MODULAR TECHNOLOGY

GENERATION OF ENERGY, HEAT, PELLETS, ETHANOL, BIOBUTANOL, ACETONE & LIGNIN FROM WASTE BIOMASS AND MUNICIPAL WASTE

ELIS plus

CONTENT

1. INTRODUCTION

This brochure contains the basic information about the modular technology in generating biobutanol, lignin, electric energy and the heat production from wasted biomass.

We briefly introduce the technology of parallel connection of classical biogas plant with the biobutanol production and energetically independent system for biobutanol and lignin production.

After a short analysis of the current state of energy carrier from renewable resources, you will find a description of our project, its main idea and our unique know-how of this modular technology.

2. THE ENERGY & ENERGY CARRIER FROM RENEWABLE RESOURCES CURRENT STATE (A SHORT ANALYSIS)

The facts

a) The most common ways of producing electrical power from renewable resources in Europe:
    a. wind power
    b. photovoltaic
    c. water energy
    d. energy from burning bio gas in cogeneration plants produced in typical fermentation plants. Inputs are usually corn silage or cow manure.

b) In individual countries of the European Union, the mentioned technologies are determined by legislative (law) which strictly restricts building of new plants or does not offer electricity in affordable prices as it was before. In other words, it disadvantages and discourages potential investors.

c) The truth is that within EU countries, there are many typical bio-gas plants which deal with one common issue: real and effective usage of residual heat from cogeneration plants.

3.THE MAIN IDEA OF THE PROJECT

Our company with cooperation of other partners is dealing with an idea of implementing suitable technologies and their use in a right combination, to be able to use residual heat from cogeneration plants, in addition to operate according to the EU legislative and the legislative of individual EU countries. It includes not only the legislative about usage of biomass from agricultural activities but also ecological disposal of communal waste. All of these should be in accordance with needs and possibilities of particular micro regions.

The main input criterion and conditions for realization of these projects are:

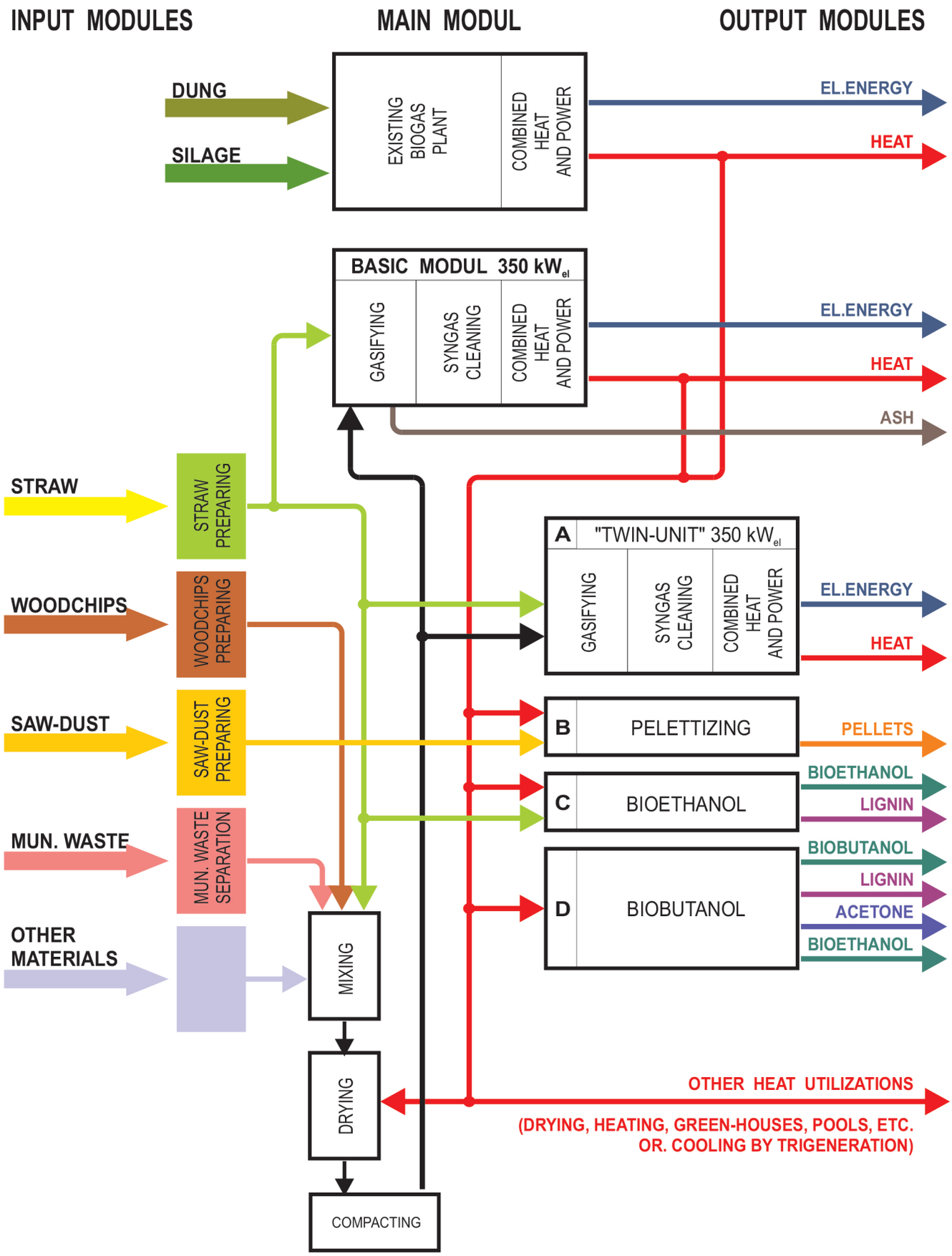
a) suitable place (location)
b) ability to join electricity distribution networks. This criterion is not important when dealing with energetically-independent system
c) sufficient quantity and quality of biomass
d) suitable technologies
e) financial resources

Based on availability of the mentioned conditions, we may consider a modular combination of the following technological subgroups:

a) separation and preparation of biomass (also communal waste if necessary)
b) drying and compacting of the input biomass
c) energy production from a biomass gasifying and a following usage of a synthesis gas in cogeneration plant. Here can be parallel connected modul:
    - production of pellets for heating, or
    - biobutanol, lignin and acetone production

Picture 1: A multipurpose scheme of modularity of the system. It shows possible combinations of each technological moduls

MODULARITY SYSTEM AND PARTICULAR MODULES INTERCONNECTION POSSIBILITIES



4. MODULAR TECHONOLOGY

One from our designed and offered technology used for a parallel production of biobutanol, electrical energy and heat from wasted biomass allows usage of the heat that is created by producing electrical energy in existing typical bio-gas plant.
By a combination of the existing and operating technologies and by technologies offered by our company, it is possible to use the heat which usually deals with problems. In such case, we may reach better economic results in terms of processing wasted biomass and its following usage for energy.

The technological unit that we designed, consists of the following modules:

a) Preparing the input materials (separation, shredding, drying and compacting of biomass – intermediate product are briquettes),
b) Gasification (product is synthesis gas),
c) Cogeneration unit (using synthesis gas and producing power. Energy and heat),
d) Production of biobutanol (preparing the input materials, hydrolysis, fermentation, distillation and cleaning the biobutanol, processwater and lignin).

The result should be a production not only of electric energy, but also mainly biobutanol, lignin and acetone. It is necessary to emphasis that it is combination of technologies, which is only one from many possibilities.

Picture 2: The scheme

Following the valid legislation in the sector of biofuels and biochemical products, we recommend the investment in technology for production biobutanol, lignin and other biochemical products from wasted agricultural biomass (strow,..), which is energetically independent. In this case we can use different kinds of strow, miscanthus, woodchips…

Picture 3: The principle scheme

In principle, there will be use of technology, which is known many years, but it will be improved by modern and powerful hardware and software control. Genetically modified microorganisms with higher mass yield and resistance will be used for the production of biobutanol.

The final technological components can be designed as a module, based on local conditions for gaining sufficient amount and quality of input materials and in a sufficient form of output (portion of electricity, heat and other products).
Energy and material connection of individual modules – technological subgroups are described in schema (Picture 3).

Described schemes shows that the existing typical bio-gas plant, or other cogeneration unit is in parallel connected to the technology recommended by our company and it has these general modules:

a) Production of electricity from waste of biobutanol fermentation and wasted products from typical fermentation in bio-gas plants.

This module consists of these "submoduls":

- Mechanical separation of digestate from biogas
- Mechanical separation of biobutanol fermentation
- Drying and compacting
- Gasification and cogeneration units – used for non-waste material from biogas plant and materials from biobutanol unit. The produced energy is used to cover the electricity consumption and heat in the biomass preparation for production of biobutanol and also in the biobutanol unit itself.

The main idea is production of biobutanol from wasted biomass which was created from agricultural activities or from "planted" biomass which are not competing to food industry.

MODULAR SYSTEM OF TECHNOLOGY CONJUNCTIONS

INPUT MATERIAL INTO THE EXISTING BIOGAS PLANT

INPUT MATERIAL COMBINATION ALTERNATIVES

INPUT MATERIAL NEEDED FOR BIOFUEL PRODUCTION

A)

B)

EXISTING BIOGAS PLANT

C.H.P.

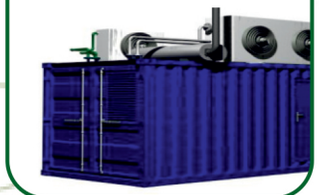
PRODUCTS SELLING IN THE AREA OF INTEREST

ELECTRIC ENERGY

HEAT

SORTING - DRYING COMPACTING

GASIFYING AND C.H.P.



ELECTRIC ENERGY

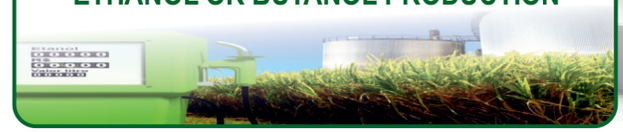
HEAT

RESIDUAL HEAT FROM C.H.P.

DRYING, PELLETIZING, BRIQUETTING

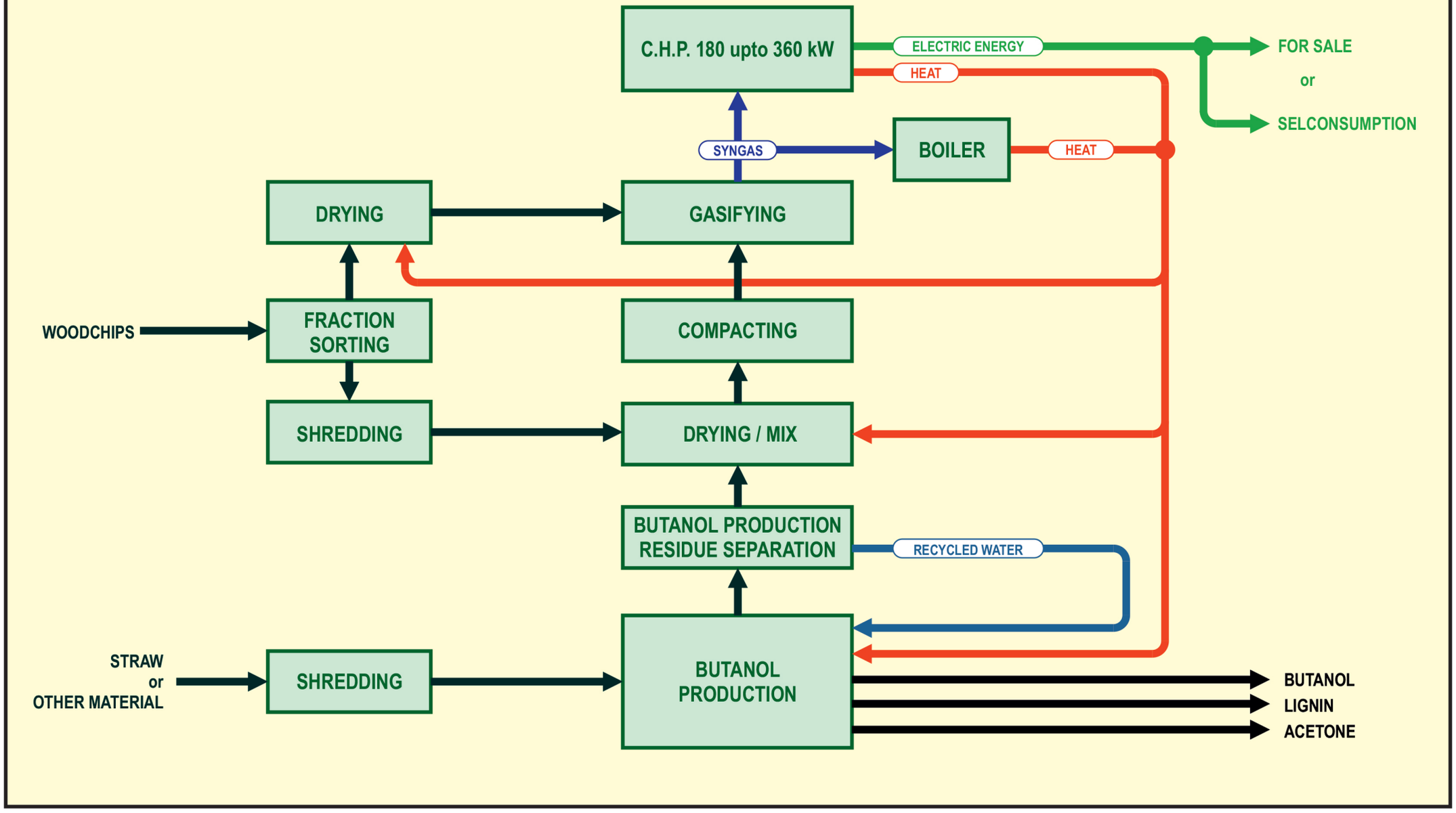
PELLETS (BRIQUETTES)

ETHANOL OR BUTANOL PRODUCTION



ETHANOL or BUTANOL, LIGNIN, ACETONE

PARALLEL TECHNOLOGY FOR BIOBUTANOL, LIGNIN, ACETONE AND ELECTRIC ENERGY PRODUCTION



5.DESCRIPTION OF GASIFICATION, COGENERATION AND PRODUCTION OF BIOBUTANOL

We use technologies that have not been used in such a combination and technical conditions before. There are no previous entries about existing of such technologies that can prove ecological and economic ways of processing biomass.

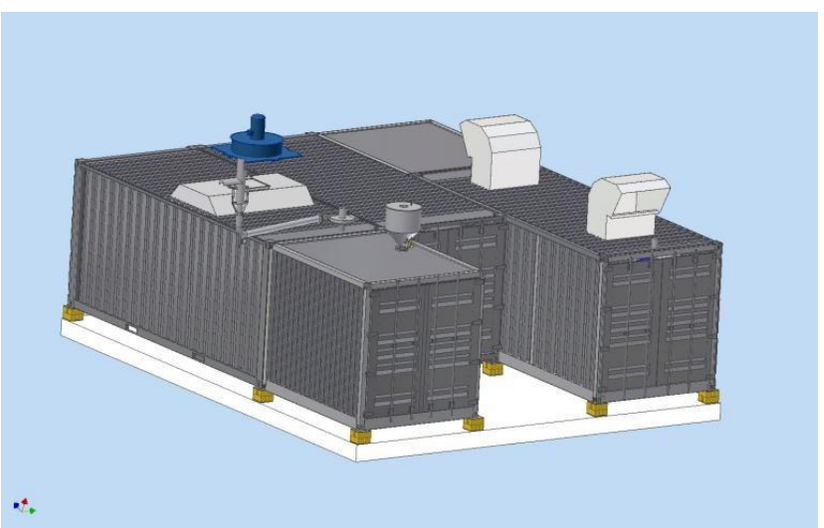
Using such a combination of technologies is not dependent on necessity of selling the produced heat because it can be used in technological process for processing biomass itself (drying, hydrolysis, distillation).

GASIFICATION AND COGENERATION

The main module of a gasifier with cogeneration is a container unit with a performance of 330 kW_{el}. It is located in three 6 meters and three 3 meters long containers with their own roof. These modules can create an energy block with increased performance based on the energy need of the individual regions and possibilities of gaining necessary amount of input materials. For processing of the input materials, it is necessary to build individual objects (they don´t have to be situated right next to the gasifier).

Cogeneration is a production of heat and electricity in one device. Majority of combustion engines (piston and turbine engines) determined for production of electricity has a problem with residual heat. Only about 1/3 of the energy from the fuel can be changed to mechanical energy (rotary motion of the shaft driving the electric generator). The rest is residual heat. The heat can be used for the following consumption and the electricity can be sold to distribution network.

It is necessary to emphasis that production of 1 kWh of electricity currently releases about 2 kWh heating energy which can be captured, transformed and used for own technological processes (drying) and for heating other objects.

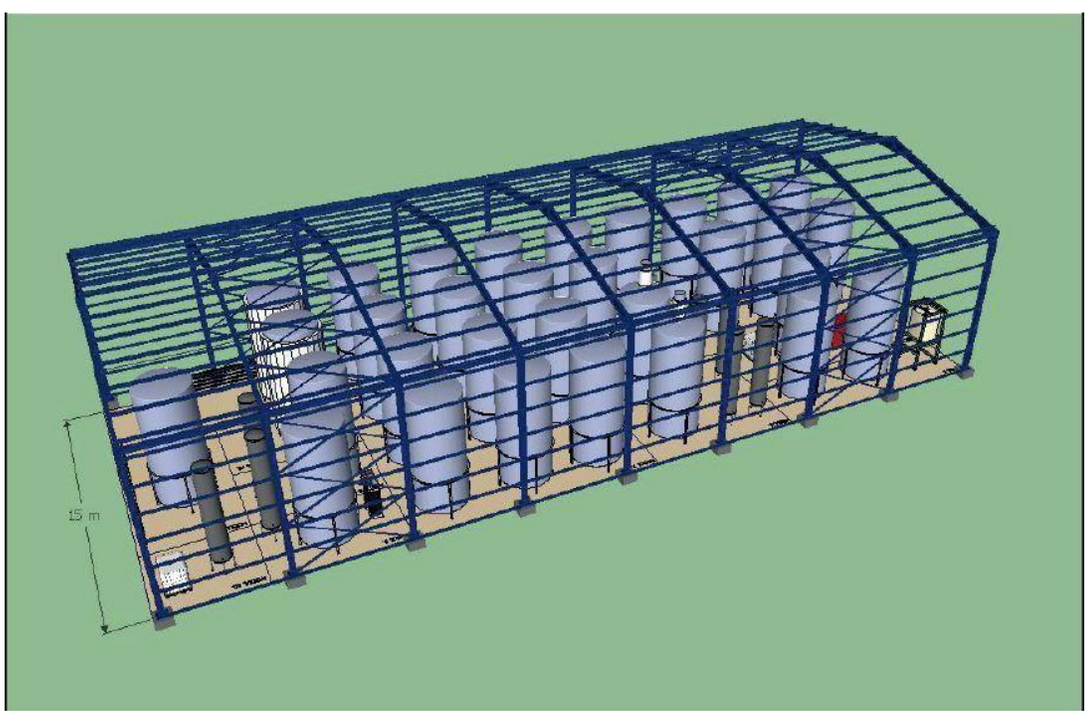


The real amount of energy from the heat is determined after including functions and excluding all additional losses in a proportion of 1 kWh_{el} + 1,5 ÷ 1,6 kWh_{ht}, when applied for producing such an amount of energy, we need to use 1.1 – 1.25 kg woodchip with humidity of 20%.

Every step is planned and projected with accordance to safety and high-quality personal skills and keeping know-how not only in the principles of functioning as a whole but also in each individual part, especially gasification, cleaning, cogeneration parts or production of liquid fuels and other chemical products.

PRODUCTION OF BIOBUTANOL

Biobutanol is a butanol that was produced in a two-stage fermentation process from biomass.



CHARACTERISTICS:

Biobutanol is alcohol, consisting of four carbons and it is produced industrially by hydrogenation of butane. Biobutanol has a heat value that is greater than ethanol and comparable with gasoline. Biobutanol can be blended into fossil fuels for motor engines in a vast ration. Biobutanol is much less volatile than ethanol or gasoline. Thus, there is no evaporation in the warm weather. Moreover, its corrosive characteristics are much smaller as in case of alcohol. Biobutanol also does not absorb water as bioalcohol, the freezing point is -89 °C and therefore, it is possible to transport and storage it in existing equipment. It can be mixed with gasoline from 10 to 99% and it can be used as a 100%-gasoline, as well.

TECHNOLOGIES

Within technologies of production, there are new cultures of microorganisms. A new species of microorganisms in fermented solution works not only at higher concentrations of biobutanol, but they allow producing mainly biobutanol. This is completely new yeast which ensure optimum production of biobutanol from glucose, more than 40%. The first strain converts glucose to hydrogen and butyric acid and the other provides biobutanol from the acid.

The production is continuous and extends in the two-stage fermenter connected to a related pumps and pipes. Next, there is also a device for the separation of biobutanol from the reaction mixture.

A brief technological process is as follows:

- dry or wet milling of grains, sterilization
- conversion of biomass to fermentable sugars
- fermentation reaction with the help of modified Clostiridium in the first stage of fermenter to butyric acid
- pumping of the reaction mixture to the second-stage fermenter
- fermentation of the butyric acid by modified Clostiridium to biobutanol
- hot gas separation, adsorption, desorption, condensation, spin
- distillation of a mixture of biobutanol with 10% of water

The total yield of biobutanol is greater when compared to ethanol, in addition hydrogen is also created which can be used as energy. So far, the traditional ABE (Acetone-Butanol-Ethanol) creates also acetone (28%) and ethanol (14%) by fermentation process. In our new ABE-Process, acetone and ethanol are produced only in a minimal amount and the amount of biobutanol is increased. Liquid remains from production of biobutanol can be used in typical bio-gas plant which is connected to this parallel technology. Finally, this technological circuit is closed and without waste.

6. SUMMARY

We recommend a composition of technological subgroups that ensures effective usage of residual heat from the cogeneration units. Individual groups are connected by energy and by material, so there are no ecological damages caused.

Input material for producing biobutanol is wasted biomass from agricultural activities, e.g.:

- all kinds of straw (from grains, oil-seed rape, corn)
- especially plants that do not compete with food (lantern, sorghum, myscantus, etc.).

From the mentioned above, we can say that the inputs to biobutanol unit and the risk of dependency on only one kind of biomass is totally eliminated.

Preparatory works for project:
For the final determination of parameters of the mentioned technology, the relevant engineering is essential and is a result of a feasibility study. This is the basis for the project implementation. Parameters mentioned in this study will be binding for both manufacturer and supplier of technology, but also for the investor.

In the particular location it is necessary to do:

a) Make a research about specific possibilities of purchasing or cultivation of necessary input materials for production of biobutanol, with necessary contracts
b) Make and defend appropriate EIA study
c) Make a complete project design work

COMPANY PROFILE

ELIS plus provide clients with innovative and modern solutions highly demanded by societal needs of today. We offer advanced systems and energy projects for technologically advanced and smart buildings, for more than 20 years.
Complex, professional and quality services make our company a credible business partner.

ENERGY PROJECTS

Our company is a proud know-how co-owner of modular technology producing electricity, heat, pellets, ethanol, biobutanol, acetone and lignin from waste biomass and municipal waste, with real and effective usage of residual heat from cogeneration plant, which can be applied all around the world.

COMPLEX TECHNOLOGY SOLUTIONS FOR BUILDINGS

Engineering	Renewable energy projects	Access systems
Energy studies / audit	Photovoltaics	Attendance systems
Supply, implementation,	Project management	Electronic fire systems
after-sales service	Security systems	Sound objects
HVAC projects and	Surveillance systems	Measuring and regulation
implementation	Hotel systems	TV, satellite systems

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REFERENCES

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Thank you for your time.
For further information or if you have any questions, please, do not hesitate to contact us.

ELIS plus

Smart House by ELIS plus

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