

ThyssenKrupp Uhde's PRENFLO® and HTW™ Gasification Technologies

Global Update on Technology and Projects

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Gasification Technologies Conference 2011

October 9-12 | San Francisco, CA

ThyssenKrupp Uhde



ThyssenKrupp



Other round numbers...

- ◆ **Over 100 gasifiers** put into successful operation by Uhde
- ◆ **Over 180,000 ThyssenKrupp colleagues** worldwide

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„...one slide on the company...“

ThyssenKrupp
Uhde



+ Further News - September 2011:

9,500 bpd CTL facility in Mozambique to apply PRENFLO® PDQ technology

+ Further News - September 2011:

ThyssenKrupp Uhde & SGC Energia sign PRENFLO® Master Contract for CTL

+ Further News - August 2011:

C.GEN selects PRENFLO® PDQ for IGCC in Killingholme, UK

- Conferences/Workshops
- ▾ News
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2011

2010 | 2009 | 2008 | 2007

June 28, 2011 | Poster Presentations Available for GTC Conference

June 22, 2011 | Charles D. McConnell to be GTC Conference Keynote Speaker

May 25, 2011 | 2011 Gasification Technologies Conference Preliminary Program Available

May 9, 2011 | TransGas Coal-to-Gasoline Facility begins Construction

April 15, 2011 | Uhde, KEPCO Announce Gasification Cooperation

March 10, 2011 | GTC Sends Letter to Sen. Feinstein Regarding IGCC and Industrial Gasification Loan Guarantees

March 8, 2011 | Uhde Services to start supplying fluidised-bed dryers

February 25, 2011 | GTC Announces 2011 Gasification Technologies Workshop

February 18, 2011 | Call for Papers for 2011 Gasification Technologies Conference

January 12, 2011 | Uhde Expands its Technology Portfolio with HTW Gasification Process

ThyssenKrupp Uhde News on GTC Website 2011

Featured Resource

Gasification: An Investment In Our Energy Future

A comprehensive overview of how gasification can help us meet our needs, now and in the future.



Order a Copy Download

E-Mail Updates

Register to receive updates about developments in the gasification industry.

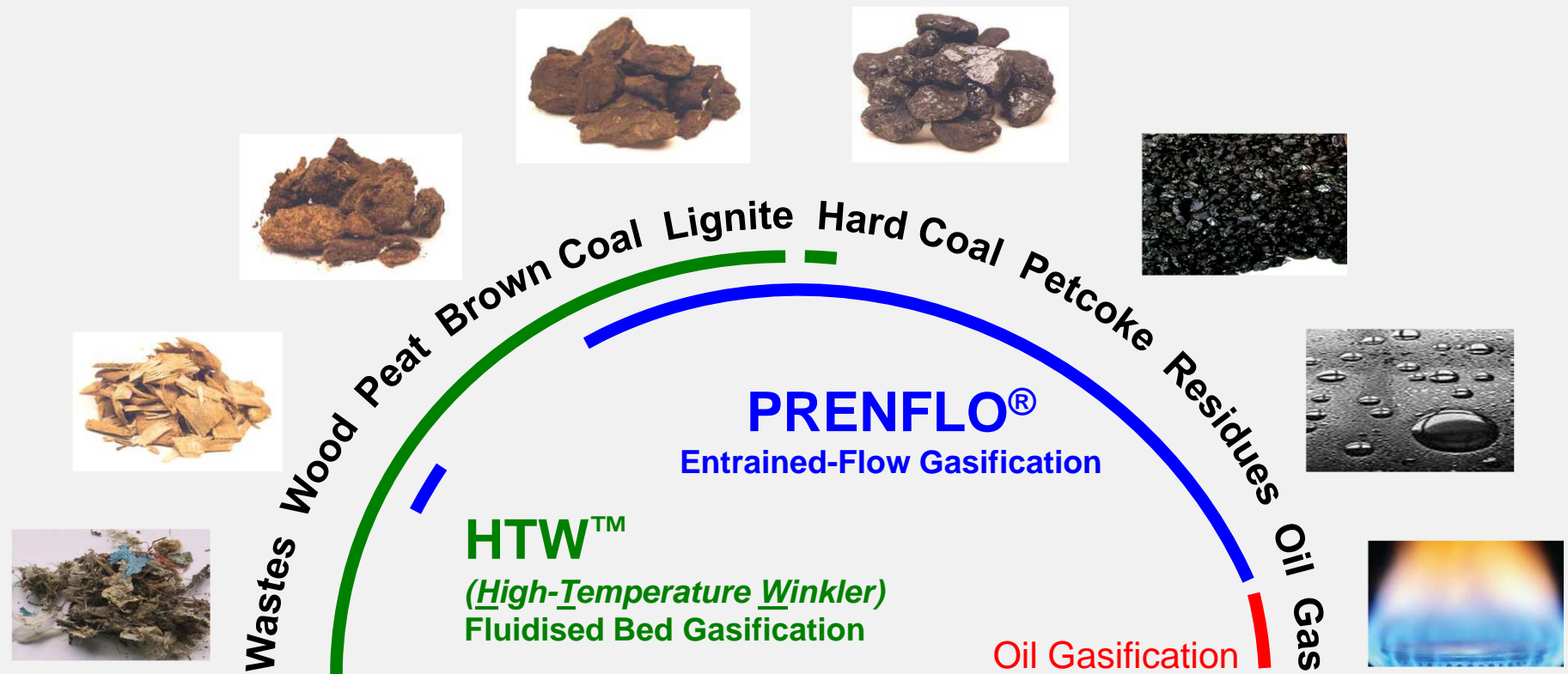


ThyssenKrupp Uhde

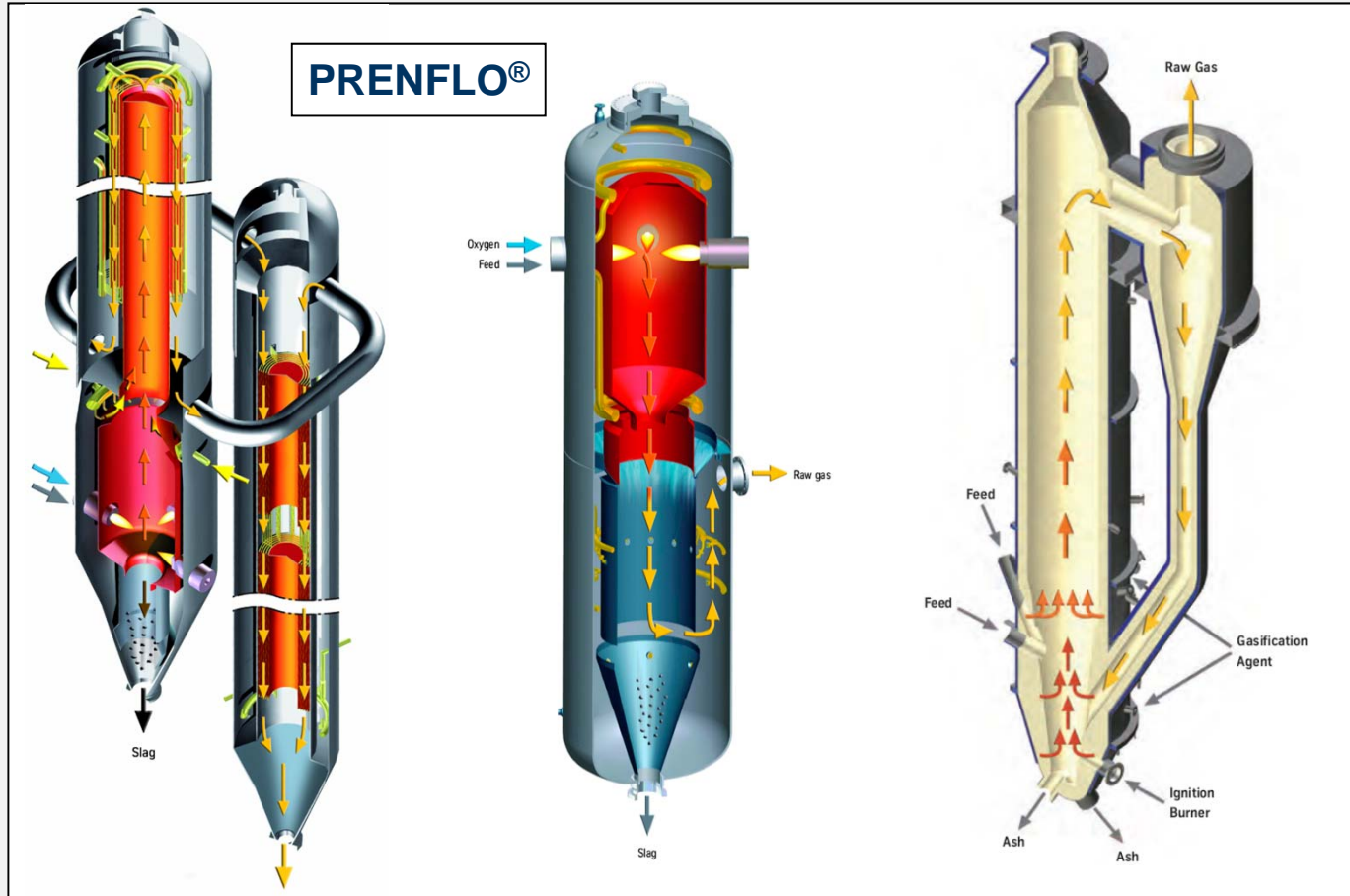
„What's New?“

Different Feedstocks require Different Gasification Technology

ThyssenKrupp Uhde's Gasification Portfolio



ThyssenKrupp Uhde's *Proprietary* Gasification Technologies



PRENFLO®

PSG **PDQ**

Entrained-Flow

HTW™

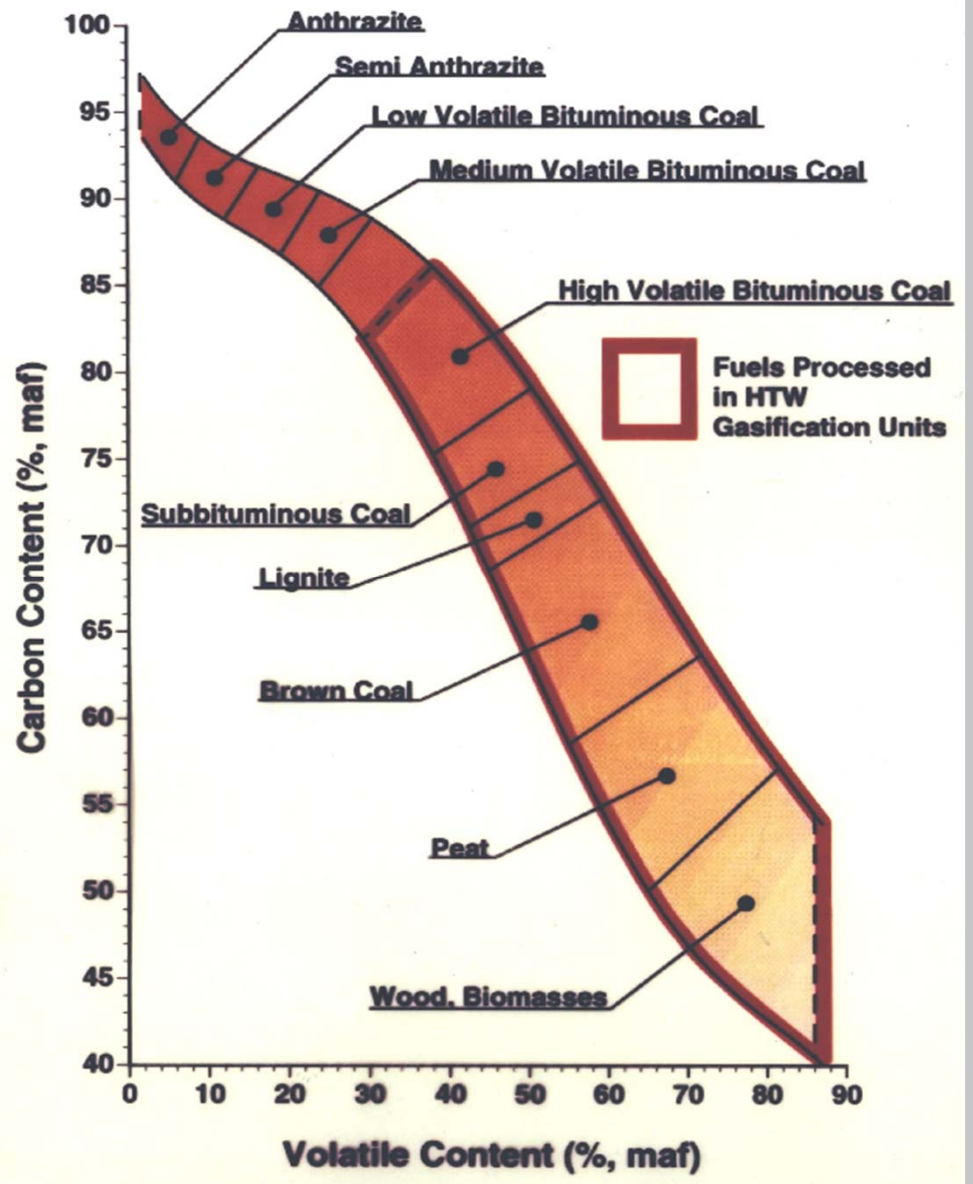
Fluidised Bed

ThyssenKrupp Uhde acquires HTW™ Gasification Technology

- HTW™ goes back to 1926 (Winkler Gasification)
- Fluidised-bed, pressurised gasification
- Main target: low-rank feedstocks, in particular: coals with high ash melting points, brown coal, lignite, wastes
- HTW™ was previously owned by RWE/Rheinbraun
- ThyssenKrupp Uhde acquires the HTW™ technology with all IP rights and know-how from RWE in December 2010
- A number of projects under development, including biomass-to-methanol and DRI projects in Sweden and India



Solid Feedstocks operated in HTW™ Gasification



HTW™

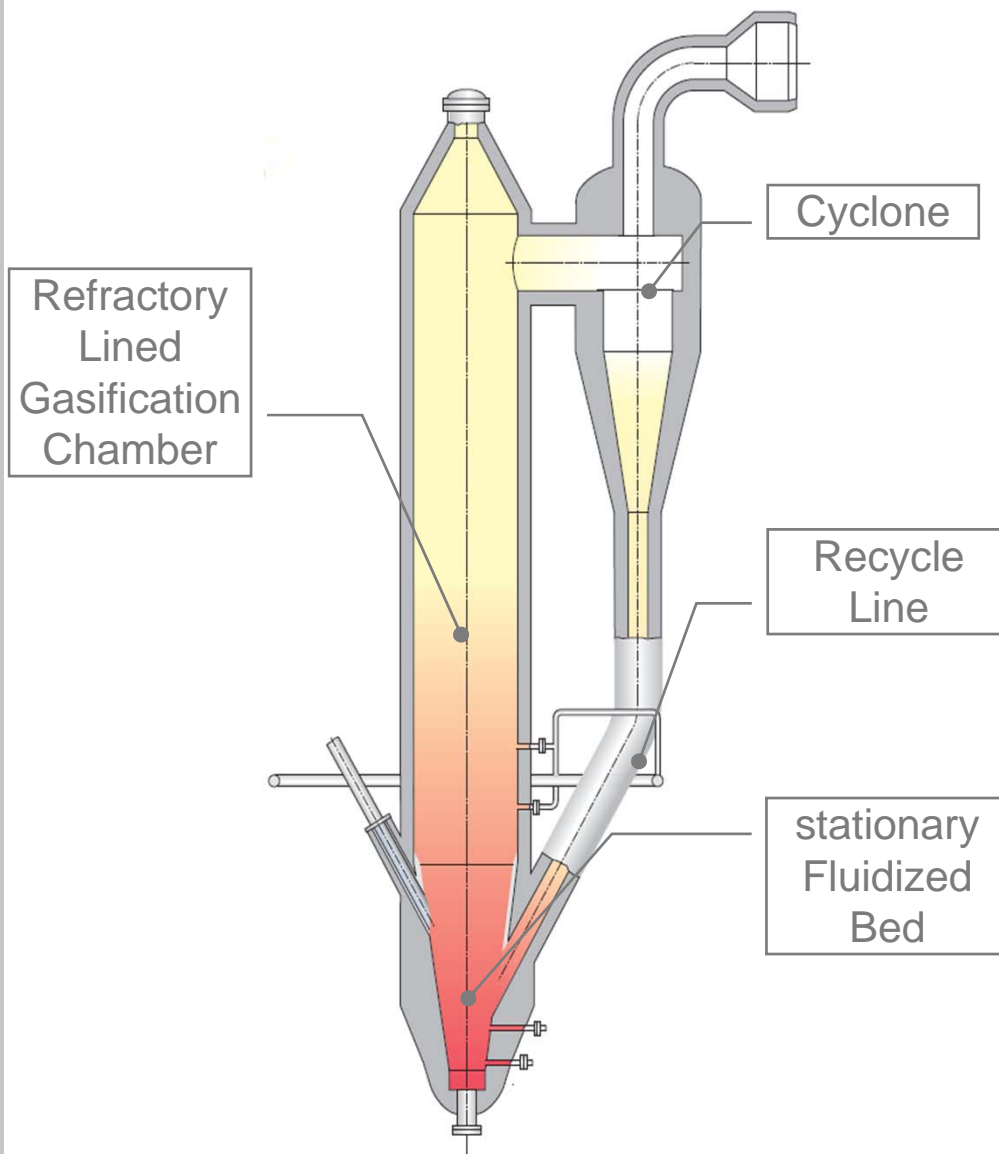
HTW™ Gasification

Rt1

- Pressurised, fluidised bed
- Temperature: 800 - 1000 °C
- Pressure: 10 - 30 bar
- Operates below ash melting point (ideal for coals with high ash melting point, biomass, lignite, waste)

Current VärmlandsMetanol Project, Sweden:

- Biomass to Methanol plant
- Feedstock: Domestic forest residue
- Grain size: < 4mm for biomass



HTW™ Gasifier

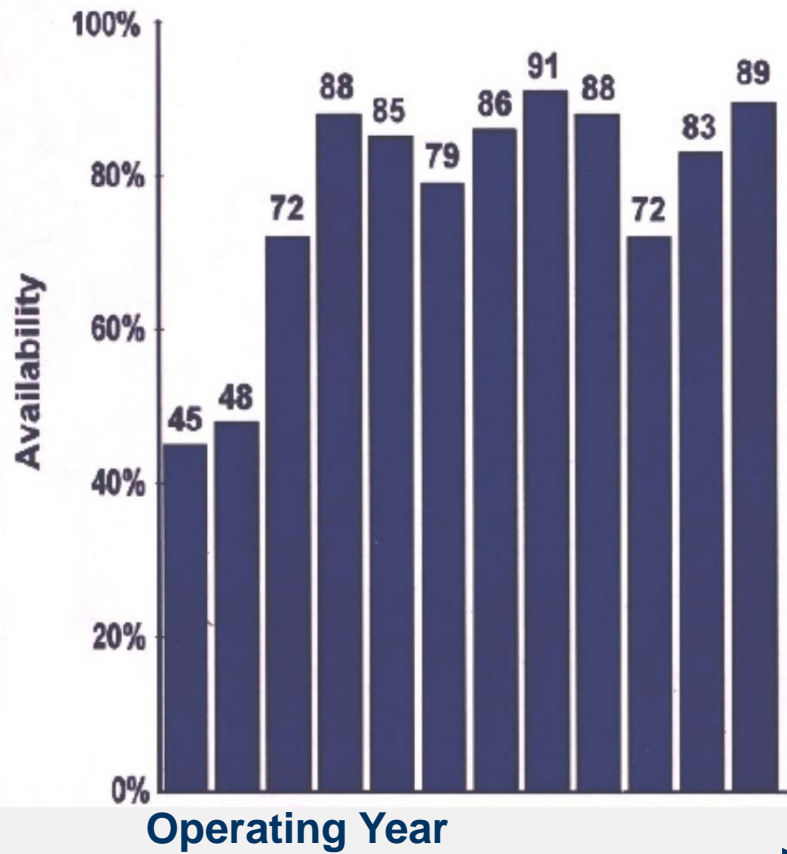
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Rt1

Karsten Rick Radtke, 10/1/2011

HTW™: Operating Experience – proven, reliable technology

Feedstock <i>operated in HTW</i>	PDU Scale	Pilot Scale	Industrial Scale
Low-rank coals			
Brown coal	●	●	●
High-S brown coal	●	●	●
Lignite	●	●	
Subbituminous coal	●		
Hard coals			
Ensdorf-Saar	●	●	
Pittsburgh No.8	●	●	
Other low-rank fuels (biomass and energy crops)			
Peat	●	●	●
Wood	●		●
Grasses	●		
Waste materials			
Sewage sludge	●	●	●
Loaded coke	●	●	●
Used plastics	●	●	●



Operating Year

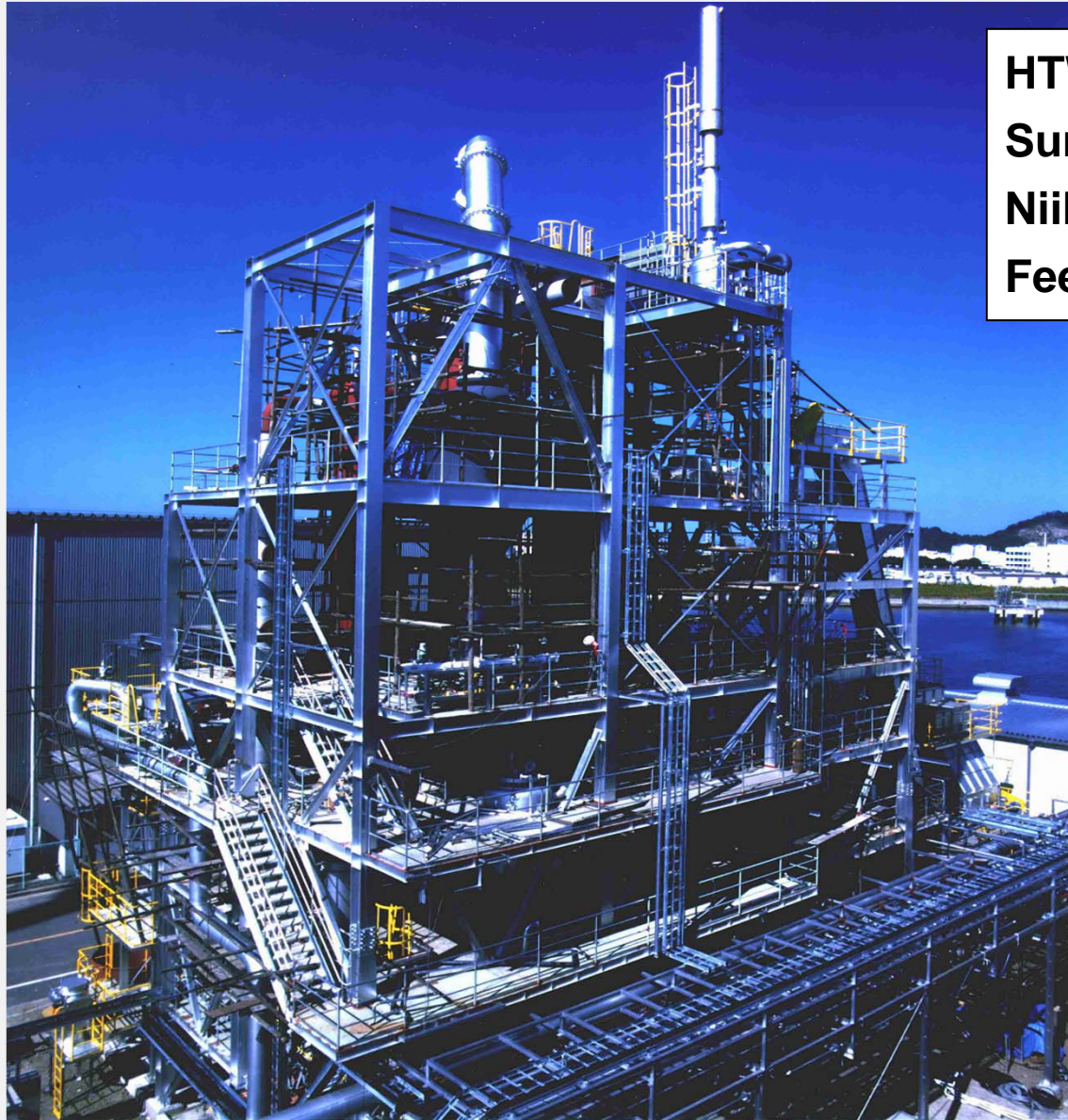
HTW Plant at Berrenrath
(entire plant complex availability)

HTW™ Gasification Plant
Berrenrath, Germany
Feedstock: 30 t/h lignite
Product: 300 t/d methanol



HTW™ Gasification Plant
Biomass Gasification
Kemira Oy, Oulu / Finland
Feedstock: 30 t/h peat
Product: 300 t/d NH₃





HTW™ Waste Gasification
Sumitomo Heavy Industries Ltd.
Niihama / Japan
Feedstock: 48 t/d MSW



MSW household waste

Co-operation with RWE for WTA Coal Drying Technology

- ▶ WTA is a fluidised-bed coal drying technology developed by RWE, which reduces the water content of raw lignite from >55 wt.-% to around 12 wt.-%.
- ▶ Key advantage: unlike alternative drying processes that use flue gas at >1,000°C, WTA drying process takes place at a temperature of only 110 °C and re-utilises the heat.
- ▶ In February 2009, RWE Power commissioned the world's largest lignite dryer in Niederaussem, Germany. Capacity: 110 t/h of dry lignite.
- ▶ With WTA, the efficiency of lignite-fired power stations increases to >47 %.
- ▶ In combination with WTA fluidised-bed dryers, ThyssenKrupp Uhde can offer an integrated process chain for efficient HTW™ and PRENFLO® coal gasification.

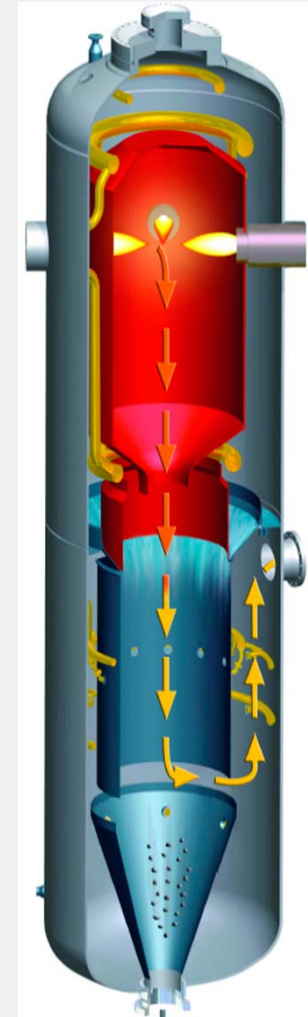


WTA Niederaussem, Germany

- IGCC Plant with a capacity of up to 450 MW net + optional hydrogen
- Choice for IGCC with CO₂ capture, based on **PRENFLO® PDQ** direct quench gasification technology
- Location Killingholme, UK: industrial port, synergies due to maximum integration into existing industrial network
- Standardization of plant to optimize learning curve for subsequent plants

Feedstocks:

- Unconventional hard coal
- Petcoke
- Sustainable biomass



C.GEN

450 MW IGCC with CCS *Killingholme, UK*



Source: http://www.cgenpower.com/en/projects_killingholme.html

New JV: Kepco-Uhde Inc.

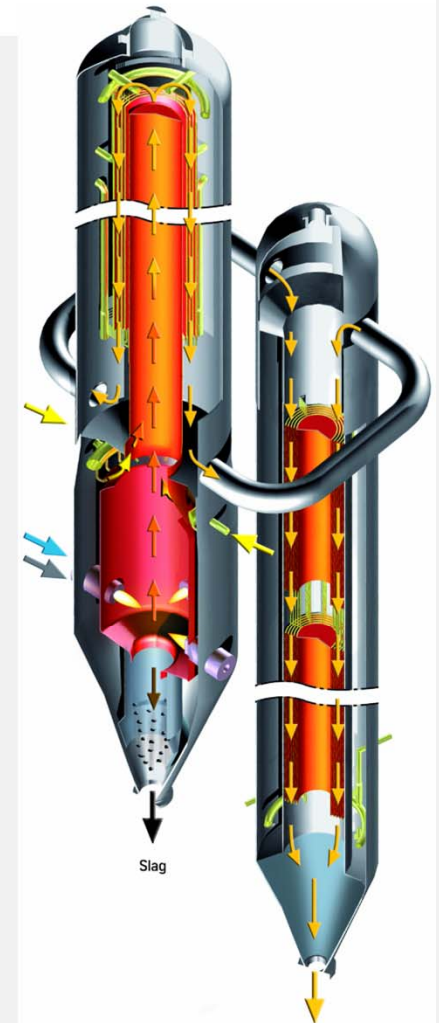
KEPCO-Uhde Inc.

- ThyssenKrupp Uhde and largest utility in Korea, KEPCO, form Joint Venture Company for **PRENFLO® PSG** gasification
- “KEPCO-Uhde Inc.” established in South Korea 14 July 2011.
- First 2 SNG projects launched for KEPCO-Uhde
- JV provides strong synergy, cost and schedule advantages



Dr. Thiemann, CEO ThyssenKrupp Uhde

Mr. Kim, CEO KEPCO



Tasks of Kepco-Uhde Inc.

KEPCO-Uhde Inc.

Market, Design and License

- PRENFLO® PSG for SNG and IGCC applications including CCS

Research & Development

- Develop standard IGCC model for > 500 MW output
- Improve efficiency of IGCC and SNG plants
- Integrate CCS solutions

⇒ **Combine leadership strengths of both Joint Venture partners...**



SGC Energia

- ThyssenKrupp Uhde and SGC Energia enter into Master License and Supply Agreement for multiple CTL projects applying **PRENFLO® PDQ** and SGCE's Fischer-Tropsch Process

⇒ SGCE's proprietary XTLH™ solution



- **September 2011:** License and Supply Agreement for 9,500 barrels/day CTL Plant in Mozambique effective



CTL Project Mozambique

- **PRENFLO® PDQ** licensed
- High-ash coal (37 %) will be utilised for generating clean Fischer-Tropsch fuels for domestic and export use
- Plant Capacity: 9,500 barrels/day



Adansonia digitata Trees, Mozambique, Africa

Plant Location: Mozambique, Southern Africa



TransGas CTG Projects: *Update*

West Virginia and Kentucky Sites



TransGas Ground Breaking, 09 May 2011

Adams Fork Energy Project

*U.S. Senator Joe Manchin III., and WV Governor Earl Ray Tomblin
at Ground Breaking Ceremony, 09 May 2011, West Virginia Plant Site*



- ✓ 18,000 barrels/day Adams Fork Energy CTG Project based on **PRENFLO® PDQ** permitted, 2 duplicate projects in Kentucky permitted
- ✓ Construction for all 3 projects commenced in May/June 2011
- ✓ Combined, these 3 TransGas CTG projects represent ~7 % of entire U.S. gasoline import

TransGas: Licensors and Contractors Kick-Off

Adams Fork Energy Project

- Leading Technology Licensors and EPC contractors teamed up for project implementation
- Adjustment to EPC structure and project execution concept arranged
- All 3 projects are in a 50 miles radius and allow for significant synergy effects in engineering, procurement, construction and schedule
- Start-up expected for 2016





BioTfuelL Project Update



Unae



ThyssenKrupp Uhde

BioTfuel - a consortium of partners with complementary core businesses...

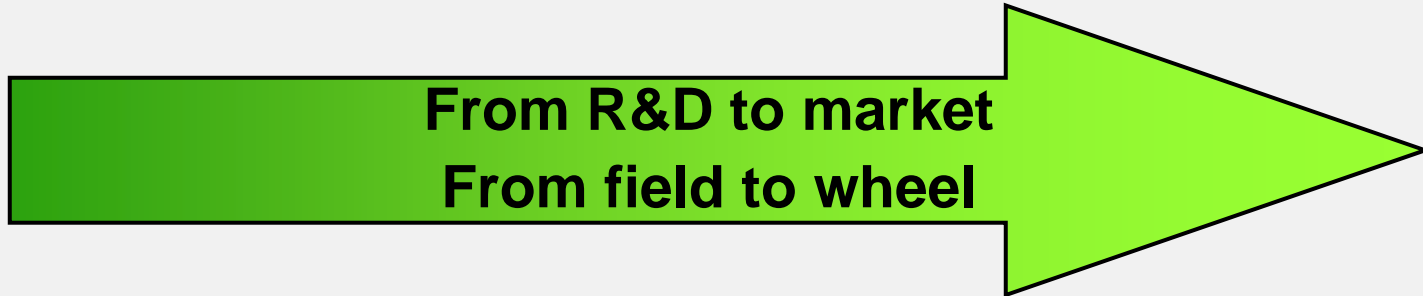
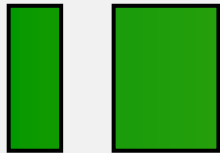
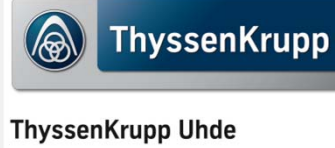
R&D

Technologies licensors

Fuels producers



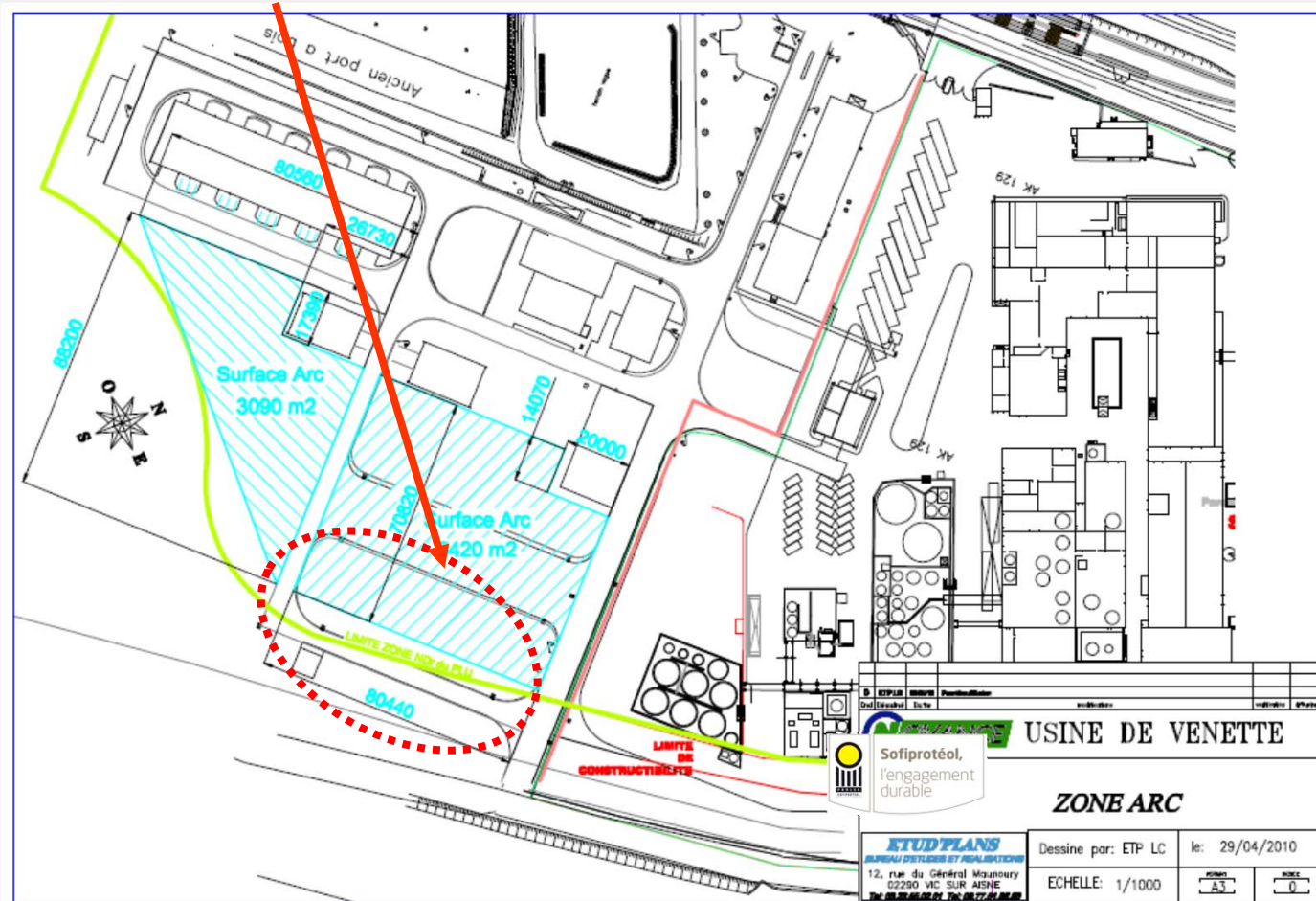
energie atomique • énergies alternatives



Development and Demonstration of a complete B-XTL process chain

BioTfuelL demo plants:

- Feedstock preparation plant (Sofiprotéol – Venette)
new area at the site border

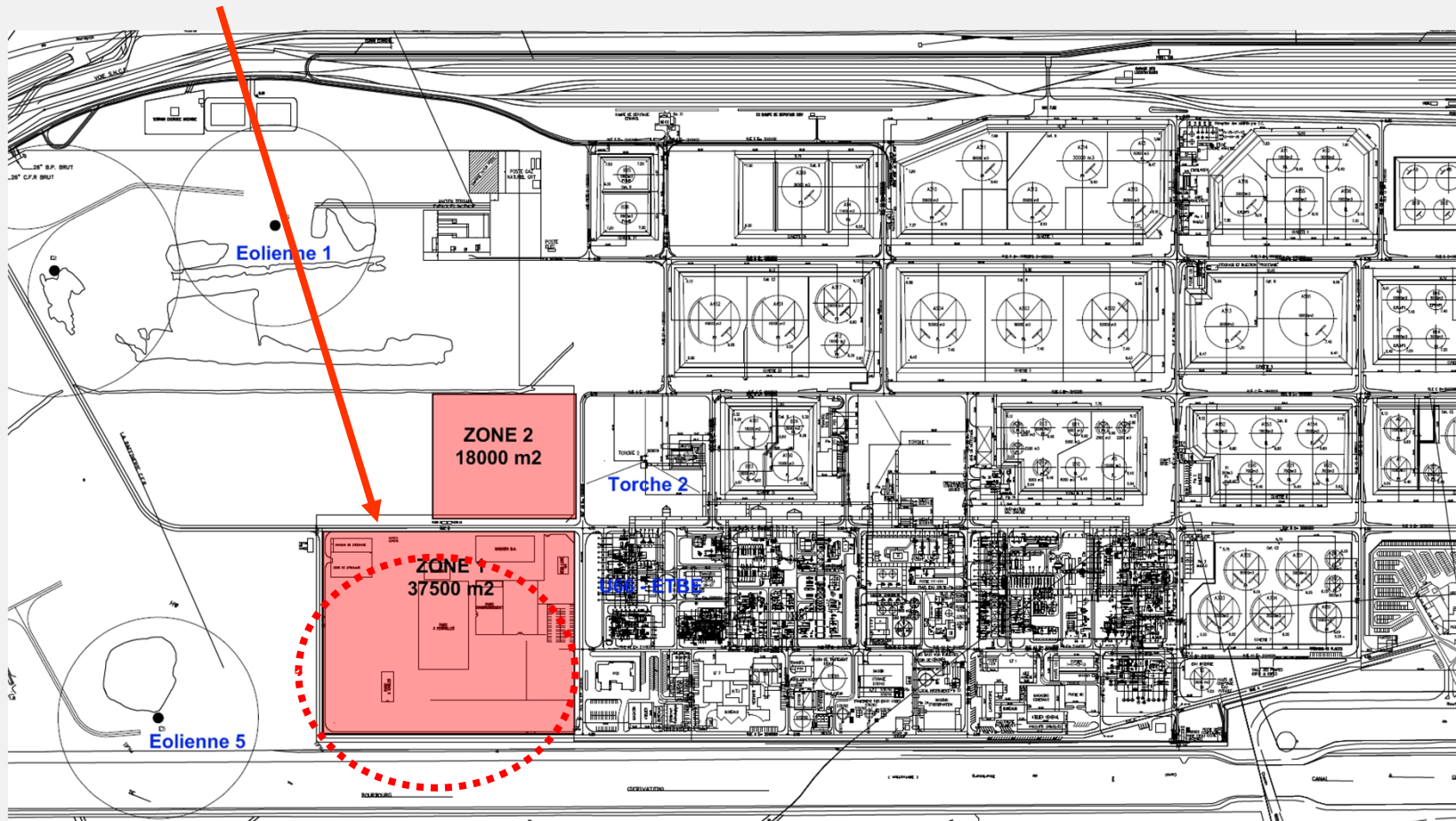


Uhde

ThyssenKrupp Uhde

BioTfuel demo plants:

- **PRENFLO® PDQ Gasification & syngas treatment**
 - Zone 1 fully connected with site facilities (control room, utilities, services...)



Uhde

ThyssenKrupp Uhde

ThyssenKrupp Uhde *GTC 2011 Summary*

- **HTW Technology** acquired to extend gasification applicability
- **WTA Drying Technology:** coal drying technology for increased efficiency
- **Joint Venture with KEPCO** to accelerate IGCC and SNG applications
- **KEPCO-Uhde Inc.:** First 2 SNG projects launched in South Korea
- **TransGas:** Commencement of construction at 3 sites for 3 x 18,000 b/d CTG complexes in West Virginia and Kentucky
- **SGC Energia:** Master Agreement for multiple 10,000 b/d class CTL
- **9,500 b/d CTL Complex:** PDQ License and Supply agreement for Mozambique effective
- **C.GEN:** IGCC with CCS in Killingholme, UK selects PDQ gasification
- **BioTfuel:** BXTL Project, France: Basic Engineering completed, Detailed Engineering and FEED commenced

Thank you for your attention



ThyssenKrupp

ThyssenKrupp Uhde

**PRENFLO Gasification Plant, Puertollano, Spain
October 2011**

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