Co-funded by the Erasmus+ Programme of the European Union

OPTIMAL USE OF THE AVAILABLE BIOMASS RESOURCES, RECYCLING AND EFFICIENT UTILIZATION OF BY-PRODUCTS AND RESIDUES

CORRESPONDING MODULE 5

Introduction

Biomass has been used as an attractive alternative to coal for some time now, mainly because it produces less pollution. This is because it is not only characterised by zero CO2 emissions, but also lower emissions of sulphur dioxide, carbon monoxide and nitrogen oxides than the combustion of fossil fuels.

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Description

General description of the CASE STUDY with information related to the questions already mentioned in section 3 of this document.
Background, types, basic information
Best practices

Biomass block Elbląg

Elbląg's residents are already being heated with environmentally friendly heat generated from biomass. The new biomass unit has been supplying Elbląg with heat since the beginning of this year's heating season. The installation was built to replace part of the company's depleted production infrastructure. Heat is generated in cogeneration with electricity, which is the most efficient way. Annual biomass consumption is estimated at around 135,000 tonnes. The construction of the new unit allowed the company to increase its heat generation capacity by 12 per cent and its electricity generation capacity by 50 per cent.

The new unit produces cogeneration of electricity and heat through a technological process called cogeneration. This method of energy production ensures higher efficiency than producing heat and electricity in separate installations. Energa Kogeneracja has additionally reduced CO2 emissions, as it uses agro biomass as fuel, Its use results in zero carbon dioxide emissions, as during combustion it emits as much as the plants take in during vegetation. It is estimated that the new biomass unit will reduce the balance of emissions of this gas by more than 150,000 tonnes per year, compared to an installation of similar capacity fired by hard coal.

The project to build a biomass unit in Elbląg was partly financed by the European Union from the Cohesion Fund. The cost of the project is over PLN 200 million, with a maximum grant of PLN 40 million.

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Fig. Biomass power unit. Source http://www.energa-kogeneracja.pl/s28-blok_biomasowy_elblag

Biomass cogeneration plant - ecological improvement of the district heating network in Lębork

June 2012 saw the start of the largest investment project in Lębork in the 21st century. Fired by biomass obtained from the waste of the local timber industry, the CHP plant is designed to improve the quality and continuity of the supply of hot water and electricity to residents, while **reducing emissions of harmful dust, gases and other substances responsible for the formation of smog**. The desire to safeguard against energy poverty and politically-driven fluctuations in coal prices was also an important factor. The EC ORC CHP plant uses an organic Rankine cycle and operates in cogeneration to generate district heating and electricity. The project started in 2012 and was implemented with the **support of Switzerland, under the Swiss-Polish Cooperation Programme** (Swiss Contribution), which bore 85% of the investment costs (CHF 9.89 million)5.

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The main objective of building the ORC CHP plant was to supply the city's residents with hot water, generated in an **environmentally friendly and economical** way. Thanks to the construction of the new CHP plant, the old KR-1 heating plant was able to significantly reduce coal combustion, reducing emissions of sulphur dioxide, carbon monoxide and dust that adversely affected the health of residents. The ORC CHP plant in Lębork consists of a number of components: the building of the CHP plant itself, a covered biomass storage hall with an area of 1,000m2, biomass unloading and storage facilities, storage yards and a biomass chipper.

The full production capacity of the ORC EC is expected to be 5.68 MW of thermal power and 1.4 MW of fully cogenerated electrical power. During the summer season, its task will be to cover the entire heat demand of about 4.5 MW and also provide about 1.25 MW of electrical power; while during the heating season it is to operate as a power source9. The system of the cogeneration plant made with this technology is based on a biomass-fired furnace with a boiler in which the medium is thermal oil (300 / 250° C), transferring its energy to an ORC block - a closed-cycle turbine unit in which silicone oil with special parameters is used. The system has an **82% efficiency in heat and power generation**, meeting the definition of a high-efficiency system as defined by the Cogeneration Act.

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Fig. Elektrociepłownia Lębork, biomass-fuelled CHP plant - ecological improvement of the district heating network source https://pfrdlamiast.pl/baza-miejskich-innowacji/lebork-elektrocieplownia-na-biomase-ekologiczne-usprawnienie-miejskiej-sieci-cieplowniczej.html

Main objective of the institution implementing the case study and main achievements.
Good to remember information, practical information, links to other CSs.....
.....

Project Number:
2021-1-FR01-KA220-VET-00034605

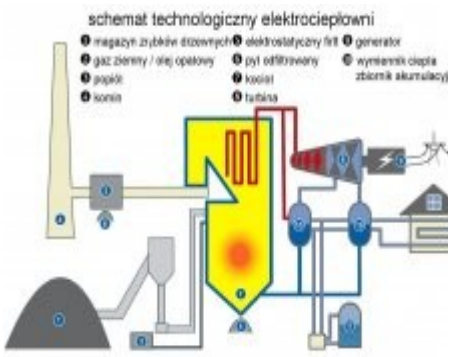

Fig. Technological diagram of the CHP plant: 1-timber chip storage, 2-natural gas/fuel oil, 3-ash, 4-chimney, 5-electrostatic filter, 6-filtered dust, 7-boiler, 8-turbine, 9-generator, 10-heat exchanger, 11-storage tank, http://agroenergetyka.pl/?a=article&id=2 source.

Advantages and challenges

The problem - the example of the Lębork power plant

- Greenhouse gas and particulate emissions from an old heating plant using coal
- Waste production by the wood and agricultural industries (failure to exploit their energy potential)
- Rising coal prices and the need to import coal
- The European Union's position on the transition to renewable energy
- Risk of energy poverty in the region

Solution

The ORC plant is self-sufficient in terms of electricity demand from the grid, while it sells surplus electricity to the distribution network. Thanks to the introduction of biomass combustion technology into Lębork's energy mix (40% share of heat production), the number of operating hours of the KR-1 heat plant and coal consumption have fallen by about 18% per year, reducing the cost of energy production. Emissions from the ORC EC are approximately 450 kg CO2/MWh - twice as low as in a standard coal-fired power plant, giving a total **reduction in CO2 emissions of nearly 25,000 tonnes in** 2016. Compared to coal-fired units, sulphur oxide emissions have also been reduced many times over.

Benefits

- Lower electricity bills - a safeguard against fuel poverty
- Development of green energy sources ("green energy" is produced by the ORC cogeneration plant from the combustion of biomass)
- Improved environmental quality (the project reduced CO2 emissions by around 25,000 tonnes in the first year after start-up)
- Cooperation between MPEC Lębork and local entrepreneurs, especially in the SME sector (10 local biomass suppliers)
- Increase in the number of jobs (potential for energy

plantations)
- Use of local energy resources for energy production
- Stimulation of the local economy (access to cheaper energy, proceeds from the sale of surpluses to the distribution network)

Main data

Budget, main dates (investment, start of production, period of raise funding, etc.), location, module name and number, contact data when possible, institution

Biomass cogeneration plant in Lębork

Project information:

- Project: Construction of a biomass-fired combined heat and power plant as the primary heat source in the district heating system of the city of Lębork
- Beneficiary: City of Lębork
- Support area: Environment and infrastructure
- Voivodship: Pomeranian
- Grant awarded: 9 892 465 Swiss francs
- Polish contribution: equivalent of 1 745 729 Swiss francs
- Project implementation period: 01.06.2012. - 31.10.2017 r.

Further Information

..... to be completed with links when possible

http://www.energa-kogeneracja.pl/s28-blok_biomasowy_elblag

https://pfrdlamiast.pl/baza-miejskich-innowacji/lebork-elektrocieplownia-na-biomase-ekologiczne-usprawnienie-miejskiej-sieci-cieplowniczej.html

https://www.programszwajcarski.gov.pl/strony/o-programie/projekty-1/srodowisko-i-

infrastruktura/ biomasa-ogrzeje-lebork-budowa-elektrocieplowni-opalanej-biomasa/

https://docplayer.pl/13393608-Elektrocieplownie-na-biomase-produkcji-ekol-o-mocy-2-20mwe-dla-kogeneracyjnego.html

ANNEX - STRUCTURE OF MODULE CONTENT TO PREPARE SLIDES

Module Name: The name of the partner: Country:

The name of the module	
Target group involved	
Current information about the topic	
Principles of the specific module	
Basic terms/measures of the module/topic	
Training materials (tasks, case studies, exercises)	
Short description of the materials	
Link of the online resources (film or video resources)	
Specific images (to support the purpose of the resources)	
Duration	
Materials	
No of Learners/Representatives	
Individual or group work	
Step by step guide	