Brightsite

Transforming industry

Hans Linden

Production of Hydrogen and Hydrocarbons using Plasma Technology

Proud partners

Sitech Services

TNO

Maastricht University

Brightlands Chemelot campus

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(5)
Safe, sustainable and economically responsible **transition** of Chemelot **towards 2030/50** climate goals.

Plasma Technology for Climate and Business Proof Decarbonisation

Application

Demonstration

Research

Electrification	Circular	Site and Process innovation
(1) Replacement of natural gas by durable electricity	**(2)** Replacement of fossil based oil by recycled materials and biomass	**(3)** Reduction of emissions by introduction of new processes

(4) Safe and societally **acceptable** innovation

(6) Education of a new generation of researchers and coworkers for development and application of **sustainable circular technology**.

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Plasma technology as game changing technology

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Plasma

- Fourth state of matter
- Ionized gas with equal numbers of positively charged ions and negatively charged electrons
- Electrical conductive

Examples:

Lighting

Aurora Borealis

HR+ glass coating (Pilkington)

Welding

Neon Light

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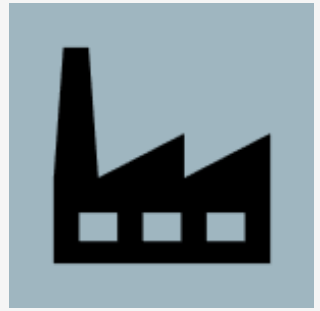
Green house gas emission in the chemical industry

Ammonia Plant:
Typically 9 ton CO_2 is emitted per 1 ton of hydrogen



Steam Cracker:
Typically 1 ton CO_2 is emitted per 1 ton of olefins

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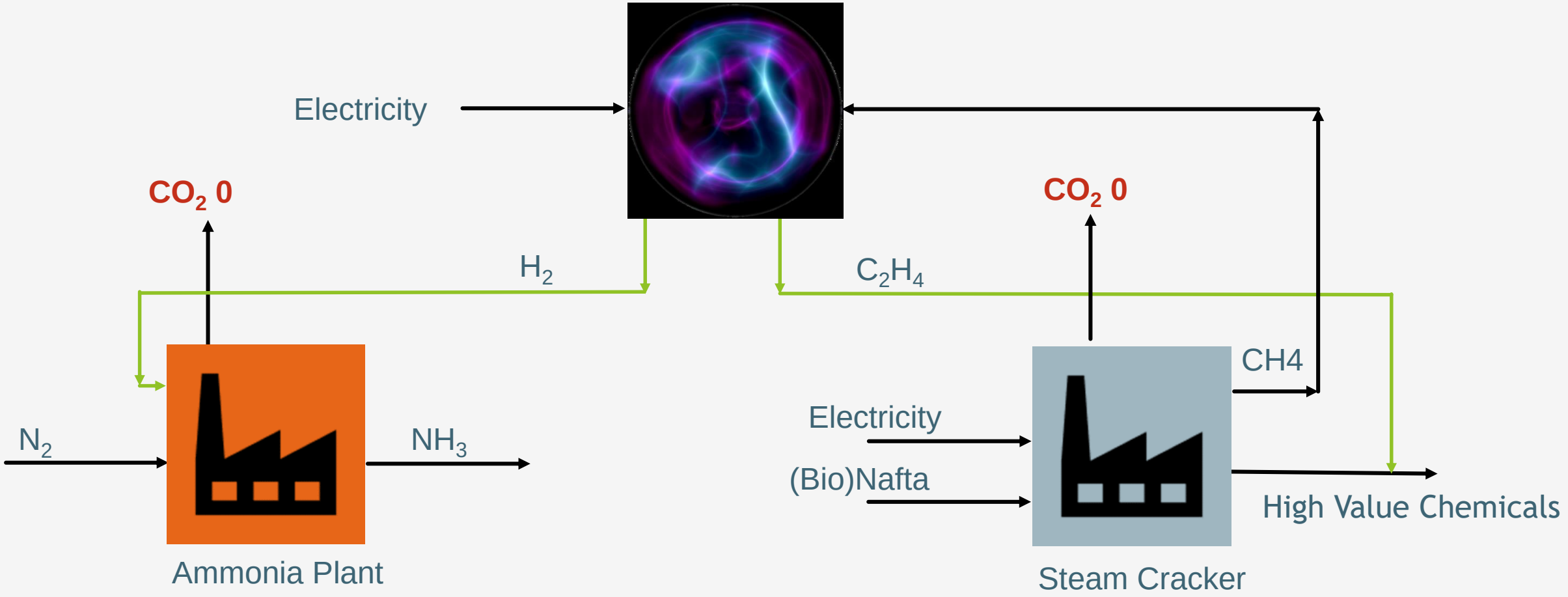
Combined Transition



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Brightsite Hydrogen key energy carrier versus hydrogen as feedstock

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Future fuel (intermediate)

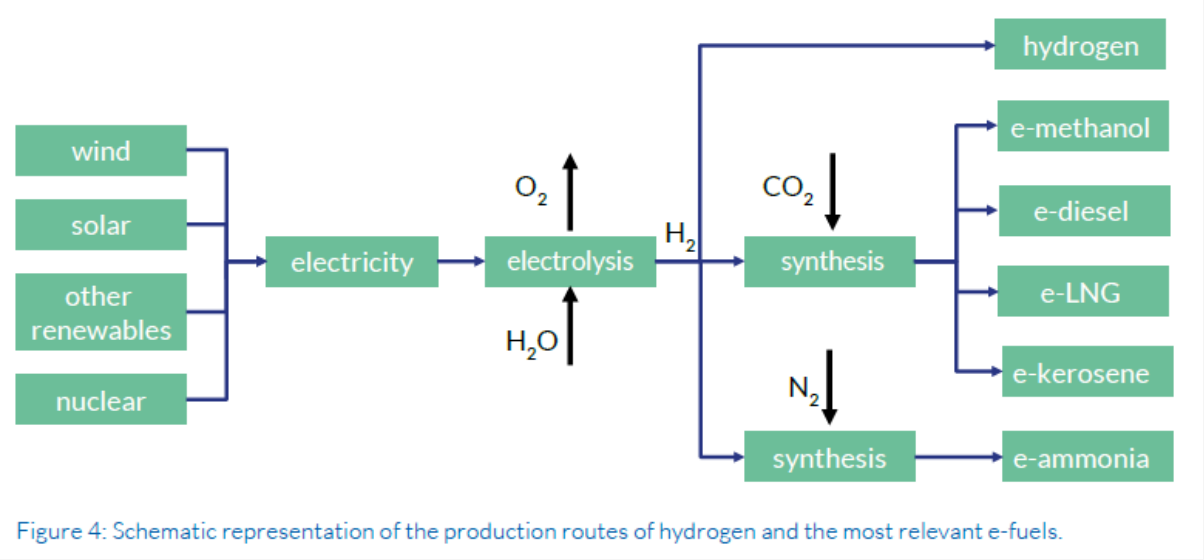
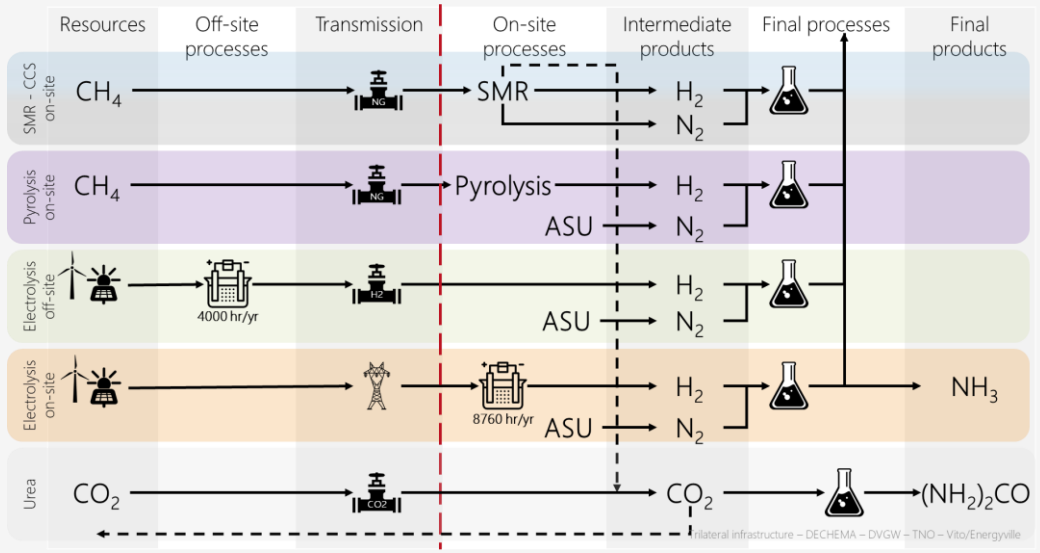


Figure 4: Schematic representation of the production routes of hydrogen and the most relevant e-fuels.

Source: Power-2-Fuels innovation outlook, TNO/Smartport (2020)

Future intermediate for chemicals



Source: Trilate, TNO/DECHEMA/DVGW/VITO (2020)

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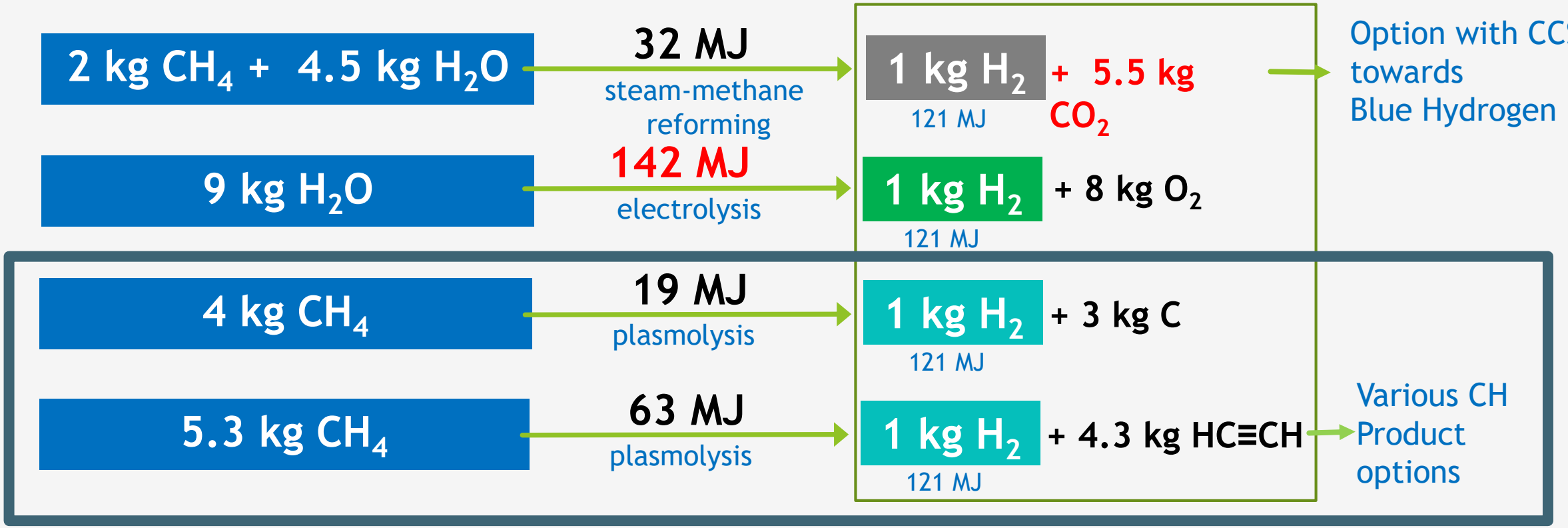
Motivation for plasma decarbonization



Thermodynamic numbers, no heating or cooling

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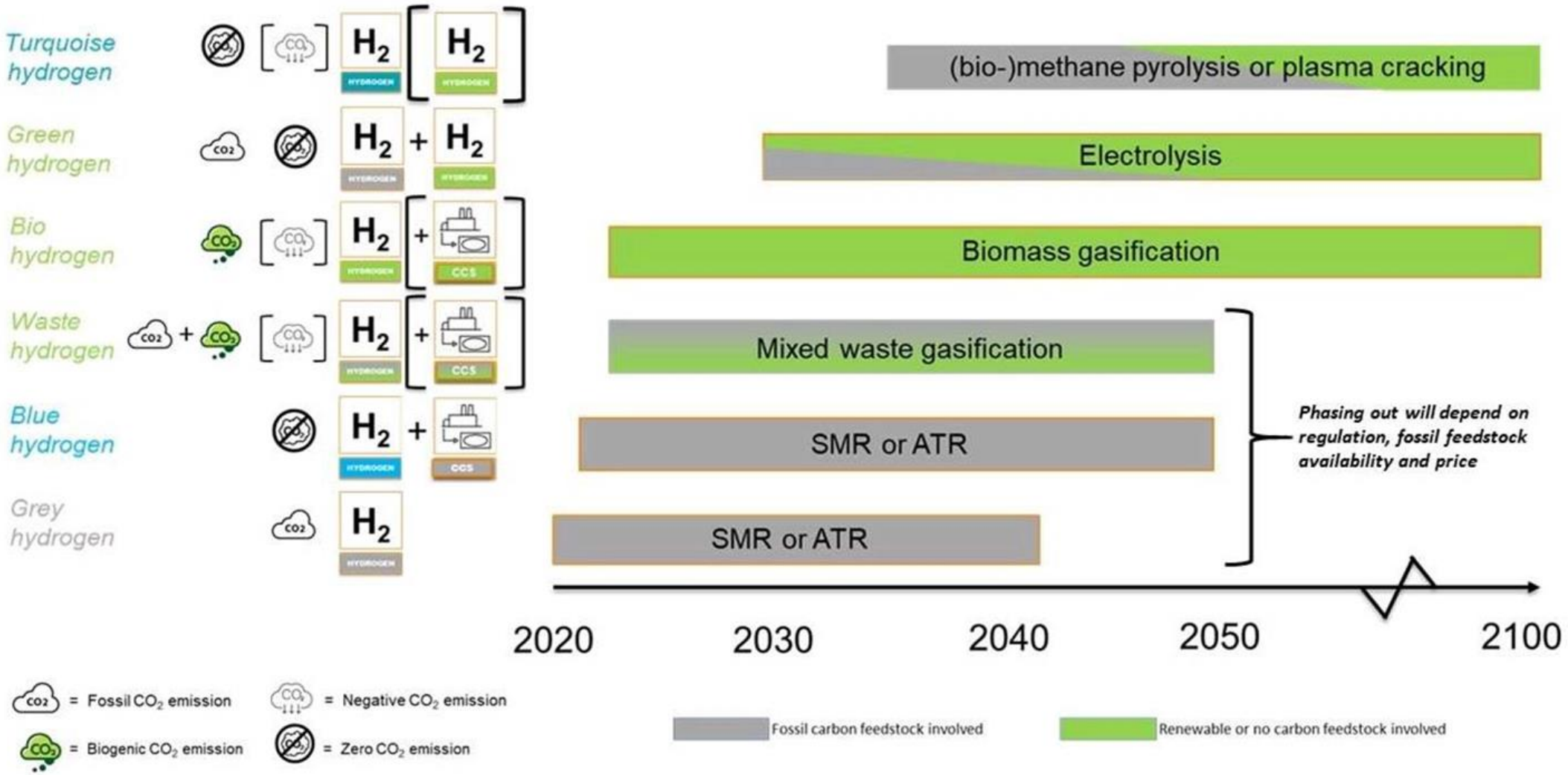
Hydrogen production technologies



Source: TNO/Brightsite (2021)

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Plasma technology at Brightsite

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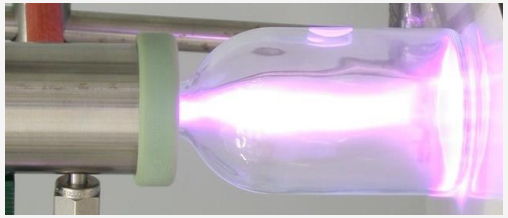
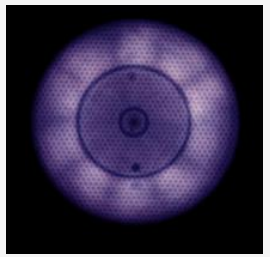
Plasma technology at Brightsite

Lab Plasma Trl 1-3	Benchscale Plasma Trl 4-5	Pilot Plant Plasma TRL 6-7
2020	2021-2022	2022-23
3 kWe	50 kWe	1-3 t/a H2
R&D program	R&D program	C2H4/C
Generation 3	**Generation 2**	**Generation 1**

Plasma lab at Brightlands



Generation 1:
- Hüls process
- Hydrogen and carbon
- Arc technology



Generation 2:
- Optmised Hüls process
- Arc technology and microwave

Generation 3:
- Direct formation of Ethylene
- Microwave

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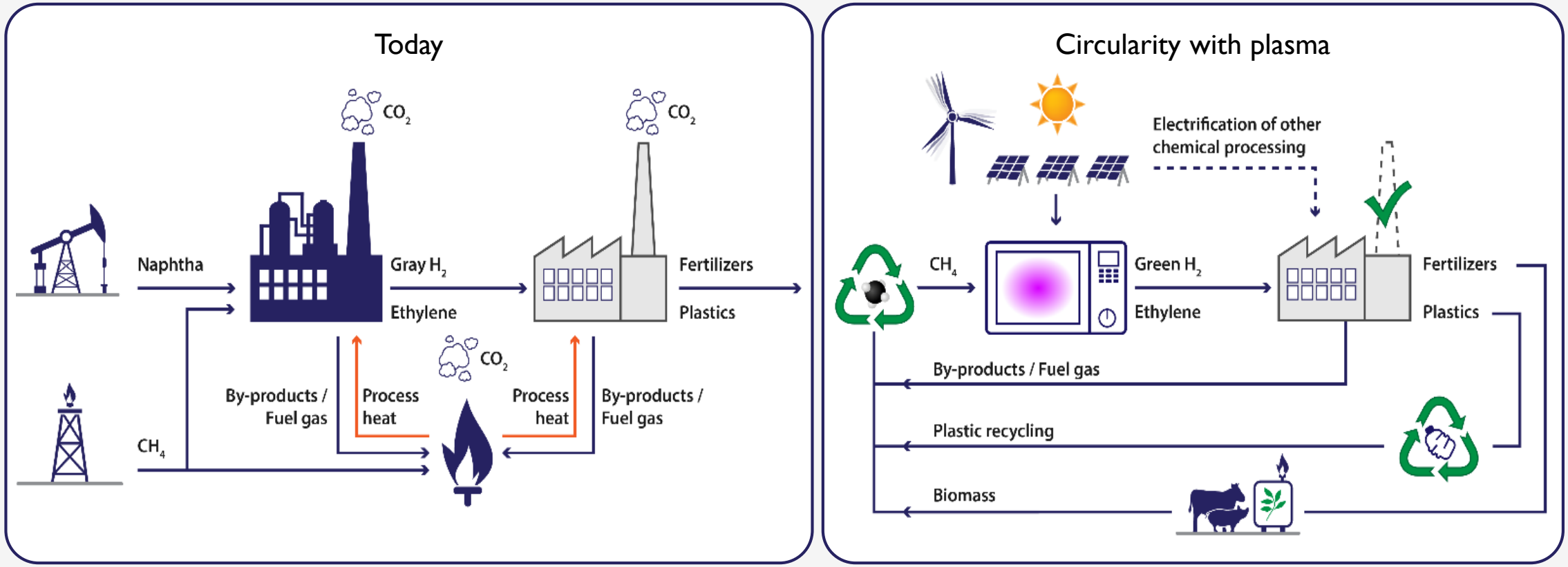
Plasma technology an important step towards the ultimate circular chemistry



Courtesy Gerard van Rooij

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