings are very important in the context of Estonia's national energy conservation policy. The Development Plan was put together on the basis of a strategic objective contained in the ‘Estonia 2020’ competitiveness plan, i.e. to ensure that total final energy consumption in Estonia, taking into consideration climatic differences from year to year, is not be higher in 2020 than in 2010. The Development Plan describes a possible route for achieving the objectives set out in Directives 2010/31/EU, 2012/27/EU and 2009/28/EC, the 2011 Energy Efficiency Plan of the European Commission (COM(2011) 109/4) and the ‘Estonia 2020’ plan, involving a study of improvements in energy efficiency in the most important consumption sector, i.e. buildings (particularly households).

The energy demand of buildings is a significant part of the Estonian energy balance. Reducing the energy consumption of buildings is the most efficient way of reducing final energy consumption. While wishing to achieve economic growth on the one hand and energy conservation on the other hand, energy conservation policy must focus chiefly on matters pertaining to the energy savings of buildings. In order to achieve the goals for 2020, energy savings of up to 3.5 PJ/y must be achieved in buildings by 2016. The lion's share of these savings should be achieved by reconstructing existing buildings. The amendments in the Building Act mainly affect new buildings and buildings to be substantially reconstructed.

The aim of the Development Plan was to shape a cost-effective and energy efficient lifespan of buildings, i.e. the planning, construction and usage of buildings with a healthy interior climate or the replacement or demolition of buildings in an energy efficient manner. The Development Plan covers energy demand and usage of buildings (particularly residential buildings), the application of energy efficiency requirements and differences in the living environments of low and high density areas, including the comprehensive spatial planning of public space. The main focus is the housing economy; where possible, the situation is also expressed in terms of the entire building stock.

On the basis of the sectoral description of the situation given in the Development Plan, the following main issues in the Estonian housing economy relating to energy efficiency have also been identified:

- High energy consumption of the existing building stock (the energy consumption of buildings in 2010 was 85 PJ, of which electricity consumption made up 25 PJ and thermal energy consumption, 60 PJ. Households have the highest rates – energy consumption in 2010 was 34.5 PJ whereas the required level in 2020 is 31.5 PJ. The energy consumption of the housing stock makes up approximately 40% of the entire energy balance);
- Interior climate of buildings, which needs to be improved;
- Absence of cooperative construction and uniform planning principles and the weak link between the current planning processes of various levels and the energy efficiency objectives.

High energy consumption of the housing stock. Average energy consumption in Estonia is higher per square metre than in other Member States of the European Union. In Estonia, the indicator is 220-250 kWh/m^2 whereas the indicator is below 150 kWh/m^2 in Finland and Sweden. The price of district heating in Estonia differs to a great extent, but given the ever increasing prices of energy carriers, housing expenses are too high with respect to wage levels. By reconstructing the housing stock, the heating needs of buildings can be reduced by up to 50%, thereby reducing the volume of imported fossil fuels and CO_2 emissions, improving the quality of the physical and social environment and decreasing maintenance costs.

The interior climate of buildings does not comply with standards. The interior climate consists of the physical (temperature, humidity, airflow speed and air cleanliness), chemical and biological parameters of the air. These must be suitable to enable people to healthily spend prolonged periods of time in the interior space in question and comply with the levels provided for in Standard EVS-EN 15251. Regrettably, the ventilation system as designed has been damaged due to independent and incorrect renovation techniques. As a result, the interior climate parameters are no longer healthy in many rooms, resulting in the deterioration of public health and a reduction of healthy life expectancy. People spend approximately 80% of the time indoors, which is why it is extremely important to ensure the modernisation of the heating and ventilation systems of buildings and the healthiness and environmental friendliness of the construction and finishing materials; this is to ensure that energy savings are not achieved at the expense of interior climate within the framework of ENMAK 2030+.

Absence of cooperative construction. Estonia has failed to tap into the potential that is widespread in Western European countries, i.e. mutual cooperation of the State, local governments and citizens in creating housing stock. In addition to the construction of housing, cooperative construction could also enable joint energy production based on renewable energy for the local supply of buildings with the required energy volumes. The promotion of cooperative construction and energy associations supports the principle of uniform planning of residential areas. Cooperative construction can also increase the proportion of renewable energy production.

The Development Plan also considers possible State intervention measures for problem resolution.

It was found that, given the issues of Estonian housing stock and the energy consumption of buildings and on the basis on the objectives of the EU climate and energy policies, ENMAK and the 'Estonia 2020' competitiveness action plan, the following measures can be implemented to reduce the energy consumption of buildings, including housing, and increase the efficiency of the living environment:

1. To reconstruct existing buildings to achieve energy savings and improve the interior climate:

- Supporting the reconstruction of apartment buildings
- Supporting the reconstruction of small residential buildings
- Supporting local renewable energy solutions

2. Promoting energy efficient new buildings

- Establishment of minimum energy efficiency requirements and making them stricter every five years
- Organising a procurement for ordering standard projects of nearly-zero energy buildings
- Supporting the construction of nearly-zero energy buildings
- Supporting local renewable energy solutions
- Creating the know-how required for the construction of low-energy buildings and raising the awareness related thereto
- Drafting legislation on cooperative construction (energy associations)
- Improving the efficiency of construction supervision

3. Improving the efficiency of land usage and planning

- *Ex ante* assessment of energy consumption and CO_2 impact in the planning process
- Introduction of amendments that allow for and favour increases in the density of the urban environment into the Planning Act and the implementing legislation thereof
- Implementation of infrastructure charges for valuing land with detailed plans and direction of construction

4. Exemplary role of the public sector

- Reconstruction of public sector buildings to become energy efficient to the extent of 3% per year
- Conducting pilot projects for near-zero energy buildings
- Promotion of and support for the creation of energy associations
- Creation of an energy efficient rental housing fund owned by the public sector
- Comprehensive spatial renovation of apartment building regions with the objective of improving the physical and social environment in the surroundings of the buildings

All the categories of measures provided above include the cross-cutting bringing into conformity of the legal environment in order to achieve the objectives (including the elaboration of guidelines; surveys and analyses, and monitoring of the measures), raising the awareness of society and supporting the organisation of training events to increase competence in the respective fields.

Various national action strategies (scenarios) have also been considered in the Development Plan.
Scenarios for shaping the building stock:

The technical potential for energy savings of the building stock is 9.3 TWh/y of heat and 0.2 TWh/y of electricity. The technical potential for energy savings in heat is therefore remarkable and equal to approximately 80% of the current heat usage of the building stock. There is essentially no potential for savings on electricity as controlling the interior climate (ventilation) and the usage of heat pumps replaces the savings on electricity to be achieved by means of insulation.
The input that affects the choice of the housing economy scenarios the most are the energy savings and improvement of the interior climate to be achieved by means of thorough renovation of the building stock and the energy savings on new buildings to be achieved mainly by means of the new regulations. Energy savings and improvement of the interior climate depend on how much of the building stock is reconstructed and at which levels, and also depend on how strict requirements are established for new buildings. Comprehensive renovation solutions have been chosen for the scenarios pursuant to the net present values calculated in the ENMAK building survey. The measures used in the scenarios allow for implementing the solutions in various volumes; therefore the energy savings and costs and possible gains (both direct and external impact) differ for each scenario. In addition to reconstruction and new buildings, energy savings are provided by plans if they allow reducing passenger car traffic, and by the exemplary role of the public sector by means of creating pilot projects and know-how for the usage of the correct and sustainable technical solutions. The scenarios contain a different necessity for the development of the legal environment and in addition to the aforesaid, additional measures for improving the living environment may be used as a supportive objective for energy savings.

Three very different scenarios were chosen, with substantially different methods and target levels as regards the objectives of EU climate and energy policies, ENMAK and the plan 'Estonia 2020':

1. The <u>non-interventional scenario</u> seeks a market economy-based improvement of energy efficiency and proceeds from the viewpoint that there are more important fields into which the resources of the state should be directed.
2. The <u>minimally interventional scenario</u> attempts to achieve the meeting of the objectives of ENMAK and the improvement of the socioeconomic and living environments by using the existing resources in the most economically efficient ways.
3. The <u>knowledge-based interventional scenario</u> invests and risks in order to receive economic gain from contributing to energy efficiency and pursues a high-quality living environment.

The first scenario includes the comprehensive renovation solutions with the smallest investments. The second and third scenarios include comprehensive renovation solutions that ensure a higher rate of energy savings, yet their net present value is either smaller than or equal to the net present value of the existing situation (where nothing is done). These solutions are economically feasible in terms of the net present value, but require significantly bigger investments; in case of housing, this would be implemented by means of state supporting measures. For non-residential buildings, a market economy-based reconstruction is expected (state contribution only lies in the elaboration of know-how) and conservative solutions have been chosen at reasonable costs. In the figure, the solutions of the first scenario correspond to the first dots on the left (smallest cost) on the scale of building types, and the options of the second and third scenarios are marked by circles. For old small residential buildings, the two circles indicate that in 50% of the instances, a solution with a geothermal heat pump has been considered and in the other 50% of the instances, a solution with a pellet boiler has been considered as it is not possible to install a geothermal heat pump, providing higher energy savings, on numerous plots or in numerous houses. The scenarios proceed from the main prerequisites of ENMAK concerning the building stock:

- Arising from the increased percentages in the construction of residential buildings and non-residential buildings, the volume of new buildings has been considered to be 1% and 1.5% per year, respectively (the same in all scenarios)
- The rate of reduction of the building stock has been considered to be 0.3% per year
- The base value of the energy use of new buildings has been calculated pursuant to the currently applicable minimum requirements (the same in all scenarios), from which energy savings are achieved with the implementation of nearly-zero energy requirements (different implementation in the scenarios)

Tax revenue has been considered to constitute 25% of the cost of the construction work (initial, subject to clarification).

Concerning the monetary energy savings and gains provided in the scenarios, it must be considered that the energy savings will be retained by the owner, i.e. it does not constitute public revenue except for public buildings, plus the increase in the value of real estate. Therefore, the aforesaid and other respective components must be viewed separately from tax revenue to be received by the state either in the same or in the following budgetary year after making a decision on the supporting measure (whereas the payment of the support will be effected after the performance of the work, i.e. essentially simultaneously with the receipt of tax revenue).

1. Non-interventional scenario

The current regulation remains valid; only requirements directly arising from EU directives pursuant to the directive minimum programme will be established and no other intervention by the state will take place. The non-interventional scenario essentially contains the continuation of a single measure, the support for apartment buildings introduced by SA KredEx, in the minimum volume pursuant to the requirements of the Energy Efficiency Directive. As the persons ordering the reconstruction of residential buildings are not professionals and the state has not contributed to the development of know-how in this scenario, many construction faults will occur; the cost thereof has been considered to be 20% of the cost of the procurement in every third procurement. For new buildings, it has been expected that the establishment of nearly-zero energy requirements will be delayed by 5 years, i.e. construction will continue pursuant to the minimum requirements for 15 years and pursuant to nearly-zero energy requirements for 5 years. The scenario results in small energy savings and also small tax revenue from reconstruction procurements. The energy savings to be achieved are not sufficient to decrease the energy usage of the building stock as the energy usage of the new buildings to be constructed is significantly higher than the savings. Therefore, in this scenario, the energy usage of the building stock continues to grow. The scenario is characterised by construction faults arising from the lack of developed know-how, and the economic damage caused by insufficient interior climate is especially notable since the ventilation issue of the building stock will remain unresolved in the majority of the buildings.

2. Minimally interventional scenario

In this scenario, attempts will be made to initiate the reconstruction of buildings so as to achieve the energy savings objective along with improving the housing conditions and increasing the lifespan of buildings. With support by the state, private capital will be involved in the reconstruction activities and by means of the elaboration of know-how and exercising supervision, the usage of the correct and sustainable technical solutions will be ensured both in reconstruction and for new buildings. Thanks to the considerable support (25%), it is possible to demand that extensive and comprehensive reconstruction solutions with high energy savings be used, generally resulting in achieving the energy performance class C, which corresponds to the minimum requirements of new buildings. In the case of the plans, it has been estimated that the detailed plans to be prepared will follow the established comprehensive plan; the impact of the measure is quantified in transport scenarios.

This scenario ensures a high level of energy savings and the state contribution and support will be returned to the full extent by means of tax revenue. As the buildings will be reconstructed with the correct and sustainable technical solutions, the value of real estate will increase considerably. Increasing the density of the urban environment with the help of planning will provide additional energy savings thanks to a decrease in passenger car traffic, which is quantified in the transport scenarios.

3. Knowledge-based (dedicated) scenario

The knowledge-based scenario includes a collection of almost all the possible measures with which the state is able to achieve the objectives of energy savings and improvement of the living environment to the maximum extent. The chosen measures and the volumes thereof are at the risk limit, taking into consideration the long-term economic feasibility. If contributing to energy efficiency in such a volume initiates the anticipated creation of jobs, economic growth and export, the contributed money will be returned to the state. The risk herein means approximately 40 million euros per year, which should be received by the state thanks to external impact in addition to direct tax revenue for the scenario to be economically feasible.

The impact of the described scenario on the field is also reflected in the indirect impact in addition to the direct costs and gains. As the result of the renovation work, domestic consumption in Estonia will increase and the economy will grow. The increasing demand for renovation work will increase employment. The increased employment and increase in real wages will increase domestic demand. In addition to improving employment in the construction sector, supporting the renovation of residential buildings will have an indirect impact on retaining jobs in other branches of the economy. The mapping of energy usage, preparation of high-quality building design documentation and increasing the competence of specialists will have an indirect impact on reducing the primary energy of the final consumers. The reconstruction of residential buildings will help increase the employment of energy auditors, designers, builders, persons exercising owner supervision and manufacturers and sellers of construction materials, and help increase the state budget revenue by means of value added tax and other tax revenue. The sector of new buildings and reconstruction with well-developed know-how will also mean a significant export potential as regards numerous construction materials, products and services, which in turn enlivens the economy. The installation of equipment for the usage of renewable energy sources with the help of the support will promote the increase of alternative energy producers and increase national energy security.

In addition to the Estonian Development Plan for the Energy Sector 2030+, future visions pertaining to buildings and housing development are also reflected in the following national strategic development documents: ‘Sustainable Estonia 21’, competiveness strategy ‘Estonia 2020’ and the National Plan ‘Estonia 2030+’.

Sustainable Estonia 21 (SE21) is a development strategy that provides the strategy for the development of the state and society until 2030 with the aim of joining the requirements for success arising from global competition with the principles of sustainable development and preserving the traditional Estonian values.

SE21 describes the global trends of which Estonia is currently a part of, as a country whereas the trends served as the basis for the preparation of the sustainable development strategy. The current main global trends are globalisation, valuing the local identity, population growth and ageing, continuation of the consumer society and ongoing polarisation. When analysing the Estonian housing sector development trends 2030+, we must take into consideration the global trends that undoubtedly affect the development of Estonia as a country and the development of our housing.

The **competitiveness strategy 'Estonia 2020'** is a source document that guides the development of Estonia and is directly related to the built environment. One of the sub-goals of the strategy is preserving the level of final consumption of energy in Estonia at the level of 2010. This is approximately 2,866 ktoe, i.e. a decrease in the final consumption of energy by approximately 11% compared to the level estimated for 2020. Proceeding from the strategy, the final consumption of energy in 2015 should not significantly exceed the current consumption and it should remain between 2,938-2,986 ktoe. Maintaining the final consumption of energy at the level of 2010 entails the limitation of energy consumption, improving energy efficiency and the elaboration of renewable energy solutions in all sectors. The second sub-goal emphasises the necessity to reduce the general resource and energy intensity of the economy.

The document proves that the current final energy consumption level in the sectors and the forecast for the following ten years indicate that the biggest growth and necessity for sectoral measures will be evident in industry, households and transport. In the next few years, attention must be paid to savings on electricity, motor fuel and other fuels in households. Investments in the energy savings of apartment buildings must be continued and the state measures for promoting the energy savings of private residences must be extended.

The **National Plan 'Estonia 2030+'** is another important document that shapes the trends and principles of the Estonian housing economy.

The new national plan was prepared thanks to the coordination of the Planning Department of the Ministry of the Interior on the basis of the principles of the currently valid Planning Act and also taking into consideration the principles of the new Planning Act. On 30 August 2012, the Government of the Republic enacted the National Plan 'Estonia 2030+' and the action programme for the implementation thereof.

The National Plan 'Estonia 2030+' is a strategic document aiming to achieve the expedient utilisation of space on the scale of Estonia as a whole. The national plan has been prepared for the entire territory of the state. It defines the policies and trends for sustainable and balanced national spatial development. The purpose of the plan is to obtain spatial bases, informed by the specific character of the environment, for shaping settlement, mobility, national engineering infrastructure and regional development. Estonia 2030+ covers the demographic processes related to the ageing of the population and urbanisation, the emission of greenhouse gases in relation to climate warming and finding an ecological balance between economic growth and energy savings. Significantly more attention has been paid to the energy sector as compared to the earlier plans and documents:

- Energy efficient solutions that increase the sustainability of society and reduce spending on energy and the environmental impact resulting from energy production. Energy conservation requires the conscious planning of settlements to be energy efficient, the systematic implementation of energy conservation measures in buildings, preference for public transport, etc.
- High potential for energy conservation is tied to increasing the energy efficiency of buildings, which will cut the need for thermal energy by 30-50% and decrease the demand for electricity by up to 20%. Requirements for the thermal resistance of buildings must be made stricter. More than earlier, resources need to be allocated to the development of low-energy or nearly-zero energy buildings. Even though Estonia has few energy intensive industries, the potential for energy conservation needs to be exploited in the manufacturing sector.

An evidence-based estimate of expected energy savings and wider benefits

Pursuant to the survey report prepared by the Development Fund, the technical energy savings potential of Estonian buildings is up to 80% of the current energy consumption of the building stock. The technical savings potential of thermal energy is thereat extremely big – 9.3 TWh/y whereas the savings potential of electricity is nearly non-existent – 0.2 TWh/y. The potential for savings on electricity is very small as controlling the interior climate (ventilation) and the usage of heat pumps replaces the savings on electricity to be achieved by means of insulation. The technical energy savings potential of buildings – approximately 10 TWh/y – amounts to nearly a third of the total final consumption of energy (33-34 TWh/y) in Estonia.

The report of the Development Fund has assessed the energy savings potential by various scenarios of ENMAK.

1. The non-interventional scenario seeks a market economy-based improvement of energy efficiency and proceeds from the viewpoint that there are more important fields into which the resources of the state should be directed.
2. The minimally interventional scenario attempts to achieve the meeting of the objectives of ENMAK and the improvement of the socioeconomic and living environments by using the existing resources in the most economically efficient ways.
3. The knowledge-based interventional scenario invests and risks in order to receive economic gain from contributing to energy efficiency and pursues a high-quality living environment.

Non-interventional scenario

The current regulation remains valid; only requirements directly arising from EU directives pursuant to the directive minimum programme will be established and no other intervention by the state will take place.

Scenario

Scenario	***Non-interventional (-1% 'savings', 52.1 million €/y, 670 man-years/y)***	***Cost, million €/y***	***Savings/gains, million €/y***	***Energy savings, GWh/y***
Objectives	Market economy-based improvement of energy efficiency, directing the resources of the state elsewhere and ensuring minimum compliance to the EU requirements			
List of measures and sub-activities	Implementation of measures			
Reconstruction of the existing building stock	15% of apartment buildings to be reconstructed in 20 years (level E), support for apartment buildings 15%	3.47	0.88	*8.53*
	10% of small residential buildings to be reconstructed in 20 years (marked economy-based, level E)	0	-0.41	*-2.88*
	10% of non-residential buildings to be reconstructed (marked economy-based, level D)	0	0.49	*3.37*
Energy efficient new building	Minimum requirements to be taken to the level of a nearly-zero energy building	0	0.80	8.90
Raising awareness	Organising training events for improving competence in the field	0.1	0	0
Direct tax revenue	Tax revenue from renovation procurements	0	13.99	0

External impact	Possible EU fines and sanctions; legal aid	0	-1.0	0
	Construction faults caused due to a lack of know-how	0	-3.20	0
	Savings to be achieved by controlling interior climate	0	1.85	0
	Impact of reduction and new buildings	0	0	-29.37
Result	**Costs and revenue related to the implementation of the scenario and energy savings**	**3.57**	**13.39**	**-11.5**

The scenario would bring about an increase of energy consumption of 1% in 20 years and reconstruction-related employment by 670 man-years per year. The overall cost without new buildings is 52.11 million €/y, of which the contribution of the private sector amounts to 48.54 million €/y and the contribution of the state amounts to 3.57 million €/y. The non-interventional scenario essentially contains the continuation of a single measure, the support for apartment buildings introduced by SA KredEx, in the minimum volume pursuant to the requirements of the Energy Efficiency Directive. 15% of the apartment building stock would be reconstructed in 20 years, meaning an annual support of 3.47 million € at a support percentage of 15%. The support for apartment buildings would provide energy savings of 8.53 GWh per year, resulting in a monetary value of 0.88 million € per year. Small residential buildings and non-residential buildings will also be renovated on a market economy basis to a small extent (10% in 20 years). The reconstruction of small residential buildings without the support of the state will lead to the exploitation of partially heated rooms and a slight increase in energy consumption. Minor energy savings would be gained in non-residential buildings. As the persons ordering the reconstruction of residential buildings are not professionals and the state has not contributed to the development of know-how in this scenario, many construction faults will occur; the cost thereof has been considered to be 20% of the cost of the procurement in every third procurement (3.20 million €/y). For new buildings, it has been expected that the construction of buildings that only meet the nearly-zero energy building requirements will be delayed by 5 years, i.e. construction will be conducted for 15 years pursuant to the established minimum requirements and for 5 years pursuant to the nearly-zero energy building requirements (as upon the implementation of the nearly-zero energy building requirements, the construction sector lacks the technical solutions and skills to construct buildings at a new technical level). The situation would become unavoidable and the state would only be able to delay the implementation of the requirements by 5 years in order to develop the respective technology and skills in cooperation with the construction sector during that period. Compared to the current construction pursuant to minimum requirements, even construction pursuant to the nearly-zero energy requirements delayed by 5 years would result in significant savings (8.90 GWh/y).
The scenario results in small energy savings and also small tax revenue from reconstruction procurements (13.99 million €/y). The energy savings to be achieved are not sufficient to decrease the energy usage of the building stock as the energy usage of the new buildings to be constructed is significantly higher than the savings. Therefore, in this scenario, the energy usage of the building stock continues to grow (25.2 GWh/y, indicated in the table as negative savings). The scenario is characterised by construction faults arising from the lack of developed know-how, and the economic damage caused by insufficient interior climate is especially notable since the ventilation issue of the building stock will remain unresolved in the majority of the buildings. In the scenario, the savings on the health care costs of 1.85 million €/y to be achieved by means of indoor climate control arise from new buildings with indoor climate control and the reduction of the building stock.

Minimally interventional scenario

In this scenario, attempts will be made to initiate the reconstruction of buildings such as to achieve the energy savings objective along with improving the housing conditions and increasing the lifespan of buildings.

With support from the state, private capital will be involved in the reconstruction activities and by means of the elaboration of know-how and exercising supervision, the usage of the correct and sustainable technical solutions will be ensured both in reconstruction and for new buildings. Thanks to the considerable support (25%), it is possible to demand that extensive and comprehensive reconstruction solutions with high energy savings be used, generally resulting in achieving the energy performance class C, which corresponds to the minimum requirements of new buildings. The levels D and C of small residential buildings provided in the table mean that in newer buildings, energy performance class D would be achieved (reconstruction to class C is not justified in a relatively new building) and a geothermal heat pump (C) would be installed in half of the older small residential buildings and a pellet boiler (D) in the other half. Thanks to state support, the energy savings to be achieved in residential buildings would be many times higher than in the first scenario.

As the exploitation of correct and sustainable technical solutions is generally successful, the value of the real estate of the renovated residential buildings will increase by €69/m^2, which at the reconstruction volumes of 1.5% and 1% per year of the scenario would amount to 53.46 million € per year. The marked economy-based renovation of non-residential buildings is 5% higher as the respective know-how has been elaborated with state support and the awareness of people has been raised. Thanks to the considerable reconstruction volumes, the tax revenue is three times higher than in the first scenario.

In new buildings, the nearly zero energy building requirements are implemented pursuant to the Directive and according to plan, resulting in a doubling of the achieved energy savings compared to the first scenario. This is possible as standard projects and the required know-how have been elaborated in advance and contributions have been made to make construction supervision stricter. Pilot projects involving the construction of public sector nearly-zero energy buildings are also of great help; this includes the support of training of specialists for the construction of nearly-zero energy buildings in the amount of 1.5 million €/y whereas the projects will be completed immediately before the implementation of the new requirements. As a result of the aforesaid, in this scenario, the construction sector is able to achieve a qualitative leap without any major setbacks. In case of the plans, it has been estimated that the detailed plans to be prepared will follow the established comprehensive plan (instead of amending the plan according to the needs of the owner); the impact of the measure is quantified in transport scenarios.

Scenario	*Minimally interventional; (8% savings, 171 million €/y, 2,150 man-years/y)*	*Cost, million €/y*	*Savings/gains, million €/y*	*Energy savings, GWh/y*
Objectives	Meeting the objectives of ENMAK and the improvement of the socioeconomic and living environments by using the existing resources in the most economically efficient ways			
List of measures and sub-activities	Implementation of measures			
Reconstruction of the existing building stock	30% of apartment buildings to be reconstructed in 20 years (level C), support for apartment buildings 25%	20.54	3.76	42.59
	20% of small residential buildings to be reconstructed in 20 years (levels D and C), support for small apartment buildings 25%	16.57	1.07	26.70
	15% of non-residential buildings to be reconstructed (marked economy-based, level C + know-how measure)	0	1.10	7.86
Energy efficient new building	Minimum requirements to be taken to the level of a nearly-zero energy building	0	1.59	17.79
	Ordering standard projects of nearly-zero energy buildings	0.3	0	0
	Creating the know-how required for the construction of nearly-zero energy buildings that are energy efficient and raising the awareness related thereto	0.5	0	0
	Making construction supervision stricter	0.4	0	0

Improving the efficiency of land usage and planning	Introduction of amendments that provide preference for more efficient transport and infrastructure solutions in the Planning Act and the implementing legislation thereof (quantified in transport scenarios)			
	Energy consumption and CO2 impact assessment of buildings and transport to be required upon the preparation of plans	0	0	0
Exemplary role of the public sector	3% of the central government buildings to be reconstructed (included in non-residential buildings)	0	0	0
	Pilot projects for the construction of public sector nearly-zero energy buildings	1.5	0	0
Development of the legal environment	Content and volume of the surveys and monitoring of measures required for modernising legislation	0.5	0	0
Raising awareness	Organising training events for improving competence in the field	0.2	0	0
Direct tax revenue	Tax revenue from renovation procurements	0	45.08	0
External impact	Increase in the value of real estate (+69 €/m2 in reconstructed residential buildings)	0	53.46	0
	Savings to be achieved by controlling interior climate	0	3.91	0
	Impact of reduction and new buildings			
Result	**Costs and revenue related to the implementation of the scenario and energy savings**	**40.51**	**109.97**	**65.6**

The scenario would result in energy savings of 8% in 20 years and reconstruction-related employment by 2,150 man-years per year. The overall cost without new buildings is 170.98 million €/y, of which the contribution of the private sector amounts to 130.46 million €/y and the contribution of the state amounts to 40.51 million €/y.

The public sector obligation to reconstruct 3% of the central government buildings pursuant to the minimum requirements will be performed by the local governments in this scenario. It is expected that the aforementioned buildings must be reconstructed in any case and the state need not provide support for this purpose. The monetary cost of the pilot projects, surveys and training activities is provided in the table, but the impact thereof in terms of energy savings and other possible revenue has not been separately indicated as the savings and revenue are contained in the activities of reconstruction and construction of new buildings. This means that the pilot projects, surveys and training must be interpreted as the facilitators of activities of reconstruction and the construction of new buildings as without contributing to know-how, achieving the above savings would not be possible. The savings on the health care costs of the state to be achieved by means of indoor climate control arise in this scenario from indoor climate control in both reconstructed buildings and new buildings and the amount is therefore over two times higher than in the first scenario.

The minimally interventional scenario ensures a high level of energy savings (51.8 GWh/y) and the state contribution and support (40.51 million €/y) will be returned to the full extent by means of direct tax revenue (45.08 million €/y). As the buildings will be reconstructed with the correct and sustainable technical solutions, the value of real estate will increase considerably and the total revenue of the scenario without the impact of plans is approximately 110 million €/y. Increasing the density of the urban environment with the help of plans will provide additional energy savings thanks to a decrease in passenger car traffic, which is quantified in the transport scenarios.

Knowledge-based (dedicated) scenario

The knowledge-based scenario includes a collection of almost all the possible measures with which the state is able to achieve the objectives of energy savings and improvement of the living environment to the maximum extent. The chosen measures and the volumes thereof are at the risk limit, taking into consideration the long-term economic feasibility. If contributing to energy efficiency in such a volume initiates the anticipated creation of jobs, economic growth and export, the contributed money will be returned to the state. The risk herein means approximately 40 million euros per year, which should be received by the state thanks to external impact in addition to direct tax revenue for the scenario to be economically feasible.

Scenario	*Knowledge-based interventional (18% savings, 354 million €/y, 4,240 man-years/y)*	*Cost, million €/y*	*Savings/gains, million €/y*	*Energy savings, GWh/y*
Objectives	Economic gains by contributing to energy efficiency, investment and risks, a high-level socioeconomic and living environment			
List of measures and sub-activities	Implementation of measures			
Reconstruction of the existing building stock	50% of apartment buildings to be reconstructed in 20 years (level C), support for apartment buildings 35%	47.93	6.27	70.99
	40% of small residential buildings to be reconstructed in 20 years (levels D and C), support for small apartment buildings 35%	46.40	2.15	53.41
	20% of non-residential buildings to be reconstructed (marked economy-based, level C + know-how measure)	0	1.46	10.49
	Support for the demolition of abandoned apartment buildings	2	0	0
	40% of schoolhouses and nursery schools to be reconstructed in 20 years, support 35%	6.0	0.36	6.17
Energy efficient new building	Accelerated implementation of nearly-zero energy building requirements	0	2.39	26.69
	Support for the construction of nearly-zero energy buildings	5.0	0	0
	Elaboration of legislation for energy associations for the production of local renewable energy	0.5	0	0
	Ordering standard projects of nearly-zero energy buildings	0.3	0	0
	Creating the know-how required for the construction of nearly-zero energy buildings that are energy efficient and raising the awareness related thereto	0.5	0	0
	Making construction supervision stricter	0.6	0	0
Improving the efficiency of land usage and planning	Introduction of amendments that provide preference for more efficient transport and infrastructure solutions in the Planning Act and the implementing legislation thereof (quantified in transport scenarios)			
	Implementation of infrastructure charges (€100/m2, 30% of buildings) for valuing land with detailed plans and direction of construction	0	23.12	0
	Energy consumption and CO2 impact assessment of buildings and transport to be required upon the preparation of plans	0	0	0
Exemplary role of the public sector	3% of the central government buildings to be reconstructed (25% support)	2.64	0.28	3.79
	Green labels and green public procurements (environmental impact as a quality criterion)	0	0	0
	Pilot projects for the construction of public sector nearly-zero energy buildings	4.0	0	0
	Creation of a rental housing fund owned by the public, allocation of the resources of pension funds in the foundation (100 apartments per year)	4.8	0	0

	Comprehensive spatial organisation of apartment building regions	4.0	0	0
	Supporting the preservation of building heritage on areas of cultural and environmental value	0.2	0	0
Development of the legal environment	Content and volume of the surveys and monitoring of measures required for modernising legislation	1.0	0	0
Raising awareness	Organising training events for improving competence in the field	0.3	0	0
Direct tax revenue	Tax revenue from renovation procurements	0	88.95	0
External impact	Increase in the value of real estate (+€93/m2 in reconstructed residential buildings)	0	128.18	0
	Savings to be achieved by controlling interior climate	0	5.33	0
	Impact of reduction and new buildings	0	0	-29.37
Result	**Costs and revenue related to the implementation of the scenario and energy savings**	**126.17**	**258.48**	**142.2**

The scenario would result in energy savings of 18% in 20 years and reconstruction-related employment by 4,240 man-years per year. The overall cost without new buildings is 353.85 million €/y, of which the contribution of the private sector amounts to 227.68 million €/y and the contribution of the state amounts to 126.17 million €/y.

In the knowledge-based scenario, reconstruction is performed at the same level as in the minimally interventional scenario, but in a bigger volume. Even more attention is paid to creating the know-how and raising the awareness. The support, volumes and energy savings are therefore bigger. Additional reconstruction activities include support for the demolition of abandoned apartment buildings and support for schoolhouses and nursery schools. For new buildings, the additional cost of the first nearly zero energy buildings is partially compensated in order to initiate the construction thereof rapidly. Legislation for energy associations will be elaborated for the flexible production of renewable energy by nearly-zero energy buildings, allowing developers to invest and link a nearby renewable energy production facility with a building and use this as evidence for proving the nearly-zero energy requirements. Upon the guidance of land use and planning, measures will be taken to enable more efficient transport and infrastructure solutions, resulting in a slight reduction of passenger car traffic and a decrease in the investments in the construction of infrastructure. The savings on the construction of infrastructure has not been quantified. In this scenario, the public sector takes the exemplary role. The state supports the local governments with the aim of reconstructing central government buildings and a foundation will be created to construct energy efficient and economic rental apartments for the open market with the resources of pension funds. The scenario also pays heed to areas of cultural and environmental value and the spatial organisation of apartment building regions. The measure of organisation of apartment building regions includes state support of 2 million €/y (25%), local government participation of 2 million €/y (25%) and the contribution of applicants (50%).

Long-term results of the scenarios

The energy savings of the scenarios have been indicated as the savings percentage to be achieved in 20 years (2030 in this case) of the initial situation (2010 in this case). In the first scenario, the energy consumption of the building stock increases by 1% while in the second and third scenarios the energy consumption decreases by 8% and 18%, respectively. The unit cost of energy savings has been calculated on the basis of the total energy savings and budgetary cost. The employment in the scenarios has been calculated as the direct employment of reconstruction procurements, which depending on the scenario ranges between 670-4,240 man-years of work per year. Indirect employment will accompany the direct employment, and also indirect tax revenue in the construction materials industry, planning, supervision, etc.; this has not been quantified. As an approximate evaluation, one job at the construction site will create 0.5-1 jobs in the industry, services and commerce, i.e. the actual employment is approximately 1.5-2 times higher compared to the direct employment numbers provided in the table.

The consolidated data of the electricity and heat consumption of buildings, energy savings, investments and state support in 2030 and, provided that the same process continues, in 2050, is provided in the table below.

Expected results, 2030	S1 Non-interventional	S2 Minimally interventional	S3 Knowledge-based
Electricity and heat consumption of buildings			
Heat consumption, TWh/y	11.7	10.3	8.9
Electricity consumption, TWh/y	5.0	5.0	4.9
Electricity and heat consumption of buildings/maintenance costs1			
Savings on heat consumption (for owners of buildings), million €/y	29.9	188.4	345.8
Savings on electricity consumption (for owners of buildings), million €/y	-110.4	-96.3	-76.4
Savings on maintenance costs of buildings, million €/y	1.5	3.1	5.5
Investments/support2			
Reconstruction (investment), million €/y	48.5	130.5	227.7
Energy efficient new building (investment), million €/y	953.0	953.0	953.0
Support paid (total state support), million €/y	3.6	40.5	126.2
Tax revenues from reconstruction procurements, million €/y	14.3	46.1	90.9
Expected results, 2050	**Scenario 1**	**Scenario 2**	**Scenario 3**
Electricity and heat consumption of buildings			
Heat consumption, TWh/y	11.2	8.5	5.9
Electricity consumption, TWh/y	5.2	5.2	5.1
Electricity and heat consumption of buildings/maintenance costs1			
Savings on heat consumption (for owners of buildings), million €/y	134.2	575.5	1013.0
Savings on electricity consumption (for owners of buildings), million €/y	-287.4	-271.7	-235.1
Savings on maintenance costs of buildings, million €/y	3.1	6.2	11.0
Investments/support2			
Reconstruction (investment), million €/y	48.5	130.5	227.7
Energy efficient new building (investment), million €/y	953.0	953.0	953.0
Support paid (total state support), million €/y	3.6	40.5	126.2
Tax revenues from reconstruction procurements, million €/y	14.3	46.1	90.9

[1] The energy savings have been calculated for 2010 and the increase in the price of energy has been taken into consideration

[2] Changes in prices have not been taken into consideration; all prices are at 2010 levels and include value added tax

Summary

The Ministry of Economic Affairs and Communications will submit the Estonian Development Plan for the Energy Sector 2030+ along with its recommendations for the operational programme to be approved by the Government of the Republic in November 2014. Thereafter, a choice will be made between the described strategies by means of a political decision-making process. When making the choice, it will be considered in which ways the economic capacity of the state could be used most expediently for achieving the desired environmental impact.

After making the decisions on principles, the further measures with which the cost-effective renovation of buildings is promoted will be clarified along with the extent of the implementation of the measures deemed to be necessary for the realisation of the energy savings potential that is established as the objective.

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