

Negative Carbon and Blue Hydrogen: Two Roots - one Technology

Energy Transformation and Climate Change Challenges

25th REFORM Group Meeting, Salzburg – October 3 – 7, 2022

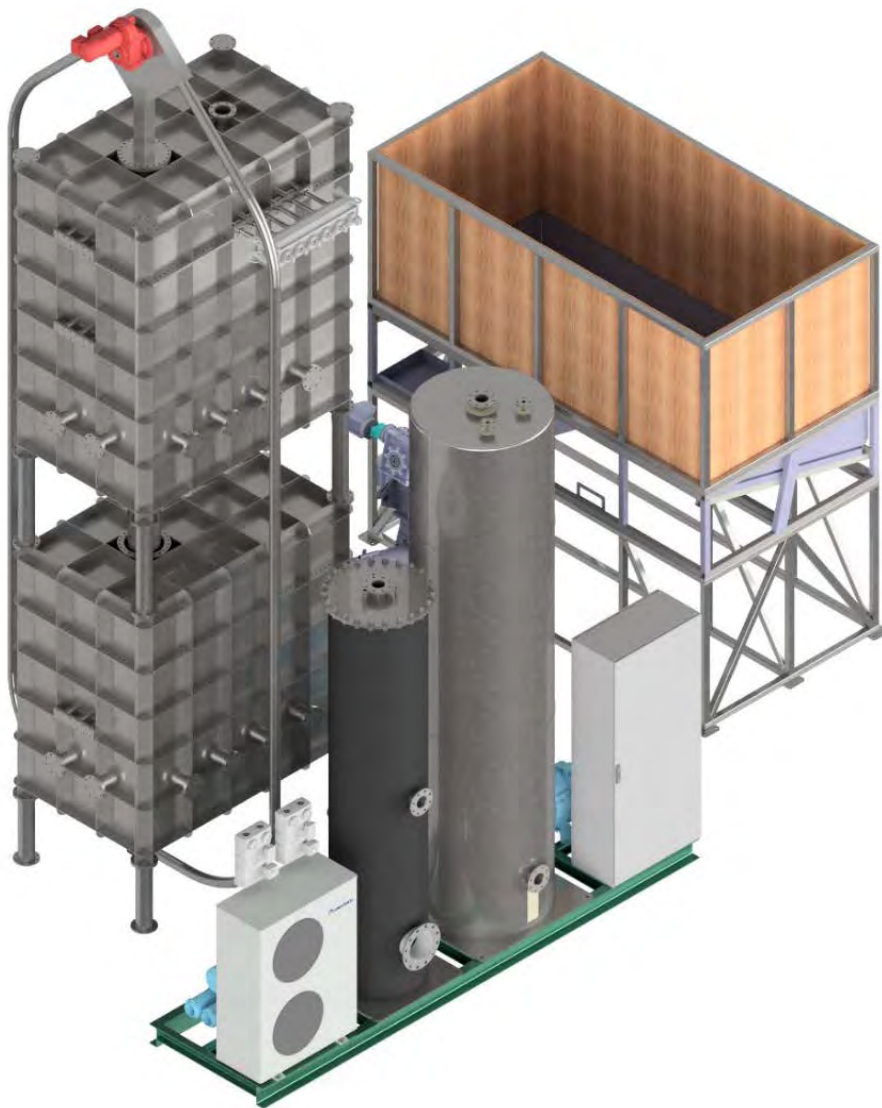


TECHNOLOGY DEVELOPMENT AND R&D FOCUS



- Climate neutral
- Fuel flexible
- Process flexible
- Scalable
- Short time to market
- Contributing for circular economy and resource efficiency
- Cost-effective

PILOT PROJECT LATVIA/NETHERLANDS



CERTIFICATE

Product certificate
No. 2-4.2.1./794/2021



Hereby we certify that the equipment, mentioned below, is found to comply with the technical specification HG-11082021/1

HOLDER OF THE CERTIFICATE:



SIA HYROGAS

Kokles iela 27, Mārupe, Mārupes novads,
LV-2167, Latvia
Registration No. 44103131472

DESCRIPTION OF PRODUCT:

MANUFACTURER
PRODUCT NAME
MODEL

SIA HYROGAS
Autothermal reformer
HG-11082021/1

FIELD TESTING

11., 13.08.2021. at pilot plant facility in Jēkabpils, Latvia;
uninterrupted operation duration in steady state - 5 h

BIOMASS FEEDSTOCK

moisture content: 33,7%; LVH 11,5 MJ/kg

COMPOSITION OF
SYNGAS (content v/v)

H ₂	CO	CO ₂	CH ₄
>10%	>5%	>15%	>3%

TAR CONTENT
(benzene and polycyclic
aromatic hydrocarbons),
mg/MJ

1 Ring Pm<110 g/mol	2 Ring 110<Pm<152 g/mol	3 Ring 152<Pm<200 g/mol
<20	<5	<0,1

CERTIFICATE ISSUED:
CERTIFICATE VALID:

24.09.2021.

24.09.2026.

Mārtiņš Maskavs
Certification manager

Any significant changes in design, construction and technical requirements of the product may render this statement invalid. The manufacturer shall notify the AS "Inspecta Latvia" of any modification or changes to the approved model.

Certificate issued on 1 (one) page

AS Inspecta Latvia
Skanstes street 54A, Rīga
LV-1013, Latvia

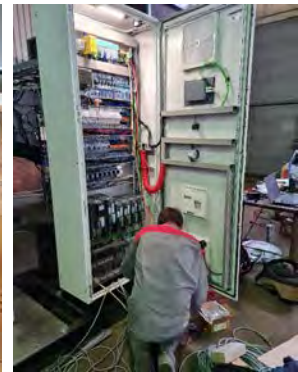
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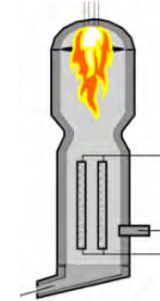
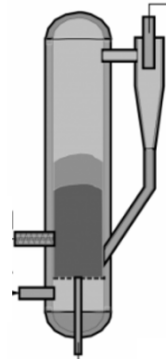
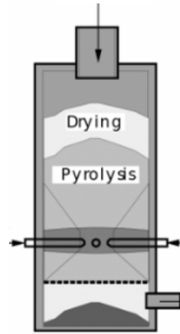
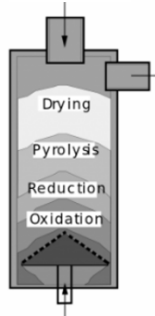
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DEVELOPMENT OF DEMO PLANT (FLARE)



GASIFICATION TECHNOLOGY COMPARISON



parameters	Up draft	Down draft	Fluidized bed	Entrained	BlueRevo
Fuel size flexibility	high	low	low	low	high
Fuel moisture	high	low	low	high	high
Allowed impurities	medium	low	low	low	high
Tar production in reactor	high	medium	medium	low	low
Ability for low ash melting fuels	high	low	low	high	high
Oxygen/steam	yes	no	yes	yes	yes
Scalability	high	low	high	high	high

Based on the gas–solid contacting mode, gasifiers are broadly divided into three principal types (1) fixed or moving bed, (2) fluidized bed, and (3) entrained flow.

LIFE IP WASTE PROJECT, LATVIA



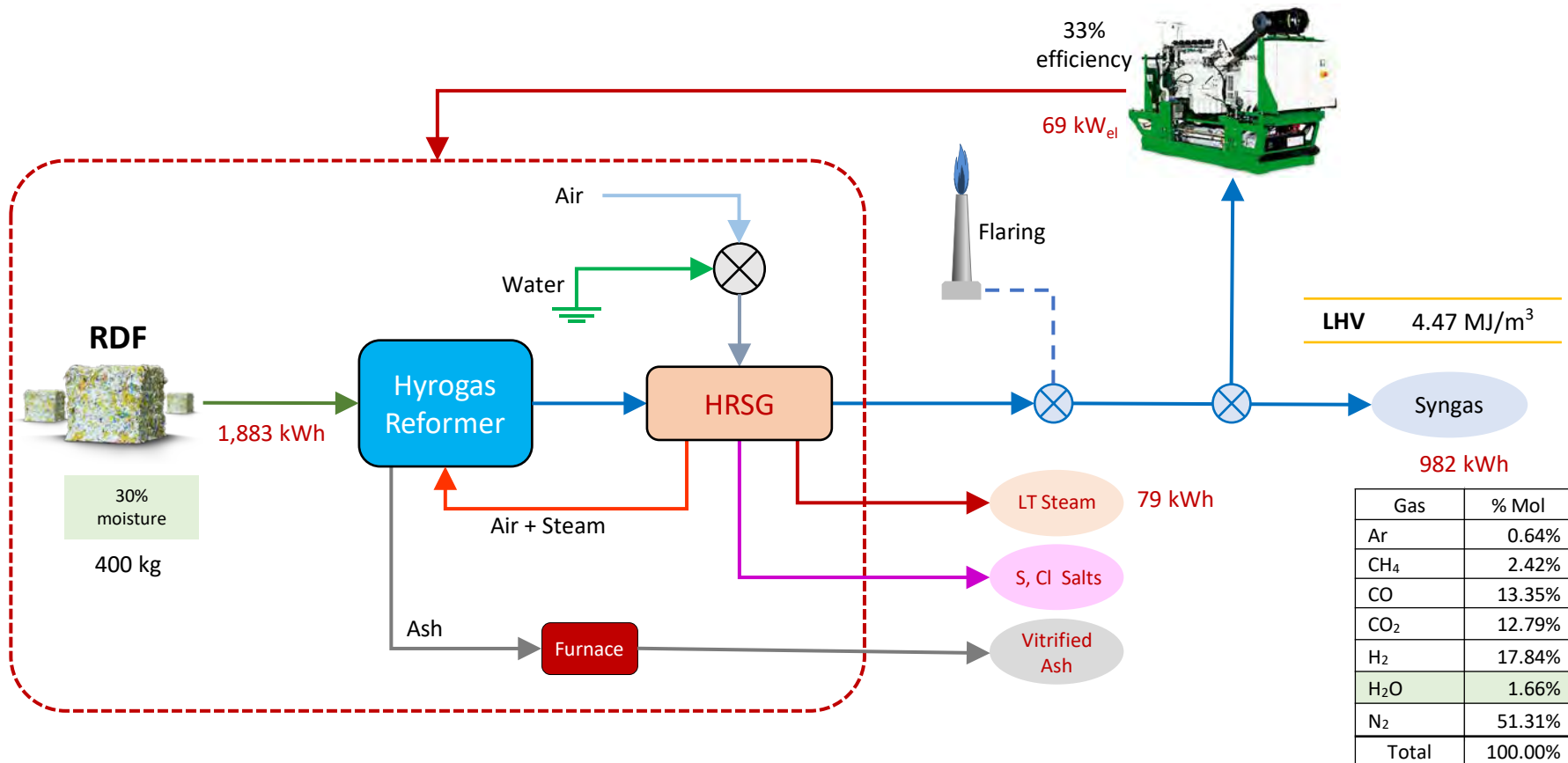
Action C3 aims at testing and demonstrating new recycling possibilities of non-recyclable fraction of municipal waste and separated wood waste according to recycling code R3 and R3B.

End-of-waste qualification criteria:

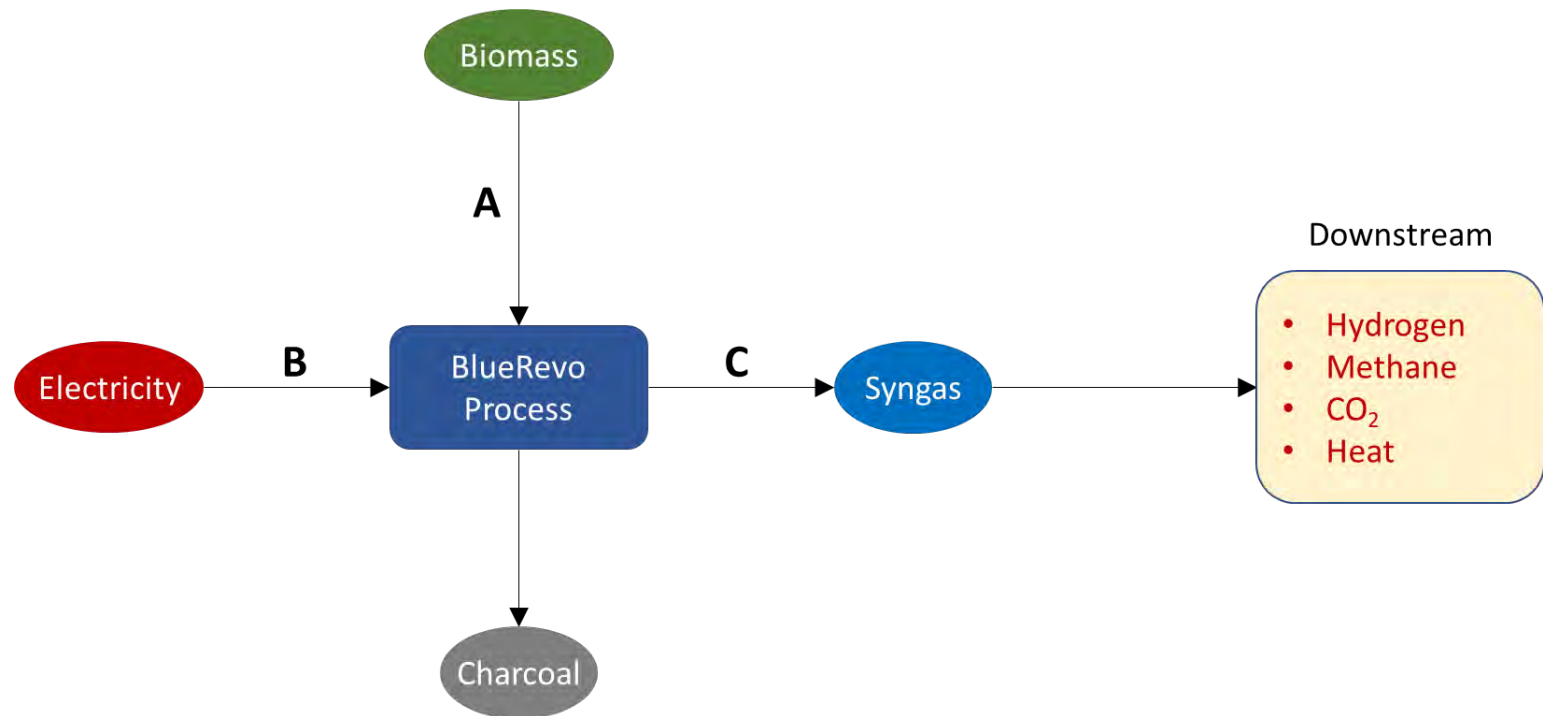
- 1) **PRODUCT**- the substance or object is commonly used for specific purposes
- 2) **MARKET** - there is an existing market or demand for the substance or object
- 3) **STANDARTIZED** - the use is lawful (substance or object fulfils the technical requirements for the specific purposes and meets the existing legislation and standards applicable to products)
- 4) **ENVIRONMENTAL IMPACT** - the use will not lead to overall adverse environmental or human health impacts



LIFE IP WASTE PROJECT, ENERGY BALANCE



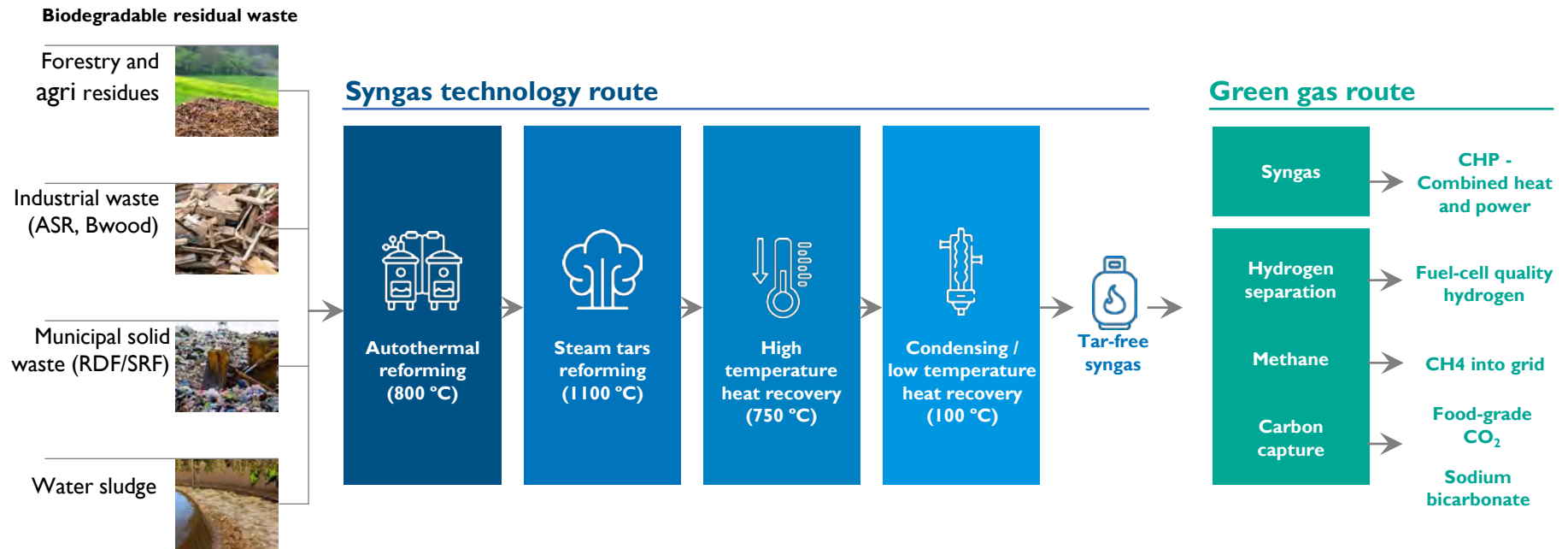
UPSCALE UNIT WITH DOWNSTREAM



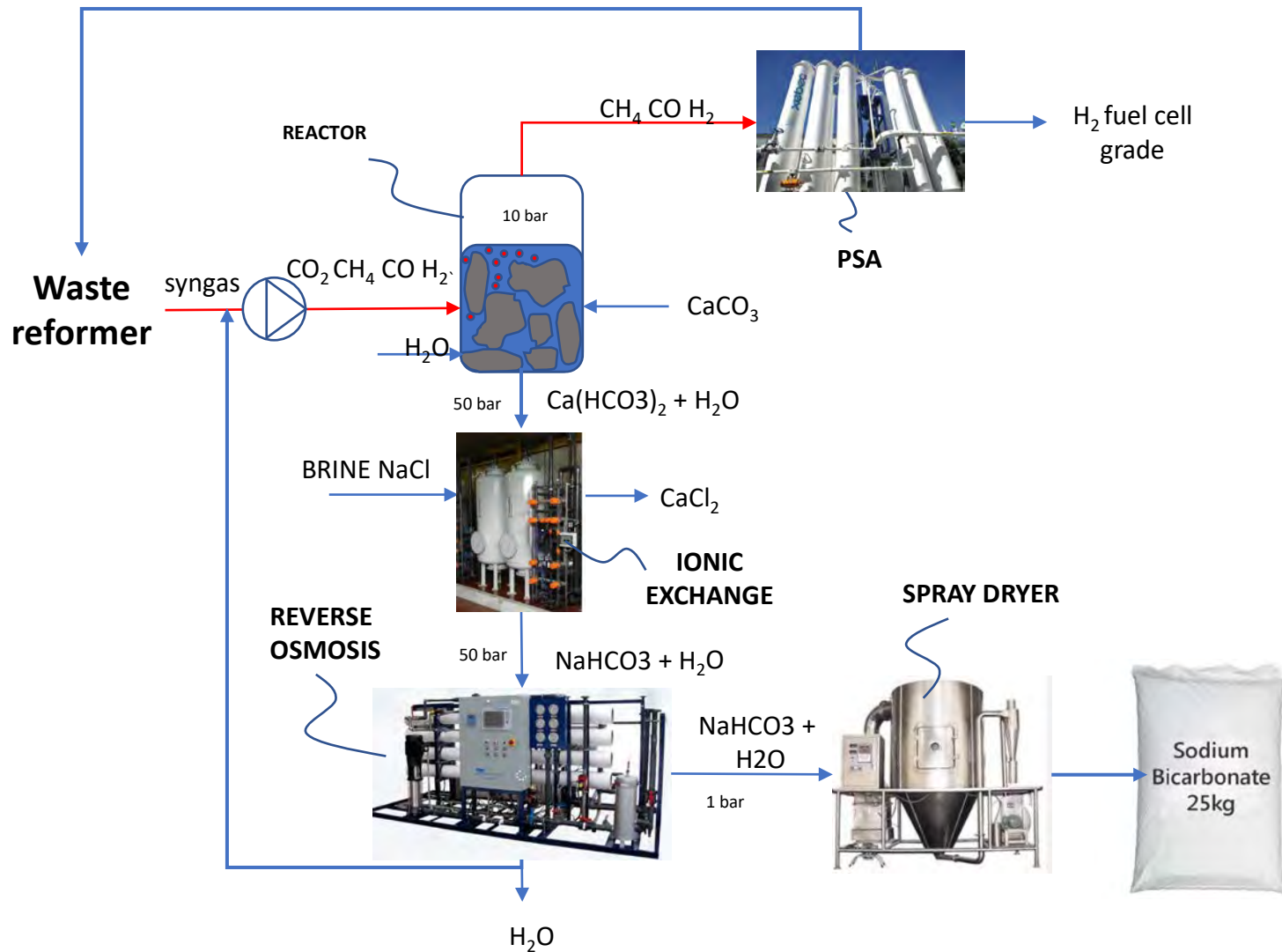
IN				OUT
A			B	C
moisture	kg	kWh	kWh	kWh
30.0%	1,912	7,449	477	4,957

Downstream			
Main Products		By products	
H ₂ kg	CH ₄ kWh	CO ₂ kg	Heat kWh
62.8	2,918	2,035	1,666

FUEL AND PROCESS (PRODUCT) FLEXIBILITY

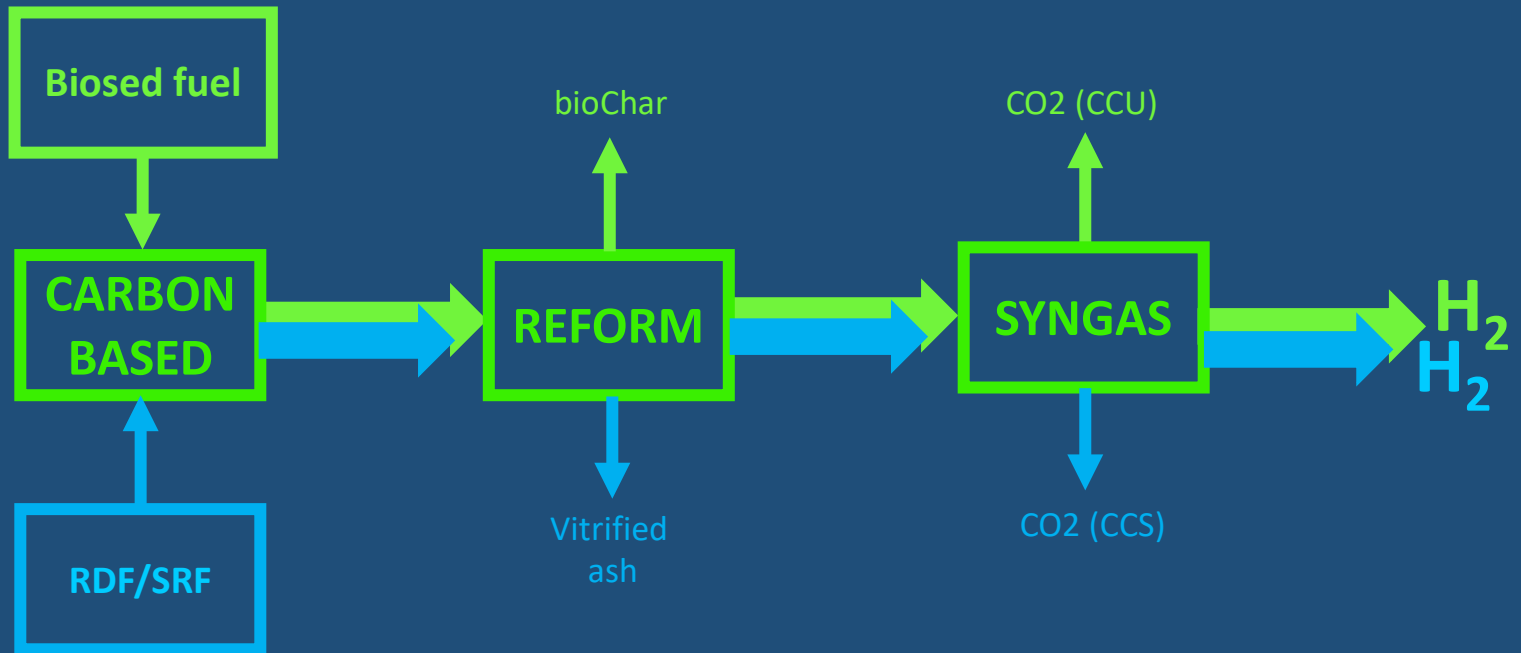


DOWNSTREAM CCS/CCU PLUG-IN



Ref: BlueRevo PCT patent pending

Two routes – one technology



CONCLUSION AND MAIN TAKE AWAYS

- Climate neutral (guarantee of origin, biogenic carbon, modular CCS/CCU systems)
- Fuel flexible (any carbon-based waste, no pretreatment)
- Process flexible (steam/oxygen variations, down-stream plug-ins, HYBECCS and Blue or Carbon free hydrogen)
- Scalable (by modularity, redundancy)
- Short time to market (pre-fab, modular systems)
- Contributing for circular economy and resource efficiency (waste stream valorisation, local sustainability)
- Cost-effective (competitive total costs of ownership)



Environmental Science Programme

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