Annex No. 1
Cabinet of Ministers
Regulations No._____
_____________, 2010

Calculation of Reduction of Carbon Dioxide Emission

1. Carbon dioxide (hereinafter – CO_2) emission reduction is characterised by the relation between CO_2 emission saving, which is achieved by implementation of the project, and energy produced during a year using renewable energy resources.

2. The following emission factors shall be used in the calculations of CO_2 emission reduction:

2.1. CO_2 emission saving, which is achieved in heat production by transition from technologies using fossil energy resources to technologies using renewable energy resources, shall be determined in compliance to CO_2 emission factor – 0.264 tCO_2/MWh (hereinafter – average emission factor);

2.2. CO_2 emission saving, which is achieved by replacing electricity generated from fossil energy resources by electricity generated from renewable energy resources in a power grid, shall be determined in compliance to CO_2 emission facto – 0.397 tCO_2/MWh, which characterises CO_2 reduction by replacing the last marginal electricity generation unit based upon fossil energy resources and transmitted generated electricity to the end consumer in a power grid.

3. The average emission factor represents the average extent of CO_2 emitted in the atmosphere in order to produce 1 MWh of thermal energy. The average emission factor is calculated pursuant to the total emissions in Latvia within the conversion sector (boiler houses and cogeneration units), which are applied against the final consumption of the centralised thermal 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 the cogeneration units and which has been consumed for the generation of electricity, i.e. not taking into consideration the CO_2 emissions that have occurred during electricity generation process.

4. If centralised heat supply and hot water for a building is provided by a heating fuel with a higher emission factor than the average value of emission factor specified, the emission factor, which is set by the operator of the heating network may be used, applying the fuel emission factors in compliance to Table 1 of this Annex and network losses. The applicant shall prove application of this emission factor based upon documents. The actual emissions shall be calculated by applying the following formulae:

$$E = E_{CO_2} \times Q_{pat}\text{, where}$$

E – CO_2 emission reduction per year (tCO_2/year);

E_{CO2} – average emission factor – 0,264 (tCO_2/MWh) – or emission factor determined in compliance to Table 1 of this Annex;

Q_{pat} – consumed thermal energy volume (MWh/year). The average index of last five years shall be calculated.

5. If heat supply and hot water for a building is provided by an autonomous heating system or replacement of thermal energy production technology by transition from technologies using fossil energy resources to technologies using renewable energy resources is performed by the district heating system operator, the project applicant shall use the CO_2 emission factor of the relevant fuel in compliance to Table 1 of this Annex. The actual emissions shall be calculated by applying the following formulae:

$$E = E_{CO2} \times \frac{Q_{sar}}{\eta}\text{, where}$$

E – CO_2 emission reduction per year (tCO_2/year);

E_{CO2} – CO_2 emission factor (tCO_2/MWh) in compliance to Table 1 of this Annex;

Q – produced thermal energy (MWh/year). The average index of last five years shall be calculated;

η – efficiency rate of the combustion equipment to be replaced (boiler house), which is equal to 0.9, if natural gas or diesel fuel is used, and equal to 0.85 if other types of fuel are used. The project applicant may use a lower value of efficiency rate if it is proven by documents.

6. CO_2 emission reduction, which is achieved by producing thermal energy be means of heat pumps, shall be calculated by applying the following formulae:

$$E = E_{CO2siltumsuknis} \times Q\text{, where}$$

E – CO_2 emission reduction per year (tCO_2/gadā);

$E_{CO2siltumsuknis}$ – CO_2 emission factor for heat pumps (tCO_2/MWh);

Q – planned thermal energy amount produced by heat pumps (MWh/year).

7. Thermal energy production emission factor for heat pumps shall be calculated by applying the following formulae:

$$E_{CO2siltumsuknis} = \left(k \times E_{CO2silt.} - E_{CO2ee.}\right)/k \text{ , where}$$

$E_{CO2siltumsuknis}$ – CO_2 emission factor for heat pumps (tCO_2/MWh);
$E_{CO2silt}$ – CO_2 emission factor in compliance to Table 1 of this Annex or average emission factor (0.264 tCO_2/MWh);
E_{CO2ee} – electricity generation and transmission CO_2 emission factor (0.397 t/MWh);
k – heat pump transformation rate.

Carbon dioxide emission factor

Table 1

N.	Type of fuel used for producing energy	E_{CO2} (tCO_2/MWh)
1.	Natural gas	0.201
2.	Liquefied gas (propane, butane)	0.225
3.	Peat (40 % humidity)	0.374
4.	Peat briquettes	0.342
5.	Coal	0.332
6.	Coke	0.313
7.	Diesel	0.266
8.	HFO	0.276
9.	Oil shale oil	0.272
10.	Gasoline	0.247
11.	Kerosene	0.257

8. Minimum requirements for heat pumps depending on the type of heat pumps are stated in Table 2.

Table 2

Minimum requirements for heat pumps

No.	Type of the heat pump	Initial heat impulse source/ its temperature	Transformation rate / temperature of liquid or air to be supplied to the heating circle
1.	Non-freezing liquid / water	Non-freezing liquid / 0 ^oC*	k = 4.0 / +35 ^oC
2.	Non-freezing liquid / water	Non-freezing liquid / 0 ^oC*	k = 3.4 / +50 ^oC
3.	Liquid / air	Liquid / +10 ^oC**	k = 4.0 / +35 ^oC (air)
4.	Water / water	Water / +10 ^oC	k = 4.5 / +35 ^oC
5.	Water / water	Water / +10 ^oC	k = 3.5 / +50 ^oC
6.	Air / water	Air / +2 ^oC	k = 3.5 / +35 ^oC
7.	Air / water	Air / -7 ^oC	k = 3.0 / +50 ^oC

Notes.
1. * Initial heat impulse source – non-freezing liquid with 0 ^oC – is from a closed circuit geothermal heat exchanger (horizontal system or a vertical heat exchanger).

2. ** Initial heat impulse source – liquid with r +5 °C – is from an artesian well (an open circuit geothermal heat exchanger system).

9. CO_2 emission reduction, which has been obtained by replacing electricity generated from fossil energy resources with electricity generated from renewable energy resources, shall be calculated by applying the following formulae:

$$E = E_{CO_2} \times Q_{ee}\text{, where}$$

E – CO_2 emission reduction per year (tCO_2/gadā);

E_{CO2} – electricity generation and transmission emission factor (0.397 tCO_2/MWh);

Q_{ee} – planned electricity amount generated from renewable energy resources (MWh/year).

10. The average index of last five years shall be calculated for electricity generating equipment to be replaced.

11. If within the framework of the project upgrading (replacing) of electricity generation equipment is planned, CO_2 reduction shall be deemed to be equal to the difference between the expected CO_2 emission from the planned electricity generating equipment and CO_2 emission of the existing electricity generating equipment.

12. Carbon dioxide equivalent for biodegradable waste shall be calculated in compliance to Table 3 of these Regulations.

Table 2

Carbon dioxide equivalent

Type of waste	**Degradable organic carbon portion (DOC) in waste**	**DOC dissimilated (DOC(f))**	**CH4 in waste gas (F)**	**CH4 half-life period (years)**	**Methane production rate (k)**
Unsorted household waste	**0.18**	0.6	0.5	14	0.049510513
Paper	**0.4**	0.5	0.5	23	0.030136834
Garden, park waste	**0.17**	0.5	0.5	14	0.049510513
Food waste	**0.15**	0.5	0.5	12	0.057762265
Wood waste	**0.4**	0.5	0.5	14	0.049510513
Textile	**0.2**	0.5	0.5	23	0.030136834
Industrial waste	**0.1**	0.5	0.5	18	0.038508177
Sludge	**0.185**	0.5	0.5	14	0.049510513

$$L_o\, CH_{4\ \text{potenciāla emisija}} = MSW_L * MCF * DOC * DOC_F * F * 16/12$$

$$CH_{4\ \text{radīts gadā t (t/gadā)}} = \sum_x [\ (A*k*MSW_{L(x)}*Lo(x))*e^{-k(t-x)}]$$

$$CH_{4\ \text{gada emisija (t)}} = [CH_{4\ (t)} - R_{(t)}] * □(1 - OX)$$

$$CO_{2\ \text{ekvivalenti (t)}} = CH_{4\ \text{gada emisija (t)}} * 21$$

where:
L_o – potential annual methane emission (tons);
MSW_L – annual buried amount of waste (tons);
MCF – CH_4 correction factor, depending on the type of dump;
Managed dump – 1;
DOC – degradable organic carbon (0.18);
DOC_F – DOC dissimilated fraction (0.6);
F – CH_4 fraction in the waste gas (0.5);
R – CH_4 recovered (tons);
CH_4 – actual emission of methane;
A – normalisation factor $A=(1-e^{-k})/k$
K – methane production rate (1/y) (0.05);
x – calculation start year:
t – calculation year;
R(t) – recovery of methane in the calculation year t;
OX – oxidation factor (default 0).

Minister of the Environment R.Vējonis

Submitted by: Minister of the Environment R.Vējonis
Approved:
State Secretary G.Puķītis