Mepol part of LyondellBasell Sustainability strategy

Il calcolo e il monitoraggio delle emissioni di CO2 nell'industria del riciclo della plastica: strumenti per il calcolo e fattori determinanti per la riduzione dell'impatto carbonico.

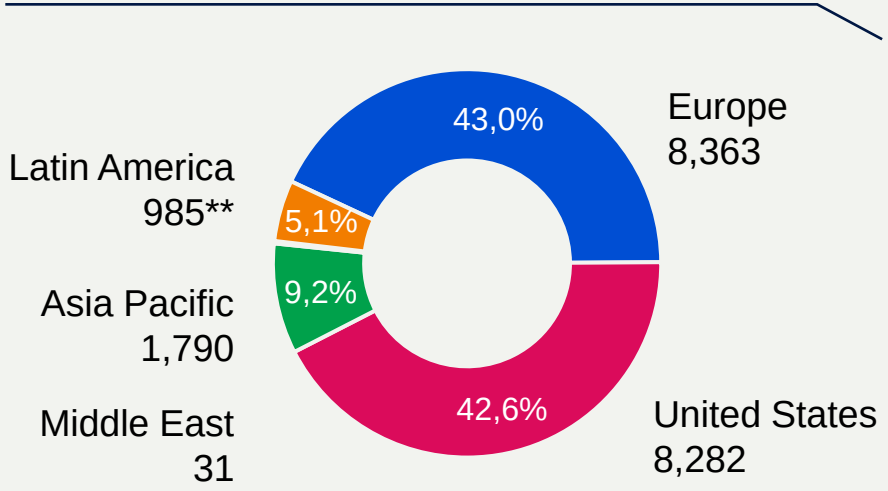
Dott.ssa Tatiana Melato

Settimana della Sostenibilità | 21 Marzo 2024 | Riduzione delle emissioni di CO2: metodologie e certificazioni

LyondellBasell at a Glance

We are LyondellBasell (LYB) – a leader in the global chemical industry creating solutions for everyday sustainable living. Through advanced technology and focused investments, we are enabling a circular and low carbon economy. Across all we do, we aim to unlock value for our customers, investors and society. As one of the world's largest producers of polymers and a leader in polyolefin technologies, we develop, manufacture and market high-quality and innovative products for applications ranging from sustainable transportation and food safety to clean water and quality healthcare. For more information, please visit www.lyb.com or follow @LyondellBasell on LinkedIn.

Our 19,451 employees globally:*



#1
largest producer of polyethylene (PE) and polypropylene (PP) in Europe

21
countries with manufacturing sites and joint ventures

6,000
patents and patent applications worldwide

#2
largest producer of propylene oxide (PO) worldwide

$34M+
in charitable investments globally over the past four years through 4,500 grants

23 TONS
of waste collected in the environment during our 2021 Global Care Day events

*Full-time and part-time employees as of December 31, 2022.

**Including Mexico

Serving Global Markets

Legend
- ★ Regional Headquarters /Offices
- ■ Manufacturing
- ● Research /Technical Centers
- ◆ Joint Ventures

~100

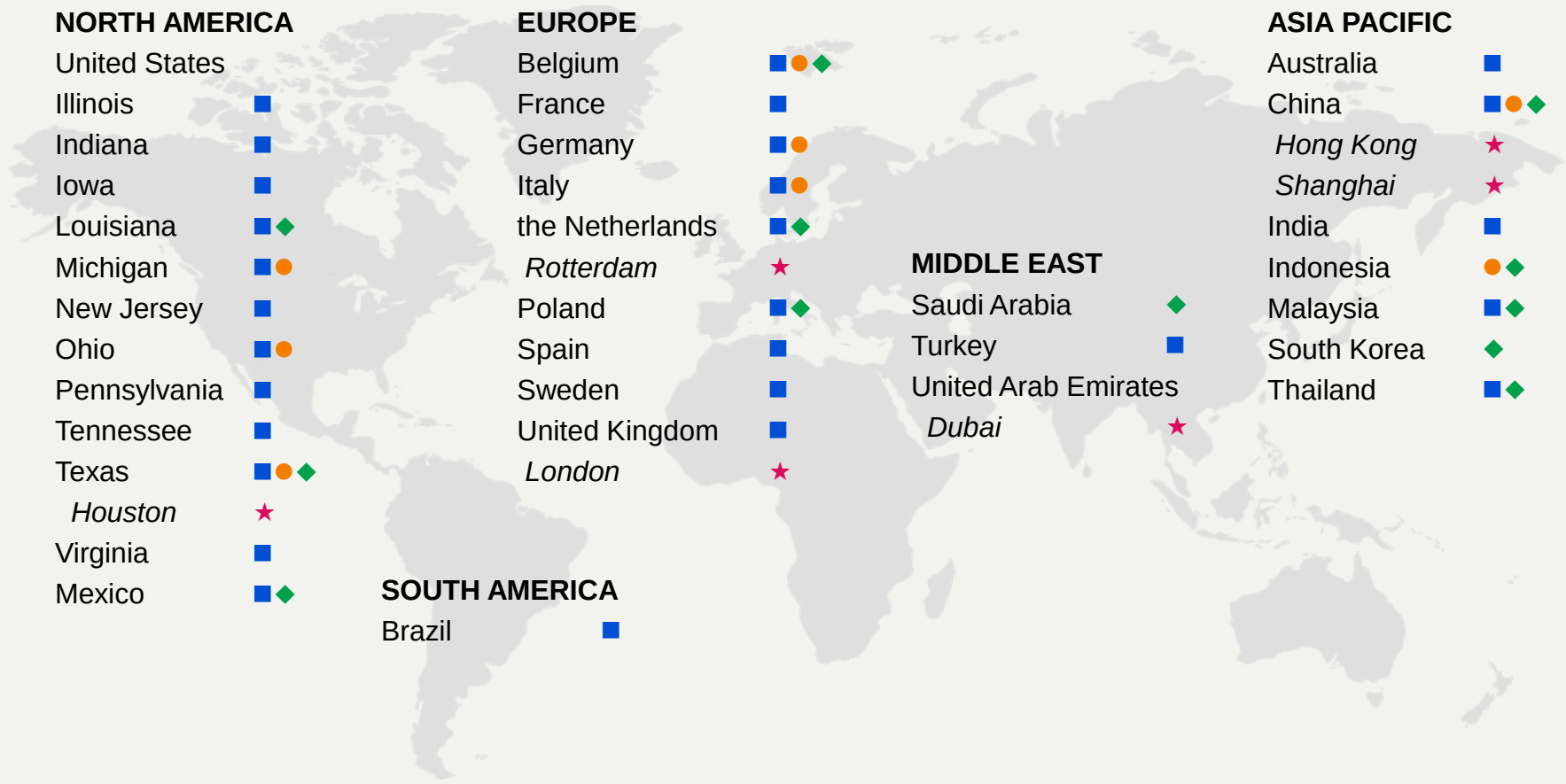
Manufacturing Sites and JVs Globally

53M TONS

of global capacity

>100

Countries with sales



NORTH AMERICA
- United States
- Illinois ■
- Indiana ■
- Iowa ■
- Louisiana ■◆
- Michigan ■●
- New Jersey ■
- Ohio ■●
- Pennsylvania ■
- Tennessee ■
- Texas ■●◆
- *Houston* ★
- Virginia ■
- Mexico ■◆

EUROPE
- Belgium ■●◆
- France ■
- Germany ■●
- Italy ■●
- the Netherlands ■◆
- *Rotterdam* ★
- Poland ■◆
- Spain ■
- Sweden ■
- United Kingdom ■
- *London* ★

SOUTH AMERICA
- Brazil ■

MIDDLE EAST
- Saudi Arabia ◆
- Turkey ■
- United Arab Emirates
- *Dubai* ★

ASIA PACIFIC
- Australia ■
- China ■●◆
- *Hong Kong* ★
- *Shanghai* ★
- India ■
- Indonesia ●◆
- Malaysia ■◆
- South Korea ◆
- Thailand ■◆

Note: Information as of December 31, 2022.

Our sustainability approach

Our Industry-Leading Sustainability Ambitions and Actions

Leading the way to profitably advance and innovate sustainable solutions

TAKING CLIMATE ACTION

- **NET ZERO**
  greenhouse gas emissions from operations by 2050[1]
- **42%**
  absolute scope 1 and 2 greenhouse gas emissions reduction from operations by 2030[2]
- **30%**
  absolute scope 3 greenhouse gas emissions reduction by 2030[2]
- **50%**
  minimum of electricity produced from renewable sources by 2030[2]

ENDING PLASTIC WASTE

- **2 MM+ TONS**
  of recycled and renewable-based polymers produced and marketed annually by 2030
- **FOR EVERY $**
  we will invest in venture funds that address the plastic waste challenge; we help catalyze $5 from co-investors
- **ZERO**
  plastic pellet loss to the environment from our facilities

SUPPORTING A THRIVING SOCIETY

- **ZERO**
  incidents, injuries and accidents
- **ACHIEVE**
  gender parity in global senior leadership by 2032
- **INCREASE**
  the number of people from underrepresented groups in U.S. senior leadership roles to reflect the general population ratio by 2032
- **ASSESS**
  a minimum of 70% of our key global suppliers using sustainability criteria by 2025

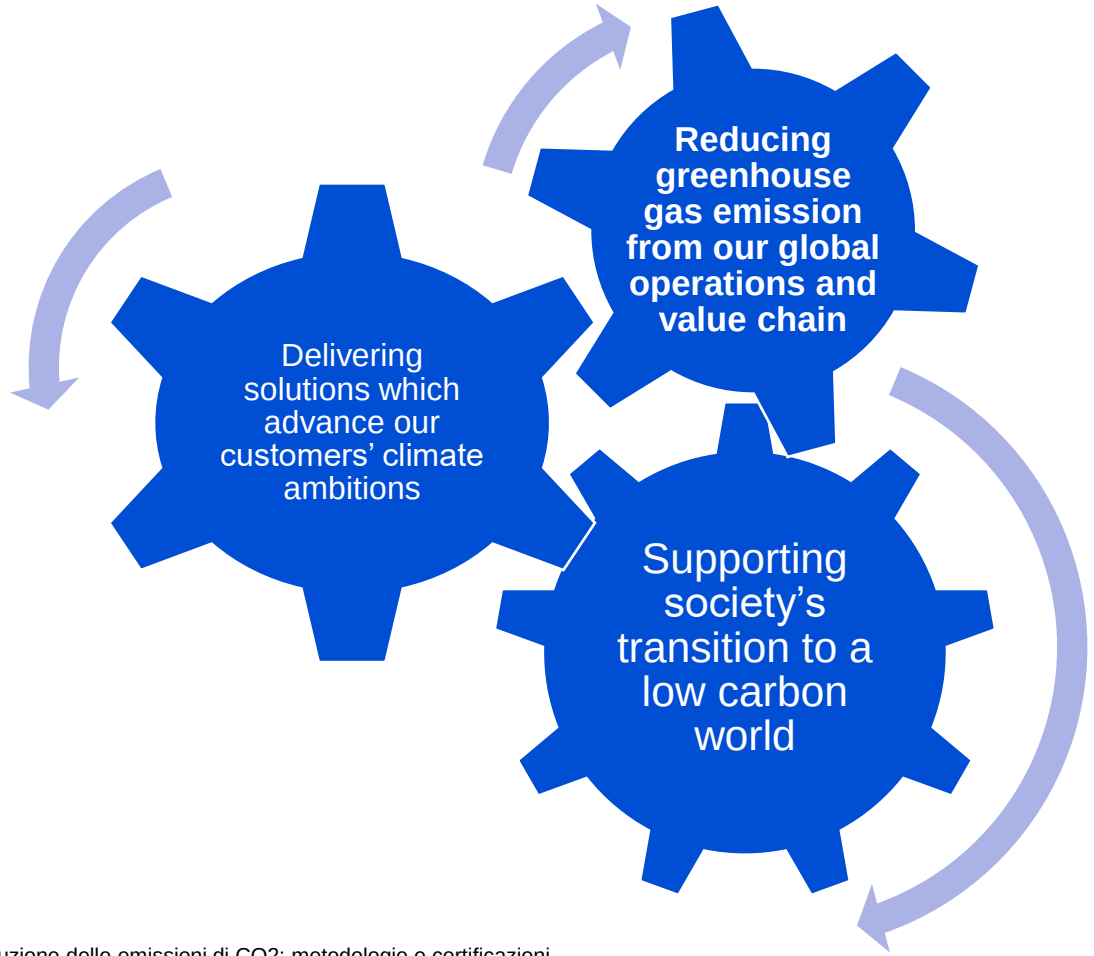
1. Our 2050 net zero greenhouse gas emissions goal includes scope 1 and 2 emissions.
2. Relative to 2020 baseline.

Taking Climate Action

Our commitment

Addressing climate change is one of the most pressing challenges our world faces and we believe collective action and a sense of urgency are needed.

We are committed to reducing GHG emissions from our global operations and value chain, and to delivering solutions which advance our customers' climate ambitions and support society's transition to a low carbon world. We believe a commitment to net zero scope 1 and scope 2 emissions by 2050 and a credible pathway to 2030 for scopes 1, 2 and 3 are critical to the long-term success of LyondellBasell.



Our goals

NET ZERO

- greenhouse gas emissions from operations by 2050[1]

42%

- absolute scope 1 and 2 greenhouse gas emissions reductions from operations by 2030[2]

30%

- absolute scope 3 greenhouse gas emissions reductions by 2030[2]

50%

- minimum of electricity produced from renewable sources by 2030[2]

1. Our 2050 net zero greenhouse gas emissions goal includes scope 1 and 2 emissions.
2. Relative to 2020 baseline

Site Carbon footprint

Every site collects and monitor enviromental performace

Environmental records

New equipment
- **Authomatic packaging line**
- **Debagging system**
- **Filtration system**

Anno	2015	2018	2019	2020	2021	2022	2023
Produzione (kg)	23.785.530	27.865.494	29.197.839	27.919.012	26.431.700	25.581.801	23.743.896
Energia elettrica (KW/h)	6.727.375	7.506.900	7.648.436	7.295.829	8.369.640	8.047.058	7.368.934
Kwh/kg	0,2828	0,2693	0,26195	0,26132	0,31665	0,31456	0,31035
GPL	10.100	12.610	12.940	12.480	13.550	13.600	12.450
Gasolio (solo per trazione muletti/auto aziendali/camion) l	54.900	47.040	84.000	68.000	31.717	22.000	35.000
Absolute Climate Footprint in Production kg CO2 eq	2.253.089	2.646.823	2.748.106	2.450.362	107.289	81.209	114.351

progressive conversion to electric forklifts

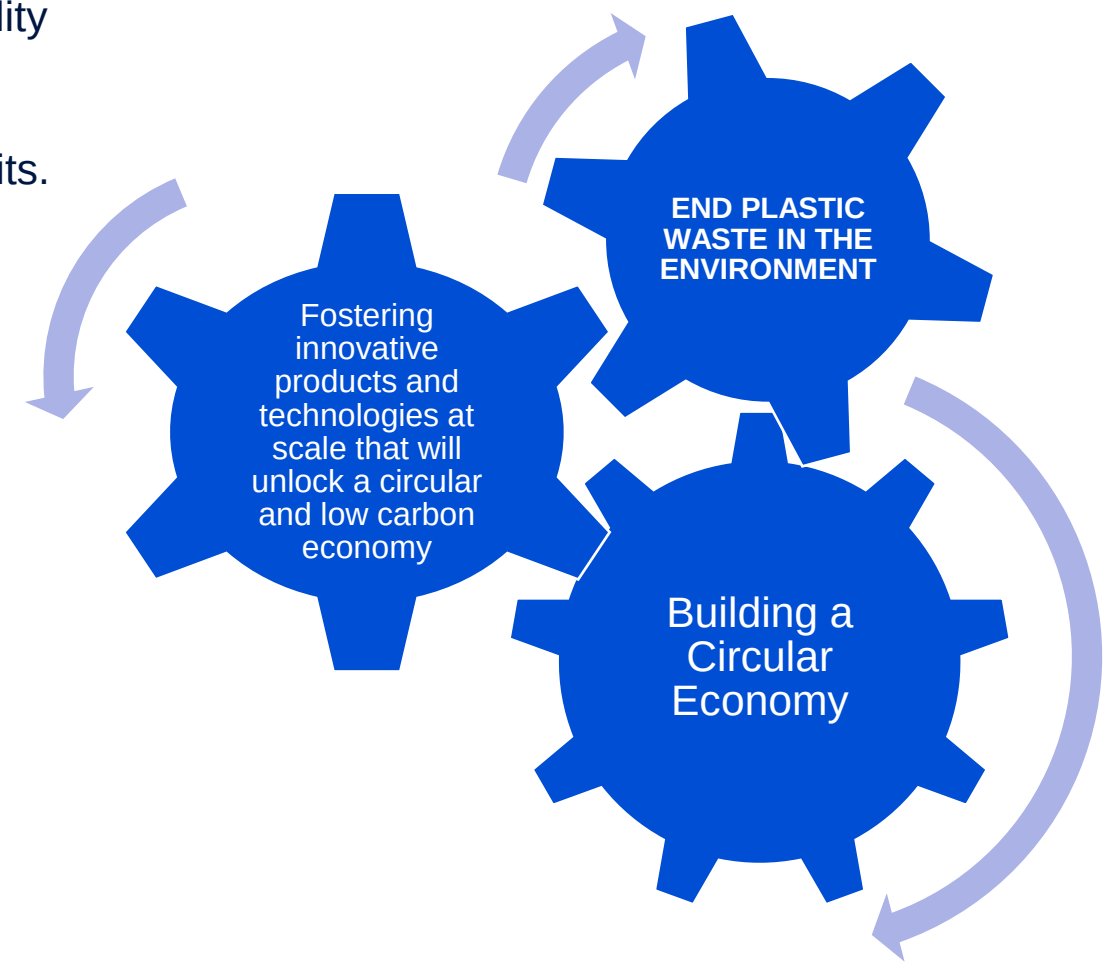
Power Quality Stabilizzatori di tensione

Renewable energy

Ending Plastic Waste

Our commitment

Plastics are essential in providing solutions to everyday sustainable living. As lightweight, hygienic and durable materials, they play a vital role in products used around the globe, from keeping food fresh longer, to safe and high-quality solutions for healthcare, to the energy transition.
We believe circularity is critical to helping end plastic waste, and it also offers strong economic, social and climate benefits.



Our goals

- **2 MM+ TONS**
  of recycled and renewable-based polymers produced and marketed annually by 2030

- **FOR EVERY $**
  we will invest in venture funds that address the plastic waste challenge; we help catalyze $5 from co-investors

- **ZERO**
  plastic pellet loss to the environment from our facilities

Our Circulen products enable customers to deliver on their sustainability ambitions

circulen
By LyondellBasell

circulen recover
By LyondellBasell

Polymers made from plastic waste through a **mechanical recycling process**

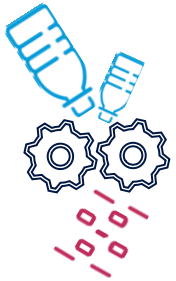
circulen revive
By LyondellBasell

Polymers made by converting plastic waste into feedstock to produce new polymers using an **advanced (molecular) recycling process**

circulen renew
By LyondellBasell

Polymers made from **renewable feedstocks** such as used cooking oil

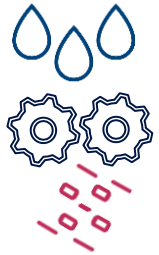
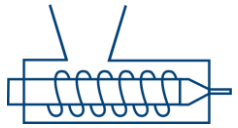
Advancing circularity through mechanical recycling

Technology	Feedstock	Process	Products	Applications
Mechanical recycling	Pre- and post-consumer plastic material 	Requires highly sorted and cleaned waste stream 	circulen recover By LyondellBasell	 Consumer packaging & goods*

Play Video

- ***Circulen*Recover** products are made from plastic waste through a **mechanical recycling** process
- Mechanical recycling upgrades plastic waste into usable materials through mechanical processes including **sorting, washing, grinding, melting and forming new pellets**
- LyondellBasell offers customers **high quality PP and PE** with mechanically recycled content under our *Circulen*Recover brand
- Our Mechanical Recycling footprint includes our **Quality Circular Polymers (QCP)** business in Europe, and planned joint ventures in **China and India**

Advancing circularity through Mepol projects

Technology	Feedstock	Process	Products	Applications
Mechanical recycling	Pre- and post-consumer plastic material 	Requires highly sorted and cleaned waste stream 	 eco compound	 Durable goods*

- ***Eco-compounds*** are made from plastic waste through a **mechanical recycling** process
- Mechanical recycling upgrades plastic waste into usable materials through mechanical processes including **sorting, washing, grinding, melting and forming new pellets**
- Mepol part of LyondellBasell offers customers **high quality customized polypropylene eco-compounds formulated with at least 30% of PCR content.**
- Our Mechanical Recycling footprint includes certification for recycled content based on **EN 15343** and traceability of the waste chain of custody **UNI ISO 22095:2021**

Advancing circularity through advanced recycling

Technology	Feedstock	Process	Products	Applications
Advanced recycling	Hard to recycle plastic material 	More tolerant of mixed plastic waste 	circulen revive by lyondellbasell	 Incl. food packaging and healthcare Applications*

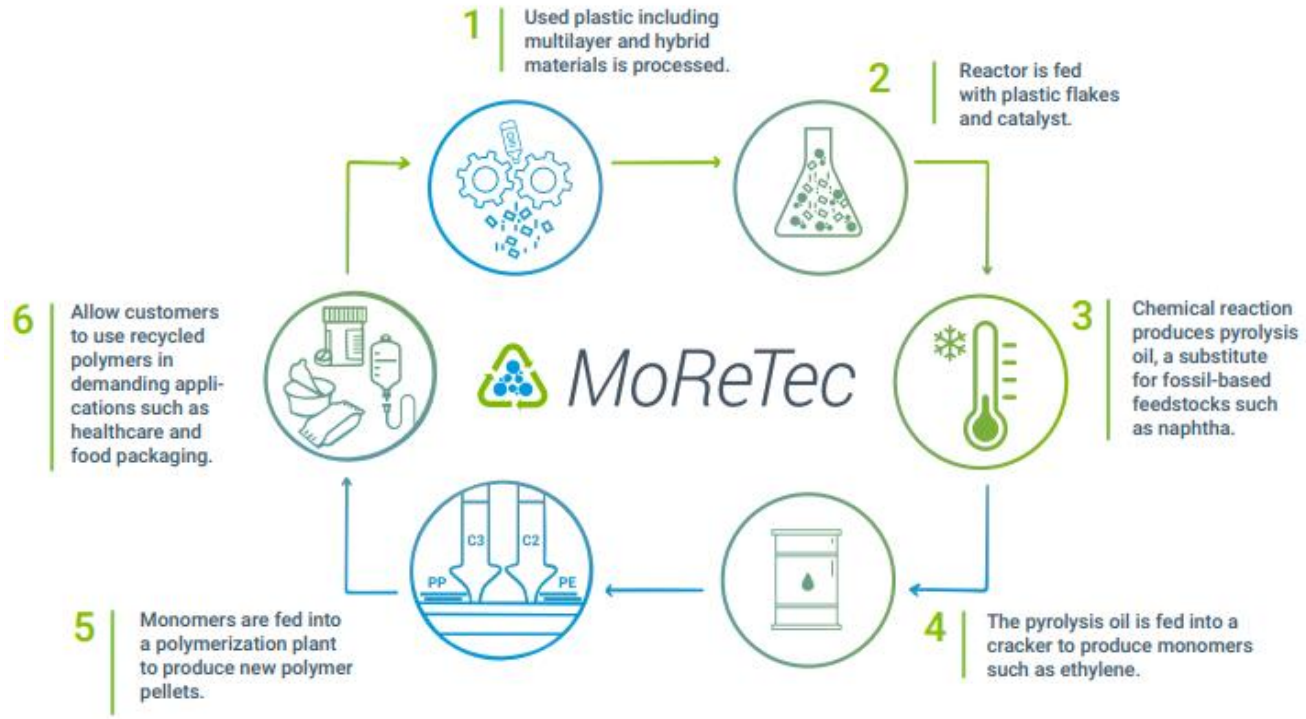
circulen revive By LyondellBasell

Play Video

- ***Circulen*Revive** products are made from plastic waste through an **advanced (chemical) recycling** process
- **Advanced recycling is complementary to mechanical recycling** as it expands end use application options and can be used to process a wider and broader variety of waste
- Advanced recycling converts **plastic waste back to its molecular form**, which is then used as a feedstock in our conventional production processes to produce new polymers
- Advanced recycled feedstock is mixed with conventional feedstock during the production process, and allocated to the final polymer using a mass balance approach
- LyondellBasell provides **solutions for highly regulated food and medical applications** with advanced recycled content under our *Circulen*Revive brand
- We are developing our own advanced recycling technology, *MoReTec* which combines scale with a leading energy efficiency and carbon footprint

*Are some of the end use applications for *Circulen*Revive

MoReTec: Our Advanced Recycling Technology



- We recently announced **plans to progress engineering for a commercial-scale advanced recycling plant** at our Wesseling, Germany, site.
- The proposed plant will be the **first commercial scale, single-train advanced recycling plant** using our *MoReTec* technology

Advancing circularity through renewable feedstocks

Why use Polymers from **Renewable-based Resources?**

- At least 210% **lower GHG emissions** for renewable-based PE and PP** compared with virgin-based feedstocks
- One to one Virgin Quality
- Drop in solution
- Life Cycle Analysis ISO 14040-14044 compliant for PP grades – peer reviewed externally

Play Video

These polymers are created based on a mass balance approach

**Cradle-to-gate LCA calculations based on a feedstock composed of waste and residue oils, *when taking a waste like approach to all raw materials in the feedstock including palm fatty acid distillates (PFAD). PFAD are a production residue from the refining process of palm oil. Taking this approach for PFAD implies that neither upstream burdens nor process burdens for refining of palm oil are attributed to PFAD.* Compared to fossil alternatives when using incineration as end-of-life scenario.

Our Circulen brand of products provides solutions for everyday sustainable living

circulen recover By LyondellBasell

Products made from **mechanical recycling processes**, including through our QCP business

SAMSONITE Magnum ECO suitcase[1]

circulen revive By LyondellBasell

Products linked to **advanced recycling processes**, including our proprietary *MoReTec* technology[2]

L'OCCITANE EN PROVENCE cosmetic packaging tubes[1]

circulen renew By LyondellBasell

Products sourced from **renewable bio-based feedstocks**[3]

CORINE DE FARME personal care packaging[1]

Building business and operating models to support rapidly growing customer demand

220,000+ Tons

of recycled and renewable-based polymers sold by LyondellBasell since 2019

2,000,000+ Tons

of recycled or renewable-based polymers produced and marketed annually by 2030

Approximately 20% of 2022 PE and PP sold globally by LyondellBasell

1. Customer applications using *Circulen* products.
2. The advanced recycled feedstock is mixed with conventional feedstocks in our process and allocated to CirculenRevive products using a mass balance approach certified according to the International Sustainability and Carbon Certification (ISCC) PLUS standard.
3. These feedstocks are used in our conventional production processes along with conventional feedstocks and are allocated to CirculenRenew products using an ISCC PLUS-certified mass balance approach.

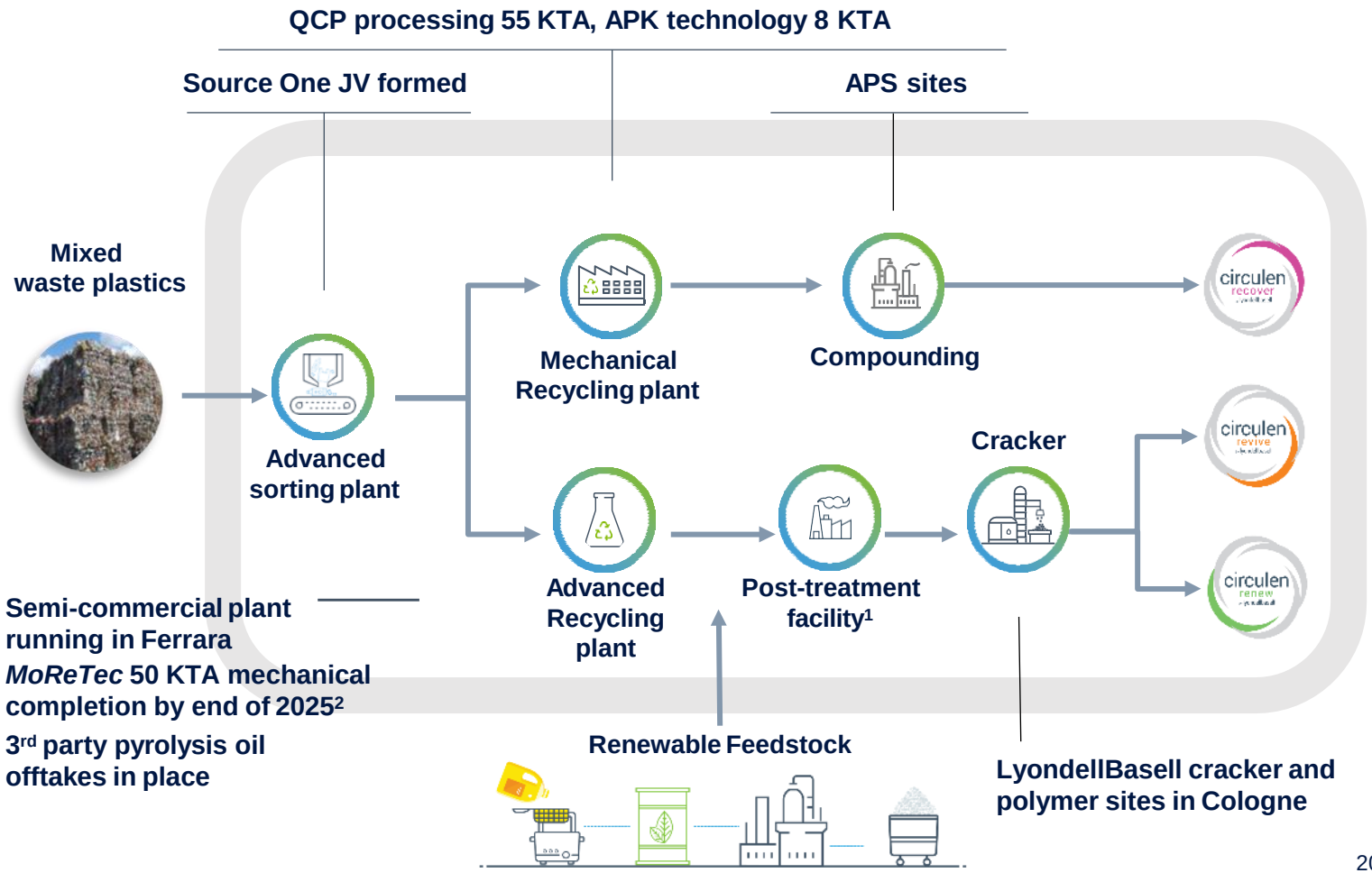
Optimizing the value chain for circularity by building integrated hubs and leveraging existing capabilities

Building scale, reducing cost and capturing value from waste to final product

INTEGRATED 'HUB' CONCEPT

- Leveraging existing capabilities in the **Cologne and Houston regions**
- **Preferred strategic partner** to feedstock owners
- **Collaborating with brand owners** to provide a range of optimal solutions via *Circulen* brands
- **Differentiated technology** play (e.g., *MoReTec*) through the value chain
- **Regional hubs** to access and supply feedstock into integrated hubs

LYONDELLBASELL INTEGRATED 'HUB' IN COLOGNE



1. Feasibility studies underway in Houston and Cologne.
2. The final investment decision is targeted for the end of 2023.

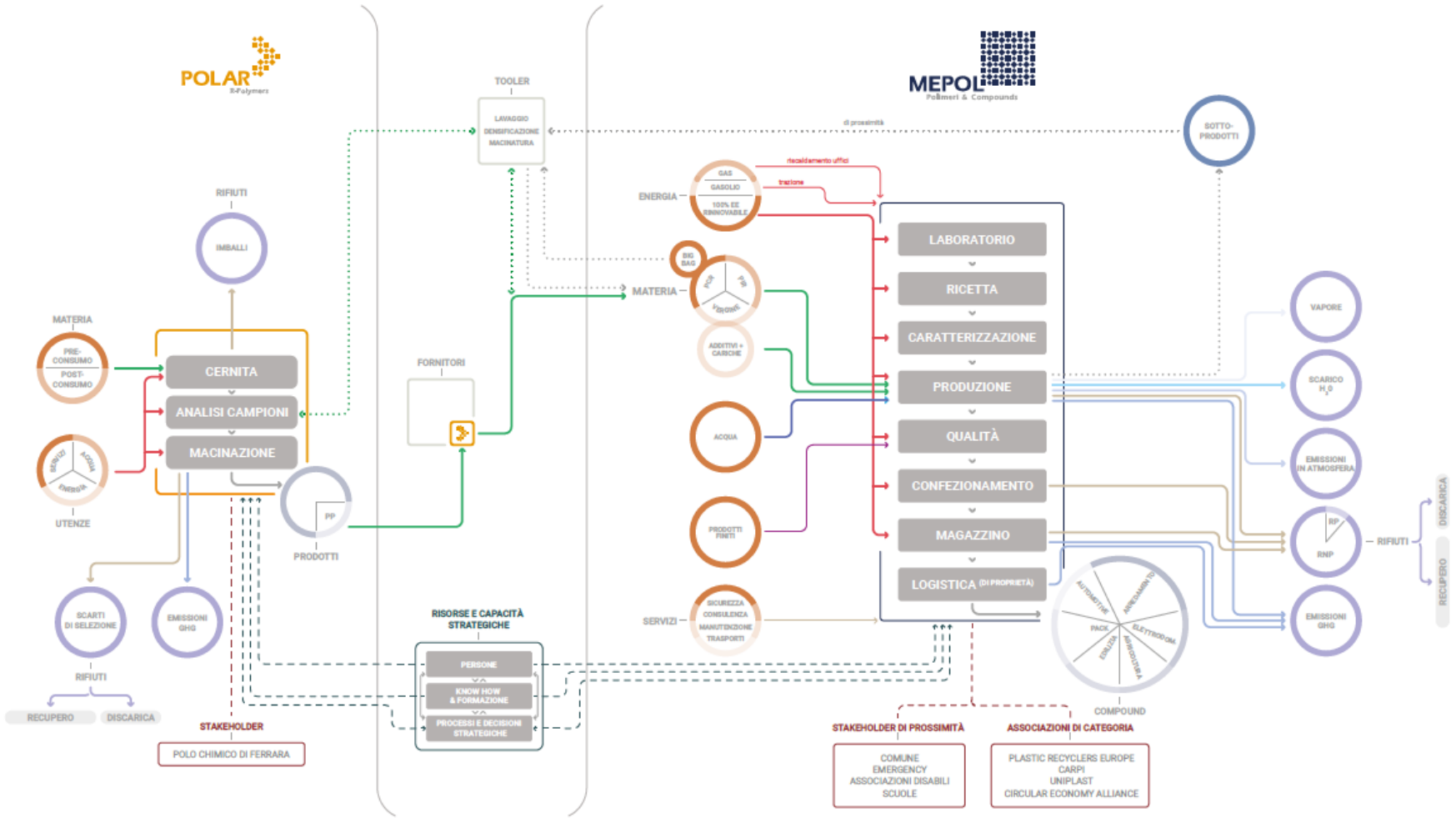
How we calculate product carbon footprint?

1. Life cycle assessment

2. Analisi della rendicontazione ambientale

3. Product carbon footprint systematic approach

CFP Systematic Approach di **Assindustria Venetocentro** conforme alla **norma ISO 14067:2018 ANNEX C** e validato da **DNV Business Assurance Italy S.r.l** con **Certificato No. 10000476317**



il nostro sistema

focus: compound vergini e compound da riciclo a confronto

in collaborazione con ASSINDUSTRIA VENETOCENTRO IMPRENDITORI PADOVA TREVISO

Abbiamo messo a confronto l'impronta di CO_{2e} di due compound in polipropilene utilizzati per prodotti nel settore arredamento:

- ECO MEPLEN®, composto da materiale da riciclo post-industriale, caricato a fibra di vetro e stabilizzato UV
- MEPLEN®, composto da polipropilene vergine, caricato a fibra di vetro e stabilizzato UV

Il risultato lo dice chiaramente: nel caso nel compound da riciclo, l'impronta è dimezzata. Scegliere un compound da riciclo permette per ciò non solo di risparmiare risorse vergini, di alleviare il carico ambientale dato da rifiuti altrimenti non recuperati e di pesare di meno su comunità lontane (da dove parte la catena di estrazione per creare il polimero vergine, ma anche di avere un'impronta, in termini di gas ad effetto serra, più leggera.

Questo calcolo viene offerto a tutti i nostri i clienti, per sostenerli nel prendere la scelta migliore rispetto alle loro esigenze di prodotto, nonché per poter avere un tassello importante nel costruire l'impatto globale del prodotto che immettono sul mercato. La modalità di calcolo è dalla «culla al cancello», ovvero dalla materia prima, compreso il trasporto, fino al nostro cancello, compreso l'imballo. Siamo inoltre in grado di calcolare anche l'impatto, sempre in termini di CO_{2e}, legato al trasporto del compound acquistato da noi fino al cancello del cliente. I dati sono da fonte primaria quando la materia prima proviene da Polar e sono estratti dal database ECOINVENT quando dati primari non sono disponibili.

RISULTATI ECO MEPLEN® IC F30 LS

Carboon footprint per unità dichiarata

UPSTREAM

	Unità di misura	GWP Fossile
Materie prime	kg CO_2 eq/U.D.	3,56E-01
di cui trasporti	kg CO_2 eq/U.D.	6,40E-02
Ausilari/additivi	kg CO_2 eq/U.D.	7,53E-01
di cui trasporti	kg CO_2 eq/U.D.	4,85E-02
Imballaggi	kg CO_2 eq/U.D.	3,45E-05
di cui trasporti	kg CO_2 eq/U.D.	1,01E-01
TOTALE UPSTREAM	kg CO_2 eq/U.D.	1,11E+00

CORE

	Unità di misura	GWP Fossile
Consumo energia elettrica	kg CO_2 eq/U.D.	0,00E+00
Consumo energia termica	kg CO_2 eq/U.D.	3,12E-03
Emissioni in atmosfera	kg CO_2 eq/U.D.	0,00E+00
Produzione rifiuti	kg CO_2 eq/U.D.	0,00E+00
TOTALE CORE	kg CO_2 eq/U.D.	3,12E-03
TOTALE	**kg CO_2 eq/U.D.**	**1,11E+00**
INCERTEZZA	**6,04%**	

RISULTATI MEPLEN® IC F30 LS

Carboon footprint per unità dichiarata

UPSTREAM

	Unità di misura	GWP Fossile
Materie prime	kg CO_2 eq/U.D.	1,56E+00
di cui trasporti	kg CO_2 eq/U.D.	8,59E-02
Ausilari/additivi	kg CO_2 eq/U.D.	7,53E-01
di cui trasporti	kg CO_2 eq/U.D.	4,85E-02
Imballaggi	kg CO_2 eq/U.D.	3,45E-05
di cui trasporti	kg CO_2 eq/U.D.	1,01E-01
TOTALE UPSTREAM	kg CO_2 eq/U.D.	2,31E+00

CORE

	Unità di misura	GWP Fossile
Consumo energia elettrica	kg CO_2 eq/U.D.	0,00E+00
Consumo energia termica	kg CO_2 eq/U.D.	3,12E-03
Emissioni in atmosfera	kg CO_2 eq/U.D.	0,00E+00
Produzione rifiuti	kg CO_2 eq/U.D.	0,00E+00
TOTALE CORE	kg CO_2 eq/U.D.	3,12E-03
TOTALE	**kg CO_2 eq/U.D.**	**2,31E+00**
INCERTEZZA	**6,25%**	

Helping eliminate plastic waste in the environment

ALLIANCE TO END PLASTIC WASTE

LyondellBasell is a founding member of the Alliance, a CEO-led, not-for-profit organization made up of 65+ global companies across the value chain dedicated to help end plastic waste in the environment.

THE ALLIANCE IN ACTION

Divert plastic waste, improve livelihoods, and contribute to a circular economy. The Alliance's 4 strategic pillars as the foundation of their approach:

[View the 2022 Progress Report here]

Infrastructure

Innovation

Education & Engagement

Cleanup

Eliminating pellet loss from our operations

Through the **Operation Clean Sweep® (OCS)** program, we are demonstrating **our commitment to a clean environment** and have joined the **"Pledge to Prevent Plastic Loss"**

- An initiative of the American Chemistry Council's Plastics Division and the Plastics Industry Association (PLASTICS)
- Dedicated to helping plastics resin handling operations achieve zero plastic resin loss, including through proper containment of plastic pellets, flakes and powder
- This program provides guidelines to help plastics operations reduce the accidental loss of pellets, flakes and powder into the environment
- LyondellBasell has incorporated OCS principles into its Operational Excellence management system

Solutions for a better tomorrow