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***Implementation and application of renewable energy sources
at the facilities of Ergonomics RPC LLP jointly with PRO ECO
PA***





Characteristics of the facility

Office building

Area - 2300 m²

Volume - 6500 m³

Year of construction - 2007

Walling material - foam concrete, insulation

Glazing - 40% (south facade)

Heating - central

Air conditioning (cooling) - geothermal

System type - warm (cold) floors

Achieved results

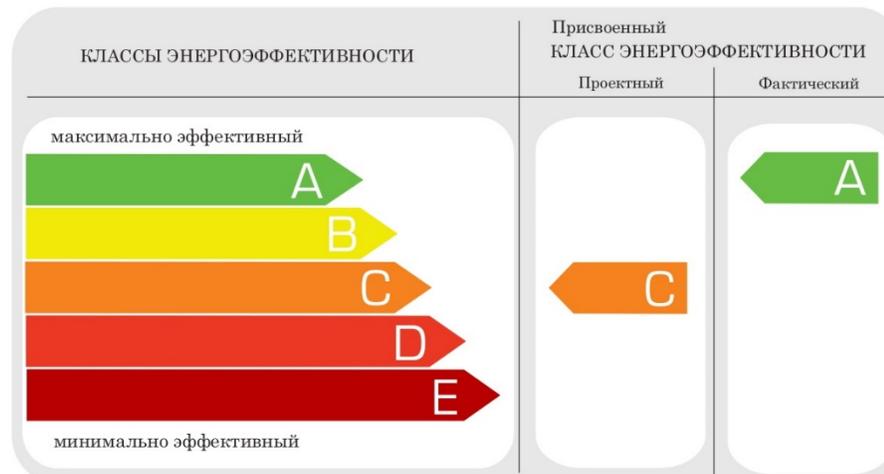
Heating

Energy efficiency certificate

СЕРТИФИКАТ ЭНЕРГОЭФФЕКТИВНОСТИ

В соответствии с Постановлением Правительства Республики Казахстан от 26 ноября 2015 года №1105.
Об утверждении формы маркировки зданий, строений, сооружений по энергоэффективности

АДРЕС ОБЪЕКТА	Г. КАРАГАНДА, Ул. Кривогуза 57/2
ГОД ПОСТРОЙКИ	2007
ТИП, ЭТАЖНОСТЬ	ОФИСНОЕ ЗДАНИЕ, 4 ЭТАЖА
ОБЩАЯ ПЛОЩАДЬ ОБЪЕКТА, м ²	2 270
ОБЪЕМ ОБЪЕКТА, м ³	6 500



Величина отклонения фактического значения показателя энергоэффективности на отопление и вентиляцию здания от нормативного	-42%
Фактическое теплотребление объекта, кВтч/м ²	70
Нормативное теплотребление объекта*, кВтч/м ²	120
Фактическая удельная величина расхода тепловой энергии на отопление и вентиляцию жилых и общественных зданий, Вт/(м ² °C)	0,182
Нормируемая (базовая) удельная характеристика расхода тепловой энергии на отопление и вентиляцию жилых и общественных зданий за отопительный период, согласно Приказу Министра по инвестициям и развитию Республики Казахстан от 31 марта 2015 года № 406, Вт/(м ² °C)	0,313

КЕМ ВЫДАН	ОО «PRO ECO»
ДАТА ВЫДАЧИ	30.06.2019

* Нормативные требования по теплотреблению здания, установлены согласно Строительным нормам РК 2.04-03-2011 «Тепловая защита»

Air conditioning (cooling) system

BEFORE (standard solution)

Central air conditioning system

Components:	Chiller; supply and exhaust ventilation; air duct system for supplying fresh cooled air; recuperation system
System capacity including:	≈ 50 kW,
fan load	25 kW
chiller load	25 kW
Operation mode	continuous!!!
Electricity consumption	≈ 100,000 kWh / season
Payment for electricity	≈ 3 million tenge / season (prices of 2021)
Capital expenditures	10 million tenge
CO2 emissions	92 tCO2 / season

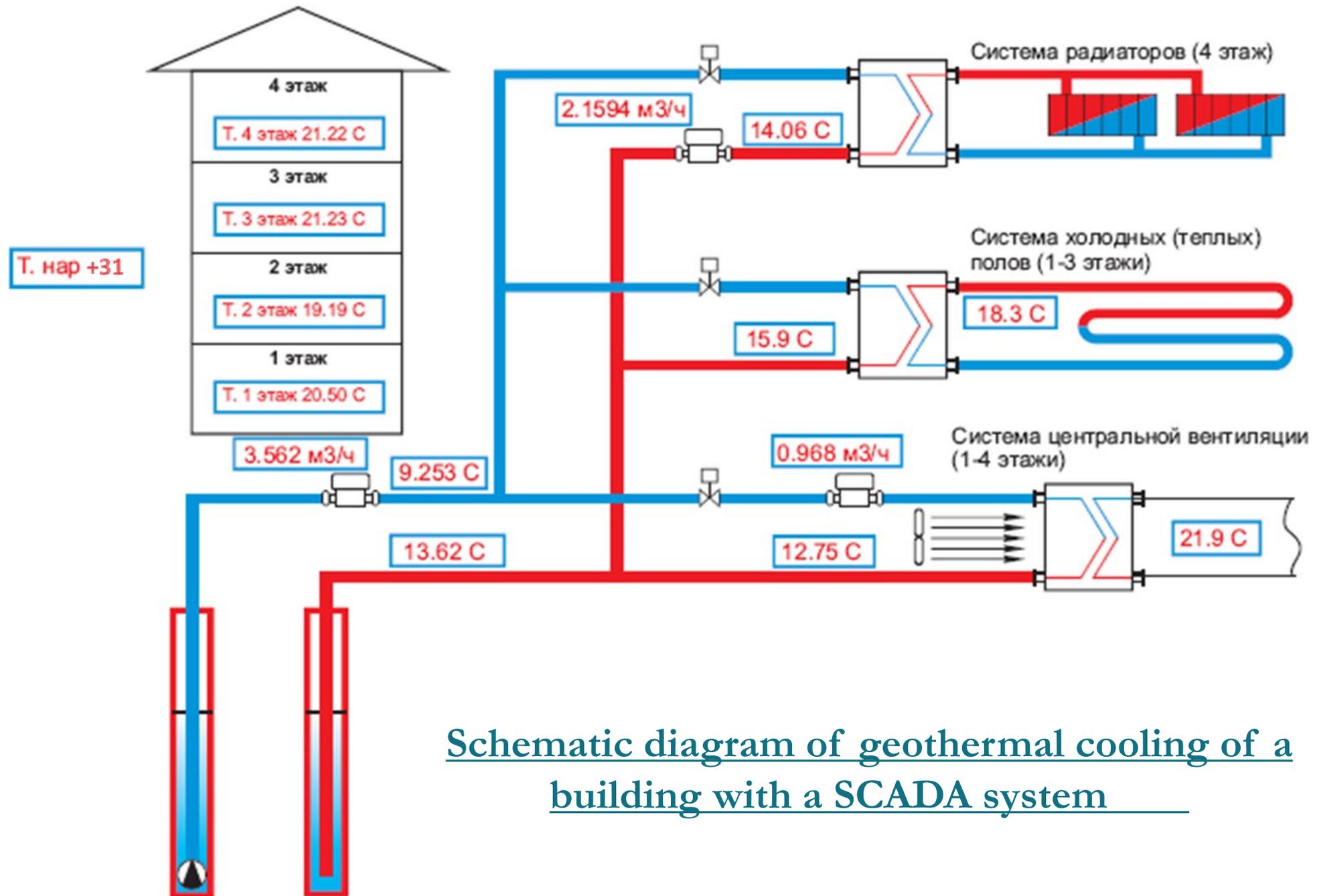
**Under these conditions office temperature reached + 29 ° C (t outside + 35 ° C)
with continuous operation of the cooling system**

AFTER («green solution»)

Geothermal cooling system of the building

Componnts	borehole pump; two wells; supply and exhaust ventilation system; «cool" floors
System capacity	≈ 5 kW,
including:	
borehole pump	0.7 kW
circulation pump	0.8 kW
ventilation system	3.5 kW
Operation mode	intermittent
Electricity consumption	≈ 10,000 kWh / season
Payment for electricity	≈ 0.3 million tenge / season (prices of 2021)
Capital expenditures	2 million tenge
CO2 emissions	3 tCO2 / season

Office temperature + 22 ° C regardless of temperature outside



Schematic diagram of geothermal cooling of a building with a SCADA system

COMPARISON OF TWO SOLUTIONS

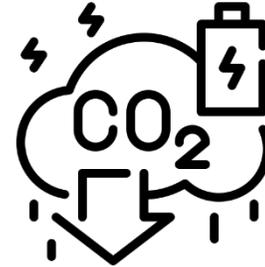
<u>BEFORE</u> Central air conditioning system		<u>AFTER</u> Geothermal cooling system of the building
+ 29 ° C (at t + 35 ° C)	Office temperature	+ 22 ° C (at t up to + 40 ° C)
Continuous	Cooling system operating mode	intermittent
50 kWt	System capacity	5 kW
100,000 kWh / season	Electricity consumption	10,000 kWh / season
3 million tenge / season	Payment for electricity	0.3 million tenge / season
10 million tenge	Capital expenditures	2 million tenge
92 tCO ₂	CO₂ emissions	9.2 tCO ₂
	Saving electricity	90,000 kWh / season
	Saving money	2.7 million tenge
Employee complaints (stuffy, hot air, colds from cold air)	Payback	<1 year

Staff gratitude (fresh, cool, safe air)

RESULT



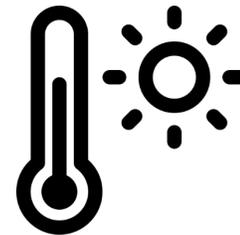
Reducing capital costs by 5 times



Reducing CO2 emissions by 10 times



Decrease in consumption of electricity by 10 times



Important !!

Office temperature + 22 ° C
while outside temperature
+ 40 ° C

Payback period 1 year

Production facility heating



Characteristics of the facility

Production facility

Area - 1500 m²

Volume - 7300 m³

Year of construction - 2010

Walling material - sandwich panel

Heating - heat pumps (geothermal; air)

Air conditioning (cooling) - heat pumps

System type - warm (cold) floors

BEFORE (standard solution)

Boiler heating

Heating source	5 electric boilers
Boiler capacity	1x36 kW; 1x30 kW 2x12kW; 1x48 kW } 138 kW
Heating system	underfloor heating
Electricity consumption	≈ 361,000 kWh / heating season
Electricity costs	≈ 7.6 million tenge / heating season
Capital costs	2.5 million tenge (prices of 2021)
CO2 emissions	330 tCO2 / heating season

AFTER («green solution»)

Heating by heat pumps

Heating source	4 air heat pumps 1 geothermal heat pump 5 electric boilers
Heat pump capacity	89 kW (2x16 kW; 2x12 kW; 1x33 kW) 60% of the boiler capacity (40% required)
Boiler capacity	1x36 kW; 1x30 kW 2x12kW; 1x48 kW } 138 kW
Heating system	Underfloor heating
Electricity consumption	≈ 143,000 kWh / season
Electricity costs	≈ 3 million tenge / heating season
Capital costs	≈ 25 million tenge (prices of 2021)
CO2 emissions	130 tCO2 / heating season



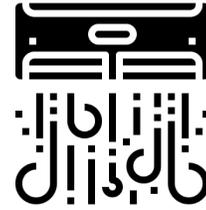
Comparison of two solutions

<p><u>БЫЛО</u> Electric boilers</p>		<p><u>AFTER</u> Heat pump+ el/boilers</p>
361 000 kWh/heating season	Heat generation	361 000 kWh/heating season
361 000 kWh/heating season	Electricity consumption	143 000 kWh/heating season
7,6 mln. tg/heating season	Payment for electricity	3 mln. tg/heating season
25 thousand tenge / 1 Gcal	Cost of 1 Gcal	9,7 thousand tenge / 1 Gcal (central heating 9.0 tenge / 1 Gcal)
2.5 million tenge	Capital expenditures	25 million tenge
330 tCO ₂ / year	CO₂ emissions	130 tCO ₂ /heating season
	Saving electricity	218 000 kWh/heating season
	Saving money	4,6 mln. tg/heating season
	Payback	< 6 years Indirect benefit: no air conditioners needed !!!

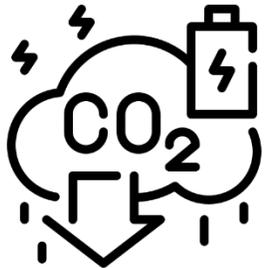
RESULT



Decrease in consumption of electricity by more than 2.5 times



Using heat pump to cool the building



Reducing CO2 emissions by more than 2.5 times



Reduced electricity bills by 60%

Payback period < 6 years

Planned activities

Implementation of the system of seasonal "daily" accumulator of thermal energy with phase transition using low-potential solar panels

Thank you for your attention!
