CONCERTED ACTION
ENERGY PERFORMANCE OF BUILDINGS

EPBD implementation in **Estonia**

Status in December 2016

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NATIONAL WEBSITES

www.mkm.ee/en/objectives-activities/construction-and-housing-sector, www.kredex.ee/energy-efficiency

1. Introduction

In Estonia, the implementation of the EPBD is the overall responsibility of the Ministry of Economic Affairs and Communications. Improving the energy efficiency of buildings has been one of the priorities of the governmental energy and housing policy in Estonia. The amendments of the Building Act[1], which transposed the main elements of Directive 2002/91/EC, came into force in October 2006. However, the regulations transposing all the EPBD requirements were finalised in January 2009[2], and the main regulations[3], in compliance with Directive 2010/31/EU, came into force in January 2013. The Ministry of Economic Affairs and Communications plans to adopt even more strict energy performance requirements in 2018. Before the EPBD requirements, there were no specific legal obligations, e.g., thermal transmittance values, or requirements for technical building systems.

In 2015, a new renovation grant scheme[4] started for apartment buildings. During 2015 – 2018, a total of 102 million € will be used to renovate existing apartment buildings in Estonia.

This report presents an overview of the current status of implementing and improving the EPBD in Estonia. It addresses certification, minimum requirements and inspection systems as well as quality control mechanisms, training of qualified experts, information campaigns, etc.

2. Current Status of Implementation of the EPBD

2.I. Energy performance requirements: NEW BUILDINGS

The minimum energy performance requirements are expressed as a primary energy performance indicator calculated for the building according to its standardised use, and applied to the building as a whole. Data for standardised use include a description of occupants, small power equipment and lighting usage profiles, operation times as well as indoor climate requirements. The energy performance calculation takes into account the energy needs for space heating, domestic hot water, cooling, lighting, ventilation, and electrical appliances. The minimum energy performance value characterises the primary energy use of the building; in other words, the delivered energy is multiplied by the primary energy factors (Table 1) of the energy carriers, and the exported energy multiplied by the same factors can be deducted (Figure 1).

Renewable energy (wood, biofuel)	0.75
District heating	0.9
Electricity	2.0
Fossil fuels (oil, gas, coal)	1.0

Table 1. Primary energy factors.

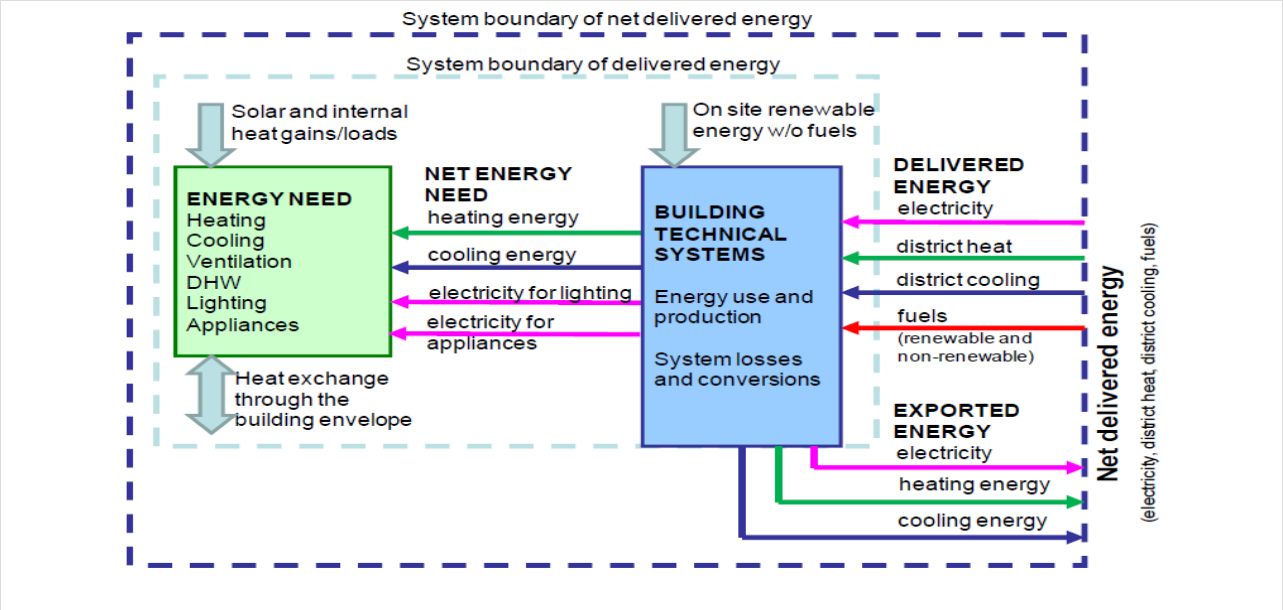

Figure 1. System boundary of minimum energy performance requirements.

Compliance with the minimum energy performance requirements must be proven through an energy calculation of the building, using the prescribed methodology. The calculated energy performance value must not exceed the maximum energy performance value set by legislation. Energy calculations for non-residential buildings must be executed by use of a dynamic energy simulation. For residential buildings, the monthly methodology is also accepted. All the input data, including requirements for the calculation tool, are specified in the Act of Minimum Requirements[5].

2.I.i. Progress and current status of new buildings

The minimum energy performance requirements are expressed as a primary energy performance indicator. The maximum primary energy values are listed in Table 2. Estonia has not set minimum requirements for U-values. The building has to meet the minimum energy performance requirements as a whole.

For detached and terraced houses, compliance with the minimum energy performance requirements can also be demonstrated by a simplified calculation of the specific heat loss through the building envelope. This method requires only envelope heat transfer coefficients (U) to be subjected to heat loss calculations for conduction and infiltration losses, and can be used if a mechanical supply and exhaust ventilation system with specified heat recovery and specific fan power is used. Depending on the heat source, specific heat loss values are set, so that they comply with minimum energy performance requirements. With this method, no further energy calculation is required. For example, the maximum specific heat loss value to be fulfilled in the case of a ground source heat pump serving as the heat source is 1.0 W/(m^2.K), and in the case of a gas boiler, it is 0.6 W/(m^2.K). It is important to note that these values are not U-values, but specific conduction (average U-value of building envelope including thermal bridges) and infiltration heat loss values calculated per heated floor area.

No.	Building type	Energy performance requirements (kWh/m^2)
1	Detached houses	160
2	Apartment buildings	150
3	Office buildings and libraries	160
4	Commercial buildings	210
5	Public buildings	200
6	Shopping malls and terminals	230
7	Schools, universities	160
8	Kindergartens	190
9	Hospitals and other medical buildings	38
Energy services included in energy performance requirements are shown in Figure 1.		

Table 2. Primary energy requirements for new buildings.

Requirements are also set for summer thermal comfort in buildings. For residential buildings, this requirement is defined as the hourly mean indoor temperature in excess of the maximum limit of 150 degree-hours (ºCh) over +27°C during the summertime period (from 1 June to 31 August). For compliance assessment, detailed procedures are described in regulation “Methodology for calculating the energy performance of buildings”[6]. Temperature calculations are needed for typical living rooms and bedrooms that are most likely to encounter overheating. The verification is to be conducted considering rooms as single zones, and by using dynamic simulation software.

2.I.ii. Format of national transposition and implementation of existing regulations

The energy performance requirements for new buildings and major renovations of existing buildings are regulated by three acts:

- The “Minimum Energy Performance Requirements”[7] Act. This act applies for new buildings and buildings undergoing major renovations, and includes the main requirements, e.g., maximum allowable primary energy consumption, general recommendations and requirements for building envelope elements and technical building systems, and requirements for energy calculation tools. General recommendations include a thermal comfort-based U-value recommendation (0.5 W/(m^2.K), a building leakage rate recommendation (q_{50} < 1.0 m^3/(h.m^2)) and some requirements for technical building systems, e.g, for mechanical ventilation and some individual metering requirements. In addition to these, there are no specific component-based requirements for new buildings and for buildings undergoing major renovations. Numeric energy performance requirements are set only for the building's primary energy consumption. Some recommendations for building envelope elements and technical building systems are given in the regulation, to be used as initial values in the design in order to help the designer achieve the requirements for primary energy consumption, while clearly stating that the final values depend on design solutions and exact values for these solutions. Besides that, the regulation gives the definition and primary energy performance value for low-energy buildings and NZEB. This act also includes primary energy factors of different energy carriers.

- The ”Calculation Methodology for Building Energy Performance Calculations” Act[8]. This act includes all the necessary information about the calculation of the energy performance, e.g., efficiencies of heating and ventilation systems, infiltration airflows, tabulated values of thermal bridges and standardised patterns of use of the nine (9) different building types and other energy calculation input data, as well as detailed calculation formulas and guidelines for energy calculations. Basically, this act provides guidance on how to run dynamic energy simulation that results in energy needs as well as calculation rules and methods from energy needs to energy usage for delivered, exported and primary energy.

- The “Requirements for Technical Building Systems” Act[9]. This act applies for buildings where smaller, rather than major, renovations will be performed. It specifies system performance requirements for building service systems that will be installed or replaced (heating, domestic hot water, ventilation, cooling and lighting).

2.I.iii. Action plan for progression to NZEB for new buildings

The current energy performance legislation includes the definition of low-energy buildings, NZEB and net zero- energy buildings. A low-energy building is a building that is characterised by sound engineering solutions, considering the current best practices without the on-site renewable electricity production, and meets the set primary energy performance requirements (Table 3). A NZEB is a building that is characterised by sound engineering solutions, considering the current best practices, on-site energy production by RES (the share of energy by RES is not fixed) and meets the set primary energy performance requirements (Table 3). The regulation defines also a net zero-energy building, for all building types, as a building whose primary energy performance indicator is 0 kWh/m^2.year. Delivered energy may be imported to a net zero-energy building if this is offset by energy fed into energy networks. Requirements for the NZEB and net zero-energy building are fully based on the primary energy indicator. There are no component-based requirements.

No.	Building type	NZEB	Low-energy building
1	Detached houses	50	120
2	Apartment buildings	100	120
3	Office buildings and libraries	100	130
4	Commercial buildings	130	160
5	Public buildings	120	150
6	Shopping malls and terminals	130	160
7	Schools, universities	90	120
8	Kindergartens	100	140
9	Hospitals and other medical buildings	270	300
Energy services included in energy performance requirements are shown in Figure 1			

Table 3. Energy performance requirements, (kWh/m^2).

The final update of the NZEB requirements will be issued in 2018. After 31 December 2018, all new public buildings should be NZEB, and after 31 December 2020, all new buildings must be NZEB.

2.I.iv. Requirements for systems and / or building components for new buildings

Estonia has not set minimum requirements for systems and / or building components for new buildings.

2.II. Energy performance requirements: EXISTING BUILDINGS

Primary energy requirements apply to renovations that fall under the definition of “major renovations”'. As major renovations are defined any renovations involving more than 25% of the construction cost of a similar new building.

For renovations not falling under the definition of major, no minimum requirements for building envelope elements apply. Only the requirements set for technical building systems (i.e., when a system is replaced or a new system is installed), and the performance requirements for these systems (for heating, domestic hot water, cooling, ventilation and lighting systems) must be followed (see chapter II.iii.).

2.II.i. Progress and current status of existing buildings

The minimum energy performance requirements are expressed as a primary energy performance indicator calculated for the building according to its standardised use, and applied to the building as a whole. The maximum primary energy values are listed in Table 4.

Estonia has not set minimum requirements for U-values. The building has to meet the minimum energy performance requirements as a whole.

No.	Building type	Energy performance requirements (kWh/m^2)
1	Detached houses	210
2	Apartment buildings	180
3	Office buildings and libraries	210
4	Commercial buildings	270
5	Public buildings	250
6	Shopping malls and terminals	280
7	Schools, universities	200
8	Kindergartens	240
9	Hospitals and other medical buildings	460
Energy services included in energy performance requirements are shown in Figure 1		

Table 4. Primary energy requirements for existing buildings.

2.II.ii. Plans to improve the existing building stock

Estonia has not set a separate definition for NZEB for existing buildings. At the moment, there are no national plans for renovating the existing building stock towards NZEB standards. Renovation of residential buildings is mainly guided through renovation grants that require major renovation or achievement of new building energy efficiency levels.

2.II.iii. Regulation of system performance, distinct from whole building performance

The “Requirements for Technical Building Systems” Act specifies system performance requirements for building service systems that will be installed or replaced when a renovation meets the major renovation requirements. Performance requirements are set for installing or replacing the heating and the hot water system's heat source, cooling systems, AC and ventilation systems, and air-handling units.

For the heating and hot water systems, the requirement is that the heat source's primary energy efficiency (the efficiency or performance coefficient of the heat source divided by the primary energy factor of the energy carrier) must be at least 0.8.

For the cooling system, the performance requirement is that the AC to be installed must have a SEER[10] of at least 5.1.

For the ventilation system, the requirement is that the performance efficiency of the heat recovery must be at least 70%. If the ventilation system requires the use of a liquid-coupled heat exchanger, then the efficiency of the heat recovery must be at least 50%. Specific fan power of the air-handling unit may not exceed 2.5 $kW/(m^3/s)$.

2.II.iv. Encouragement of intelligent metering

In new buildings or existing buildings undergoing major renovations with more than one owners, metering equipment must be installed in the heating system to determine the use of heating energy in the different parts of the building. Intelligent metering does not factor in the energy efficiency calculations or requirements.

2.II.v. Financial instruments and incentives for existing buildings

Financial grants are available for renovation of apartment buildings and detached houses. Grant schemes are managed by *Fund KredEx*.

Existing apartment buildings fall usually into EPC Classes F or G (Figure 2).

A 15% grant can be given when, after the completion of a minor renovation work, EPC Class E will be achieved (Primary Energy (PE) ≤ 220 kWh/(m^2.year). A 25% grant can be given when, after the completion of a major renovation work, EPC Class D will be achieved (PE ≤ 180 kWh/(m^2.year)), and finally, a 40% grant can be given when EPC Class C will be achieved (PE ≤ 150 kWh/(m^2.year).

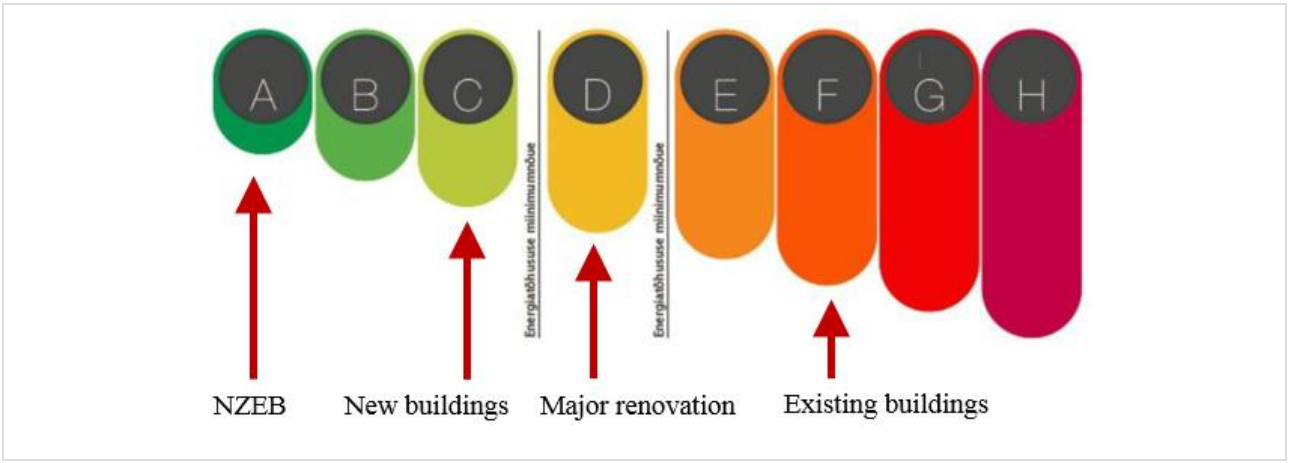

Figure 2. EPC classes for apartment buildings.

For detached houses, a 30% grant can be applied when energy efficiency renovation is performed. In that case, achievement of prescribed EPC Class is not required.

2.II.vi. Information campaigns / complementary policies

Public awareness for energy efficiency and energy certification systems is at a quite good level in the case of renting or buying buildings. People generally ask for the EPC, and the building law states that, in the case where a buyer or tenant enquires about the EPC, the seller has to provide it.

Fund KredEx and the Ministry of Economic Affairs and Communications, together with the *Tartu* Regional Energy Agency organise a national energy week once a year. *Fund KredEx* has also carried out several other information campaigns, mostly targeted at apartment buildings, as their share is roughly 70% of the total

residential building stock. These campaigns have been organised on an annual basis to inform tenants of apartment buildings about energy saving measures and the potential magnitude of the savings, in order to give expert advice and to inform them about support provided by the state (subsidy programmes). Several methods have been used in these campaigns. Information has been distributed through TV, radio, print media, internet, street advertisements, training courses for persons responsible for building maintenance, etc. As a result of these campaigns, energy saving activities have taken off and renovation grants have become very popular among apartment associations and detached house owners.

The Estonian Technical Surveillance Authority is responsible for an information campaign about the requirement to add information about the EPC to the property rental or sale advertisement.

Figure 3. Information campaign on adding information about the EPC to the property rental or sale advertisement.

2.III. Energy performance certificate requirements

2.III.i. Progress and current status on sale or rental of buildings and EPCs

Estonia has one central public building register, named “Register of Construction Works”[11], through which experts issue EPCs. All the EPCs issued, including related data, calculations and other information available, are compiled into this database, which is publicly available to all citizens.

2.III.ii. Quality Assurance of EPCs

The Estonian Technical Regulatory Authority makes random checks on EPCs and deals with complaints. This authority has the power to impose penalties for deviations from the building act. A total of ten (10) EPCs for existing buildings were checked in 2013, the launch year for the EPC central database and the new regulations. In 2014, the number of EPCs checked rose to 115. In 2015 and 2016, the number of EPCs checked rose to 120 each year. Out of the ones inspected, 10-15 EPCs each year contained different types of small mistakes (i.e., mistakes in the calculation of degree days or weighting factor, etc.). The energy auditors who issued these EPCs were informed of the shortcomings by letter and, as a result, all the mistakes have been corrected. So far, all the shortcomings are corrected by letter and no precept or penalty payment have been applied. In case the mistakes are not corrected, it is also possible to apply penalty payment up to 64,000 € for a company, or 6,400 € for individuals, until the shortcomings are corrected.

EPCs for new buildings are checked before issuing a building permit, and form the basis of evaluation as to whether or not a building meets the minimum energy performance requirements. The building permits are issued by the local government authority. This is why EPCs for new buildings are submitted to the local government authority for inspection. A building permit is given only in the case that the energy performance requirements are met.

2.III.iii. Progress and current status of EPCs on public and large buildings visited by the public

Current legislation requires an EPC for every public building used by the government that has a floor area larger than 250 m^2. The EPC must be placed in a location visible to visitors.

In 2015, the Technical Regulatory Authority focused on central government buildings, so that by the end of 2015, 90% of them, where required (exceptions are in place for, e.g., historical buildings, etc.) had an EPC.

In the period 2016-2017, the Technical Regulatory Authority has been focusing on local government buildings. By the end of 2016, all local governments were reminded of the certification obligation. Almost 1/3 of local governments have already complied, whereas 2/3 of them plan to comply with the EPC requirements by the end of 2017. The Technical Regulatory Authority's goal is that, by the end of 2017, 80% of local government buildings will have EPCs placed where it is required.

After the central and local governments' buildings have EPCs, the focus will be on private sector public buildings, starting in 2018.

2.III.iv. Implementation of mandatory advertising requirement – status

Current regulations require an EPC for renting and/or selling of buildings, since January 2013. The National Building Act also requires advertisements to include at least the building energy class and the primary energy consumption per heated area. The compliance rate for advertisements has risen from 3% in 2013, to 10% by the end of 2014.

In the period 2015-2016, the Technical Regulatory Authority worked intensely to increase the information provided on EPCs in the real estate sector. With information provided directly to different stakeholders

(real estate agents and companies, real estate sales portals) and seminars, the compliance rate for advertisements has risen from 3% in 2013 to 58% by end of 2016.

2.IV. Inspection requirements – heating systems, air conditioning

Estonia has adopted the alternative approach (model B) instead of mandatory inspections for heating and AC systems.

The role of on-site heat generation in water-based heating systems is significantly lower than the heat supply from district heating. At the same time, the data of on-site heat generation devices that are being used, or even data of companies that are selling and installing the devices, was incomplete and unreliable, as it has not been recorded systematically. With these restrictions in place, it was obvious that at the time of the inspection scheme's scheduled implementation, the requirement would be difficult to enforce. Therefore, for boilers, Estonia adopted option B of Article 14 of the EPBD. Instead of implementing the inspection scheme, three specific measures were developed:

- Requirements were set in legislation for conducting energy audits of residential buildings. Energy audits have been conducted voluntarily, but at the same time, conducting an audit is one of the reconstruction activities subsidised by *KredEx* as part of the reconstruction grant. *KredEx* has also had different versions of grants in place for small residential houses, for the renewal of the heating system.
- The building act includes a requirement for boiler sellers to provide advice on energy demand to consumers whenever a new boiler is installed or an existing boiler is replaced. Provision of advice on energy demand may include an on-site inspection of the system. If such an inspection is carried out, the inspection report should include information on options for boiler replacement, on other modifications to the heating systems as well as on alternative solutions that would enable the energy-efficient operation of the system.
- In order to gain a better overview of the heating devices that are being used, the boiler must be registered when it is sold, and its rated output, efficiency and type of fuel must be recorded. The selling company must register the boiler in the National Building Register if its output is higher than 20 kW.

2.IV.i. Progress and current status on AC systems

The use of AC systems is not widespread in buildings, due to the prevailing cold climate in Estonia. In cases where an AC system is installed, it usually concerns small devices (heat pumps) with a rated output lower than 12 kW. Larger systems are usually installed in new buildings that must fulfil the minimum energy performance requirements according to the current regulations. The Estonian Building Act establishes similar rules for AC systems as those for boilers, when their rated power is above 12 kW.

3. A success story in EPBD implementation

A new grant scheme, managed by *Fund KredEx*[12], started in 2015 to renovate existing apartment buildings, and is strongly linked to the EPC system. A 15% grant can be applied when EPC Class E (minor renovation) will be achieved after the completion of renovation works. A 25% grant can be applied when EPC Class D (major renovation), and a 40% grant can be applied when EPC Class C (energy efficiency requirement for new apartment buildings) will be achieved after the completion of renovation works. In addition to the EPC class, requirements are also in place for thermal transmittance in the building envelope, the heating system, and the ventilation system. Requirements for the thermal transmittance levels are shown in Table 5. Fulfilling the thermal transmittance requirements for external walls usually means the creation of an insulation layer that is 150-200 mm thick. Fulfilling the thermal transmittance requirements for the roof usually means 300-400 mm of insulation layer. The 40% grant also has a requirement for the window and external wall thermal bridge. Windows must be moved into the insulation layer or insulate the window jamb with an insulation layer that is at least 50 mm thick. The requirements for windows are only for those windows that are going to be replaced. A 15% renovation grant does not come with any additional requirements for the building envelope. A heating energy reduction of at least 20% is required.

Renovation grant share levels	15%	25%	40%
Thermal transmittance of external walls, W/(m^2·K)	-	0.25	0.22
Thermal transmittance of the roof, W/(m^2K)	-	0.15	0.11
Thermal transmittance of windows, W/(m^2K)	-	1.1	1.1
Linear thermal bridge in connection of window and external wall, W/(mK)	-	-	0.05

Table 5. Requirements for thermal transmittance in the building envelope.

The heating system has only two requirements: the system must be balanced, and radiators have to be equipped with thermostats in order to allow room-based indoor temperature control.

Special attention was paid to the requirements regarding the ventilation system. The 15% and the 25% grant have the following requirements for the new / improved ventilation system:

- continuous ventilation (for each apartment) 0.5 1/h;
- supply air flow rates 10 l/s in bedrooms, with sound levels that are no more than 25 dB(A);
- extract air flow rates at least 10 l/s in the WC, 15 l/s in the bathroom, and 8 l/s in the kitchen.

The 40% grant generally has the same requirements, with one principle addition: the requirement of a mechanical supply and exhaust ventilation with heat recovery. An exhaust ventilation system with an exhaust air heat pump for heat recovery was previously used in standard renovation work practices. A new solution for renovation in Estonia is a central air-handling unit with ventilation ducts inside the facade insulation layer.

The process of renovation can be divided into three steps:

1. Preparation:
   - an energy audit and an EPC for the building;
   - a renovation work decision being taken by the apartment association - with a simple majority of 50% +1 in a general assembly meeting;
   - a qualified technical consultant for steering the process;
   - a designer for the developed buildings design (including the calculated EPC);
   - a building permit;
   - an estimation of the renovation cost;
   - a preliminary credit decision from the bank.
2. Grant application:
   - the grant application;
   - a review of developed design documents by third party experts;
   - a revision of improved developed design documentation, if required;
   - a funding decision if all requirements are met;
   - tendering with contractors (consisting of at least three tenders);
   - a credit decision from the bank.
3. Renovation work:
   - construction;
   - commissioning protocols for ventilation rates and the heating system;
   - loan payments;
   - grant payments in two parts;
   - an EPC based on measured use after one year in operation.

Approximately 400 apartment buildings will be renovated with the help of the new grant scheme by the end of 2018. Grant applications and calculated energy performance certificates show that over 90% of those renovations should meet the energy efficiency requirements of new apartment buildings. On average, over 60% of the heating energy use is reduced after the renovation.

The execution of the renovation work grant schemes in Estonia has shown that extensive integrated renovation is possible in situations in which buildings are managed by apartment associations, where apartment owners have to agree on the extent and budget of the renovation work. New innovative solutions can be implemented and it seems that apartment owners are willing to invest in order to renovate their apartment and building. Financial support keeps the cost of renovation work to an acceptable level. The grant scheme also allows requirements to be set out for the measures involved in any renovation work, thus promoting extensive integrated renovation work.

4. Conclusions, future plans

The EPBD, Directive 2010/31/EU, has already been fully transposed into national legislation in Estonia. Updated requirements and new acts came into force in January 2013. Estonia will continue conducting information campaigns and seminars to improve the level of knowledge of building owners, designers, architects as well as specialists working in the municipalities. The next update of the energy performance requirements started in 2016, and will provide the final update before the main NZEB objective in 2018-2019.

Endnotes

1. www.riigiteataja.ee/akt/12742131
2. www.riigiteataja.ee/akt/12903585
3. www.riigiteataja.ee/akt/105092012004, https://www.riigiteataja.ee/akt/118102012001
4. www.riigiteataja.ee/akt/113042017004
5. www.riigiteataja.ee/akt/128022017002
6. www.riigiteataja.ee/akt/109062015021
7. www.riigiteataja.ee/akt/128022017002
8. www.riigiteataja.ee/akt/109062015021
9. www.riigiteataja.ee/akt/109112012012
10. SEER – Seasonal Energy Efficiency Ratio (net energy need for cooling / electricity used for cooling)
11. www.ehr.ee
12. http://kredex.ee/en/apartment-association/

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