Asociación Española de Fabricantes de Pasta, Papel y Cartón

La ruta de descarbonización del sector papelero en España

Rodrigo Álvarez. Director de energía e innovación

Pulp & Paper at EU level - Cepi

500 pulp, paper and board producing companies

895 mills across Europe of which **139** biorefineries

180.000 people employed directly

19 member countries

21,7 % share (35,2 Mt pulp + 85 Mt paper) of global production

Working across the value chains – from forest owners to converters

2022

P&P sector - SPAIN

Turnover

6.991 Millons €

Investments

6,9% VS total turnover

Production

69 Paper mills

10 Pulp mills

Paper **6,3** millon t
(40% export intensity)

Pulp **1,5** millon t
(62% export intensity)

Jobs

92% Permament jobs

Direct **16.968**

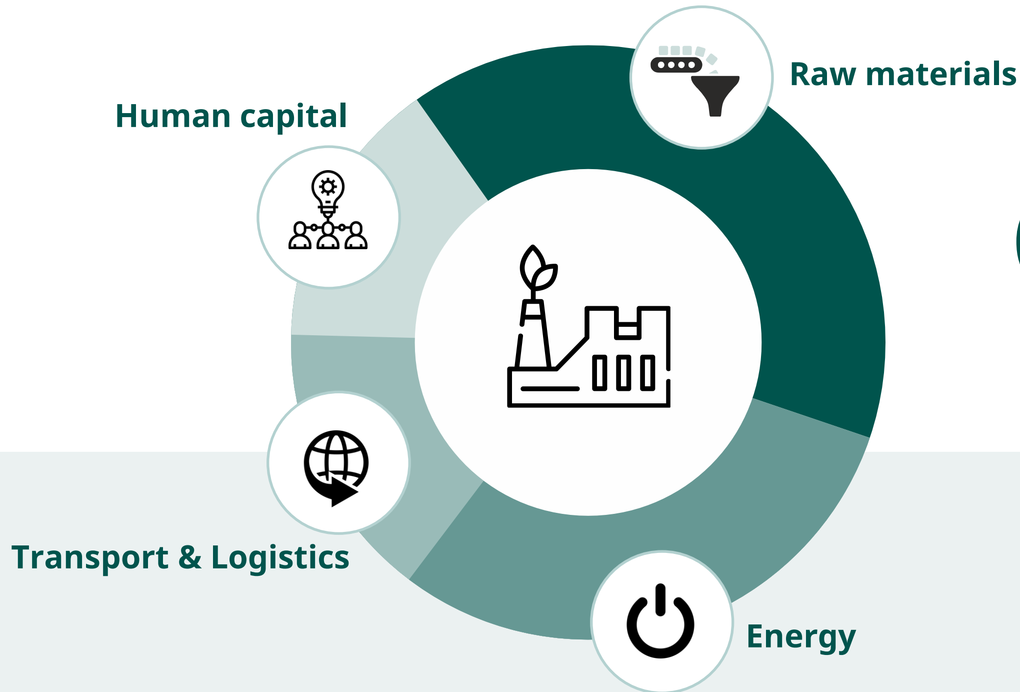
Indirect **84.000**

<u>Position in Europe</u>

6º	3º	5º
Paper producer	Recycler	Pulp producer

Value Chain

4,5 %	8,8 %	2 %	18,5 %	1,8 %	13,2 %
Spanish GDP	Total Industrial turnover	Total employment in Spain	Industrial jobs	Tax Revenues in Spain	Out of Industrial added value



Costs

Typical structure of operating costs in a factory

40% Raw materials

30% Energy

15% Transport & logistics

15% Human capital

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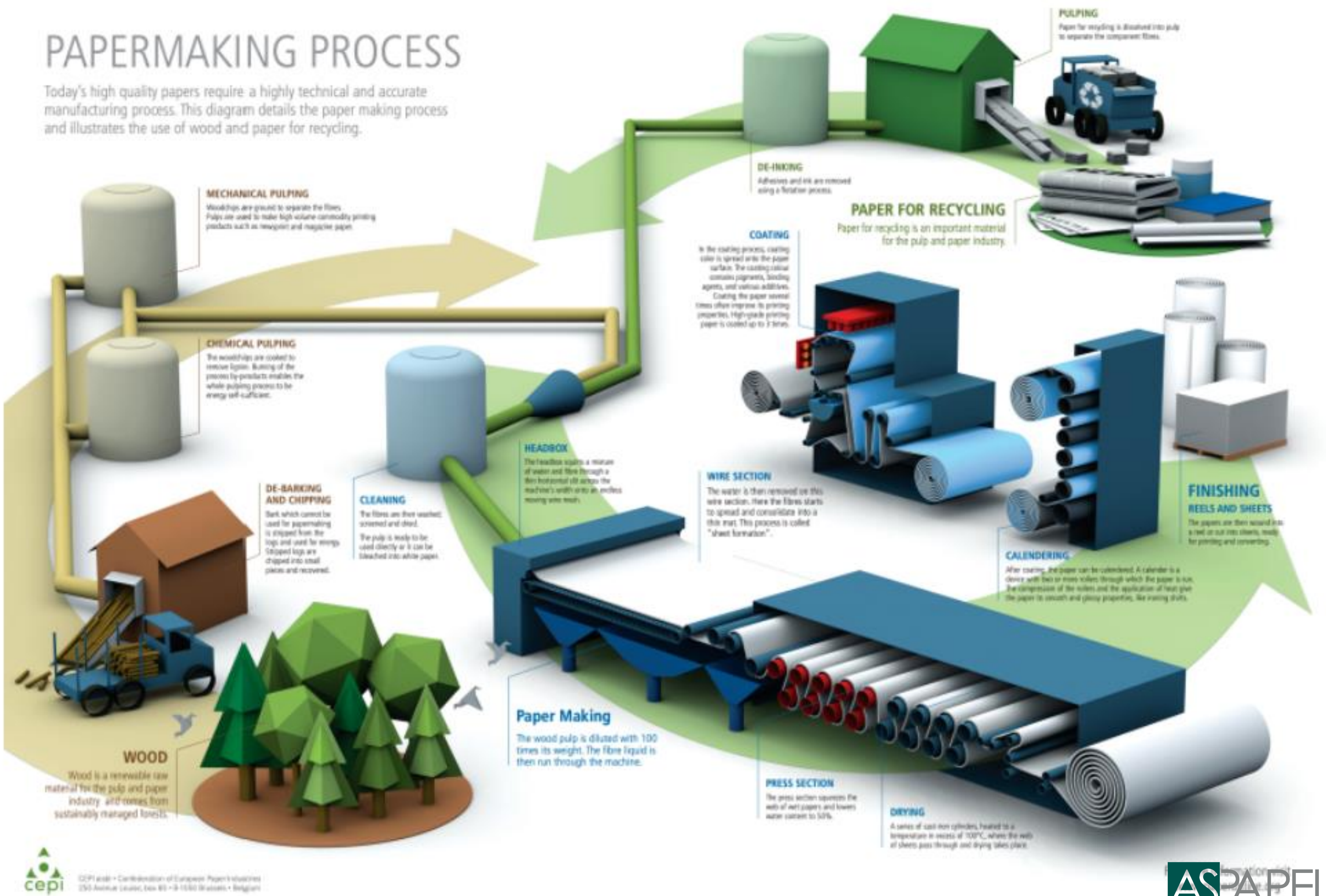
P&P sector | Leading circular economy



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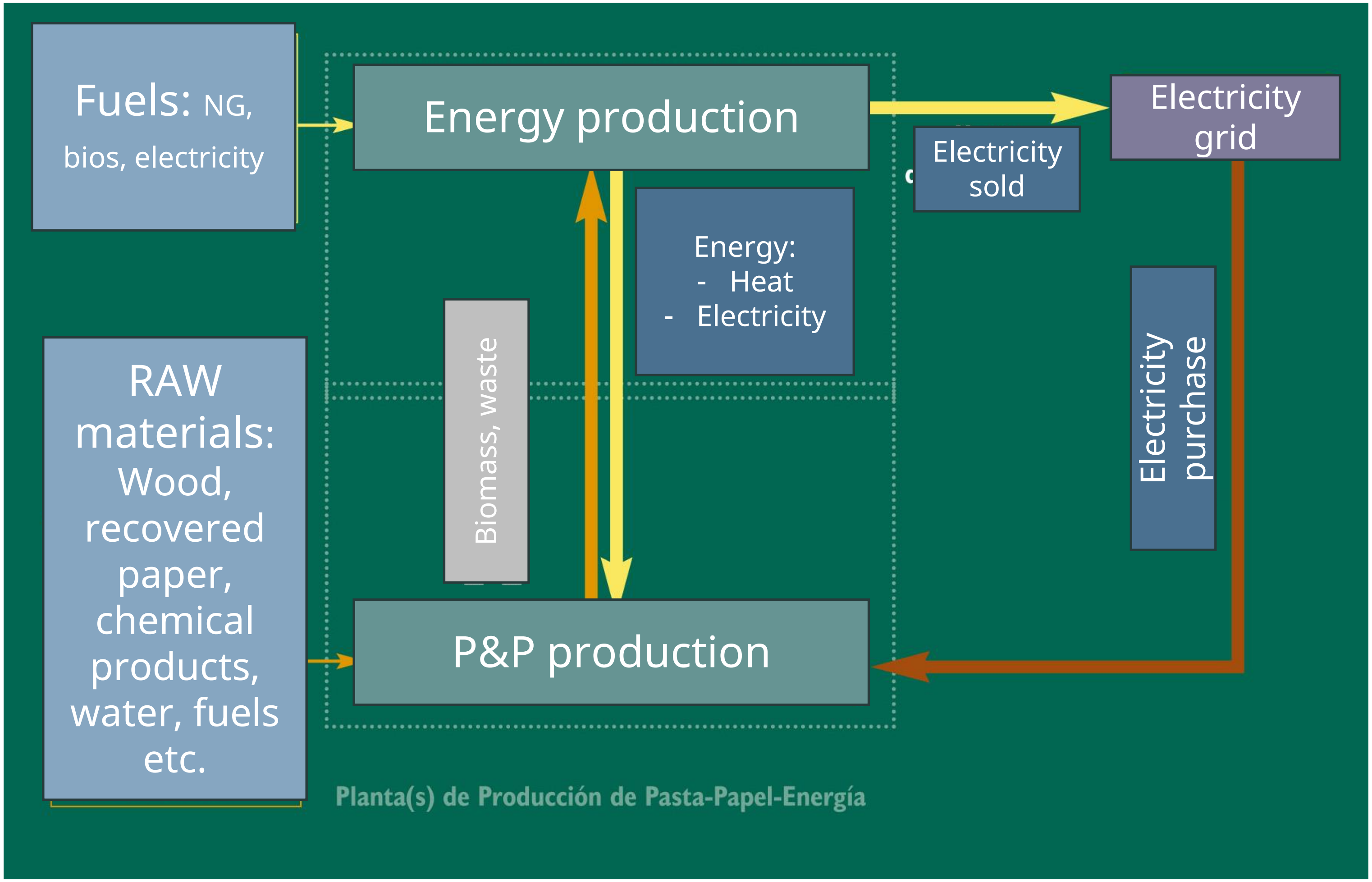
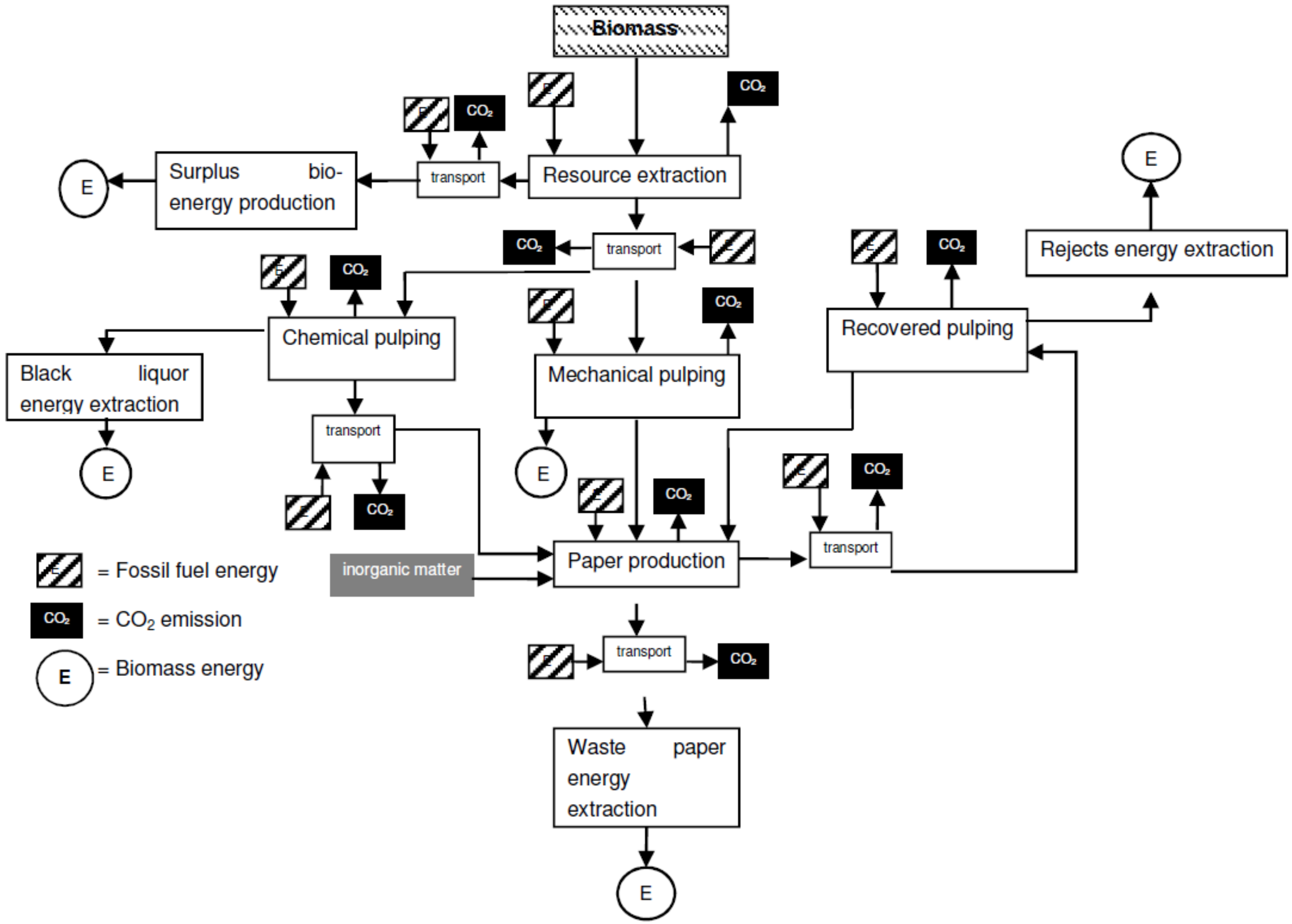
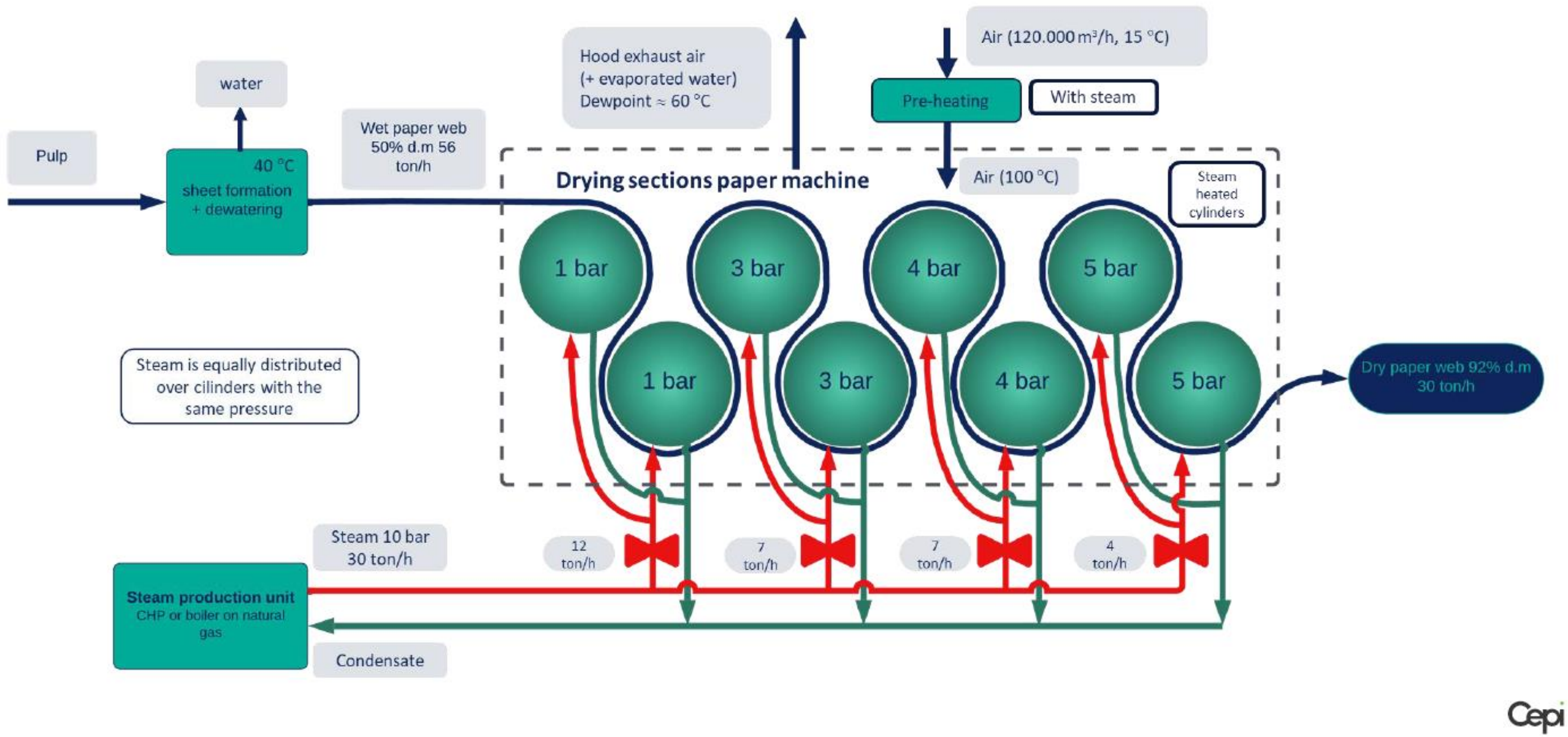

Fuels: NG,
bios, electricity
Energy production
Electricity grid
Electricity sold
Energy:
- Heat
- Electricity
Biomass, waste
Electricity purchase
RAW materials: Wood, recovered paper, chemical products, water, fuels etc.
P&P production
Planta(s) de Producción de Pasta-Papel-Energía

Energy & CO2 emissions in the process

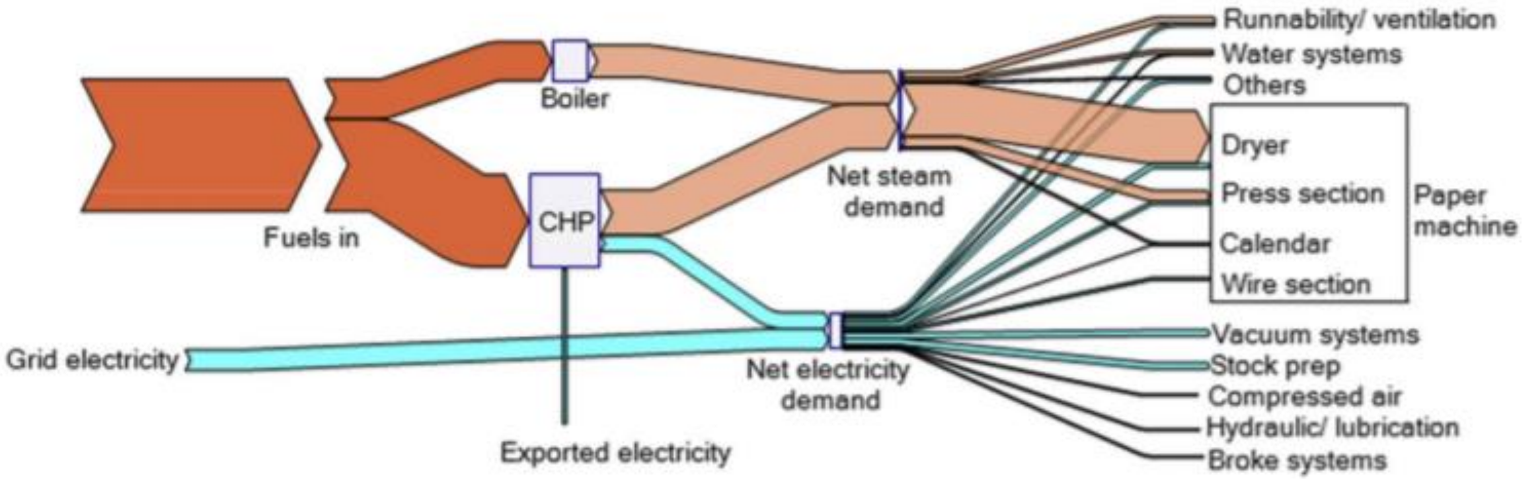


Jobien Laurijssen, 2013

Virtual average paper mill



Source: CEPI



Sankey diagram paper mill UK

Industrial decarbonisation of the pulp and paper sector. Paul W. Griffin, 2018

P&P sector | Energy consumption per product

(GJ/t) Prospective scenarios for the pulp and paper industry. JRC, 2018

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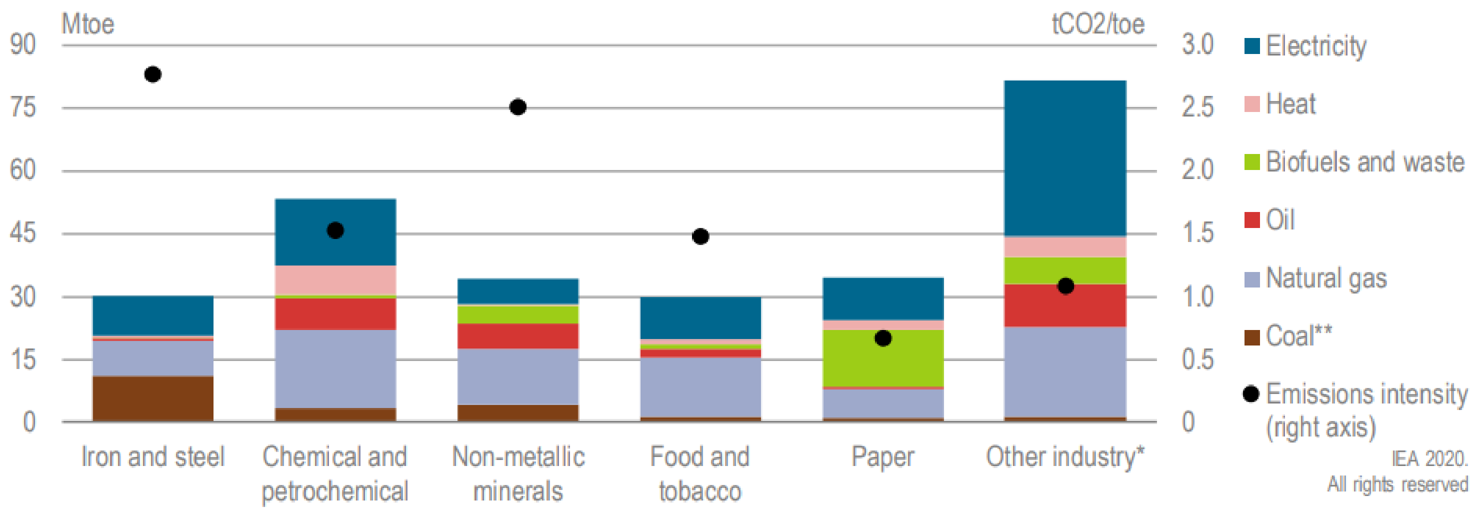
Industrial energy consumption & CO2 emissions

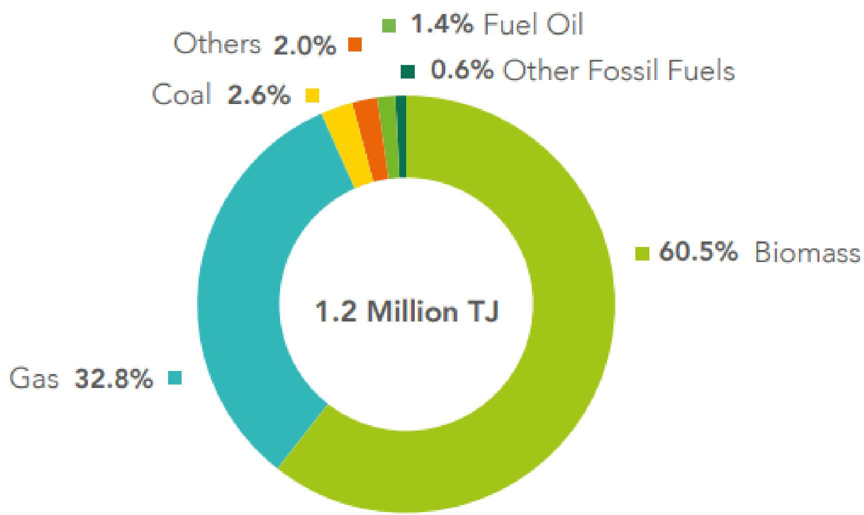


Energy consumption & CO_2 intensity emissions per industrial sector

IEA, EU Review 2020

Energy indicators | European Union

Fuels Consumption in 2021[1]

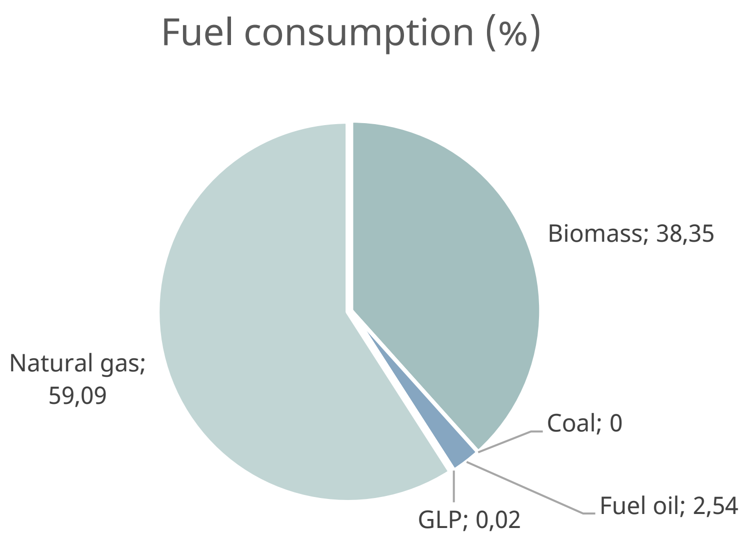


[1] Excluding Hungary, Romania & Slovenia - excluding Poland before 2003
2022 data will be available end-2023
[2] CHP: combined heat and power (compared to total on-site electricity generation)
[3] Share of total primary energy consumption (including net bought electricity)

Total fuel consumption: 334,4 TWh (2021)
Total electricity consumption: 93,4 TWh (2021)

Main energy indicators 2021. Source: CEPI 2022

Energy indicators | Spain



Total fuel consumption: 21,6 TWh (2022)

Electricity consumption

4,37 TWh

Elec. gen. VS consumption

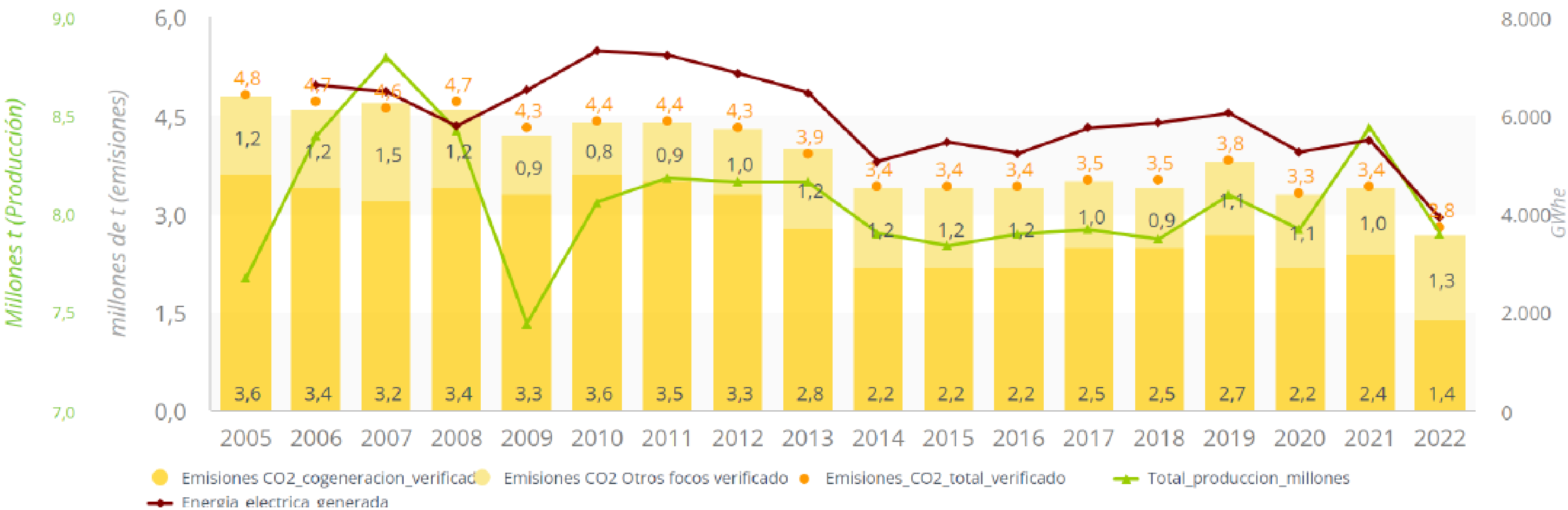
0,89

Energy efficiency

0,55 MWhe/t

Main energy indicators 2022. Source: ASPAPEL 2023

P&P Sector | Energy production & CO2 emissions



Source: ASPAPEL

Since 2003:

- We have cut emissions by **39%**
- reduced energy consumption by **15%**
- became the largest industrial generator and user of renewable energy with a share of **60%**

The overall and positive climate effect of the wider European forest-based sector is estimated at -806 million tonnes (net) of carbon dioxide equivalent annually. This corresponds to mitigating 20% of all fossil emissions in the European Union

Photovoltaic

Renewable cogeneration

Biomass

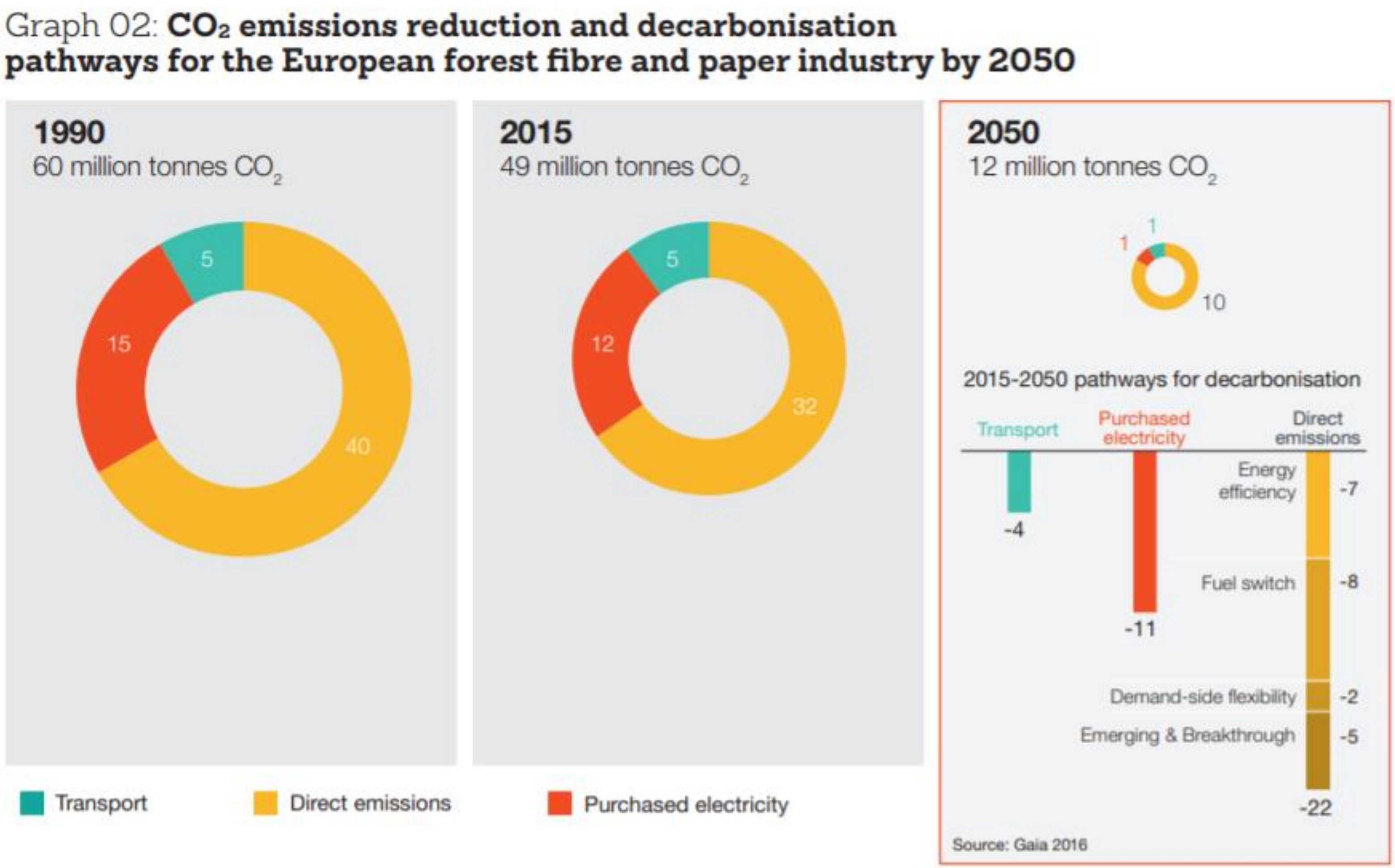
Heat pumps

Solar thermal

Biogas&Biomethane

A SOLUTION TAILORED FOR EACH SINGLE INSTALLATION

Competitive decarbonisation of electrical & thermal demand



Source: CEPI, 2021

Competitive decarbonisation of electrical & thermal demand

The carbon saving technologies	SHORT TERM Up to 2025 – Best Practices and Operational excellence	MEDIUM TERM Up to 2030 – Modular innovations	LONG TERM After 2030 - Breakthrough Technologies	CROSS-CUTTING 2025-2040 Integration of cross-cutting technologies
The technological innovation concepts	• Lightning • Data automation and control • Improved mechanical dewatering • Water and heat saving through inline water cleaning • Drives and valves • Adjust pressure levels • Personnel training and behaviour analysis • Heat recovery by heat exchangers • Electrification • Direct renewable heat sources • Raw material replacement	• Mild repulping technologies • More effective fibre refining technologies • Innovative mechanical dewatering technologies • Advanced process control, machine learning and digital twins • Heat storage during breaks • Electric drying assisting technologies • Demand side flexibility • Hydrogen to increase pulp mills product portfolio • New systems eliminating or minimizing the use of vacuum	• Integral drying and heat recovery processes • Paper making without water • Water removal without evaporation • Mild pulping processes, e.g. by Deep Eutectic Solvents	• Industrial components (boilers, pumps, valves, compressors, fans, conveyors… all of which systems typically contain motors and drives) • Heat pump technologies • Industry 4.0: digitalisation and machine learning • System integration • Industrial symbiosis • Renewable energy systems (e.g. Solar thermal, hydrogen, nuclear)
Activities	Facilitate exchange of knowledge • Best practice sharing meetings • ESF toolkit • Industry discussion meetings • Online database with Best Practice stories	Facilitate consciousness + implementation • Technology carrousels with suppliers • Pilots and demo's among the European paper industry	Realise joint development programmes • Create public funding opportunities • Set up joint development programmes • Acquire innovative ideas	Cooperation with and between the (new) equipment suppliers for integrated solutions
Average savings to be expected	10%	25-30%	>50%	5-100%

Source: CEPI, 2021

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P&P sector

Energy structure & Decarb potentials

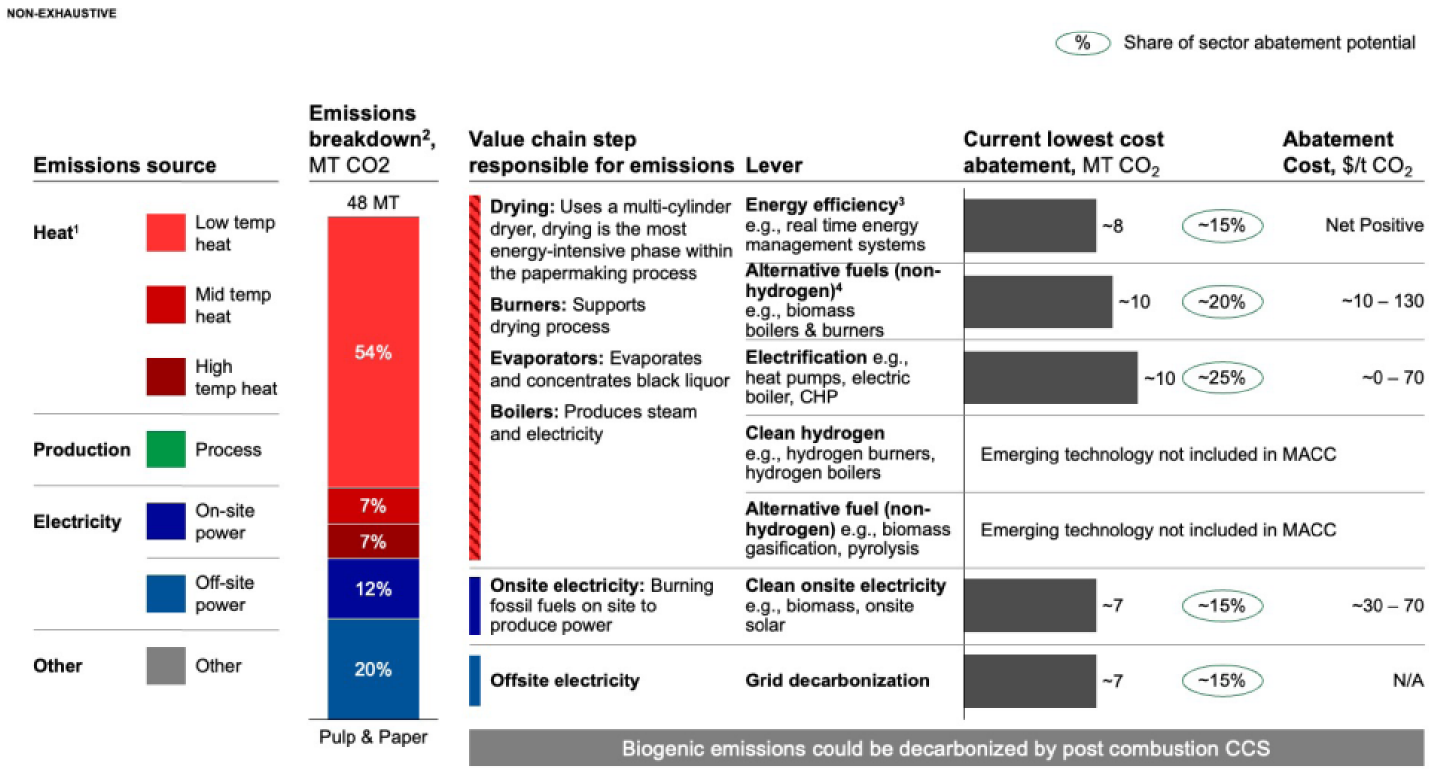


Figure 3.6.1: Pulp and paper production emissions can be abated with energy efficiency measures, alternative fuels, and electrification. | 1. Temperature ranges are defined as low-temperature heat (-30°C to 200°C), medium-temperature heat (200°C to 400°C), and high-temperature heat (400+°C). | 2. Breakdown of 2021 pulp and paper production emissions | 3. Energy-efficiency levers could include real-time energy management systems, air dryers, variable speed drivers, turbo blower pumps, new-technology pulper, radial blowers, mechanical vapor recompression, stationary siphon and drying bar | 4. Includes biomethane boilers (brownfield), biomass burner, RDF boiler, biomass boiler, and biomethane burner (brownfield).
Source: FisherSolve Next 4.0.23.0301, expert interviews

Liftoff – Industrial decarbonization – 2023

Big challenges, and opportunities

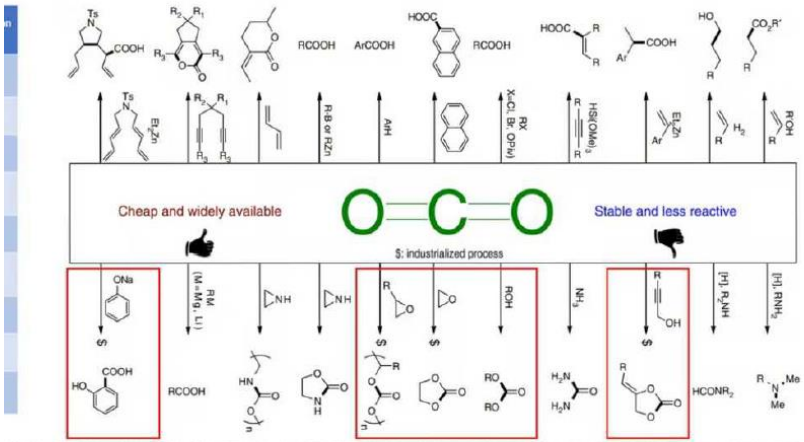
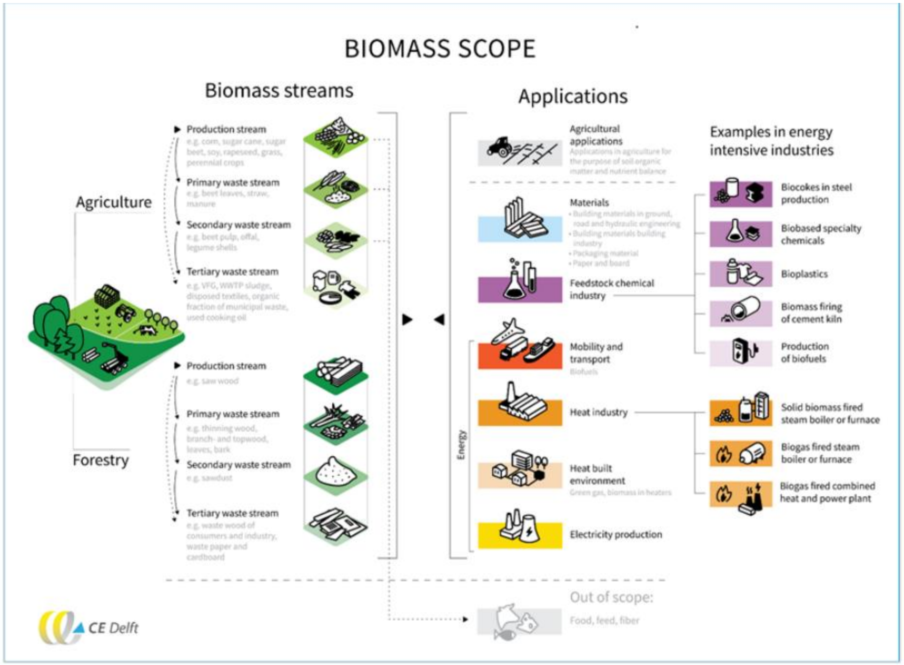


Figure 1 | Representative examples using CO_2 as C1 building block in organic synthesis. Along with the rapid development of organometallic chemistry and catalysis, various types of efficient CO_2 transformations were have been discovered in the past decades. However, in general, the substrat scope and efficiency of these reactions are still limited due to the requirement of reactive agents for CO_2 activation. As a result, only a few process have been industrialized until now (marked by $).

Using carbon dioxide as a building block in organic synthesis; Qiang Liu, Lipeng Wu, Ralf Jackstell & Matthias Beller; DOI: 10.1038/ncomms6933, Nature communications



SECTORIAL PERSPECTIVE - Pros & Cons for our decarb.

EUR perspective:

- **PROs:**
  - **Funding effort: Next Generation EU, Innovation Fund, etc.**
  - **Temporary aid framework to support decarbonisation.**
  - **Political awareness of the need to increase support for the competitiveness of European industrial sectors.**
- **CONs:**
  - **Insufficient agility in adopting measures to boost competitiveness.**
  - **High risk of relocation due to cost overruns: energy, CO2, administrative burdens, etc.**

SECTORIAL PERSPECTIVE - Pros & Cons for our decarb.

NAT perspective:

- **PROs:**
  - **Opportunities arising from the Recovery, Transformation and Resilience Plan: PERTE circular economy, PERTE decarbonisation, etc.**
  - **High Renewable resource availability.**
  - **Sector firmly integrated in the local economy.**
  - **Social awareness in support of recycling and sustainability.**
  - **Support framework for intensive industries.**

- **Cons:**
  - **Extremely short project implementation deadlines.**
  - **Very complex processing procedure for grants.**
  - **Lack of electricity grid capacity.**
  - **Insufficient funds.**
  - **Insufficient technological development of technically and economically viable alternatives for decarbonising heat.**

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por su atención

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