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Energy savings and carbc.. footprints from different types and ages of buildings - study from St.Petersburg

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What is a carbon footprint?

A carbon footprint is the amount of greenhouse gas emissions (carbon dioxide, methane and ozone) generated directly or indirectly from certain human or enterprises.

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Many of our activities contribute to the rapid formation of greenhouse gases in the atmosphere:

- ✔ burning fossil fuels,
- ✔ resource mining,
- ✔ use of vehicles with gasoline and diesel engines,
- ✔ construction,
- ✔ agriculture,
- ✔ production of various goods and others.

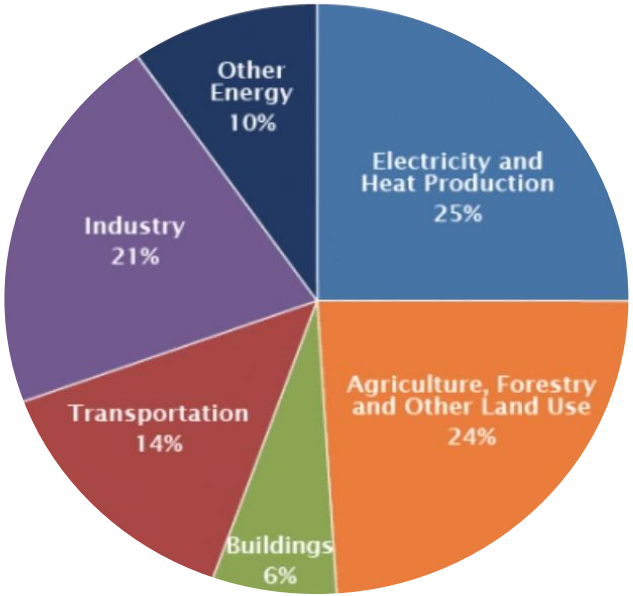
Impact of CO_2 emissions

Greenhouse gases released into the atmosphere affect climate change.
They are the main reason for the growth of damage caused by hydrometeorological events or natural disasters!

Sustainable Development Goal:

By 2030, the *total volume of global emissions* should be reduced by 60-65% compared to the 2005 level.

Global Greenhouse Gas Emissions by Economic Sector



Intergovernmental Panel on Climate Change, IPCC

GEO Green Energy 1

Project "Energy service contract in the urban environment" Concept - Green Energy One (**GEO**) / First Green Energy in St. Petersburg.

GEO was developed with the support of the Ministry of Foreign Affairs of Norway, the Norwegian Secretariat for the Barents Sea, the Ministry of Oil and Energy of Norway, the Nordic Council and in cooperation with the Government of St. Petersburg.

The project is part of the cluster project "Energy Service for the Urban Environment" of the international consortium "St. Petersburg Cluster of Clean Technologies for the Urban Environment" and brought together members of the Cluster: Norwegian, Danish and Russian companies working in the field of energy conservation and energy efficiency in the urban environment.

Первая СПбЭСКО

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Object of study

~~Pr. Industrialny, 11, building 2~~

Energy service object:

Building - large-panel 137 series,

12 floors, 2 entrances, 214 apartments

built in 1984

building area 10758 sq.m

building volume 47759 cubic meters

The large-panel 137 series makes up 17% of the existing housing stock of St. Petersburg.

Energy efficiency measures

In 2014-2015, the following activities were carried out:

- express energy audit
- installation of motion sensors
- replacement of incandescent lamps with energy-saving lamps
- supply and installation of soundproof materials manufactured by "ROCKWOOL" (Denmark) for thermal insulation of pipes
- design, installation of 2 block heat points manufactured by Danfoss (Denmark), 2 pcs.
- and 40 balancing valves AB-QM DN 25

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УНИВЕРСИТЕТ ИТМО

Household energy consumption CO_2 emissions are considered in two ways:

1.Thermal energy

2. Electricity

The calculation is carried out taking into account the conversion factor of electricity for the Russian Federation

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УНИВЕРСИТЕТ ИТМО

Currently, there is a large number of online calculators with which you can calculate your carbon footprint.

The calculator calculates not only the length of the carbon footprint, but also shows **how this negative impact can be compensated** by financing various programs aimed at reforestation, the creation of alternative energy sources, assistance to the least developed countries, etc.

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УНИВЕРСИТЕТ ИТМО

The calculation of the carbon footprint from household energy consumption was carried out using this calculator **www://calculator.carbonfootprint.com/**

The electricity conversion factor for the Russian Federation is
0.3302

Thermal energy conversion factor (fuel - natural gas) is
0.1838

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Brief description of the methodology used:

Steps for estimating CO_2 emissions:

- Step 1: Assessment of the baseline data on heating and electricity consumption before the implemented measures
- Step 2: Converting Gcal to kW using a factor of 0.00086
- Step 3: Calculation of CO_2 based on the RF electricity conversion factor and the thermal energy conversion factor (fuel - natural gas)
- Step 4: Assessment of baseline data on heating and electricity consumption after the implemented measures
- Step 5: Converting Gcal to kWh using a factor of 0.00086
- Step 6: Calculate CO_2 based on RF power conversion factor and thermal energy conversion factor (fuel - natural gas)
- Step 7: Conduct CO_2 Benchmarking Before and After Implemented Activities

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УНИВЕРСИТЕТ ИТМО

For 2011-2014 the average consumption of heat and electricity was:

1 880.75 Gcal and 54 262.33 kW

which is 2 186 919 kW and 54 262.33 kW

that is CO_2 emissions into the atmosphere:

419.98 tons per year

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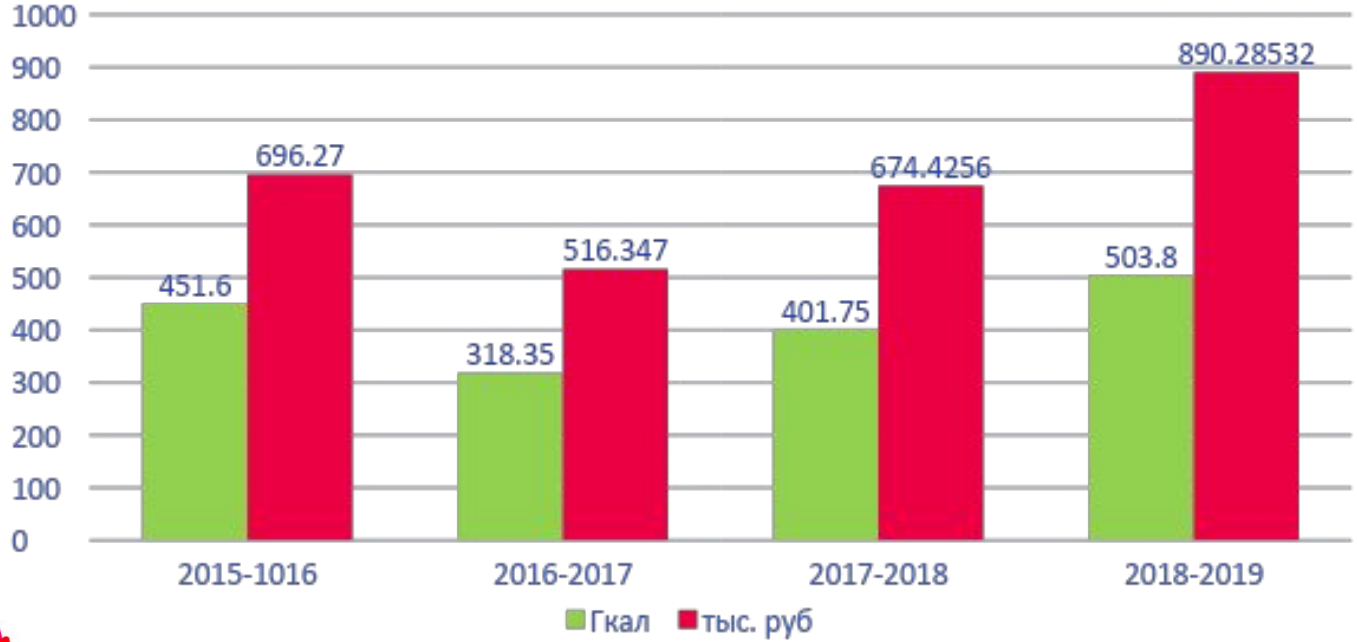
Saving **heat energy** after the implementation of measures



Total: **1675.5 Gcal** **2 777 326.55 rub.**

30 770.29 euro

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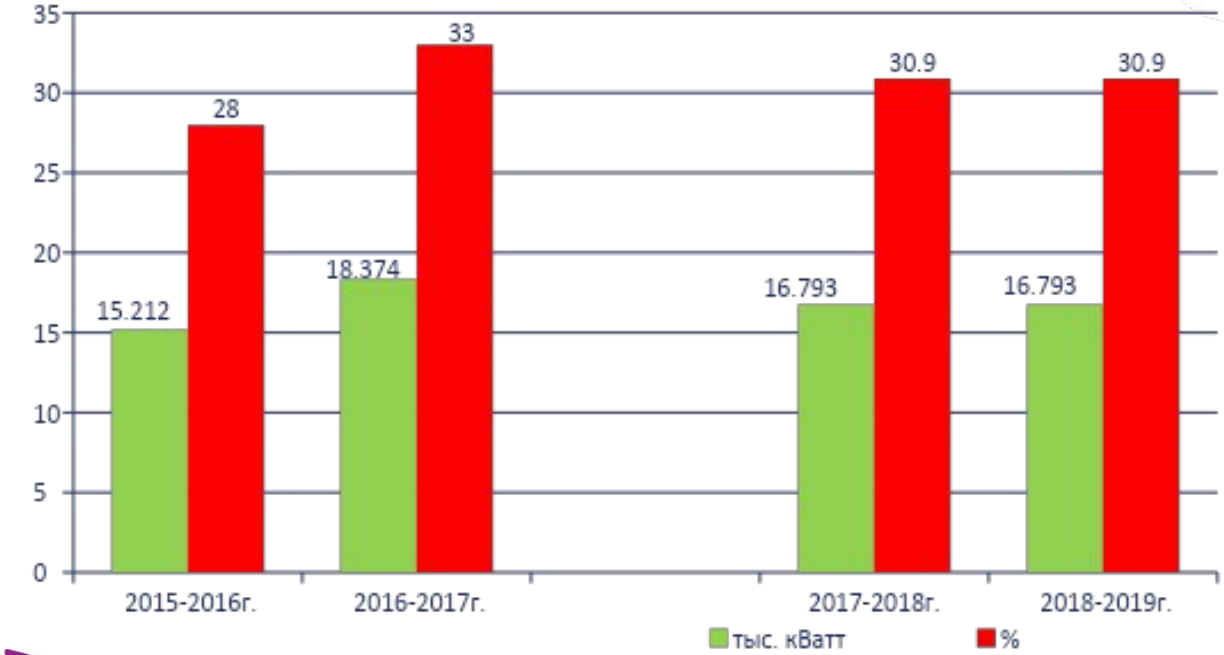
Saving **electricity** after the implementation of measures



Total: **67 173 kWh** **30,7%** from the values of the base period 2012-2014. (average value)

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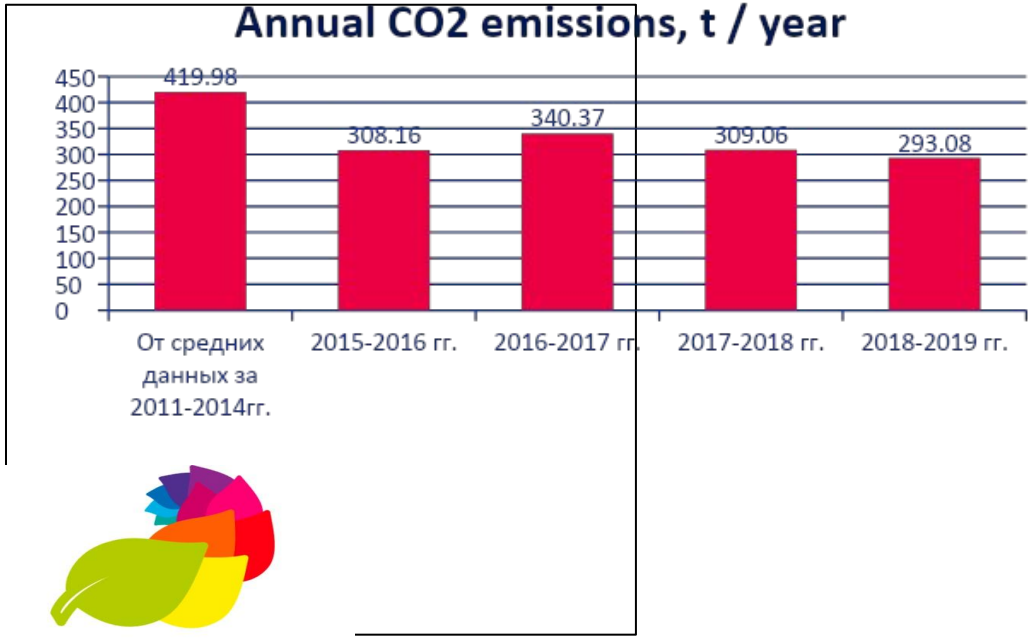
The amount of investments was **2.6 million rubles** (about 28 805 euro)

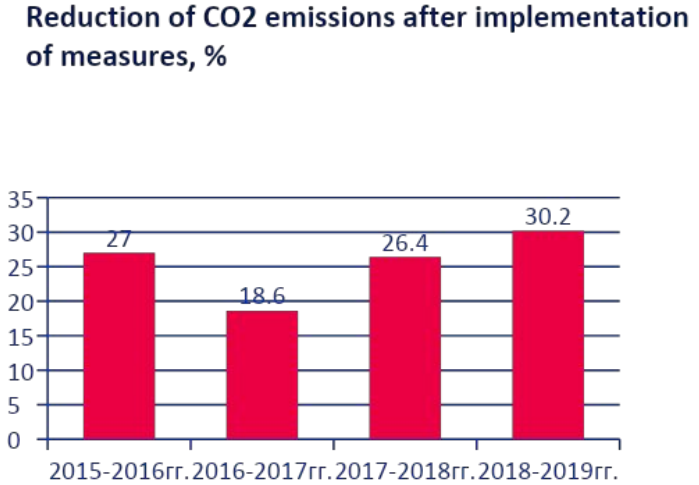
The estimated payback period of the project (investment costs / annual savings) was **4.7 years**

The real savings in heat energy for 4 heating seasons was obtained in the amount of - 11,675 Gcal or 24.77%;

in monetary terms - **2.78 million** rubles (**30 770.29 euro)**

After the implementation of measures, CO_2 emissions decreased by an average of 25.5%





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Summary

after the implementation of measures:

- ✔ saving heat energy – 24.8%,
- ✔ saving electrical energy – 30.7%,
- ✔ CO_2 emissions have been reduced on average by 25.5%.

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Conclusion

1. The introduction of energy audit practice, the use of new technologies, energy-saving equipment and alternative energy sources will provide economic benefits and environmental results in the housing and communal sector;
2. In a metropolis such as St. Petersburg, the reduction in carbon footprint can be quite significant, which will contribute to the achievement of the goals of the St. Petersburg Climate Strategy;
3. In the future, it is planned to conduct a comparative assessment of energy saving projects in St. Petersburg and Helsinki;
4. Special attention will be paid to the use of alternative energy sources.

Additionally for comparative analysis

calculated CO_2 for an apartment building, built in 2015, located in the Krasnoselsky district of St. Petersburg, at the address - st. Marshala Kazakova, 78, building 1 (1500 flats)

Object - Year of construction	2015
Series, type of building construction	individual
House type	apartment house
Number of floors	26
Number of entrances	10
Number of elevators	24
Total area	62 498,00 sq.m
Total living space	59 707,80 sq.m
Total area of non-residential premises	1 826,30 sq.m
Total area of premises included in the common property	963,90 sq.m
Energy efficiency class	B

on average from **1 apartment – 1.5 tons of CO_2 per year**

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Heat consumption data for the heating period 2018-2019 and data on electricity consumption (November 2018 - October 2019)

2018-2019	Heating, Gcal	Electricity, kW * h		Heating, kW	Electricity, kW * h
		day	night		
November	385,32	28261	12870	448046,512	41131
December	623,63	35591	16037	725151,163	51628
January	1013,62	32544	14303	1178627,91	46847
February	1059,24	34579	15644	1231674,42	50223
March	921,19	39680	17394	1071151,16	57074
April	757,87	32903	16175	881244,186	49078
May	599,93	30931	14142	697593,023	45073
June	207,63	30866	13405	241430,233	44271
July		24040	10348		34388
August		24260	11212		35472
September		24983	11625		36608
October		22617	10419		33036
					0
Total	**5568,43**	**361 255**	**163 574**	**6 474 918,6**	**524 829**

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Additionally for comparative analysis

calculated CO_2 for an apartment building, built in 1962,
located in the Nevsky district of St. Petersburg, at the address - st. Krupskoi, 45 (60 flats)

There is no centralized hot water supply, water heating is carried out through an individual gas instantaneous water heater

Object - Year of construction	1962
Series, type of building construction	individual
House type	apartment house
Number of floors	5
Number of entrances	3
Number of elevators	-
Total area	2 648.80 sq.m
Total living space	2 571.10 sq.m
Total area of non-residential premises	-
Total area of premises included in the common property	224,10 sq.m

on average from **1 apartment – 3.32 tons of CO_2 per year**

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Heat consumption data for the heating period 2019, data on electricity consumption and gas consumption

2019	Heating, Gcal	Electricity, kW * h		Heating, kW	Electricity, kW * h	Gas consumption, m^3
		day	night			
November	42,52	198	131	49441,9	329	11460
December	49,2702	216	115	57290,9	331	4740
January	84,45	180	98	98197,7	278	4080
February	87,54	176	96	101791	272	4290
March	90,51	178	105	105244	283	4290
April	72,16	120	78	83907	198	2700
May	53,29	112	80	61965,1	192	2220
June	18,08	100	66	21023,3	166	2460
July		93	74		167	2460
August		92	14		106	3300
September		114	137		251	4020
October		151	118		269	4020
Total	**497,82**	**1730**	**1112**	**578861**	**2842**	**50040**

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Additionally for comparative analysis

calculated CO_2 for an private house in the Leningrad region

heating with electricity

Object - Year of construction	2017
Series, type of building construction	individual
House type	Private house
Number of floors	1
Number of entrances	1
Number of elevators	-
Total area	80 sq.m
Total living space	80 sq.m

on average **– 3.5 tons of CO_2 per year**

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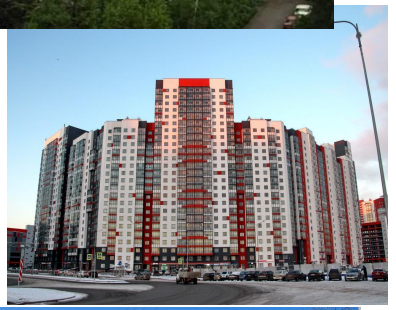
For comparison:

Before the implemented activities: apartment building built in 1984
on average from **1 apartment - 1.96 tons of CO_2 per year**

After the implemented activities: apartment building in 1984
on average from **1 apartment - 1.46 tons of CO_2 per year**



In apartment building built in 2015:
on average from **1 apartment - 1.5 tons of CO_2 per year**

In apartment building built in 1962:
on average from **1 apartment - 3.32 tons of CO_2 per year**

In private house built in 2017:
on average **– 3.5 tons of CO_2 per year**

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Thank you for attention!

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