CENTRAL OSTROBOTHNIA UNIVERSITY OF APPLIED SCIENCES

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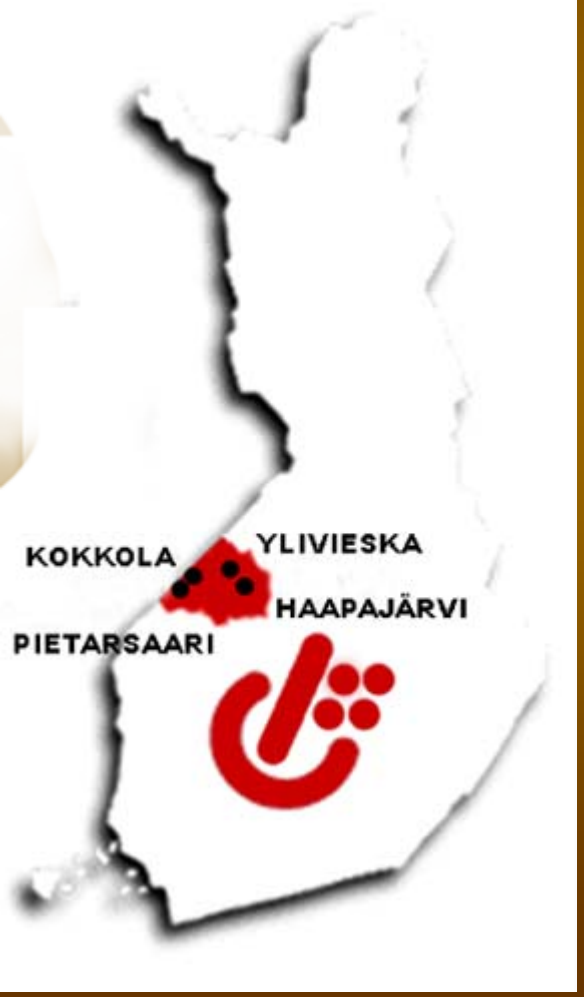
Energy technology



- Students
  - Kokkola n. 1750
  - Ylivieska n. 1050
  - Pietarsaari n. 290
  - Haapajärvi n. 100
- Approximately 3200 students

- Engineering
- Business and Administration
- Tourism
- Health Care and Social Services
- Culture
- Humanities and education

CENTRAL OSTROBOTHNIA
UNIVERSITY OF APPLIED SCIENCES

CENTRIA is the unit of research, development and further education of Central Ostrobothnia University of Applied Sciences.

- CENTRIA implements applied research and development projects mainly in co-operation with the region's enterprises and communities. Annually CENTRIA participates in more than 100 separate R&D projects.

Woodgas production and energy use

CENTRIA`s RESEARCH MISSION

CENTRIA Ylivieska unit study designed to investigate the efficiency measurements, based on looking for the scientific justification for the whole gasification process

The research from August 2008 has progressed as follows:

- Experiences and the identification of properties
- The measurement points determination and placement
- Product gas analysis with Gasmet-analyzer
- Temperature measurements
- Wood chips consumption and gas volume measurements of the different power
- Searching for a theory to explain the measurement

Woodgas production and energy use

OPERATIONS AND MEASUREMENTS DURING HIGHBIO PROJECT.

The gasifier was placed in the industrial hall and equipped with an automatic feed of chips. Heat of the engine can be used in radiator network of the hall.

During tests we have added fuel manually, so that it has been easier to measure consumption of fuel.

We have two engines Mopar V8 5,6 litre and Scania straight 6 7,8 litre.

Most measures we have done with Scania.

Running speed of both engines are 1500 rpm

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FUEL

As fuel we have used the normal chips. The humidity has ranged from 30-40% and a calorific value 9,05-12,51 MJ/kg (2,51-3,475 kWh/kg)

Below analyzes of two samples

		Sample 1	Sample 2
Humidity	%	44,61	29,87
Ash content in dry matter	%	1,09	0,81
Caloric heating value, MJ / kg	MJ/kg	19,71	20,27
Effective heating value dry matter	MJ/kg	18,31	18,88
Effective heating value income humidity	MJ/kg	9,05	12,51

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WOODGAS IN BURNER USE

In one test we used in one hour 57 liter chips which corresponds to about 16 kilograms of density 280 kg/m^3

We had blower for aspirating the gas from reactor to burner 16 l/s. So one kilo produced 3,61 m^3 gas.

Burning was a very peaceful and the actual flame is not visible in daylight. A clear development target is the air volume control, because the burner was for use of natural gas.

Air and woodgas mixture ratio should be 1 part of gas and 1.24 of the air when the over-air coefficient is 1.1

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WOODGAS IN ENGINE USE

ENGINE POWER with woodgas

Our engine is a 7,8-liter V6.

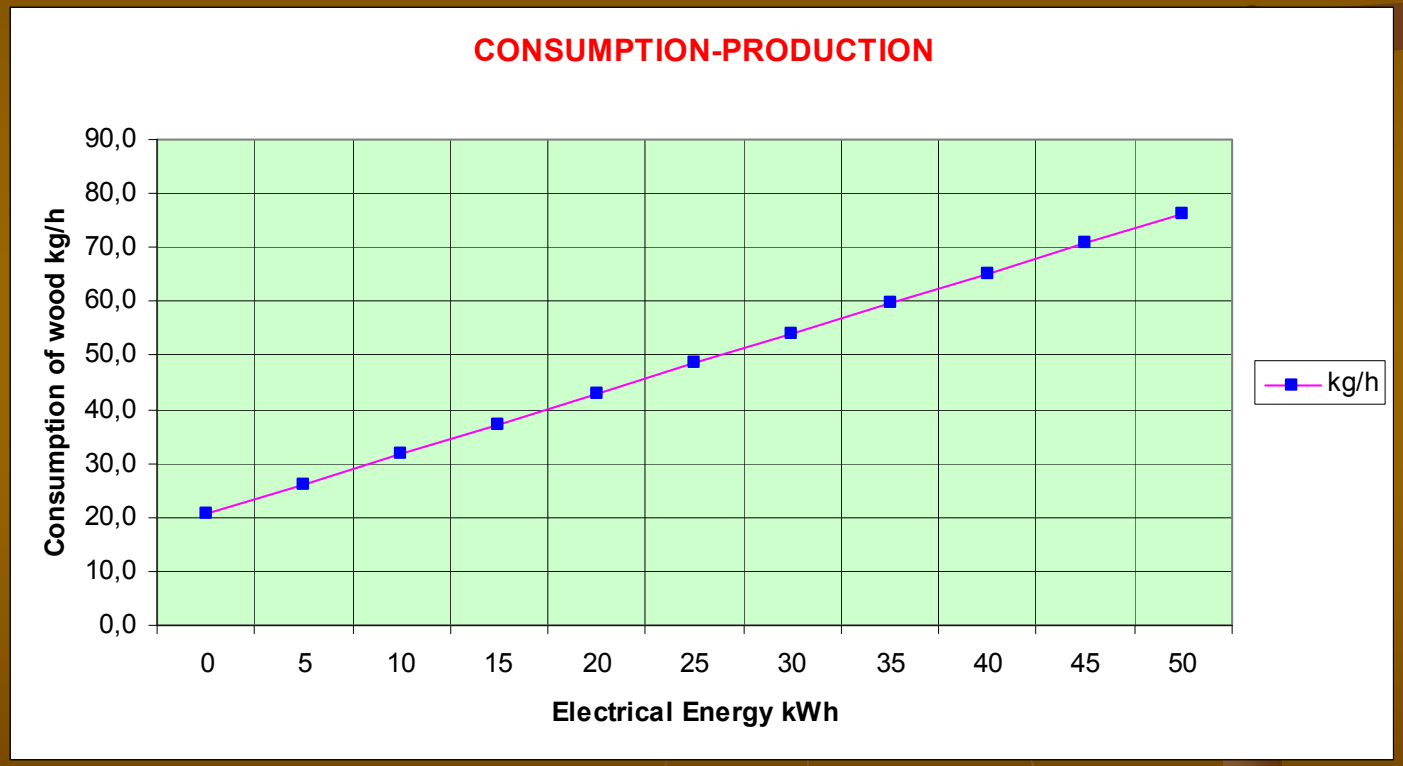
Below is the VTT's presented by the naturally aspirated engine power for woodgas

Moottorin kierrosnopeus rpm	Teho kW/ 1000 cm^3 iskutilavuus
1000	4,4
1200	5,25
1500	6,5
1800	7,35

Running speed of generator is 1500 rpm, so the achieved power is a 8x6,5 = 52 kW. Engine size seems a suitable, if the aim is to produce electricity 50 kW.

Woodgas production and energy use

WOODGAS IN ENGINE USE



The table is prepared in such a way that is measured for wood consumption with powers 9 kW, 18 kW and 27 kW.

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WOODGAS IN ENGINE USE

ELECTRIC POWER	0 kW	9 kW	18 kW	27 kW
Measurement 1	20,2 l/s	26,6 l/s	35,0 l/s	42,5 l/s
Measurement 2	19,0 l/s	25,0 l/s	33,0 l/s	42,5 l/s
Measurement 3	19,0 l/s	27,0 l/s	35,0 l/s	41,5 l/s
Measurement 4	20,0 l/s	26,0 l/s	35,0 l/s	41,5 l/s
Average	**19,6 l/s**	**26,2 l/s**	**34,5 l/s**	**42,0 l/s**
Average	**70 m3/h**	**94 m3/h**	**124 m3/h**	**151 m3/h**
Electricity production	0 kWh	9 kWh	18 kWh	27 kWh
Gas consumption	**70,4 m3/kWh**	**2,6 m3/kWh**	**3,0 m3/kWh**	**3,0 m3/kWh**

This table is made of gas flow in different amounts of power.

At the moment we do not have a sufficiently precise measure of the hydrogen and nitrogen to determine the amount, if these gas components are known, as may be determined by the gas heat value and allows the gas output. At a general level, the gas heating value is around 4,5-5 MJ/nm3.

Woodgas production and energy use

Thank you for your attention!