



## **TC Biomass Conference**

**Gijs Jansen**

September 2024

Thermochemical recycling of

paper sludge

to

circular mineral

and

bio-based pyrolysis liquid

# COMPANY

## Introduction



### Company highlights

- Born in Spain
- Mission: making industrial minerals circular
- Technology developer of innovative waste solutions
- Pyrolysis experts
- Office, lab and workshop in Cuijk (Netherlands)
- Coöperations with large corporates and knowledge institutes



UNIVERSITEIT  
TWENTE.

**TNO** innovation  
for life



Netherlands Enterprise Agency



Funded by  
the European Union

# CALCIUM CARBONATE TODAY

*CC filler business is a complete linear industry depleting important earth's CO<sub>2</sub> sink as CC is composed of almost 50% CO<sub>2</sub>*

Current  
**minerals are linear**,  
mined from open-pit sites and  
cause CO<sub>2</sub> emissions and  
threaten **Bio-diversity**

In Europe alone, about  
**53,000,000**  
**tons of minerals**  
are mined  
each year

This equals  
filling up almost  
  
**1 football stadium**  
**every day!**

# PAPER SLUDGE TODAY

*Paper sludge is the largest waste stream in the enormous global paper industry*

In Europe alone,  
about  
**9,000,000 tons**  
of paper sludge  
is generated  
each year

This waste is  
generated in the  
water treatment  
facilities at  
paper mills

Disposal  
requires over  
**300,000**  
truck  
movements  
each year

Incineration  
and landfilling  
generates  
substantial  
greenhouse  
gases!



# CIRCULAR CALCIUM CARBONATE

*Paper sludge contains large amounts of calcium carbonate fillers that can be mined and circulated back to large off-take market*



*Circular Calcium Carbonate (CCC)*



*Consumer Products*



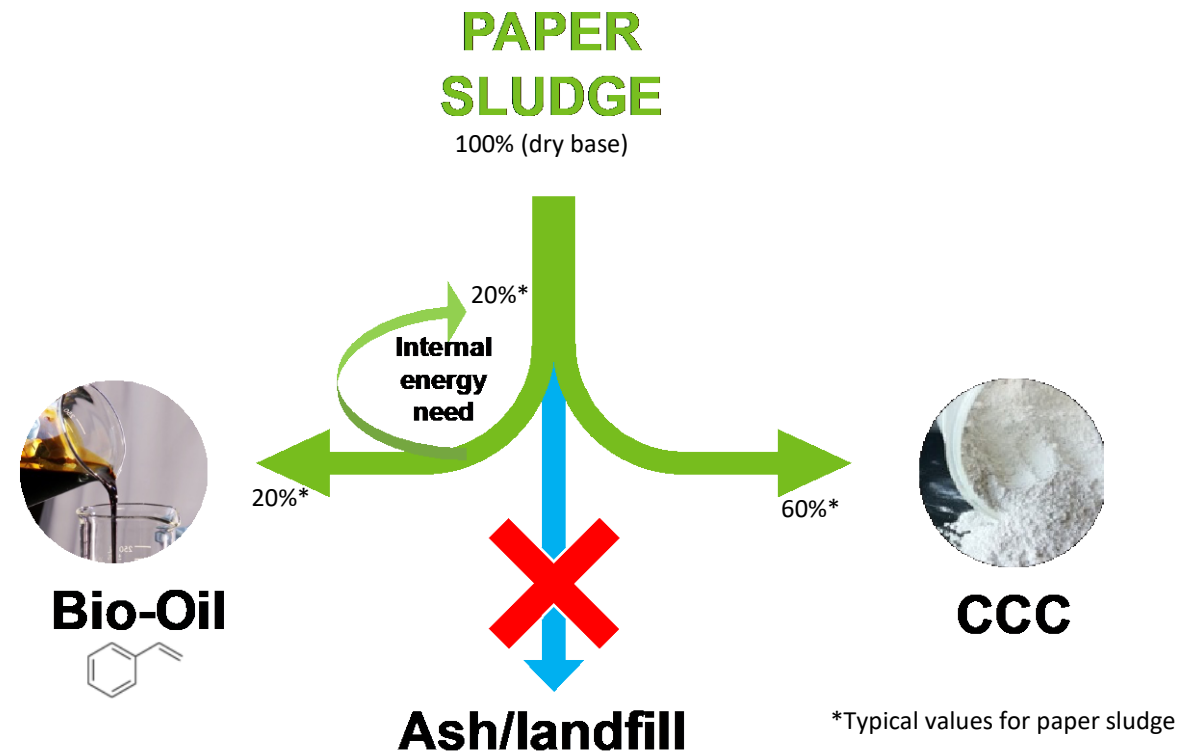
*Paper sludge waste*

# ALUCHA SOLUTION

*Patented technology turns paper sludge into CCC and bio-oils - without leaving any waste!*

## Unique selling points

- Breakthrough technology **separates** solids **AND** produces bio-liquids
- **Patented** core reactor and process turns sludge into circular and renewable products
- Part of energy from fiber fraction used for **internal energy** needs
- **Flexible** in feedstocks and location
- Substantial **CO<sub>2</sub> savings**

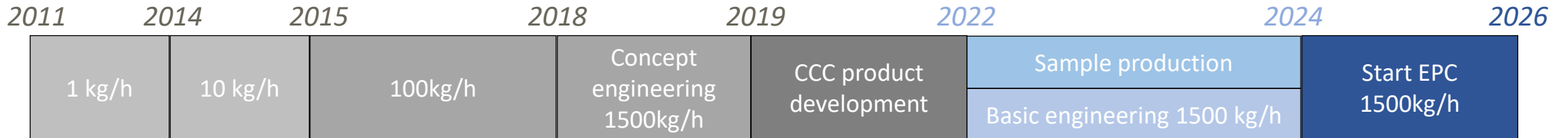
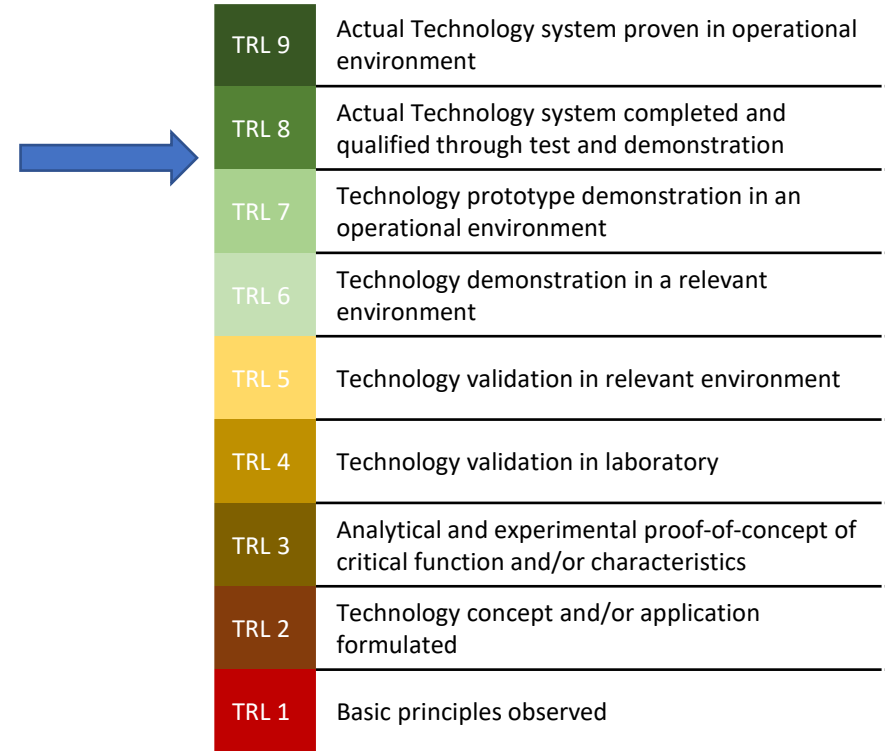


# TECHNOLOGY DEVELOPMENT

*Patented core reactor technology & process ready for scale-up to industrial size*

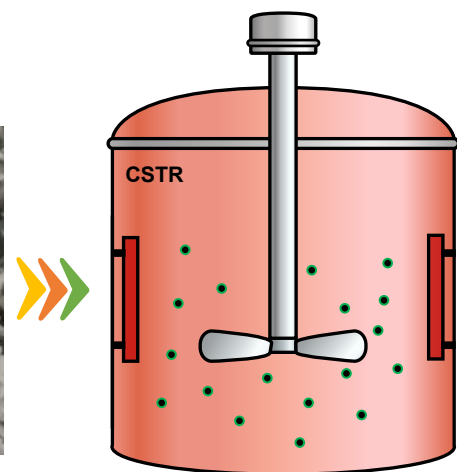
## Technology development status

- PoC completed in several R&D phases 2011-2019
  - 1 kg/h scale
  - 10 kg/h scale
  - 100 kg/h scale (Mine1)
- Pilot plant Mine1 fully tested (TRL 6-7) in 2015-2019
- Scale up & modelling of patented reactor by Univ. of Twente
- Concept & Basic engineering of 1500 kg/h plant (Mine2)
- Current status: start of EPC phase



# 1 kg/h

## Fast pyrolysis of paper sludge



**Liquid product**  
Yield: 23.7±2.2 wt. %  
(on feed basis)

**Solid product**  
Yield: 63.2±2.1 wt. %  
(on feed basis)

**Fast pyrolysis bio-liquid**  
Yield: 49.2±6.7 wt. %  
(on biomass basis)

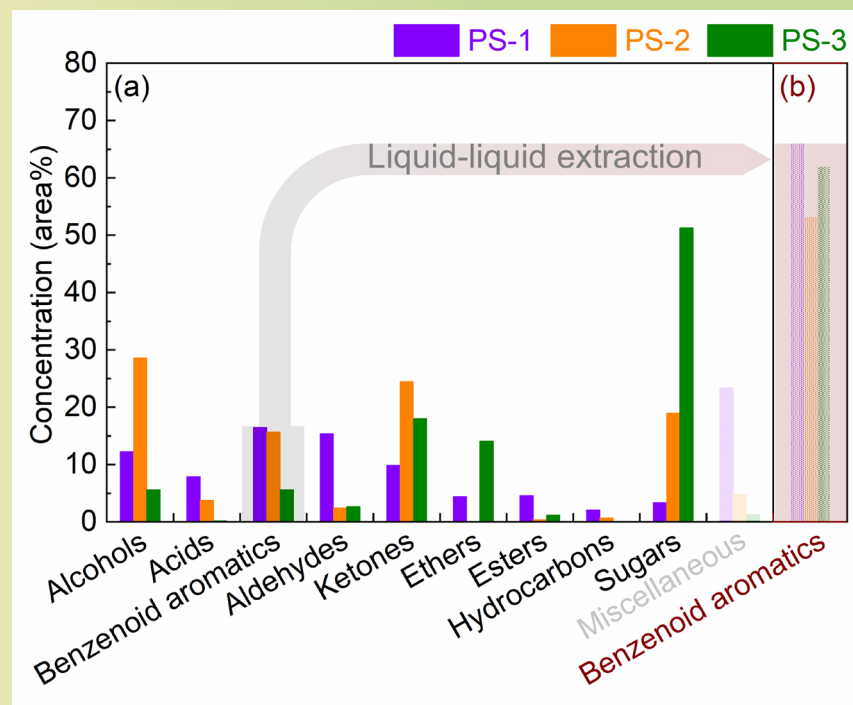
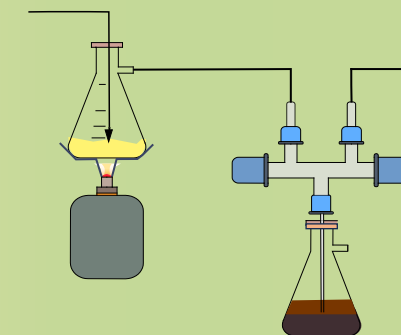
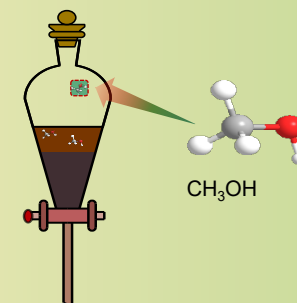


**Circular minerals**  
Recovery: 87.1±2.2 wt. %  
(on mineral basis)

## Liquid-liquid extraction of fast pyrolysis bio-liquid

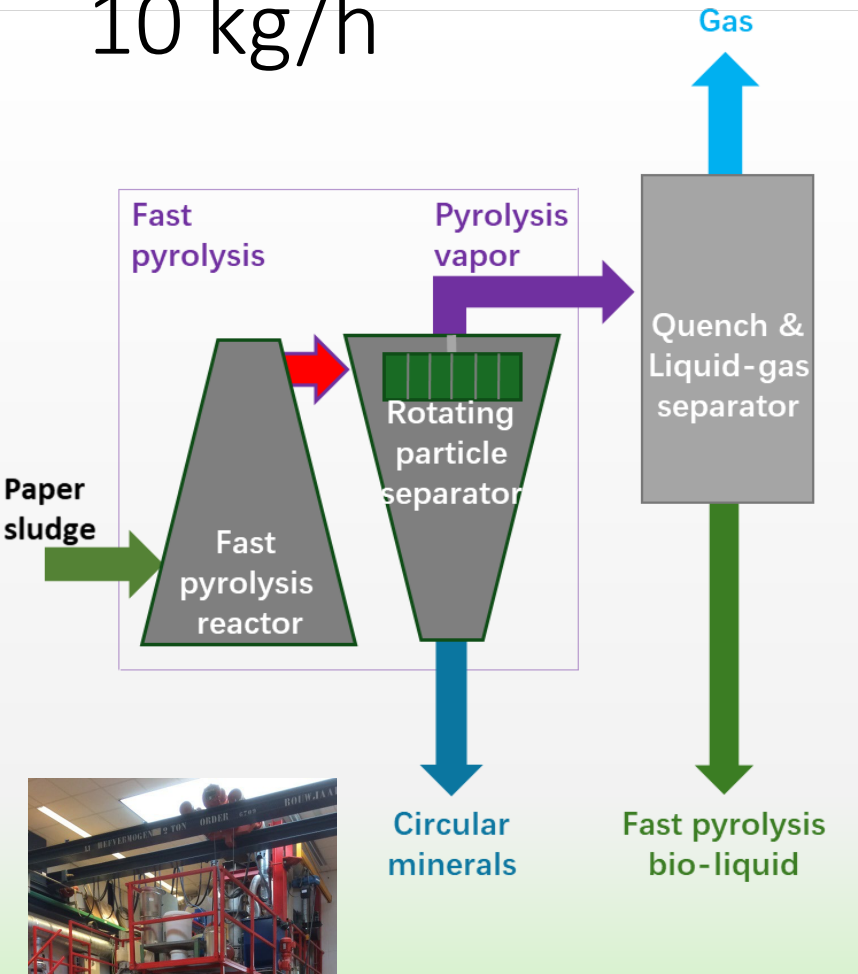
CH<sub>3</sub>OH/H<sub>2</sub>O

SO<sub>2</sub>/H<sub>2</sub>O

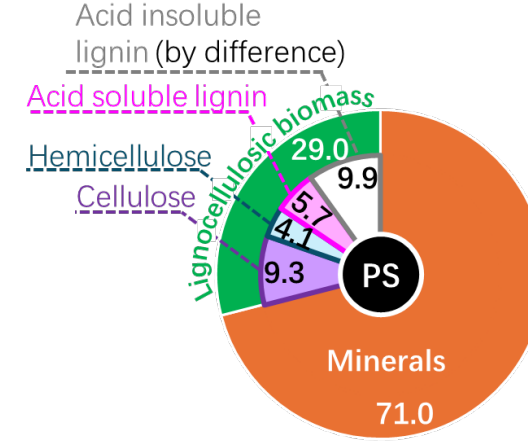




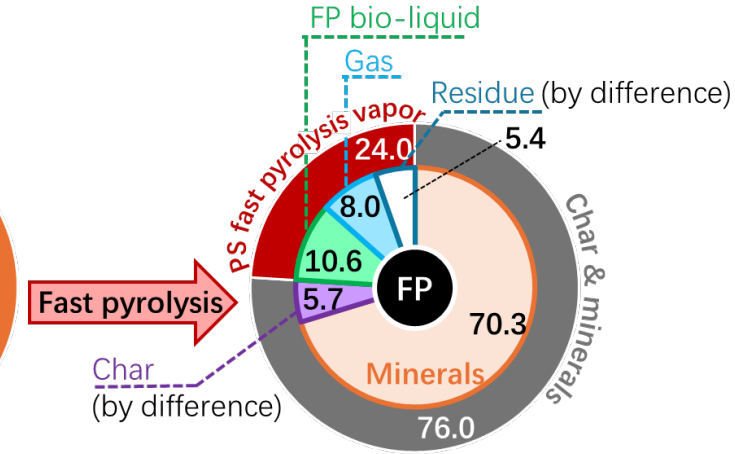
# 10 kg/h



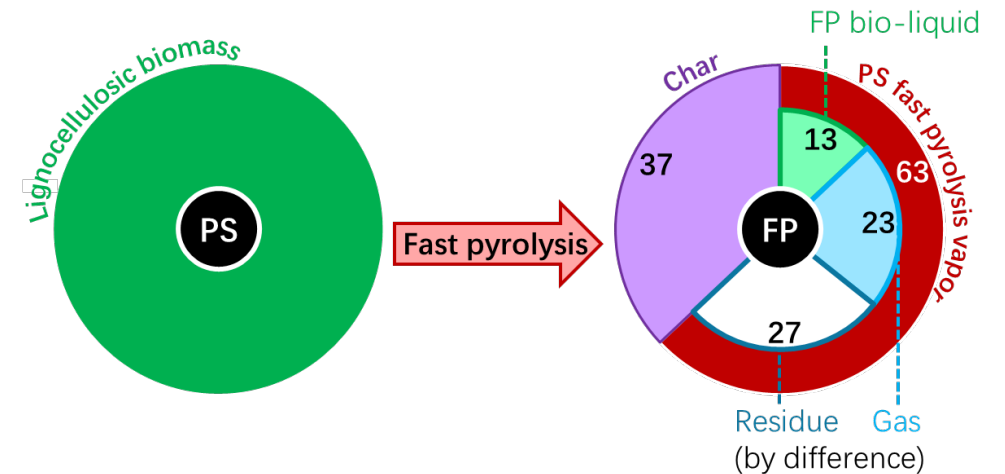
## Composition of PS (wt.%)



## Mass yield for FP of PS (wt.%)



	FP bio-liquid
<b>N (wt.%)</b>	1.3
<b>C (wt.%)</b>	16.7
<b>H (wt.%)</b>	8.8
<b>O (wt.%)</b>	73.2
<b>HHV<sub>Milne</sub> (MJ kg<sup>-1</sup>)</b>	8.4
<b>HHV<sub>Milne</sub> (MJ kg<sup>-1</sup>, on dry basis)</b>	17.2
<b>H<sub>2</sub>O (wt.%)</b>	67.0
<b>TAN (mg KOH g<sup>-1</sup>)</b>	49.1
<b>Viscosity at 25 °C (mPa·s)</b>	1.6



# OUR PRODUCT CCC

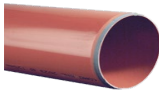
*Off takers welcome Alucha's CCC offering to meet SDGs and raise recycled content*

### CCC – recap unique product features

- 100% circular from post-consumer waste
- Substantial lower carbon footprint: we keep the CO<sub>2</sub> in the loop!
- Efficient way to increase recycled content in end products and reduce footprint & primary resources
- Circular certification in progress (f.e. ISCC+)



CCC4adhesives



CCC4pvc



CCC4rubber



CCC4cars



CCC4foil



CCC4paint



CCC4walls

# SCALE-UP ROADMAP

*From Mine1 to first industrial production plant and expansion*

Alucha is commissioning and starting up CCC production in Cuijk (NL)

2023/2024

## **Mine1 (100 kg/h)**

CCC production for larger scale production testing customers

Long test runs with other paper sludge samples

Collecting offtake commitments

2026-Q1

## **Mine2 (1500 kg/h)**

Start operations first industrial scale plant

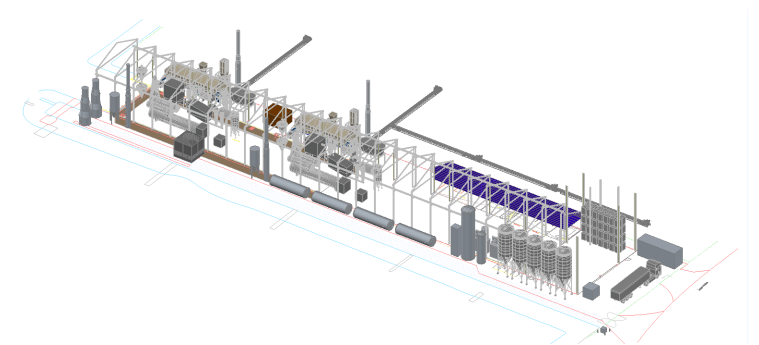
Production capacity of 20 kt/y paper sludge (wet) producing  
7 kt/y CCC

2027 >>

Further roll out & develop next mines in Europe/US

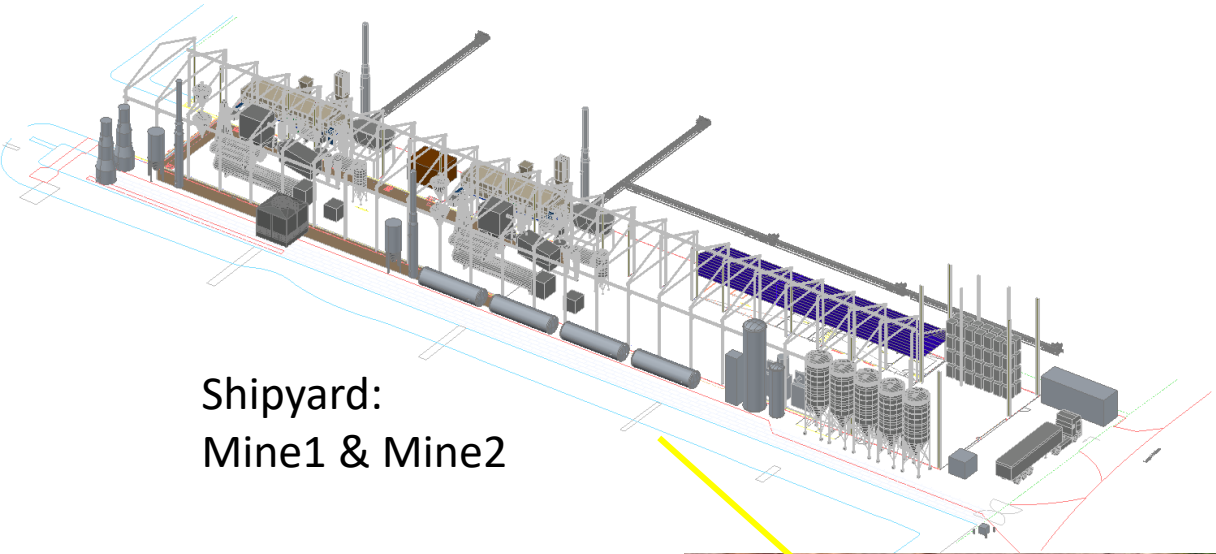


*Mine1*



*3D model Mine2*

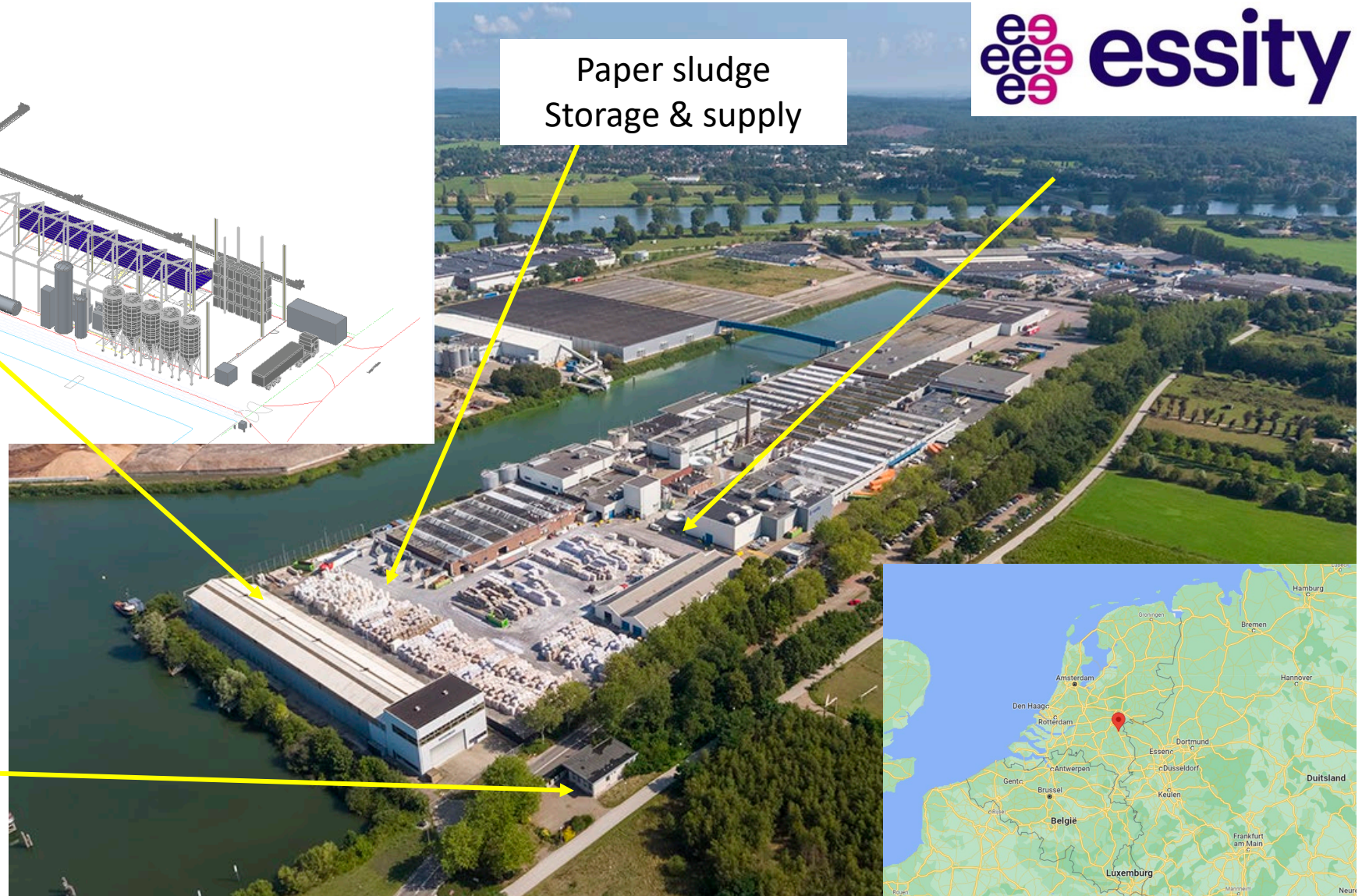
# ALUCHA IN THE NETHERLANDS



Shipyard:  
Mine1 & Mine2



Office  
building



Paper sludge  
Storage & supply

alucha

**Thank you**