

TotalEnergies

TotalEnergies Vision on Gasification of Plastics

Cindy ADAM

PSYCHE, Closing Event
December 08, 2022.

TotalEnergies' climate ambition

Carbon Neutrality : Getting to net zero carbon by 2050 together with society



Invest in low-carbon products



Biofuels

Lead in biofuels

Produce nearly

5 Mt/year

of renewable diesel

by 2030



Circular economy

Produce

30% recycled and renewable plastic in 2030

Capture

10% market share in bioplastics and become the world leader in PLA



CO₂

Develop the use of CO₂ as a raw material (*)

Alternative feedstocks to fossil oil offering **lower carbon footprint virgin polymers**

* Incl Syngas & misc industrial waste gas as feedstocks

TotalEnergies' climate ambition



Accelerate in the circular economy: Recycling

- Invest in low-carbon products



Recycling

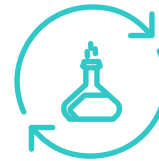
Produce 30% recycled and renewable polymers by 2030



Mechanical Recycling

Circular Compounds
(>50% recycled material)

Synova, the French leader in manufacturing recycled polypropylene for the automotive sector



Advanced recycling

Grandpuits: project to build France's first chemical recycling plant with **Plastic Energy** – startup in 2023

Partnerships with **Technology providers** (off-take)

PureCycle Technologies

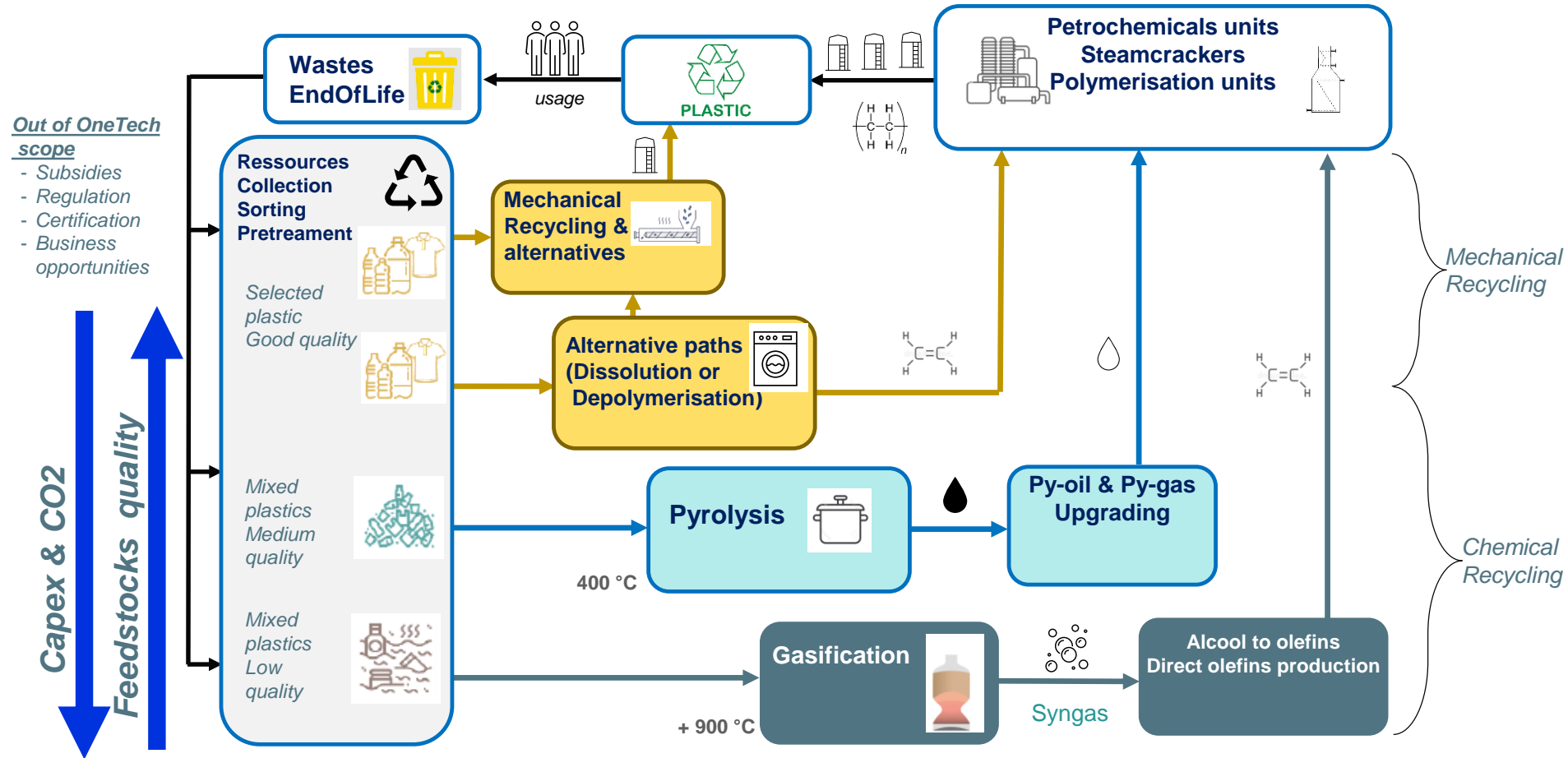


Founding member of the Alliance to End Plastic Waste

\$1.5 billion to reduce pollution from plastic waste in the environment



Circular Economy : Mechanical & Chemical Recycling



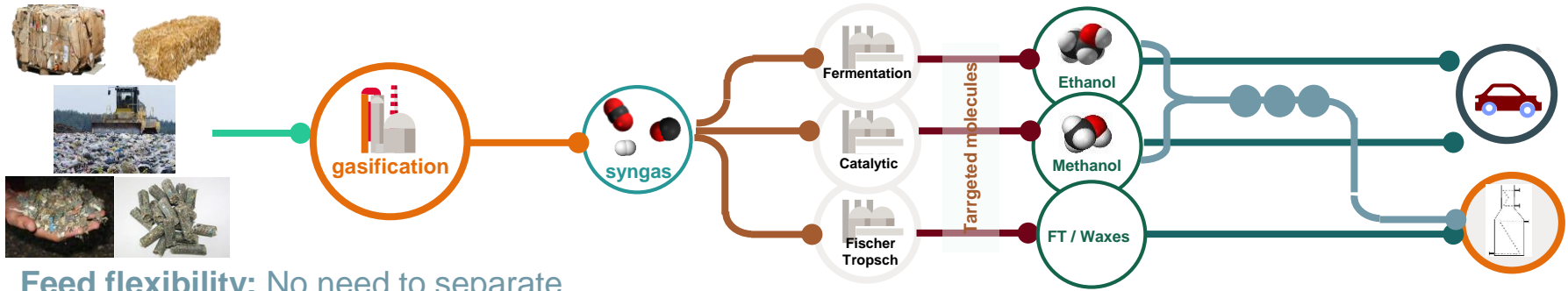
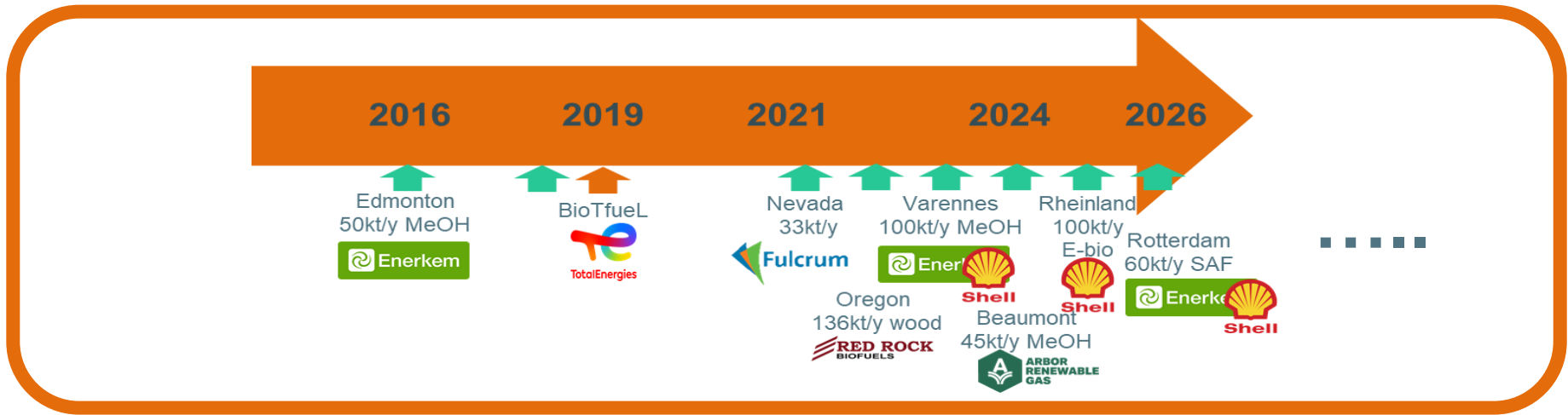
Integrated Assessment: compare pertinence of different pathways

Constraints: GHG Emission reduction, Regulation (quick change/instability), Large competition on easy feedstock, Waste Logistic (Sparse, low density, not well collected)

Gasification: Feedstock & Products Flexibility...

....From Bio-feedstock to Waste

Some actors are starting to move....



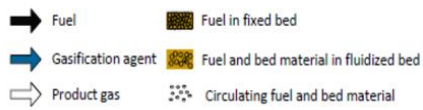
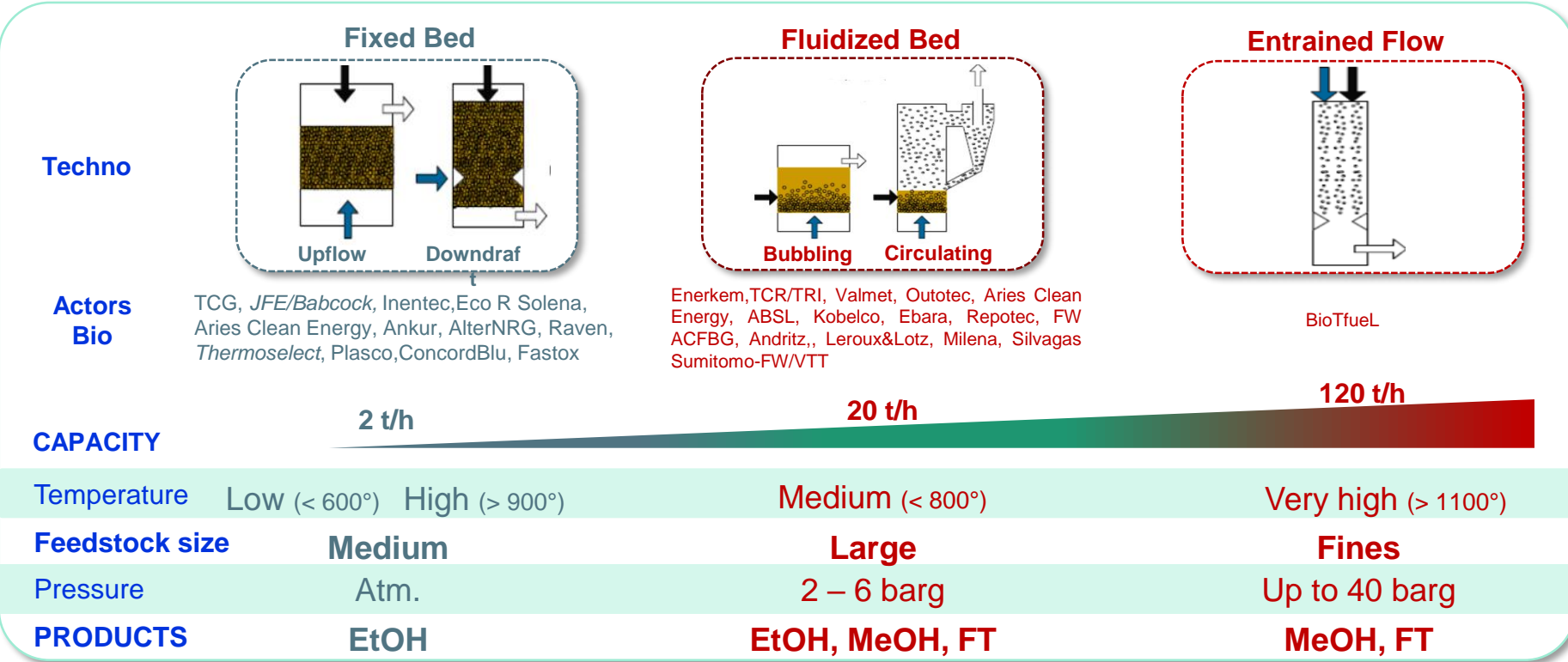
Feed flexibility: No need to separate plastic from organic wastes (no need for secondary sorting), Organic fraction attracting “bio value”

Integration/synergies with petrochemicals



Several Designs And Actors For Gasification Technologies

Gasifier selection according nature of feed, plant capacity and application of syngas



Plastic Gasification Value Chain in TotalEnergies



COMPETITIVENESS

Drivers & Stakes

- Valorise residual stream currently going to incineration/landfill and not suitable for the pyrolysis value chain
- **Feed flexibility**
- Large scale units (from 200 to 500 kt/y feed) : Large volumes of wastes valorized

Barriers

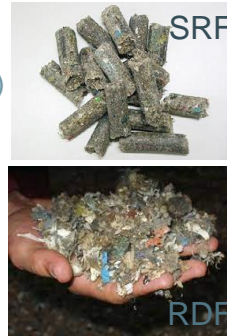
- LCA
- Life Cycle Costs
- Need for large feedstock supply with/without biomass

R&D works

- Selection of adequate gasifier type for plastic rich waste + biomass (co-processing)
- Take advantage of **BioTFuel demo unit** in Dunkirk (Entrained Flow Gasifier)
- PSYCHE (Interreg project, 2019-2022)
- PLASTICE (UE project, 2022-2026)

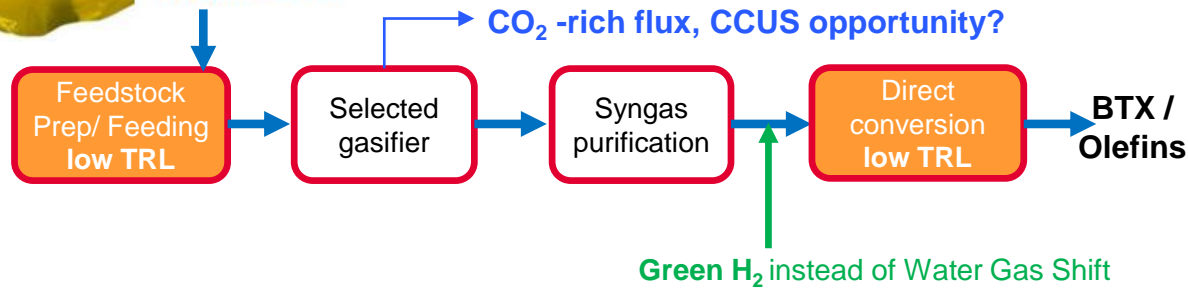


Accessible volume level providing that RDF/SRF (several million tons in EU) are included



To Pyrolysis

Residual stream



⇒ **Seek low TRL bricks** including alternative to MTO/OCP & ATOL routes

BIOTFUEL Demo Unit

- **Gasifier** : Entrained Flow
- **Demo plant** : Dunkirk (FR) – 2,0 t/h
- **Partners**: Axens, CEA, IFPEN, Avril, ThyssenKrupp Industrial Solutions, TotalEnergies
- **Commercial plant** : None
- **Operating pressure** : 35 barg
- **Feedstock** : Biomass (*woody, agricultural residues*), Waste Wood & Plastic
- **Very flexible technology** if proper feeding ensured
- **Fully integrated in XtL chain**
- **Applications** : FT/MeOH/Chemicals

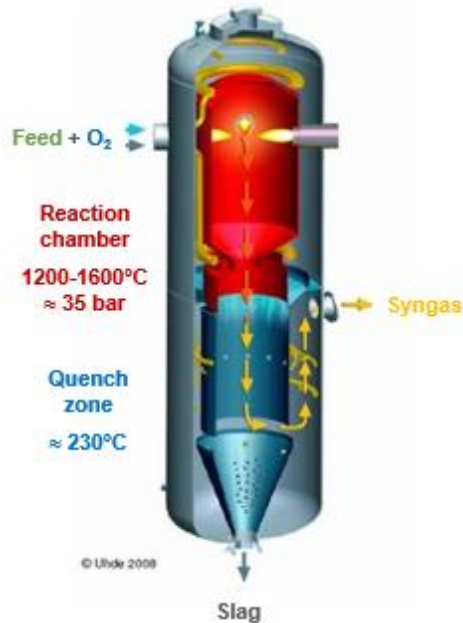


DIAGRAM OF THE THERMOCHEMICAL CONVERSION PROCESS

PRETREATMENT

- 1 Lignocellulosic feedstock
- 2 Initial grinding and drying
- 3 Torrefaction
- 4 Hydrocarbon feedstock (if coprocessed)

GASIFICATION

- 5 Air separator
- 6 Input, gasifier
- 7 Quench chamber



FISCHER-TROPSCH PROCESS AND UPGRADING

- 11 Fischer-Tropsch plant
- 12 Hydrotreating/hydrocracking
- 13 **BIODIESEL/BIOJET FUEL**

SYNGAS CONDITIONING

- 8 H₂/CO Ratio adjustment
- 9 Cleaning with physical or chemical solvents
- 10 Final purification

Disclaimer and copyright reservation

Definition - TotalEnergies / Company

The entities in which TotalEnergies SE directly or indirectly holds an interest are separate and independent legal entities. The terms "TotalEnergies", "TotalEnergies company" and "Company" used in this document are used to refer to TotalEnergies SE and its affiliates included in the scope of consolidation. Similarly, the terms "we", "us", "our" may also be used to refer to these entities or their employees. It cannot be inferred from the use of these expressions that TotalEnergies SE or any of its affiliates is involved in the business or management of any other company of the TotalEnergies company.

Disclaimer

This presentation may include forward-looking statement within the meaning of the Private Securities Litigation Reform Act of 1995 with respect to the financial condition, results of operations, business, strategy and plans of TotalEnergies that are subject to risk factors and uncertainties caused by changes in, without limitation, technological development and innovation, supply sources, legal framework, market conditions, political or economic events.

TotalEnergies does not assume any obligation to update publicly any forward-looking statement, whether as a result of new information, future events or otherwise. Further information on factors which could affect the company's financial results is provided in documents filed by TotalEnergies with the French *Autorité des Marchés Financiers* and the US Securities and Exchange Commission. Accordingly, no reliance may be placed on the accuracy or correctness of any such statements.

Copyright

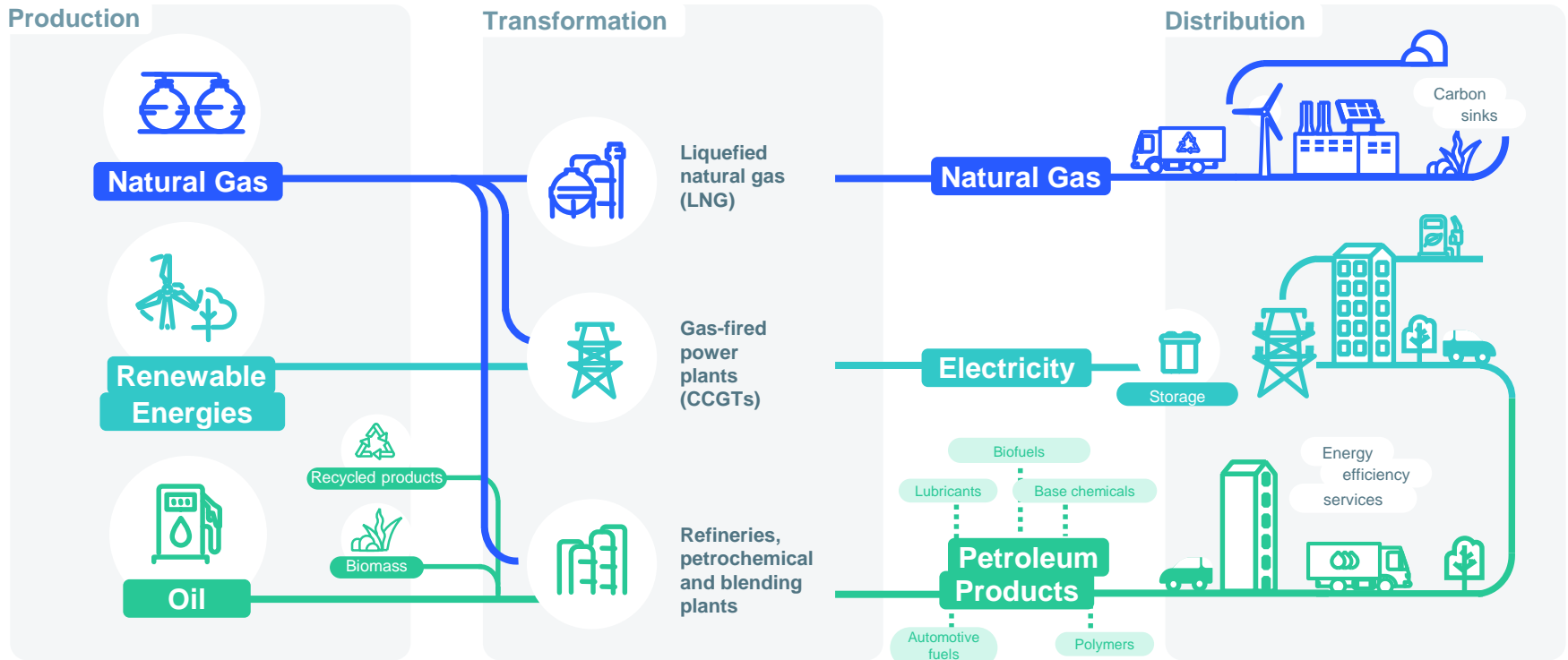
All rights are reserved and all material in this presentation may not be reproduced without the express written permission of TotalEnergies.



Annex

TotalEnergies, a major player in the energy transition

- Integrated across the entire energy chain



TotalEnergies, Refining & Chemicals

- Producing fuels and plastics that are essential to our day-to-day lives



Refining

14 Refineries
worldwide

Including

2 Biorefineries*



Petrochemicals

28 Petrochemical plants
worldwide

Including

2 Bioplastics plants*

2 Plastics recycling
plants*



 | HUTCHINSON®

Global leader in elastomer
processing

89 Production
sites

*Including the plan to convert Grandpuits into a zero-oil platform

TotalEnergies' climate ambition

- Getting to net zero carbon by 2050 together with society



Carbon neutrality

in our global
operations
Scopes 1 + 2



Carbon neutrality

worldwide for all indirect
emissions from the use by
our customers of energy
products sold to them

Scope 3



Carbon neutrality

in Europe, from
production to use by our
customers of the energy
products sold

Scopes 1 + 2 + 3

A Flexible Offer To Fit Customers' Needs And Objectives

		TotalEnergies offer	Feedstock	Drop in	Food contact	Type of offer	Cost	CO2 reduction*	Availability**
Recycled based products	Mechanical recycling	PE compounds	Plastics waste (> 50%)	No	Yes / No	Segregation	€	Savings on a Case by case study for each compounds ↓	Today
		PP compounds	Plastics waste (Up to 100%)	No	No	Segregation	€		Today
	Chemical recycling	PE, PP, PS	Plastics waste Pyrolysis oil	✓	✓	Mass balance	€€€		By 2025
New polymer	PLA	PLA By JV TotalEnergies Corbion	1G (Sugar cane)	No	✓	Segregation	€€€€	↓ ↓	Today
Alternative feedstocks for virgin polymers	Bio	PE, PP, PS	1G, 2G	✓	✓	Mass balance	€€ to €€€	↓ ↓	Today
	Waste carbon	Recycled Carbon based PE	Waste gas (CO, CO2..)	✓	✓	Segregation	€€€	↓ ↓ ↓	Post 2025



SRF/RDF (CSR)

RDF: Refused Derived Fuel = produced from domestic and business waste, includes biodegradable material as well as plastics; used to generate energy at recovery facilities. ,

SRF: Solid Recovered Fuel = alternative to fossil fuel produced from mainly commercial waste including paper, card, wood, textiles and plastic. It has a higher calorific value than RDF and is used in facilities such as cement kilns.

