Title of the measure:	***LV 10*** ***Low Energy Buildings*** *(Zema enerģijas patēriņa ēkas)*

General description

The described measure is included in the Latvia's 2nd NEEAP for years 2011-2013 [1] for the tertiary sector (however it was not specified (in Table 16, page 58) the amount of energy savings to be reached). The importance of development of low energy building is particularly underlined by Report (2014) regarding the progress towards the indicative national energy efficiency targets in 2014-2016 according to Directive 2012/27/EU [2].

The energy end-use sector – buildings. The objective of the measure – reduction of CO_2 emissions by low energy consumption building. The measure had been co-financed by the national Climate Change Financial Instrument (CCFI) and had demonstration value, the projects had been implemented up to the 1st November 2013. The continuation of the measure in Tertiary sector in years 2015-2016 had been co-financed by the EEA Financial Mechanism for years 2009-2014 [3]

Climate Change Financial Instrument Programme "Low Energy Buildings" (2011-2013)

Latvia, due to active participation in the GHG emissions trading mechanism, has the revenues from the sale of GHG emissions under procedures pursuant to Article 17 of the UNFCCC Kyoto Protocol. Part of these revenues had been allocated as the national CCFI programme for CO_2 emissions reduction by both

(i) existing buildings' (older than 10 years) reconstruction to reach low energy consumption, and

(ii) construction of new buildings corresponding low energy consumption criteria.

The measure had been implemented by the open tender announced in year 2011 [4]. Responsible ministry - the Ministry of Environmental Protection and Regional Development (MEPRD), the responsible institution supervising implementation – state ltd. company "Environmental Investment Fund" (*valsts sabiedrība ar ierobežotu atbildību "Vides investīciju fonds")* [5].

The applications within the open tender "*Low Energy Consumption Buildings"* [4] in the Tertiary/Business sector might be submitted by (i) state administration institutions (both direct and mediates ones), (ii) municipalities and (iii) registered in Latvia micro, small and medium business entities[1]. Financial support was available for the following 9 groups of buildings:

1. offices and bureaus buildings (both new building and reconstruction, applicants – state administration institutions, municipalities, business entities),
2. retail sales buildings (reconstruction, applicants- business entities),
3. industry sector buildings (reconstruction, applicants – business entities),
4. museums (both new building and reconstruction, applicants – state administration institutions and municipalities),
5. kindergartners (both new building and reconstruction, applicants – state administration institutions, municipalities, business entities)
6. schools (reconstruction, applicants – state administration institutions and municipalities),
7. sport buildings (both new building and reconstruction, applicants – state administration institutions, municipalities, business entities)
8. stations, terminals and buildings of communications' function (both new building and reconstruction, applicants – state administration institutions, municipalities, business entities),
9. hotels (reconstruction, applicants – business entities).

[1] According the conditions defined in Annex 1 of the EC Regulation Nr.800/2008; business entities under the Article 1.7 of the given Regulation were not eligible.

The building must be the property of the project applicant, the land – the applicant's property or in the possession on the long-term basis (at least 5 years after project completion). The applicant must state that at least 5 years after project completion the function of the building will not be changed.

The following threshold criteria regarding tangible results – energy consumption and CO_2 emissions reduction – were stated for the implemented projects within the framework of the noted tender:

1) the threshold for reduction of CO_2 emissions in relation to the requested financing provided by CCFI - not less than 250 g CO_2/EUR per year for applicants - business entities, and not less than 180 g CO_2/EUR per year for applicants - state administration institutions and municipalities, the threshold should be fulfilled in buildings undergoing reconstruction,
2) the threshold of annual heat energy consumption for heating - 35 kWh/m^2 [Art.11 of [4]).
3) the total primary energy consumption (summing up heating, hot water supply and electric energy consumption) should not exceed 150 kWh/m2 per year [Annex 2 of [4])

The thresholds for technical parameters for low energy buildings are presented in the Table 2 below.

Implemented projects

It had been built 2 new buildings and renovated 6 buildings according low energy consumption criteria. From these buildings five ones are public buildings and three ones – tertiary business sector buildings. The expected output indicator for level of heat energy consumption assessed for those 8 buildings as result of implementation of energy saving technologies does not exceed 15 kWh/m2/year [7].

Financing.

The total costs of all 8 implemented projects constitute 8.565 MEUR, ***the CCFI programme co-financing – 4.139 MEUR[2].*** The CCFI programme co-financing for public buildings had constituted 2.745 MEUR, for business sector buildings 1.394 MEUR [10].

Maximum financing available from CCFI for 1 project was ~ 1067 thousand EUR.

The project's financial support rate was defined up to 65% from the total eligible costs for micro and small business entities, 55% - for medium size business entities, 80% - for state administration institutions and municipalities. For business entities the amount of available financial support was based on the conditions defined by the EC Regulation Nr.800/2008. The state administration institutions and municipalities must not use the buildings under construction for commercial activities except certain cases (museums, stations, terminals, buildings of communications' function) when the conditions of the EC Regulation Nr.800/2008 are applied.

The project's financing by CCFI was based on the principle of additionality, namely, to implement the project the beneficiary had not received a co-financing within the framework of other financial programmes, from other financial instruments, European Union or foreign financial assistance resources for the eligible costs co-financed by the CCFI.

The costs of the following project activities might be supported within the framework of the tender:

- the costs of the energy audit (for buildings under reconstruction), the costs of preparation of the technical design, construction supervision costs, consultations in relation to the issue (these "soft" costs should not exceed in total 10% of eligible costs of the project, business entities' costs related to consultations were covered up to 50%),
- the costs of construction works for new low energy consumption building,
- the costs of renovation works if they ensured reduction in consumption of heat energy, for existing buildings,
- the costs of heat supply switch from fossil to renewable resources, installation of renewable energy based heat supply system (wood pellets or chips, solar heat, heat pumps) for buildings under renovation (for new buildings the costs of heating system installation were not eligible),
- the costs of building's energy certification (not applicable for business entities).

[2] In addition, the administrative costs, evaluated for the whole CCFI, constitutes around 2.3% of the finances paid to beneficiaries [15]

For new buildings the eligible costs were defined as the difference between the costs of low energy consumption building and the costs of „standard" building (the „standard" building was stated as the building fulfilling the minimal requirements defined by the Latvia Building Standard [6]). Furthermore, the eligible costs were defined depending on the level of heat energy consumption for heating to be reached as a result of project implementation, see the following Table 1.

Similarly, if heat supply switch from fossil to renewable resources was done, the eligible costs were defined as the difference between the costs of renewable and fossil fuels based technologies. The specific eligible maximum level of financial support, provided by CCFI, per 1 kW_{th} for installation of different renewables based heating technologies were determined (Annex 4, [4]). The eligible costs which exceed the defined maximal level had to be covered by the project beneficiary. According the article 23.3 of the EC Regulation Nr.800/2008, the applicants - business entities should submit the costs calculation comparing the costs of installation of new fossil fuel based heating system (calculated without any environment related financial support) and of renewables based heating system.

To submit the application, an energy audit should be performed for existing buildings (for new building – energy consumption calculation) by certified energy auditor; the building should had a technical design in respect of the activities included in the project application, detailed specification of technological equipment and devices to be installed had to be added as well. The principles of green purchase should be applied for the technical design of the building and construction works. After the completion of the project the beneficiary should place publicly available visual information demonstrating the achieved results and energy certificate for the building

Table 1. The maximal eligible costs of renovation and new building (VAT not included) (Art.26 of [4])

Heat energy consumption per year	Maximal eligible costs, EUR / 1m2 heated	
	New building	Reconstruction of existing building
less 15 kWh/m2	1422.87	426.86
15 – 25 kWh/m2	1209.44	355.72
25 - 35 kWh/m2	1067.15	284.57
Note: If during the existing building's reconstruction new boundary constructions were built, for these ones the eligible costs defined for new building were applicable.		

Table 2. Technical requirements for low energy consumption buildings in the projects approved within the framework of the tender "*Low Energy Consumption Buildings"* (Annex 2 of [4]).

	Heat penetrability coefficient U, W/m^2K			Ventilation system	Air penetrability coefficient for boundaries, air escape n_{50} (h^{-1})
Heat energy consumption per year	Windows	Roofs and ceilings	Other boundaries		
below 15 kWh/m2	not above 0.8; triple	not above 0.2	not above 0.3	recuperation, η□= 75% at least, electricity consumption not above ' 04 Wh/m^3h	0.6
up to 25 kWh/m2					1 (dwellings) 1.2 (public buildings.)
25 – 35 kWh/m2	not above 1, improved double (if windows are not reconstructed - 1.8),		not above 0.4		1.2 (dwellings) 1.8 (public buildings)

The criteria applied for projects' quality evaluation are presented in the following Table 3.

Table 3. Layout of projects' quality evaluation criteria (Annex 8 of [4]).

	Maximum available Points	Percentage in relation to maximum score
maximum available score	65	
1. Expected heat energy consumption for heating after implementation, *threshold level – 35 kWh/m^2 annually; 15 kWh/m2 to be reached to receive the maximal score (25 points)*	25	38%
2. Reduction of CO_2 emissions in relation to the requested financing provided by CCFI (kg CO2/1EUR), applicable for reconstruction of existing buildings only *Projects are ranged, the project with the highest CO_2 specific reduction value receives 5 points, the project with the 5th CO_2 reduction value – 1 point*	5	8%
3. Existing heat energy consumption for heating, kWh/m2 per year, applicable for reconstruction of existing buildings only *Maximal score (5 points) if not above than 120 kWh/m2; 1 point if not above 180 kWh/m2*	5	8%
4. Expected heat energy consumption for heating, kWh/m2 annually, applicable for new building only *Projects are ranged, the project with the highest energy efficiency receives 10 points, the project with the 5th energy efficiency value - 1 point*	10	15%
5. Expected heat energy consumption for heating, kWh/m2 annually, *additional points for the 1st best (10 points) and for the 2nd best (5 points) projects within each group of buildings*	10	15%
6. Project's total eligible costs, EUR/m2, *additional points for the 1st lowest costs (10 points) and for the 2nd lowest costs (5 points) projects within each of 3 classes of buildings' annual heat energy consumption (below 15 kWh/m2, 15-25 kWh/m2 and 25-35 kWh/m2), evaluated separately for new buildings and buildings under reconstruction*	10	15%

Beneficiary Responsibility. A beneficiary is responsible for achievement of results, including reduction of CO_2 emissions, specified in the project application and project contract. Beneficiary each year shall submit project results' monitoring report. If after completion of the project the responsible institution supervising implementation determines that the planned reduction of CO_2 emissions per year specified in the project application has not been achieved in comparison with the average reduction indicated in the monitoring report submitted by the beneficiary regarding the first and second year of life of the building, as well as the stated in the application level of heat energy consumption is not reached, the responsible institution shall calculate the scope of non-conformity. A beneficiary shall submit the plan for elimination of non-conformity, the responsible institution, if necessary, provide the appropriate recommendations. A beneficiary shall implement the plan, using his own resources, within a time period of one year. If the responsible institution determines repeatedly that the planned reduction of CO_2 emissions per year specified in the project application still has not been achieved, as well as specified heat energy consumption per year (kWh/m2) is not reached regarding the third and fourth year of life of the building, the responsible authority has the right to take a decision regarding recognition of resources of the CCFI disbursed for the project as ineligible and commence recovery of them. In order to determine the amount of ineligible resources to be recovered the average heat energy consumption for heating for the third and fourth years shall be divided by the heat energy consumption for heating specified in the project application.

Method of Calculation of Reduction of CO_2 Emissions.

In the given tender the calculation of CO_2 emission savings was applied for the projects of renovation of existing buildings only.

According [4], ***the CO_2 saving, which is achieved due to reduction of heat energy consumption*** of buildings, is determined pursuant to the CO_2 emission average factor – 264 g/kWh. This average emission factor is calculated pursuant to the total emissions in Latvia in the energy conversion sector (boiler houses and combined heat-power units), which are applied against the final consumption of the district heating energy – the average value during the time period from 2000 until 2007 – by correcting the indicator value by the amount of heating fuel used in CHP units and which has been consumed for the generation of electricity, i.e. not taking into account the CO_2 emissions that have occurred during electricity generation process. The average emission factor shall be applied to buildings which are heated using biomass (for example, wood, chipped wood, granules) or which are connected to the district heating system, in which the biomass is used for the heat production. If autonomous heating of a particular building is ensured by a heating fuel with a higher emission factor than the average value of emission factor specified, a project applicant may use the CO_2 emission factor of the relevant heating fuel. If heating of particular building is ensured by district heating, the CO_2 emission factor provided by district heating operator may be used, in this case heat losses in district heating network are accounted as well.

The ***CO_2 saving, which is achieved due to reduction of electric energy consumption,*** is determined pursuant to the specific CO_2 emission factor for electricity production and transmission - 0,397 t CO_2 /MWh - this coefficient is determined as the emission factor of the last marginal power production unit, including transmission and distribution losses, which may be replaced by renewable technologies.
When calculating CO_2 saving, which is achieved due to heat supply switch from fossil fuel to heat pumps, the electricity consumption of heat pumps is taken into account by applying the above specific CO_2 emission factor.

EEA Financial Mechanism for years 2009-2014 programme "National Climate Policy" (2015-2016)

Within the open tender [9] of the EEA Financial Mechanism programme "National Climate Policy" it was allocated 3 MEUR as co-financing for demonstration projects of low energy buildings. The project's applicants might be public institutions, registered in Latvia NGOs or foundations, and registered in Latvia business institutions. The implementation of the projects should be done up to 30 April 2016. The financial support was available for following 4 groups of buildings (both construction of new building or reconstruction of existing one):

- buildings of schools, of higher education institutions and of research institutions,
- buildings used by culture sector institutions for large scale public events,
- buildings of museums and libraries,
- buildings of sport sector.

The construction of 5 low-energy buildings had been approved within the tender [11, 18][3]. It is expected, the output indicator for level of heat energy consumption assessed for those 5 buildings as result of implementation of energy saving technologies will not exceed 14.6 kWh/m2/year [13, 14].

[3] 3 of low energy buildings are sports halls aimed at improving sports infrastructure, 1 building is the business support center – library aimed at demonstrating energy efficient passive house from environmentally friendly CO_2 neutral materials as a solution for municipality buildings and improving business environment, 1 building is the science and technology museum aimed at expanding operation of the museum of science and technology by constructing a low energy building, as well as implementing and demonstrating to the greater public the principles of using renewable sources of energy. Average planned emission savings calculated (t/CO2/year) – from 300 to 500; [13].

Financing.

The total ex-ante EEA financial support is ~ 4.454 MEUR (total *ex-ante* eligible costs of the projects constitute 7.397 MEUR). The EEA co-financing for one project are within the range 0.665 MEUR – 1 MEUR.

The project's financial support rate was defined up to 65% from the total eligible costs for micro and small business entities, 55% - for medium size business entities, 45% - for large business entities, 85% - for public administration institutions , 90% - for NGO and foundations. For business entities the amount of available financial support was based on the conditions defined by the EC Regulation Nr.800/2008, articles 21 & 23.

The requirements for EEA support in general were in common line with the requirements defined by CCFI programme, described above. The land and building must be the beneficiary's property or in the possession for the period of at least 5 years after completion of the project. Similarly to CCFI support, the eligible costs could not be financed by other programme of EEA Financial Mechanism or other financial programmes. The supported activities within the project were defined similarly to CCFI programme [4], in addition the costs of installation of electricity production micro-technologies (solar PV, wind) were stated eligible as well (Art.22&26 of [9]). In common with CCFI programme, for new buildings the eligible costs were defined as the difference between the costs of low energy consumption building and the costs of „standard" building fulfilling the minimal requirements defined by the Latvia Building Standard [6]. The same applied for energy production technologies (the eligible costs were defined as the difference between the costs of renewable and fossil fuels technologies, Annex 1 of [9]). The maximum eligible costs, calculated per 1 heated m2, was the same as in CCFI programme, see Table 4 below.

The following threshold criteria regarding tangible results – energy consumption and CO_2 emissions reduction – were stated for the implemented projects within the framework of the noted tender:

(1) the threshold for reduction of CO_2 emissions in relation to the requested financing provided by EEA - not less than 280 g CO_2/EUR per year for applicants - business entities, and not less than 210 g CO_2/EUR per year for applicants –public institutions, this threshold should be fulfilled in buildings undergoing reconstruction,

(2) the threshold of annual heat energy consumption for heating - 25 kWh/m^2 [Art.80 of [9]).

(3) the total primary energy consumption (summing up heating, hot water supply and electric energy consumption) should not exceed 150 kWh/m2 per year [Annex 4 of [9]).

The Technical requirements for low energy consumption buildings were defined the same as for the CCFI programme, see the Table 2 above.

Table 4. The maximal eligible costs of renovation and new building (VAT not included) (Art.31 of [9])

Heat energy consumption per year	Maximal eligible costs, EUR / 1m2 heated	
	New building	Reconstruction of existing building
less 15 kWh/m2	1400	420
15 – 25 kWh/m2	1200	350

Table 5. Layout of projects' quality evaluation criteria (Annex 6 of [9]).

	Maximum available Points
maximum available score	30
1. Expected heat energy consumption for heating after implementation, *threshold level – 25 kWh/m^2 annually;* *15 kWh/m2 to be reached to receive the maximal score (5 points)*	5
2. Reduction of CO_2 emissions in relation to the requested financing provided by	5

EEA Financial Mechanism (kgCO2/1EUR), applicable for reconstruction of existing buildings only *Projects are ranged, the project with the highest CO_2 specific reduction value receives 5 points, the project with the 2nd CO_2 reduction value – 3 points, the project with the 3rd CO_2 reduction value – 1 point.*	
3. Existing heat energy consumption for heating, kWh/m2 per year, applicable for reconstruction of existing buildings only *Maximal score (5 points) if not above than 120 kWh/m2; 1 point if not above 180 kWh/m2*	5
4. Expected heat energy consumption for heating, kWh/m2 annually, applicable for new building only *Projects are ranged, the project with the highest energy efficiency receives 10 points, the project with the 2nd value – 7 points, the project with the 3rd CO_2 reduction value – 5 points, other projects – 0 points.*	10
5. Expected heat energy consumption for heating, kWh/m2 annually, *additional points for the 1st best (3 points) and for the 2nd best (1 point) projects within each group of buildings (new buildings and reconstructed buildings)*	3
6. The project includes the partner from Norway, Iceland or Liechtenstein	1
7. The project has already done necessary public procurement procedure	1
8. Use of renewable technologies *the project will implement at least 3 different renewable energy production technologies – 3 points, at least 1 technology – 3 points, no technologies – 0 points*	5
9.Sustainable building: the project will implement 9.1. individual regulation of indoor climate 9.2.energy consuming indoor lighting 9.3. individual energy consumption metering for consumers 9.4. at least 4 containers for separate collection of waste 9.5. bicycle stand	 1 1 1 1 1

Impact evaluation (methods and results)

The method of impact evaluation – "bottom-up", based on the data provided by the contracted projects.

The CCFI programme "Low Energy Buildings" (2011-2013)

The CCFI 2017 Monitoring Report [21] indicates 1637 tons of CO2 savings reached:

(1) in renovated buildings (6 projects) – 1610 tons (contracted savings constitute 1426 tons annually [10], one can see monitored savings are per ~13% higher than contracted savings),

(2) in new buildings (2 projects) – 27 tons (contracting of CO2 savings did not apply for new buildings)

If all these CO_2 savings are attributed to heat energy savings, one can calculate 6.2 GWh (0.022 PJ) heat energy savings. In practice, final energy savings are somewhat lower, due to the part of CO_2 savings relate to savings in electricity consumption (having higher specific CO_2 savings per 1 MWh) as well as new renewable energy production.

Energy Savings evaluated by bottom-up method

The evaluation of savings by bottom-up method is presented in Latvia 2018 " Report on the progress made in 2016 towards implementing national energy efficiency targets for the year 2020 pursuant to Article 24(1) and Section 1 of Annex XIV to Directive 2012/27/EU" [20]. Table 6 (page 16) indicates in 2015 final energy savings of 5 GWh (0.018 PJ).

The EEA Financial Mechanism Programme "National Climate Policy" (2015-2016)

Evaluation of CO_2 savings is presented in [18, page 11]. According to baseline level of energy consumption, average heat consumption in Latvia was 195 kWh/m2 per year. If heat supply and hot water

is ensured to the building by using central heating system, the national CO2 emission from average educational institution building is 51,48 kgCO2/m2 per year, whereas low energy building with average heat consumption 15 kWh/m2 per year - only 3.96 kgCO2/m2 per year. Emissions factor (kgCO2/kWh) was determined in accordance with the regulatory enactment on energy efficiency calculation method of the building. Total heating space of 5 open call buildings is 5860 m2. It was calculated that a typical (or average) CO2 emission from such buildings' space is 301,67 t/CO_2/year, but from low energy building with average heat consumption 15 kWh/m2 - emission is 23.21 t/CO_2/year. Thus, annual emission saving of **278.47 CO2** tons is calculated.

Thus, assuming energy efficiency improvement of 195 kWh/m2- 15 kWh/m2 = 180 kWh/m2 /year, it might be calculated 180 kWh/1m2 * 5860 m2 = 1.055 GWh (0.004 PJ) annual energy savings.

Contracted level of energy consumption assessed for buildings as result of implementation of energy saving technologies is lower than 15 kWh/m2/year. Project promoters will submit monitoring reports about the first service year of the building in year 2018, and the actual energy consumption for heating (kWh/m2 per year) will be measured [18].

Total Both programmes

Thus the CO_2 savings after implementation of the both programmes, in year 2017, constitute 1.915 thsd tons annually.

The energy savings, both programmes, constitute 7.25 GWh (0.026 PJ) in 2017.

The actual final energy consumption in Latvia tertiary sector (commercial and public, in total) in years 2010-2015 varied in the range 23.45-26.1 PJ (average ~ 25 PJ) [16]. Thus the impact of the measure is around 0.1% and semi-quantitative impact might be attributed as low..

Interaction of measures

The given measure has the value of technical demonstration regarding the implementation of new building standards. It is introduced by the new Governmental Regulations [12] six (A-F) energy efficiency classes of non-residential buildings, see the Latvian Tertiary sector measure of MURE database TER-LV15 "Energy Certification of Non-Residential Buildings".

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