Société Chimique de France

TRANSITION PATHWAY FOR THE CHEMICAL INDUSTRY

Highlights after conference Days with Academia & Industry

SCF 2026

Session DCI-Div CD

Bordeaux, 22.06.2026

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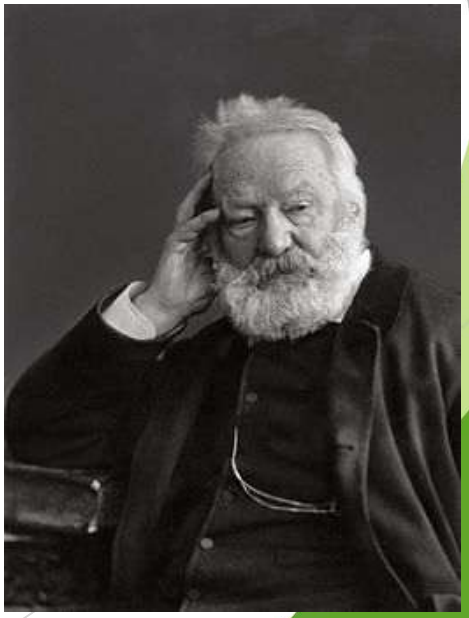
"IT'S HEARTBREAKING TO CONSIDER THAT NATURE COMMUNICATES WHILE HUMANITY FAILS TO PAY ATTENTION"

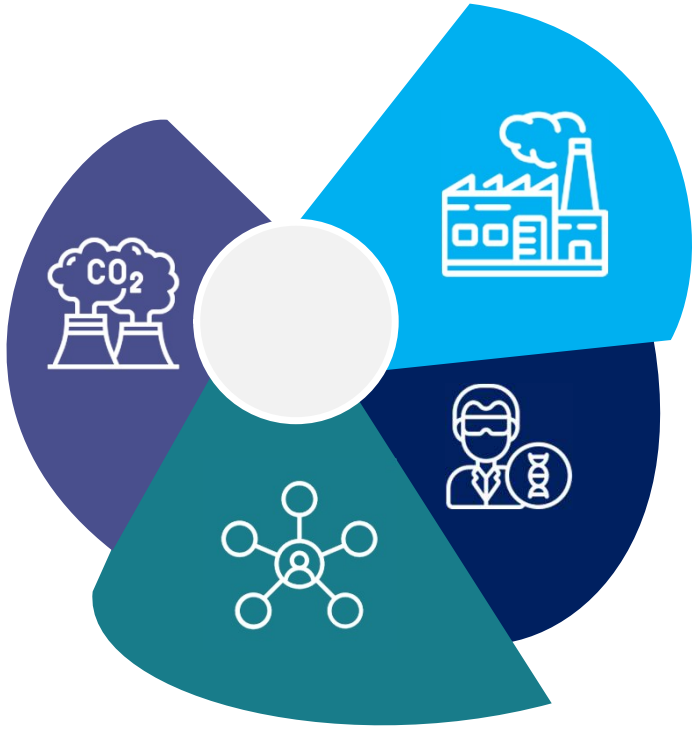
VICTOR HUGO, “CARNETS”, 1870



The EU Chemical Industry

Among the largest CO_2 emitters with the cement and steel industries.

Global direct CO_2 emission from primary chemical production in 2022: 935Mt[3]



Europe is the **2nd largest chemical producer** in the world with €760 billions of sales in 2022[1]

4th largest manufacturing industry with
7% of EU manufacturing turnover
1.2 million direct highly skilled jobs[2]
3.6 million indirect jobs
19 million jobs across all value supply chains

The chemical industry is at the heart of many value chains: ≈ 56% of chemicals are sold to other industries[2]

European Commission

The Transition Pathway for the Chemical Industry

European Commission

Société Chimique de France

RENCONTRES

TRANSITION PATHWAY FOR THE CHEMICAL INDUSTRY

❖ **Reminder of the objectives of our meetings (2024-2026):**

- ❑ Discussions on the TPCI-EU program
- ❑ Presentation of the program for the chemical industry
- ❑ Perception in France in industrial and academic circles
- ❑ Priority developments in research, innovation, and industry with presentations of industrial examples and academic priorities

The Transition Pathway for the Chemical Industry

- Publication: 27 January 2023
- It is an **actionable plan co-created** by the European Commission with EU countries, industry, NGOs and other stakeholders
- Based on **8 building blocks**

Sustainable competitiveness | Investment and funding | Research and Innovation | Regulation and Public Governance | Access to energy and feedstock | Infrastructure | Skills | Social dimension

- It identifies about **190 actions, grouped in 26 topics**, needed for the **twin transition and increased resilience** of the EU chemical industry

European Commission

The content: CHEMTP topics

Building Blocks	Topics
Sustainable Competitiveness	Topic 1: International Competitiveness
	Topic 2: Reduction of unsustainable dependencies and supply chains vulnerabilities
	Topic 3: Safety and Sustainability
	Topic 4: Innovation and growth of SMEs
	Topic 5: New synergies
Investments and Funding	Topic 6: Fund for Green Investments
	Topic 7: Access to Funding
R&I, Techniques and Technological Solutions	Topic 8: Better conceptualisation of new techniques and technical solutions (TRL 1 to 5)
	Topic 9: Developing new techniques and technological solutions (TRL 6 to 7)
	Topic 10: Deployment of new techniques and technological solutions (TRL 8 to 9)
Regulation and Public Governance (Legislation)	Topic 11: More effective and predictable regulation
	Topic 12: Vertically and horizontally coherent legislation
	Topic 13: Effective and efficient enforcement
Access to energy and feedstock	Topic 14: Anticipate long-term needs for Energy and Resource Supply
	Topic 15: Economically viable purchase of clean energy
	Topic 16: Feedstock Substitution
	Topic 17: Process and resource efficiency
Infrastructure	Topic 18: Large-scale electricity and hydrogen infrastructure
	Topic 19: Development of new sustainable production facilities
	Topic 20: Sustainable transport of raw materials and chemical products
	Topic 21: Deployment of digital technologies
	Topic 22: Circularity: recycling and reuse infrastructure
Skills	Topic 23: Education (reskilling/upskilling the workforce)
	Topic 24: Sufficient supply of jobs at technical level
Social Dimension	Topic 25: Impact on workforce and consumers
	Topic 26: Improve gender diversity and equality in the sector

TPCI : INITIATIVES (2025)

- **NEARLY 300 TRANSITION INITIATIVES HAVE BEEN RECEIVED THROUGH THE SINGLE WINDOW**

- **THE 2024 INITIATIVES ARE MAINLY FROM INDUSTRY (95%), WITH GERMANY LEADING (43%), FOLLOWED BY BELGIUM (21%) AND THE NETHERLANDS (9%)**

The main themes are:

✓ **Sustainable competitiveness** (24.06%): chemical substitution and development of safe and sustainable products

✓ **Access to energy and raw materials** (20.86%): replacement of fossil fuels and improvement of energy efficiency

✓ **Infrastructure** (14.97%): development of green energy (hydrogen, electrification)

European Commission

ACTION PLAN FOR THE EUROPEAN CHEMICAL INDUSTRY

(published 07.2025)

- Maintain critical production in the EU
- International trade: opening new markets and protect EU industry
- Ensuring an affordable energy supply
- Lead markets and green taxation (including innovation)
- Simplification packages

CREATION OF AN ALLIANCE FOR CRITICAL CHEMICALS

(with Steering Committee and Working Groups)

- Act as a strategic umbrella to facilitate cooperation with member states and stakeholders, in order to map and address the risks of production capacity closures
- Contribute to the development of criteria for identifying production sites and critical molecules in the EU
- Mapping of critical molecules, which will serve as a basis for enhanced surveillance under the Customs Surveillance System, diversification of supply, and a possible legislative proposal on critical molecules
- Support member states and regions in identifying EU critical chemical sites to facilitate investment, innovation, access to finance and upgrading of critical production capacities.

SOCIÉTÉ CHIMIQUE DE FRANCE

«Notre but est de pousser les chercheurs académiques et industriels à développer l'écoconception»

La **Société chimique de France** (SCF) revient sur **les conclusions** d'une journée de **réflexion** sur les **enjeux** de la **Transition Pathway for Chemical Industry** (TPCI) qui avait été lancée, en **janvier 2023**, par la Commission européenne, pour **permettre** à l'industrie chimique de **se tourner** vers le **futur**. La société savante met tout particulièrement **l'accent** sur l'**écoconception** qu'elle souhaite **encourager** dans les milieux de **recherche académique** et **industrielle**, dès la conception d'un produit. Détails avec **Joël Barrault** et **Michel Philippe**, membres des divisions **Chimie durable** et **Chimie industrielle** de la SCF.

des pratiques de conception. L'Ademe en a proposé une définition, de même que pour la norme ISO 14 006, révisée en 2020. Il s'agit bien d'une approche méthodique, qui prend en considération les aspects environnementaux du processus de conception et de développement, dans le but de réduire les impacts environnementaux négatifs tout au long du cycle de vie d'un produit. Notre but, au niveau de la SCF, est de pousser les

Actions de transition prioritaires pour l'industrie chimique

Résumé Les Divisions de chimie durable et de chimie industrielle de la Société Chimique de France, en collaboration avec France Chimie, ont organisé une 2e rencontre Académie-Industrie sur le thème « *Transition Pathway for the Chemical Industry* » le 14 juin 2024 à la Maison de la Chimie, à Paris. Plusieurs axes du document européen *Transition Pathway for the Chemical Industry* ont été développés par Kristin Schreiber (Commission Européenne). L'importance fondamentale de l'écoconception et du recyclage dans ces voies de transition a notamment été soulignée par Bob Diderich (OCDE), Hélène Olivier-Bourbigou (IFPEN), Pascal Breuilles (CNRS) et Xavier Montagne (MESR). La vision des industriels sur cette transition a été détaillée par Hélène Moumrikoff (France Chimie), Ismahane Remonnay (Veolia), Fabien Deswarte (L'Oréal), Olivier Teillac (BASF), Régis Marchand (SEPPIC-Air Liquide), Hervé Plessix (Stéarinerie Dubois), Norbert Patouillard (Pennakem) et Bernard Chaud (Global Bioenergies). En premières conclusions, les défis scientifiques et techniques à relever pour accompagner cette transition s'articulent autour de l'écoconception pour une innovation durable. Cette dernière sera basée sur des substances et matériaux à faible impact environnemental avec l'utilisation de matières premières si possible renouvelables, de catalyseurs et procédés durables s'appuyant sur des sources d'énergie renouvelables ou bas carbone. Les actions futures des deux divisions de la Société Chimique de France seront focalisées sur ces défis majeurs pour la chimie.

Mots-clés **Biosourcé, circularité, écoconception, innovation et procédés durables, partenariats, transition chimique.**

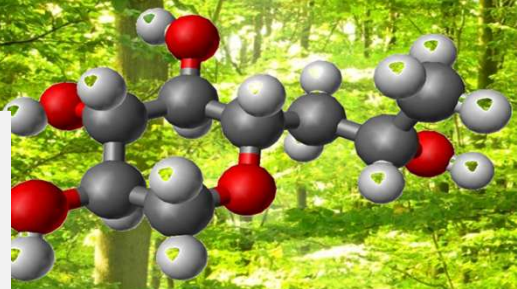
Société Chimique de France

- ❑ 1ère Rencontre TPCI-Paris-06/2024
- ❑ Interview
  J. Barrault/M. Philippe
  Infochimie Magazine N°587- 11/2024
- ❑ L'Actualite Chimique:
  - ❖ Compte-Rendu 1ère Rencontre TPCI: n°500-01/2025
    (Coordonnateurs J.Barrault/M.Philippe)
  - ❖ La Feuille de Route pour TPCI: n°501-02/2025
    (Commission Européenne)
- ❑ ISGC 2025 La Rochelle-05/2025
  - ❖ Présentation Avancées TPCI
    (Coordination SCF DCI/Div. CD)
- ❑ 2nde Rencontre TPCI-Puteaux-03/2026
  Article de Compte-rendu en préparation

KEY POINTS HIGHLIGHTED BY THE MAJORITY OF ACADEMIC-INDUSTRY PRESENTATIONS

- Safety and sustainability from the conception of innovation: Eco-design including sourcing, process and end-of-life/recycling (OECD, IFPEN, C.E., Veolia, SEPPIC, BASF, Pennakem, L'Oréal...):
- To make progress, you need to know how to assess impacts throughout the product's life cycle, using a holistic approach that takes recyclability into account (C.E., OECD, IFPEN, L'Oréal, Véolia, SEPPIC, CNRS): metrics, KPIs, WFP, CFP.
- Need to develop partnerships/collaborations, particularly for technology transfers and industrial maturation (CNRS, Ministry of Research, C.E., BASF, Véolia, L'Oréal, Stéarineries Dubois)
- Sustainable competitiveness/Sustainable business (C.E., Veolia, Stéarineries Dubois...

Importance of Ecodesign based on respect of supply chain sustainability

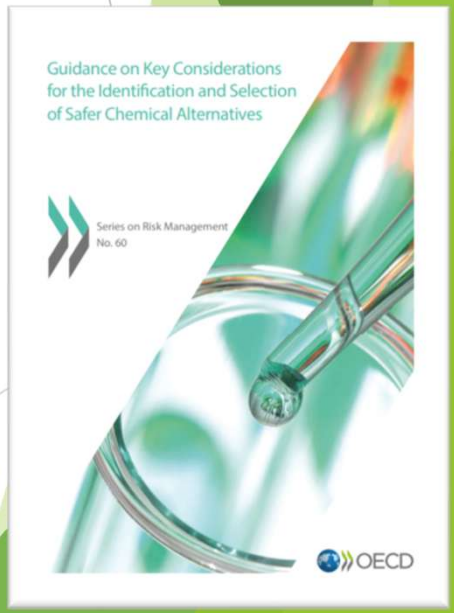


- Biosourced materials are one of the key elements to be taken into account
- However, "Biosourced" implies renewable but not necessarily sustainable character:

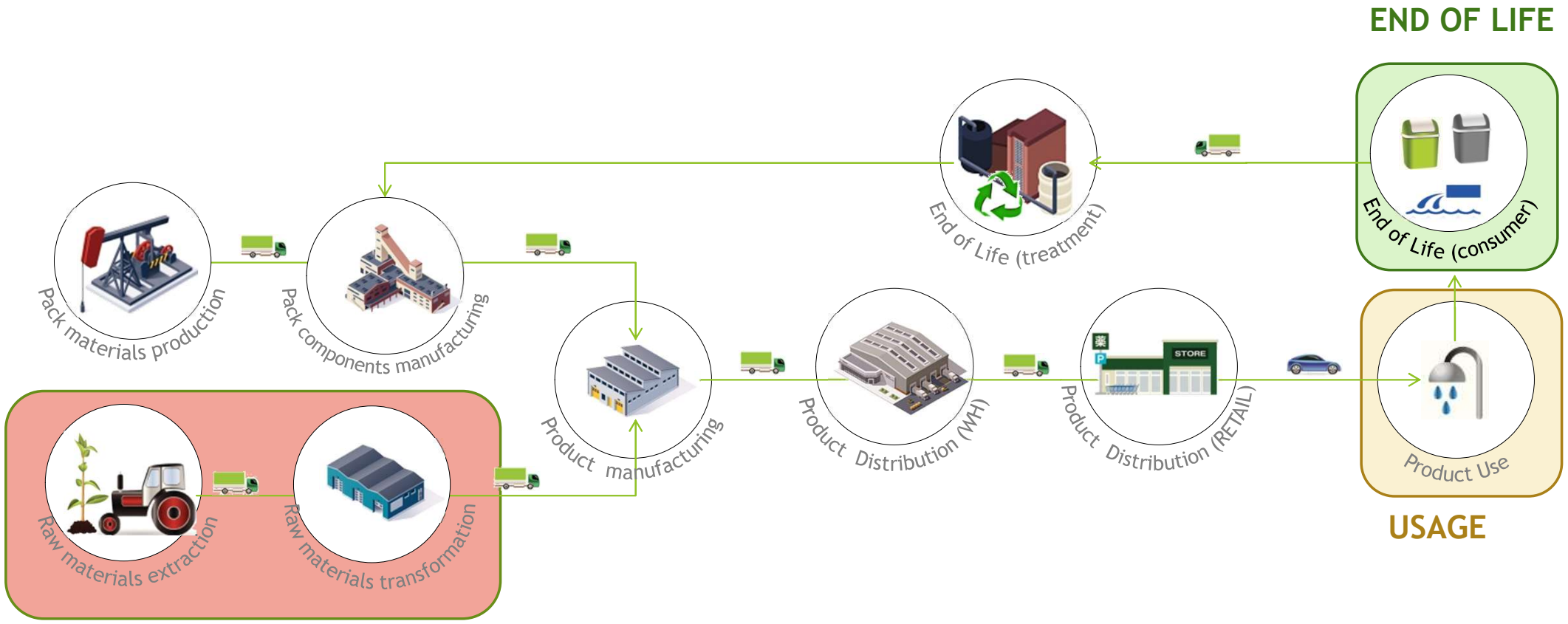
  - ❖ Analysis of the origin and supply chain to be done beforehand:
    - ✓ Deforestation?
    - ➢ Fair return?
    - ➢ Biopiracy?
    - ➢ Protection of species? ...

OECD work on Assessment of Alternatives, Substitution and Sustainable Chemistry

- Work managed by the OECD Working Party on Risk Management.
- **Key Resources :**
  - OECD Guidance for considerations for selecting safer chemicals: identifies the minimum requirements for determining whether an alternative is safer.
  - The Substitution and Alternatives Toolbox (SAAToolbox): compilation of resources related to substitution and evaluation of alternatives.
  - Recent activities: Inform approaches for a more sustainable selection of chemicals, in line with previous OECD work on sustainable chemistry.



ENVIRONMENTAL IMPACT OF PRODUCTS
COMPLETE LIFE CYCLE ANALYSIS (slide from L'Oréal R&I)



SUSTAINABLE SUPPLY CHAINS ***with*** **RESPECT of GREEN CHEMISTRY PRINCIPLES** ***to*** ***SUSTAINABLE CHEMISTRY***

FURTHER TO OUR CONFERENCE DAYS ON
TRANSITION PATHWAY FOR THE CHEMICAL INDUSTRY:

INITIAL CONCLUSIONS AND MESSAGES TO TAKE AWAY

Conclusion

CHEMICALS

But….do not promise too much

TAKE HOME MESSAGES

- ❑ A biobased product does not mean a sustainable product
- ❑ Don't compete with fossil-based feedstocks : improve performances
- ❑ Take benefit of the chemical complexity of biomass

OPPORTUNITIES IN THE FIELD OF CATALYSIS

► Alternative technologies : revisit activation modes

Generation of highly reactive species (photons, electrons, waves, radicals, etc…

Activation energies close to 0 kJ/mol

► Control of the reaction selectivity : coupling with catalysis

► And improve reactor productivity, energy consumption etc…

THE BIOTECHNOLOGICAL REVOLUTION

- **Why A revolution? A Nobel Prize of Chemistry awarded in 2020 for genetic engineering serving the Chemistry of Life (CRISPR-Cas 9)**

- ***«Chemistry can no longer ignore that it comes from the living »***

- **Biotechnological Revolution will accelerate development of:**
  - **Plant-based ingredients, Bio-systems,**
  - **Eco-respectful processes,**
  - **Biodegradation…**

  in many fields: food, pharmaceuticals, cosmetics, fragrances, paintings, clothings, electronics…
- **Acceleration of the Research speed due to AI, computing**
- **60% of physical inputs to the global economy could be produced using biological means (Mc Kinsey)**
- **7 to 9% of annual man-made GHG emissions could be reduced by 2040 to 2050 (Mc Kinsey)**

What Future in Biotechnologies?

- Creation of new enzymatic activities
- Complementarity / Coupling with Green Chemistry
- Control and optimization of metabolic pathways
- Optimization of the conduct of microbial cultures
- In silico design of performance enzymes
- Mastery of enzymatic cascades (regeneration of cofactors)

CHALLENGES AND OBSTACLES TO OVERCOME

- Securing the supply of biomass and/or sustainable raw materials
- The higher prices of bio-based or recycled solutions compared to petrochemical molecules in order to achieve the same level of performance while reducing the carbon impact
- Acceleration of the development of continuous processes that are levers for the decarbonization of current production units.
- Simplification of regulations that hinder the development of new, more sustainable processes
- Difficulties in using existing metrics, particularly for circularity issues / Life cycle analyses and resource-intensive techno-economic analyses
- Need to mobilize public support to better accompany the development of new, more sustainable processes.