ELECTRICAL AND THERMAL ENERGY PRODUCTION USING COGENERATION TECHNOLOGIES AT THE WASTE WATER TREATMENT STATIONS

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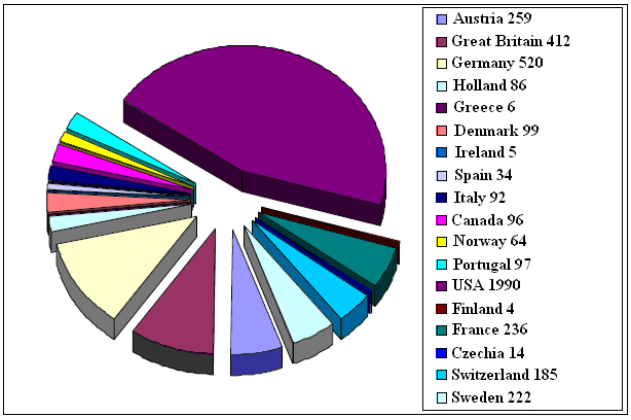
Abstract: Biogas is one of the most common renewable energy resources. It can be produced by the anaerobic fermentation of wood or agricultural waste, on landfills or in sewage plants. These last two ways of producing biogas are the most interesting for cities in their policies of promoting renewable energies. The use of biogas is also interesting economically as it is in 1999, already one of the cheapest renewable energy sources. It often is burned in combined heat and power plants. J.S.C. Energy Investment Group has constructed first in Moldova Republic and first in post Soviet Union Cogeneration Station which will operate on biogas. Now Station is started on natural gas, but in 3 years will be transferred on biogas.

1. Definition

Cogeneration, also known as combined heat and power (cogeneration) or CHP, and total energy, is an efficient, clean, and reliable approach to generating power and thermal energy from a single fuel source. That is, cogeneration uses heat that is otherwise discarded from conventional power generation to produce thermal energy. This energy is used to provide cooling or heating for industrial facilities, district energy systems, and commercial buildings. By recycling this waste heat, cogeneration systems achieve typical effective electric efficiencies of 50% to 70% — a dramatic improvement over the average 33% efficiency of conventional fossil-fueled power plants. Cogenerations' higher efficiencies reduce air emissions of nitrous oxides, sulfur dioxide, mercury, particulate matter, and carbon dioxide, the leading greenhouse gas associated with climate change.

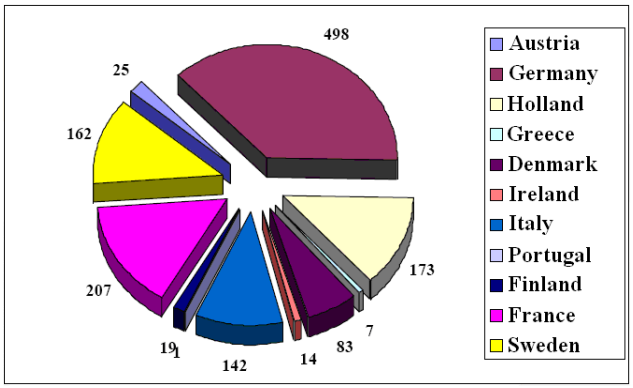
2.More About Cogeneration

Cogeneration now produces almost 10% of our nation's electricity, saves its customers up to 40% on their energy expenses, and provides even greater savings to our environment [1].

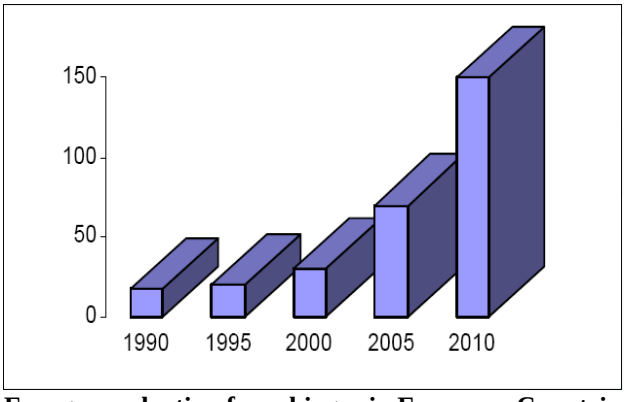


The number of the cogeneration installations in the world

The concept of cogeneration is not new. Early, before there was an extensive network of power lines, many industries had cogeneration plants. As utilities became established and grew, most countries began to regulate them in order to limit their pricing power [1].



Effective Power of the biogas plants in European Countries, MWe



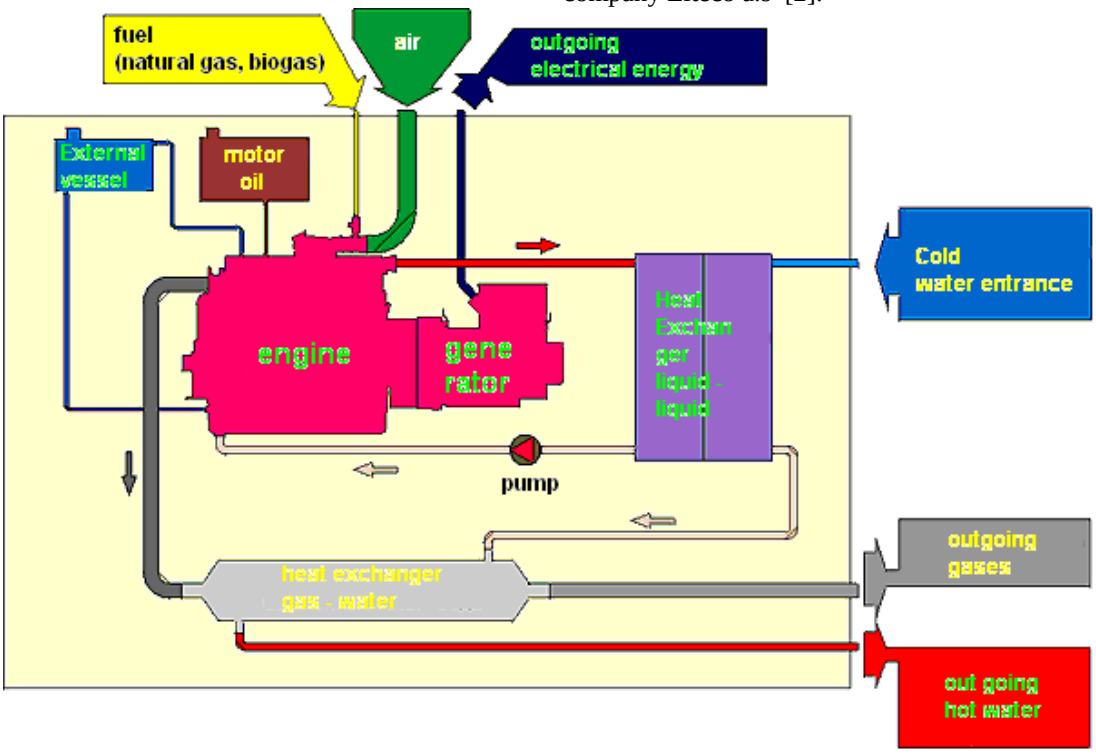
Energy production from biogas in European Countries

3. Energy Investment Group project.

JSC "Energy Investment Group" first large-scale investment was the erection of a 1,94 MW cogeneration plant for biogas utilization in the production of cheap

electrical and thermal energy resources at the Waste Water treatment station in Chişinău.

The equipment used in the production of energy resources at the cogeneration plant was acquired from the Slovak company Elteco a.s [2].

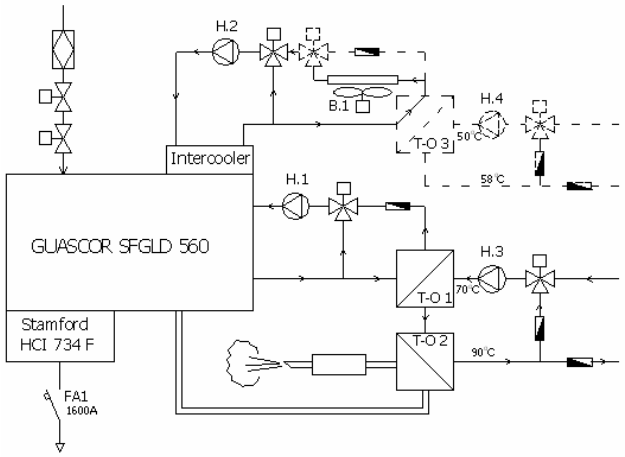


The cogenerating application Petra 1250 CDB represents an equipment for continuous and simultaneous long-term production of electrical energy and heat [2].

The basic components of the cogeneration application are:

- energy generating application with a GUASCOR internal combustion engine and a STAMFORD synchronous generator;
- electrical energy distribution device;
- system of heat exchangers;
- cooling system.

The GUASCOR internal combustion engine is working on natural gas and biogas, and has a rotation frequency of 1500 rot/min. The activity of this engine is complemented by a cooling system. The engine meets the DIN 6271, ISO 3046 and TA Luft ecological norms [2].

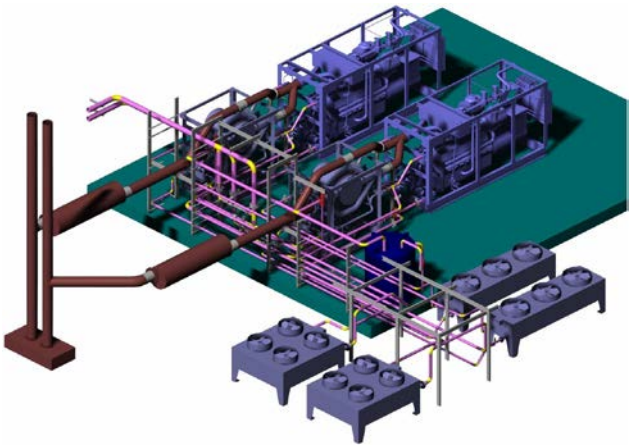


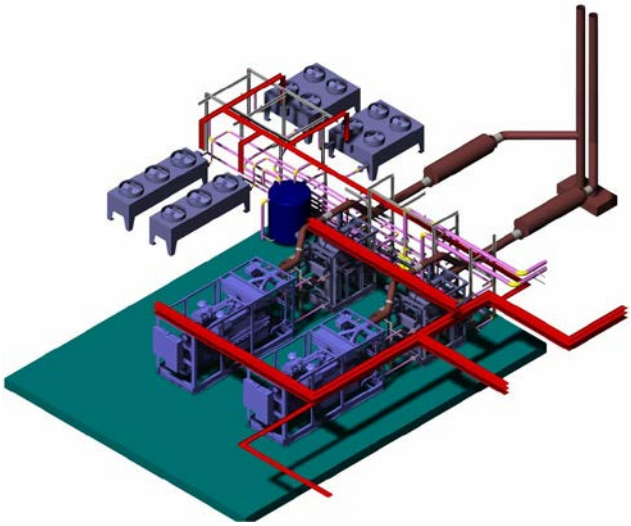
The thermal module is placed on a separate rigid steel frame consisting from heat exchangers, an exhaust line, and armatures of the main and auxiliary circuits, automatic deaeration system and a secondary circuit pump. All the exchangers, exhaust pipelines and armatures are thermally isolated.

The engine cooling is provided through the circulation of a cooled liquid through water – water exchangers.

The energy distribution device is formed from separately established cases containing managing, regulating and power circuits. On the face doors there is placed a managing multiprocessor controller with serving keys, a display and an optical diode, allowing the execution of simple service, monitoring and presentation of electrical and non-electrical plots [2].

The cooling system is designed for the internal combustion engine compulsory cooling (of a part or the entire amount of produced heat) within the framework of the cogeneration application.





Produced electrical energy completely will be used for maintenance of own needs of the Waste Water Treatment Station and the thermal energy, partially, will be used for a covering of needs of administrative and household buildings in hot water and heating. Further, all thermal energy (about 3 GCal/h) will be used for biogas manufacture, which will be a fuel for cogeneration equipment.

4. Conclusions

Cogeneration Equipment possibilities:

- qualitative thermal and electrical energy manufacture which corresponds all Governmental standards on the Republic of Moldova territory;
- to ensure the Waste Water Treatment Station with an additional source of the qualitative thermal and electrical energy;
- to carry out functioning of the cogeneration equipment in automatic control mode at parallel work with the external electrical lines, when all processes will be controlled by the modern computer facilities, and the role of the man in management of technological process will be shown to a role of the observer;
- to lower the tariffs on made electrical and thermal energy;
- to increase reliability of functioning of the equipment of the Waste Water Treatment Station in the moments of unpredictable disconnections from the external electrical greeds;
- to decrease significant the danger of ecological accident, which will arise when the technological process at the Waste Water Treatment Station will be stopped;
- to remove completely unpleasant smells and to lift the level of capital of Republic of Moldova up to a level of the European Countries;
- to start the cogeneration equipment on biogas - fuel, which for today is not a source of the income, but is a source of unpleasant smells and environment air pollution;
- biogas producing as a result of the complete silt processing, which will allow to receive, as a final product, dry deposit - qualitative agricultural fertilizer;
- after reconstruction to lift the status of the Waste Water Treatment Station up to the world standards;
- to ensure functioning of the cogeneration equipment on biogas with maximum efficiency, which will essentially decrease the natural gas consumption;

5. References

[1] Proceedings of the First International Ukrainian Conference on Cogeneration for Industry and District Heating Systems October 18-20, 2004 Kyiv, Ukraine

[2] Slovak Company internet address www.elteco.sk