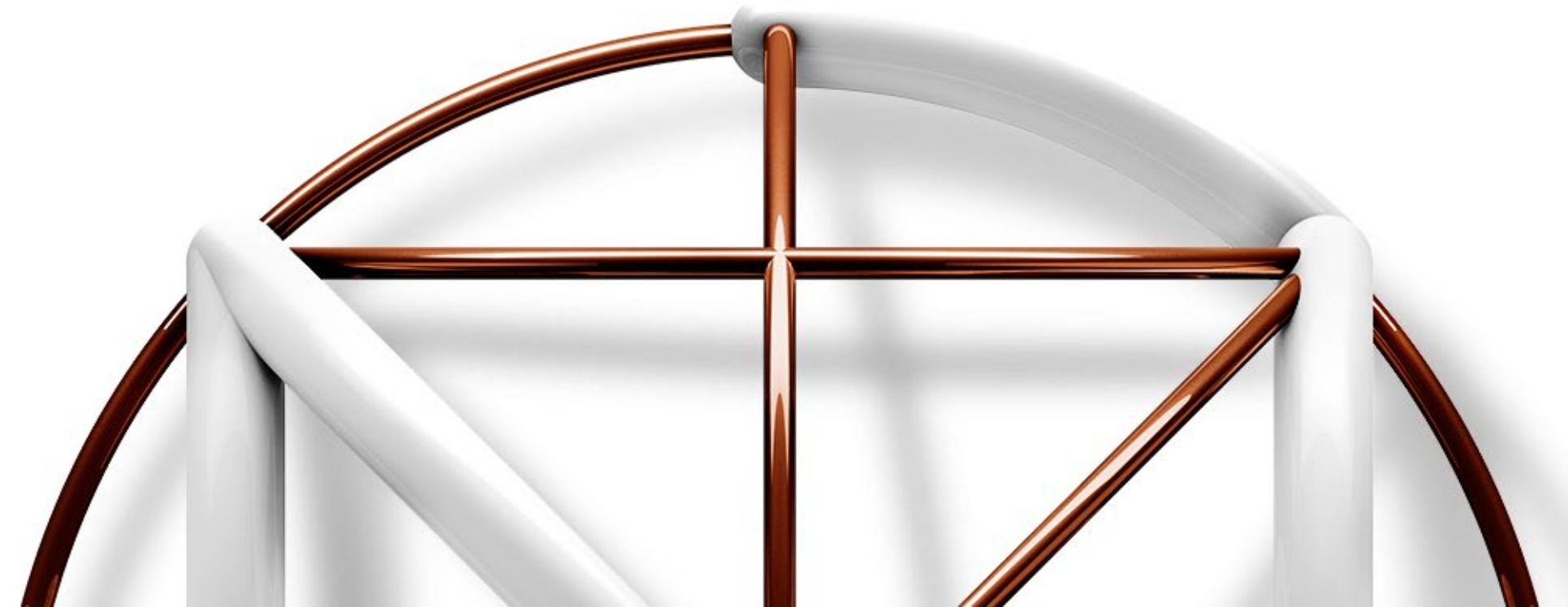
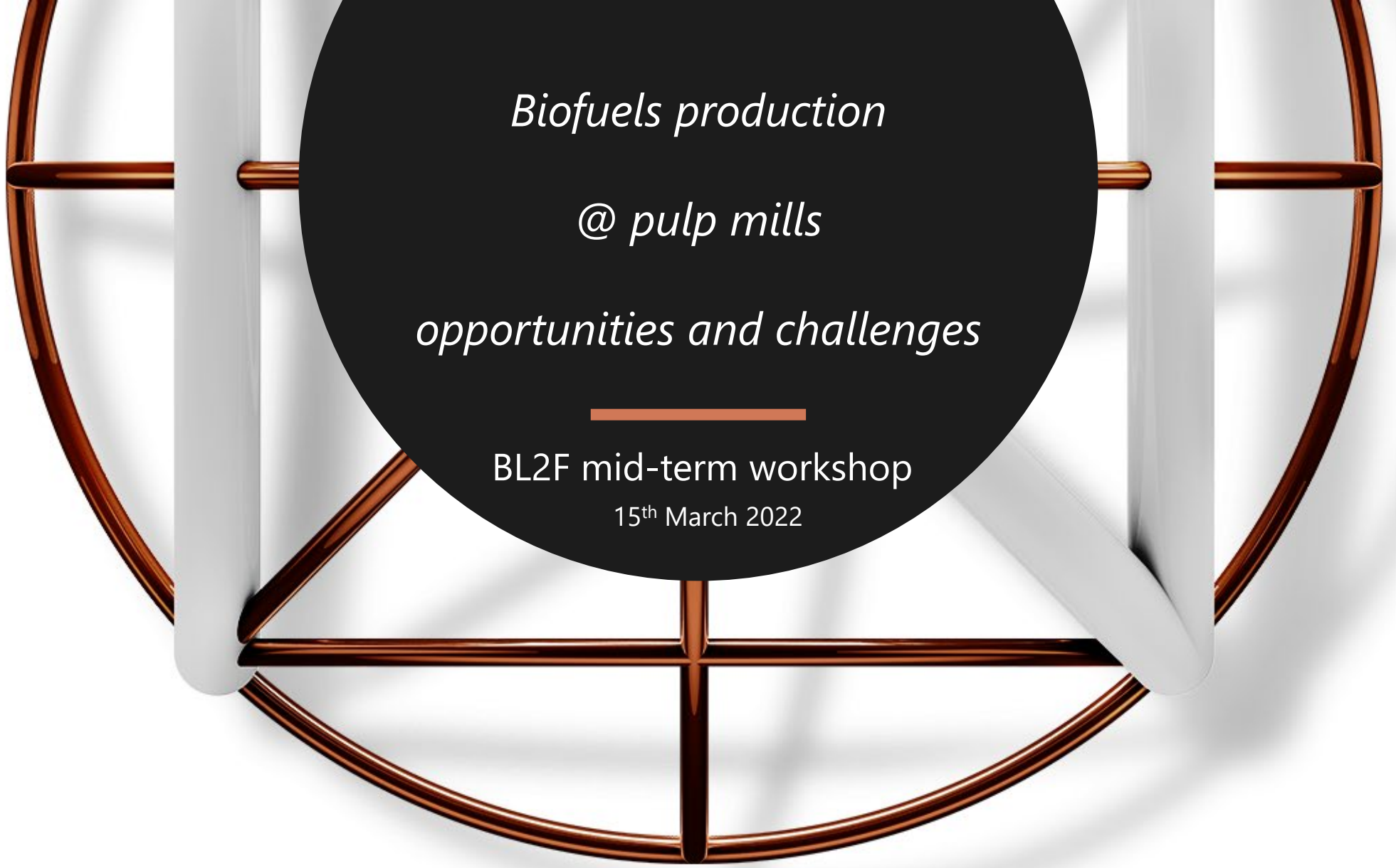
THE
NAVIGATOR
COMPANY





Biofuels production

@ pulp mills

opportunities and challenges

BL2F mid-term workshop

15th March 2022

THE NAVIGATOR COMPANY

KEY NUMBERS

Leading European manufacturer of printing and writing paper, 6th largest in the World

One of the largest producing bleached eucalyptus kraft pulp (BEKP).

Annual industrial capacity:

- 1.6 Mton of paper
- 1.6 Mton of pulp (1.1 Mton incorporated into own paper)
- 120 kton of tissue paper
- 2.5 TWh of electricity (≈ 5% Portuguese consumption)

Annual turnover ≈ 1.6 billion euros, 95% of pulp and paper sales exported to ≈ 130 countries

30.000 jobs (direct and indirect). Source: KPMG

THE NAVIGATOR COMPANY

KEY NUMBERS

Four production sites at Portugal:

350.000 tAD pulp & 70.000 ton Tissue

650.000 tAD pulp & 790.000 ton paper

550.000 tAD pulp & 775.000 ton paper

70.000 ton tissue

International offices

Pulping industry

Beyond pulp, paper and board

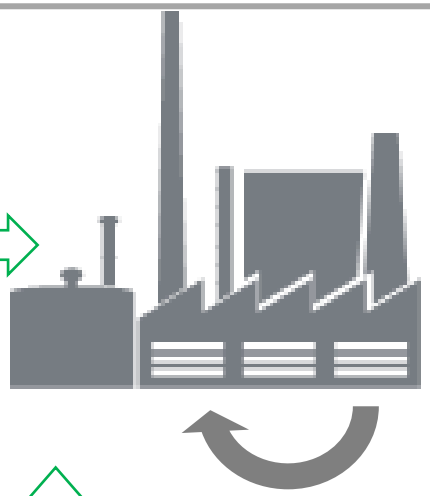
FUTURE PERSPECTIVES FOR PULP MILLS

DIFFERENTIATION / UPGRADE

THE NAVIGATOR COMPANY

Wood logs

Forest residual biomass



Chemicals recovery & energy production

Cellulose pulp

- **Pulp**
- **Papers / board**
- **Tissue**
- **Energy**

Biomass deconstruction & fractionation processes

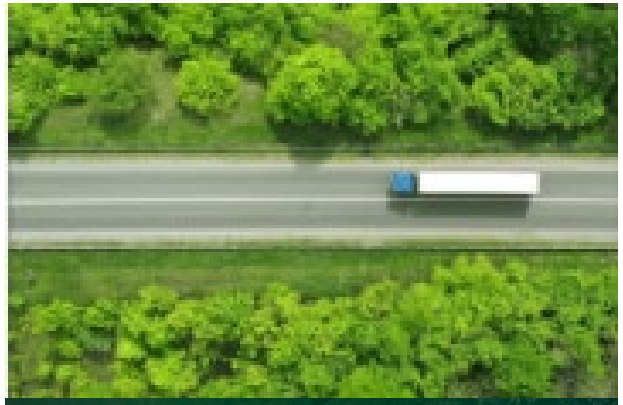
Side streams

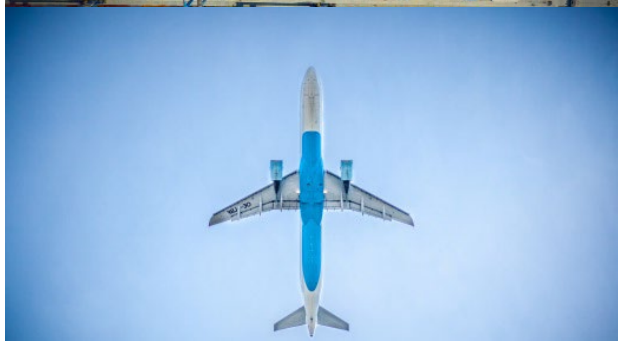
Sub products

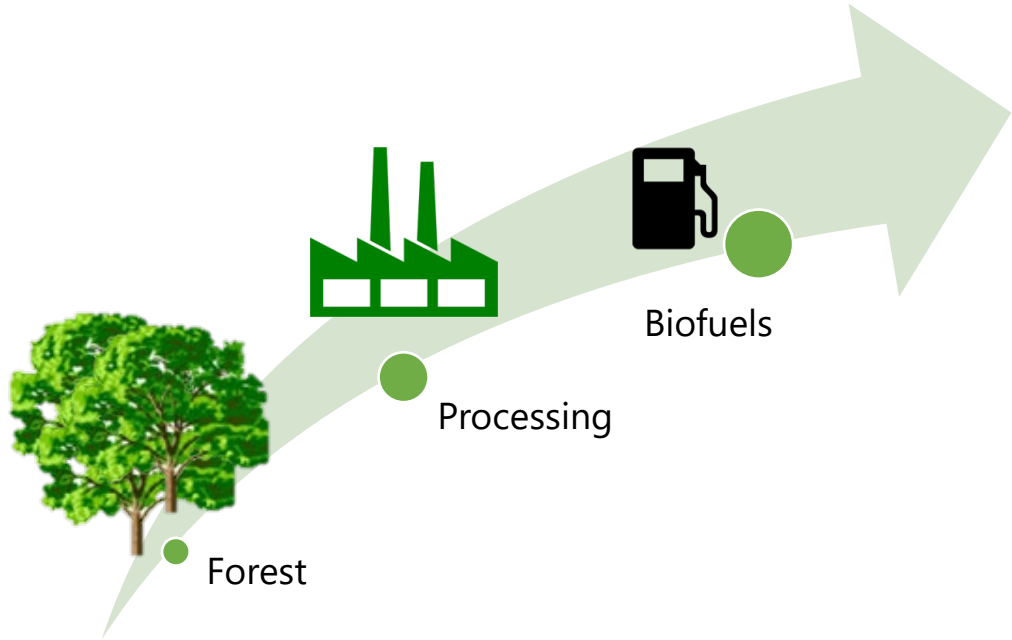
Biomass molecules

- **Bio fuels**
- **Bio products**
- **Bio materials**

RAIZ







Advanced biofuels production @ Pulp industry

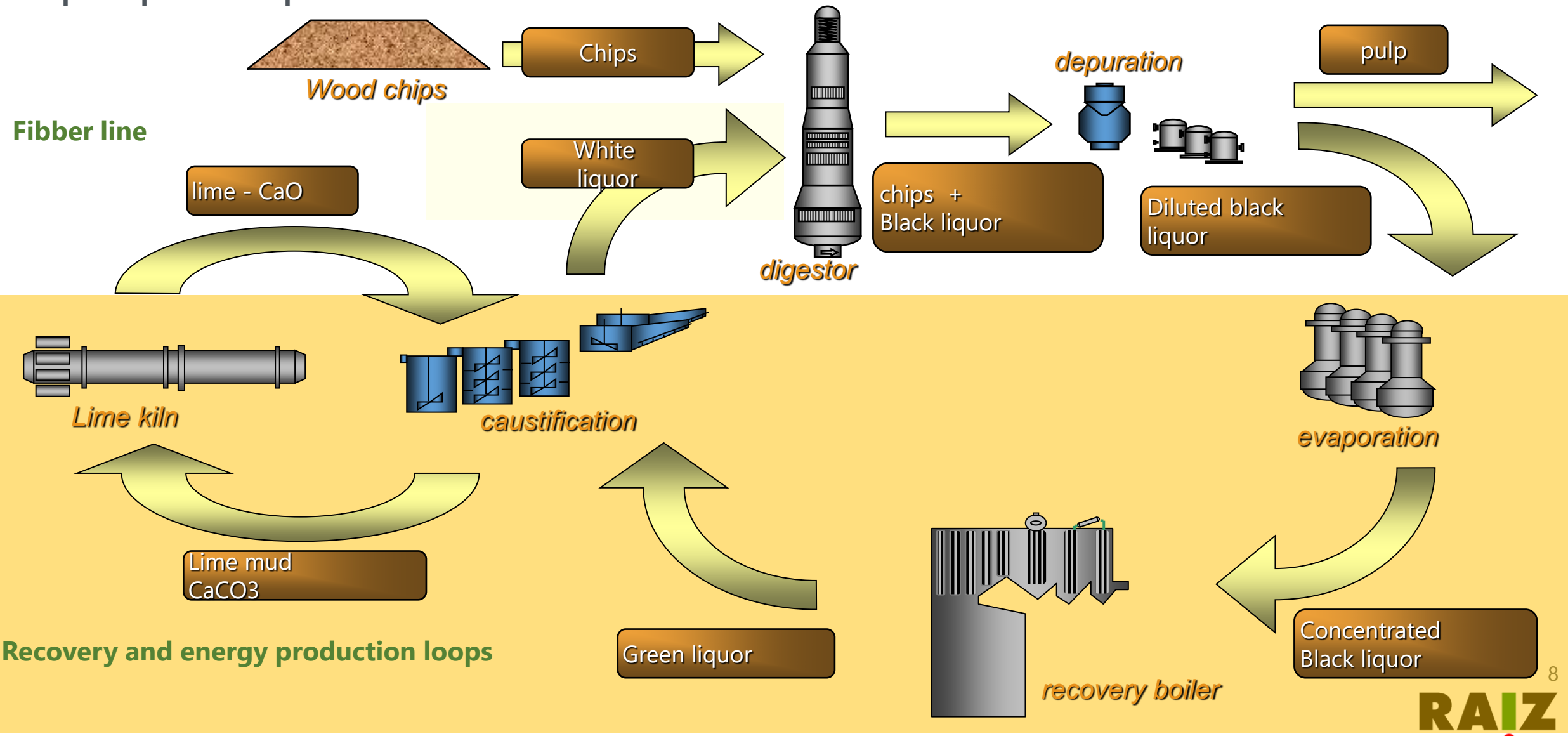
Paths and opportunities

SIDE STREAMS UPGRADE: BLACK LIQUOR

A BYPRODUCT FUELING THE P&P INDUSTRY

THE NAVIGATOR COMPANY

Pulp mill process loops:

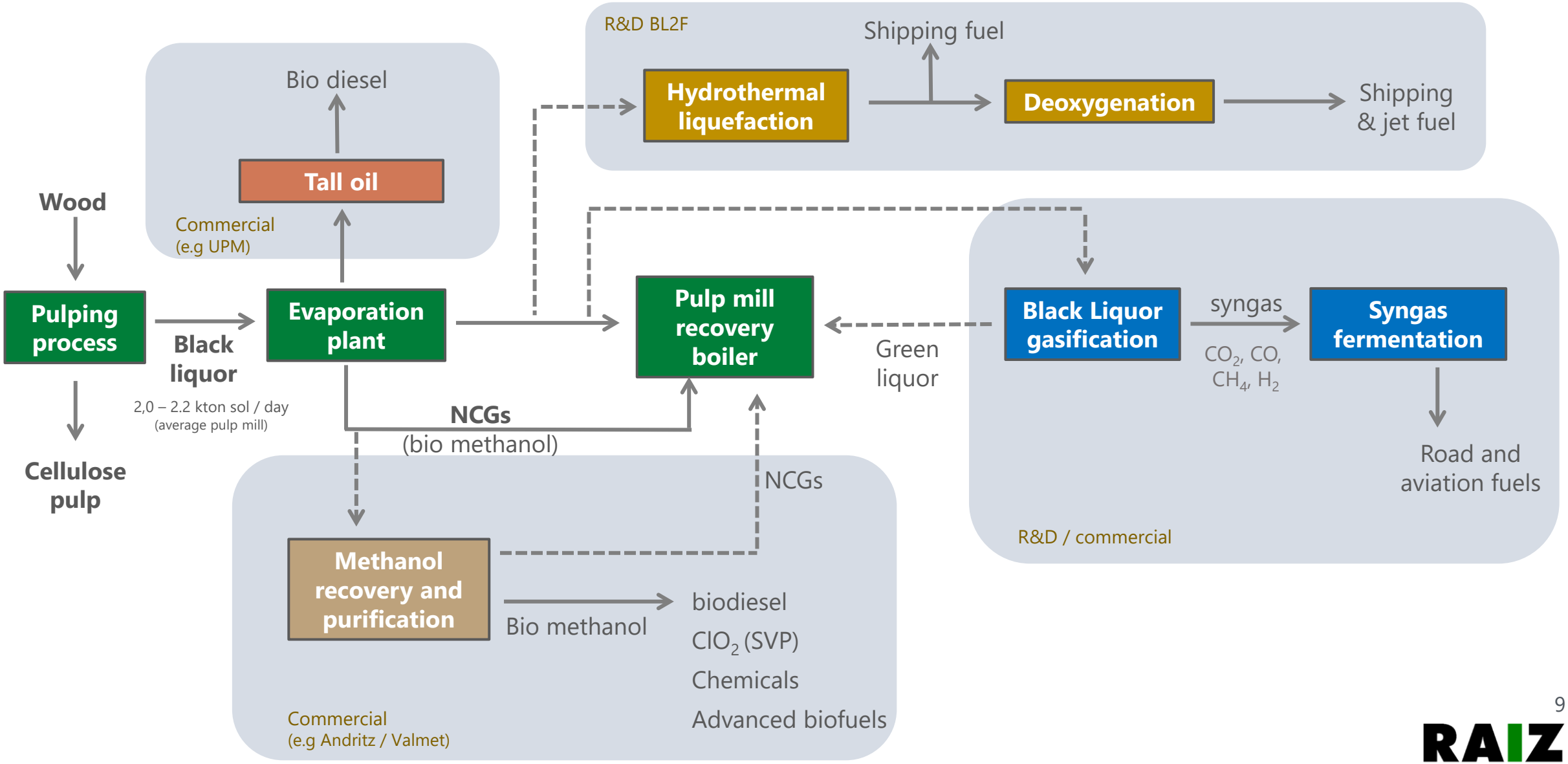


SOURCE: Seminário - UFRRJ – Aracruz - 2002

RAIZ

SIDE STREAMS UPGRADE: BLACK LIQUOR

OPPORTUNITIES



SIDE STREAMS UPGRADE: BLACK LIQUOR

CHALLENGES

Industrial black liquor upgrade advisable within / close to a pulp mill:

- BL diluted streams (before evaporation plant): higher logistic costs – water transport
- BL concentrated streams: viscosity is increased, pumping costs / difficulty may ramp up

Legislation / formalities:

- BL is a high alkali solution
- Rules and standards for hazardous products transport may be applied.

Sustainability of the pulp mill recovery loop:

- BL inorganics are recovered and reused (closed loop). Diverting BL would lead to make-up needs (economy & sustainability costs)

Threat pulp mills energy independence (thermal & electricity):

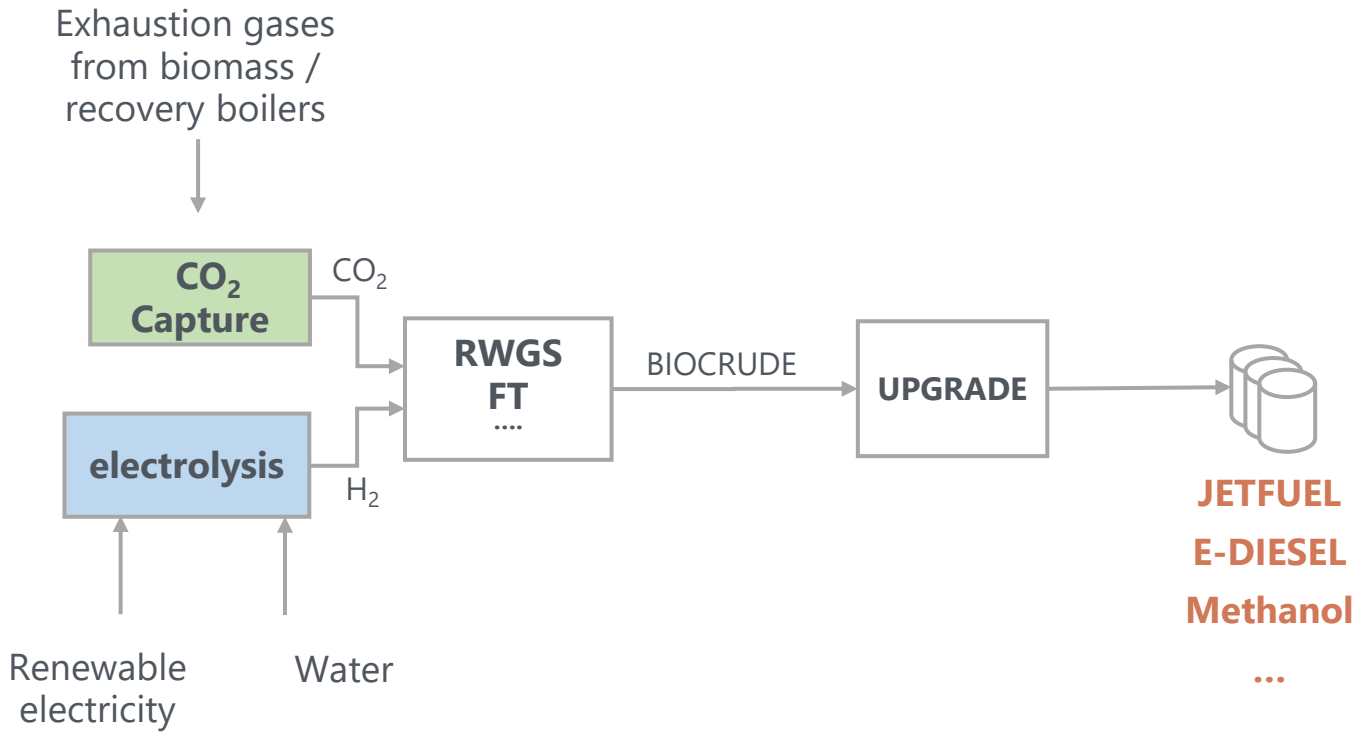
- Burning BL allows pulp mills to be energetically self-sufficient.
- How much BL can be diverted keeping the energy balance without replacement fuels requirements? May need to be assessed for each case.

SIDE STREAMS UPGRADE: "REVERSE PETROCHEMISTRY"

OPPORTUNITIES / CHALLENGES

Crude oil break down (refining) is the starting point to a relevant number of goods on use nowadays

how about build-up with simple chemical molecules "reverse petro chemistry", using biogenic CO_2 and green H_2 ?



- Pulp mills have relevant emission of biogenic CO_2
- Are normally close to railways / harbors (expedition)
- Close to fresh water sources
- Have utilities & manpower

- Technology on development (maturity)
- Still high production costs vs fossil fuels

RESIDUAL FOREST BIOMASS

A REPLACEMENT FOR FOSSIL BASED PRODUCTS

Fuels

Chemicals

Materials

Forest

Forest, pulp mill yard residues and energetic crops assessed at The Navigator Company R&D division

Fines

Saw dust

Bark

Tree branches

Willow

Acacia

Miscanthus

Eucalyptus energetic crops

Arundo donax

RESIDUAL FOREST BIOMASS VALORIZATION: THERMOCHEMICAL PLATFORM

ON GOIN WORKS @ NAVIGATYOR COMPANY

On going activities at The Navigator Company:

Pyrolysis	• R&D activities / projects •Technology survey
Gasification	• R&D activities / projects • Technology survey • Interaction with technology providers
Liquefaction	• R&D activities / projects

RESIDUAL FOREST BIOMASS VALORIZATION: THERMOCHEMICAL PLATFORM

CHALLENGES

Several R&D and pilot projects getting public funding and being announced over the last decade

but widespread industrialization seems not be taking-off

Challenges !!!

- Technology readiness level
- Biomass homogeneity and suitability for smooth process runability, (not always available at relevant quantities)
- End products stability / market maturity
- Lack of willingness from upstream players to use this products, blend / mixture at refineries
- Production costs still not competitive

Some failures / idle projects, keep present how risky can be, for private companies, to take a step further on this investments (e.g. Kior – USA, GoBiGas – Sweden).

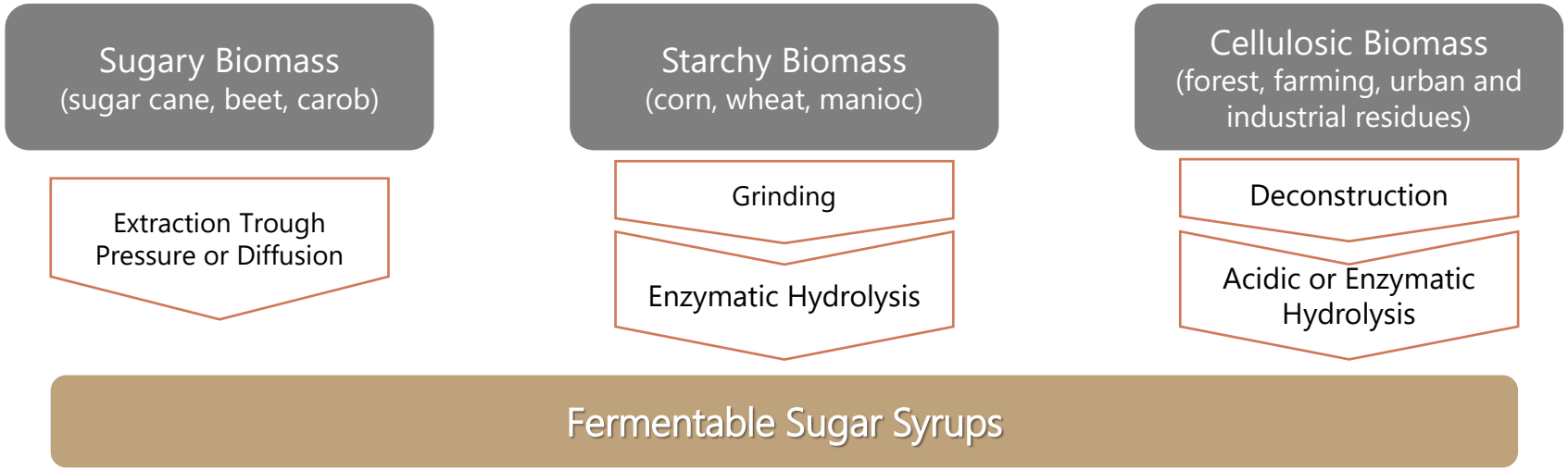
- Often public support is asked to move on, either for CAPEX or as a “feed in tariff” for the end products.

RESIDUAL FOREST BIOMASS VALORIZATION: BIOCHEMICAL PLATFORM

OPPORTUNITIES

Cellulosic bioethanol production from forest biomass: ongoing pilot tests and scale-up activities @ NVG

BIO ETHANOL – PRODUCTION PROCESSES



- Several start-ups and flagship units along last decade
- Several are idle but a few concepts are still in operation
- Bioethanol versatility as a platform chemical, a road fuel and suitability to be upgraded to SAF, may trigger this market

Clariant's bioethanol plant @ Romania

https://www.euractiv.com/section/alternative-renewable-fuels/opinion/making-european-sustainable-mobility-a-reality-with-cellulosic-ethanol/

BIOFUELS PRODUCTION @ PULP MILLS:
SUM UP

Pulp mills are able to provide utilities and raw materials for advanced biofuels production:

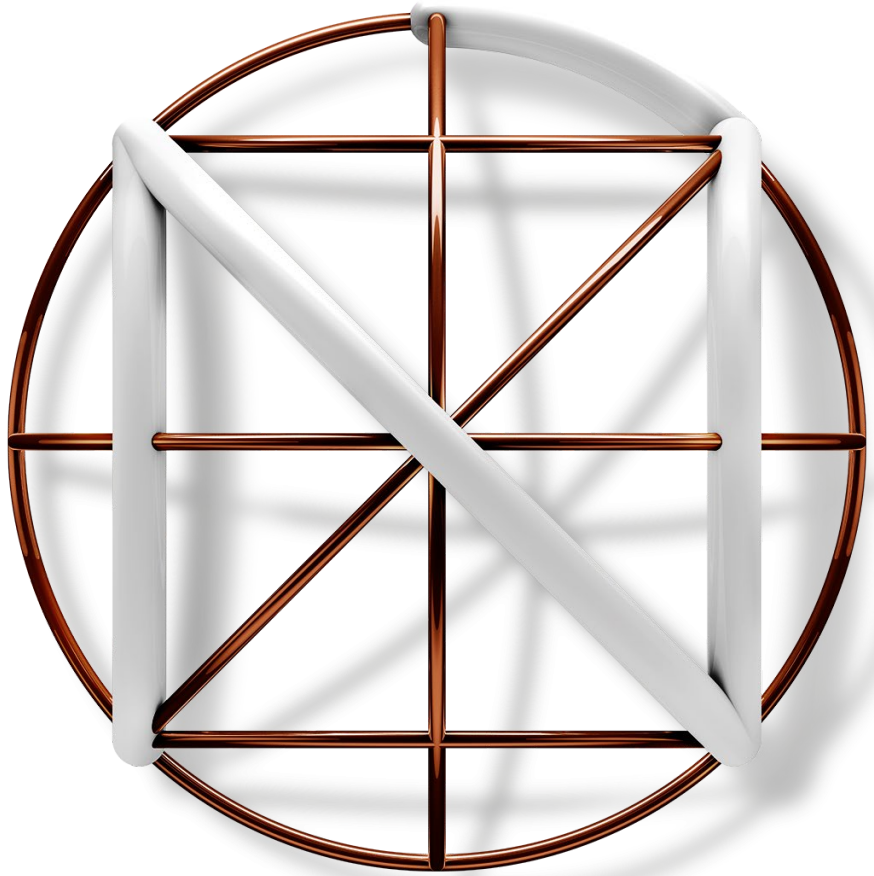
- Synergies may reduce global investment cost vs green field projects
- Have the knowledge and supply routs to source and process biomass, reducing supply risks

Nevertheless the successes of this new investments are quite dependent of:

- Technologies readiness level
- Funding (to lower investment risks)
- Market driven investment "*market pull*"

Globally, seems there are good perspectives for the advanced biofuels production:

- Several decades of R&D have brought maturity to the technological concepts.
- World population is eager for more sustainable products and policy makers are complying
- At EU, the post Covid resilience investment plan and the Green Deal, are grabbing companies attention to this investments
- The EU RED II directive, and its targets for this decade, are also bringing attention over advanced biofuels production
- There might be a path ahead full of new business opportunities



THANKS

Alexandre Gaspar