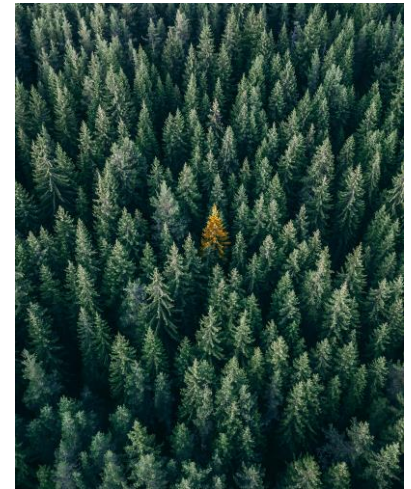


BrigH2

the
renewable
alternative



RENEWABLE HYDROGEN AND CARBON FOR A NEW CHEMICAL
WORLD

- **Research Institutes**

Brightsite Own Institute with labs for discovery of new technology

- **Circular Hub**

Creates knowledge and EU funding options

- **Pilot and Demo plants**

Solutions for 2,20,200 and 2000 M2 plants, to demonstrate to license partners or to produce customer evaluation samples

Temporary use of the Multi Purpose Pilot Plant to do specific scale-up experiments in a shared environment

Single use or shared

Business Offices

- Offices to support connections with research institutes close by

Offices for marketing, sales and technical service

Single use or shared

Embedded in Chemelot

- License to scale

- In the backyard of Major chemical companies
- Umbrella permit provides a time saving process

Brightlands
Chemelot Campus



Brightlands
Chemelot Campus

Problem :

There is no affordable process to continuously produce large amounts of renewable hydrogen.

- Renewable energy with electrolysis requires massive investments and but remains interrupted
- Low carbon hydrogen requires expensive and disputed carbon storage and new installations
- Renewable energy in the Netherlands remains more expensive compared to other regions



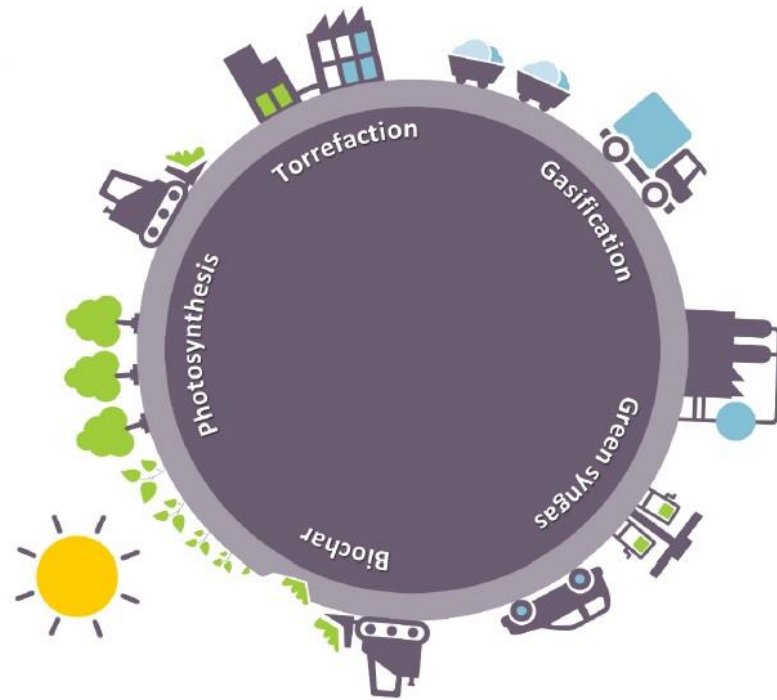
Problem :

Carbon from fossil sources is difficult to replace sustainably

- Oil, Gas and Coal supply our addiction to hydrocarbons in fuel and products
- Direct air capture is extremely energy intensive at 0,04% CO₂ concentrations
- Recycling is an excellent solution to solve a significant part of the problem



Solution



Renewable H₂
Bio CO₂
Bio Char
Bio Steam

Torrefaction and gasification

Innovative and scalable technology that produces a sustainable synthetic gas

In addition to sustainable electricity, the energy transition also requires more and more renewable gas. The Torrgas process converts waste streams into synthetic gas (syngas), more sustainable and efficient than combustion. The resulting syngas is a good alternative for fossil fuels and feedstocks. Besides, it enables the sustainable synthesis of a wide range of base chemicals.

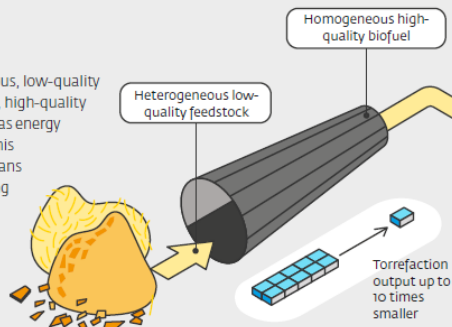
Waste streams as feedstock



Torrefaction processes use a wide range of waste streams that would otherwise be burned or left to perish. This greatly increases the amount of waste that can be reused.

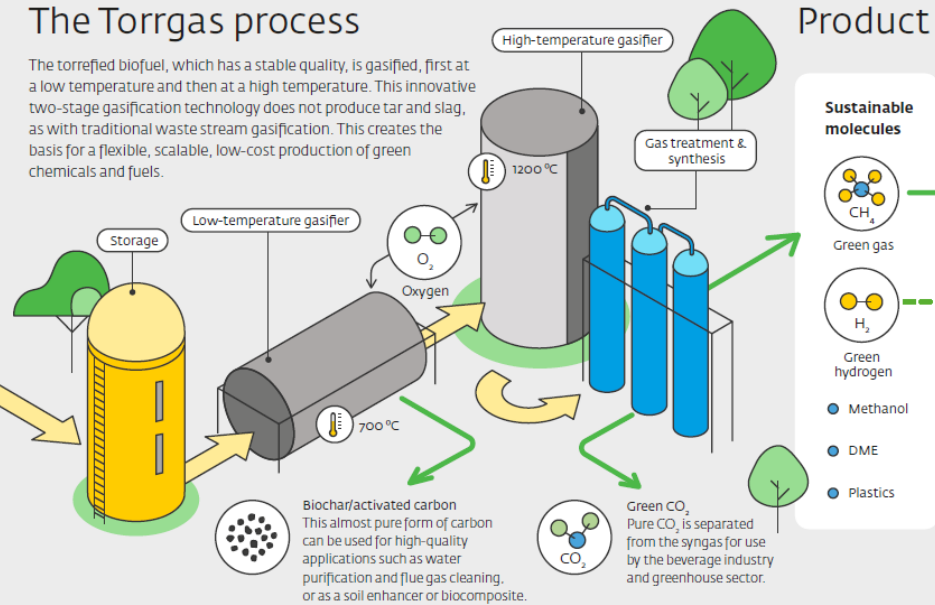
Torrefaction

Torrefaction converts heterogeneous, low-quality waste streams into homogeneous, high-quality biofuels that are around ten times as energy dense as the original feedstocks. This enables efficient transport and means torrefaction is a vital link in enabling large-scale reuse of problematic waste streams.



The Torrgas process

The torrefied biofuel, which has a stable quality, is gasified, first at a low temperature and then at a high temperature. This innovative two-stage gasification technology does not produce tar and slag, as with traditional waste stream gasification. This creates the basis for a flexible, scalable, low-cost production of green chemicals and fuels.



Uses of green gas

The Torrgas process produces green gas from syngas. This gas is transported through gas infrastructure to users in the industrial domain (for use as a feedstock and for process heating) and to the built environment.



Industry & chemistry

Built environment

Transport & mobility

Benefits of the Torrgas process



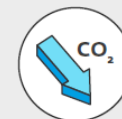
Scalable
A Torrgas plant can be scaled up to 100 MW.



Affordable
Activities such as the scaling up and marketing of biochar and green CO₂ make it increasingly cheaper to produce syngas. So much so, in fact, that it can even compete with fossil alternatives on price.



Fully circular
Low-quality waste streams are fully converted into high-value molecules (syngas and green CO₂) and products (biochar).



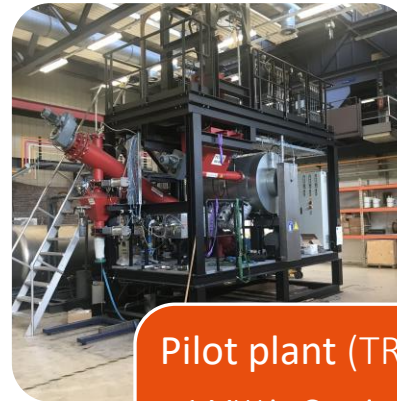
CO₂ reduction
Waste streams are converted into usable products. This prevents combustion and carbon emissions, effectively removing CO₂ from the atmosphere.

Technology Level



Production plant (TRL 8-9)

- 30km distance (B)
- Commercially free available
- Solution for sick forests
- Highly transportable due to densification in energy value and volume



Pilot plant (TRL 7-8)

- 1 MW in Groningen
- 25 MW in Detailed Engineering phase for Delfzijl
- IP @ Torrgas, co-owner in BrigH2



Water gas shift : Standard process (TRL 9+)

- Commercially free available
- Process engineering based on 50MW plant

Technologies compared



Water Electrolysis

- RMC : 0 EUR / ton H2
- VPC : 3000 EUR / ton H2
- TPC : 5000 EUR / ton H2
- Carbon footprint : Neutral at best



Biomass gasification + water shift

- RMC : 1300 EUR / ton H2
- VPC : 1400 EUR / ton H2
- TPC : 2200 EUR / ton H2
- Carbon Footprint : Negative with CCS



Steam Methane Reforming + CCS

- RMC : 900 EUR / ton H2
- VPC : 1800 EUR / ton H2
- TPC : 2300 EUR / ton H2
- Carbon Footprint : Always Positive

Business Model 50 MW Demo



Capacity plant: 50MW_{th}

Products:

H₂: 6.3kt (3% of Chemelot demand of H₂)

CO₂: 95kt (25% of current CO₂ liquefaction capacity, 14% of consumption)

Steam: 34kt (or power generation)

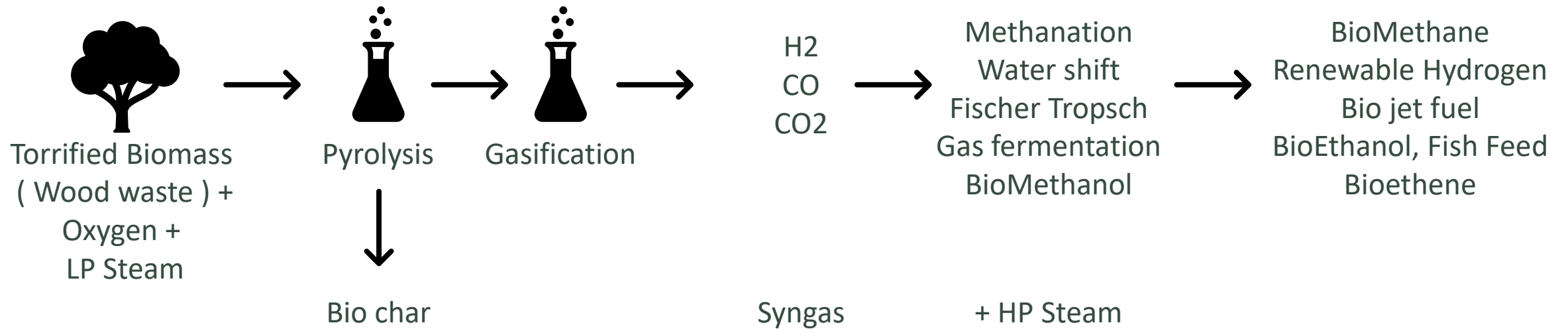
Char: 10kt

Input: 63kt **Torrified Biomass**

20kt Oxygen : direct from the oxygen pipeline on site

At this scale subsidies are required to cover investment costs and depreciation

Gasification process options



Further Scale-up options

Increase capacity from 50MW to 250MW scale at Chemelot (subsidy free size !)

Roll out to European Land Locked Chemical Sites

Increase torrefaction capacity worldwide

Green H₂ for Mobility heavy transport (on site !)

Green CO₂ to Green Chemicals

Brigh2

JOIN US

In making affordable renewable Hydrogen and
circular recarbonization

