A world designed to last

Sustainable Chemicals

Leading solutions to advance carbon efficiency and feedstock resilience



T.EN TECHNIP ENERGIES

Reducing our carbon footprint

Technip Energies is a leader in the process development, commercialization, design and realization of sustainable chemical units.

Our services range from applied research and development to full engineering, procurement and construction (EPC) of complexes based on our proprietary or partner technologies or collaboration agreements.

“How to the reduce the CO_2 released to the atmosphere whilst continuing to meet the increasing consumer demand for valuable plastics?”

Breaking from traditional models

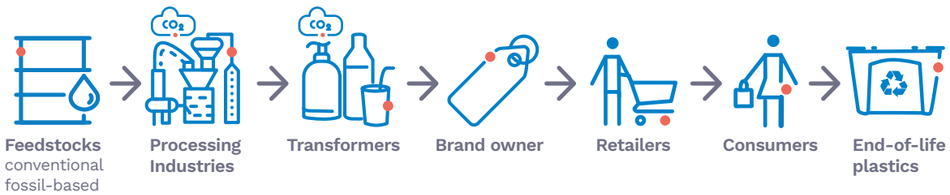
Today, fossil-sourced carbon is extracted in the form of gas, oil and ctoal using a traditional linear extractive model. Through the processing industries, this carbon is transformed into longer chain molecules and ultimately into valuable plastic resins. At end-of-life, plastics are incinerated or landfilled, releasing carbon into the atmosphere as CO_2, and contributing to pollution and global warming.

Creating new ways to cut carbon

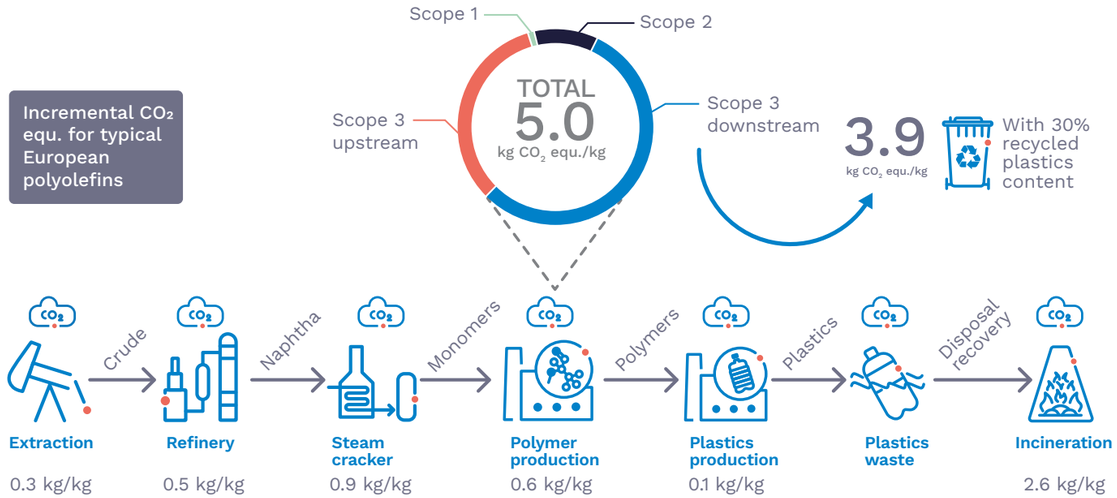
By finding ways to make our designs and processes more carbon efficient, electrify components in a plant or capture carbon in a process, Technip Energies is accelerating the energy transition by reducing the overall carbon footprint for many chemical products.

We are leading efforts to:

- decarbonize chemical processes
- test and commercialize circular solutions
- explore renewable carbon technologies



Creating new ways to cut carbon



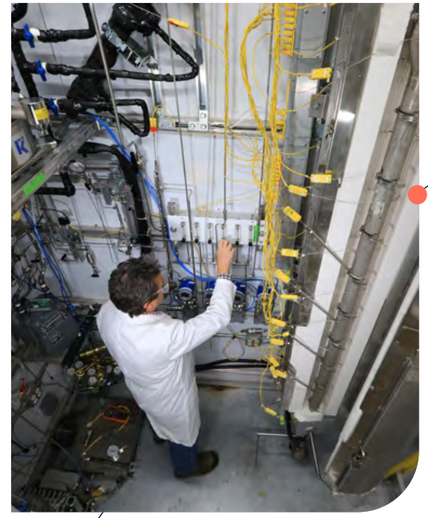
The carbon footprint of chemical derivative units is most efficiently decreased through the reduction of Scope 3 emissions upstream and downstream of the polymer unit.

Scope 3 upstream: Electrification and carbon capture techniques may be applied to the steam crackers, upstream monomer production engines and auxiliary production units (e.g. the SMR for hydrogen).

Scope 3 downstream: Recycling avoids energy required for incineration of waste plastics. We also are able to improve Scope 1 and Scope 2 emissions of the technologies for the derivative units that we license, engineer and build.

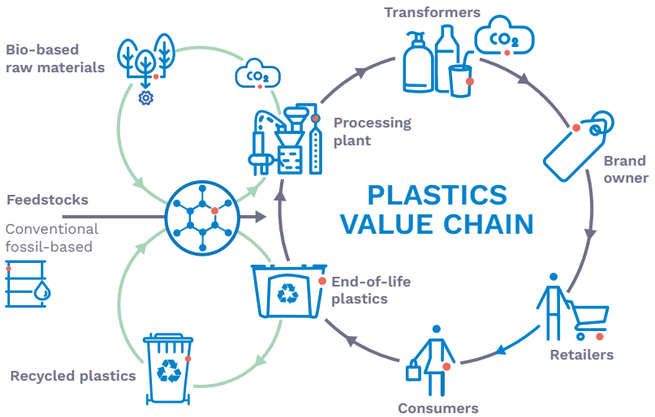
We pursue the optimal use of carbon from fossil-based feedstocks by:

- Improving monomer efficiencies of our plants
- Proposing better catalytic-based processes to use less energy
- Enhancing product performance requiring less feedstock
- Proposing carbon efficient clustering of monomer production engines with derivative units
- Limiting the generation of side products and waste effluents



Circularity

Technip Energies reduces the use of fossil-based carbon by offering our clients more efficient processes fed with increasing amounts of biobased and recycled plastic feedstocks.



Introducing Circularity

> “It’s all about carbon sourcing, use and reuse.”

We focus on sustainable feedstocks and circular solutions for end-of-life plastics recycling.

Conventional carbon feedstocks are being replaced by recycled plastic material and biogenic carbon feedstocks:

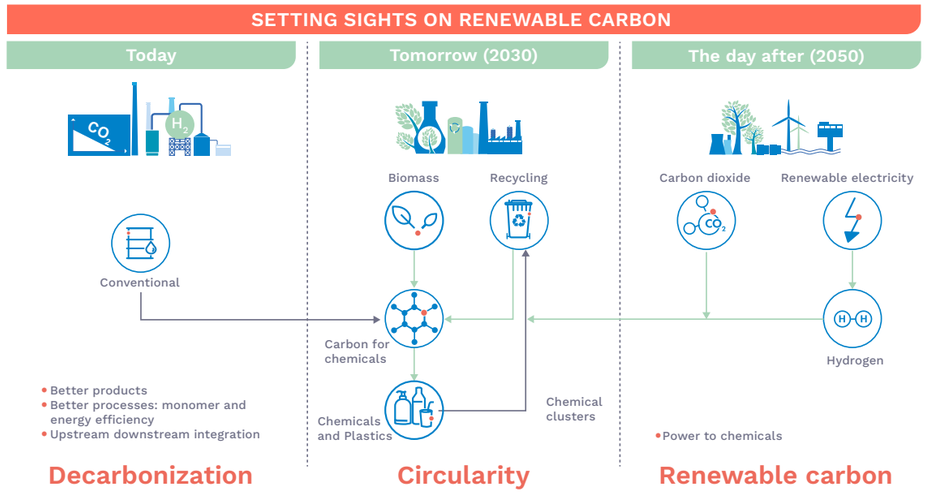
- Recycling end-of-life plastics is realizing a growing uptake in the industry. Carbon sourced from conventional feedstocks is substituted in part by recycled material, reducing pollution and carbon released into the atmosphere by incineration or landfilling.
- With biogenic feedstocks, the pace of uptake is gradual and in line with the technological maturity of the processes and logistic constraints of local feedstock sourcing.

The traditional value chains will be fed in the near term by a mix of recycled, biogenic and conventionally sourced carbon.

Our team of experts provides:

- Purification systems to allow pyrolysis oils or gases to be returned to the steam crackers
- Chemical recycling techniques to transform waste plastics to purer monomers and enable lower-carbon footprints by returning directly to the polymerization units
- Biobased processes to produce feedstocks to drop into existing value chains or feed new chemical pathways for novel biopolymers.





Achieving net zero through renewable carbon

The road to net zero and renewable carbon is dependent on multiple factors, including the maturing of technologies and lowering of costs. New technologies that combine and transform captured CO_2 with green hydrogen produced from renewable electricity likely will emerge in the future. Technip Energies is working to develop and accelerate the commercialization of these technologies to find the right pathway to net zero and advance the energy transition.

Renewable carbon feedstocks
Upstream integration

+

Carbon efficient products and processes

+

End-of-life plastics recycling

Our offering



In the field of sustainable chemicals, Technip Energies offers market leading technologies to successfully deliver projects around the globe. We provide solutions to improve carbon efficiency and feedstock resilience, adding value through proven services and technologies:

- **Licensed technologies**
- **Applied research and development**
- **EPC projects**

Technologies and licensing

We are engaging efforts to decarbonize the industry by improving our portfolio of 30-plus technologies and offering the most carbon-efficient and reliable solutions.

We are licensing our proprietary technologies in the polyesters, phenolic and styrenics resin value chains with the help of our Badger Licensing and Zimmer® brands.

We are partnering with leading licensors in the polyolefin, vinylic and aromatic value chains. We are expanding our portfolio to offer new technologies to the growing biopolymer market.



From design to delivery

A world leader in the process design, engineering, procurement and construction of chemical derivative and polymer units, Technip Energies has delivered more than 350 facilities in the past 50 years. We offer a full-service combination of technologies and project delivery capabilities.

Our successful track record in delivering EPC projects is based on our extensive know-how, proven methods and experienced project execution teams. We employ the most up-to-date technologies and carbon-efficient processes.

We offer a wide range of services starting with master planning and early conceptual design. We provide a seamless rollover through FEED and detailed execution to procurement, construction and startup. We reduce interfaces during project development, allowing us to de-risk and execute on a fast track. And we deliver projects on schedule and on budget.

A proven partner for your projects

- **Consulting services for conceptual, integration and master planning studies**
- **Licensing**
- **Process development and basic engineering, value gineering and FEEDs**
- **Project management**
- **EPC projects**

“Our goal is to optimize the final EPC project with experience and dedication.”

Our technology portfolio

Polyethylene	Partner	Collaboration
LDPE	SABIC	Licensing support
LLDPE/HDPE	UNIVATION	Club contractor
Hexene-1	SIBUR	Exclusive licensor

Polyesters	Partner	Collaboration
Polyesters (PET, PBT, PTT)	Proprietary	Zimmer®
Specialty polyesters (PETG, PCT, TPEE)	Proprietary	Zimmer®
Polyethylene naphthalate (PEN)	Proprietary	Zimmer®
Propanediol	Proprietary	Zimmer®

Vinyls	Partner	Collaboration
EDC/VCM	OXYVINYLS	Licensing support
PVC	KEM ONE	Licensing support

Styrenics	Partner	Collaboration
Ethylbenzene	Proprietary	Badger Licensing
Styrene • Stabilization • Phenylacetylene reduction	Proprietary	Badger Licensing
Polystyrene (GPPS/HIPS)	TOTAL PETROCHEMICALS	Exclusive licensor
ABS	SABIC IP	Exclusive licensor

Polystyrene	Partner	Collaboration
Polystyrene	GRACE	Licensing support

Phenolics	Partner	Collaboration
Acetone to cumene or IPA	Proprietary	Badger Licensing
Cumene	Proprietary	Badger Licensing
Bisphenol-A	Proprietary	Badger Licensing



Others	Partner	Collaboration
Polyamides (PA6, PA6.6)	Proprietary	Zimmer®
EDC via eShuttle	CHEMETRY	Licensing support
HCl oxidation	SUMITOMO	Licensing support
BenzOUT™	Proprietary	

Glycerine	Partner	Collaboration
ECH EPICEROL®	Proprietary	

Ethanol	Partner	Collaboration
1G ethanol	Proprietary	Krebs heritage
2G ethanol sunliquid®	CLARIANT	Licensing collaboration
Ethanol to ethylene Hummingbird®	Proprietary	

Bio polymers	Partner	Collaboration
PBAT, PBS	Proprietary	Zimmer®
PLA with PLAnet™	FUTERRO / SULZER	Alliance

Circularity	Partner	Collaboration
Polystyrene recycling	AGILYX	Exclusive licensor
PET recycling	IBM / UNDER ARMOR	JV
PET recycling - enzymatic	CARBIOS	
Pyrolysis	Pyrolysis club, proprietary purification	

Zimmer®and Badger Licensing are wholly-owned subsidiaries of Technip Energies

Applied R&D



Technip Energies is engaged with universities and institutions, as well as technology providers and startups, to find and develop novel technologies. We accelerate process commercialization using the extensive know-how of experts at our applied technology centers.

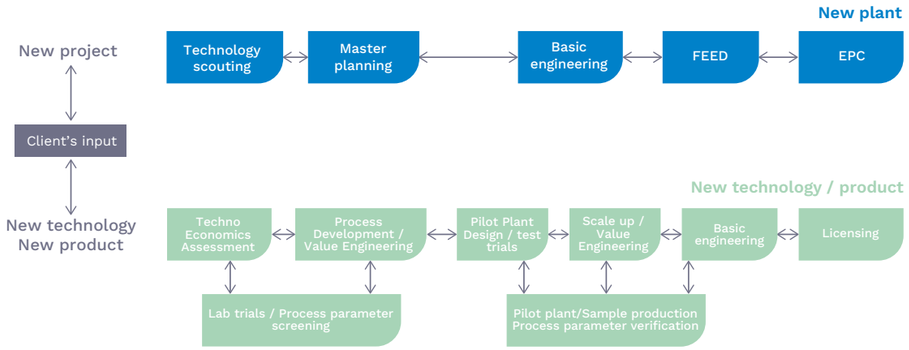
We encourage the introduction of new technologies and the optimization of our own proprietary or client technologies. The licensing of these new products, combined with more energy and monomer-efficient processes, allows us to play an important role in the energy transition by decarbonizing and optimizing the use of carbon for chemicals.

Our technology centers in the USA and Germany offer leading expertise to improve current technologies and develop tomorrow's technologies.

Through basic and applied R&D programs, we are complementing and extending existing chemical value chains and reducing our carbon footprint with the introduction of better resins and more efficient processes, important parts of our overall decarbonization efforts.

Process and new product development

Workflow for joint development projects starting from R&D



Our Technology Centers

Weymouth, USA

SERVICES

- Development and optimization of process technologies
- Bench, pilot and demonstration scale testing
- Catalyst development and evaluation
- Physical property and VLE determination
- Determination of reactor and unit operation types
- Metallurgical evaluations
- Advanced analytical methods
- Technical due diligence and economic evaluations

EXPERTISE

- Support and develop Technip Energies technology portfolio
- Perform R&D programs for third parties ranging from discovery to commercialization for the petrochemical, biochemicals and specialty chemical industries
- Utilize 10 fully automated plants, advanced separation techniques and analytical equipment to generate data for commercial plant scaleup
- Develop critical design information on reactor sizing, construction materials, physical and thermodynamic properties, and process safety during each R&D program
- Achieve scale-up factors in excess of one million to one in a variety of process applications

Frankfurt, Germany

SERVICES

- Experiments design
- Techno-economic studies
- Kinetics studies and reactor design
- Process modeling and plant design
- Lab testing
- Polymerization in bench, lab and pilot plants
- Analytical laboratories
- Chromatography
- Chemical analysis
- Physical-chemical analysis

EXPERTISE

- Develop and improve polymer recipes for process designs and new technologies
- Support clients with an open innovation approach to commercialize polymer products
- Provide derisked approach to cost- effectively scale up polymer processes from concept to commercial plant
- Generate and evaluate sample products in trials to confirm product quality and process viability



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