



Gasification power plant 1MW

Thermochemical gasification of biomass

1. Project of the gasification power plant

1.1 Some information about gasification process

Gasification is a thermo-chemical reaction without oxygen in which there is a rapid heating of the input material

This leads to hydrocarbon chains fission, and thus the solid state input is converted into gaseous state.

The resulting gas is then used as fuel for engine drive in cogeneration units, and subsequently production of heat and electricity is realised.

The energy value of the process or some other energy utilization is increased by the use of the released gases and liquids.

The electricity produced in the cogeneration unit or in the turbine is supplied to the distribution system through high voltage transformation station for the guaranteed purchase price.

To achieve the highest return of the costs on this complex power generation equipment, particularly with regard to current legislation, the most effective is production of power plants with a total installed capacity of 0,999 MW.

The heat produced as a by-product at electricity production can be used to sell for thermal management, or for any other projects where you need to use steam or hot water.

Another alternative is the use of the heat to the next electricity production for example ORC cycle- Organic Rankine Cycle.

Although gasification has been known for several decades, we have managed to improve this technology, and the result is a unique technology which we are offering.

1.2 Feedstock

Feedstock for gasification technology is biomass in various forms of agricultural products or waste produced at sawmill industry, cellulose plant or fitomass processing.

The ideal materials for this technology are for example.: wood chips, bark, sawdust, wood shavings, straw, hay, corn, sorghum and other fast-growing plants with relative humidity - maximum of 60%. The test case is modified for wood chips from waste wood and wood fibre with normal humidity of about 30% in annualized consumption of about 5000 tons. The important factor is composition and quality of the wood chips and at the same time very

important is size of the crushed particles. Handling of biomass can be implemented by using mechanisms - loaders, conveyors or it can be mechanised with rotors and belts according to the requirements and possibilities of the investor.

1.3 Legislation

The legislative environment in the field of renewable energy sources ("RES") in Slovakia is relatively a complex structure of laws, decrees, orders, regulations and other laws that are related to each other and together form defined legal conditions for the implementation and operation of energy facilities producing electricity RES.

The most important pieces of legislation:

Act no.251/2012 on Energy and amending certain laws (hereinafter the "Energy Act").

Energy Act, which was put into operation on 1 september 2012 regulates

- business conditions in the energy sector,
- market access rights and obligations of participants in the energy market,
- measures to safeguard security of electricity and gas and functioning of the internal market in electricity and the internal gas market,
- rights and obligations of persons whose rights and obligations may be affected by market participants in the energy sector,
- state administration in power,
- state supervision and control of the business in the energy sector.

According to the Act:

- power generation equipment means equipment that is used to convert different energy sources to electricity; involves building part of a technological device
- electricity producer means a person who has authority to generate electricity under this Act
- business in the energy sector means transmission, distribution and supply of electricity
- business in the energy sector can only be based on and in accordance with a permit or certificate of compliance with the notification requirement, and this permission is not required for the production of electricity supply and electricity generation facilities with a total installed capacity of up to 1 MW, including
- energy device means a electroenergetic device
- to build a power plant may only be upon certification for the construction of an energy facility. This does not apply to the construction of the energy facility to generate electricity with a total installed capacity of up to 1 MW or less, but

uses a different primary energy sources, like solar energy, to increase the installed capacity of such power equipment above 1 MW can only be based on the construction of an energy certificate equipment

-basic contractual relations in the electricity market

the electricity supply contract

the contract on connection to the transmission system

the contract on connection to the distribution system

Contracts for access to the transmission grid and electricity transmission

Contracts for access to the distribution system and distribution of electricity

Contract on electricity deviations

the Treaty on the assumption of responsibility for deviations

Act No. 309/2009, on Promotion of Renewable Energy Sources and Highly Effective Combined Production and on Amendments and Supplements to Certain Laws (hereinafter the “RES Promotion Act”)

The RES Promotion Act was adopted in Slovakia in June 2009 and last amended by Regulation No. 189/2012 with efficiency from August 1, 2012.

The Act stipulates:

- the way to promote and support the production conditions
- electricity from renewable energy sources,
- electricity from highly effective combined production,
- biomethane
- rights and obligations of producers
- rights and obligations of other participants of the electricity and gas markets.
- conscription law and legal or natural person who markets motor fuels and other energy products used for transport purposes.

The RES Promotion Act specifies the support of renewable energy, conditions when this support can be claimed, and also a method and procedure for setting prices for electricity produced from renewable energy sources and highly effective combined production.

It describes in detail what an application on the certificate of origin should contain – it is issued by URSO – The Regulatory Office for Network Industries.

The RES Promotion Act defines the accounting rules and the record of electricity, the activities of The Ministry of Economy of the Slovak Republic and administrative offenses for stakeholders in relation to the promotion of RES.

Under this Act:

- renewable energy sources means a non-fossil source, which energy potential is constantly renewed by natural processes or human activity, these are the following resources:
- electricity from renewable energy sources means electricity produced in facilities to produce electricity using only renewable energy or electricity, which corresponds the share of renewables in electricity generation facilities
- producers of electricity from renewable energy sources means electricity producer, who produces electricity from renewable energy sources
- biomass means the biodegradable fraction of products, the rest of the vegetable matter and animal substances from agriculture, forestry and related industries
- combined production means the technological process in which electricity and heat are generated simultaneously
- small combined production means the combined production in a cogeneration facility with an installed electric capacity from 50 kW to 1 MW including 1MW
- total installed capacity means the total installed electrical power equipment of the electricity manufacturer
- the support of electricity production from renewable energy sources and the support of electricity production by highly efficient combined production

Is provided

a. By prioritising

- connecting the device to generate electricity to the regional grid system
- the access to the system
- electricity transmission, electricity distribution and supply of electricity,

b. electricity consumption by regional distribution system operator, into which the electricity device is connected directly or through a local distribution system for the price of electricity losses,

c. additional charge,

d. taking responsibility for deviations caused by the regional distribution system operator.

Support under paragraph d. Is applied to the electricity producer with a total installed capacity of less than 1 MW. When electricity producer is using solar energy as a source, the support under paragraph d. is applied only to equipment with an installed capacity of up to 100 kW.

Support under paragraph b., C. and d. Is applied to the electricity producer for 15 years after the system startup

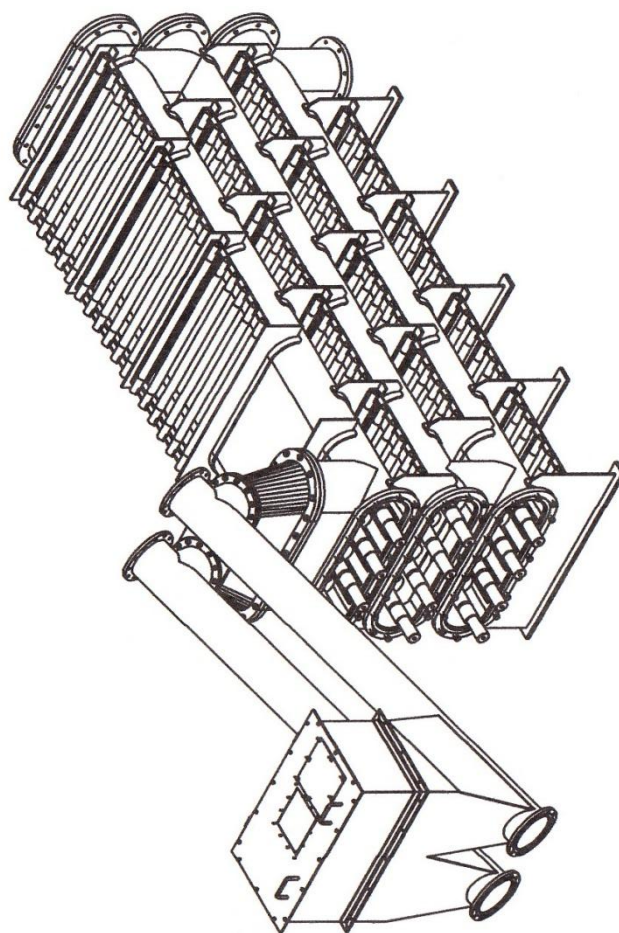
Support under paragraph b. and d. is applied to the electricity producer with a total installed capacity of up to 1 MW for the lifetime of the device producing electricity

The Regulatory Office for Network Industries's Edict No. 184/2012 amending and supplementing the RONI's Edict No. 225/2011 laying down regulation of prices in power engineering industry, as amended by Edict No. 438/2011.

According to the Edict, a price of electric energy produced by burning the gas produced by thermochemical gasification in a gasification generator in a power producer's facility put into operation from January 1, 2014 onwards is determined as a fixed price in the amount of EUR 122.62 per MWh.

Main tasks:

- monitoring of legislation and resource balance
- communicating with investors
- due diligence
- technical audit
- acquisition of the city (town), for approval of construction
- the acquisition for the financing bank
- assistance in the preparation of the project
- project documentation for building permit, except for project construction parts, continuity and location of buildings
- coordination of the complex realisation



2.2 Photos

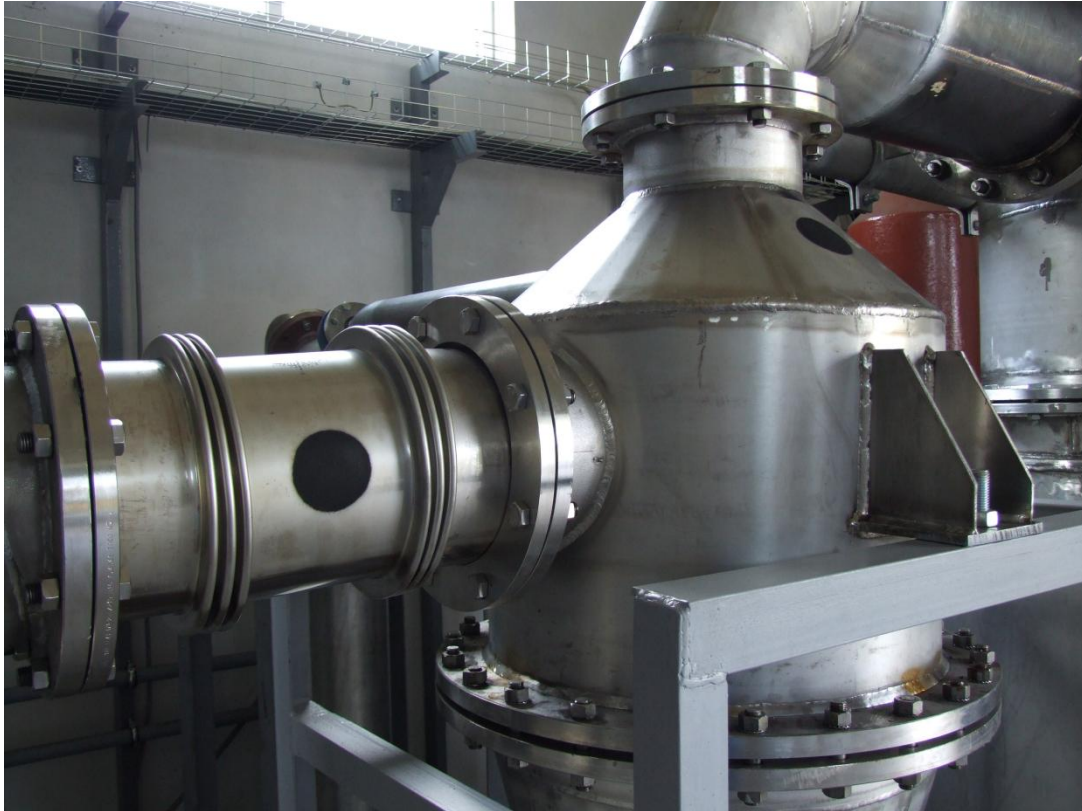




















2.3 Description of the technology

Gasification technology consists of the following components:

- Warehouse management

Size of warehouse space in terms of supply and reserve of biomass depends on conditions of the specific project and its supply options. It serves as a warehouse or for the preparation of initial biomass.

- Conveyor of biomass. – (feeder)

It is used for continuous supply of biomass to the gasification generator.

- Gasification generator

Is the most important part of the technology. The generator there occurs the rapid heating of biomass without oxygen and thus the conversion the solid state input is converted into gaseous state (gasification).

- Separator of dust particles

is used to remove dust particles from the gas.

- Stack of solid waste

It stores the residual ash and dust.

- Filtration of the gas

Serves to further purification from dust particles and to stabilize its velocity

- Shower column

it is used to wash and cool the gas

- Water cooler shower

Exchanger, which is used for cooling water in a closed circuit shower column.

- Cooling tower

It is used for cooling water for the shower exchanger column.

- Exhaust fan

Used to transport gas to the cogeneration unit.

- Cogeneration unit

Used to generate electricity from the resulting gas in the gasification generator.

- Automated control system.

used to manage and operate the whole technologies.

2.4 Parameters of the Technology

Electricity generation- 0,999 MW

Production of thermal energy -1 MW to 1.2 MW

Consumption of starting material - approximately - 610 kg / h

Electricity consumption- 250 kW

2.5 Composition of the exhaust gas

The composition of the gas in this technology is the most important indicator, alongside with energy, it represents the most relevant parameter.

The energy value of the gas is over 10MJ/m³

Gas composition:

CO 15 % - 32%

CO₂ 10 % - 22%

N₂ 1% Unwanted (extinguishing) gas

H₂ 26% - 47% - important gas

Methane CH₄ 8% - 12% - important gas

Ethane 0.2% - 1.0% - important gas

2.6 Effective specifications of the technology

The uniqueness of this technology lies in the following indicators:

- It can regulate the quantity and quality of gas (gas is stable and there are no significant variations)
- It can operate with biomass having high relative humidity up to 60% (other technologies work with max. humidity 15%, which is associated with the necessary drying of biomass, which represents the loss of energy)
- Minimum space requirements (a small area, about 300 square meters, and the minimum height, about 6 m, compared to other technologies)
- Simplicity of the technology (less demands on maintenance and thus minimal risk of failure)
- Low consumption of biomass (high efficiency of the gasification generator)
- The lowest emissions per 1kW in this class (high proportion of hydrogen H₂ up to 47%)

2.7 Construction part

Minimum requirements on the technological part:

- reinforced concrete area of size min. 300 m²
- simple roofing and cladding of buildings without insulation
- minimum requirements for storage management:
- paved area measuring approximately 500 m² (depending on the specific conditions of the project)
- driveway

2.8 Safety and environmental impact of the technology

Operation of the present technology is environmentally friendly and causes no damage to the environment.

Construction and operation of the gasification plant will comply with the relevant standards and regulations.

2.9 Operation of the gasification plant

Service is dependent on the conditions of a particular project, but within legal norms it is necessary to have a continuous supervision by one authorized person.

3. Price of the project

3.1 The basic technological unit – inventory of components

- conveyor of biomass
- gasification generator
- separator of dust particles
- stack of solid waste
- filtration of the gas
- shower column
- water cooler shower.
- cooling tower
- exhaust fan
- cogeneration unit
- automated control system.
- transformer station

3.2 Price of the technology

Price of the basic technological unit on the performance of 0,999 MW is 3.200.000,-EUR without VAT.

3.3 Project costs

Project costs - 350.000,-EUR

4. Requirements for investor

The rights to the property

Consent of the community (approval of the town)

Reservation of capacity

Contract for the supply of raw materials

Legal Due Diligence

Building permit

Financial Preparedness