Mothermik®
Wood electrification installations

Regenerative, CO_2 neutral energy – Made in Germany

Member company in the Bundesverband BioEnergie e.V.

Mothermik®

Bio energy, electricity and heat from native wood. Our wood electrification concept is unique in the market.

Much more than 10 years of development work stand behind our innovative, trend setting, regenerative cogeneration technology – in addition the more than 25 years of mature know how of a company which is extensively independent from suppliers.

The goal was the development of an automatic complete system for the electrical conversion of wood. Our own developed wood gasifier with the appropriate components, like wood logistics, including dryer, gas and water processing, as well as the adjustment of proven pilot injection engine technology make possible the continuous operation.

The automatic Mothermik® wood electrification installation (WEI) is currently unique in the market. The highest safety technical standard (CE, Atex, GS) as well as the consequent environmental and emission protection characterize the Mothermik® WEI.

The CO^2 neutral production of energy using native, growing wood is a decisive contribution to the reduction of our dependence on fossil, finite energy carriers. The political demands for future-safe, climate friendly production of energy is thus accommodated for.

The function principle

Untreated forest or landscape maintenance wood serves as a fuel. Wood in the form of chopped wood chips (G50), including the bark, is used. One year old plant components like needles, leaves etc. are not suitable for the process. The chopped wood is, depending on the delivered condition, dried to the water contents needed for the process of < 15 %. The needed heat energy is provided from the ongoing process.

The entire necessary wood manipulation, as of the chopped chip warehouse, within the facility building is carried out by an intelligent grabbing crane system which is measured in three axles. All transport tasks, from the delivery surface to the gasifier infeed, are reliably taken care of in an energy efficient manner. Due to the wood logistic concept, you can completely do without the conventional conveyor technology, like spirals, bottom dischargers, belts or manual infeeds.

The wood chop chips are automatically fed into the wood gasifier in the required amounts. There with the addition of air as a gasifying means continuously wood gas is produced.

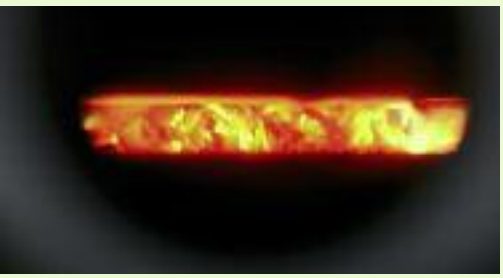
At the end of the process, before the complete ashing, a small amount of charcoal coke is discharged. This accumulates in the form of a powder, is transferred using a chain conveyor system to special collection containers and can be sold to the industry for example as a raw material for the production of grill briquettes. You do not need to dispose of the ash.

The hot wood gas which is discharged from the reactor is processed in several stages and then fed into the pilot injection engine. There under continuous feeding in of a low amount of ignition oil (bio diesel RME) the wood gas is burned in the engine.

The motor cogeneration plant, consisting of the pilot injection engine with exhaust fume heat exchanger and generator, is completely operated with power heat coupling. The heat flow of the gasifier facility and the motor can completely be made available for chopped chips drying, or essentially coupled out for the external heat use (heating, consumption water heating or process heating at 80 °C/60 °C).

The produced electrical energy is fed into the public mains, must be accepted by the local network operator and is paid for according to the valid regulations.

The installation is equipped with a novel gasification reactor – Geometry and highly effective gas processing



View in the oxidation zone

Chemical reactions with wood gasifying

Pyrolysis (endothermal/exothermal):	
Wood polymers	→ gaseous and liquid pyrolysis products
Oxidation (exothermal):	
$C + O_2$	→ CO_2
$CxHy + (x + {}^1/_4\ y)\ O_2$	→ $x\ CO_2 + {}^1/_2\ y\ H_2O$
Boudouard reaction (endothermal):	
$C + CO_2$	→ $2\ CO$
Water gas reaction (endothermal):	
$C + H_2O$	→ $CO + H_2$
$C_xH_y + x\ H_2O$	→ $x\ CO + (x + {}^1/_2\ y)\ H_2$

exothermal: energy supplying *endothermal: energy consuming*

Pre-dried fuel and condensed water is added to the gasifying reactor.

In the drying zone, the moisture escapes the bio mass with continuously increasing heat at up to 200 °C.

The decomposition of chemical connections (pyrolysis) occurs with temperatures between 200 °C and 700 °C. Here above all hydrocarbons result.

In the homogenous firebed of the oxidation zone, the thermal-chemical gasification is triggered when air is added at up to 1,100 °C.

In the reduction zone, the actual wood gas with an end temperature of approx. 550 °C is created, as well as charcoal coke.

The produced wood gas flows through the output of the reactor for the gas processing stretch. High quality charcoal coke is discharged for the further usage.

Gas and water processing

Wood gas is a low calorie weak gas (main burning shares CO, H_2 and CH_4) with a heating value of approx. 1/7 of the heating value of natural gas. After the discharge from the reactor, it is a gas with approx. 550 °C, contaminated with charcoal coke dust, flue ash and a diversity of unburned hydrocarbons (wood tar). In order to make possible an enduring use of the wood gas, a reliably highly effective gas processing is needed. For this Mothermik® uses a two stage process which they have developed themselves.

In the first stage, the gas is cooled down using a quenching unit to a temperature of approx. 50 °C which is suitable for the motors, and thus is freed from the dust particles (see flame image pre-cleaned, orange-red through hydrocarbons). Then the gas is lead to a redundant, highly effective high voltage separator which removes remaining particles, drop shaped hydrocarbons and condensed water (see flame image final cleaned, light blue through purity and CO). The refined wood tar and the condensed water are led back to the quenching water cycle.

In the facility's internal quenching water cycle, there is a settling tank. There a sludge settles which consists of charcoal coke dust, wood tar and water. This sludge is discharged from the system using an automatic conveyor system and taken to the collective container. The sludge is properly disposed of. A system for the homogenizing and refeeding of the sludge in the oxidation zone, to the complete recirculation, is in the test phase.

Excessive condensed water is stored in the quenching water cycle and directly returned to the reactor, so that operation of the facility without waste water is possible. Only with unfavorable operating conditions can there be an excessive onset of condensed water. This must then be properly disposed of.

Pre-cleaned

Final cleaned

Laureate of
Innovation Award 2004
Rhineland-Palatinate

Control, cogeneration and heating part of the dryer are compactly located in the outer area of the installation.

Fresh wood is fed in by the grabber when needed and automatically led to the chopped chip dryer.

The feeding of the reactor occurs depending on the level through the vibration groove and the lock lid.

Through a tableau with a display and keyboard all processes for the crane, dryer and gasifier are controlled.

An additional visualization of all essential parameters supplements the monitoring. Remote monitoring using a modem or internet is standard.

A high capacity hydraulic facility with accumulator ensures a proper shutdown when the mains fails or there is a disturbance.

Charcoal coke is hydraulically dispersed from the system. Through a coil and chain belt, it is placed in the collective container.

The coke accumulates in a powder form, has a heating value of approx. 6.0 kWh/kg and can be used for the production of grill briquettes.

Mothermik® wood electrification installations (WEI)

Typ MTHG.CNm.250

Our delivery and service scope consists of:

- Gasification reactor with gas and water treatment
- Automatic grabbing crane including control
- Wood chopped chips dryer including control
- Control with visualizing and date remote conveyance in the container
- Motor cogeneration plant in soundproofed container with proven pilot injection engine, rotary current generator, SPS control, exhaust gas heat exchanger, oxidation catalyzer, exhaust gas chimney and wood gas flare

- Available in the module construction of 1, 2 or 4 modules, each 250 kW
- Support with projecting, planning and implementation of authorization procedures
- Assembly and start up of operation
- Training of operators
- Customer service and spare parts supply around the clock, directly by Mothermik®, outside of Germany by Mothermik® representatives

Specific values of a 1 module WEI (mass balance)

referring to 7,000 operating hours

Initial quantities	per hour	per year
Ignition oil consumption approx.*)	7.0 liters	56,000 liters
Chopped chips consumption atro max approx.	189 kg	1,323 to
Wood volumes spruce/fir approx.	1.26 srm	8,820 srm

Wood apparent weight atro approx. 150 kg/srm (chopped chips, spruce/fir G50)

Output quantities	per hour	per year
Charcoal coke discharge approx.	12-18 kg	105 to
maximum electrical infeed capacity	250 kW	1,750,000 kWh
maximum heat coupling approx.**)	240 kW	1,680,000 kWh

*) Bio diesel (RME)

**) Only motor cooling water heat 80 °C/60 °C. All other heat flows are used for the drying of the fuel and have an essentially lower temperature level. The given heat amounts can only be coupled out externally with the acceptance of the input fuel to the dryer with a medium water content of a max. of 35 %. With a higher water content, the heating amount clearly is reduced.

Energy balance of the WEI based on 7,000 operating hours

Initial quantities (relating to the fuel dry mass)

Heating value of the wood H_u atro	5.00 kWh/kg
Heating value of the ignition oil H_u approx.	9.50 kWh/l
Input wood atro approx.	1,323 to
Input bio diesel / RME approx.	56,000 liters
Q_{zu} wood atro approx.	6,615,000 kWh
Q_{zu} Bio diesel / RME approx.	532,000 kWh
Q_{zu} total approx.	7,147,000 kWh
Energy consumption electrical approx.	105,000 kWh
max. electrical infeed capacity	250 kW

Output quantities

Output charcoal coke approx.	105 t
Q_{ab} electrical approx.	1,750,000 kWh
Q_{ab} thermal heating warmth approx.	1,680,000 kWh

Efficiency and specific quantities

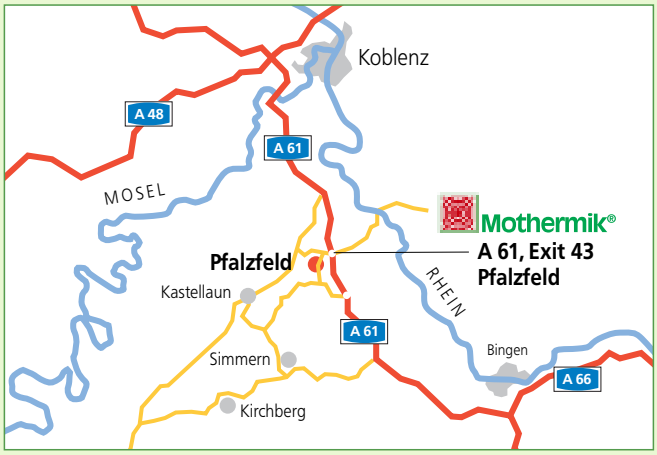
η_{el} of the WEI*) approx.	25-28 %
spec. wood consumption atro approx.	0.72 kg/kWh_{el}
spec. electrical work approx.	1.25-1.40 kWh_{el}/kg
spec. thermal work (80°C) approx.	1.2 kWh_{th}/kg

*) relating to the chopped wood chips according to the input quantities (atro), input feeding / power on the clamp generator

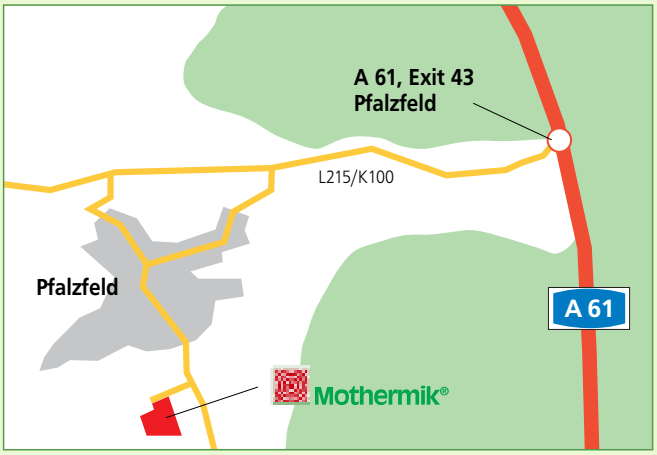

TÜV
betreut.

Wimmer, Lahnstein 6/2008

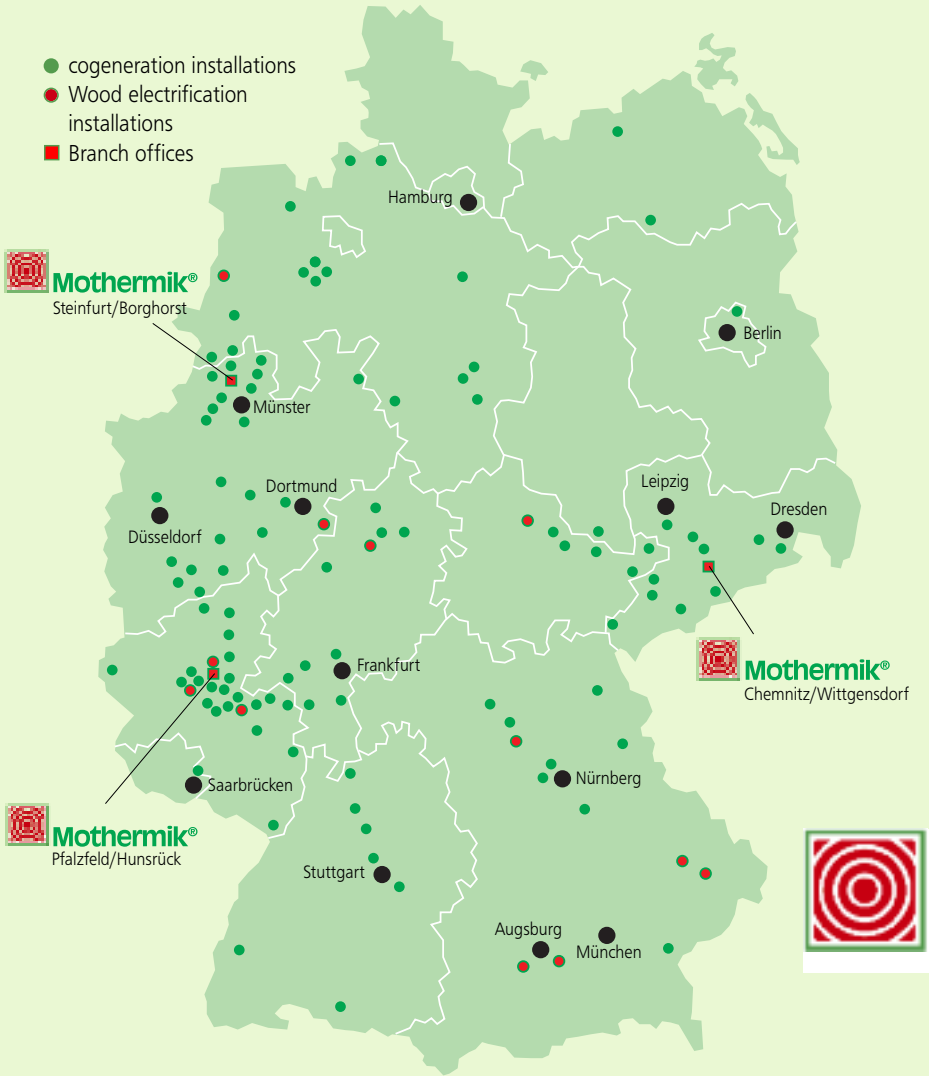
Energy heat coupling with competence and experience. Renewable energy – Made in Germany.



How to find us: A 61, Autobahn exit 43, Pfalzfeld.



Via the L 215/K 100, after 1.5 km you reach the town.
Follow the street in the direction of Laudert as of the middle of the town.
After approx. 300 meters after leaving the town, turn right,
industrial park.



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Conventional and renewable cogeneration technology

Mothermik®

Mothermik® is a Wilms Group company