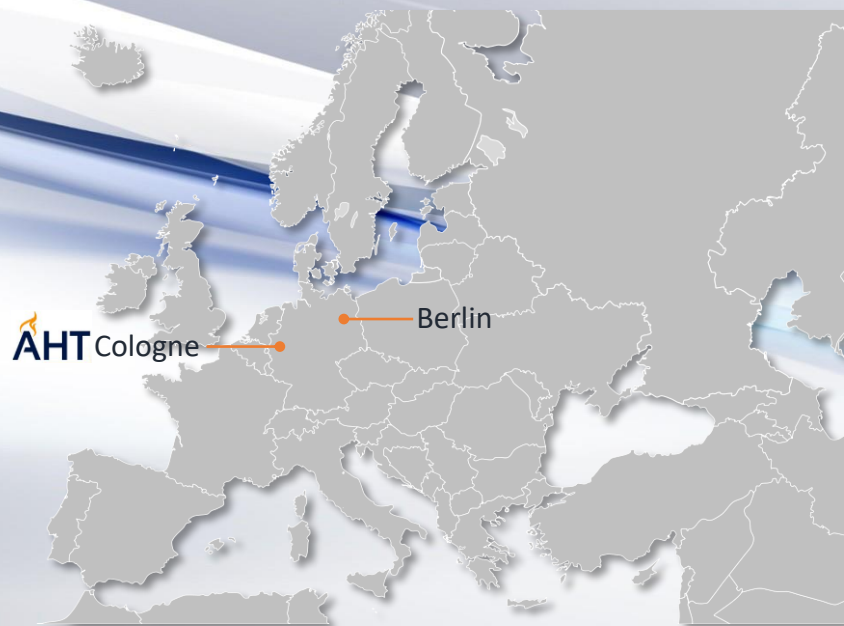




A.H.T. Syngas Technology N.V.

**Market Advantages
and
Market Outlook
of
Medium Scale
Biomass Heat & Power Plants
-
Experiences in Europe and Asia**



Company Introduction and A.H.T.'s Relation to Medium-sized Cogeneration Solutions from Biomasses

**Decentralised Energy Provision Strategies:
Experiences, Challenges and Solutions
in A.H.T.'s Domestic and Overseas Markets**

Conclusions

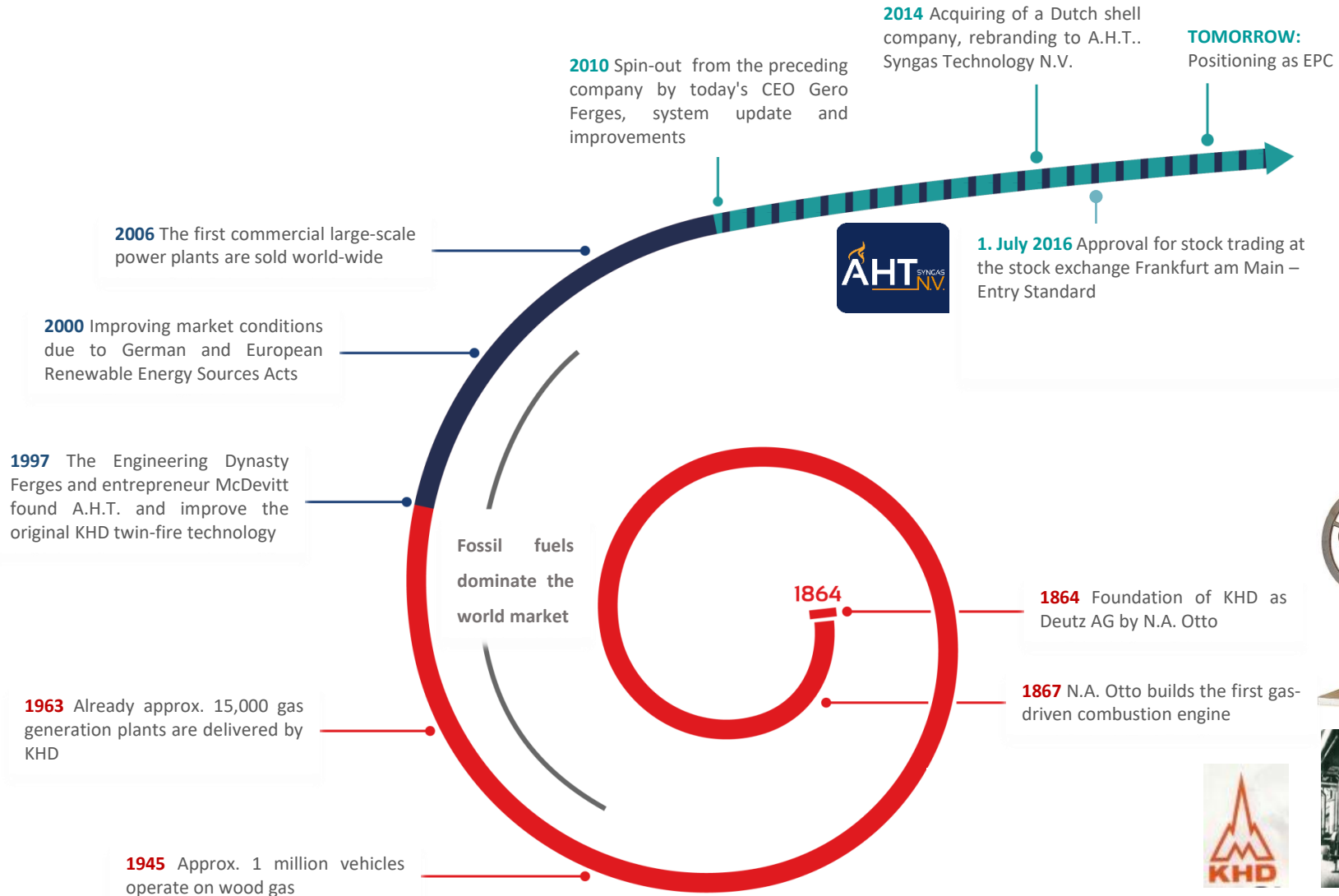
Cogeneration re-thought: Tri- and Quadruple Generation?

RAW & CLEAN GAS for Industrial Applications	CLEAN GAS for Decentralised Power Plants	SERVICES
$600 \text{ kW}_{\text{th}}$ - $50 \text{ MW}_{\text{th}}$	$200 \text{ kW}_{\text{el}}$ - $12 \text{ MW}_{\text{el}}$	<ul style="list-style-type: none"> • Feasibility, Engineering • Delivery, Erection, Supervision • Support, Spare-parts & Maintenance

Consulting & Empowering	Design & Customisation	Sales, Shipment & Implementation	Maintenance & Services	R&D / Engineering

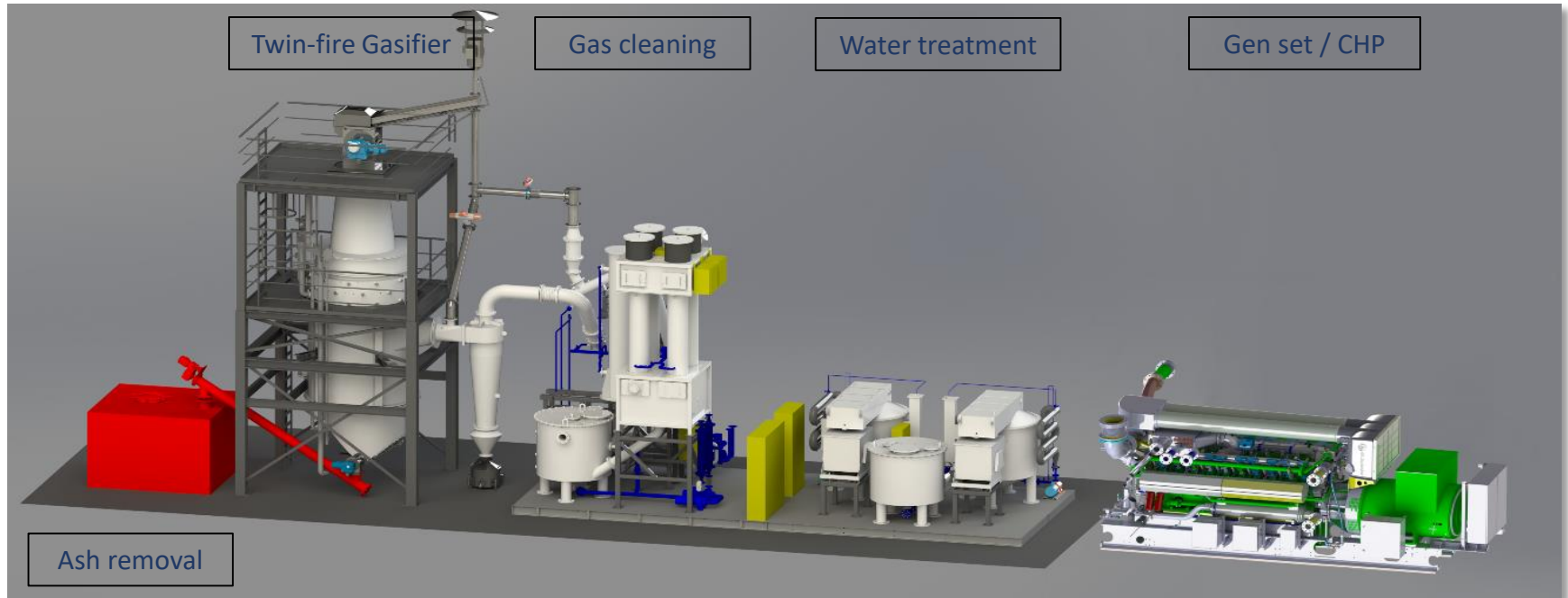
Company Introduction and Our Relation to Medium-sized Cogeneration Solutions

Our History



Company Introduction and Our Relation to Medium-sized Cogeneration Solutions

How We Do It - Overview



Feedstock



Preparation



Gas Generation



Gas Conditioning



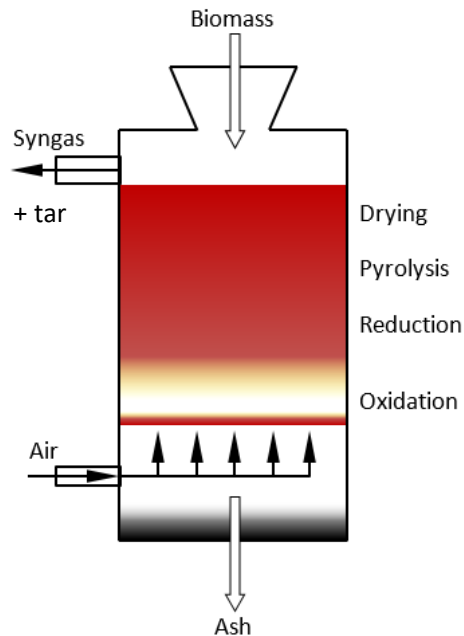
**Syngas, Heat &
Power Generation**

Company Introduction and Our Relation to Medium-sized Cogeneration Solutions

How We Do It – Twin-Fire Gas Generation



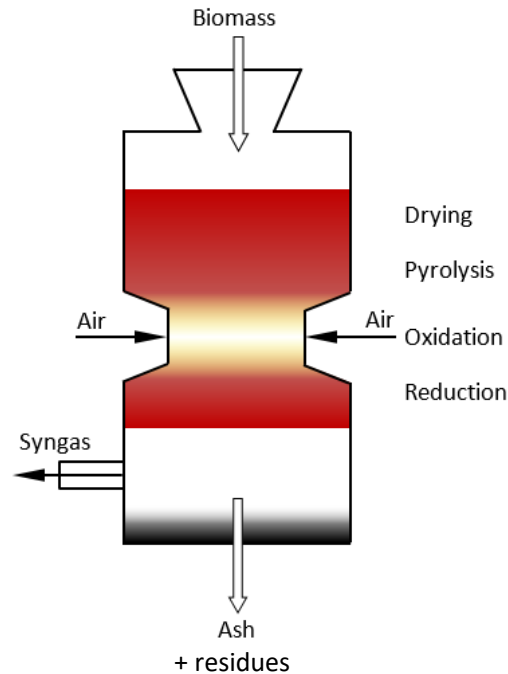
Updraft (counter-current)



High tar content, low ash content

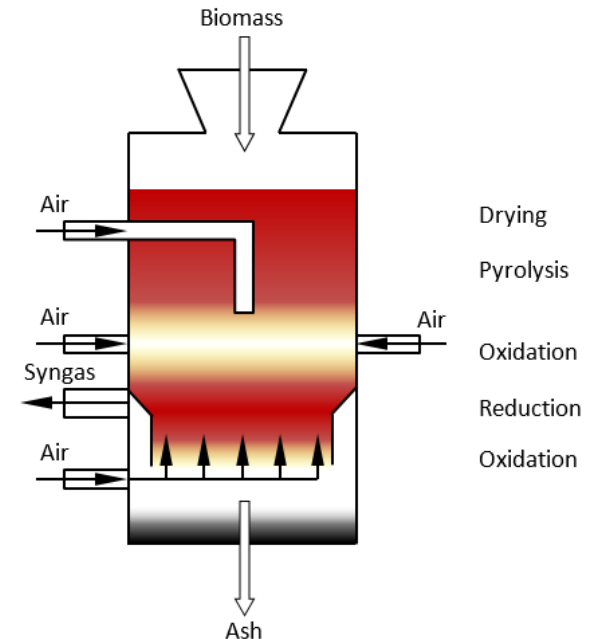
Usually incomplete gasification (char coal remaining in ash)

Downdraft (co-current)



Low tar content, high ash content

AHT Twin-fire (co- & counter-current)



Low tar content, low ash content

Almost complete gasification



Broad range of original or briquetted feedstock: wood chips, saw dust, empty fruit bunches, straw, Miscanthus, (low-grade) coal, sludge, etc.

Company Introduction and Our Relation to Medium-sized Cogeneration Solutions References



Location:

***Tayan, Kalimantan /
INDONESIA***

Application:

Clean Gas to Power

Feedstock:

Coal

Output:

6 MW_{el}



Company Introduction and Our Relation to Medium-sized Cogeneration Solutions References



Location:
Chur / SWITZERLAND

Application:
Clean gas, heat & power

Feedstock:
Hydrochaar from sludge

Output:
200 kW_{el} / 185 kW_{th}

- Commissioning
- Can be used for trials



Company Introduction and Our Relation to Medium-sized Cogeneration Solutions References



Location:

Surakarta, Java / INDONESIA

Application:

Clean gas, power

Feedstock:

Hydrochar from MSW

- Pilot plant (150 kW_{el}) installed
- Detail engineering for 10 MW completed



Company Introduction and Our Relation to Medium-sized Cogeneration Solutions References



Location:
Kesennuma / JAPAN

Application:
Clean gas, heat and power

Feedstock:
Woodchips

Output:
800 kW_{el}





Germany

- A.H.T. Experiences:
 - Many installations in the heydays of high feed-in tariffs (early 2000's to 2010)
 - Contract awarding during a European-wide tender for a research facility to evaluate different types of biomass
- Challenges:
 - Feed-in tariffs fading out
 - No clear strategy for own energy production
- A.H.T.'s solutions:
 - Process heat and cold provision for industries, diaries, agriculture for own consumption (including heat from co-generation)
 - Delivery of baseload and balancing capacities for hybrid systems with volatile energy carriers
 - Eligible for current governmental market intensive program to switch from fossil energy carriers to biomass
 - Hydrothermal carbonisation (HTC) to utilise manure, digestates and biomass, as these waste streams are regulated to be brought back onto soils
 - Biogenic waste valorisation
 - H2 separation from syngas by patented technologies



Switzerland

- **A.H.T.'s experiences:**
 - Installation of Switzerland's first combined HTC and gasification plant with heat and power generation to use manure, sewage sludge and digestates
- **Challenges:**
 - Obtaining approvals for erection and grid connection
 - Bureaucracy
- **A.H.T.'s solutions:**
 - Both material and energetic utilisation of biomass and biogenic residues as well as sewage sludge
 - Decentralised heat and power generation for the smaller communities, local industries, agriculture and animal husbandry
 - Local partnerships, also for R&D
 - Medium-sized wood gasification systems also for treated waste wood



Japan

- **A.H.T. Experiences:**
 - Installation of a wood gas power plant with baseload capacity serving 2000 households with power and two hotels with heat
- **Challenges:**
 - Currently difficult to apply for grid connection, especially for medium- to large scale biomass power plants
- **A.H.T.'s solutions:**
 - Syngas constituent's utilisation (H₂, CO, CO₂), licensing of A.H.T. technology
 - Local partners for sales & operation to overcome language and culture barriers



Indonesia

- **A.H.T.'s Experiences:**
 - Installation of a coal fired power plant to serve a nearby city with electricity
- **Challenges:**
 - Feed-in tariff to be individually negotiated with state-owned utility provider
- **A.H.T.'s solutions:**
 - Flexible energy carriers, also fossil, can be used – coal gasification still cleaner than incineration
 - Broad range of biomass available, which A.H.T. can handle
 - Local partnerships for domestic manufacturing and EPC services

Conclusion on Market Chances for Medium-sized Co-generation

▪ Challenges:

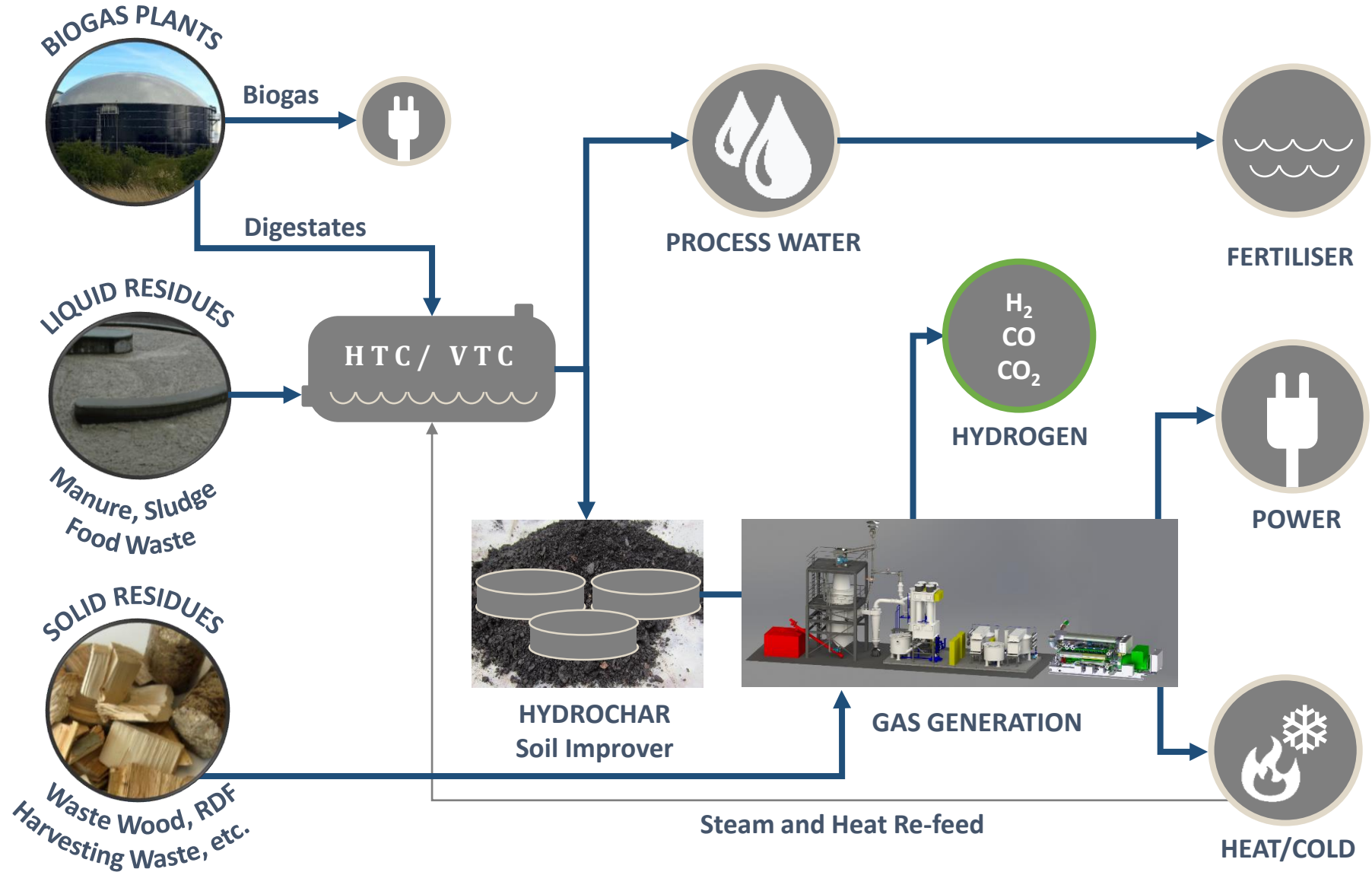
- Currently unpredictable subsidies' or incentives' changes expected for 2021 in EU and (SE-) Asia

▪ A.H.T.'s solutions:

- Taking own power and heat consumption of industries and agriculture into account
- Delivery of controllable, high-efficient (> 90 %) and clean energy in form of heat, cold, power and syngas
- Baseload capacities, high availability, modular
- Integration of other CO₂-neutral technologies, interface design for up- and downstream technologies
- Co-generation redefined:
 - Material usage of syngas and biogenic residues
 - Waste reduction (avoiding dumping costs) and re-use/re-feed into production cycle
- To realise successful projects:
 - Feasibility studies
 - Basic and detail engineering, feedstock tests
 - Financing options, contracting

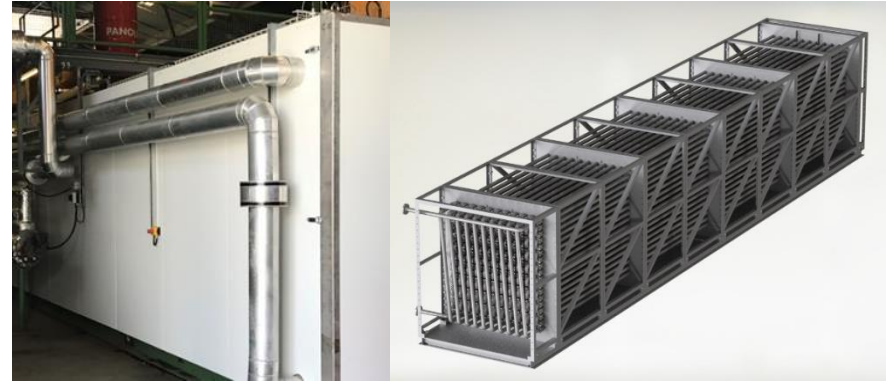


Co-generation Re-thought: Options



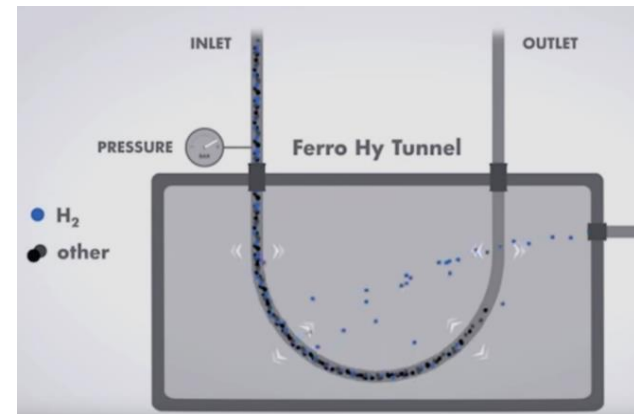
Hydrothermal Carbonisation (HTC)

- Biomass conversion into brown-coal-like HydroChar and water in a semi-closed system
- Continuous process for high-moisture and liquid/slurry biomass
- Application of temperature (220 °C), pressure (22 bar) and time (2-12 h) **above** the steam pressure curve within water



Hydrogen Separation (FHT)

- Patented low-energy, low-pressure technology to separate hydrogen from syngas
- Absolutely pure hydrogen for industrial applications, fuel cells and mobility
- Hydrogen from biogenic residues can be produced directly where it is needed



Co-generation Re-thought: Targets



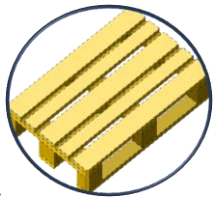
Chemical Industries



Biogas Plants



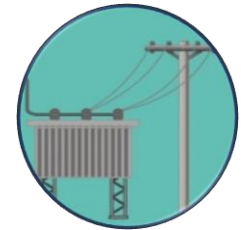
Sewage Plants



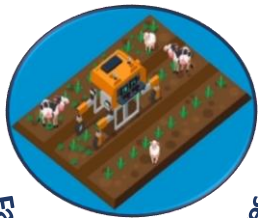
Wood Processing



Smart Cities – Hybrid Systems



Power Producers



Farmers & Cooperatives



Production & Manufacturing



Food & Beverage

Thank you for your attention! Any questions?



Dirk Bonse ▪ Sales Manager

A.H.T. Syngas Technology N.V. Domicile

Hurksestraat 43
5652AH Eindhoven
The Netherlands

A.H.T. Syngas Technology N.V. Administration

Diepenbroich 15
51491 Overath
Germany

dirk.bonse@aht-syngas.com

www.aht-energy.com



Tel.: +49 2206 95190-299

