



# LIGNIN INDUSTRIES AB™

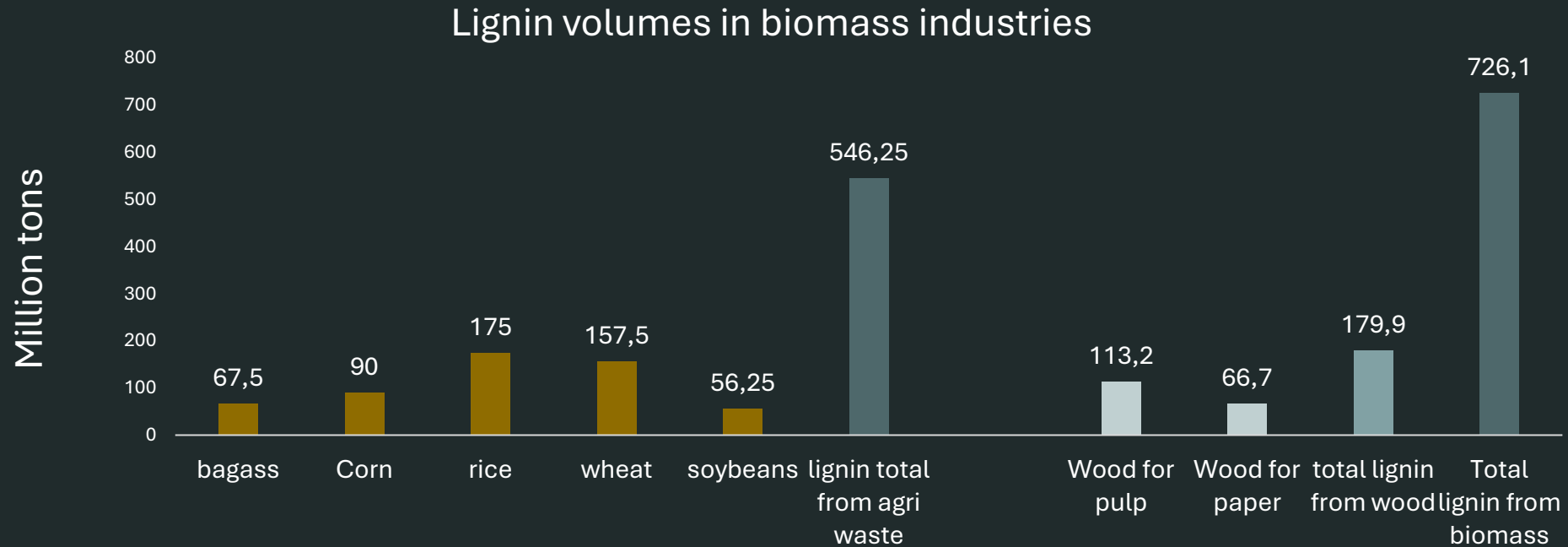
With Lignin as a base – scalable CO<sub>2</sub>-reduction in the plastics industry

# Plastic data in Sweden

- Annual consumption of plastics in Sweden is 1.3 million tons
  - 130 kg of plastics/person and year
- Sweden collects 650 k tons
  - 65 kg/person and year
- Recycled into new materials 120 k tons (year 2022 data)
  - 12 kg/person and year
- **Lignin produced in Sweden:**
  - Domsjö fabriker 100 k tons lignin production
  - Södra investing in 50 k tons lignin production
  - Sweden annually process 7 million tons of lignin in forest industry
- Scania reference: total consumption of plastics is about 35 k tons of plastics (400 kg of plastics/truck)

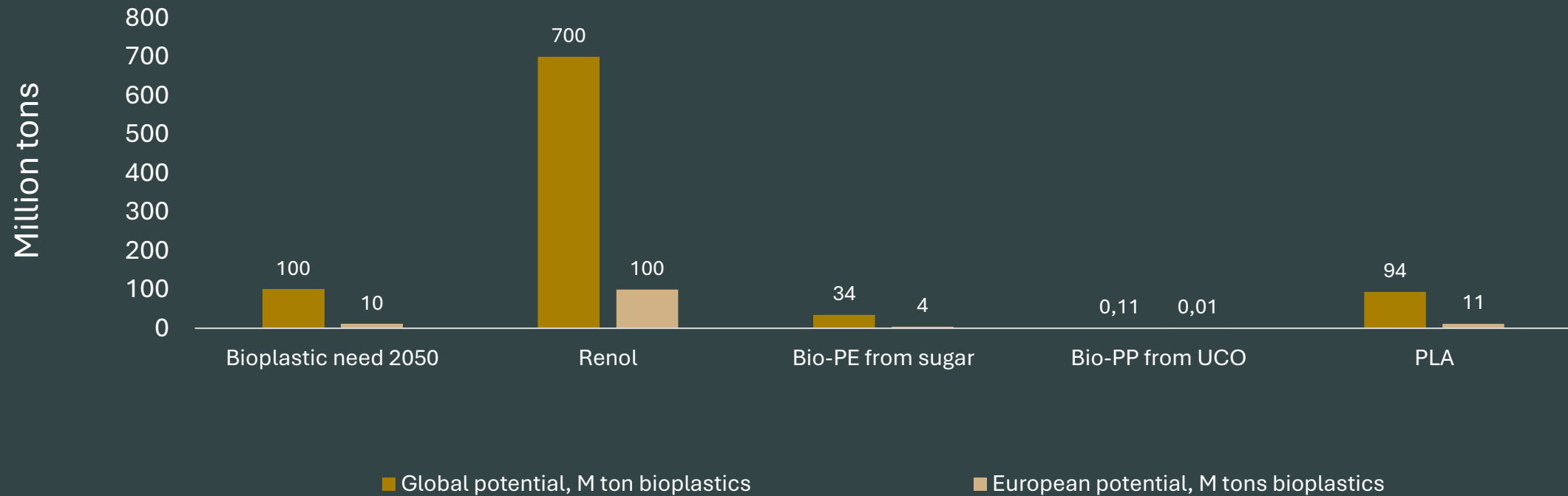


# Lignin availability

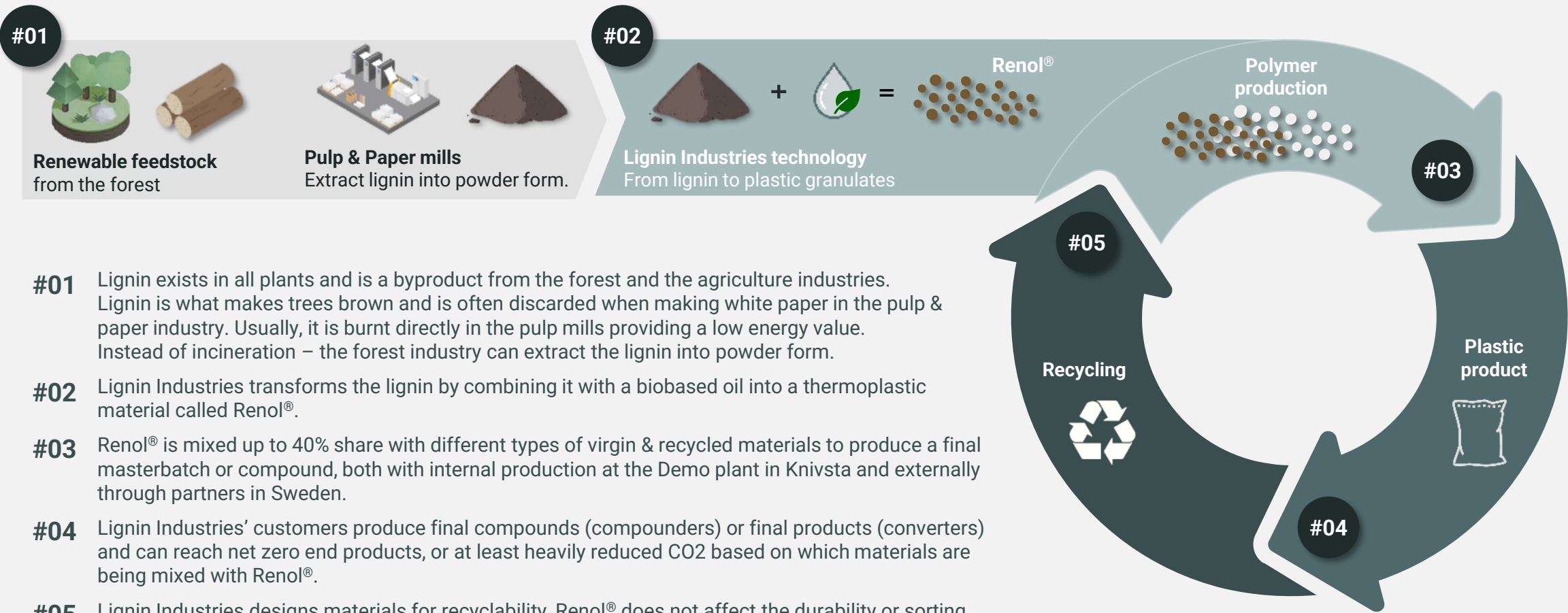


# Bioplastics potential

**Feedstock availability** (M tons of bioplastics potential) for different bioplastics if using all global production of lignin, sugar and used cooking oil UCO



# From tree to plastic



- #01** Lignin exists in all plants and is a byproduct from the forest and the agriculture industries. Lignin is what makes trees brown and is often discarded when making white paper in the pulp & paper industry. Usually, it is burnt directly in the pulp mills providing a low energy value. Instead of incineration – the forest industry can extract the lignin into powder form.
- #02** Lignin Industries transforms the lignin by combining it with a biobased oil into a thermoplastic material called Renol®.
- #03** Renol® is mixed up to 40% share with different types of virgin & recycled materials to produce a final masterbatch or compound, both with internal production at the Demo plant in Knivsta and externally through partners in Sweden.
- #04** Lignin Industries’ customers produce final compounds (compounders) or final products (converters) and can reach net zero end products, or at least heavily reduced CO2 based on which materials are being mixed with Renol®.
- #05** Lignin Industries designs materials for recyclability, Renol® does not affect the durability or sorting of materials and goes straight into recycling streams to become new products.

# From tree to plastics

**VINNOVA**

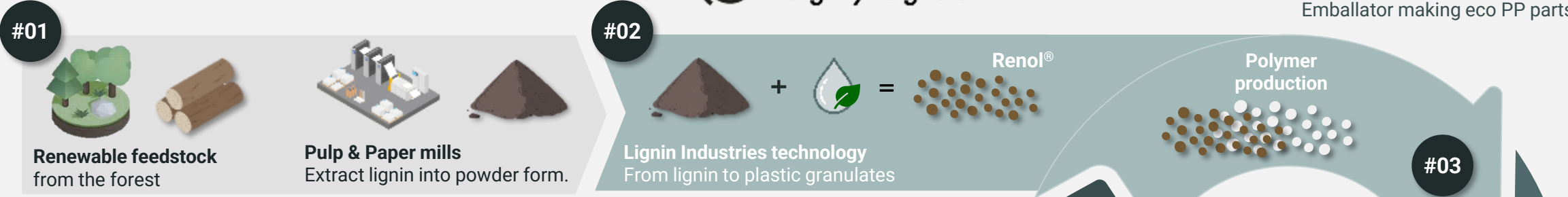
Sveriges innovationsmyndighet

**Sustainable plastics**

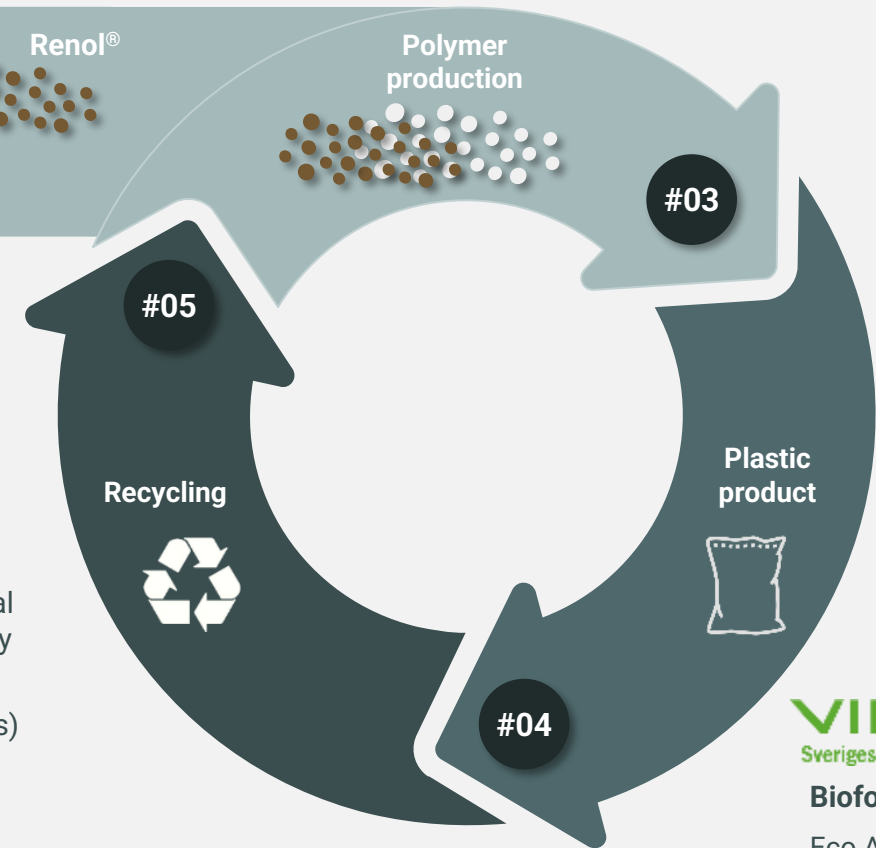
Trioworld making eco PE- films

Thevinyl making eco PVC parts

Emballator making eco PP parts



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**VINNOVA**

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**Bioform**

Eco ABS

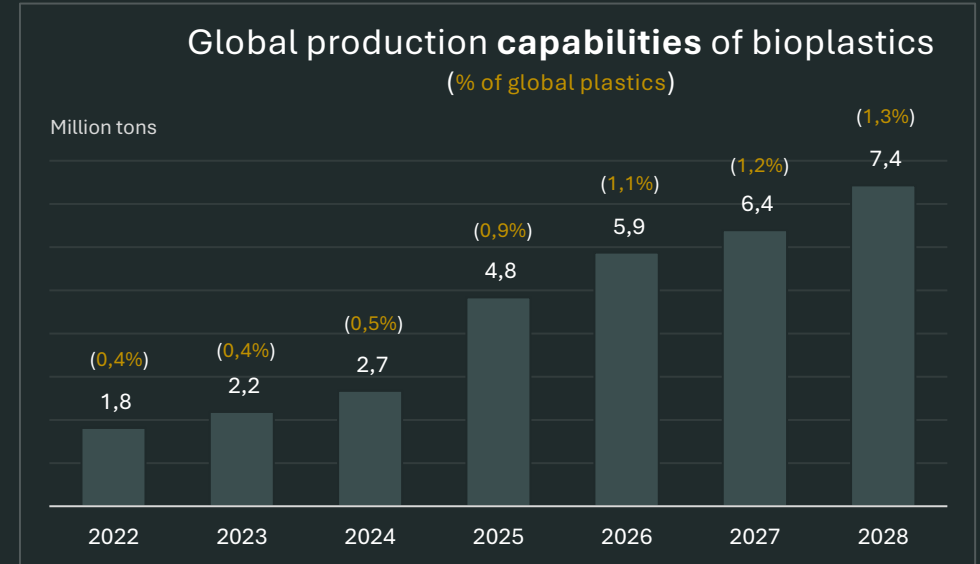
Scania, KTH, SLU and Autoform automotive

**LIGNIN**  
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# Bioplastic market is small due to low incentives for change and poor performance

- » For bioplastics to advance, some key requirements are needed.
  - **Ease of implementation:** Similar to fossil plastics in both material properties and processability
  - **True sustainability:** Recyclable, resource efficient in all aspects, low CO<sub>2</sub>
  - **Low cost and high scalability:** Low cost and CAPEX, scalable raw material

At 30 ktons/yr we will achieve unit cost leadership



Proprietary technology

# Carbon neutral end products can be produced by mixing Renol<sup>®</sup> with recycled plastics

LCA - total Carbon Footprint of RENOL<sup>®</sup>

**-1,90 kg** CO<sub>2</sub>-eq./kg

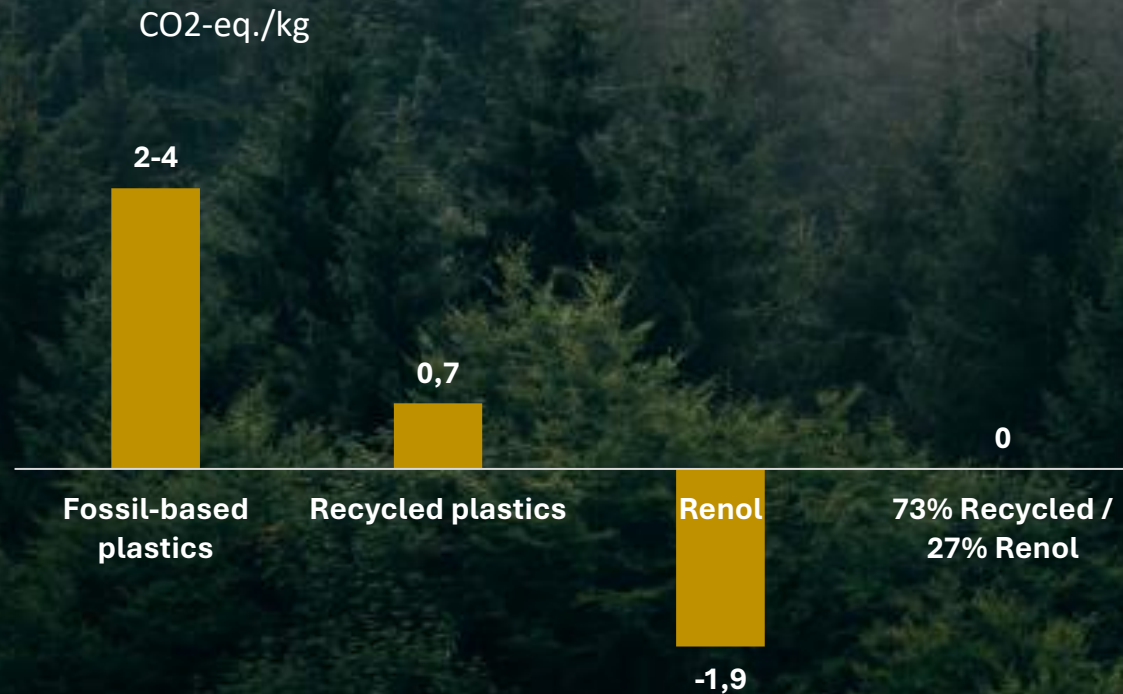
Manufacturing  
RENOL<sup>®</sup>  
0.43 kg CO<sub>2</sub>

GWP is 0,43 kg CO<sub>2</sub>-eq./kg  
during the production of 1 kg  
RENOL<sup>®</sup> pellets

Biomass carbon  
stored in RENOL<sup>®</sup>  
-2.33 kg  
CO<sub>2</sub>

1 kg RENOL<sup>®</sup> contains -2.33  
kg CO<sub>2</sub> of stored biogenic  
carbon content

Potential to make plastics CO<sub>2</sub> neutral



# After 5 years of development, Lignin Industries is now commercialising with multiple sales-ready products

## **November 2023 Polyethylene (PE)**

- » Since November 2023, Lignin Industries is marketing net-zero CO2 eCom bags
- » “Whole-product concept” developed to create a new sub-category in eCom packaging
- » eCom bags are fully recyclable

## **January 2024 ABS**

- » In January 2024, Lignin Industries secured the first larger commercial agreement of 300 tons over two years
- » This contract primarily supports industrial uses such as EV chargers, heat pumps, vacuum cleaners, pallets, and trays
- » Few bio-based options

## **Q2 2024 Polypropylene (PP)**

- » Strong features with at least 30% Renol® content and solid properties
- » Commitment to sustainability, having produced net-zero CO2 master batches
- » +20 customer projects on-going

# Hypergrowth through External production in existing infrastructure

## Industry standard equipment

- » Lignin Industries use a standard plastic industry extruder, that has been adapted for our process.
- » However, since building our demo plant, the process has been developed to fit in a standard extruder.



## Volumes from External production in standard process

- » Installed overcapacity on a global basis is estimated to be between 50 – 100 million tons
- » Can be compared to the global production of plastics which is 500 million tons

Building a new plant takes about 2 years and requires extensive capital  
Using existing infrastructure enables an asset light business model with low risks that can scale fast in any geography

# Summary

1

Unique solution for large CO<sub>2</sub> reduction in ordinary plastics (PE, PP and ABS)

2

Large availability of lignin raw material ~ 700 million tons/year

3

Large increase of biomass value from €<100/ton (incineration) to €500/ton.

4

Ramp-up with already existing infrastructure in the plastic industry which enable speed with small investments

5

Unit cost leadership to compete at large scale in plastics





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