MYRECHEMICAL - WASTE TO CHEMICALS

TECNOLOGIA “WASTE TO CHEMICAL”

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March 7th, 2022

NextChem
Maire Tecnimont for Energy Transition

MyRechemical

AGENDA

1. MAIRE TECNIMONT Group for Energy Transition
2. Waste to Chemical Introduction
3. Case study Waste to Methanol
4. To zero carbon emission
5. Conclusions

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GROUP STRUCTURE AND AREAS OF EXPERTISE

BUSINESS UNITS

Maire Tecnimont

HYDROCARBONS				GREEN ENERGY		
Tecnimont	KT Kinetics Technology	Stamicarbon	Met Development	NextChem Maire Tecnimont for Energy Transition	Neosia Renewables	MST
LARGE-SCALE EPC: • OIL&GAS REFINING • PETCHEM • FERTILIZERS	OIL&GAS REFINING	FERTILIZERS TECHNOLOGY	PROJECT DEVELOPMENT	• GREEN CHEMISTRY • ENERGY TRANSITION	RENEWABLE ENERGY	• ENERGY EFFICIENCY • FACILITY MGMT

AREAS OF EXPERTISE

GAS MONETIZATION & TRANSITION FUELS

PETROCHEMICALS

- Polyethylene (LDPE, HDPE)
- Polypropylene
- Propane Dehydrogenation (PDH)
- Aromatics

OIL & GAS REFINING

- Refining
- Hydrogen and Syngas
- Sulphur Recovery
- Tail Gas Treatment
- Fire Heaters

FERTILIZERS

- Urea
- Ammonia
- Nitric Acid

ENERGY TRANSITION

- Low-Carbon Hydrogen
- CO_2 Capture and Valorization
- Renewable Diesel, 2G Ethanol and SAF
- Plastic Upcycling, Waste to Chemical
- Bioplastics
- Solutions for Renewable Energy
- Energy Efficiency

~45 COUNTRIES | 50 OPERATING COMPANIES | ~1,500 TOTAL DELIVERED PROJECTS

FINANCIAL DATA

FY 2021 Consolidated Financial Results

SOLID AND IMPROVING FY2021 FINANCIAL PERFORMANCE*

REVENUES

€2.9 BN

+8.9%

DRIVEN BY
NEW ORDER INTAKE

EBITDA

€173.7 MN

+0.9%

EBITDA MARGIN
6.1%

ORDER INTAKE

€6.4 BN

+ €3.701 M

THE HIGHEST ORDER
INTAKE EVER

BACKLOG

€9.5 BN

THE HIGHEST BACKLOG EVER

3.3X BACKLOG COVER**

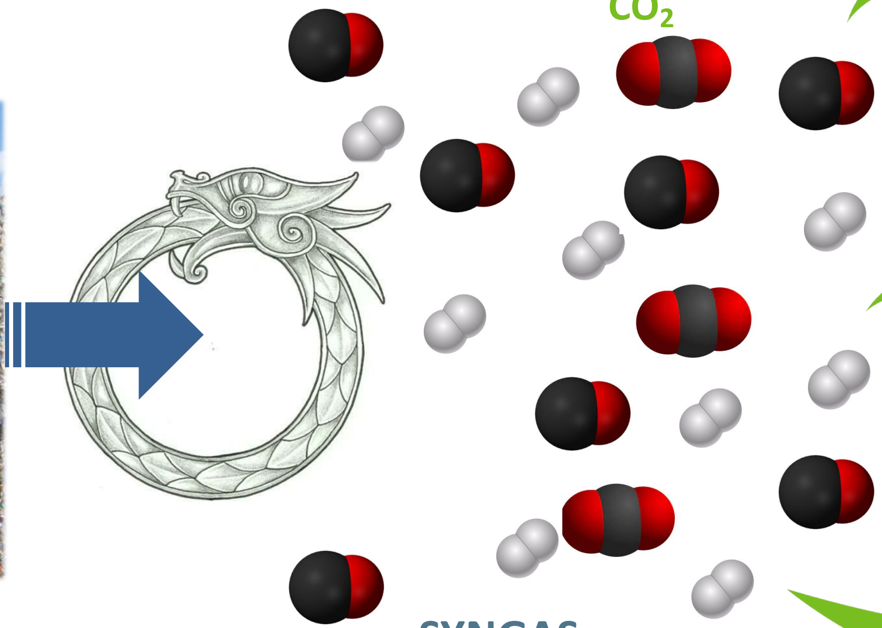
(**) Defined as the ratio between backlog and the last twelve months' revenues.

** Changes vs FY 2020*

WASTE AS A RESOURCE

Municipal Solid Waste,
RDF, Plasmix

(10 MMton)



CO_2

H_2

CO

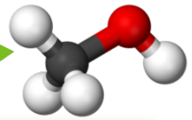
SYNGAS

Waste
energy content
16 MJ/kg

> 1/3
<

Diesel
energy content
43 MJ/kg

Methanol



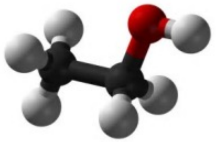
(5 MMton)

- *MTBE*
- *FAME*
- *CHEMICAL*
- *BUNKER*

H_2 - *Hydrogen Valley*

(800 Mton)

Ethanol



(3 MMton)

- *ETBE*
- *CHEMICAL*
- *SAF*

INTRODUCTION

UNRECYCLABLE WASTE

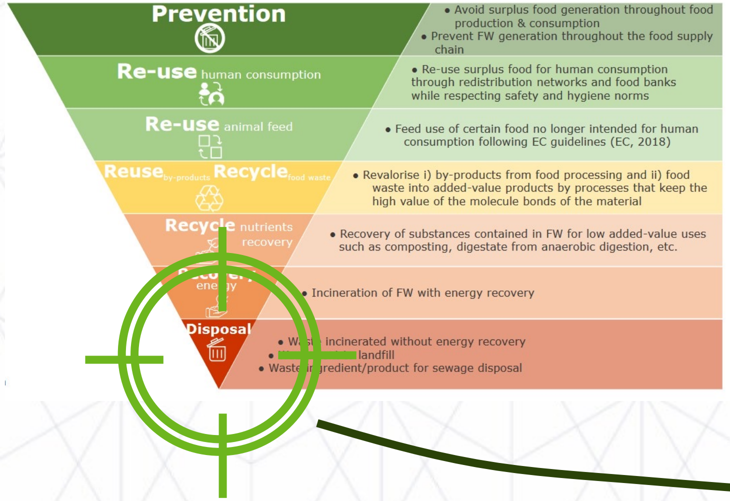
Refuse Derived Fuel

C	**47-61%**
H	**5-7%**
O	14-20%
Cl	0.8-1.5%
N	0.2-0.5%
S	0.02-0.3%
Moisture	5-9%
Ash	7-20%

C	**40-55%**
H	**5-8%**
O	20-28%
Cl	0.5-3%
N	0.5-1.5%
S	0.1-1%
Moisture	10-20%
Ash	5-20%

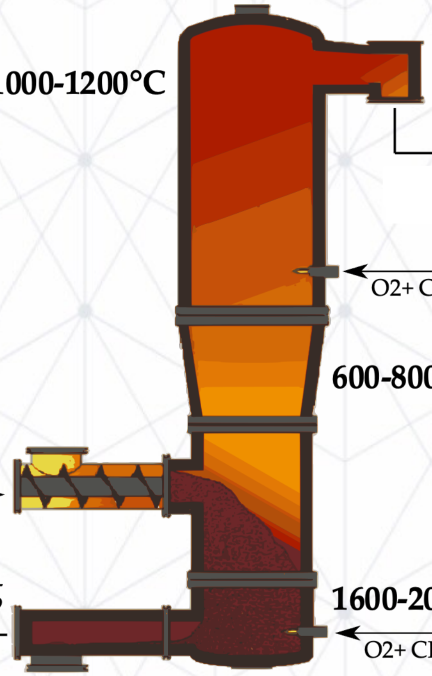
Plasmix

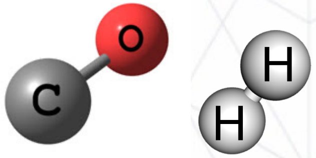
CONVERSION REACTOR



Stabilization zone

1000-1200°C





SYNGAS

O2+ CH4

600-800°C

Partial oxidation zone

Waste

Slag

1600-2000°C

O2+ CH4

Melting zone

Vitrified granulate

Ceramic industries

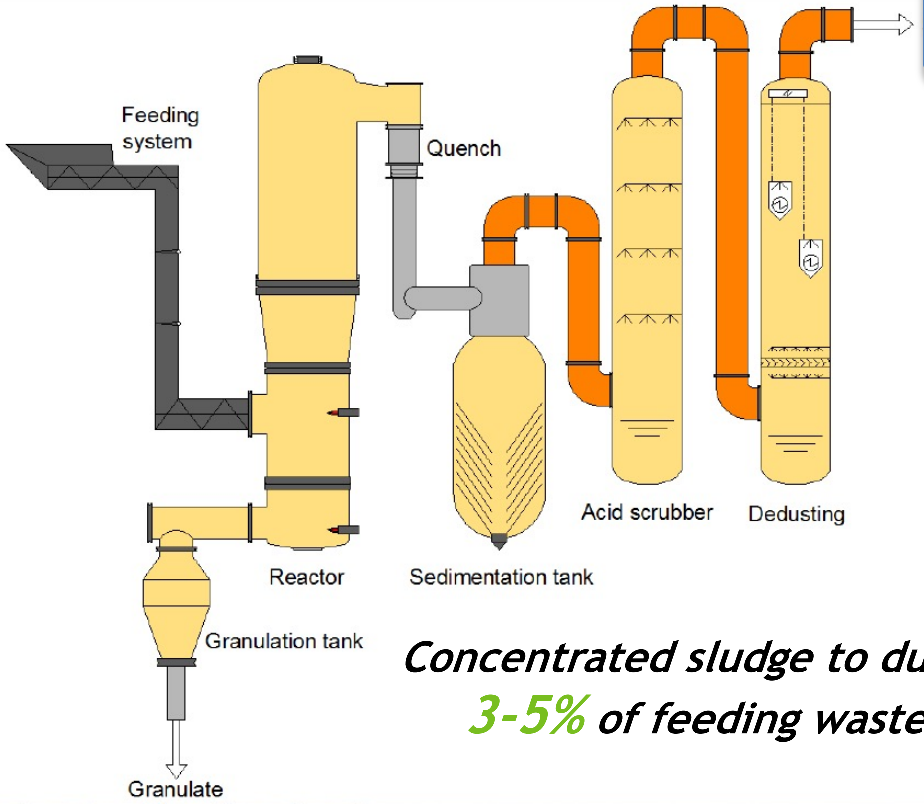
INERTS

Concrete industries

Inert granulate is mostly composed of oxides: SiO_2, CaO, Al_2O_3, Fe_2O_3

WASTE TO CHEMICAL TECHNOLOGY - WASTE CONVERSION

C	40-55%
H	5-8%
O	20-28%
Cl	0.5-3%
N	0.5-1.5%
S	0.1-1%
Moisture	10-20%
Ash	5-15%



Concentrated sludge to dump
3-5% of feeding waste

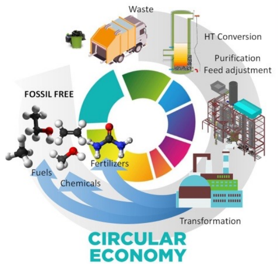
5-15%
of feeding waste is converted to valuable inert granulate

Two Wet Electrostatic Precipitators

Subcooled cleaning column

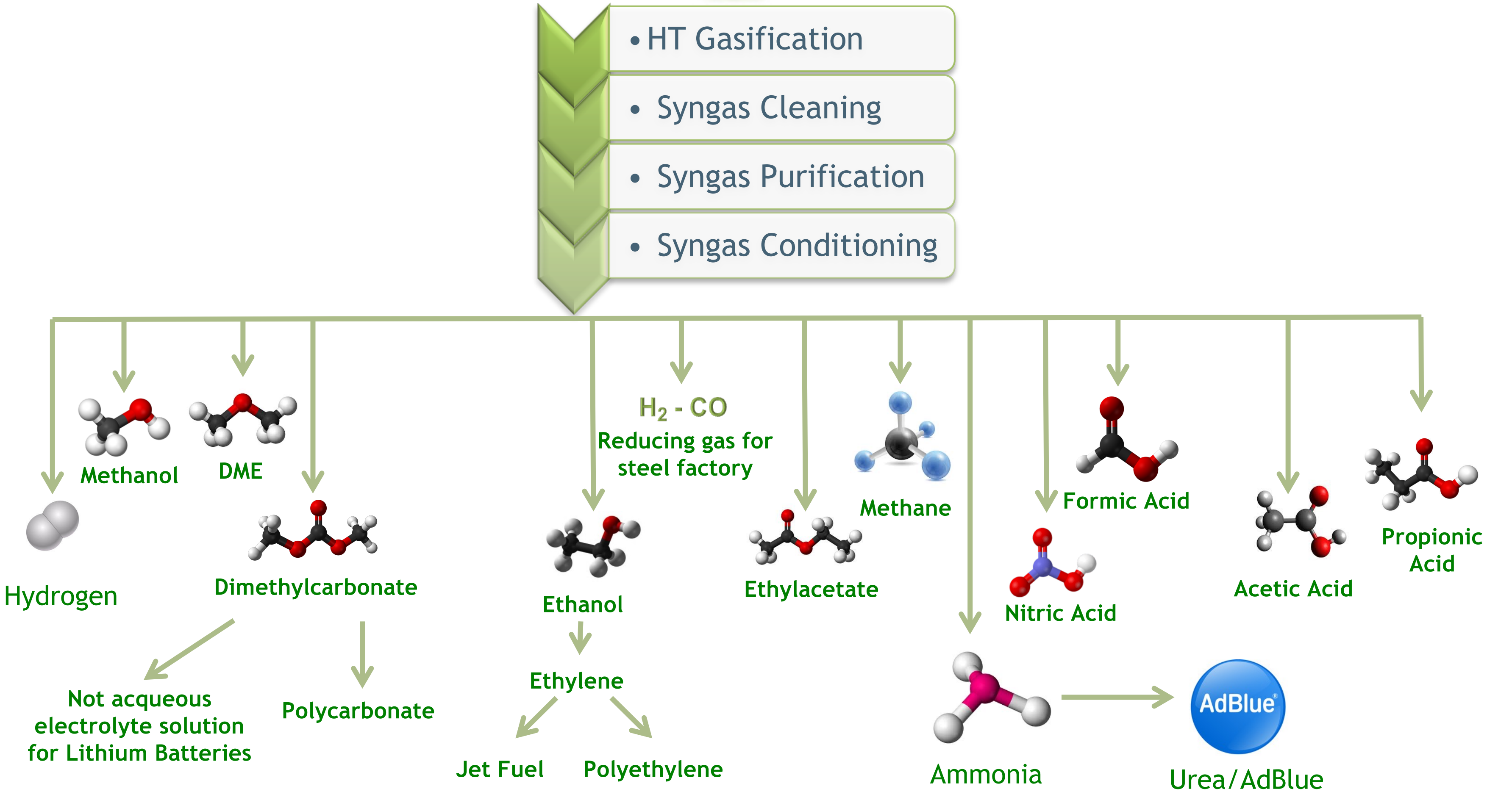
Balance of waste is converted into Syngas

Output syngas		
Pressure	40	mbarg
T	30	°C
Composition range		
H_2	37-42	% vol
CO	40-44	% vol
CO_2	7-12	% vol
N_2	3-4,5	% vol
Ar	0,02	%vol
H_2O	4-4,4	%vol
Inorganic Compound Maximum		
H_2S	700	ppm
COS	35	ppm
HCl	50	ppm
Hg	0,1	ppm
PM	0,1	ppm
Metals		



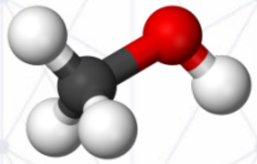
CHEMICALS PATHWAY FROM WASTE

Waste feedstock can be converted into SYNGAS to be used as BUILDING BLOCK for the synthesis of chemicals and fuels. A premium on final end product may be recognized.



CASE STUDY

Feedstock: 75 % RDF, 25 % PLASMIX



- WASTE: 400,000 t/y
- Productivity MeOH= 188,000 t/y
- Productivity H_2= 3,00 ton/y

6 GASIFICATION LINES IN PARALLEL

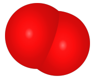
RDF/PLASMIX – 75/25

- C=39,0%w ; H=5,3%w; O=21,5%w; N=0,85%w; Cl=0,94%w; S=0,2%w; others
- Moisture= 15,7%w; Ash=16,5%w
- LHV= 16MJ/kg

WASTE TO METHANOL + H2

75% RDF +
25% PLASMIX

400.000 MTPY



O_2

ASU

AIR

N_2

Waste conversion

Syngas Purification

Syngas Conditioning

Methanol synthesis

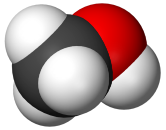
Pure H_2

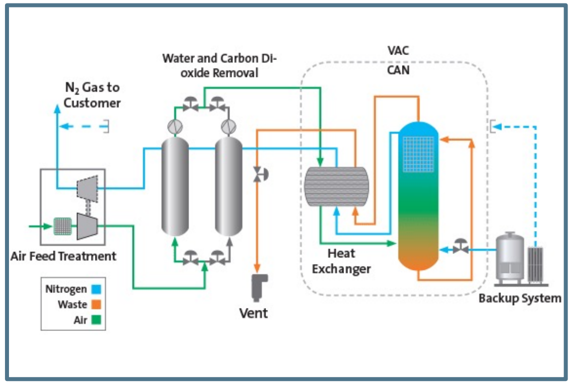
3.000 MTPY

Methanol Purification

METHANOL

188.000 MTPY





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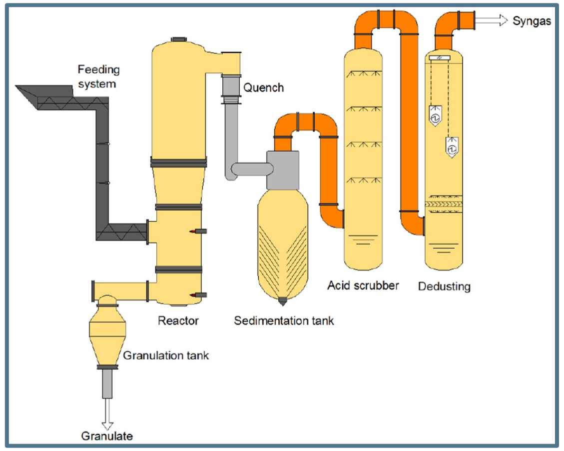
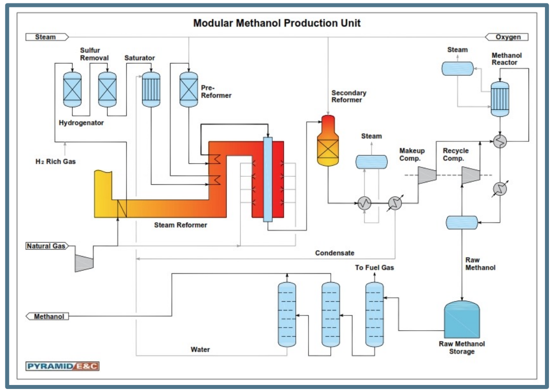
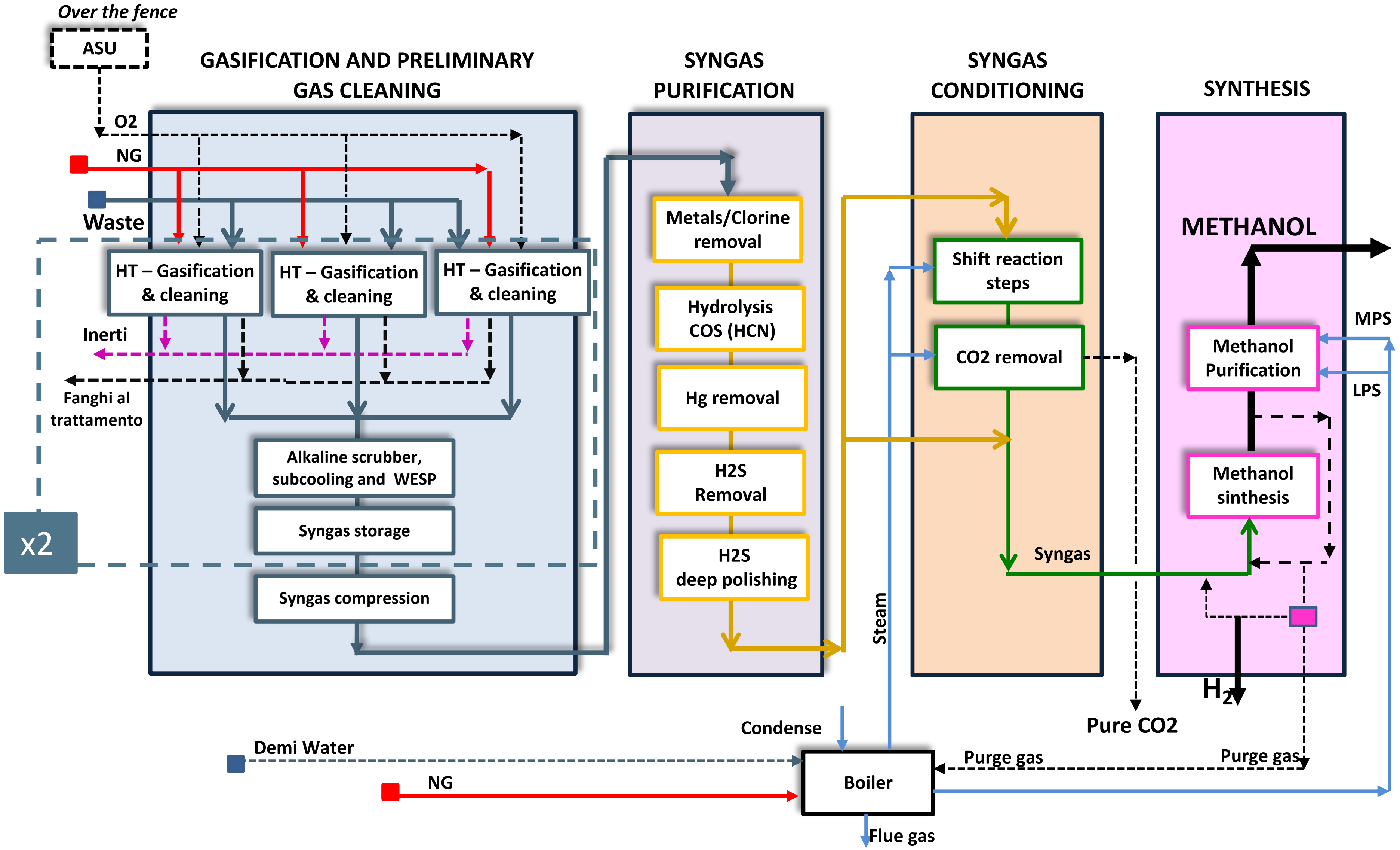


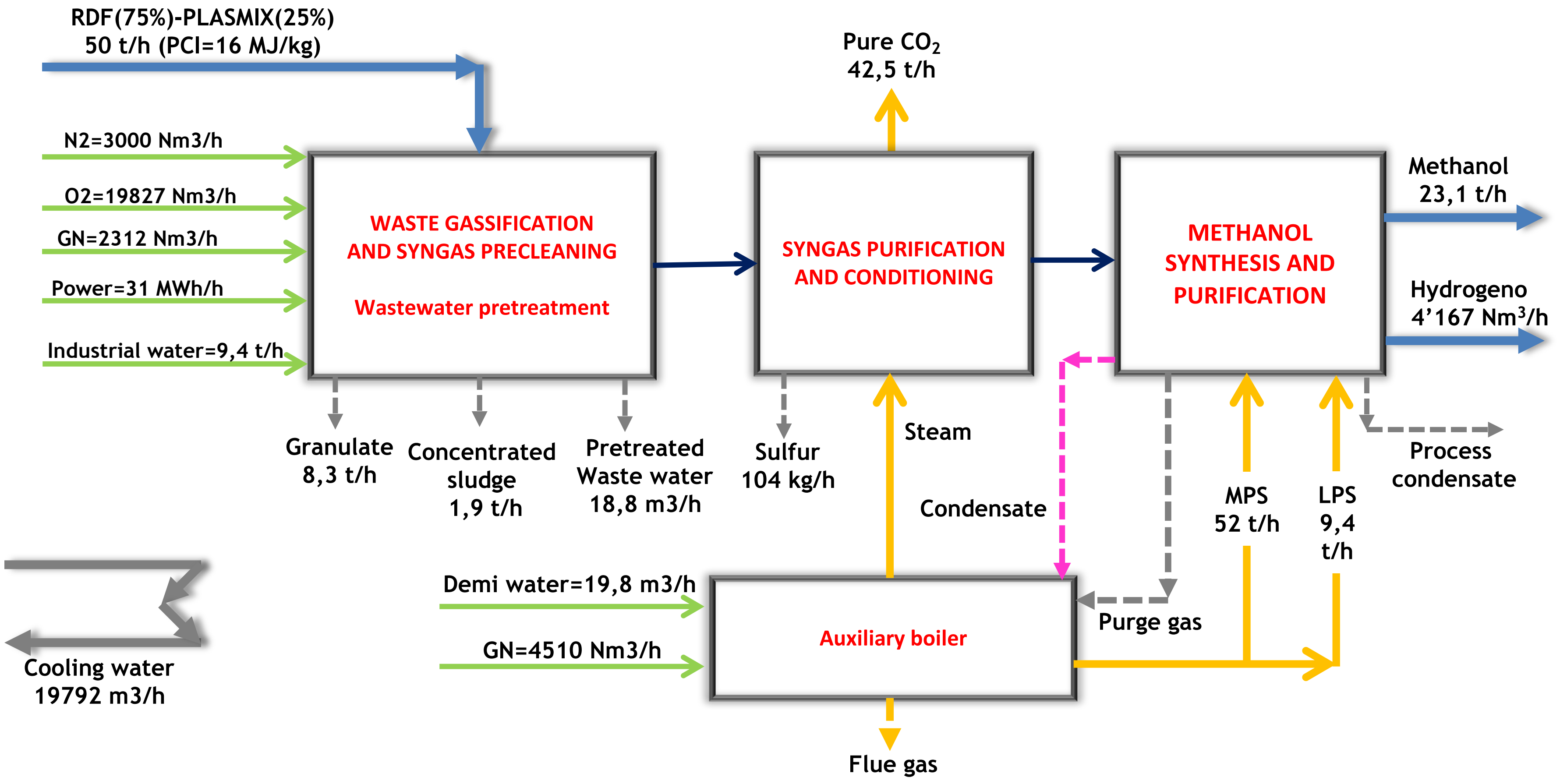
JM Johnson Matthey
Inspiring science, enhancing life



PLANT WASTE TO METHANOL + H2

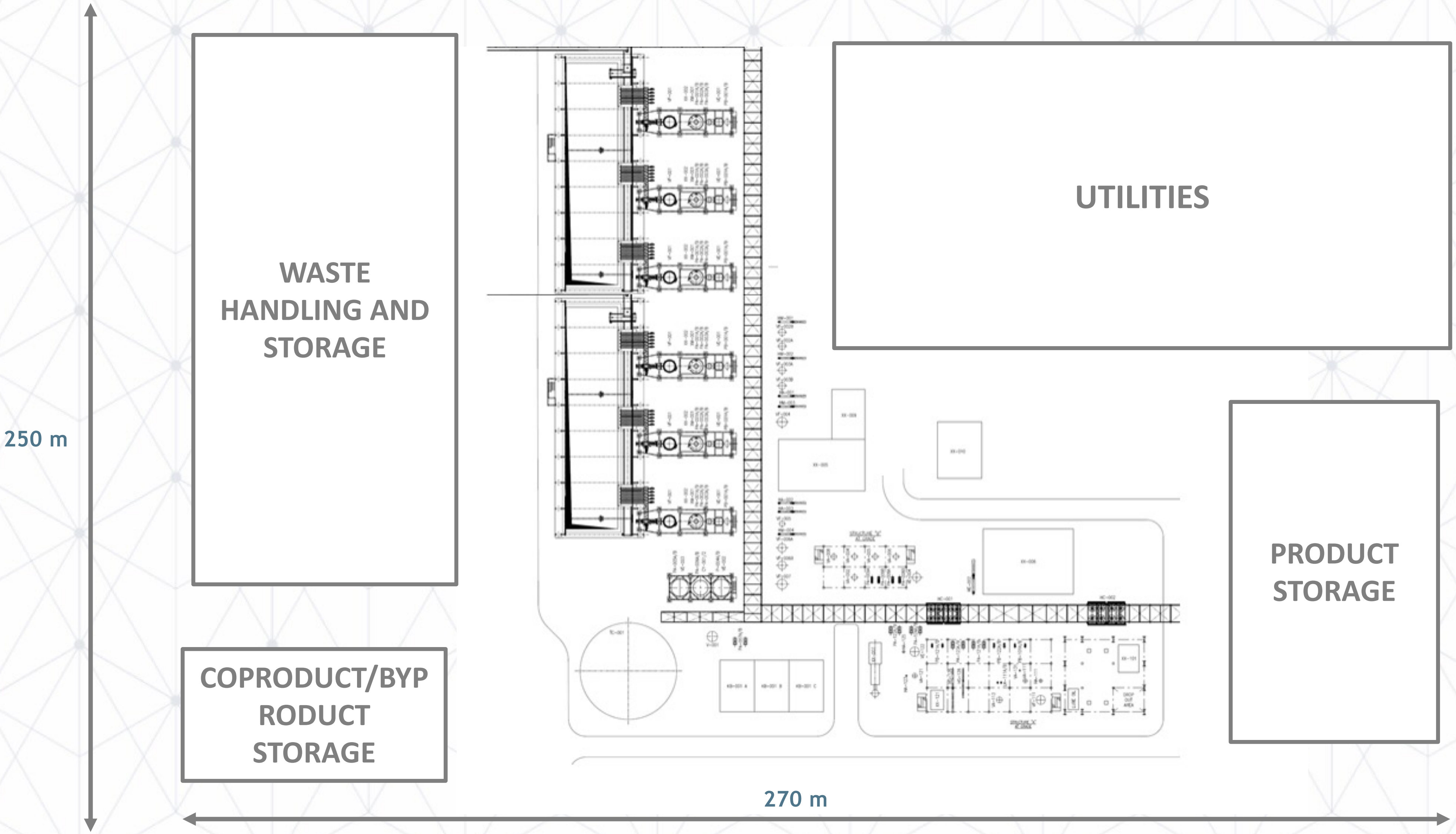


BLOCK SCHEME- WASTE TO METHANOL + H2

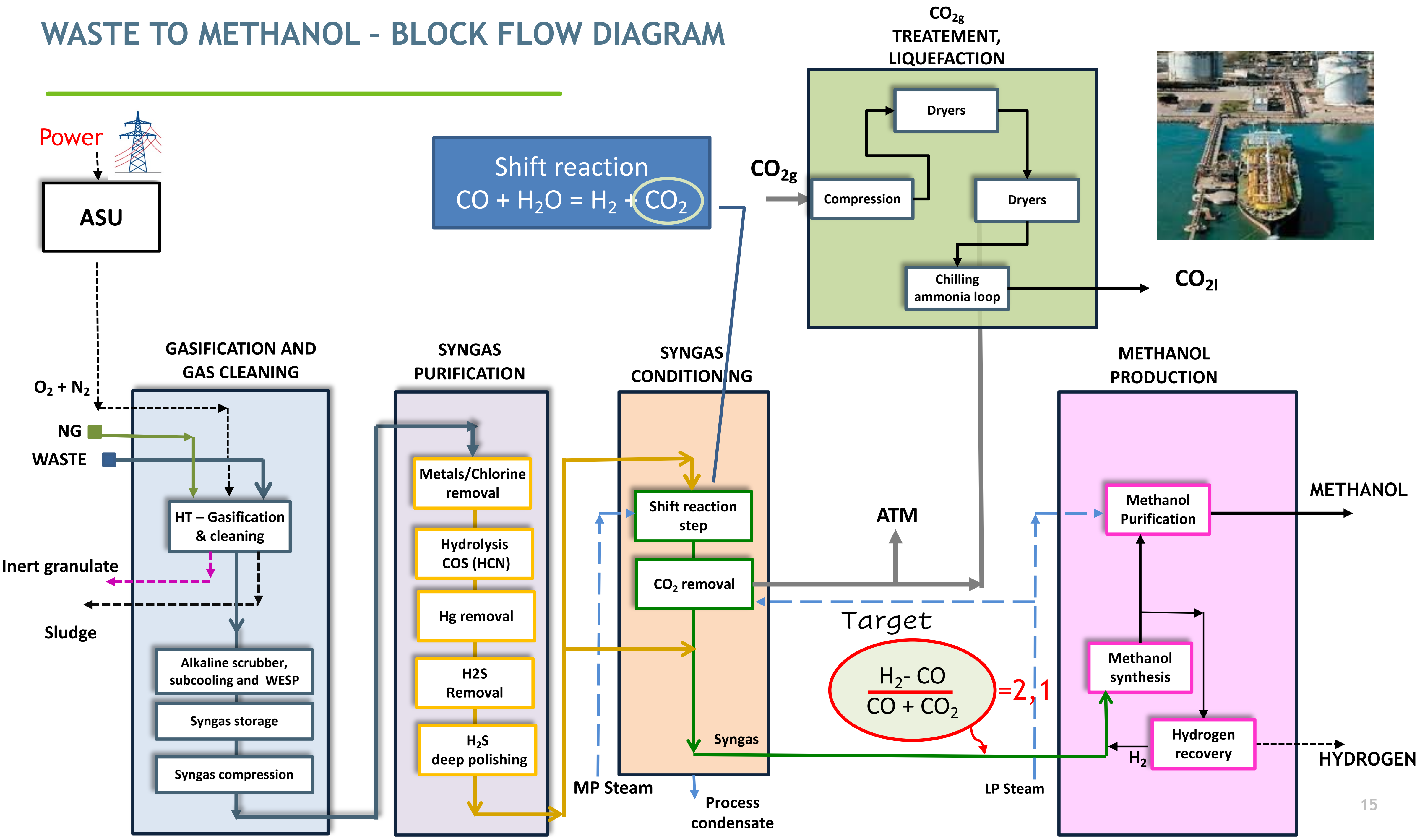


LAYOUT

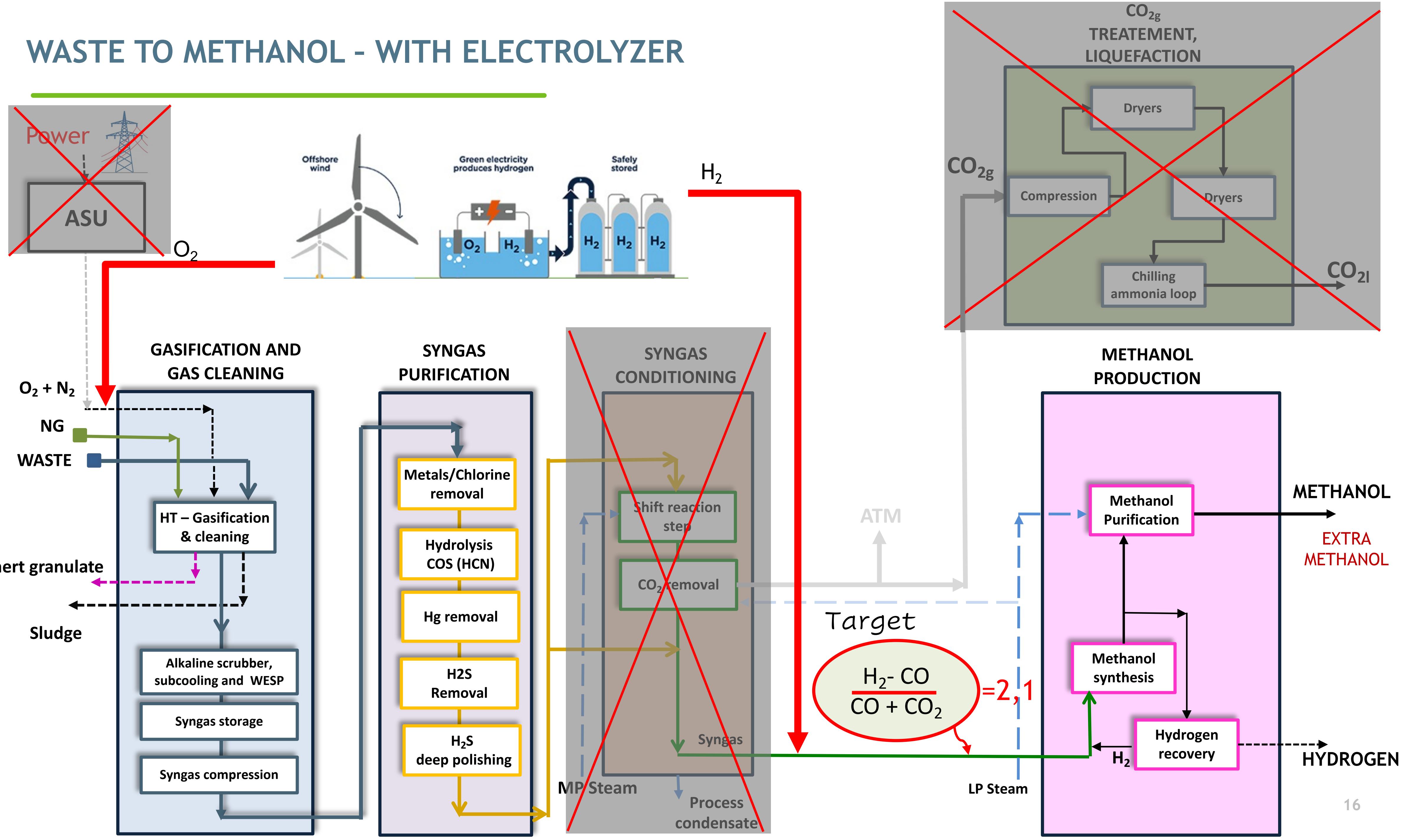
UN IMPIANTO WASTE TO METHANOL + H2 DA 400 kta DI RIFIUTO IN CARICA HA UNA PLOT AREA STIMATA IN CIRCA 6,5 ha



WASTE TO METHANOL – BLOCK FLOW DIAGRAM



WASTE TO METHANOL – WITH ELECTROLYZER



TECHNOLOGY COMPARISON

INCENERATOR	GASIFIER
Design to maximize production of **CO_2 e H2O**	Design to maximize production of **CO e H_2 (syngas)**
Almost **all carbon** of the waste goes to **CO_2**; the other fraction goes in the bottom ashes	**Carbon** of the waste is partially or totally **converted** into a **new chemical product**
The bottom residue contains carbon and it appears like a **volatile, flammable and toxic podwer.** It is disposed of in dump and can produce toxic eluate.	The bottom residue is an **inert granulate** which can be used in civil sector, to recover metals or for rock wool production.
It uses large amount of air. Combustion of solid material is hardly controlled.	It works with controlled amount of pure oxygen which ensures the control of temperature and process.
The flue gas requires suited treament of contaminants. Potential releases of **dioxins, furans, NOx, and particulate matter**, in particular during plant transient.	**Cleaned syngas** Can be used for the synthesis of chemical product, fuel or energy production, thus it is directly emitted in the atmosphere.
Sulfur from waste is converted into oxides of sulfur and released with flue gas, with potentail risk of **acid rains**	Sulfur of waste is converted into H_2S and recovered as **elemental sulfur** to be sell
Waste volume reduction of 1:5	**Waste volume reduction of 1:100**
High conusmption of natural gas to ensure complete combustion	**Low conusmption of natural gas** to control temperature profile

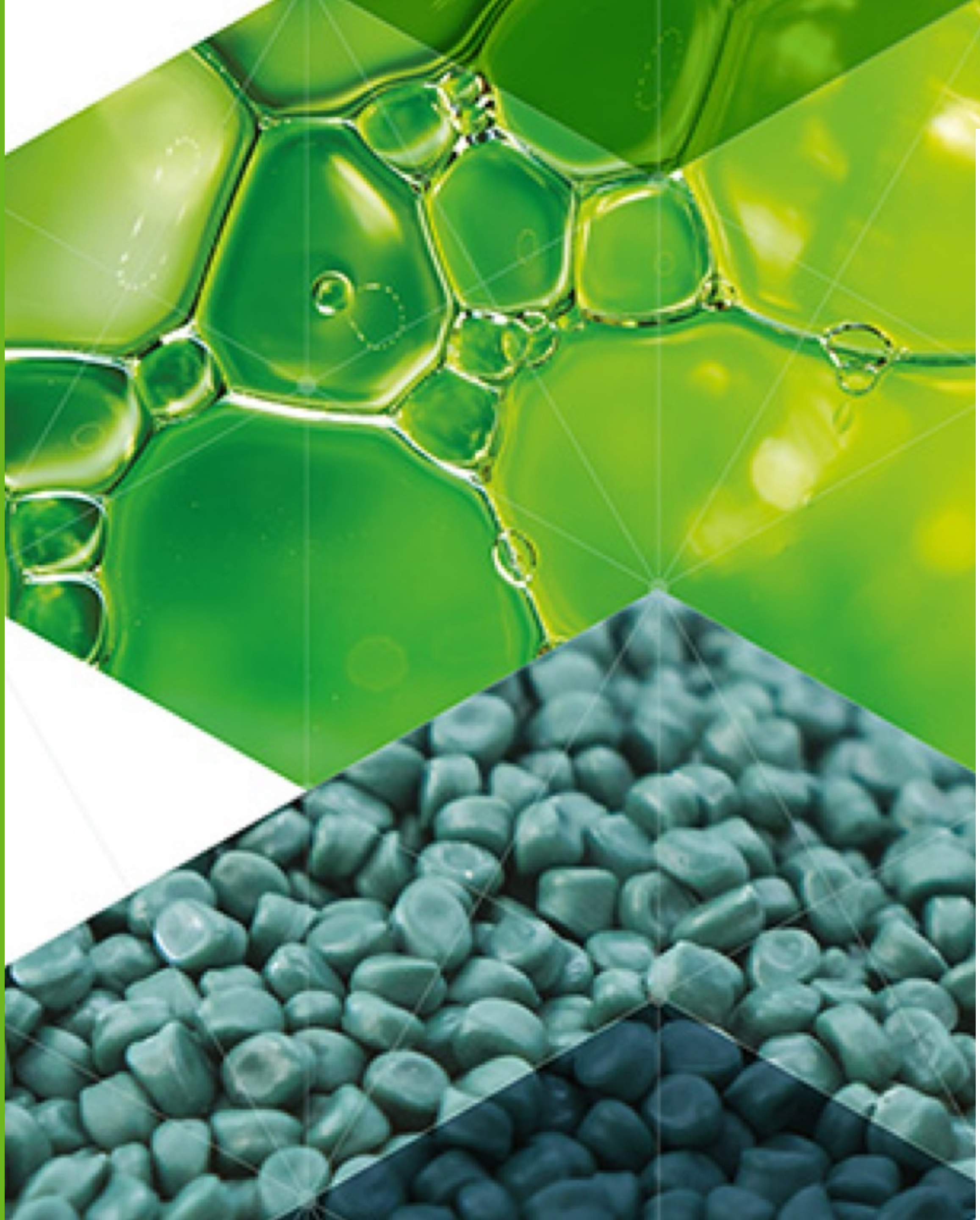
CONCLUSIONS

- Robuste and commercially proven process units for gasification, purification and chemical synthesis.
- NextChem W2C technology represents a process economically competitive with a low carbon footprint.

- Waste is a valuable source of carbon for replacing traditional fossil feedstocks

- The chemical conversion of solid waste is a valid alternative to conventional landfill or thermal valorization.

- The proposed technology fits perfectly into the concept of Circular Economy, which promotes the use of waste as a feedstock for the synthesis of new products.
- Integration of waste to chemical scheme with hdyrogen produced by electrolyzers can increase overall yields and further reduce carbon foot print down to ZeroCO2



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