INTEGRATING LOW-TEMPERATURE RENEWABLES IN DISTRICT HEATING AND COOLING SYSTEMS

Focus on Belarus

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BELARUSIAN NATIONAL TECHNICAL UNIVERSITY

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HISTORY OF THE DEVELOPMENT OF DISTRICT HEATING IN THE REPUBLIC OF BELARUS

Start: early nineties of the twentieth century.

1990.

Developed district heating systems with the extraction factors (cogeneration) of over 50%

1994 – 2000

Decentralisation (extensive construction of gas-fired boiler houses, disconnected from district heating systems)

Widespread implementation of heat metering and automation systems

Start of use of pre-insulated heat pipes

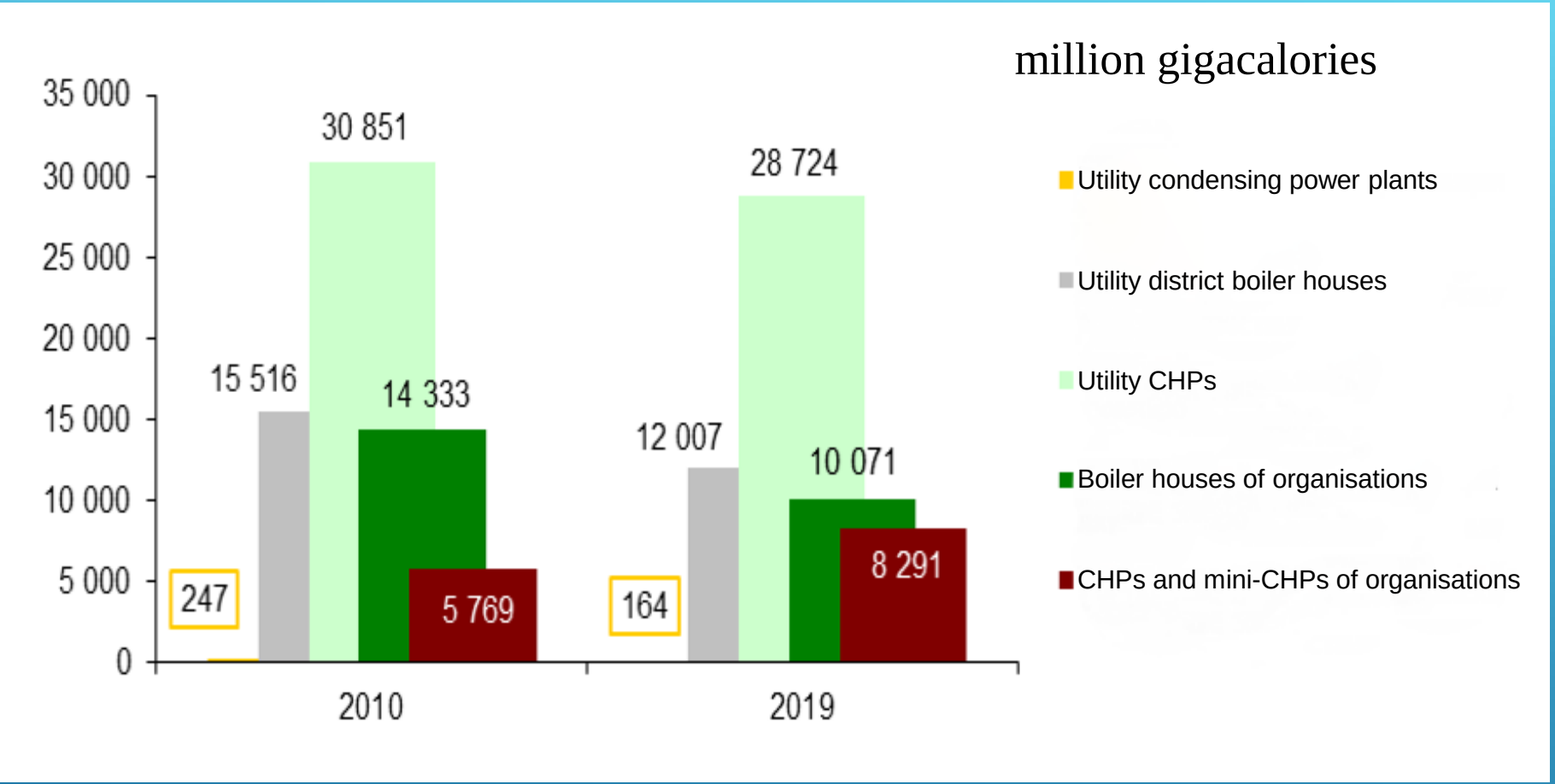
2000 – 2010

Construction of small and medium-sized gas-fired CHPs

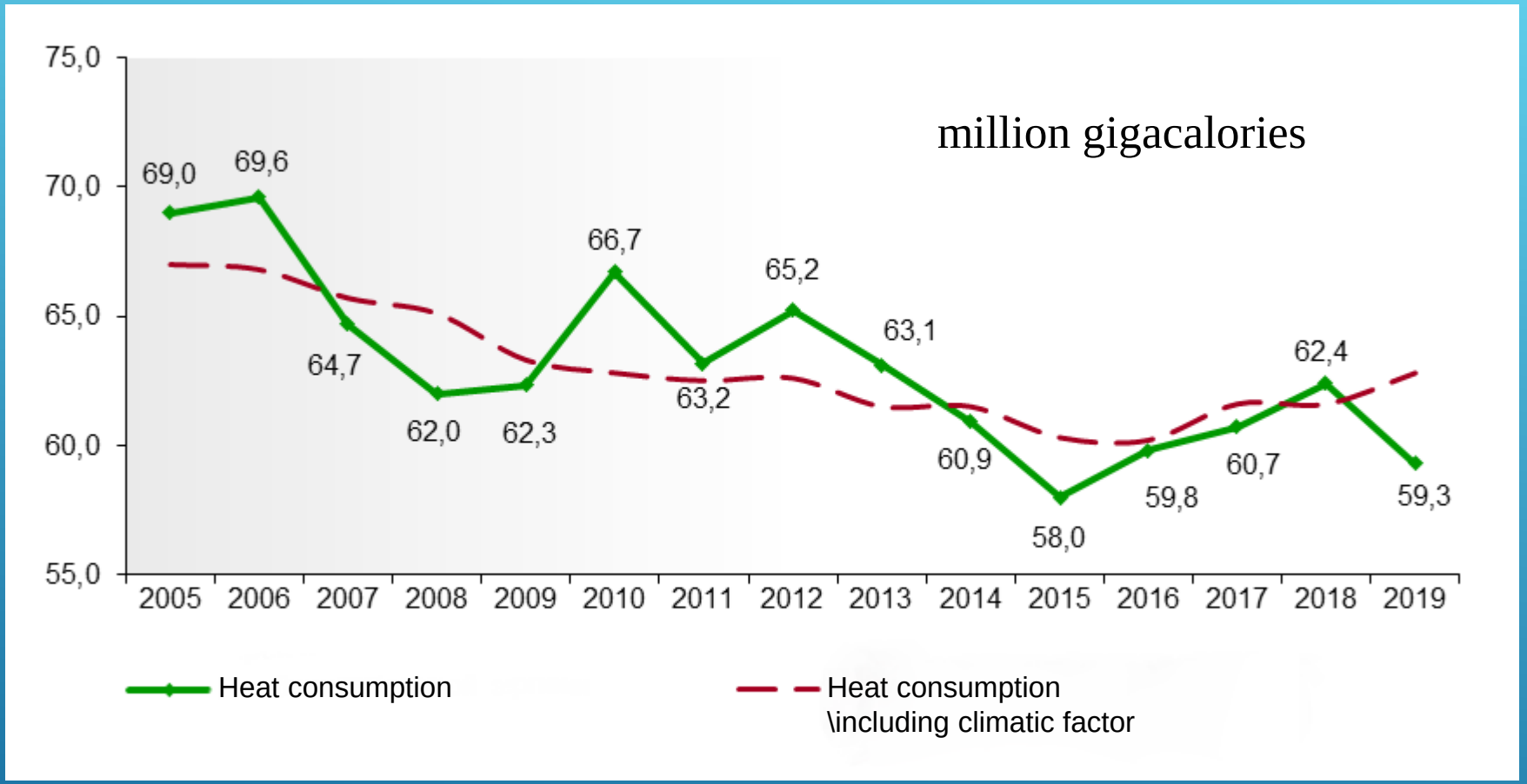
2005 – 2020

Construction of boiler houses using local fuel

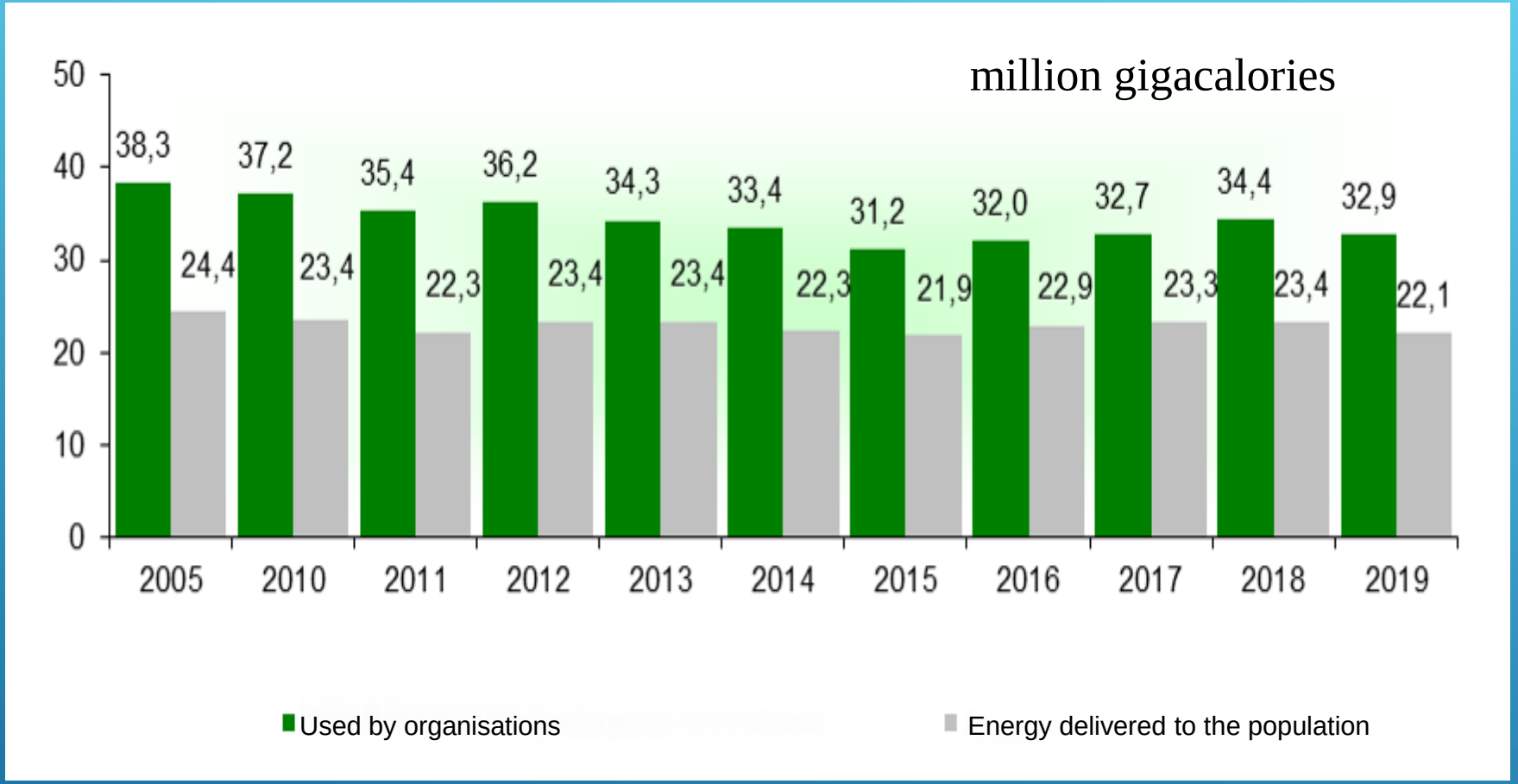
Construction of several mini-CHPs using local fuels.



Heat production by category of energy producer



Heat consumption including climatic factors



Dynamics of end-use heat energy demand

BELSTAT

Energy consumption from renewable energy sources in the Republic of Belarus

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
7.2.1.1 Share of primary energy generation (production) from renewable energy sources in gross consumption of fuel and energy resources, %	5.4	5.4	5.1	5.5	5.2	5.6	5.7	6.2	6.2	7.1
Share of electrical energy generation from renewable energy sources in total generation of electrical energy, %	0.36	0.43	0.56	0.85	0.73	0.86	1.13	2.17	1.83	2.47
Share of generation of heat energy from renewable energy sources in total generation of heat energy, %	6.1	6.7	7.0	7.3	7.9	8.5	8.6	8.8	9.1	10.6
Emissions of pollutants into the atmospheric air from fuel combustion for heat and electricity generation, thousand tonnes	112.9	91.6	96.0	90.1	83.0	83.1	89.9	87.2	89.3	85.0
per capita, kg per person	11.9	9.7	10.1	9.5	8.8	8.8	9.5	9.2	9.4	9.0
per unit area, kg/km2	543.8	441.2	462.6	434.0	399.8	400.3	433.0	420.0	430.0	409.6
Emissions of pollutants into the atmospheric air from mobile sources, thousand tonnes	942.2	944.4	955.8	928.4	880.8	800.6	791.7	787.2	782.0	775.8
per capita, kg per person	99.3	99.7	101.0	98.1	93.0	84.4	83.3	82.9	82.5	82.4
per unit area, kg/km2	4,538.5	4,549.1	4,604.0	4,472.1	4,242.8	3,856.5	3,813.6	3,791.9	3 766,9	3,737.0
Greenhouse gas emissions in the energy sector, million tonnes CO2-equivalent per year	57.8	56.8	57.5	58.5	57.3	53.4	55.4	55.7	57.0	…
of which CO2	56.3	55.3	56.1	57.0	55.8	51.9	54.0	54.3	55.6	…

TOWARDS IMPROVING AND DEVELOPING DISTRICT HEATING SYSTEMS (CONCEPT OF THE DEVELOPMENT OF DISTRICT HEATING IN THE REPUBLIC OF BELARUS TO 2020)

Adopted in 2010.

Revised in 2017.

Amended in 2020 and extended to 2025.

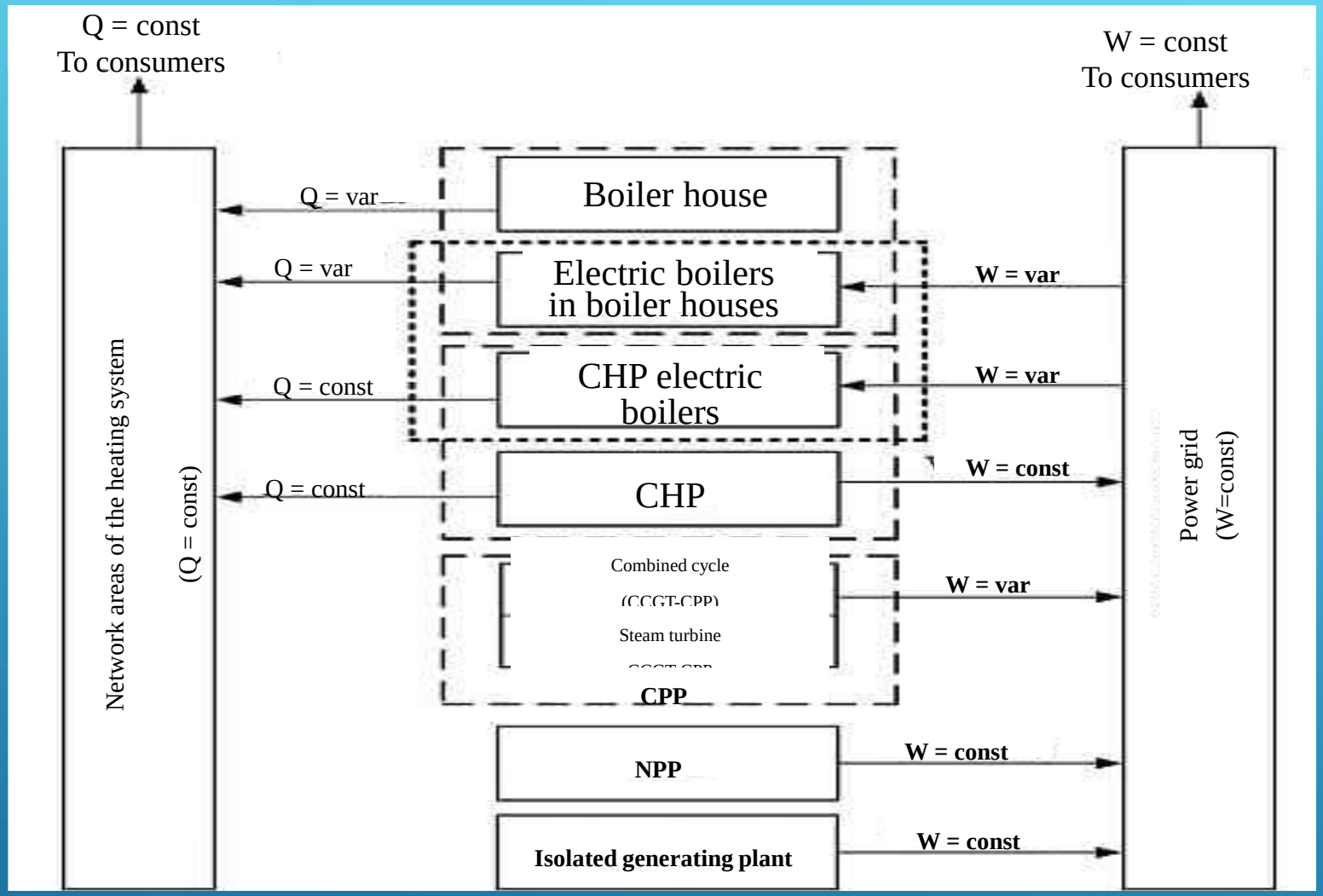
Strategic directions for the development of district heating:

- Improving efficiency and ensuring continuous development of district heating systems by applying modern technologies, using local fuel and energy resources, secondary energy resources and alternative energy sources;
- reliable, economic and secure supply of thermal energy to organisations and the population;
- maximising the use of combined heat and power generation;
- keeping the balance between the economic interests of energy supplying organisations (thermal energy suppliers) and consumers;
- ensuring an economically justified return on investment capital under the conditions of state regulation of heat tariffs;
- establishing an optimal management structure for heat supply processes;
- eliminating intermediaries in the supply of heat energy to consumers;
- improving regulations.

AMONG THE MOST REPRESENTATIVE SOLUTIONS

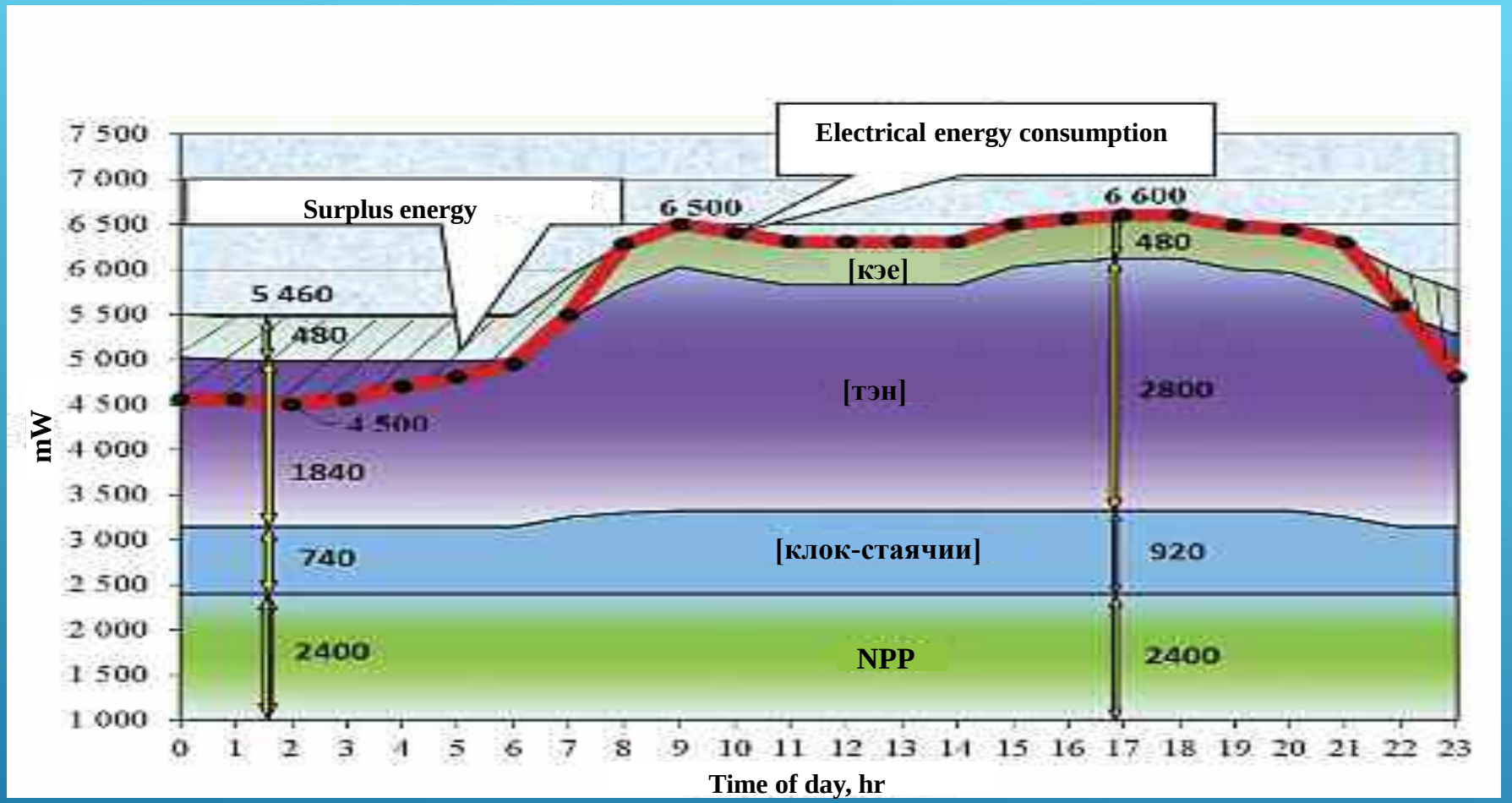
- the application of multi-rate district heating tariffs taking into account fuel taxes depending on their environmental properties;
- increased use of alternative fuels in place of natural gas and oil (combustible refuse, biomass, solar energy, geothermal energy, secondary energy resources from industrial production, etc.).

NPP

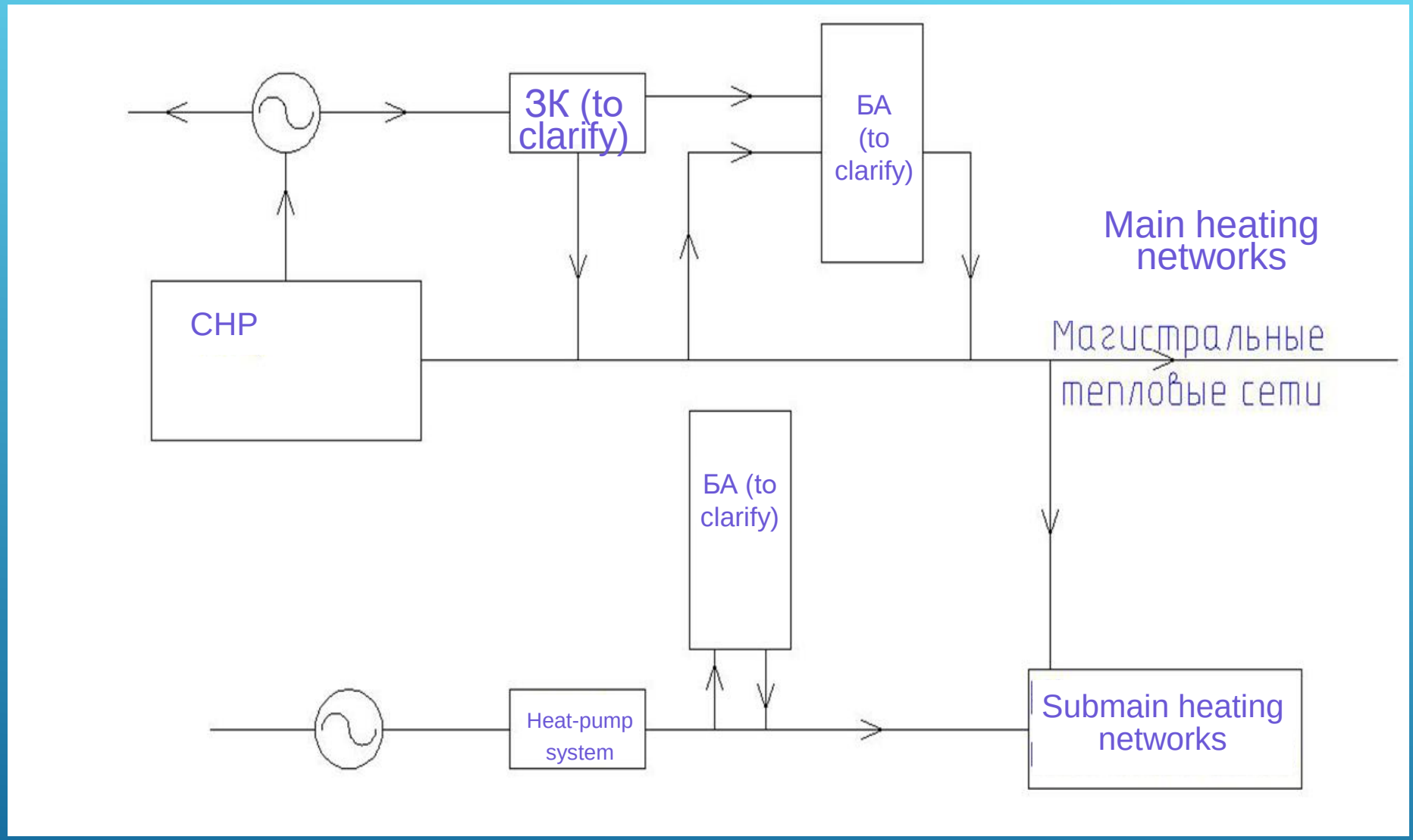


STRUCTURE OF ENERGY GENERATION SOURCES IN BELARUS AFTER 2020

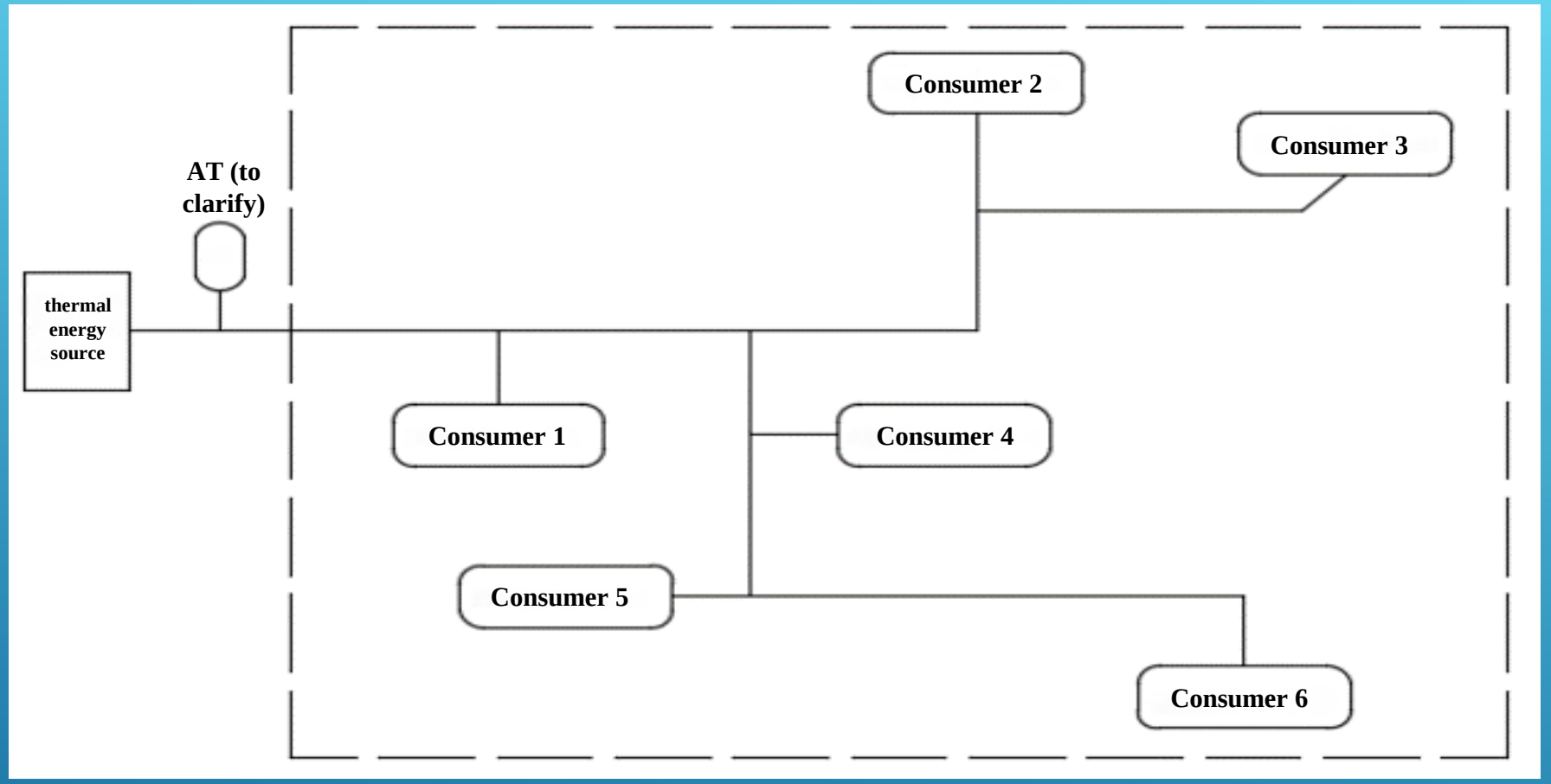
NPP



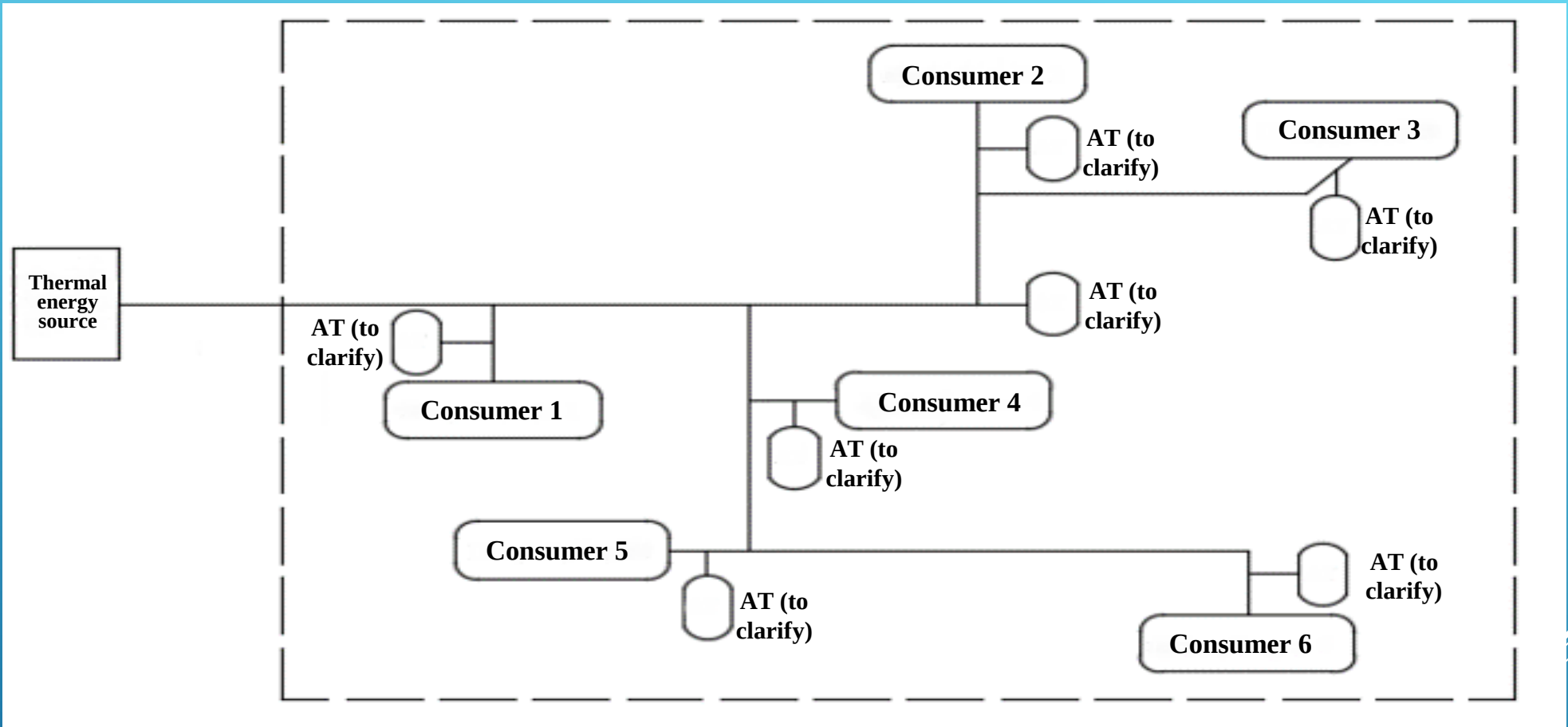
A scenario of the situation
in the Belarusian energy system after
the commissioning of the BelNPP. Heating season



A SCHEMATIC DIAGRAM FOR INTEGRATING AN ENERGY COMPLEX AND A HEAT-PUMP SYSTEM INTO A DISTRICT HEATING SYSTEM



OPTIONS FOR INTEGRATING CUSTOMER TERMINALS INTO A DISTRICT HEATING SYSTEM: centralisation



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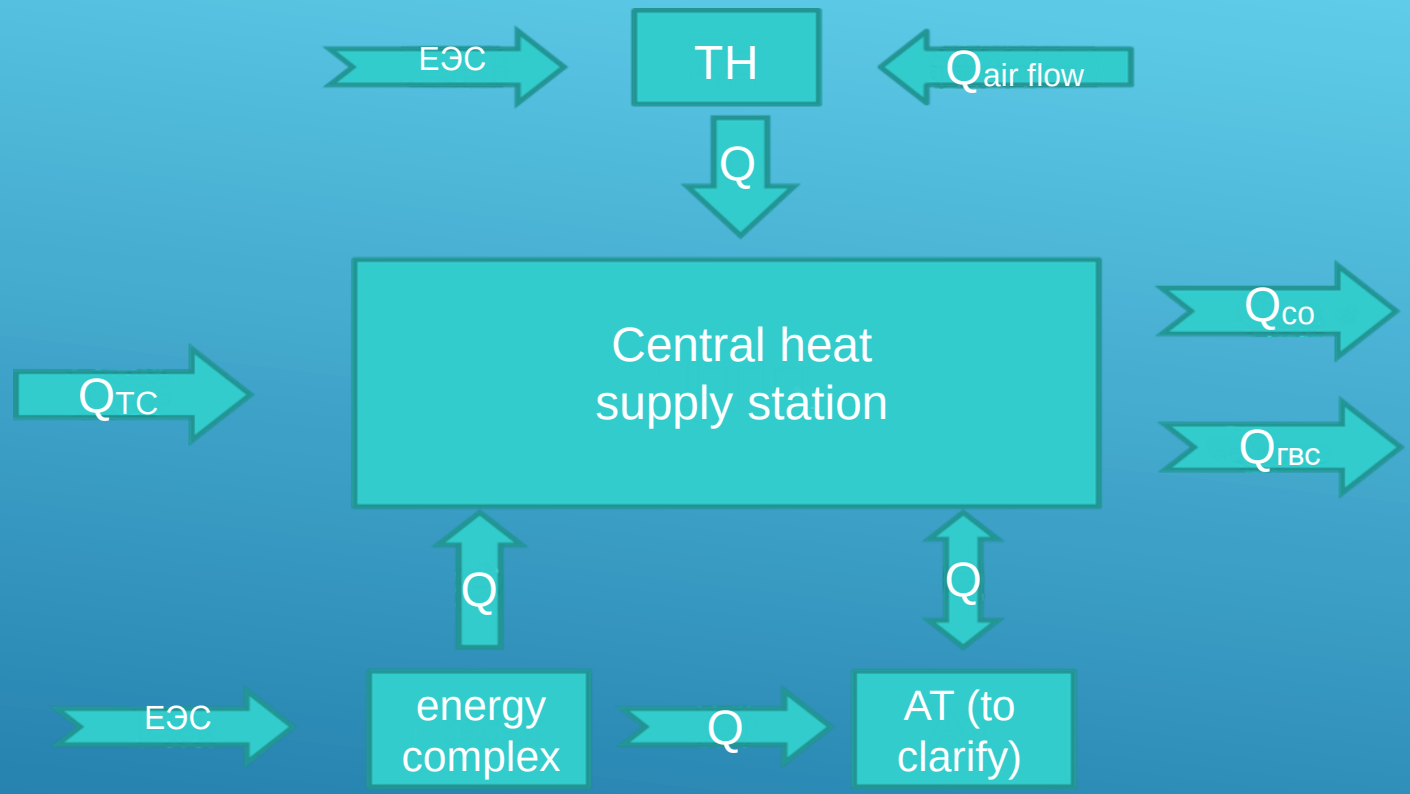
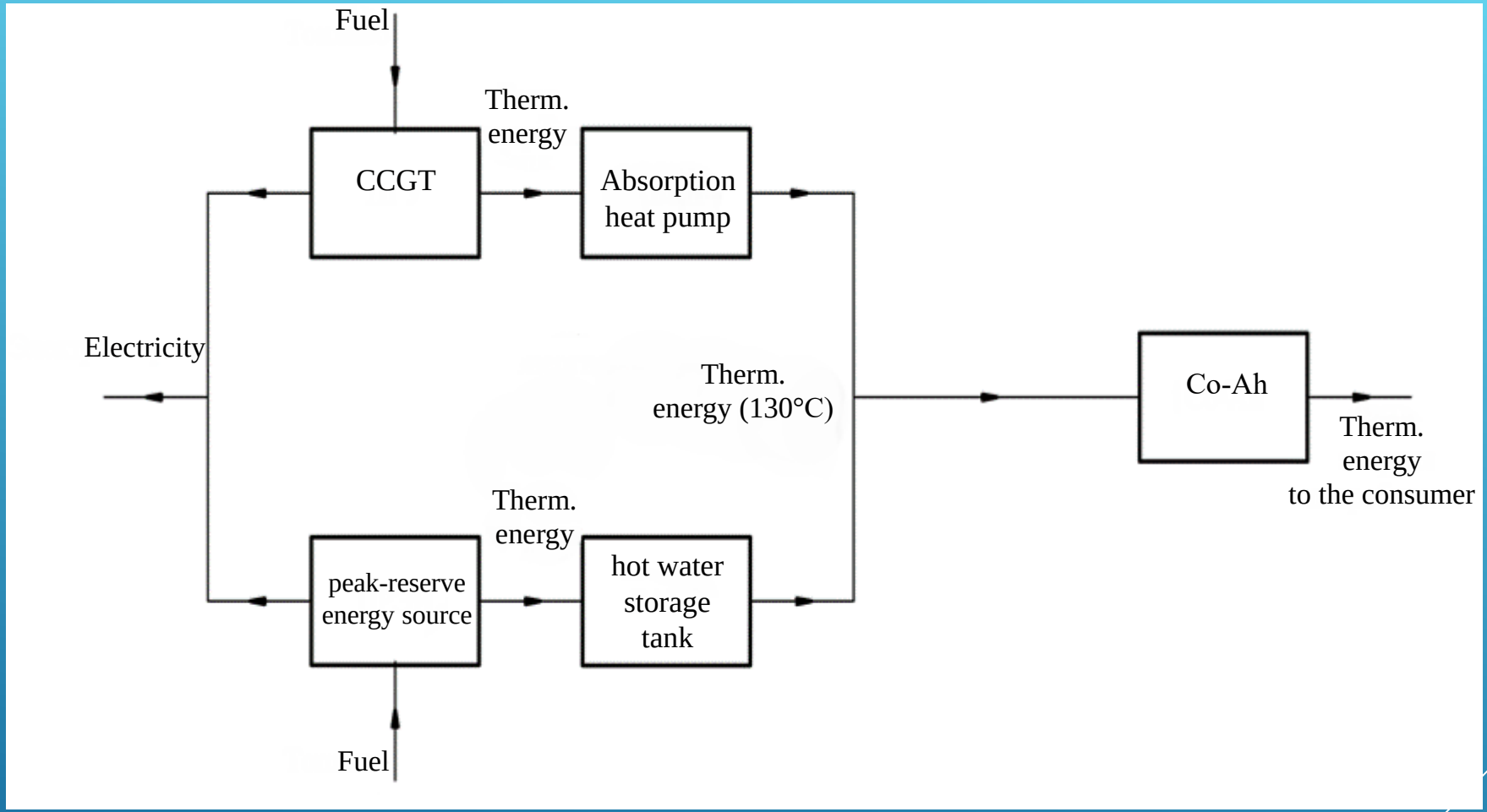
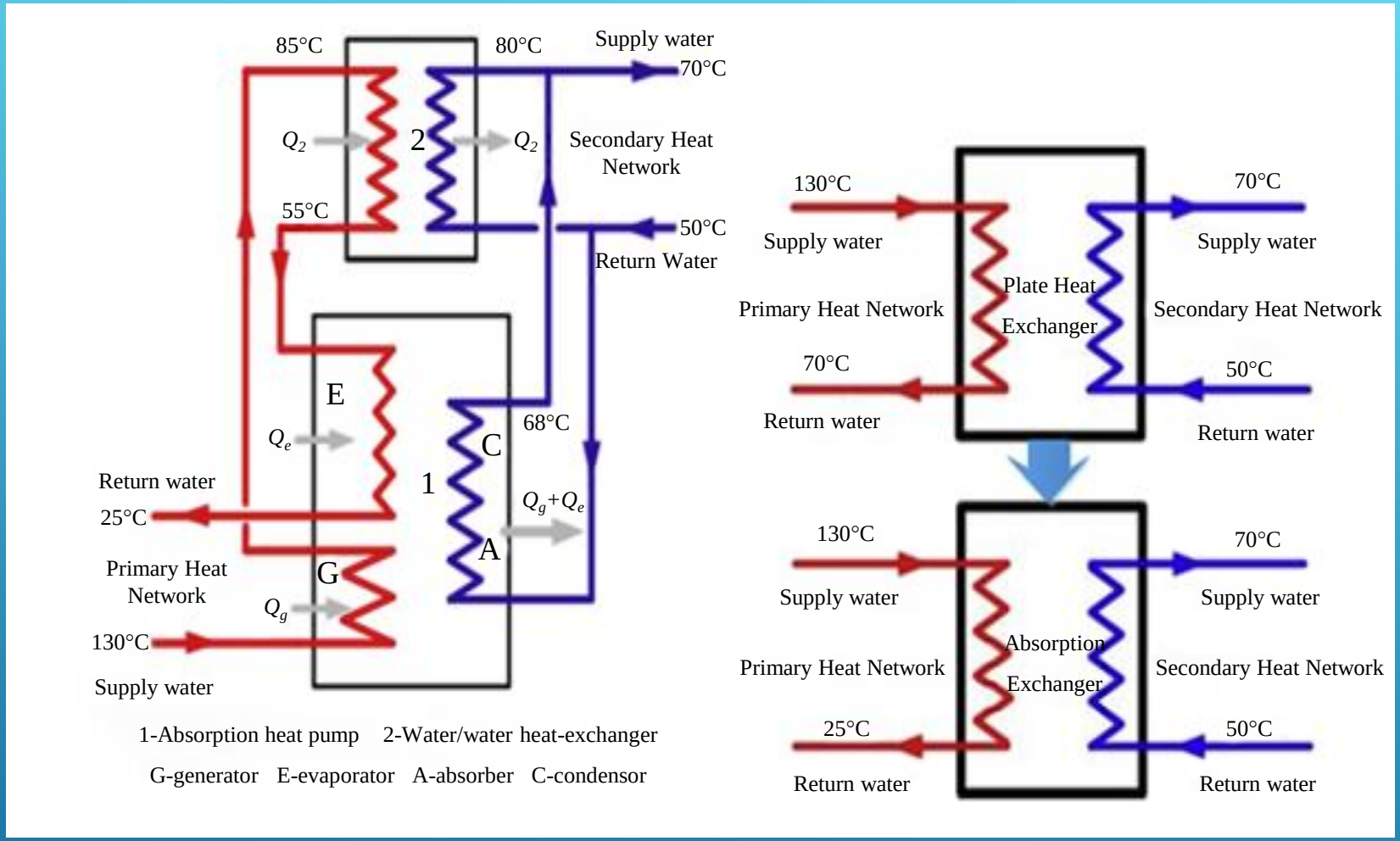


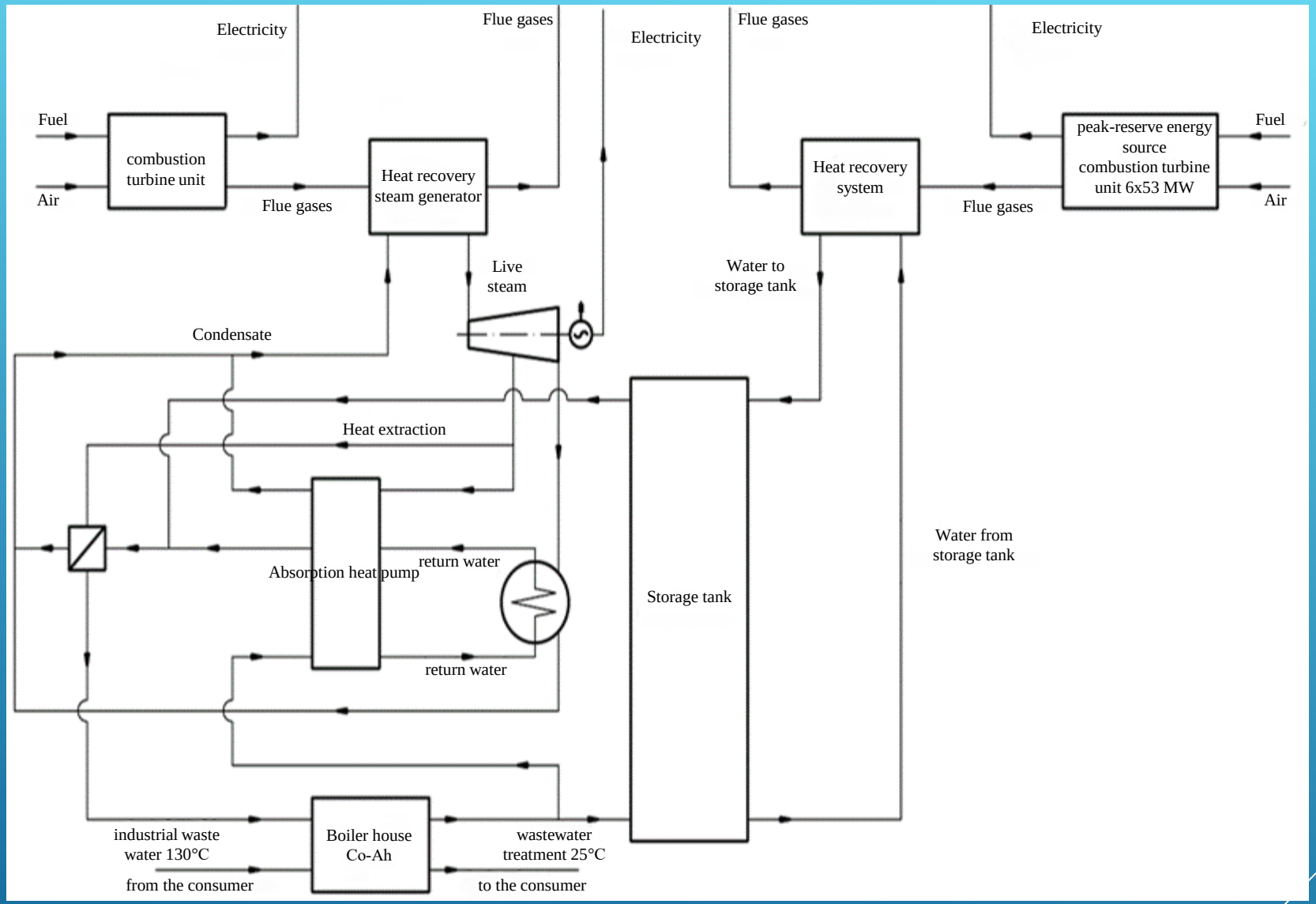
Structure of central heat supply station energy flows with energy complex and customer terminals, heat pump



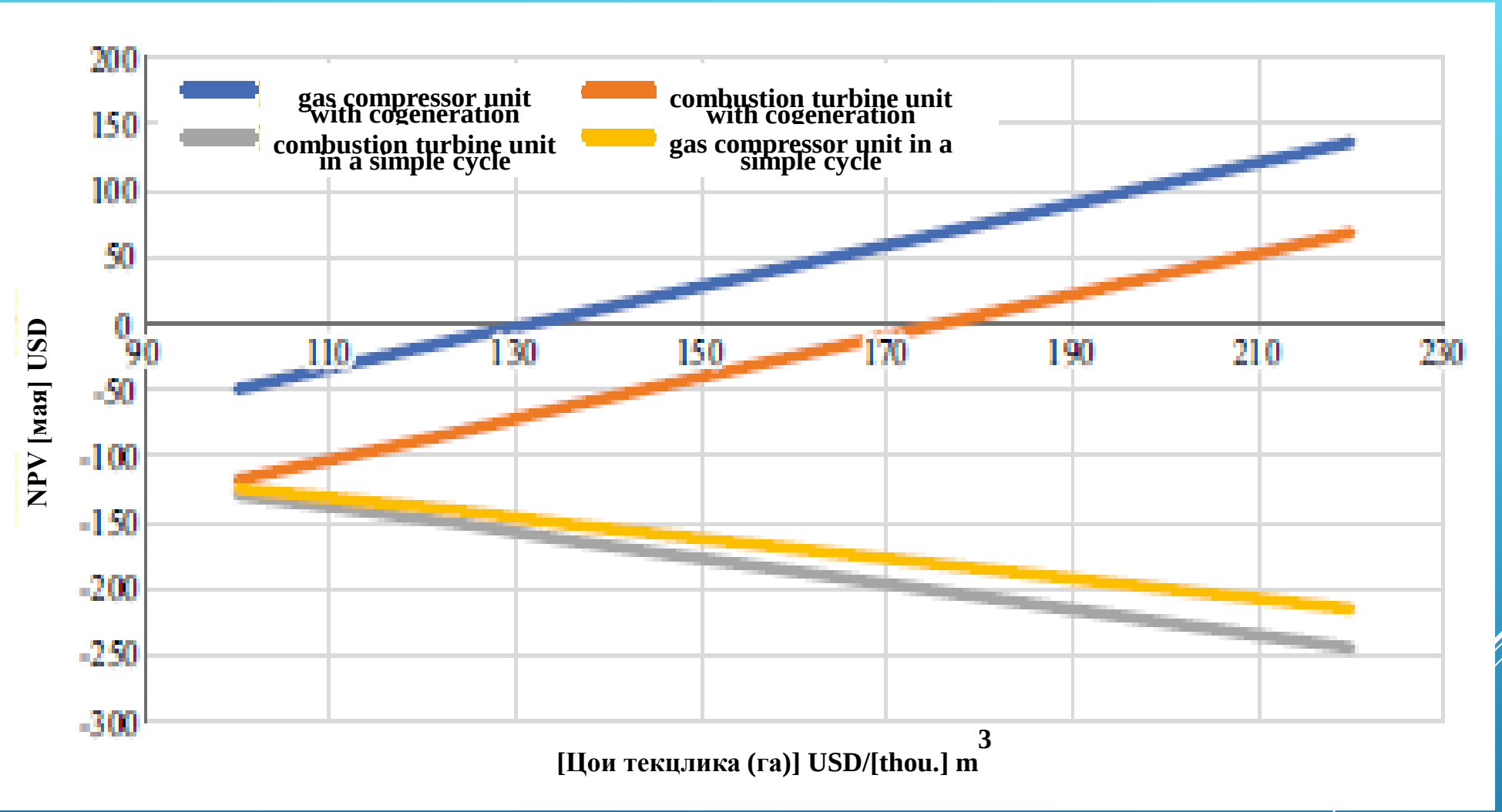
A schematic diagram of a combined heat and power unit



Co-generation-based absorption heat-exchange (Co-ah) system - a type of district heating system using absorption heat converters



A schematic diagram of a district heating peak-reserve energy source based on a combustion turbine unit
with a combined cycle gas turbine



Net present value as a function of the cost of fuel (natural gas)

Thank you for your attention!