



Biomass Gasification with Circle Draft ® Process

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Presentation outline



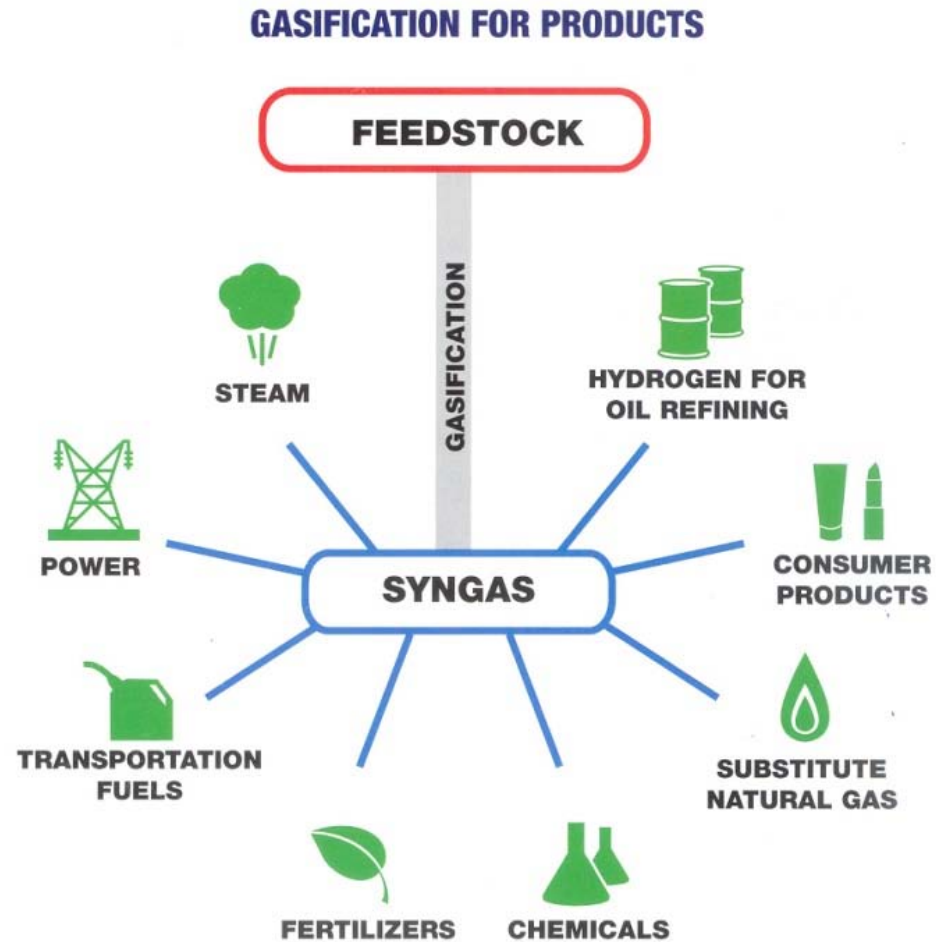
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- § Pilot Plant of Cherasco, Italy
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A Glance at INSER SpA



- Power Generation
 - Small Hydro
 - Biogas (manure)
 - Landfill Biogas
 - Solar PV
 - Biomass with gasification
- R&D
 - Gasification
 - Second Generation Biofuels

Why Gasification?



Problems Usually Associated with Biomass Gasification



- Great Experience on Coal Gasification Worldwide, But Not on Biomass
- Lack of support for Development
- Biomass is very Heterogeneous Feedstock
 - Biomass Quality, Type, Size
 - Moisture
- Quality Syngas
 - Low Heating Value
 - Tar Removal (Wash, Filter)
- Side Products management
 - Brown Water (Process)
 - Ash, Slag (Process)
 - Contaminated Water (Gas Cleaning)
- Biomass Strict Selection
- Strict Moisture Control (usually <10%)
- Non Standard Equipments Needed
- Overall Complexity
- Unreliability

Problems Solved with Circle Draft ® Process



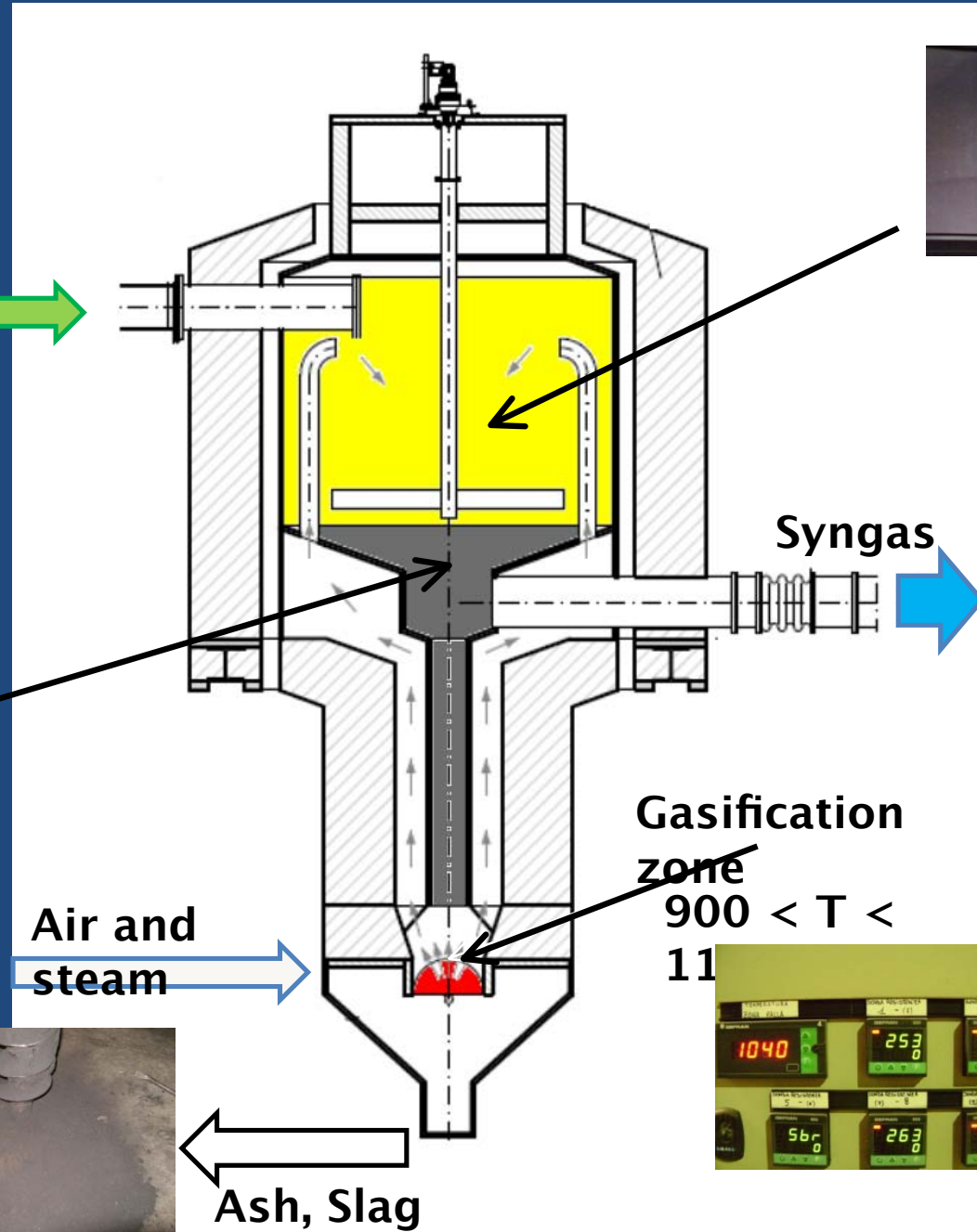
- Every type of Biomass can be Gasified (Wood, Straw, Rice Husk, Manure, etc...)
 - No Selection Required
- 20% or more Moisture Allowed
 - Moisture is Useful for the Syngas' Self Cleaning
- No Strict Gas Cleaning Required
 - No washing
- Good Quality Syngas
 - Higher LHV compared with Standard

Circle Draft [®]

Feeding



Cleaning



Pyrolysis
 $300^{\circ} < T < 450^{\circ} \text{C}$



Gasification zone
 $900 < T < 1100^{\circ} \text{C}$



Circle Draft ® Proces



Circle Draft ®
OFF



Circle Draft ®
ON

Circle Draft ®



Comparison table				
Process type		Down Draft	Circle Draft ®	Prenflo™
Company			INSER	Uhde TyssenKrupp
Feedstock		wood	wood	Coal/Petcoke
Oxidant		air	air	O ₂ 85% purity
Pressure		atmosferic	atmosferic	≥40 bar
Gas' composition % v/v				
	H ₂	12,0	33,4	21,7
	CO	12,6	47,2	59,9
	CH ₄	3,9	3,6	< 0,1
	CO ₂	15,3	< 0,1	2,9
	N ₂	51,0	15,7	14,4
	others	5,2	0,0	1,1
	Fuel gas %	28,5	84,2	81,6
	LHV (MJ/nm ³)	4,3	11,5	10,16

Circle Draft ® Pilot Plant Cherasco



**Biomass
Preparation**



**Gasification
and Gas
Cooling**



**Flar
e**



**Powe
r**

Circle Draft ® Pilot Plant Cherasco



Description	
Fuel type	Wood Chips
Oxidant	air
Gas rate	0,9 nm ³ /Kg
Gas' Heating Value	2750 Kcal/nm ³
Self consumption	20%
Efficiency	75%
Pressure (relative)	max 50 cm H ₂ O
Production	app. 100 nm ³ /h
Steam	app. 9 Kg/h
Gas Cooling	Water



Conclusions



- Main Issues connected to Biomass Gasification Solved
- Further Improvements in Mechanics Foreseen
- Switch to Air Cooling from Water Cooling
- Further Improvements for Syngas' Quality Using 85% Oxygen under Evaluation
- Improved Design for $> 500 \text{ nm}^3/\text{h}$ Syngas Production underway
- Engines and/or Gas Turbines under Evaluation
- Liquid Fuels Synthesis

Thank you



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