WASTE TO CHEMICALS TECHNOLOGIES

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Process engineer

MyRechemical
Maire Tecnimont for Energy Transition

DEFINING THE GREEN PERIMETER: NEXTCHEM INCEPTION

Stamicarbon

Tecnimont

KT
Kinetics Technology

Neosia Renewables

PATENTS
SHARES
CONTRACTS
INITIATIVES

MyRechemical
NextChem for Waste to Chemical

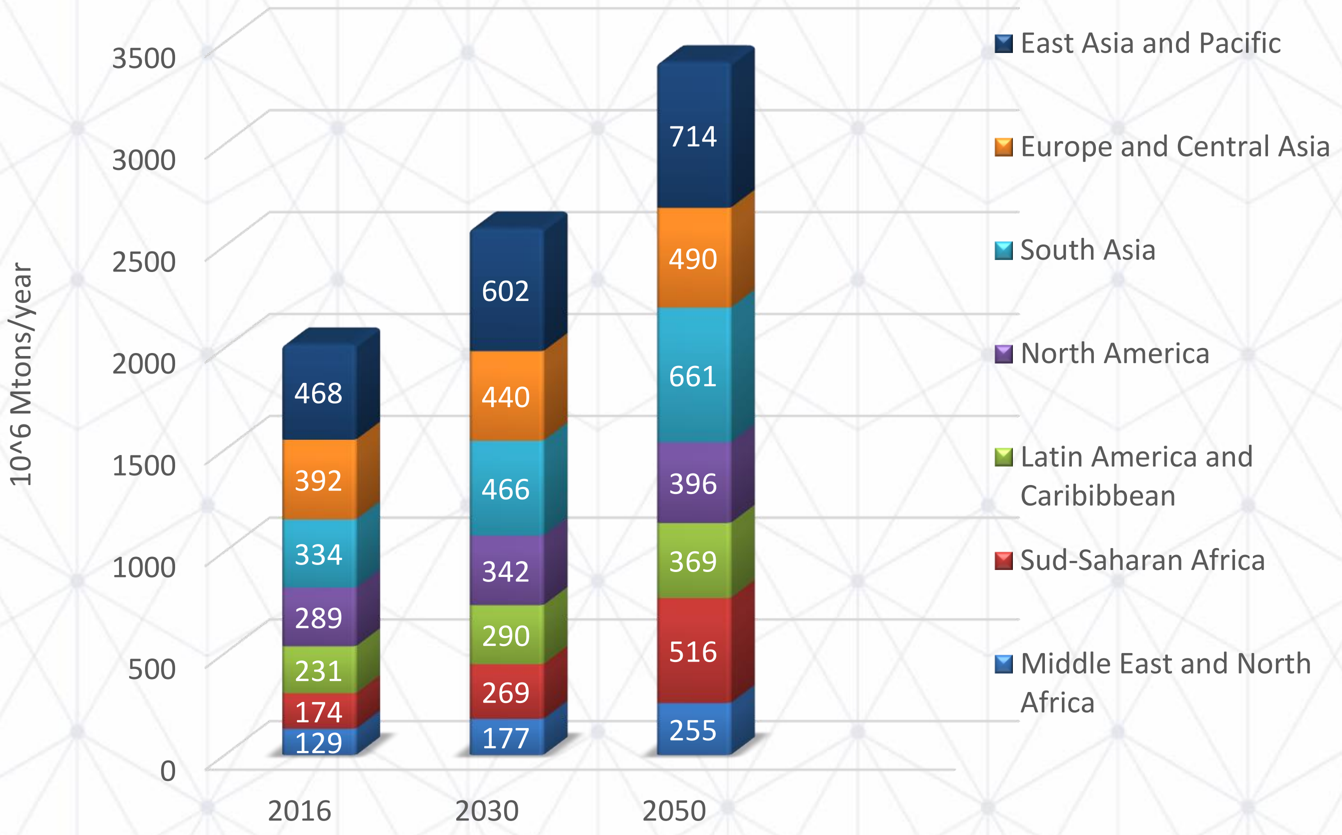
Since 2020
CONTROLLED @ 100%

NextChem
Maire Tecnimont for Energy Transition

8	>100
CONTROLLED COMPANIES	EMPLOYEES

DRIVER: WASTE AN IMPELLING ISSUE

World production of waste is close to 2 Bilion Mtons per year.
Due to growth of population and GDP, it is expected to reach 3,4 Bilion Mton per year in 2050 (WorldBank).



0.74 kg
per day per capita
(but ranges widely, from 0.11 to 4.54)

+ 19% @ 2050
in High GDP countries

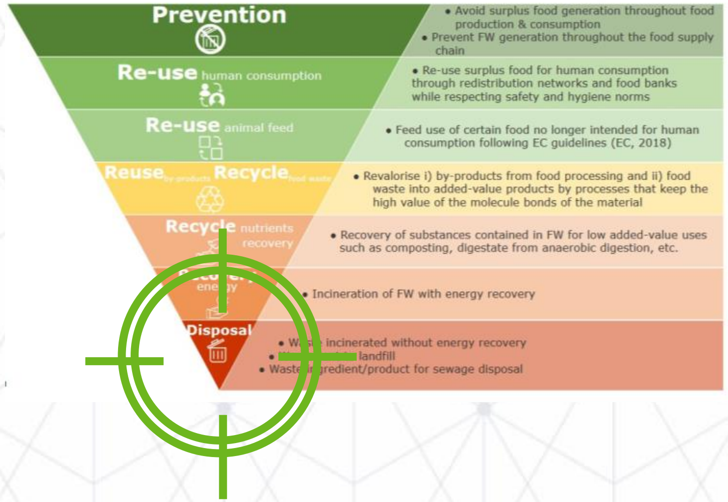
+ 40% @ 2050
in Low-Middle GDP countries

What-a-waste. World data bank.
https://datatopics.worldbank.org/what-a-waste/trends_in_solid_waste_management.html

UNRECYCLABLE WASTE

Refuse Derived Fuel

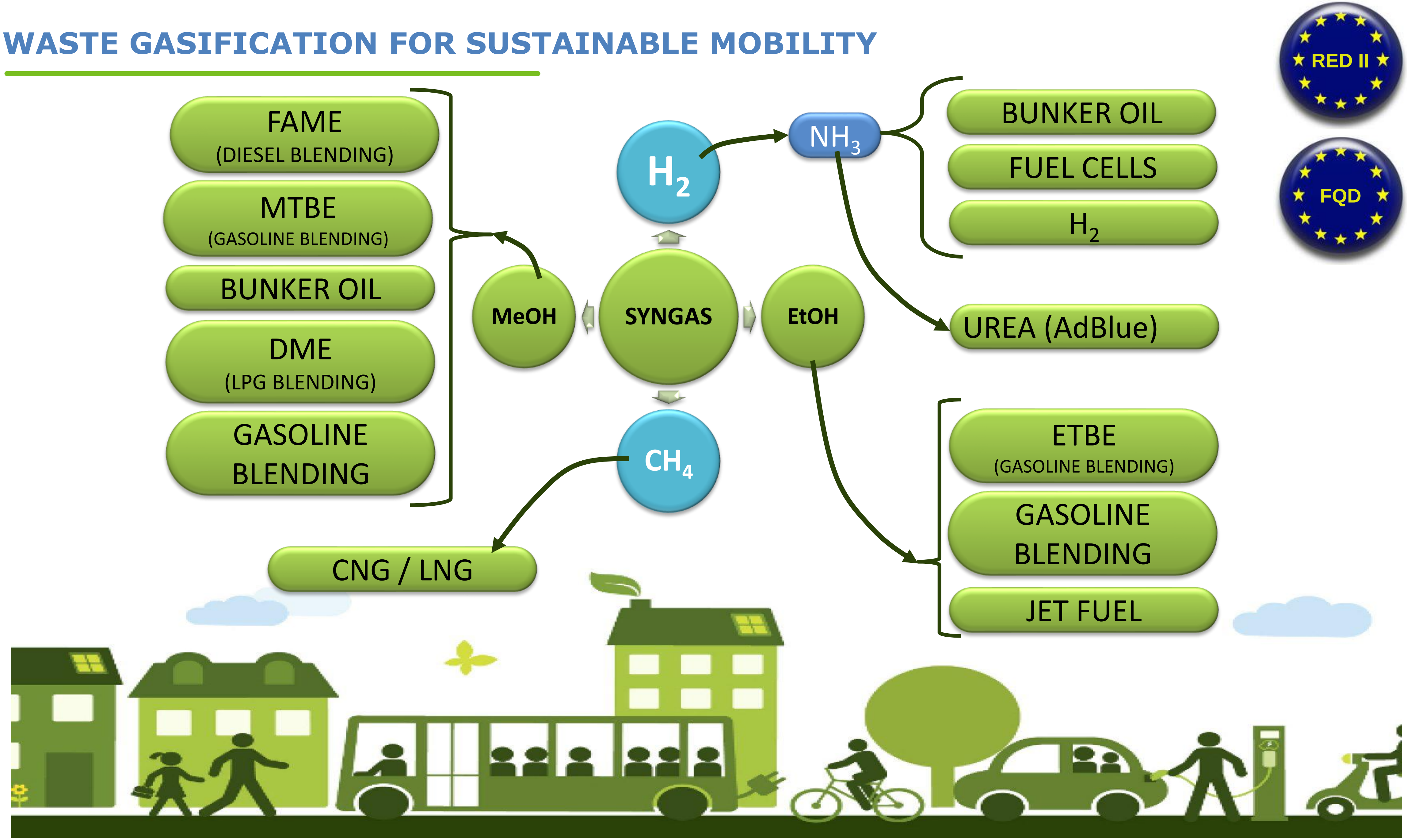
C	**40-55%**
H	**5-8%**
O	20-28%
Cl	0.5-3%
N	0.5-1.5%
S	0.1-1%
Moisture	10-20%
Ash	5-20%



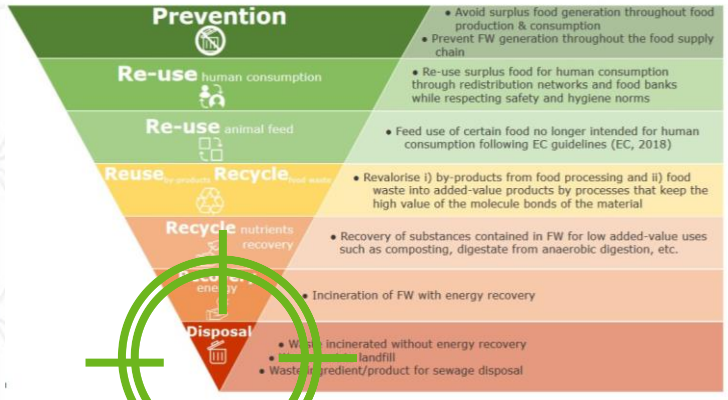
C	**47-61%**
H	**5-7%**
O	14-20%
Cl	0.8-1.5%
N	0.2-0.5%
S	0.02-0.3%
Moisture	5-9%
Ash	7-20%

Plasmix

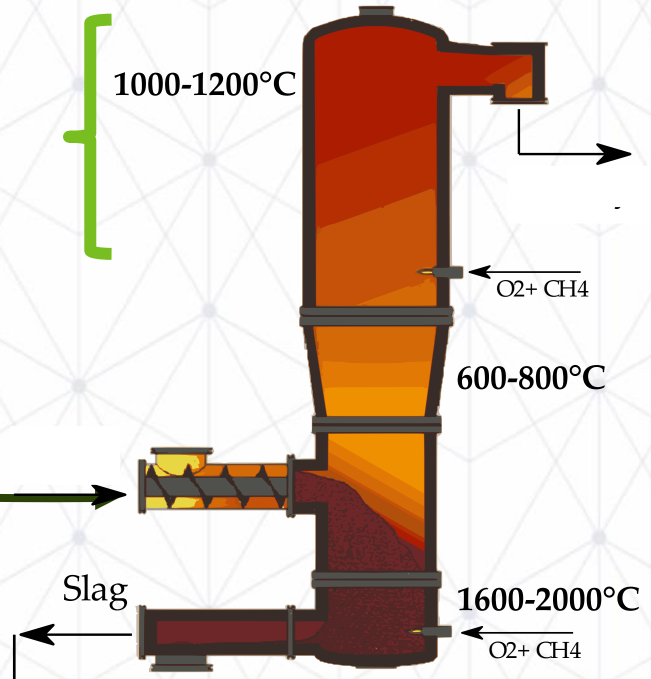
WASTE GASIFICATION FOR SUSTAINABLE MOBILITY

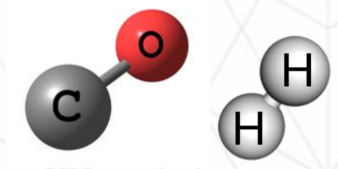


CONVERSION REACTOR



Stabilization zone





SYNGAS

Partial oxidation zone

Waste

Melting zone

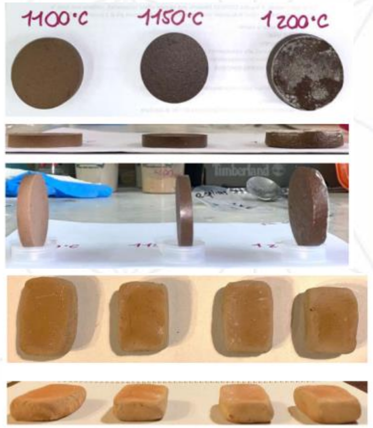
Vitrified granulate

Ceramic industries

Concrete industries

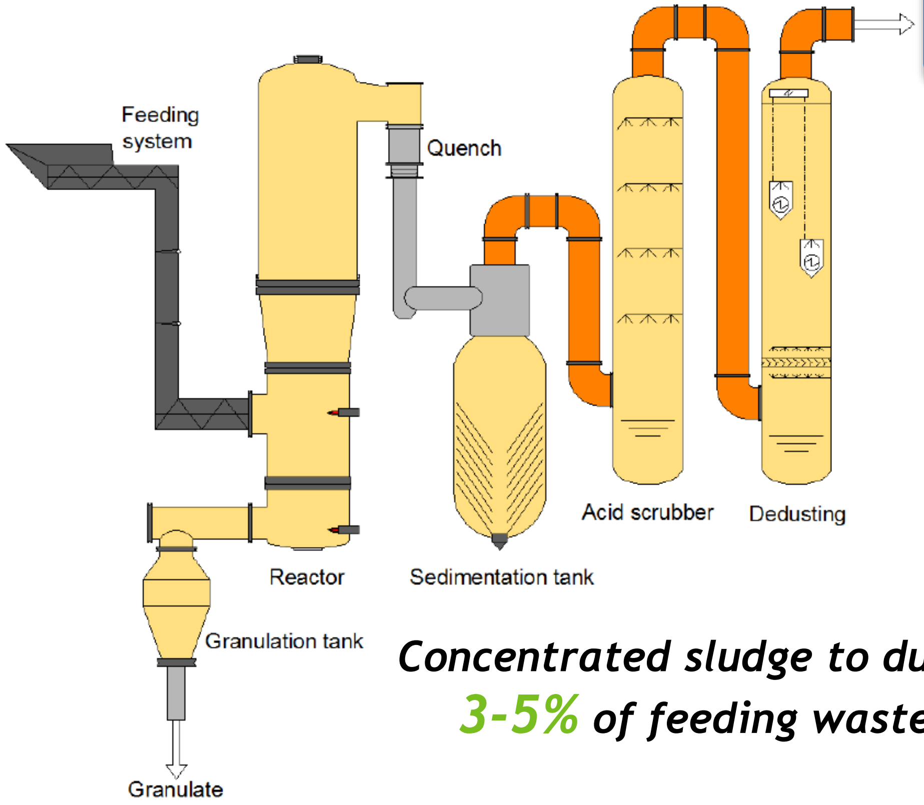
INERTS

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

Balance of waste is converted into Syngas

Subcooled cleaning column

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
H2O	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		

HIGH TEMPERATURE WASTE CONVERSION TECHNOLOGY - MAIN REFERENCES

	CHIBA	MUTSU	OSAKA	TOKUSHIMA	ISAHAYA	KURASHIKI
CAPACITY	**80 kta**	**45 kta**	**28 kta**	**36 kta**	**90 kta**	**150 kta**
LINES	2	2	2	2	3	3
STATUS	**20 YEARS OF OPERATION**					
FEED	INDUSTRIAL WASTE AND SLUDGE	INDUSTRIAL WASTE	MUNICIPAL AND INDUSTRIAL SOLID WASTE	MUNICIPAL SOLID WASTE	MUNICIPAL SOLID WASTE	INDUSTRIAL SOLID WASTE
SYNGAS USE	**POWER**					

SINCE
2001

MORE THAN 40 REFERENCES INCLUDING BOTH **ENRICHED AIR** AND **PURE O_2** AS GASIFICATION AGENT

ON THE LEFT ARE LISTED THOSE PLANTS THAT WORK WITH PURE O_2 AS A GASIFICATION AGENT.

HIGHLIGHTS SYNGAS PURIFICATION

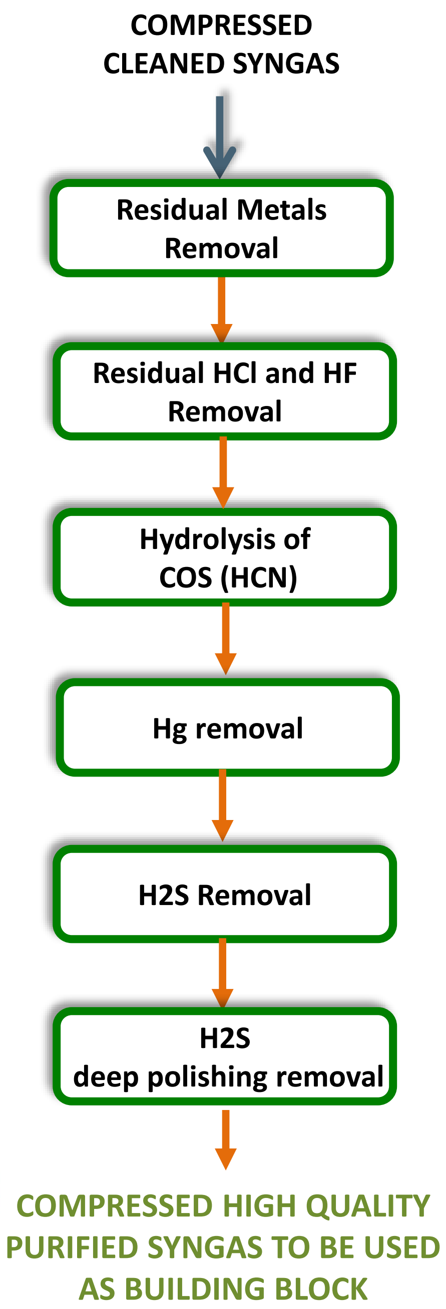
- TAILORED SYNGAS PURIFICATION ARCHITECTURE accounts for a deep pollutants removal

- A SEQUENCE OF ADSORBENTS BED AND CATALYST allows to remove residual contaminants:

  - Particles/metals
  - HCl/HF
  - COS hydrolysis (CS_2) to H_2S
  - Hg
  - H_2S
  - H_2S deep polishing step → ppb

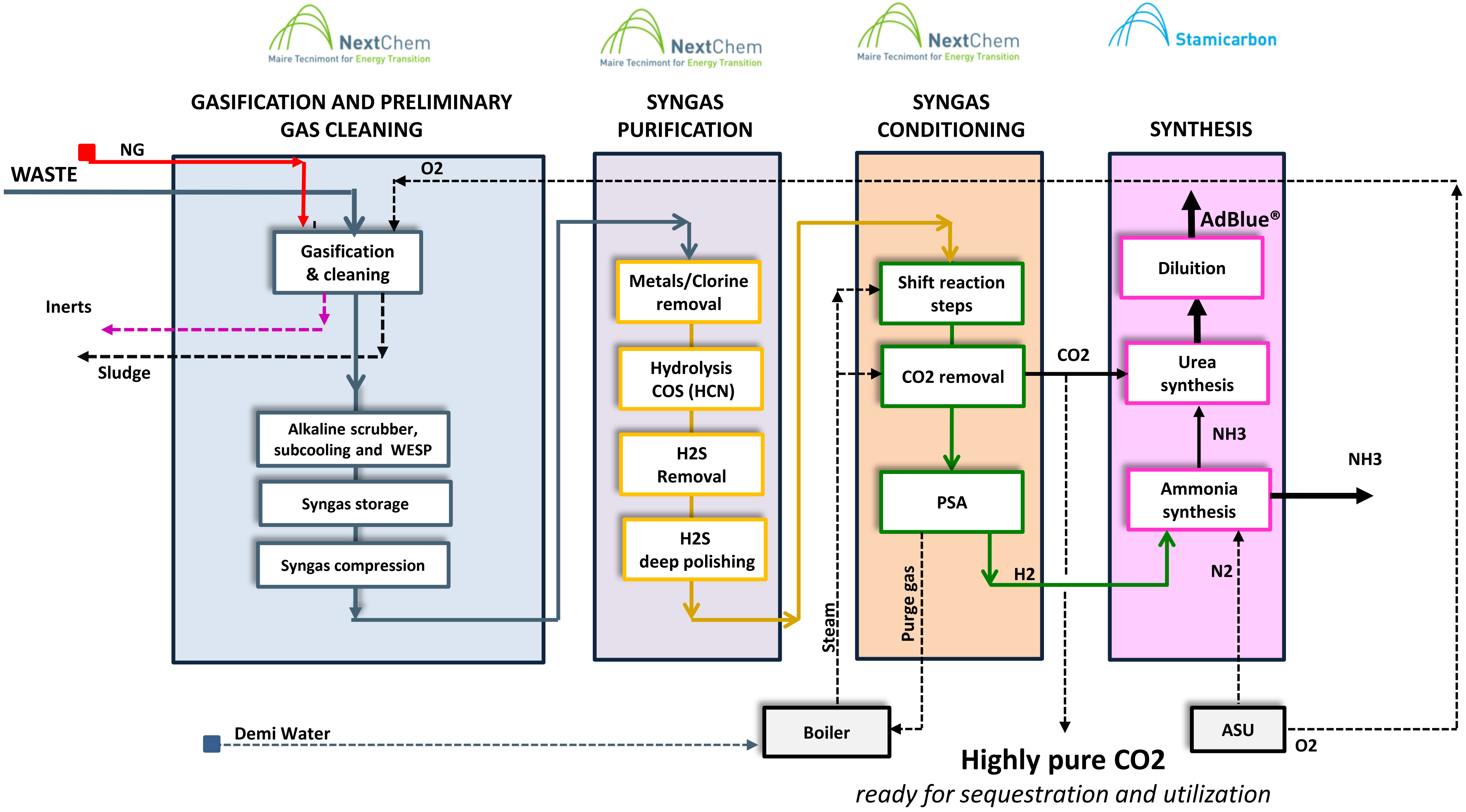
- Resulting syngas is USEFUL TO BE USED FOR SYNTHESIS

- Depending for selected end product, SYNGAS COMPOSITION MAY BE PROPERLY ADJUSTED to fit synthesis requirements



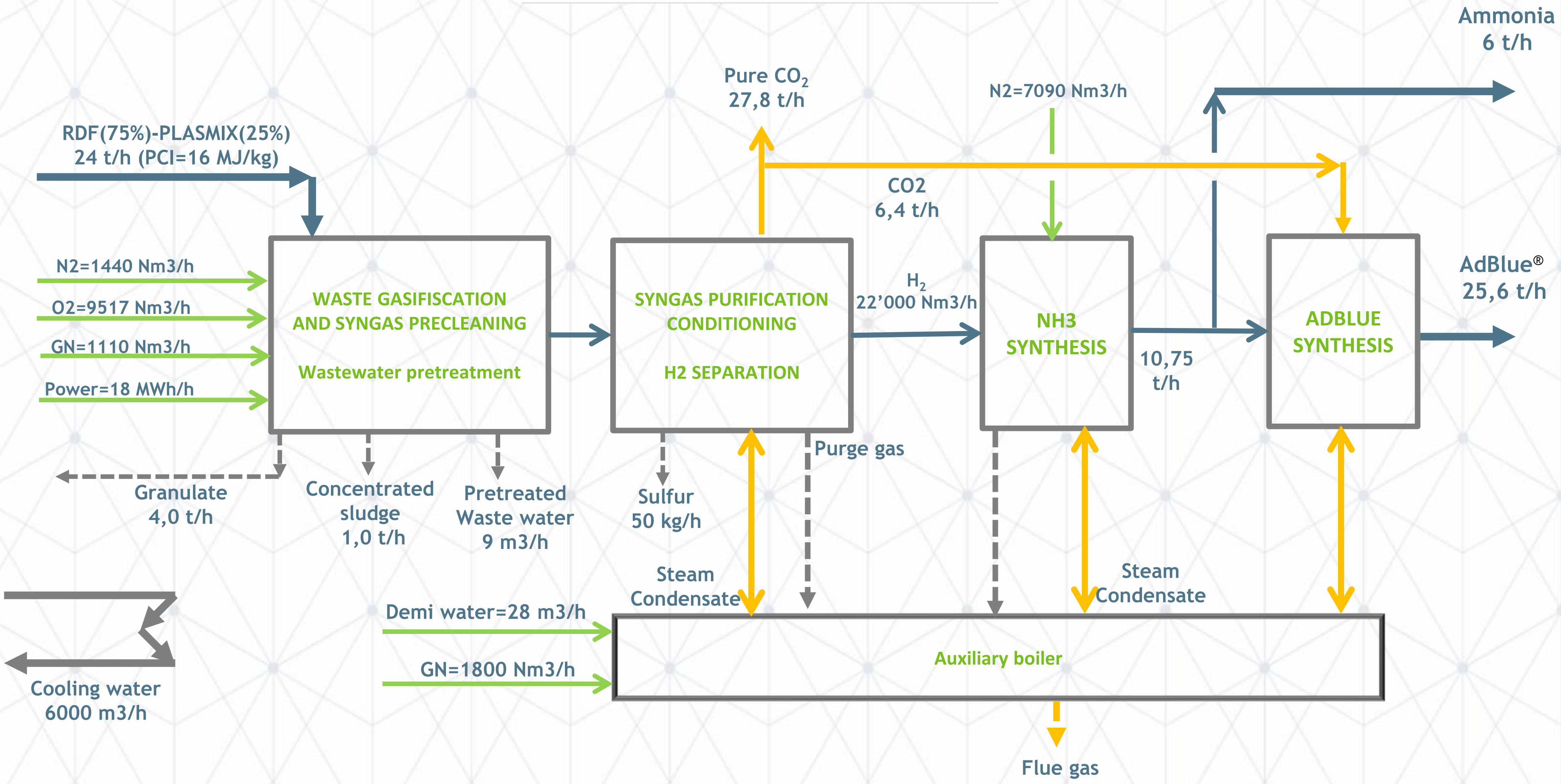
WASTE TO AMMONIA/UREA/ADBLUE®

Overall process scheme for conversion of WASTE into AMMONIA/ADBLUE



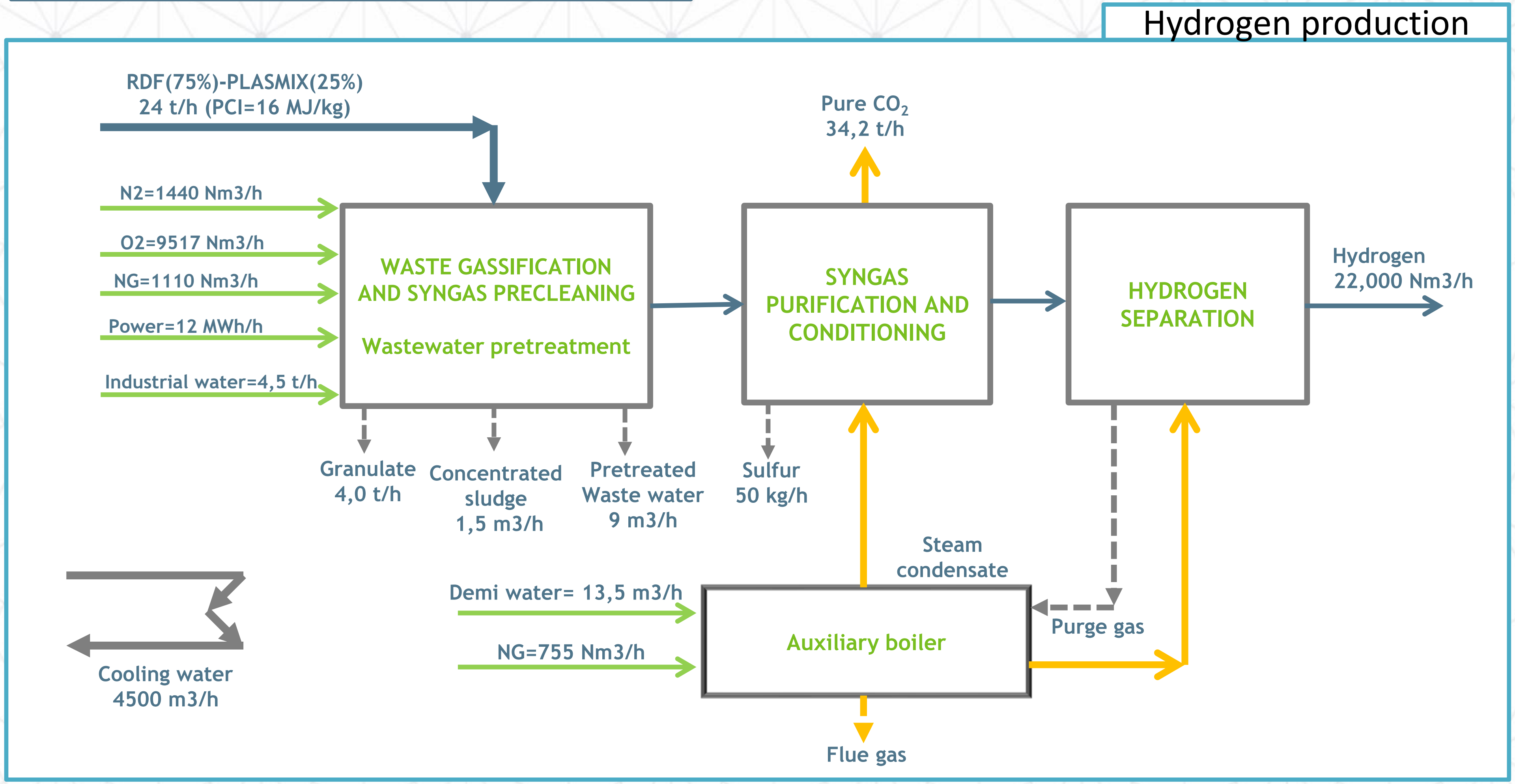
CASE STUDY - WASTE TO AMMONIA/ADBLUE® – MASS BALANCE

Overall balance	
AdBlue	625 MTPD
Ammonia	144 MTPD



ECONOMIC ASPECTS – H2 LCOP

CAPEX estimation= 250 Ml €



ECONOMIC ASPECTS – H2 LCOP

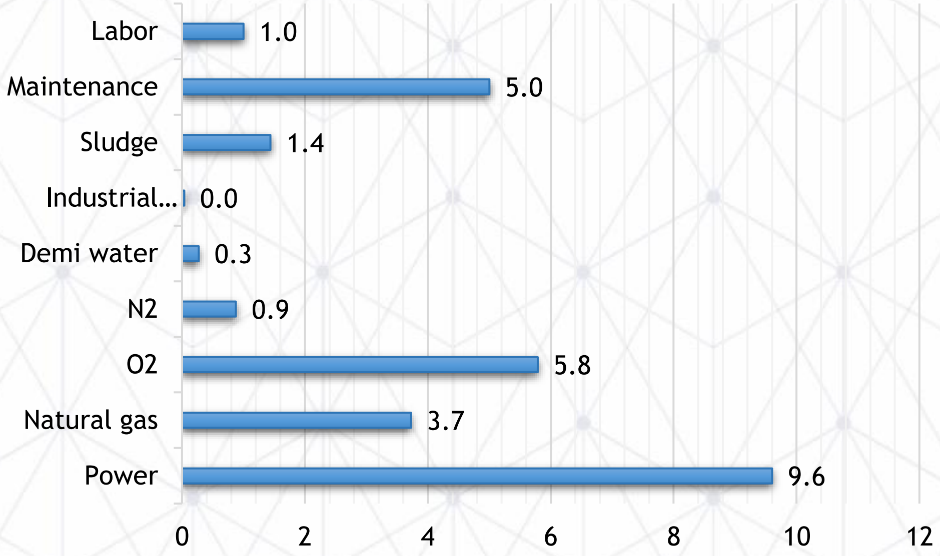
CO_2 from waste not included in ETS

Waste gate fee	*80 €/t*	*CO_2 tax*	*80 €/t*

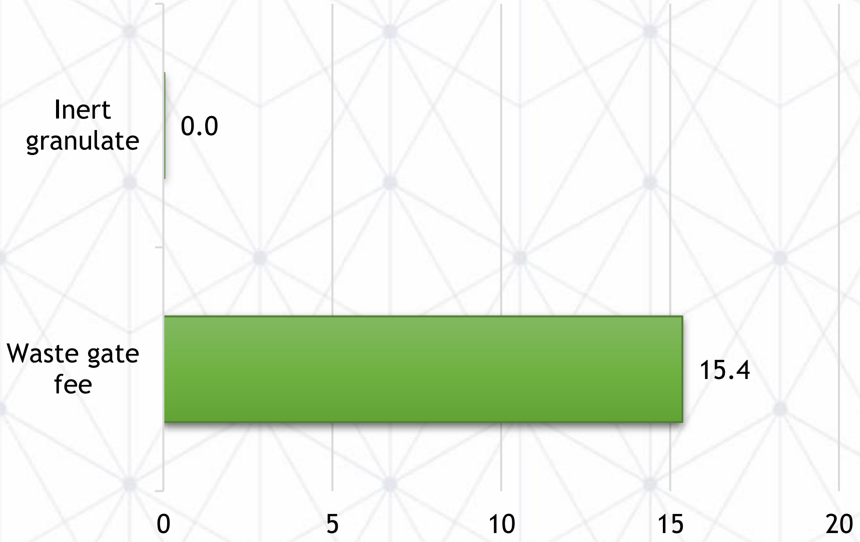
Circular

H2 LCOP ~ 2,2 €/kg

OPEX = 27,74 Ml €/a



INCOME = 15,4 Ml €/a



ECONOMIC ASPECTS – H2 LCOP

CO_2 from waste included in ETS

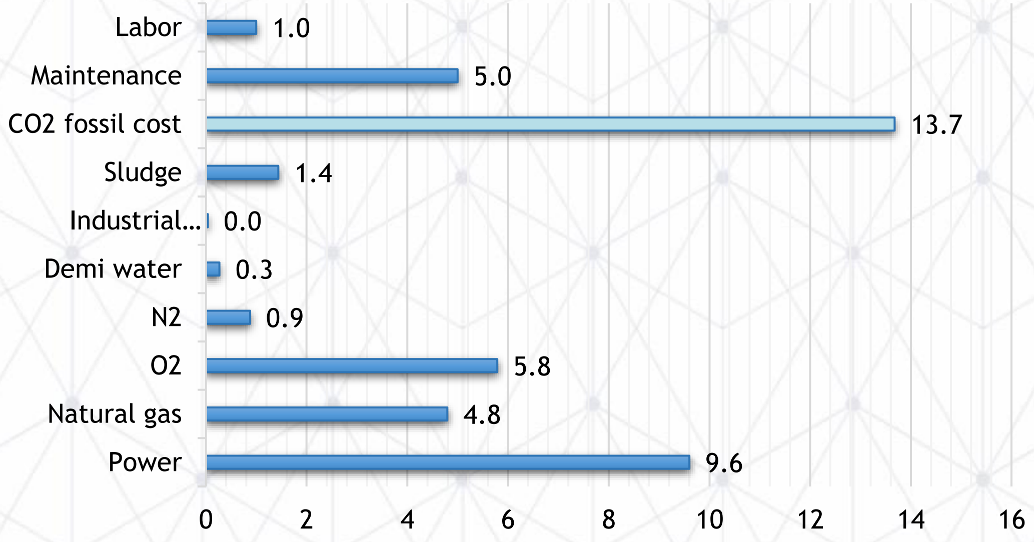
Waste gate fee	*80 +75 €/t*	*CO_2 tax*	*80 €/t*

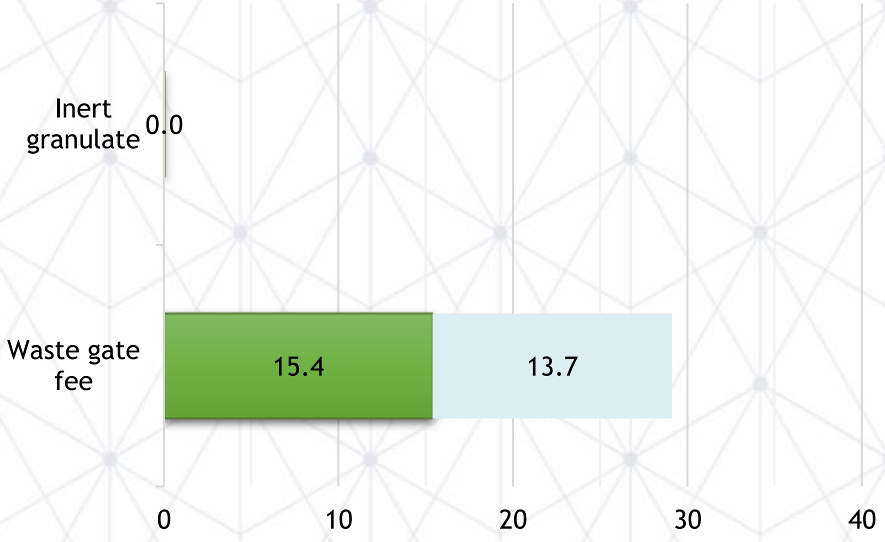
Circular

H2 LCOP = 2,2 €/kg

OPEX = 42,5 Ml €/a

INCOME = 29,2 Ml €/a





CONCLUSIONS

- Robuste and commercially proven process units for gasification and syngas purification

- Twofold beneficial process: - valid altertinative to landfill or inceneration; -subtition of fossil fuel production
- On LCA basis a WtC process allows to significantly reduce overall carbon footprint
- Circular H_2 produced an amount of CO_2 directly at high pure concentration (>95%), 50% of which is organic. If utilized or stored the process will be carbon sink

- Levelized cost of production of circular H_2 is more than competitive with blue or green H_2

- Several synergies and integration between gasifications section and NH_3 or AdBlue® synthesis which can further lower the cost of production of NH_3/AdBLue®

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