



HTW Gasification Technology for BtL-Fuels

Synthetic Biofuels - Techniques, Potentials, Perspectives

2nd International BtL-Congress
Berlin, 12th and 13th October 2006



HTW Gasification Technology

Routes, plants and feedstocks for biomass gasification

entrained flow gasification	GSP, Carbo-V-gasification	bioslurries from pyrolysis, pyrolysis gas and wooden coke
fixed bed gasification	Wiener Neustadt, Rossano	wooden chips, olive marc
staged steam reforming	Herten (Blue Tower)	wooden chips
circulating fluidised bed gasification	Ferco Batelle, Güssing FICFB, Vermont	wood
pressurised fluidized bed gasification	Värnamo, HTW Berrenrath, Oulo	wood, peat, lignite, hard coal, waste



HTW Gasification Technology

Pressurised fluidised bed gasification - advantages

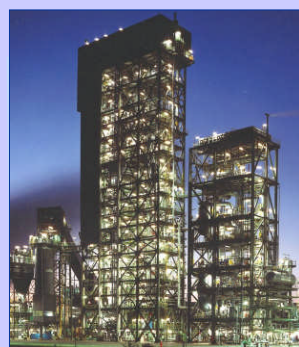
- excellent mass and heat transfer
- moderate demands on fuel properties
- acceptance for a wide range of solid feeds
- high thermal capacities and lower costs for gas compression
- low tendencies for slagging at lower temperatures
- smooth controlling
- high availability

3



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HTW history



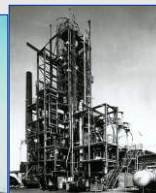
HTW demonstration plant ¹⁾
1980-1997
throughput 30 t/h ³⁾



HTW pressurized
gasification ¹⁾
1986-1992
throughput 13 t/h ³⁾



HKV test plant ²⁾
1976-1982
throughput 1 t/h ³⁾



HTW pilot plant ¹⁾
1974-1985
throughput 1 t/h ³⁾

¹⁾ HTW – High temperatur Winkler gasification
²⁾ HKV – Hydrogenating gasification
³⁾ throughput lignite

source: Hühoff J., Ewers J., RWE Power AG „Neue Wege in der Kraftwerkstechnik“, RWTH Aachen, 02. Mai 2006

4

HTW Gasification Technology – main principle

HTW gasifier

- longterm operation at 10 bars (130 MW_{th}, Berrenrath), 25 bars (25 MW_{th}, Wesseling)
- 950 °C
- feeded with coal and biomass (peat)
- oxidation agents: air and oxygen
- gas generation for methanol production
- carbon conversion >90%
- high availability >85%

5

HTW Gasification Technology for BtL Fuels

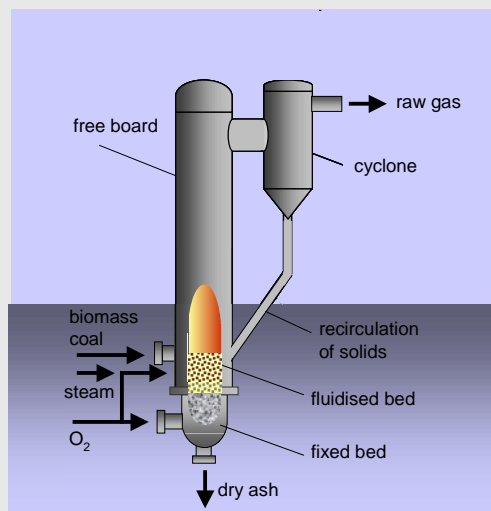
Modification for biomass conversion

Sasol-Lurgi fixed bed gasifier

HTW gasifier

6

Modified pilot gasifier - design



- operation pressure 25 bar
- operation temperature 900- 950 °C
- feeded with biomass (pellets, chips)
- oxidation agents: oxygen, steam, CO₂
- gas generation for methanol production
- complete carbon conversion (>98%)
- oxidising aftertreatment of the bottoms
- dry ash at the bottom

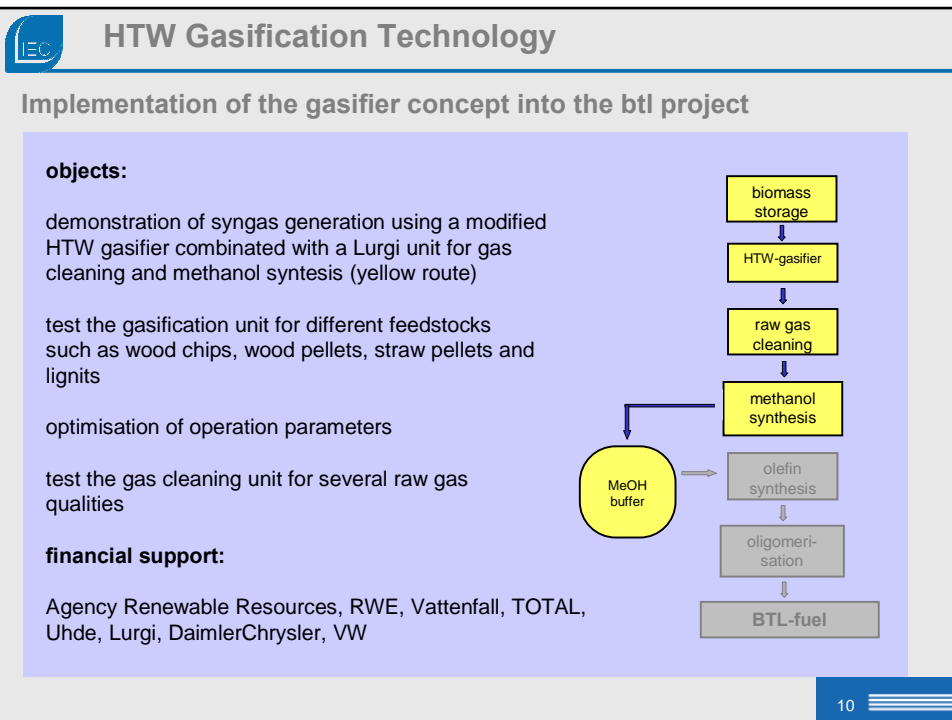
Pilot gasifier - characteristics

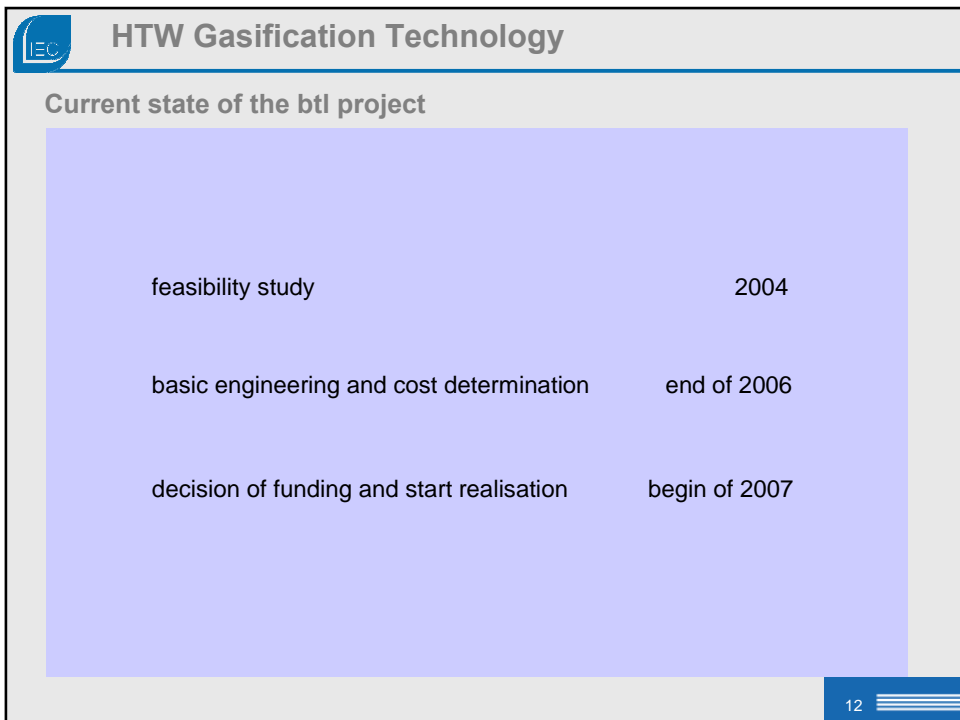
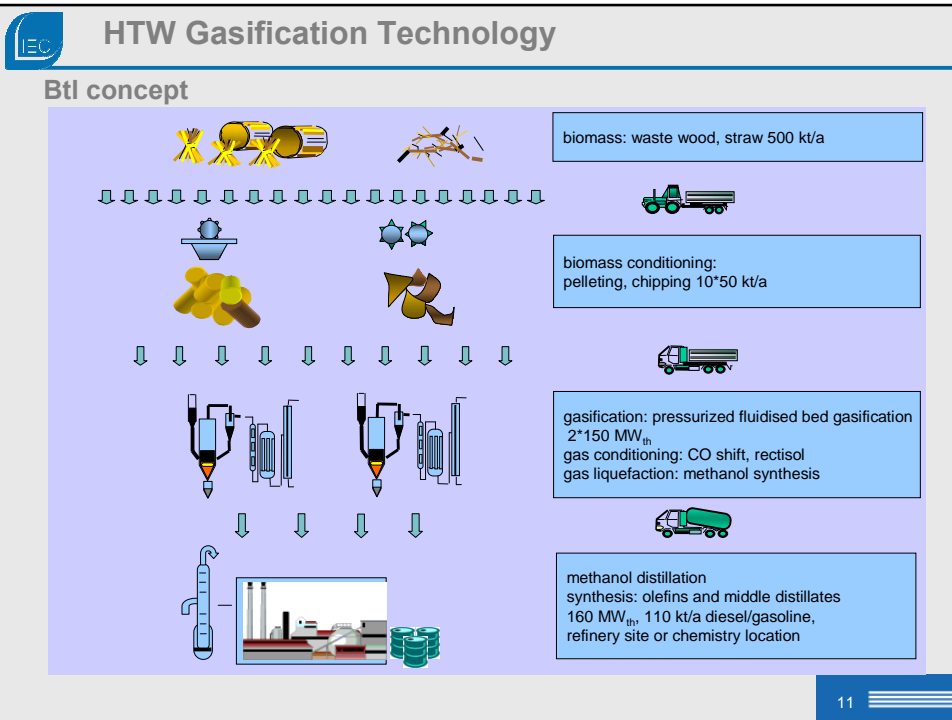
- thermal capacity: 10 MW
- gasification temperature : 900 °C +
- gasification pressure : 25 bar
- C conversion rate: ~100 %
- slag free processing biomass and coal
- feeding of gasification agents into spout zone (fluidised bed zone) as well into the oxidation zone (fixed bed)
- complete recirculation of dust
- gasification agents: oxygen and steam
- CO₂ as transportation gas
- dust separation by cyclone $\eta > 98 \%$
- steam generation by raw gas cooling down to 285 °C
- warm gas filter operating at about 285 °C

HTW Gasification Technology for BtL fuels

Pilot gasifier – calculated results

			wood	straw	lignite
fuel (mass flow rate)		kg/h	2170	2432	1652
raw gas (volumetric flow rate)		m ³ /h	650	265	641
		m ³ /h (STP)	4453	4236	3662
raw gas (mass flow rate)		kg/h	4528	4405	3401
flow of heat value (raw gas)		MW _{th}	8,6	8,5	8,6
raw gas temperature (ex gasifier)		°C	900	900	900
raw gas composition	CH ₄	vol% dry	5,7	4,9	7,9
	CO	vol% dry	33,1	33,9	30,8
	CO ₂	vol% dry	30,6	31,3	24,0
	H ₂	vol% dry	30,1	27,8	36,1
	H ₂ S	vol% dry	0,03	0,1	0,4
	N ₂	vol% dry	0,4	0,8	0,7
	NH ₃	ppm	90	120	130
	HCl	ppm	0	2290	65
C ₆ H ₆	ppm	770	770	770	
cold gas efficiency		%	81	82	83
ash (mass flow rate)		kg/h	17,0	93,3	91,3







Thank you for attention !

