btg bioliquids

BTG Bioliquids Pyrolysis technology

Lunchsessie NEO Overijssel

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Agenda

1. BTG Bioliquids company introduction
2. Fast pyrolysis technology
3. Bio oil applications
4. Conclusions

BTG Bioliquids – We replace fossil fuels

Company introduction

- As a **technology provider** and **product leader** we are committed to the commercial deployment of our fast pyrolysis technology.
- Explicitly made from biomass residues which is known as **second generation** (2G) or advanced biofuel which means that it does not compete with the food chain.

Our company milestones

1987

BTG starts as a spin-off from the University of Twente

2008

BTG Bioliquids established by BTG

2015

Start up of Empyro in the Netherlands

2016

Cooperation agreement with TechnipFMC

Starting BTG Bioliquids webshop

2019

Empyro sold to Twence, the Netherlands

Green Fuel Nordic, Finland

Pyrocell, Sweden

2020

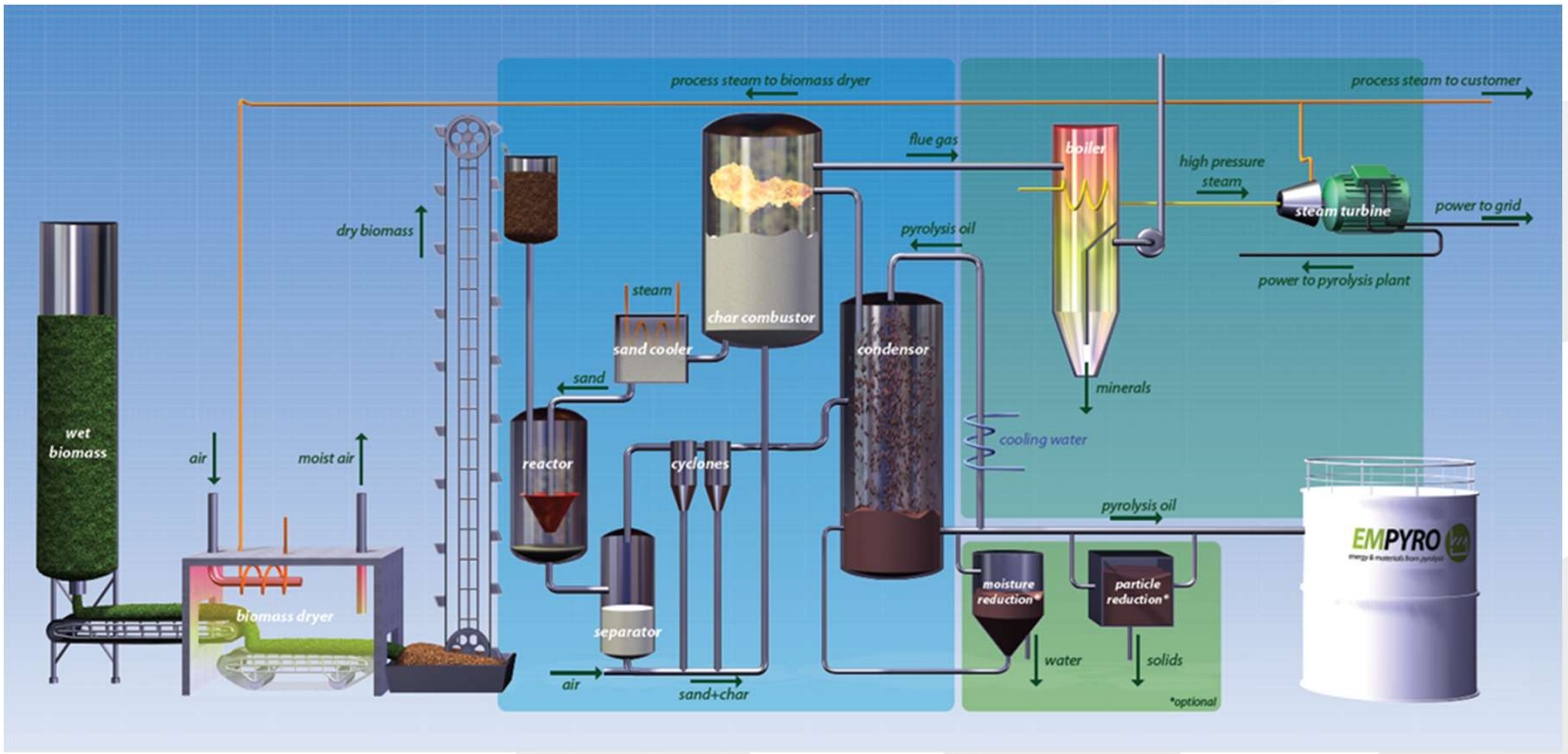
Start up of Green Fuel Nordic plant in Finland

Our technology

Fast pyrolysis technology

- **Thermochemical decomposition** of biomass residues through rapid heating (450-600 ℃) in absence of oxygen.
- Different types of biomass residues can be converted into homogeneous energy carrier: **Fast Pyrolysis Bio Oil** (FPBO).
- By products are **heat** (steam) and **power** (electricity)

Our process from biomass to FPBO

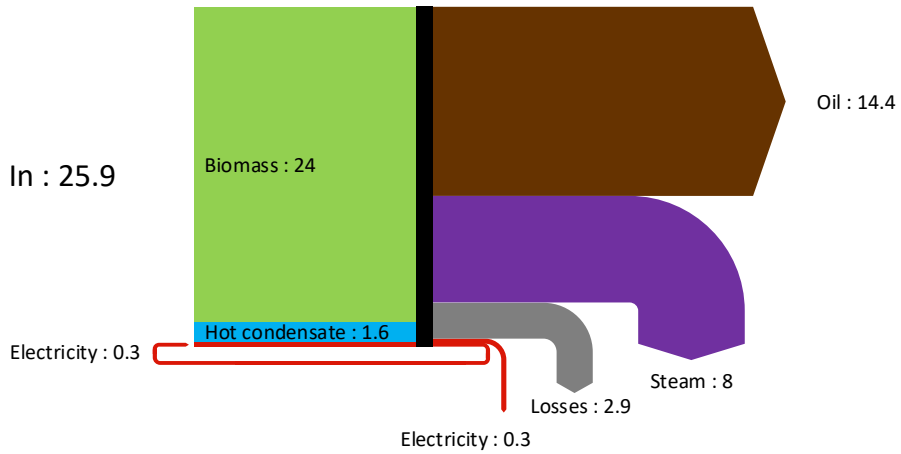


Empyro
The Netherlands

In 24/7 operation since 2015
First commercial FPBO plant in the world at Twence/Empyro in the Netherlands, in 24/7 operation since 2015. Empyro is sold to Twence at the beginning of 2019.

- Biomass feedstock – wood residue
- Biomass input – 36.000 ton/year
- FPBO output – 24.000 ton/year
- Steam output – 80.000 ton/year
- Electricity output – 2.200 MWh/year

Front view of Empyro plant including bulk silo



Empyro energy balance (MW) overall efficiency 85%

- All FPBO sold and used by off-take customer since 2015
- FPBO used to replace natural gas in a boiler to make sustainable steam.
- Switch from natural gas to FPBO give 93% GHG reduction
- Steam is sold to neighbouring salt production facility
- Excess power is sold to the grid

Empyro
and more

GreenFuel Nordic project (Finland)

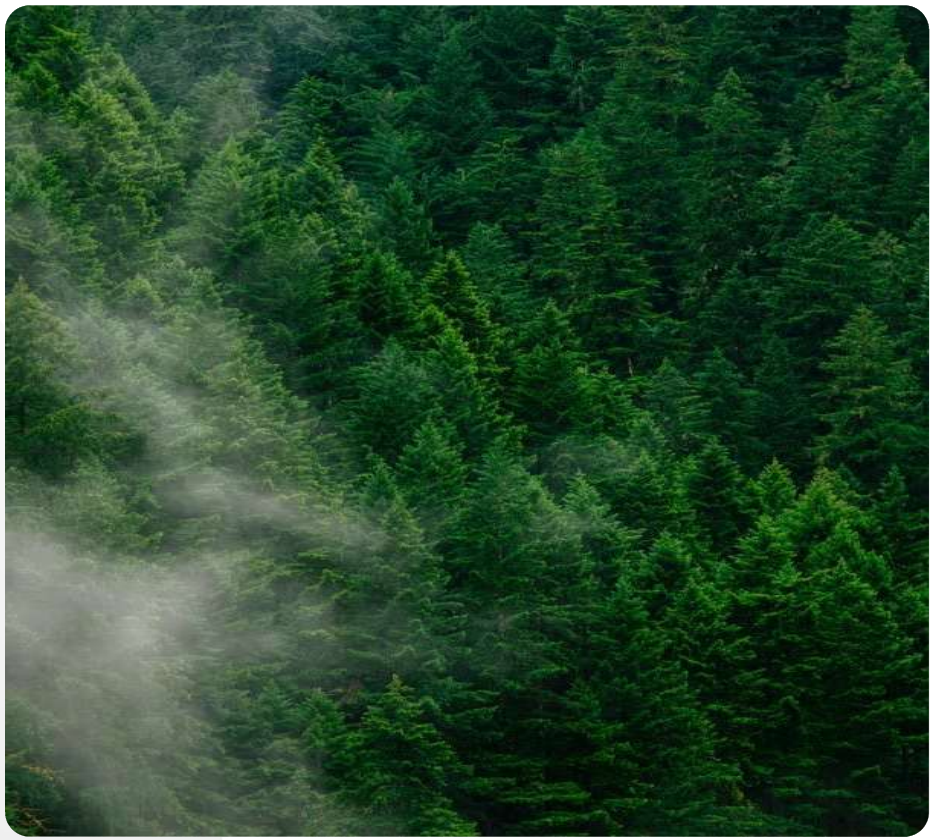
- Input: sawdust, out pyrolysis oil for heating applications.
- Delivery of modules to site summer 2020
- Mechanical complete October 2020
- First oil produced December 2020
- Small plant optimizations December 2020 and January 2021
- Continue production January 2021

Pyrocell project (Sweden)
from sawdust to tank

- Cooperation of Setra and Preem
- Production of bio-oil from sawdust – startup 2021
- Fast pyrolysis technology – annual bio-oil production 25,000 tonnes – GHG reduction vs fossil oil 80-90%. Oil is used in refinery to replace crude oil.
- Equivalent of 15,000 family cars can be powered per year
- Comply with the European RED II directive

Why pyrolysis?

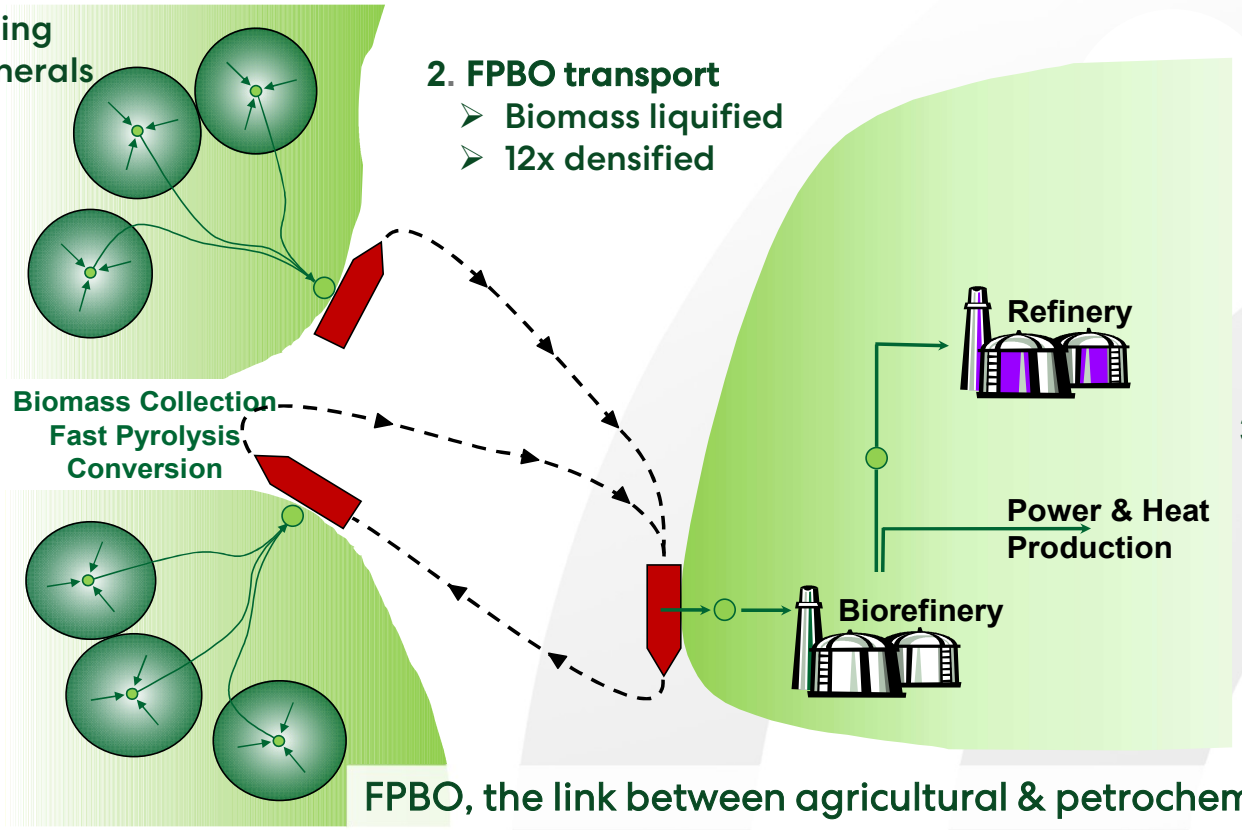
- Works with a variety of biomass feedstocks
- GHG savings well above other biofuels
- Versatile application e.g. heat, transportation fuels and bio chemicals
- Utilize existing fossil fuel infrastructure
- Viable link agriculture and (petro-) chemical industry
- Renewable feedstock for second generation bio fuels



Fast Pyrolysis in the Bio-Based Economy

1. Biomass conversion
- Local processing
- Returning minerals

2. FPBO transport
- Biomass liquified
- 12x densified

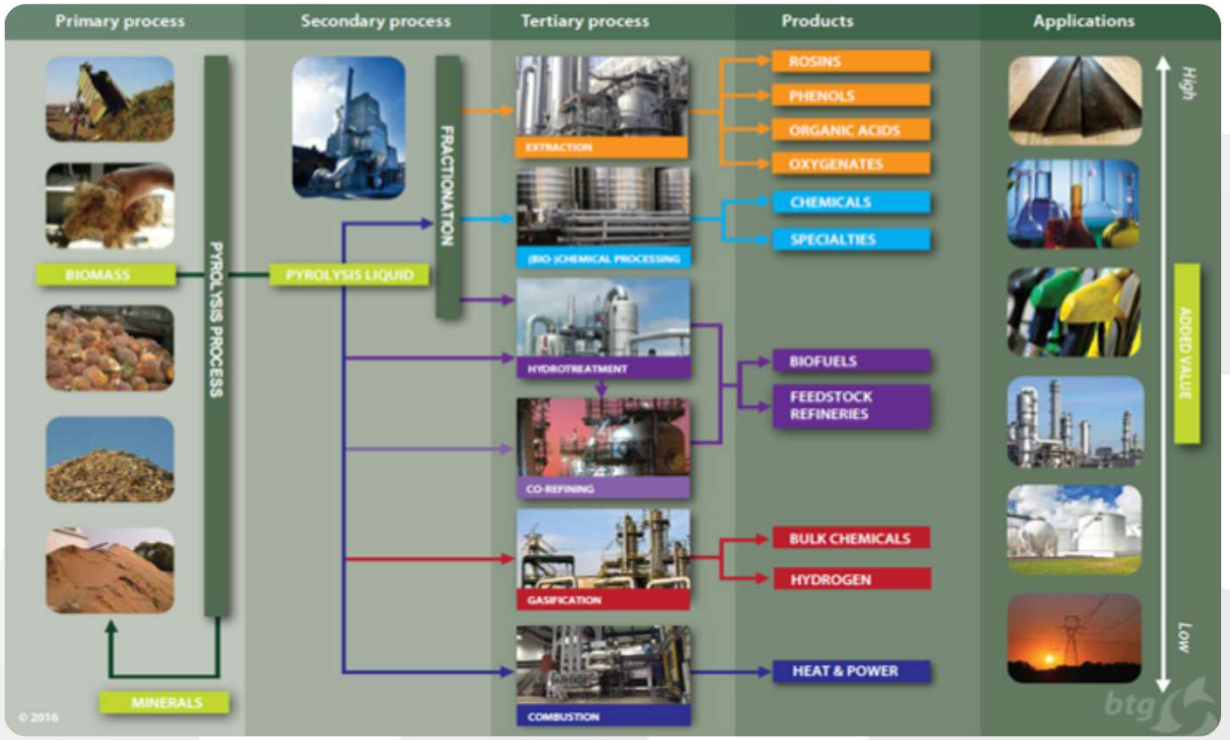


3. Processing & distribution
- Centralized
- Existing infrastructure

FPBO, the link between agricultural & petrochemical industries!

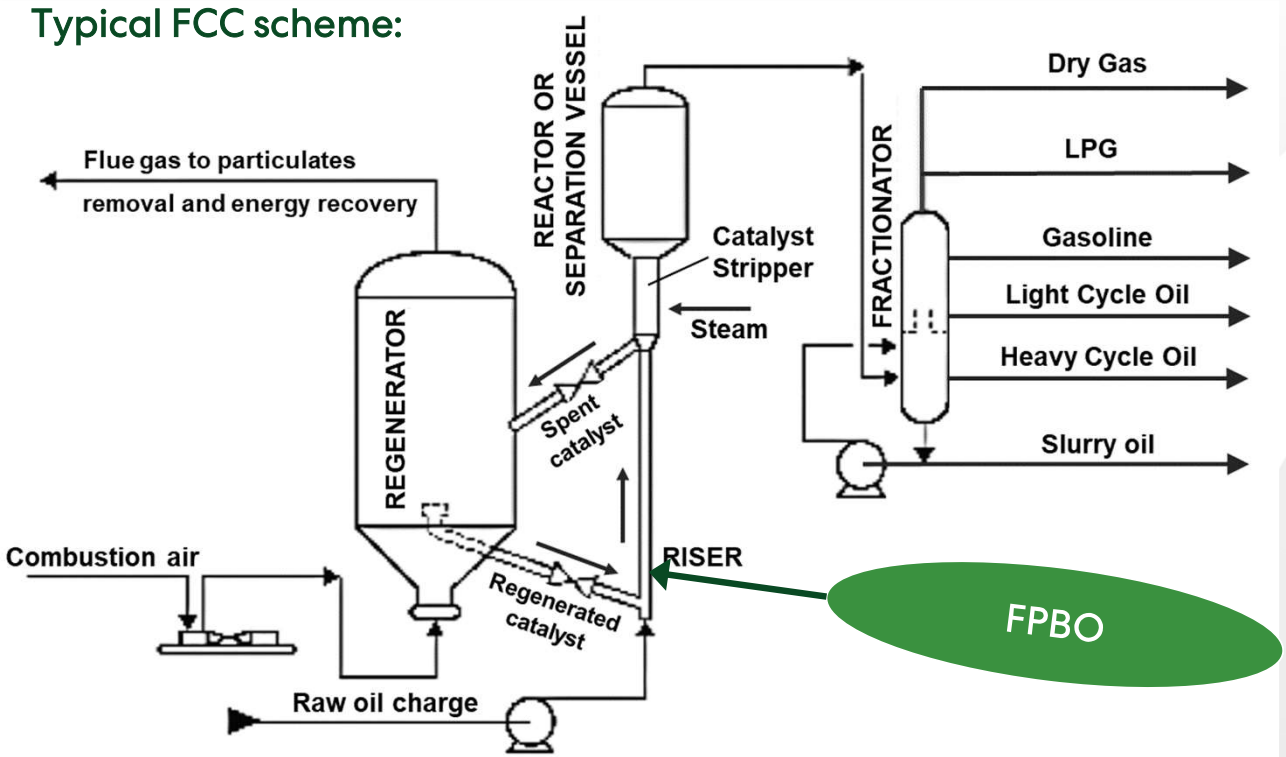
Fast pyrolysis bio oil applications

- Commodity link between agriculture and (petro-) chemical industry
- Current applications:
  - Heat at FrieslandCampina and heating customers in Finland.
  - Co-refining at the Preem refinery in Sweden
- Future markets:
  - High value applications like chemicals and additives
  - Bulk markets like jet and marine fuels
  - Production of Hydrogen



Co-refining of FPBO, how does it work?

Typical FCC scheme:



Summary and perspectives

- Fast pyrolysis is proven at commercial scale, worldwide capacity is expanding
- Current FPBO application is as renewable heating oil (e.g. replacing natural gas)
- High interest in co-processing crude FPBO in FCC units as this is a low CAPEX option to comply with RED II in Europe
- First co-processing refinery customer starting 2021
- More applications of pyrolysis oil under development, pyrolysis as starting point of bio liquids refinery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