GASIFICATION INDIA 2019

GASIFICATION OF WASTE FOR RENEWABLE ENERGY GENERATION

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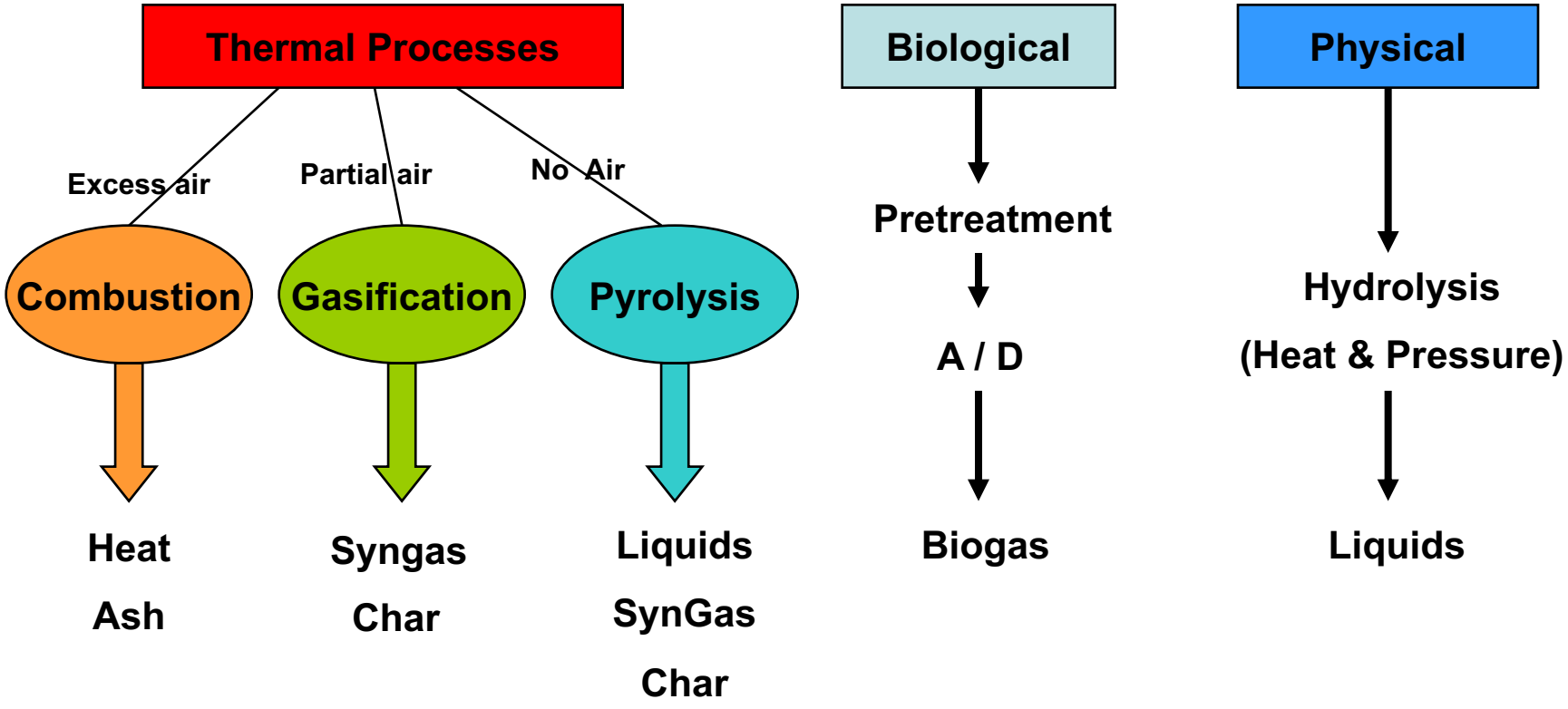
Motivation for Decentralized CHP Generation via RDF/Biomass Gasification

- RDF: Refuse Derived Fuel contains ~70% Biomass is A Sustainable and Renewable Energy Source

- Improve energy security through the technological development and utilization of small-scale power generating systems fuelled by available local resources such as biomass, municipal, industrial, and other wastes available within the vicinity.

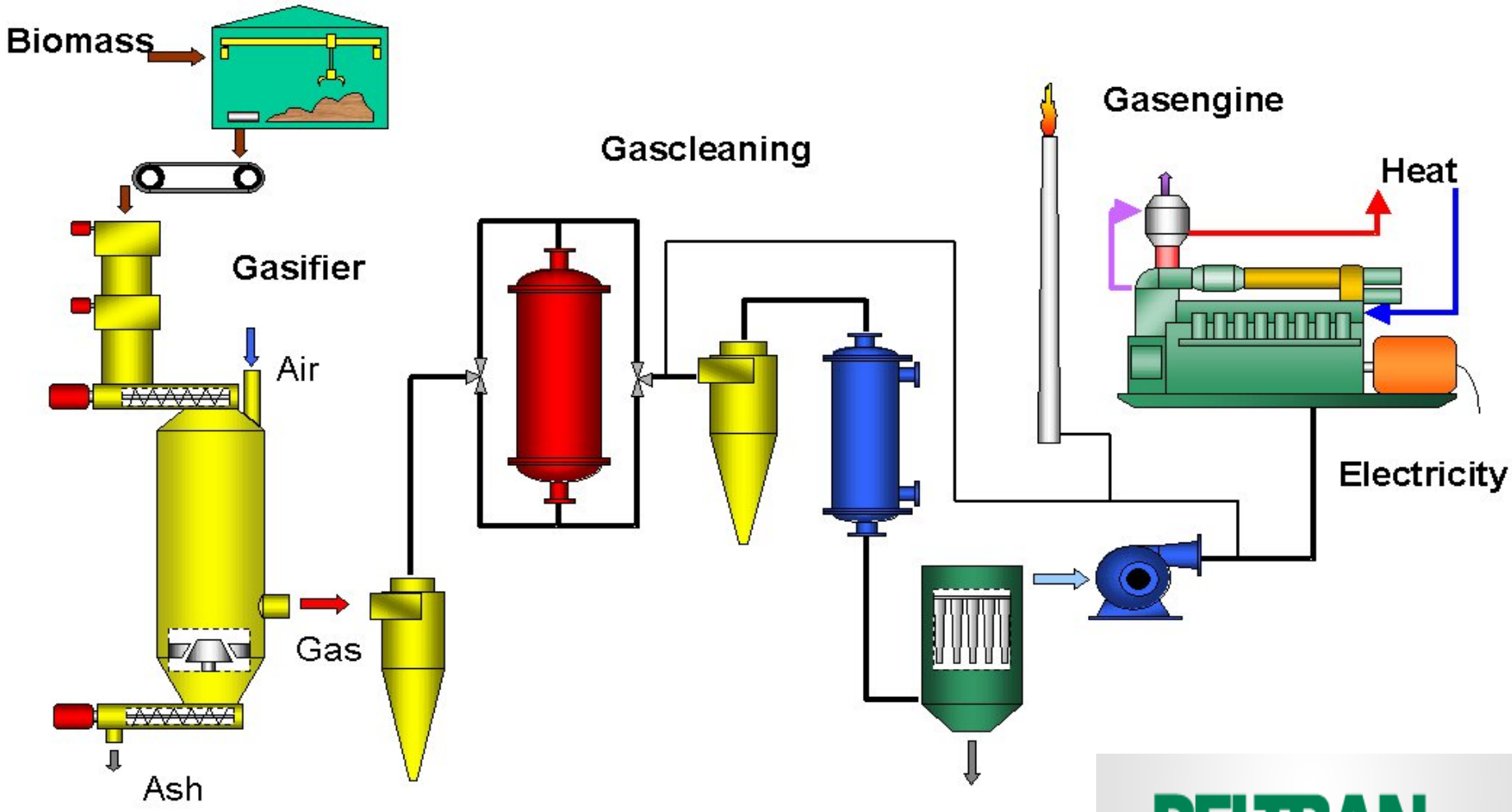
- If biomass/RDF is to supply local energy; we need to develop small scale decentralized efficient gasifier CHP generators.

Biomass Waste Conversion Paths



Thermal processes are 10-1000 times more **intense** than biological processes

Biomass Gasification with IC Engine



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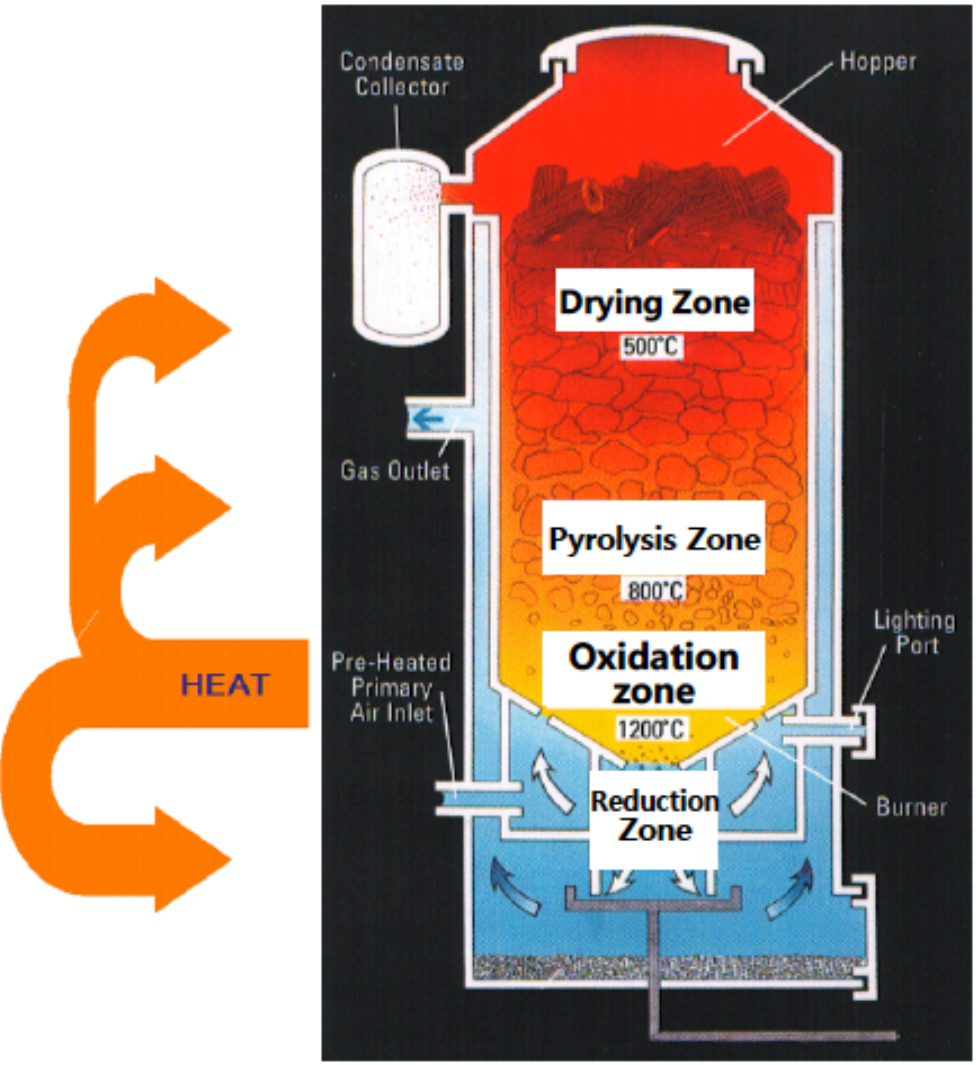
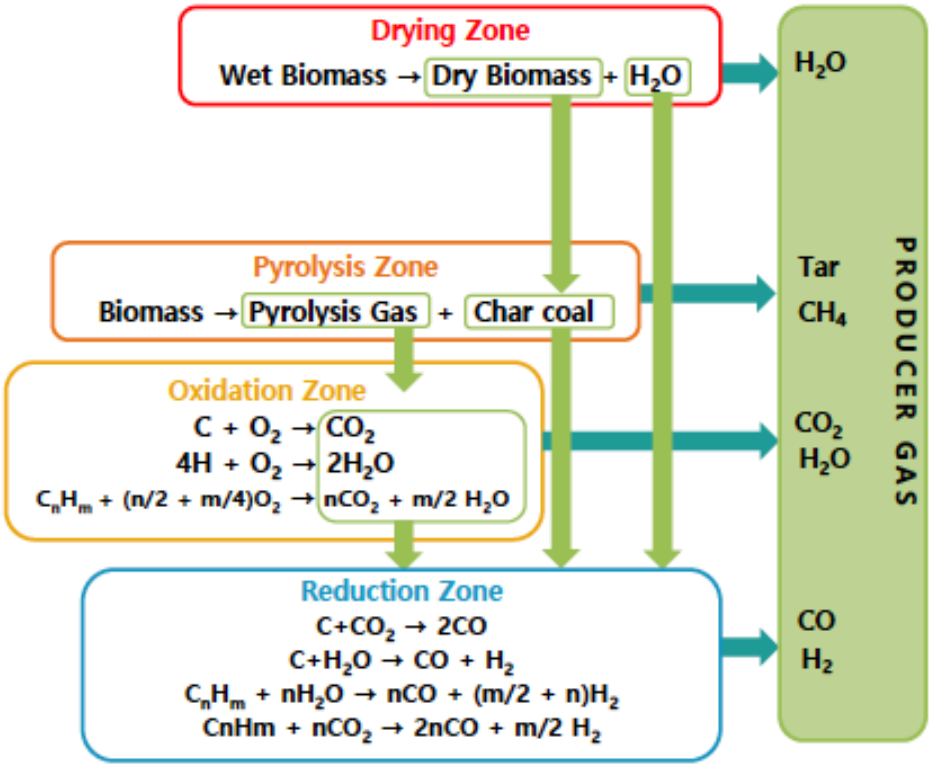
Gasification Zones





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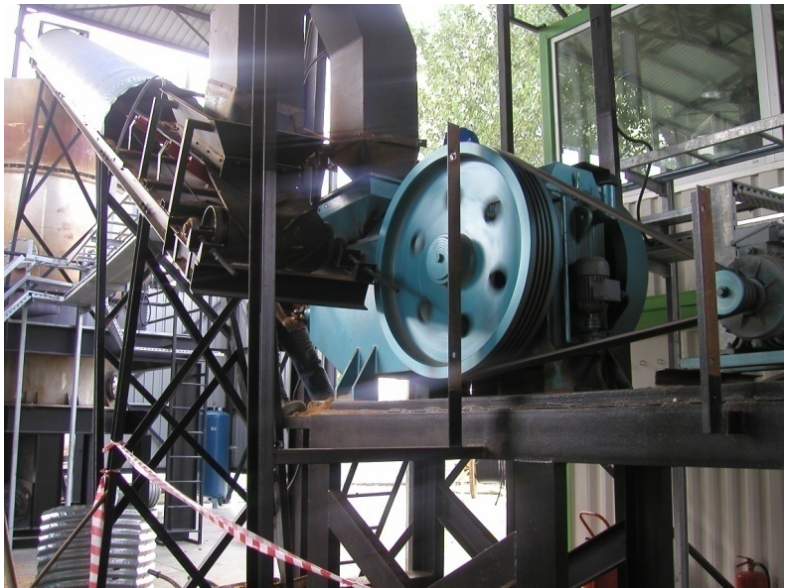
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

MSW to RDF



MSW Derived RDF Analyses

COMPONENT		RDF Pellet
Moisture	(% wt)	20
Fixed Carbon	(% wt)	12
Volatile Matter	(% wt)	55
Ash	(% wt)	13
Gross Calorific Value	(MJ/kg)	19

12 t/d Pilot Scale Test Gasification

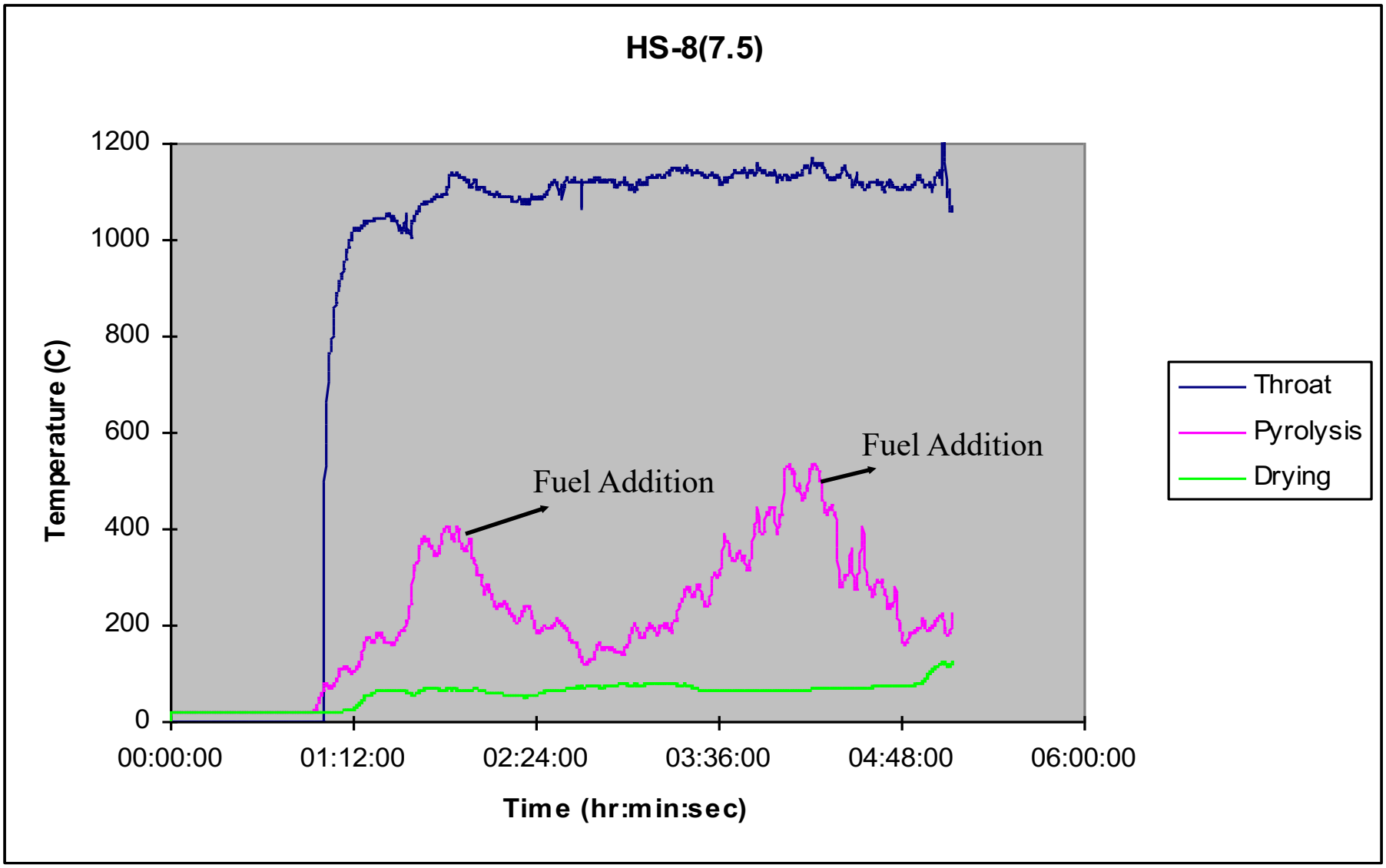
Biomasses and Wastes

- Woody waste
- RDF-Domestic
- Sewage sludge
- Industrial Wastes
- Olive pips
- Chicken Manure
- Leather waste
- Animal litter
- Sugar Cane Bagasse
- Straw Pellets
- Oil seed rape husks
- Palm Oil Waste
- Coconut Shells
- Bone-meal
- Cotton Stalks
- Hazelnut Shells

* Operation in Commercial Plant

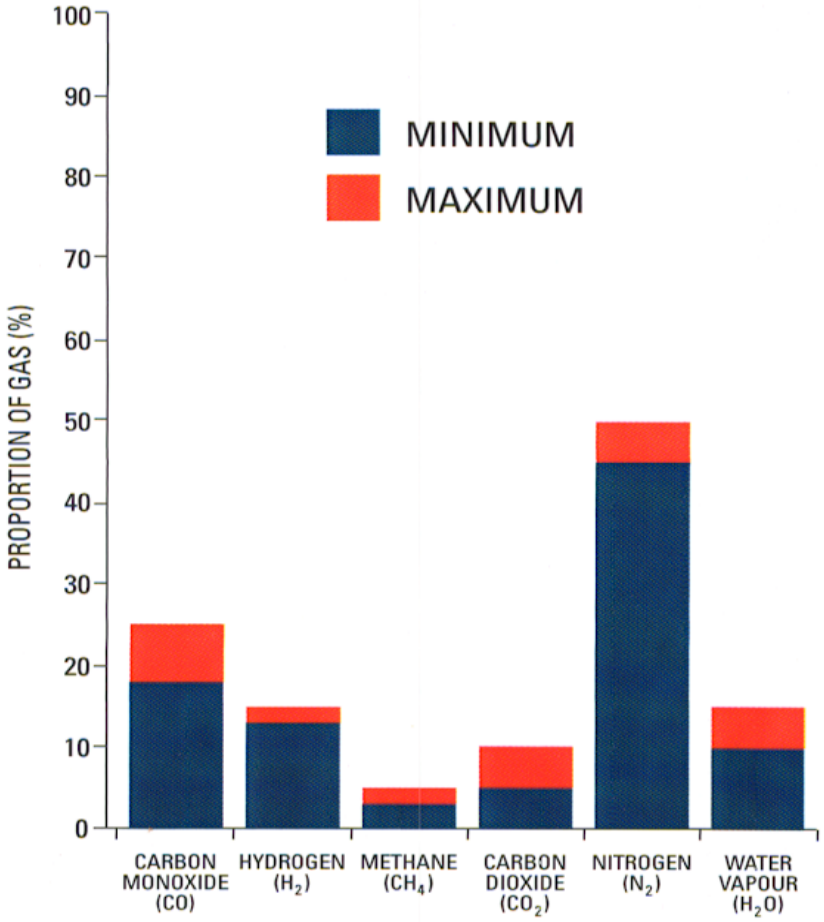
Gasifier Tested Biomasses and Wastes

RDF Gasifier Temperature Profile

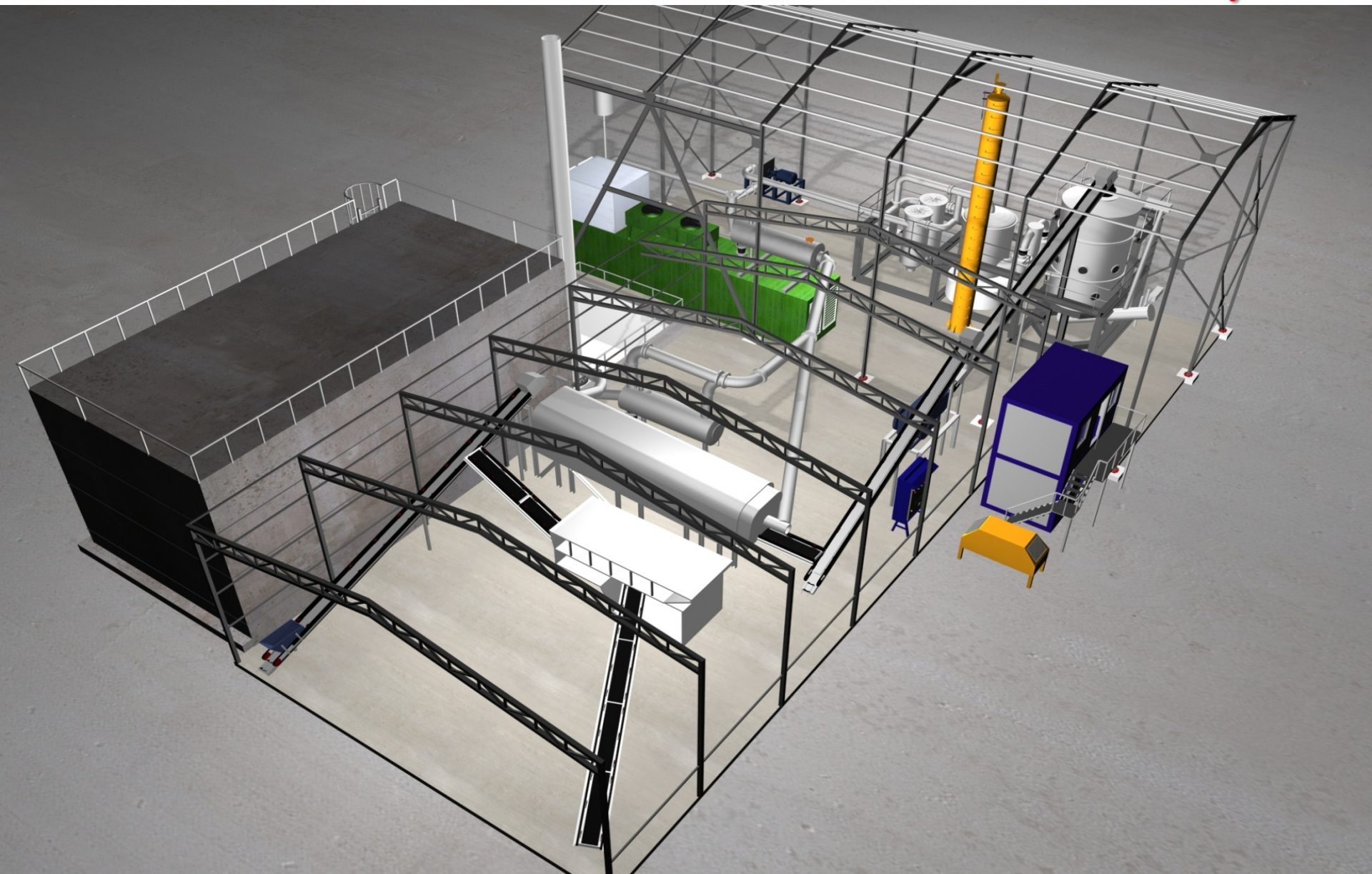


Concept Proven: Gasification Facts

- 1kg of RDF (20% moisture content) produces 2.2-2.5 Nm^3 of producer gas.
- Cool and clean producer gas density is 1.027 kg/Nm^3.
- Producer gas has an energy content of between 5 to 6 MJ/Nm^3.
- RDF/Biomass consumption of the gasifier is app. 1kg for 0.8kWh to 1.2kWh power output.



MSW->RDF Small Scale (1-5MWh) Decentralized Gasification Plant Concept

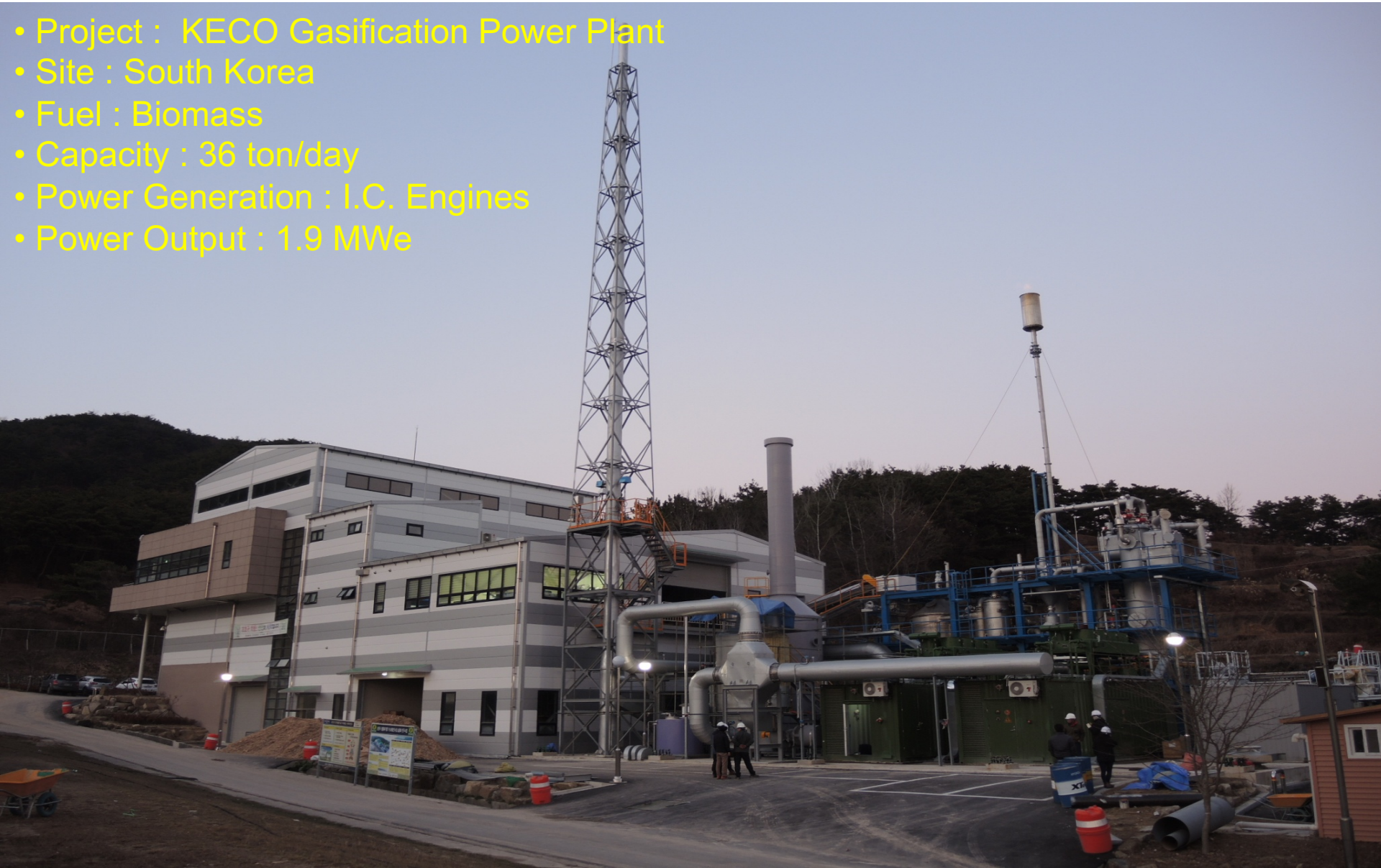


INDUSTRIAL APPLICATIONS

FIRST &

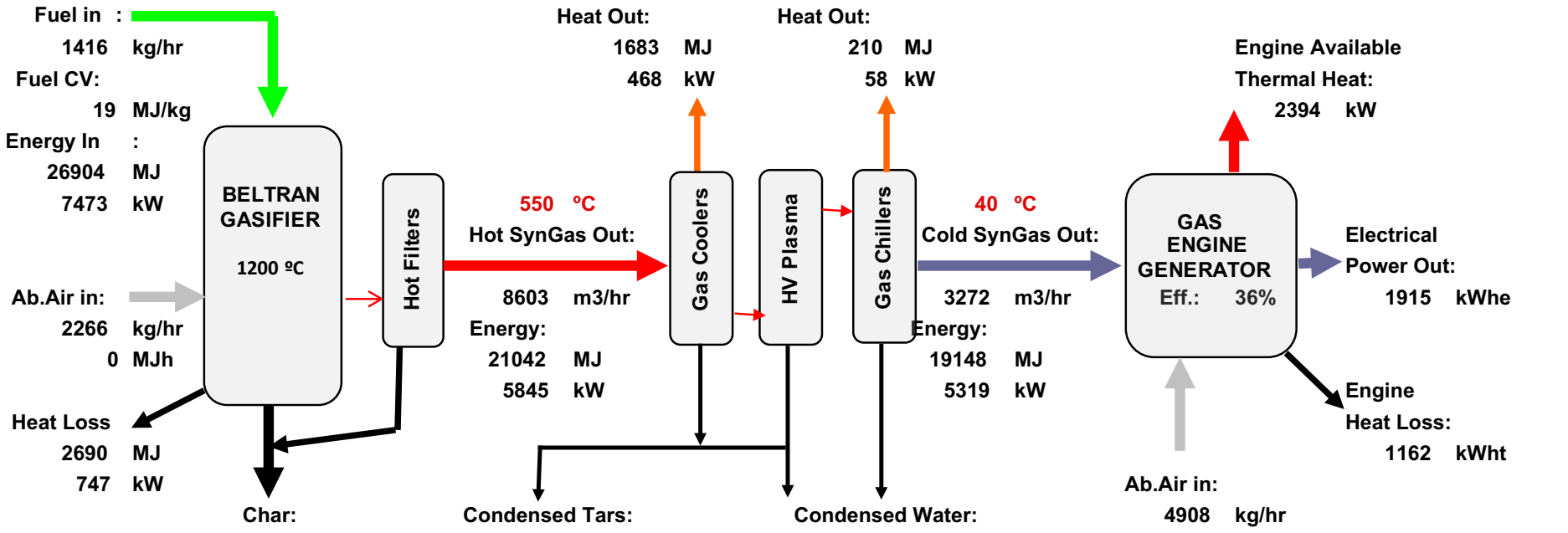
SECOND GENERATION

36 t/d Biomass Gasification System



Gasifier Syngas IC Engine System
Mass & Energy Balance Diagram

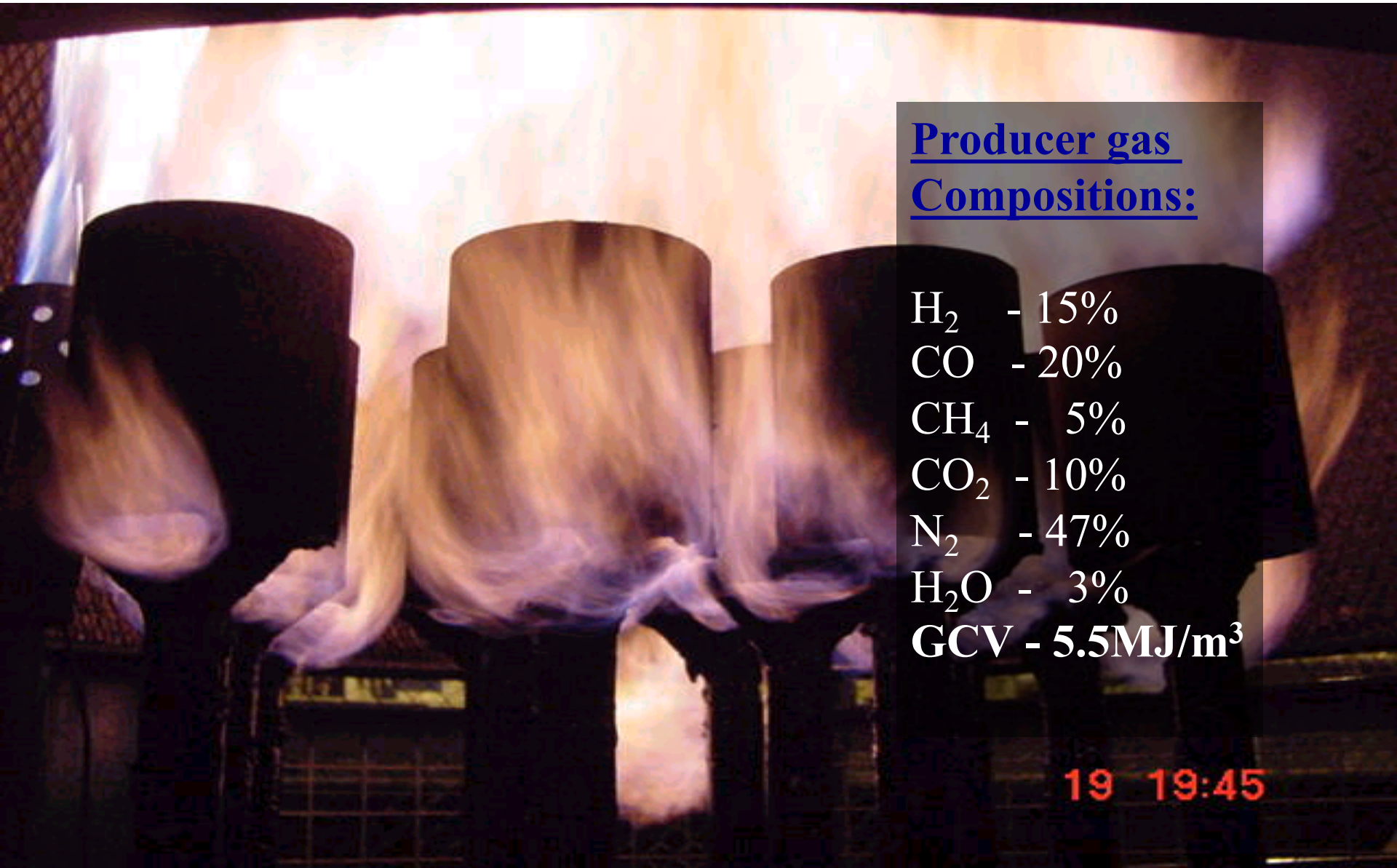
Moisture content	20	% w/w	Hot Gas Efficieny	75	%	SynGas:Fuel Ratio	2.2	m3/kg
Fuel CV (dry)	19	MJ/kg	Cold Gas Efficieny	68	%	Char:Fuel Ratio	0.1	
Calculated Net CV	15	MJ/kg	Overall Heat Loss	10.00	%	Char CV	22.4	MJ/kg
Dry Feed Rate	1416	kg/hr	Wet Feed Rate	1770	kg/hr	Engine El. Efficieny	36	%



Power: Fuel Ratio	1.1	MWe/ton
Operating Hours	8000	hrs/annum

Gross Syngas CV (HHV)	5.9	MJ/Nm3
Net Syngas CV (HHV)	5.5	MJ/Nm3
WOBBE Index	4.9	MJ/Nm4
Water condensed	0.12	

Gasifier Produced SynGas



Novel Syngas Clean-up: Beltran HV Plasma

Current/Future Research:
Biomass Gasifier Char to Active Carbon

MDF Waste Gasification ORC Turbine Plant

- Project : KEAS Gasification Power Plant
- Site : Istanbul
- Fuel : MDF Waste
- Capacity : 60 ton/day
- Power Generation : Turboden ORC Turbine
- Power Output : 2 MWe
- Plant Completion : 2017

MDF/RDF Gasification-ORC Turbine Plant
Istanbul Commissioned Feb. 2017

RDF/SRF Gasification Plant

- Project : MS Gasification Power Plant
- Site : Turkey
- Fuel : RDF and SRF
- Capacity : 120 ton/day
- Power Generation : Siemens Steam Turbine
- Power Output : 5 MWe
- Plant Completion : 2018

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