Experience on Gasification in Europe

Workshop Bangalore December 11, / 12. 2003

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Umwelt + Energie

- R&D in combustion and gasification of biomass
- R&D in gas cleaning
- Consultant to Swiss Government
- Monitoring Swiss research project in gasification
- Project “HSE guideline for biomass gasification plants” for Europe
- Quality Management for biomass district heating plants
Gasification in Europe

- Overview: “Status of Gasification in the GasNet and IEA activity”
  updated: last edition September 2002
  
  www.gasnet.uk.net
  www.gastechnology.org/pub/iea

- Focus: selection of plants for application below 2 MW_{el}
Research and Development

• Universities: TU Graz, TU Wien, Danish TU, Paul Scherrer Institute (ETH Zurich)..........

• Companies: VTT (FI), Fraunhofer (Umsicht, GE), BTG (Netherlands), dk Teknik (DE) .......

• Manufacturers: Xylowatt (CH), Pyroforce (CH), Choren (GE), TK Thomas Koch (DE), Babcock Volund (DE), Xylowatt (BE), Condens Oy (FI)
Pilot Plants (downdraft)

Selection out of 20 - 30 (\

- ReNet Austria: CIVITAS NOVA, AT (600 kWel)
- Xylo\nwat\natt-CH Bulle, CH (separate presentation)
- Pyroforce Spiez, CH (200 kWel)
- Exus (B9), GB, (100 kWel)
- Xylo\nwat\natt-BE Gazel, BE (150 kWel)
CIVITAS NOVA (Wiener Neustadt)

- Typ: Kloeckner-Humbolt-Deutz (Ferges)
- Electrical output 600 kW
- Water quench
- Wet electrostatic precipitator
- Jenbacher Engine
- Commissioning 2003
Pyroforce

- Type: Kloeckner-Humbolt-Deutz (Ferges)
- 200 kW_{el}
- Bag house filter with sorbalit injection
- Wash column
- Jenbacher engine
- 3,200 hours with engine at 100 kW_{el}
Pyroforce Hochtemperaturvergasungsanlage AC-Zentrum Spiez
Exus (B9), Beddington  ZEP, London

- Type: ?
- 100 kWel
- Gas cleaning?
- Commissioning autumn 2002
- More than 2‘000 hours of operation (?)
Exus: Beddington ZEP
Xylowatt-BE, Gazel

- Type: ?
- 150 kW\textsubscript{el}
- Gas cleaning?
- Engine?
- In operation since September 2000
- Long duration tests completed
Xylo watt-BE: Gazel
Pilot Plants („multi stage“)

- Viking, DTU, DE (approx. 20 kWel)
- TK Energy (approx. 50 - 100 kWel)
- Carbo-V, Choren (200 kWel)
Viking Gasifier, DTU Denmark

- Typ: Two stage gasifier
- Aprox. 20 kWel
- Bag house filter
- Commissioned: August 2002
- Operation: engine 1‘940 hours (17.10.03)
- Tar levels: Below detection limit of 1 mg/Nm3
- Perspective for up-scaling: 1-2 MWel
- Electrical efficiency, biomass to power: > 35%
Viking Gasifier
TK Energi, Thomas Koch DE

- Type: Three stage gasifier: pyrolysis - combustion - gasification
- Bag house filter
- Approx. 50 - 100 kW_{el}
- Tar level between 1 - 20 mg/Nm3
- Fuel - electrical: efficiency 26 - 32 %
- No moving parts in the hot zone
- Up scaling (next step: 700 kW_{el})
- Licence sold to Chemical Industries Consulting Bureau Bangalore
Carbo-V, Choren

- Principle
  - Low temperature gasification
  - Entrained flow gasification

- Pilot plant Freiberg: 200 kWeL
- Zeppelin engine
- Test plant since 1998
Novel gasifier: Condens Oy / VTT

- Forced fuel flow (not gravity alone)
- Updraft ?
- Catalytic VTT gas cleaning
- Special wet scrubbing
- Pilot plant of 500 kWth (approx. 100 kWel)
- Up scaling to 8 MW
- For various biomass and waste-derived-fuels
- Low tar content
- Suitable for turbocharged engines
Conclusions

• Many pilot and demonstration plants
• Two (multiple) stage gasifiers with low tar content and simple gas cleaning; investment at the reactor system
• Downdraft gasifiers: Several pilot plants

• Commercial success: Still in the future