

Leveraging Innovation for a Climate Neutral and Competitive Europe

The current situation and the need for a smart innovation framework

The industrial sector is crucial for the transition towards a competitive, digital, and climate-friendly Europe¹. The chemical sector has a strategic role in the European economy as chemicals are at the heart of Europe's major value chains, including pharmaceuticals, electronics, batteries for electric vehicles, construction materials etc.². At the same time, the EU chemical industry is seriously challenged by the high costs in Europe for energy, raw materials, and compliance with complex, fast changing regulations. These are significant challenges compared to EU chemical sector's global competitors in other regions.

These challenges align with a critical moment where there is an urgent need for investment to achieve the EU's Twin Green and Digital Transition objectives, especially in relation to its climate ambitions. It is estimated that the implementation of the European Green Deal needs around EUR 520bn investments per year from 2021-2030.

Taking the above-mentioned challenges into account, the recently published [Cefic Manifesto](#) outlines five priorities the chemical industry believes policy makers should urgently focus on in the next term:

1. Increasing availability and supplies of abundant renewable energy and raw material, supported by electrical power grid expansion and energy storage facilities,
2. incentivising and scaling up technologies for renewable and circular feedstocks,
3. preventing fragmentation of the EU Single Market with a harmonised framework,
4. creating demand and markets for low-carbon products, through the development of cost competitive supply chain for renewable and circular feedstocks,
5. and making the innovation framework smarter.

This white paper will elaborate in more detail on point (5) and what needs to be done to foster the *power of innovation* in Europe.

¹ [Investing in green industry can help keep sustainability momentum in Europe \(europa.eu\)](#)

² [Transition Pathway for the Chemical Industry](#)

Innovation is key for the green transition and competitiveness in Europe

The EU chemical industry is committed to achieving the European Green Deal objectives. Smart regulation can ensure that the pursuit of Green Deal targets while ensuring the necessary competitiveness be mutually beneficial. Innovation plays a key role here to address e.g. climate change and pursue competitiveness and economic growth at the same time. International Monetary Fund (IMF) research shows that doubling green patent filings (=used as a proxy to innovation) can quadruple a nation's gross domestic product³. This IMF⁴ study showed that certain domestic and international climate policies and regulations play a key role in boosting (green) innovation. Moreover, Research & Development subsidies and feed-in tariffs are particularly impactful. Given the long lead times for the market ready development of new technologies and products as well as the long investment cycles in the chemical industry, the time to act is now.

Nevertheless, certain **pre-conditions** must be in place to fully reap the benefits of a smart innovation policy framework:

1. General recognition of the crucial role of chemicals to meet the EU Green Deal objectives.
2. Cost competitive access to renewable and low carbon electricity.
3. Stimulated market demand for new, safer, and more sustainable products:
 - For example, enforce recycled content targets recognizing available recycling technologies such as chemical recycling, enforce biobased content targets and thereby support a market pull with incentives to drive the demand for more sustainable products.
 - Create an EU Single Market for waste and end-of-life resources, including critical minerals/materials recycling.
4. Recognition of the environmental benefits (including under EU Emissions Trading System (ETS)) from the utilisation of all decarbonised alternative solutions to fossil feedstocks such as recycled feedstocks, bio-based feedstocks, and CO₂ as alternative carbon feedstock to produce chemicals and polymers in Europe.
5. Application of technology neutrality: Policy frameworks should prioritise targets while allowing the freedom to apply all necessary technologies to reach the given targets.
6. Access to skilled labour forces, including:
 - Support efforts to keep and attract world-renowned university faculties.
 - Simplify and incentivise the migration of highly educated people toward the EU.
 - Ensure sufficient education facilities in digital technologies and MINT⁴.

³IMF: [Green Innovation and Diffusion: Policies to Accelerate Them and Expected Impact on Macroeconomic and Firm-Level Performance](#)

⁴ Mathematics, Informatics, Natural Science, and Technology

Achieving Climate Neutrality - Innovation for a climate neutral European chemical industry

The broad portfolio of products and the many related production processes in the chemical industry require careful consideration. To meet the EU's ambitious climate targets, there is a need for the timely and successful deployment of a wide array of innovative process technologies, which include the integration of climate-neutral energy and the utilisation of alternative carbon feedstock.

Major priorities to reduce greenhouse gas (GHG) emissions in the chemical sector include:

1. The integration of climate neutral energy especially through electrification (including indirect electrification for heat e.g., in an electric cracker and direct electrification of chemical processes through electrochemical processes).
2. The production of hydrogen with a reduced carbon footprint for use as feedstock or as an energy carrier.
3. The utilisation of alternative carbon feedstock (incl. circular feedstock such as recycled feedstocks, bio-based feedstocks, and carbon capture feedstocks).

Such priorities would require new process technologies and their combination will be essential to reach the climate neutrality objectives and will contribute to reduce EU's dependency on fossil resources import. For the successful implementation of these priorities the above-mentioned general pre-conditions like the access to cost competitive access to renewable and low carbon electricity and the recognition of the environmental benefits from the utilisation of CO₂ as alternative carbon feedstock for chemicals need to be in place.

Transition to a Circular Economy (including recycling and bioeconomy and CO₂ as feedstock)

To achieve a sustainable circular economy, a broad array of complementary technologies, new products, and new business models need to be demonstrated and deployed. Innovation will play a key role in product and process development, aiming to rethink all materials across their life cycle stages. The objective is to enhance their durability and improve their recyclability to repurpose them as sustainable resources in other products and materials while simultaneously consuming less resources.

A policy framework that would support the above would include:

1. Incentives for the technology development in bio-based processes (e.g., biotechnology) and the use of biomass, including a reliable policy framework that fosters investments in the EU.
2. Chemical and mechanical recycling technologies as complementary technologies, supported by a developed system of collection and sorting, diverting more waste from incineration, and landfilling to recycling. The Incorporation of the calculation rules for chemically recycled content, based on a credit-based mass balance fuel-use exempt model, into an enabling policy framework, is crucial. Only this model will unleash further investment into the relevant operations in Europe, which is crucial to ensure that the EU reaches its recycling and circularity targets⁵.
3. Clear and consistent approaches and regulations for recycling, incl. critical minerals/materials.
4. As we move to a circular economy, tackling the inconsistency of approaches caused by the co-existence of “waste” and “product” regulations. A key obstacle is the lack of clarity about the point at which End-of-Waste status is reached in the chemical recycling process. A harmonised EU approach is needed to eliminate the overall uncertainty and remove the barriers to cross-border recycling activities.

Zero Pollution Europe: Designing safe & sustainable chemicals through innovation

To meet the targets set out in the European Commission’s Green Deal zero pollution ambition for a toxic-free environment, both incremental and transformational/breakthrough innovation play a key role. Novel and breakthrough approaches to provide solutions for unprecedented challenges in an ever more safe and sustainable manner must be found. Striving for a continuous improvement of the safety and sustainability of chemicals, materials and production processes is at the heart of the chemical industry’s endeavors. Good regulation can trigger, stimulate, and support innovation whereas overly rigid, ambitious, and non-practical policy frameworks might stifle innovation as a creative process.

Optimal conditions to meet the zero-pollution goal will require a policy framework that prioritises:

1. A Safe and Sustainable-by-Design framework that is concise and pragmatic to demonstrate its support for (incremental and transformational) innovation that can be practically implemented.

⁵ For more details on the Bioeconomy and on recycling, see [Cefic’s latest paper Delivering the bioeconomy agenda for 2024 and beyond](#) and [Cefic’s position on Chemical Recycling](#).

2. Show a clear strategic link between the application of a lean Safe and Sustainable-by-Design framework and targeted overall innovation steering (e.g. (re-)gaining technology leadership) going beyond funding opportunities is necessary.
3. Existing product portfolios are already widely evaluated using frameworks like the Portfolio Sustainability Assessment (PSA Methodology) by the World Business Council for Sustainable Development^x thus negating the need for additional administrative burdens.
4. Supporting the development of predictive digital tools for toxicological and sustainability assessments to accelerate and de-risk the innovation process, e.g., leveraging Artificial Intelligence (AI) on already available toxicity databases, such as those maintained by ECHA.

Cefic continues to support the co-creation of a straightforward and “easily” applicable approach to safe and sustainable-by-design (SSbD) chemicals and materials between the European Commission, industry, and academia.

Innovation: Key to industry competitiveness and Europe's strategic autonomy

European companies invest more and more in assets outside of Europe. This is mainly due to high energy prices and higher regulatory burdens/regulatory uncertainty including the ones for funding compared to other regions. Financial investors limit their investments in Europe as can be seen from market values of European Chemical companies that have decreased strongly during the last 5 years. As a result, the global market share of the European chemical industry has reduced significantly over the past twenty years from roughly 25% to 15%.⁵

With higher energy prices, a lack of abundant competitively priced raw materials, and higher labour costs in comparison to other regions, for decades, innovation has been the engine for the resilience of the chemical industry in Europe. While subsidies to level the playing field, such as those for energy prices, help to bridge the time until sufficient renewable energy at cost competitive prices is available, innovation is THE basis on which the industry can compete in the long run and thereby generate by itself the funding that is needed to achieve the double twin transition.

Betting only on new, less energy intensive and potentially emerging industries seems risky when neglecting key value chain players in the existing industrial landscape. The industry in Europe enjoys a variety of strengths like a solid skilled workforce, which sets the foundation for an excellent, interdisciplinary innovation ecosystem. Currently, the EU boasts a robust innovation pipeline with numerous promising technologies under development. There is no lack of creativity to address the challenges of our times, but still the EU lags in its commercialisation of innovative technologies and products compared to other regions.

Therefore a “smart innovation framework” should include the following:

1. Create simple and efficient processes for introduction of new products (chemicals) into the market. Approaches that foster the piloting of innovative solutions should be used more frequently, like the increased use of regulatory sandboxing.
2. Increase planning reliability to ensure newly developed technologies can be applied long enough to earn a reasonable pay-back and thereby ensure resources for future R&D are available.
3. Support for investment needs, especially the scale-up of innovative technologies, goes hand in hand with support for R&D to secure a long-term competitive production base in the EU.

Supporting measures

The European chemical industry will continue to innovate, develop new products, and adopt new techniques and technological solutions that are yet to be scaled up and deployed. This requires support from a research and innovation (R&I) policy agenda. This R&I policy agenda should include the following supporting measures:

Applying advanced digital technologies to achieve sustainability objectives⁶

Green and digital transitions are at the forefront of the EU policy agenda, however, the interplay between both policy areas is currently limited. It is crucial to effectively pursue synergies between green and digital transitions as digitalisation holds the key to achieving a substantial portion of the EU Green Deal’s sustainability objectives.

The chemical sector is already making considerable efforts to apply advanced digital technologies for sustainability in the entire value chain, however, wider, and more intensive implementation will be required to accelerate the journey to sustainability. Fully unlocking the power of digitalisation requires overcoming several challenges. These include technological challenges (e.g., data availability, standardisation, interoperability, cybersecurity) as well as the required financial investments and advanced digital skills. Greater collaboration between the chemical industry and EU institutions will be needed to address some of these issues.

Policymakers can ensure beneficial implementation of digital technologies by:

1. Enabling cross-industry interoperability to establish integrated ecosystems.

⁶ More details can be found in the recent joint Cefic – Arthur D Little (ADL) study on [“Digital Technologies for Sustainability in the European Chemical Industry.”](#)

2. Facilitating data sharing mechanisms among multiple stakeholders, while guaranteeing optimal data protection.
3. Promoting better access and use of existing data (e.g., toxicity data).
4. Supporting the creation of a data space for the chemical industry while guaranteeing optimal data protection.

Public Funding: Vital for innovation in the double twin transition, securing European competitiveness and strategic autonomy

Innovation is the key to reach the Green Deal targets, to stay competitive and to increase Europe's strategic autonomy. To innovate, organisations need to have the necessary resources. Mature companies and organisations in general can only invest in innovation if they generate adequate profits in the present. Given the current and foreseeable economic challenges faced by Europe's chemical industry, companies will not have enough resources to simultaneously address all the challenges as required by the Green Deal.

With the increasing focus and funding of innovation in other regions, especially China, Europe's technology leadership is at stake. This threatens the European industry's competitiveness both in the chemical industry and its downstream value chains.

As downstream value chains and final consumers depend on finding substitutes for chemicals that need to be phased out, it is in the interest of society to support the industry with funding to find safe and sustainable substitutes as soon as possible. Policymakers at both the EU and Member States levels must⁷:

1. Increase and simplify the accessibility and availability of EU and MS funding instruments for industrial projects. The speed of accessing funding through EU instruments is much too slow compared to regions like the US.
2. Increase budgets for existing funding vehicles or implement new funding mechanisms to support the chemical industry in addressing the double twin transition while remaining competitive in a challenging economic environment.
3. Allocate funding for both Capital Expenditure (CAPEX) and Operating Expense (OPEX), using specific criteria to guarantee the swift and effective implementation of innovative projects. This includes projects at various stages of technological readiness, from those with high Technology Readiness Levels (TRL) to early-stage innovations with significant potential for greenhouse gas (GHG) reduction. Therefore, invest in pilot and demonstration plants to

⁷ A more detailed Cefic paper outlining how to raise the efficiency in current EU funding mechanisms and best practices from EU's trading partners are in the making.

expedite and mitigate the risks associated with scaling up new technologies, helping them bridge the critical "valley of death" phase that many European innovations face.

4. Provide subsidies for operating costs to support the implementation and deployment of low CO₂ emission technologies (e.g., via (Carbon) Contracts for Difference).

The way forward

The chemical sector represents a vital industrial ecosystem within the EU. Innovation plays a decisive role in fulfilling the Green Deal objectives and maintaining the competitiveness of both the chemical sector and broader European industry. Technology leadership in the European chemical industry will promote and enable regional partnerships with other industries that have synergetic potential to establish Europe as a leader in all critical technological domains. Such leadership is the foundation for the overall prosperity of European citizens and Europe's strategic independence.

Innovation thrives only when there is a viable business case for organisations. Given its critical role in meeting the Green Deal's objectives, the green transition hinges on a compelling business case for both innovation and the broader transition efforts. The transformative power of innovation in the chemical industry holds the key to addressing some of society's most pressing challenges. To this end, Cefic is actively engaging with policymakers to explore in greater detail how to harness this potential.

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About Cefic

Cefic, the European Chemical Industry Council, founded in 1972, is the voice of large, medium and small chemical companies across Europe, which provide 1.2 million jobs and account for 14% of world chemicals production.