btg bioliquids

BTG Bioliquids presentation for NewWave project

April 9th, 2025

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Company introduction

- As a technology provider and product leader we are committed to the commercial deployment of our **fast pyrolysis technology**

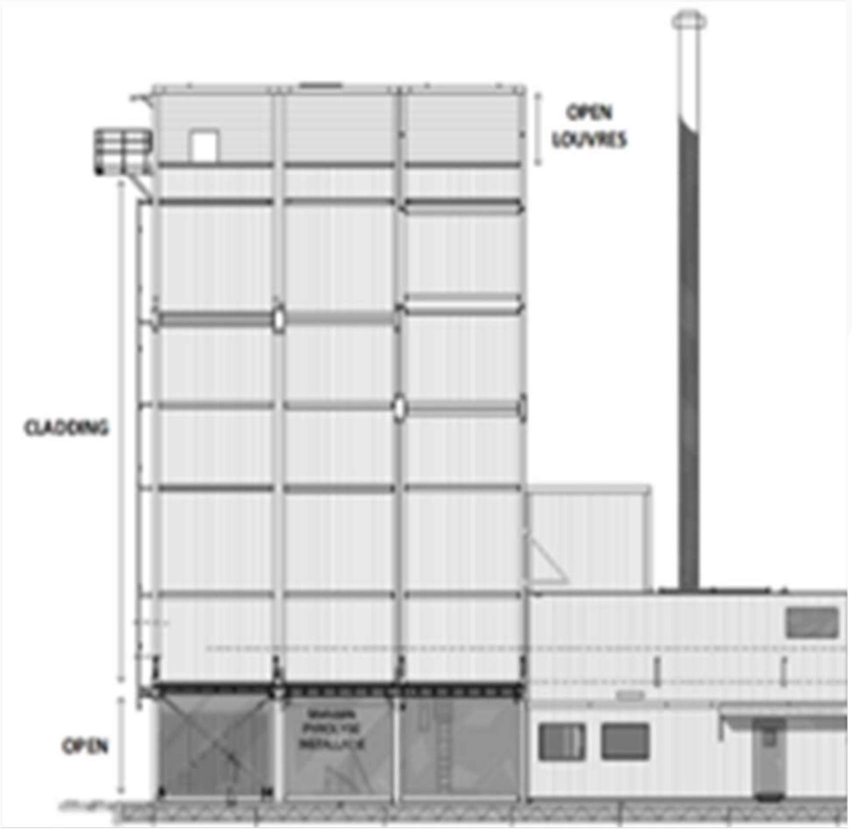
- Explicitly made from biomass residues which is known as second generation (2G) or advanced biofuel which means that it **does not compete with the food chain**

- Experienced project development team assisting customers and initiating own projects in pyrolysis oil production and upgrading technologies

- Highly standardized and modular design. Our motto is "scaling by numbers".

Value and logistic chain

- **Coupling** the biomass world (small) with the (petro) chemical world (large)
- **Disconnect** between the biomass availability and the need for energy / materials / chemicals.
- Liquids can easily be **stored and transported** and used anytime you like.



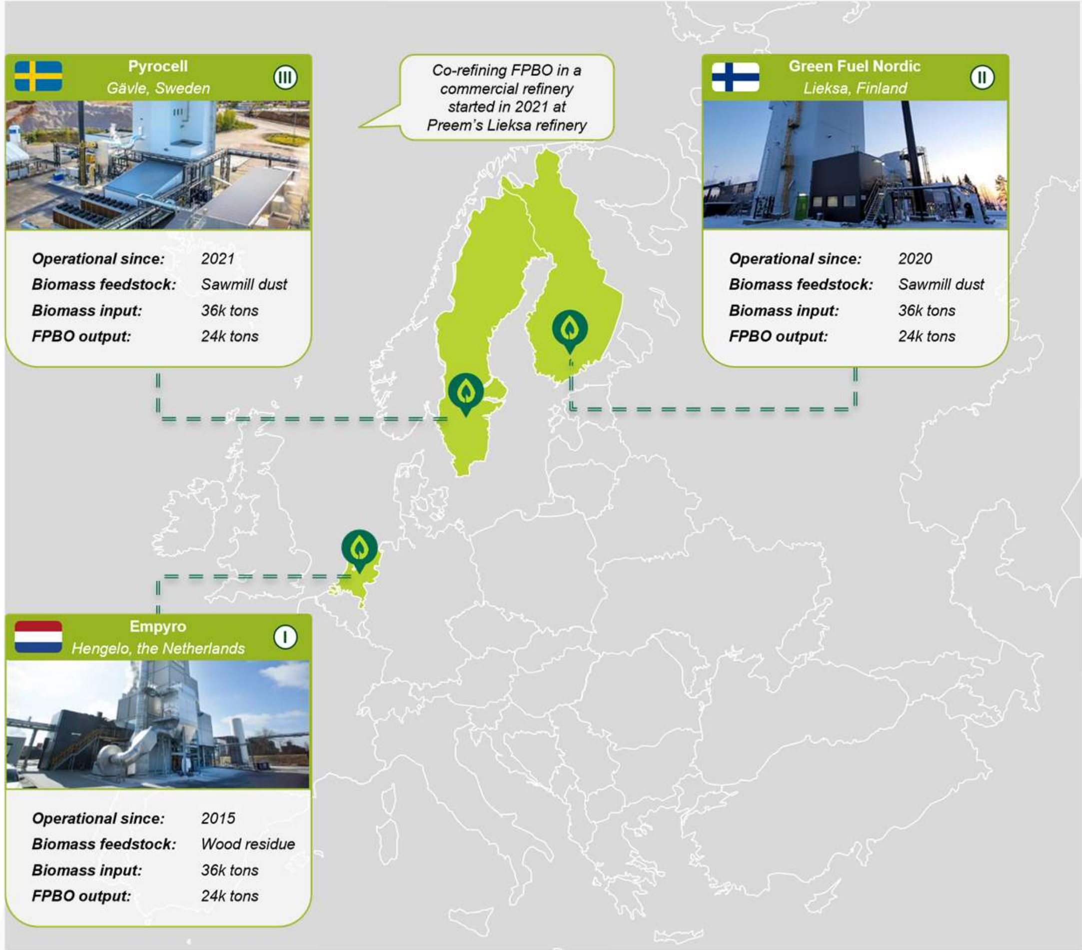
Modularization. Why?

- Lump sum turnkey projects, stick built result in high risks, long time on site, weather risks, lots of site engineering and construction leading to high CAPEX due to risk reservation in price.

- Modularization leads to:
  - Lower risks due to building of modules in factory environment.
  - Shorter delivery times. Building of modules and site preparation can go in parallel.
  - Short time on site. BTG Bioliquids modules erection time is two weeks.
  - Lower costs due to high degree of standardization.
  - High quality. All equipment and most connections can be tested in the factory in a Factory Acceptance Test. Time of commissioning is shortened.

Proven technology means less risk

- Over 175.000 tonnes of FPBO produced at three sites
- Lessons learnt from the first Empyro plant in 'own backyard' has helped optimizing the technology and operational processes to increase overall plant performance
- Performance of GFN and Pyrocell plants confirm technology is now ready for full-scale commercial roll-out
- No scale up risk. We have done it before!
- Bank loans possible with export credit guarantee from Atradius, backed by Dutch Government



Standardization

The BTG Bioliquids pyrolysis plants are highly standardized. We have the strategy to scale by numbers. Bring the pyrolysis plants to the biomass and convert the crude biomass to crude pyrolysis oil. Advantages of standardization:

- **Hardly any engineering is needed.** Within several weeks after contract award, we can order equipment.
- Very short delivery times. Within 18 months after ordering of the plant the first pyrolysis oil is produced.
- Ready for full-scale commercial roll-out
- Our pyrolysis plant with EU design is complete standardized. The US design (ASME, ASTM) is ready and will be standardized in the future.

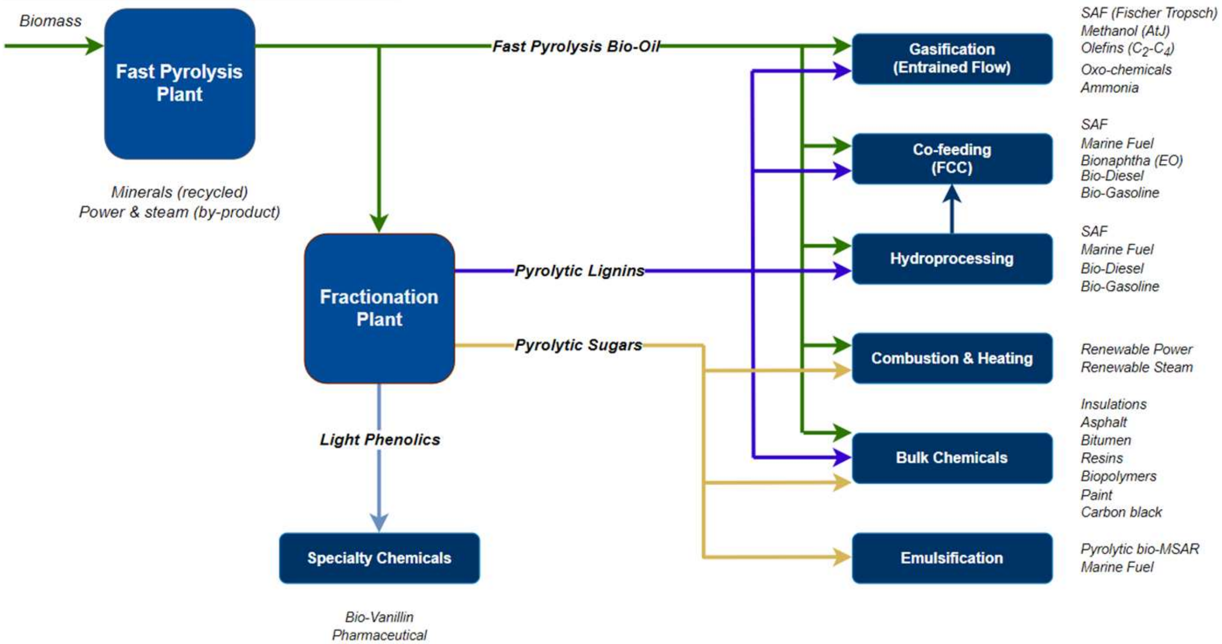
Overview FPBO Applications

More and more applications are reaching commercial readiness levels

Fast Pyrolysis Bio-Oil Applications

- Pyrolysis oil is densifying biomass and is connecting the biomass world with the chemical, petro-chemical and energy world.

- Following applications can be served via the pyrolysis oil platform:
  - Gasification on an existing gasifier (ammonia, methanol, syngas, hydrogen, SAF, marine fuel, bio diesel)
  - Co-feeding in refinery via FCC to go to SAF, Marine Fuel, Bio-diesel, Bio Gasoline.
  - Hydro-processing (BTG-NeXt technology) to make SAF, Marine fuel and Bio Diesel
  - Combustion to make renewable heat and steam.
  - Fractionation into Pyrolytic sugars and lignin to go to insulation material, asphalt, bitumen, resins, paint, impregnation of wood (bulk chemicals)
  - Fractionation using Alder technology to go to SAF.
  - Emulsification of pyrolytic sugars into HFO.



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Bio Refinery Twente

Fractionation Technology
Cost efficient way to bring green carbon to chemicals and advanced fuels

First of Its Kind Fractionation Plant

- Thermo-chemical **fractionation** is a two-step conversion process to transform different bio-resources into raw-materials for bio chemicals.
- In this approach, a **first step** short thermal treatment at elevated temperatures (fast pyrolysis) is followed by a **second step** of low temperature fractionation of the bio-oil into its functional groups being; pyrolytic lignin and pyrolytic sugars.
- The first fast pyrolysis step has already been **commercially proven** (TRL9) with over 175,000 tonnes of fast pyrolysis bio-oil produced at 3 commercial production sites. The second liquid-to-liquid fractionation step has been proven at pilot scale (3 tonnes input per day) by BTG Biomass Technology Group.
- **Basic design** has been finalized for a 1.2 tonnes input per hour (ten-fold scale up) fractionation plant situated next to the existing 3 tonnes per hour FPBO production plant in The Netherlands (Empyro).
- The fractionation plant can **easily be upgraded** in the future to 3 tonnes input per hour, matching the current production FPBO output.

Biorefinery Twente

De-risking and low investment using existing pyrolysis plant

wood residues

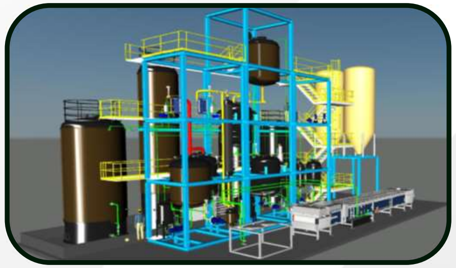
First step – FPBO production plant
- Existing Empyro plant
- Proven technology at TRL9
- Over 175kton of FPBO produced

FPBO (60%)

FPBO (40%)

Steam

Steam used by Nobian salt factory.



Second step – Fractionation unit
- First of a kind plant
- Extensive testing and experience with lab pilot plant
- Simple process using existing and proven components

sugars

phenolics

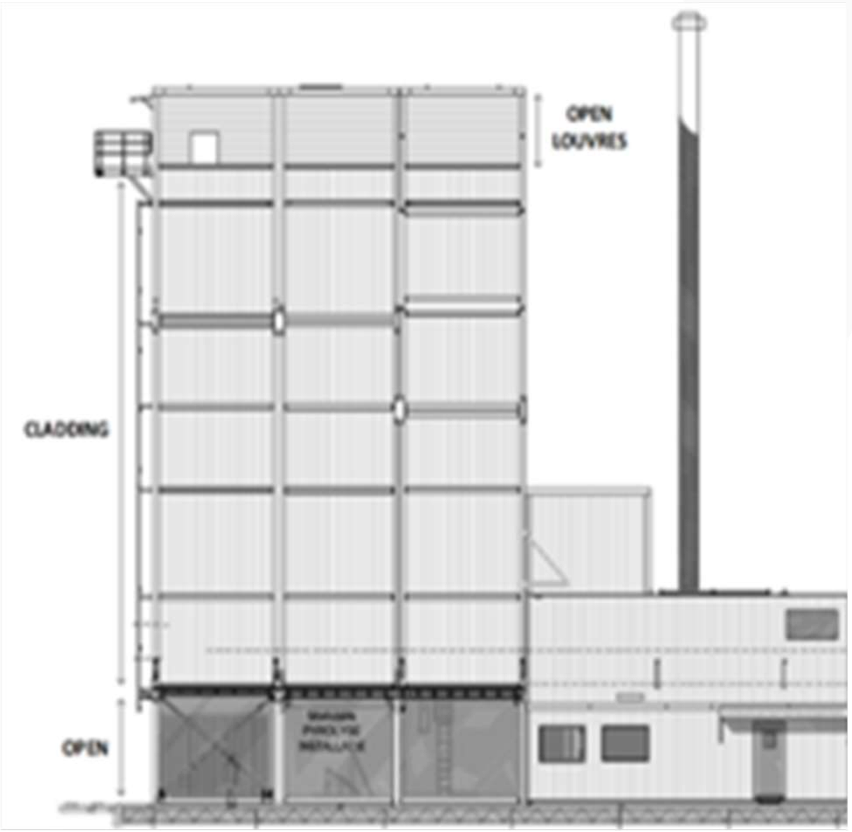
lignin

FPBO blend to Royal Friesland Campina boiler application

Lignin used by Kingspan for insulation materials.

Project Status

- Development of fractionation plant by Aurora (sister company of BTG Bioliquids) at a scale of 1.2 t/h (7,200 t/a) next to existing 3t/h (18,000 t/a) fast pyrolysis plant (Empyro) in Hengelo, The Netherlands.
- 15M euro total project costs including development of fractionation plant and modification of Empyro plant.
- Long term offtake contracts being negotiated for pyrolytic lignin with insulation company, and with Friesland Campina for combined FPBO and pyrolytic sugars. Continuation of heat supply to Nobian salt factory.
- FID is expected 3rd quarter 2025.



Summary

- The lessons learned in Empyro are implemented in Green Fuel Nordic and Pyrocell and this resulted in a standard design.
- Modularization and standardization leads to:
  Lower risks, shorter delivery times, short time on site, lower costs and high quality due to high degree of standardization. Engineering efforts are very limited
- Do not build the plants too large. Scaling by number is a good way to address the biomass availability and lower the costs.
- Pyrolysis oil is a very interesting way to connect the biomass world to the industrial world, leading to energy, fuels and chemicals.
- The Biorefinery Twente project is currently under development and FID is expected 3rd quarter of 2025.

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BTG Bioliquids we replace fossil fuels

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