btg bioliquids

BTG Bioliquids presentation for TC Biomass Chicago

September 11th, 2024

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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".

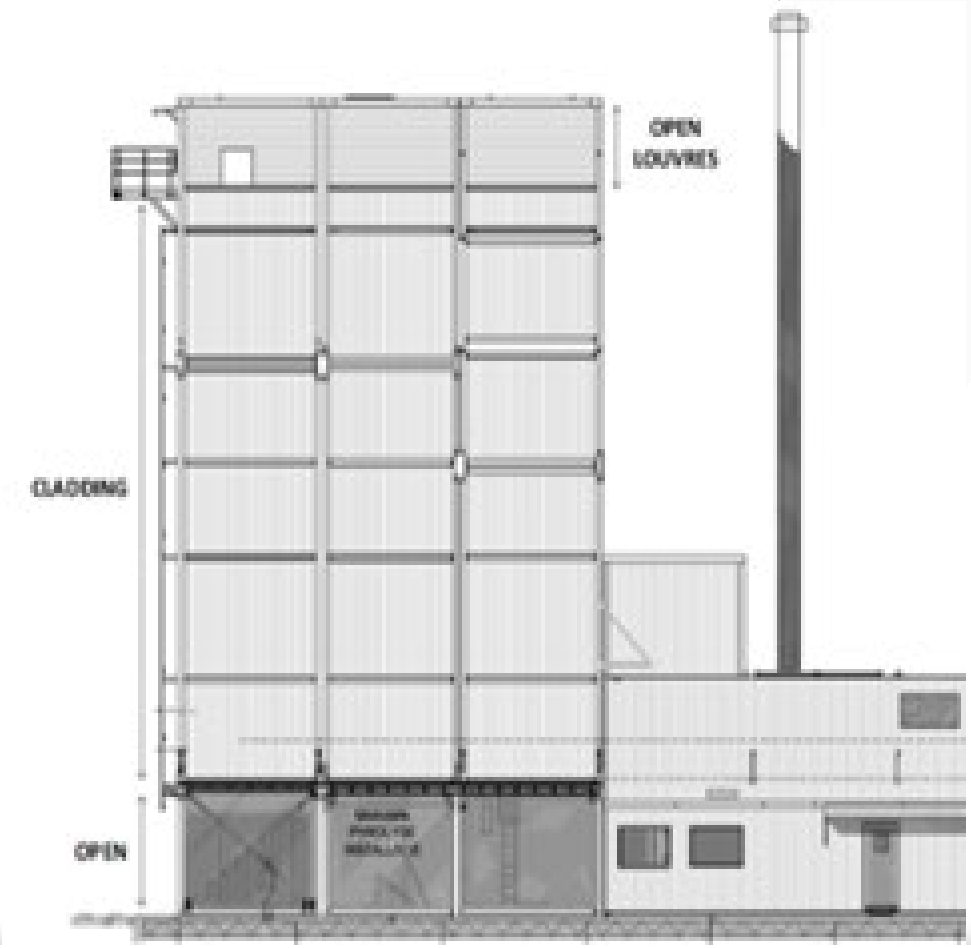
Observations with 2nd gen. biofuels

- Projects are too large with companies being too small resulting in bankruptcies.
- Companies are too impatient to follow the step-by-step approach. From laboratory to commercial scale in one jump.
- Major oil companies have a “wait and see” approach. Projects postponed / cancelled / not realized.
- EPC projects are complicated / risky. High CAPEX due to risks which need to be priced in. Bad for feasibility.
- Biomass residues are not free of charge. Why don’t we go to MSW? Looks nice on excel, is solving a societal problem, but big technical problems in the plant.

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?

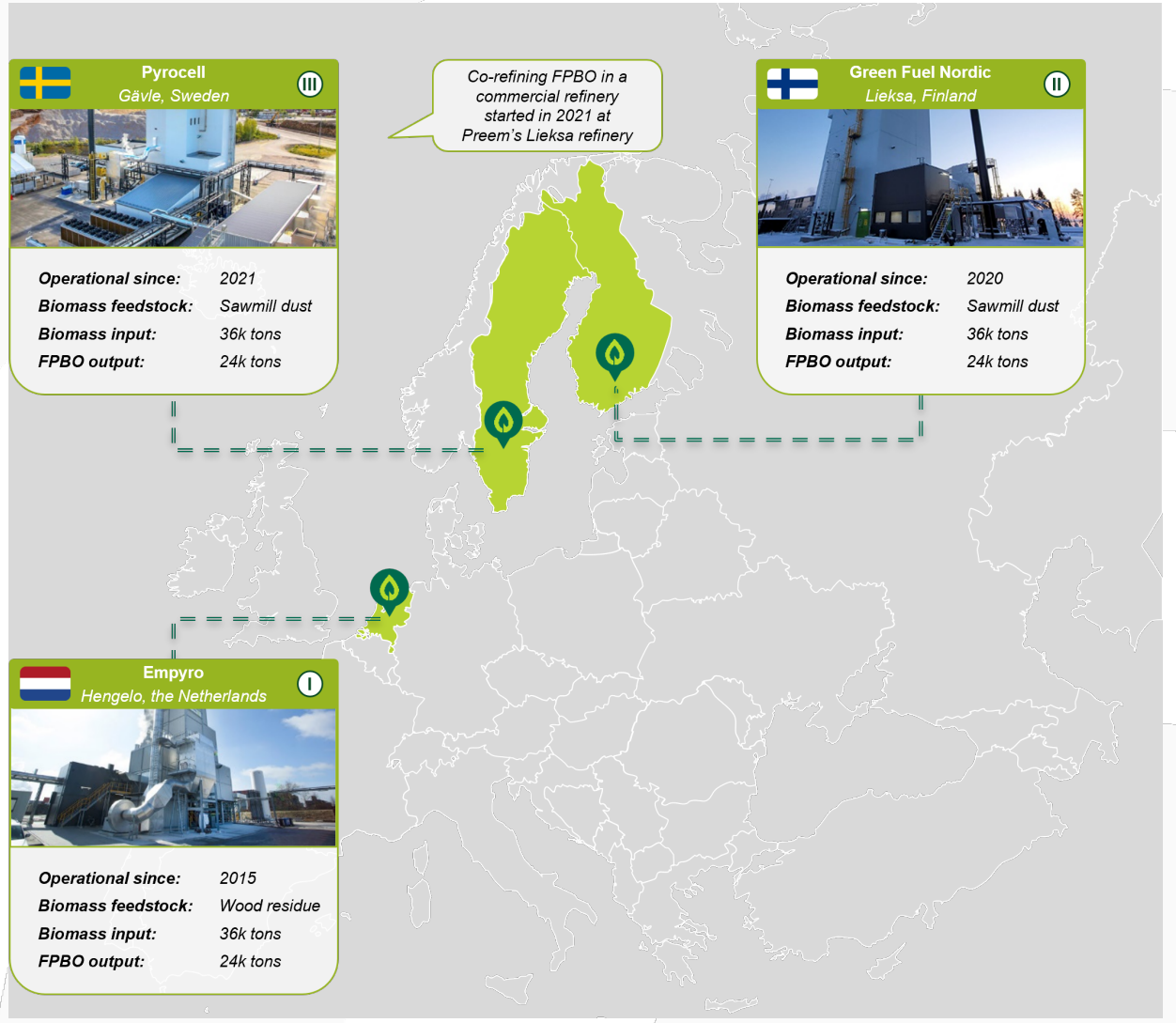


- Lump sum turnkey projects, stick built result in high risks, long time on site, weather risks, lots of site engineering and construction leading to high CAPEX due to risk reservation in price.

- 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

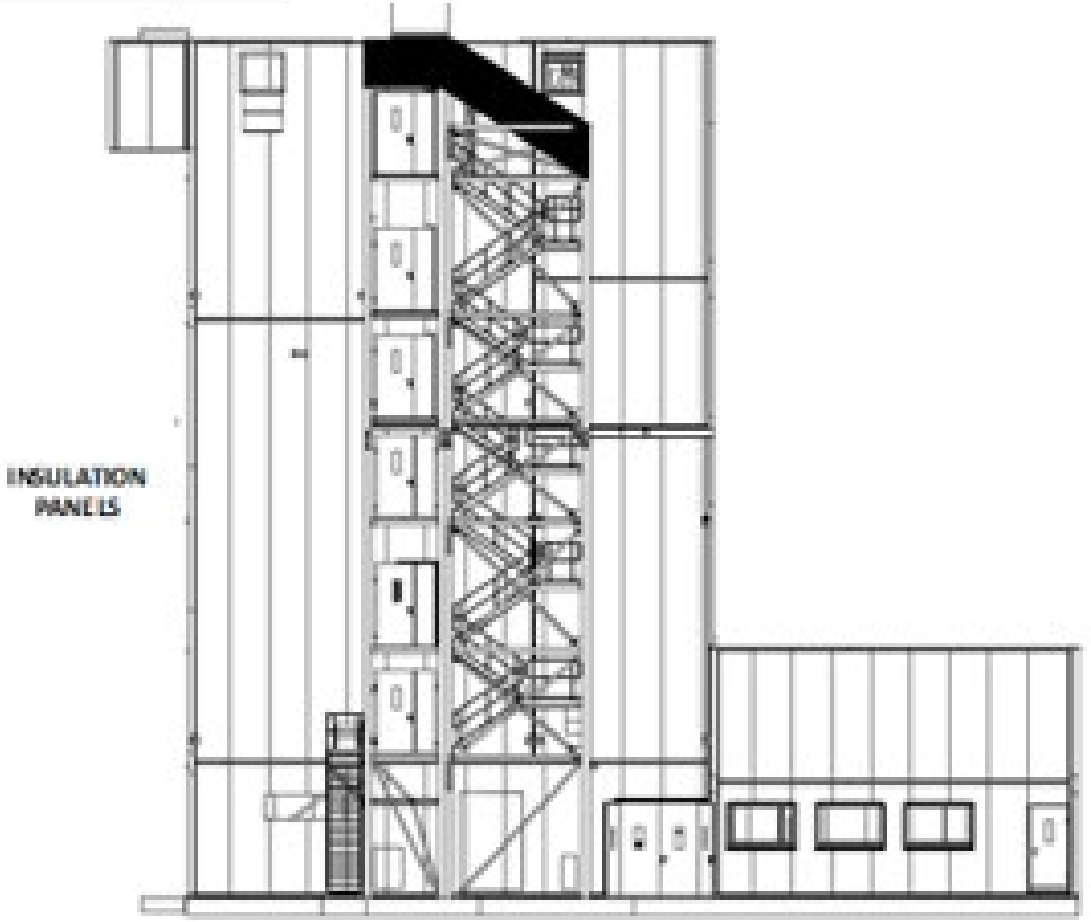
- Over 150.000 tonnes of FPBO produced at three sites
- Lessons learnt from the first Empyro plant in 'own backyard' has helped optimizing the technology and operational processes to increase overall plant performance
- Performance of GFN and Pyrocell plants confirm technology is now ready for full-scale 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

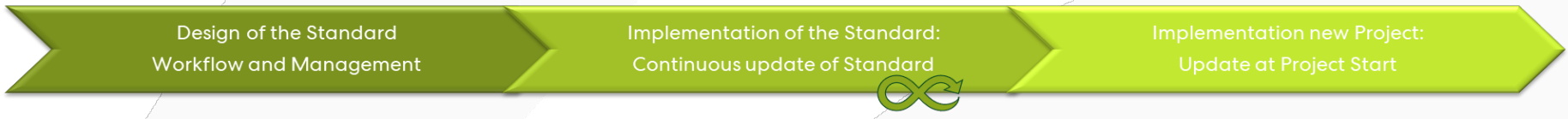
The BTG Bioliquids pyrolysis plants are highly standardized. We have the strategy to scale by numbers. Bring the pyrolysis plants to the biomass and convert the crude biomass to crude pyrolysis oil. Advantages of standardization:

- 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.



Standardization

When good choices in standardization are made, most customer demands can be satisfied and from the very first beginning of the project all documents are ready and complete.



Deliverable

- Document control system, designed to maintain the standard.
- Management Of Change procedure aligned.
- Workflow management system implemented for maintaining the standard.

Documents	Internal/External
PID	I/E
• Line List	E
PBOM	I
• First off List	E
3D Model	E
• Steel Structure (TEKLA)	E
• ISO's	E
• Insulation	E
Battery Limit List	I
General Arrangement Drawings (GAD)	I
• Step files	E
Electrical Schematics	E
• Power consumption list	E
• Sing line diagram	E
Control Narrative	I
Manufacturer Documents file	I
• Certificates	I
Operation Manual	I

Deliverable

- Standard up to date: Basic design documents updated with all changes.
- Workflow management: outstanding points for updating the detailed engineering documents are recorded.

Documents

- PID
- Line List
- PBOM
- *First off list*
- 3D Model
- Battery Limit List
- General Arrangement Drawings marked-up
- Electrical Schematics
- Power Consumption list
- Single line diagram
- HAZOP Study Report
- Control narrative

Deliverable

- At the start of the project, the detailed engineering documents are updated with all outstanding changes.

Documents

- Steel structure (TEKLA)
- Cladding / Roof
- Airco/HVAC
- Rainwater
- ISO's
- Insulation
- General Arrangement Drawings
- Step files
- Manufacturer documents file
- Operation manual

Training

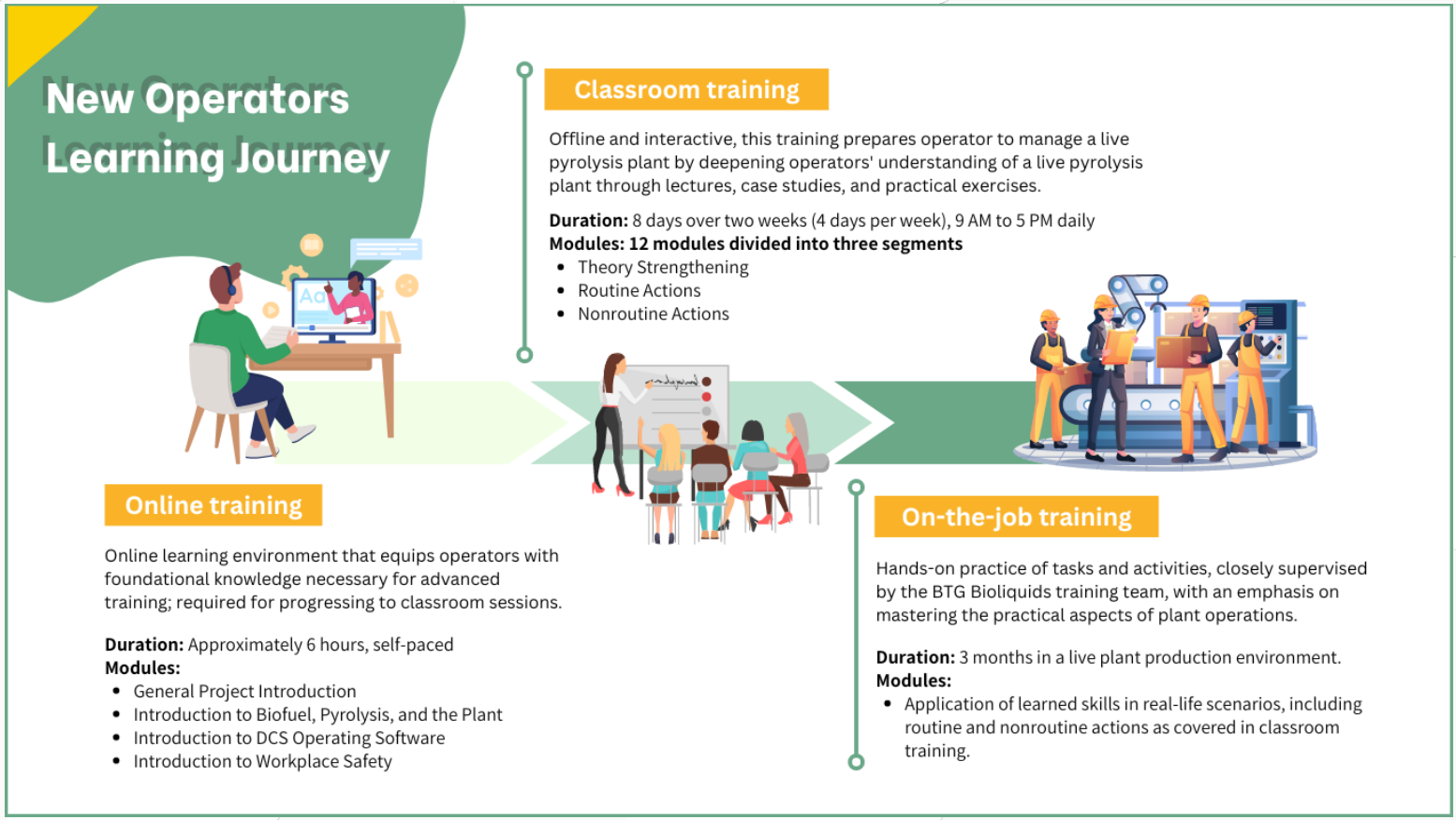
A training of the operators is part of the delivery package. The training exists out of the following parts:

- Online training environment that equips operators with foundational knowledge for classroom training. Modules:
  - General project introduction
  - Introduction to Biofuel, Pyrolysis and the Plant
  - Introduction to DCS operating software
  - Introduction to Workplace safety.

  Duration: 6 hours, self paced.

- Classroom training. This training prepares operator to manage a live pyrolysis plant by deepening operators' understanding. Duration: 8 days over two weeks (4 days per week)

- On the job training. Hands-on practice of tasks and activities, closely supervised by the BTG Bioliquids' training team. Duration: 3 months in a live plant production environment.



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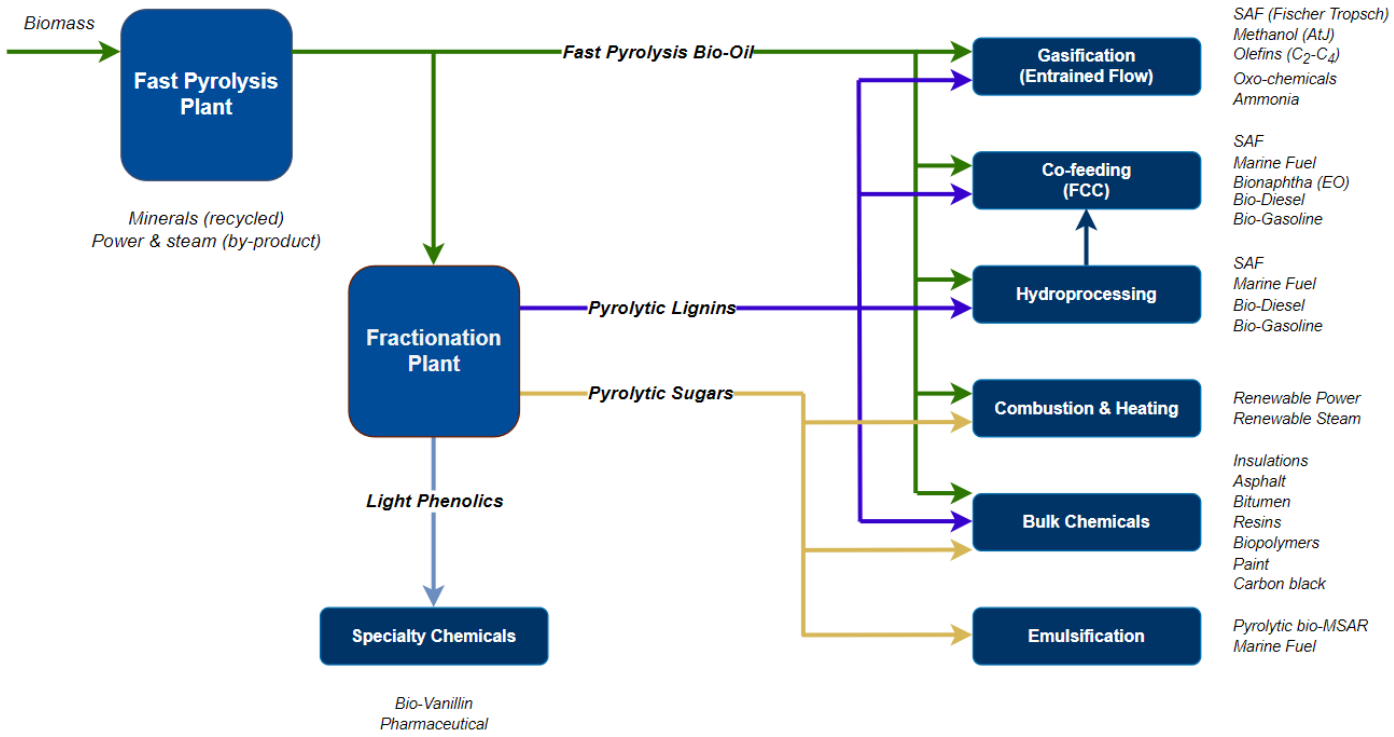
Overview FPBO Applications

More and more applications are reaching commercial readiness levels

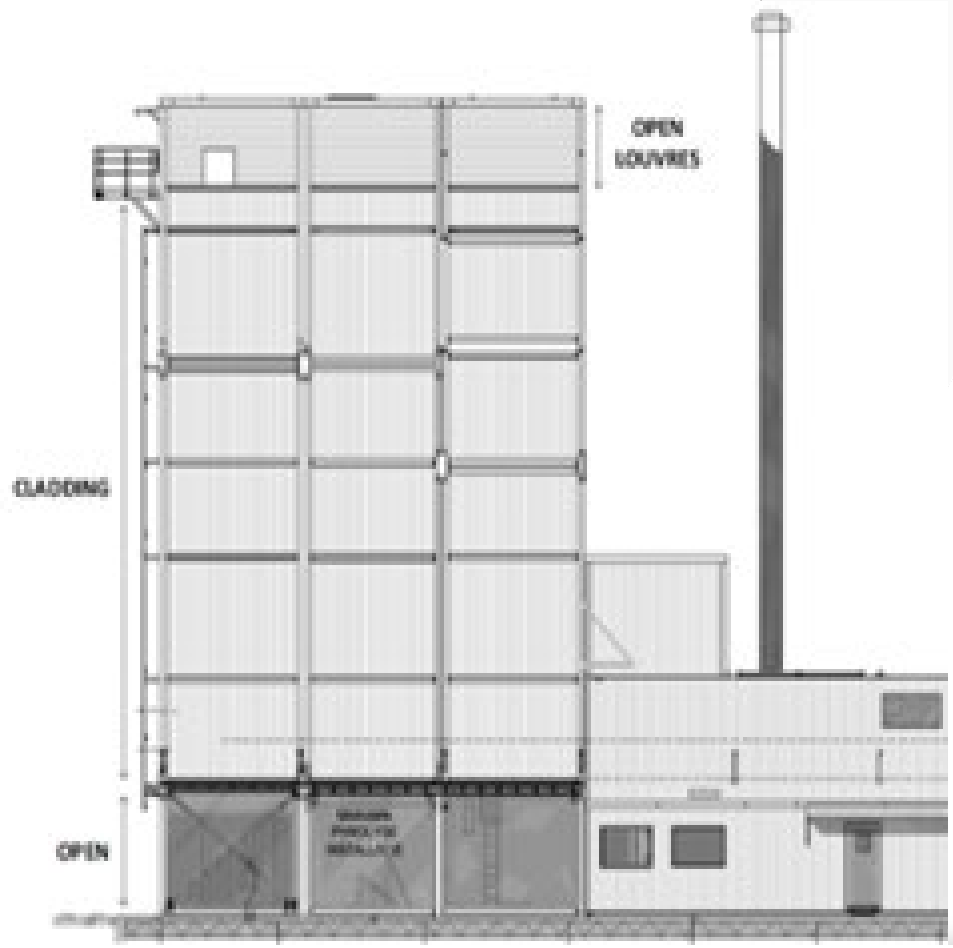
Fast Pyrolysis Bio-Oil Applications

- 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.



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.
- Training of the operator is crucial for the success of the plant.
- Pyrolysis oil is a very interesting way to connect the biomass world to the industrial world, leading to energy, fuels and chemicals.

BTG Bioliquids

we replace fossil fuels