

Electric power generation with High efficiency

- CO2 neutral electricity production
- Tar-free gas
- Fuel is widely available wood chips



2-step gasification of biomass



Prototype installation (80kW) at the Danish Technical University (DTU)

Weiss A/S in cooperation with DTU in Copenhagen on the development of the 2-step gasification.



2-step gasification of biomass



Installation of 200kW gassifier in Hadsund (DK)

In 2007 Weiss A/S built a full scale test plant of 200kW at our adress in Hadsund, Denmark.



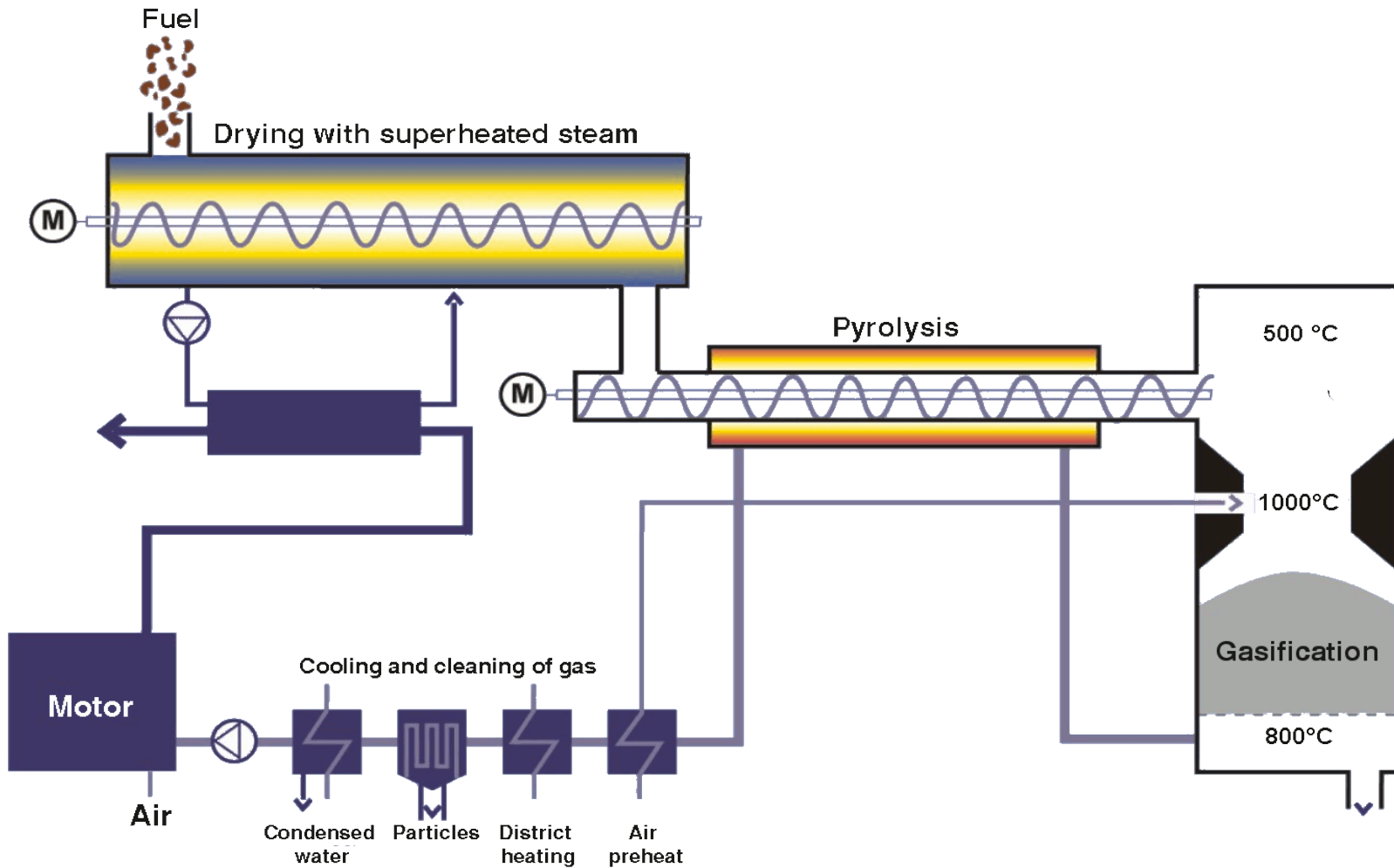
2-step gasification of biomass



Next step

- Gasifire build in Hillerød
- Upscaled to 500 kWe
- Commercial plant as demonstration
- Financially supported by PSO
- Engineering and design ongoing now.
- Expected startup to spring.

2-step gasification - principle diagram

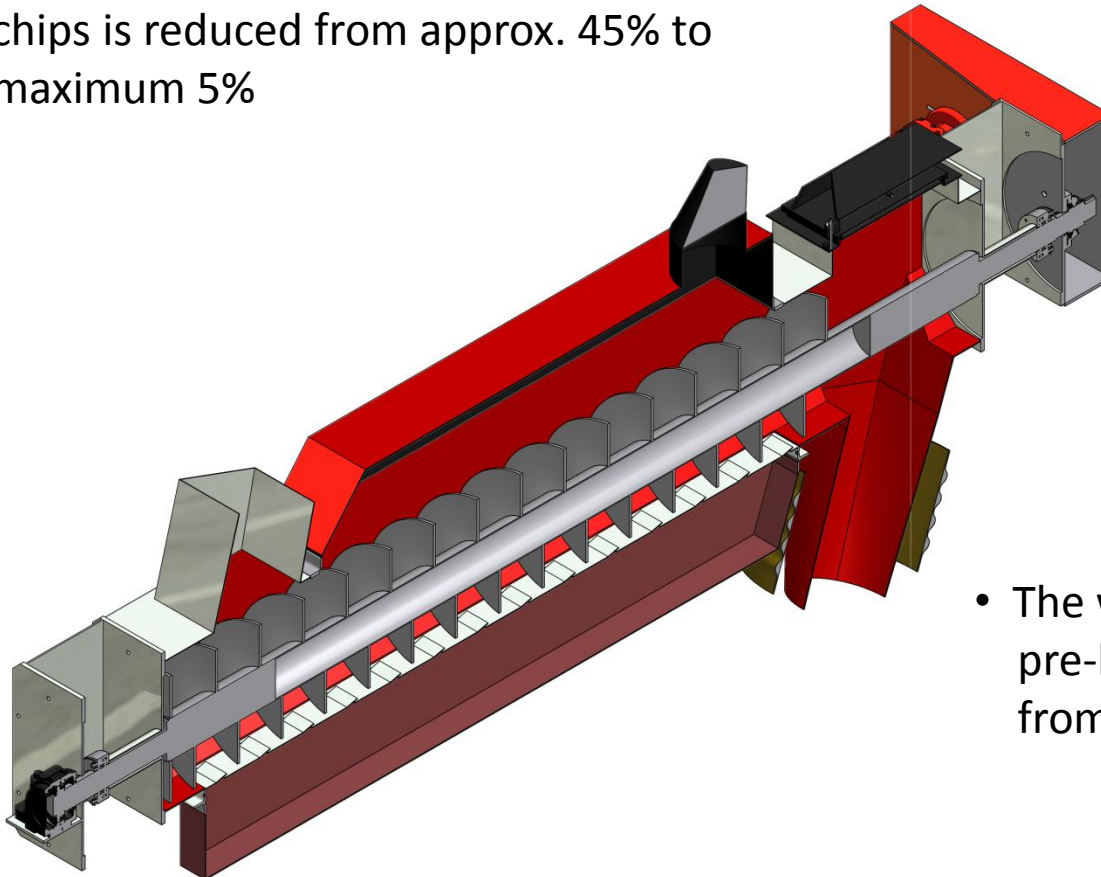


2-step gasification – drying chamber



Function:

- The moisture content in the wood chips is reduced from approx. 45% to maximum 5%



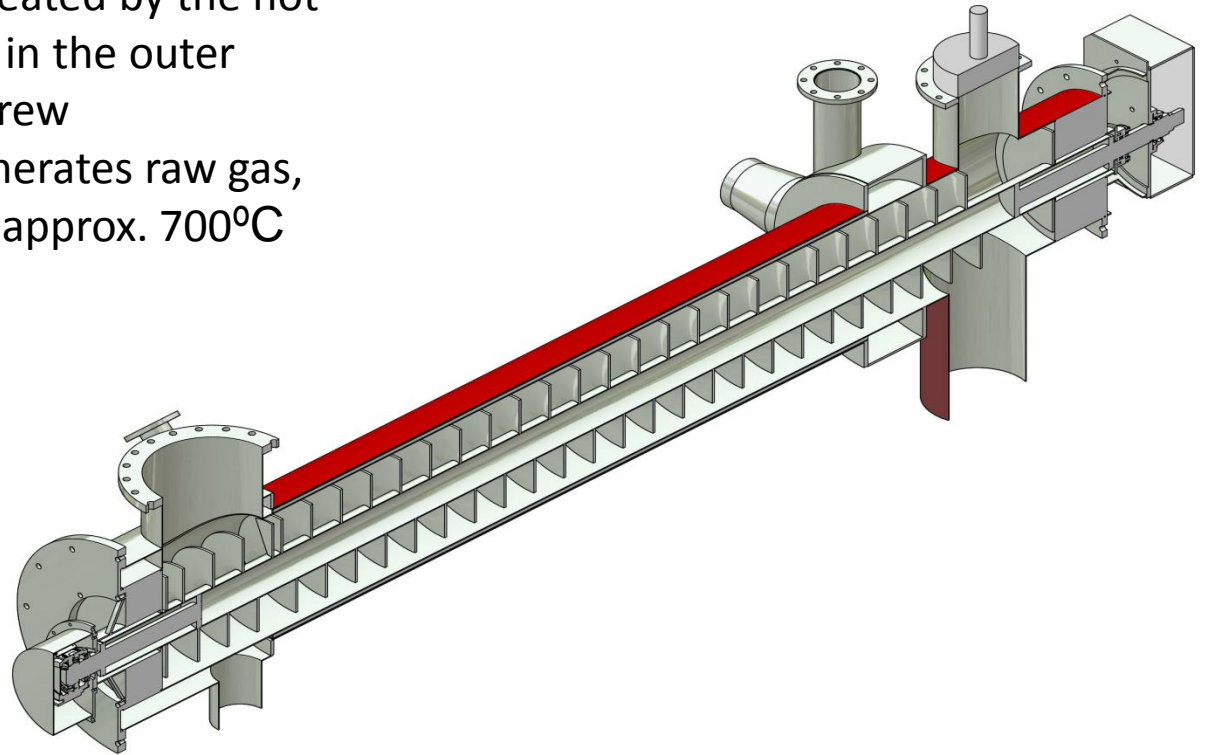
- The wood chips are dried using pre-heated air, fed by energy from gas engine exhaust gases

2-step gasification – pyrolysis screw

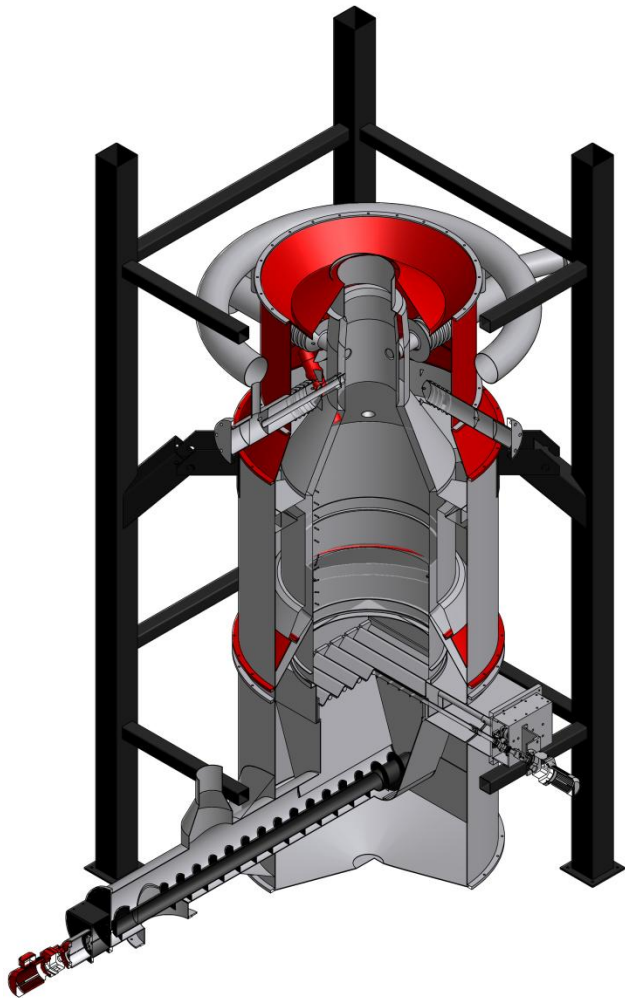


Function:

- The pre heated wood chips is fed through the center tube of the pyrolysis screw
- The pyrolysis process is heated by the hot raw gas which circulates in the outer jacket of the pyrolysis screw
- The pyrolysis process generates raw gas, coke and tar particles at approx. 700°C

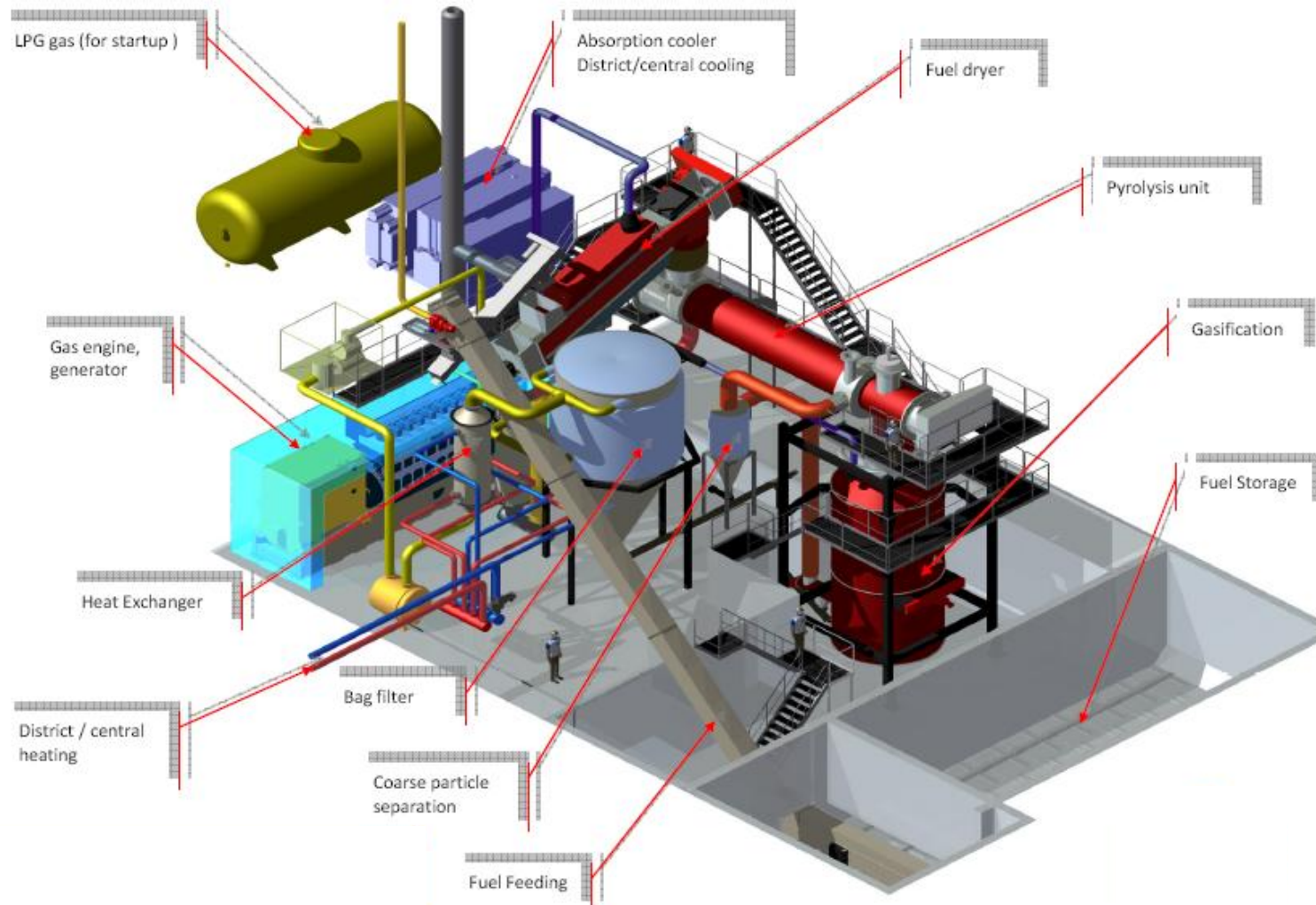


2-step gasification – the reactor



- A mixture of coke, raw gas, steam and tar particles is fed from the top of the reactor.
- Pre-heated combustion air is supplied at a high velocity through the combustion air ring and special nozzles.
- In the top of the reactor a fission of the tar particles takes place supported by the steam content.
- On the grate in the bottom of the reactor a layer of coke is build, the "*coke bed*". The height of the coke bed is controlled by means of a scanner device installed on top of the reactor.
- The raw gas is forced through the coke bed where possible tar particles are absorbed.
- Ash from the coke bed is transported to the ash container through the ash screw in the bottom of the reactor.

2-step gasification – layout 1MW-(e)



2-step gasification – technical data



Technical data

Output, electric power	: 200 kWe	500 kWe	1000 kWe
Fuel consumption	: 230 kg/h	575 kg/h	1150 kg/h
Output, thermal	: 400 kW	1000 kW	2000 kW
Fuel	: wood chips		
Moisture content in fuel	: 35 - 50%		
Investment mill. euro	: 2,4	3,1	4

2-step gasification – gas composition



	Raw gas	Gas after condensing	Flue gas	Flue gas after condensing
CO ₂	12,9%	15,0%	11,8%	12,7%
CO	13,0%	15,0%		
H ₂ O	21,9%	9,2%	15,2%	9,2%
H ₂	24,7%	28,7%		
CH ₄	1,4%	1,6%		
N ₂	26,1%	30,4%	67,4%	72,2%
O ₂			5,6%	6,0%
dew temp.	63°C	45°C	55°C	45°C

Cold gas efficiency

Lower heat value : 99%
Higher heat value : 92%

Gas engine data

lambda in engine : 1,6
Higher heat value : 6,1 MJ/Nm³
Lower heat value : 5,5 MJ/Nm³

Experience & Challenges

- 4000 h for Viking and 1000 h for Hadsund
- 30% Electric efficiency in Hadsund
33% expected I Hillerød.
- coming in to the commercial market
- Upscaling to 500 and 1000 kWe
- Reducing off coal in ashe (unburned)
- Implement Danish emissions values I EU.

2 -trin forgasning



Thank you



WEISS A/S

Ved Stranden 1, DK-9560 Hadsund, Denmark

dk Phone: +45 9652 0444

e-mail: weiss@weiss-as.dk

www.weiss-as.dk