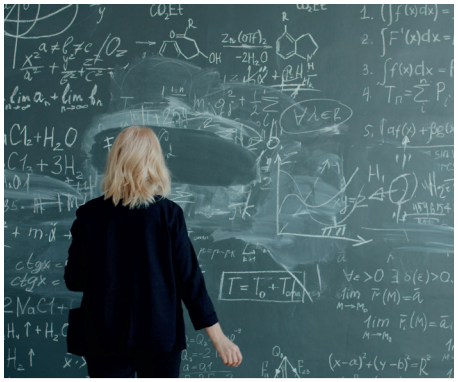
Leveraging **innovation** to accelerate the **green transition**


January 2026

EPE
Entreprises pour l'Environnement

CHAIRWOMAN'S MESSAGE

We have long believed that innovation alone would suffice and that each new technology would bring us closer to a brighter future. That the "creative destruction" theorised by Joseph Schumpeter in 1942 would inevitably generate progress.

However, reality has now caught up with us. Our technological civilisation is fast approaching its limits, as evidenced by climate change, biodiversity loss, resource depletion, water shortages, and many other issues. What is more, the pursuit of innovation breeds new problems, such as the avoidance of environmental standards, increased technological dependence, accelerated obsolescence, and the reluctance to adopt proven solutions, to name but a few. In short, innovation binds us with new chains.

Yet, turning our backs on innovation would lead to a dead end. Without research and innovation, there can be no accessible green transition, no genuinely sustainable economy, and no collective resilience. The question is no longer whether we should innovate, but how to channel innovation in support of the ecological transformation.

Progress should not be the privilege of a few or merely a frantic race towards technological innovation. In a world afflicted by crises, collective progress rooted in local realities alone can effectively address the challenges of our time. This transformation amounts to an opportunity to foster shared prosperity that is more resilient, more sufficient, and more autonomous.

This report by EPE member companies outlines their tangible efforts to mobilise and manage the innovation that drives this transformation. The core belief is that this change is at once strategic, organisational, and cultural. The robustness of innovation processes is comparable to that of heavy infrastructure. Consequently, pioneering companies are developing processes and skills necessary to re-engineer their technological options and economic models from the design stage. They are building tools to drive this transformation effectively until it ultimately benefits their customers.

We hope this research will be valuable to all stakeholders working to promote responsible innovation for the green transition, thereby reaffirming France's leadership in this field. Responsible innovation is no longer just an option; it is the essential driver of shared progress.

Estelle Brachlianoff
Executive Director, Veolia
Chairwoman, Entreprises pour l'Environnement (EPE)

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INTRODUCTION

Environmental degradation: a threat or an opportunity for innovation?

The past few years have revealed increasing evidence of the economic, logistical, health, social, legal, and reputational effects of climate change, biodiversity loss, and widespread chemical pollution on companies. To reflect these new priorities, many businesses are re-examining their activities, including their strategies and the role of innovation. The search for solutions to major environmental crises also presents substantial technological, innovative, and market opportunities, encouraging these companies to adopt sustainable transformations.

Innovation, in all its forms and across all fields, has driven and continues to support the transformation of our societies, especially since the second half of the twentieth century. Today, technological innovation acts as a catalyst for economic growth for both businesses and nations, and is regarded by many stakeholders as part of the solution to the environmental crisis. While it is clear that innovation plays and will increasingly play a crucial role in the sustainable development of our societies, to avoid undesirable outcomes and guide its future direction, its forms and boundaries may be subject to debate.

- The discovery of oil and the technological innovations it has spurred in the transportation and chemical sectors have decisively shaped our modes of travel and consumption. However, associated emissions are the root cause of the **climate crisis**. There can be no doubt, therefore, that current innovations in mobility and renewable energy are crucial for reducing our societies' carbon footprint while still meeting everyone's needs.
- Over the last few decades, innovations in farming, such as plant protection products, intensive agriculture, and seed selection, among others, have substantially increased global food production. However, these advancements have also greatly contributed to the **decline in biodiversity**. Biodiversity-focused innovations, like nature-based solutions, regenerative agriculture, and biomimicry, are therefore crucial for reducing the environmental impact of our economic activities.
- Since the early twentieth century, the production and use of plastics have become widespread across many objects and industries. Their unique properties have driven significant technological progress in medicine, electronics, transportation, and construction, making them essential in many fields. However, plastics have also been a source of controversy for many years due to the pollution they cause and their multiple adverse impacts on biodiversity and human health[1]. The same concerns apply to other **chemical substances**, such as PFAS. The European Parliament noted, in a June 2025 document, that "chemicals are part of our daily lives and contribute to our well-being, health and safety. They can also be useful for **developing low-carbon, pollutant-free and energy-efficient technologies and products**[2]". Chemicals, therefore, present both material risks for companies and opportunities for new markets, innovations, and products and services that support the green transition.

Businesses are thus beginning to focus their innovation efforts on addressing the challenges of the green transition. However, since late 2024, the environment in which they operate has become increasingly uncertain, characterised by geopolitical conflicts, declining purchasing power, market instability and slowdown, supply difficulties and disruptions, rising prices of raw materials and finished products, and unstable regulatory and political frameworks, particularly regarding environmental issues. As a result, private

1 EPE, "Combating plastic pollution: a collective effort", 2024.
2 European Parliament, "Targeted scrutiny of the EU chemicals strategy for sustainability", June 2025.

players are encouraged, on the one hand, to make lasting changes to their economic models and, on the other, to meet shorter-term goals, giving rise at times to conflicting expectations among their investors, markets, and customers. Ultimately, poor current visibility hinders investments in the green transition. For example, the latest report by the Institute for Climate Economics (I4CE) noted a decline in climate investments in France in 2025 compared to 2023, even though an additional €87 billion is needed by 2030, as climate-related investments actually drive innovation[3].

Given the circumstances, some businesses are intensifying their efforts and ingenuity to meet their climate commitments, experimenting with creative solutions to protect biodiversity and reduce their reliance on certain chemicals, while still fulfilling market and (internal and external) stakeholder expectations regarding profitability and competitiveness[4]. However, in the face of environmental challenges, many corporates are tempted to rely on technological innovation (including substitute energy sources for fossil fuels, alternative materials, and solutions to new environmental issues), often at the expense of much-needed preventive measures.

Research and innovation in the face of the green transition

Faced with these conflicting demands, the fields of innovation and research and development (R&D) present both risks and opportunities. Numerous bold decisions must be made.

- How can we mobilise innovation to support the green transition, identify problems that could lead to stranded assets, and invest in areas that will provide a competitive advantage in the future?
- What are the needs and tools for raising awareness, training, and supporting teams through this change?
- How do we (re) organise corporate innovation and R&D to address these new challenges and needs?
- How can we incorporate environmental and sustainability considerations into innovation measurement and management?
- How can we promote such sustainable innovations among customers and consumers?

Since 2022, EPE member companies have been engaging with each other and their stakeholders through the Research-Innovation Committee to work out possible solutions. This publication summarises the insights gained and the studies conducted by companies on this topic.

The first chapter of this brochure explores how innovation and R&D are transforming, or can transform, companies in a sustainable way. The following chapters, drawing on the best practices of EPE members and some of their stakeholders, show how companies can measure and support innovation and R&D sustainably, and promote these practices among customers.

3 I4C, "Panorama of Climate Finance", Report, 2025 edition.
4 Estelle Brachlianoff and Patrick Pouyanné, "The green transition: Europe must keep its lead", Collective opinion piece in Les Échos, 5 June 2025.

1

Re-engineering innovation – a prerequisite for sustainable business transformation

The current major environmental crises stem from the development of our societies, lifestyles, and consumption patterns, driven by the wave of technological innovations since the Industrial Revolution. Innovation and technological progress have become myths, albeit criticised for their negative impacts. Nonetheless, innovation is essential for the green transition and calls for rethinking its forms and objectives.

1 The limits of the myth of innovation and technological progress

The fourth edition of the Oslo Manual, developed jointly by the Organisation for Economic Co-operation and Development (OECD) and Eurostat, defines innovation as "**a new or improved product or process** (or a combination of both) that differs significantly from the unit's previous products or processes and **has been made available** to potential users (product) or **brought into use** by the unit (process)"[5]. Innovation can thus take different forms: products, services, techniques, brands, processes, organisation, management, behaviour, etc.

Over the past few decades, in a market driven by the paradigms of progress, improvement, performance, and economic growth, innovation has played an existential role and function: "innovations improve productivity and create added value, generate wealth, and increase the incomes of various economic players"[6]. Essential for economic and business growth, innovation has become an end in itself, rarely scrutinised for its adverse effects or potential rebound effects[7]. This incremental innovation often aims to sustain existing models rather than transforming them. This is obvious, for example, in automobile electrification, where total fleet substitution is neither feasible nor desirable. It also tends to reinforce lifestyles and transport systems organised around the individual car, rather than transforming our relationship with vehicles, including habits, travel needs, and urban planning schemes.

Additionally, traditional forms of innovation are mostly **incremental**, **focused on improving efficiency**, **reducing costs** and **increasing profits**.

The **myth of innovation** has quickly given rise to "**techno-solutionism**", another myth claiming that technological innovation can solve each and every problem. Technological innovation is thus seen as a remedy for the environmental crisis, ignoring the fact that the various environmental issues—climate, biodiversity, and pollution—arise from the widespread dependence on past innovations (such as internal combustion engines, concrete, digital technologies, pesticides), all designed as responses to other crises or needs. In his book published back in 1979, the German philosopher Jans Jonas warned that "modern technologies introduce systemic risks on an unprecedented scale, likely to affect not only present generations, but also future ones"[8], and called for an ethic based on foresight and the **precautionary principle**.

Innovation, in the broad sense, can nevertheless be a powerful tool for the green transition, provided it surpasses economic and technological criteria alone. In his 2023 essay, Franck Aggeri, professor at **Mines Paris-PSL**, describes this new breed of innovation and identifies several drivers of change.

> "Modern technologies introduce systemic risks on an unprecedented scale, likely to affect not only present generations, but also future ones."
>
> *Jans Jonas, 1979*

5 OECD and Eurostat, "Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation, 4th edition, The Measurement of Scientific, Technological and Innovation activities", OECD, Paris, 2019.
6 *Vie publique, "Qu'est-ce que l'innovation ?"*, 14 December 2023.
7 See IFP School box in the EPE publication, "Sufficiency, a new driver for business transformation", June 2025, p. 11.
8 Jonas (H.), "The Imperative of Responsibility: In Search of an Ethics for the Technological Age" Paris, 1979, quoted by bcom, "White Paper" "*Repenser l'innovation : tensions, responsabilités et bifurcations*", April 2025, p. 7.

Why and how to innovate differently?

Franck Aggeri, professor at Mines Paris-PSL

Innovate constantly and ever faster. This is the universal obligation of everyone: individuals, companies, and states. In the context of the green transition, this creed is embodied in "green" technological innovations that aim to reconcile economic growth with environmental preservation. However, this model has three flaws: it **overlooks pollution transfers** across the entire lifecycle of innovations; it **underestimates the scale effects** linked to their widespread adoption; and it sustains the illusion that technology alone will resolve the environmental crisis **without the need for lifestyle changes**.

"Innovation, but what for? Essay on an economic, social and managerial myth" (Seuil 2023) explores two complementary lines of thought:

- **innovator accountability** for the long-term consequences of their projects. For businesses, this entails shifting from retrospective liability to forward-looking projective liability by integrating techniques such as life-cycle assessment or multi-currency accounting, adopting the principles of responsible innovation, exercising a duty of care across the value chain, and engaging with societal missions;
- **encouraging more sufficiency-focused innovation projects** that foster new lifestyles, consumption patterns, and production methods in harmony with planetary boundaries and anticipate the needs of future generations. This involves rethinking our relationship with consumption, resources, and progress. Sufficiency is not synonymous with deprivation or constraint; rather, it is a reflexive approach based on voluntary renunciation. Sufficiency aims to achieve a conscious reduction in one's material and energy footprint by leveraging frugal innovations and sustainable practices that extend product lifespans and intensify their usage. Accordingly, service offerings and new business models such as repair, reconditioning, sharing, or the functional economy, supported by eco-design approaches, should be encouraged, as confirmed by many industrial and service companies that have already adopted this approach (e.g., FNAC-Darty, Signify, Michelin, Seb).

However, a transformation on that scale requires a **paradigm shift.** This includes adjusting our performance indicators to adopt a long-term outlook, conserving natural capital, enhancing the status of sectors affected by labour shortages (such as maintenance and repair), and consequently aligning public policies. Through sufficiency and accountability, the goal is to assign innovation its proper place: **a means to achieve societal goals** and build a truly sustainable world — in short, anything but an end in itself.

2 Sufficiency and responsible innovation: new imperatives

2.1 Unavoidable and sometimes (un)desirable sufficiency?

During a seminar in 2022, experts from the French Académie des technologies (Technologies Academy) noted that by 2030 "neither existing nor developing technological innovations, nor carbon-free energies, whether renewable or not, can be deployed at a sufficient pace"[9] to meet Europe's climate goals. The Academy therefore concluded that **"sufficiency is essential"**. The same year, the sixth report of the Intergovernmental Panel on Climate Change (IPCC) listed sufficiency as one of the drivers of climate change mitigation[10].

In turn, EPE's "Milestone 2030 of the Green Transition" study (ETE 2030)[11] identified sufficiency as a priority for the green transition in the broader sense, whose success relies on several drivers, including "sufficiency-focused **technical and organisational innovation**, circularity, a new more respectful relationship with nature, and new partnerships". An extension of this study, published by EPE and its members in June 2025, shares feedback from companies that have re-engineered their business models and made sufficiency a differentiating factor[12].

> "By 2030, neither existing nor developing technological innovations, nor carbon-free energies, whether renewable or not, can be deployed at a sufficient pace to meet Europe's climate goals"
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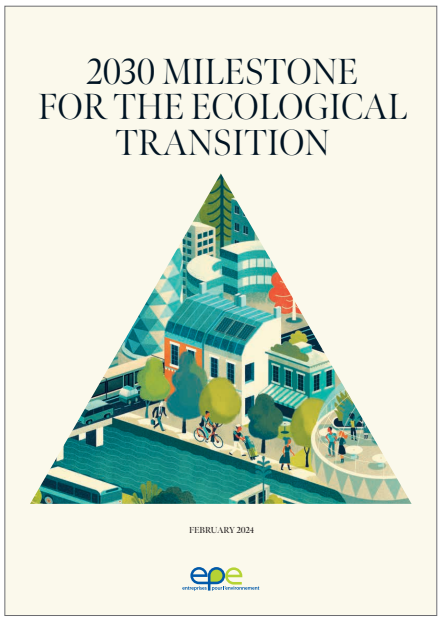
> *Académie des technologies, 2022*



The Milestone 2030 study identifies sufficiency as a priority for the green transition.

Feedback from companies that have innovated their business model and made sufficiency a differentiating factor.

9 *Académie des technologies, "Matières à penser sur la sobriété"*, Summary of the 2022 Académie des technologies seminar, 2023.
10 IPCC,"Climate Change 2022: Mitigation of Climate Change", executive summary, 2022.
11 EPE, "Milestone 2030 of the Green Transition", December 2023.
12 EPE, "Sufficiency: a new driver for business transformation", 2025.

Adopting a sufficiency-focused approach, therefore, requires enabling other forms of innovation in social, behavioural, business model, organisational, and production fields. Behavioural and social innovations, indeed, are key to supporting technological innovation.

Embedding sufficiency in business models and innovation processes can undoubtedly deliver a competitive advantage to companies leading the green transition (e.g. circular economy, renewable energies) and promoting disruptive innovations (e.g. the functional economy). It can also enhance their brand image among talented prospective employees and investors.

However, these measures can be difficult to implement due to the combined effects of resistance to change among corporate stakeholders, market competition, regulatory changes, and the lack of reliable indicators to determine the sufficiency of innovations (e.g. raw material footprint, circularity indicators), not to mention the risk of rebound effects.

Sufficiency-focused research and innovation (R&I), therefore, is not merely a constraint but a strong incentive to pursue innovation pathways that are more responsible and sustainable. This demands a long-term vision, challenging ingrained habits, and close collaboration with all stakeholders.

2.2 A new model: responsible innovation

In his 2023 essay, Franck Aggeri identifies innovator accountability as a crucial element of sufficiency (see box, p. 13) in order to establish the conditions for change appropriate to environmental crises, ensure that innovations align with environmental preservation goals, and prevent the emergence of rebound effects and other adverse consequences.

In a 2013 publication, Jack Stilgoe[13], Richard Owen[14], and Phil Macnaghten[15] define **responsible innovation** as "caring for the future through **collective management** of science and innovation in the present"[16]. In doing so, they establish four criteria, known as ARIR, to implement responsible innovation:

- **anticipation** – foreseeing various social and/or environmental impacts to avoid possible outcomes;
- **reflexivity** – defining in advance the usefulness of innovation, which must provide a tangible and measurable service;
- **inclusion** – integrating all intermediate and peripheral stakeholders into the innovation decision-making chain;
- **responsiveness** – responding to a real need of society, such as climate change, biodiversity loss, or health risks from pollution.

On the environmental aspect, responsible innovation includes **eco-innovation**, which seeks to lessen the environmental impact of new products, services, technologies, or practices from the design stage (**eco-design**). Eco-innovation aims to create better solutions for environmental protection and social well-being while encouraging economic growth. **Frugal innovation**, which focuses on saving resources (raw materials and technologies), is also part of responsible innovation.

Such types of innovation can be applied to technologies (renewable energies, nature-based solutions), processes (resource optimisation), products, or economic models (sharing economy or collaborative consumption). They often enable businesses to **reduce long-term costs**, become more resilient in the face of environmental crises, enhance their **reputation and brand image**, and discover **new markets and customer segments**.

On the other hand, they often face **higher initial costs** due to the introduction of new technologies, the adaptation of production processes, and employee training, as well as **resistance to change** among employees, suppliers, and customers.

The following three chapters describe the organisational drivers, processes and tools developed and implemented by some businesses to address these limits, while managing and sustainably rolling out their innovations.

13 Professor of Science and Technology Policy, University College London, United Kingdom.
14 Professor of Innovation Management at Bristol University's Business School (UK).
15 Professor of Technology and International Development at the University of Wageningen, Netherlands.
16 Stilgoe (J.), Owen (R.) and Macnaghten (P.), "Developing a framework for responsible innovation", 2013, Research Public, Vol. 42(9), pp. 1568-1580.

2

Embedding ecology in innovation strategy and organisation

In a 2024 study on the green transition of professions, the French startup Nouveaux Géants[17] observed that the innovation and R&D departments, when exploring needs and trends and designing offerings, "can put their skills to use for the green transition by exploring more specifically users' bare minimum requirements and the environmental challenges they face, mobilising company stakeholders to design the future they consider desirable, and designing business models, offerings, and products that help reduce the impact of the company and its stakeholders" [18].

Accordingly, the innovation and R&D professions can lead the way in the sustainable transformation of businesses by:

- anticipating trends and helping to identify desirable and undesirable outcomes;
- directing innovation and R&D towards projects that are resilient to environmental crises and assist in resolving them (see Chapter 3);
- measuring and reducing the impact of projects and portfolios;
- associating corporate stakeholders in this work;
- sharing best design and development practices both internally and with customers and suppliers.

To achieve this, businesses adopt a two-pronged integrated approach: incorporating environmental considerations into innovation and R&D projects, and re-evaluating the organisation of their innovation processes.

1 Promoting the green transition within the innovation and R&D sectors

Moving towards responsible innovation requires developing various drivers, starting with integrating sustainable development into **corporate strategy** so it permeates all levels and professions. Environmental targets can also be embedded in the company's business ***"raison d'être"*** (purpose), as many EPE members have done (EDF, Engie, OPmobility, Saint-Gobain, Suez, Veolia). A company that integrates environmental considerations in its purpose and strategy sends a strong message to its employees and stakeholders, and thus takes an essential first step in its green transition.

Developing a **culture conducive to innovation and sustainable development** is another driver that can contribute to helping a business sustainably transform its activities and prevent or reduce resistance to change. This involves raising awareness and training employees in eco-innovation through developing clear, practical guidelines and tools tailored to the company's needs, relying on communication campaigns advocating the economic and environmental benefits of the initiatives (emphasising that eco-innovation is a key investment), and engaging stakeholders, especially customers and suppliers, in the innovation process.

The **Saint-Gobain** and **Sanofi** boxes describe the steps taken to embed eco-innovation in company culture.

17 A startup that trains professionals in the green transition by offering career paths (eco-design, responsible purchasing, non-financial performance, responsible digitalisation) and micro-learning courses with expert partners. For further information, see https://www.lesnouveauxgeants.com/.

18 *Les Nouveaux Géants, "La transition écologique au cœur de chaque métier"*, November 2024, p. 91..

Rethinking innovation and its organisation from the perspective of sustainable development

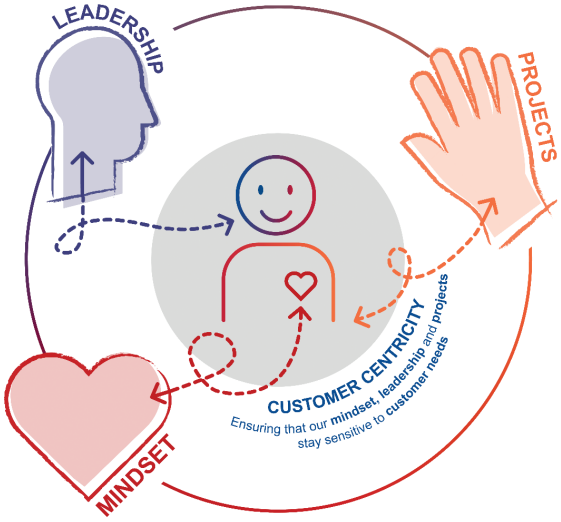
Rethinking innovation at Saint-Gobain has involved shifting from a product-focused approach to a more customer-oriented, sustainable solutions strategy aimed at creating an environmentally friendly and inclusive home. This has also entailed transforming its corporate culture, increasing employee engagement, and integrating sustainability considerations into every innovation project.

This approach is part of a broader strategy to reach carbon neutrality by 2050. Sustainable innovation then becomes a catalyst for transforming not only products but also industrial processes, logistics, and business models.

To achieve this, a **culture of change** must be fostered through team training, support across all functions, and raising supplier awareness of the entire value chain to ensure maximum transparency and trust in the approach.

Accordingly, each new researcher at Saint-Gobain receives comprehensive training in the innovation process, including a course on making sustainability essential. This transformation also involves **effective project and portfolio management**, as well as the use of quantitative tools, in accordance with the latest regulations, standards, and certifications on environmental issues. All teams can then rely on innovation and/or climate "catalysts" to support this transformation and implement the tools.

Relying solely on the R&D and R&I teams is inadequate to ensure this transition. This has necessitated a **reorganisation of various group functions** to incorporate sustainable development issues better and promote the **sharing of expertise** among marketing functions, product representatives, operations, purchasing, etc.



Thanks to these efforts, sustainable development has become an integral part of innovation, approached as a customer-focused theme, a differentiating factor vis-à-vis the competition, and a technical opportunity to redesign solutions, as illustrated below:

- **ORAÉ®**, the very first low-carbon glass with a 42% lower carbon footprint compared to the European average reference value, is produced using bespoke processes that combine renewable electricity and a high content of recycled glass;
- the new formula of **Webercol pro eco glue**[19] is top-ranked (EC1plus) in the GEV-Emicode standard, a certification for low product emissions into the environment. It has also been awarded the Origine France Garantie label for 100% domestic production.

19 https://videos.saint-gobain.com/media/Webercol+Pro+Eco/1_usriyoda?st=0.

Cultural change – the mainstay of eco-design strategy

As global leader in healthcare, Sanofi focuses its sustainability strategy on the connection between the environment, people's health, and healthcare systems. Its new "AIR" approach involves enhancing access to healthcare, minimising environmental impacts, and bolstering the resilience of health systems. Eco-design is central to this strategy.

This principle, which aims to integrate environmental considerations in product design, requires a paradigm shift in **corporate culture**, embracing changes in the mindset, skills, and daily practices of every employee.

To support this transformation, Sanofi has created a model based on six pillars:

1 **Company-wide eco-design strategy** based on two key indicators: adoption of an eco-design approach for all new products from 2025, and application of this approach to the top 20 products (representing 80% of sales) by 2030. To track progress, the company conducts ISO-compliant life-cycle assessments (LCAs), ensuring transparency and accuracy of results.

2 **Committed leadership:** Sanofi executives lead by example, prioritising sustainability and incorporating eco-design into their strategic plans[20].

3 **Success stories:** initial results are promising and allow Sanofi to share the teams' successes widely (see box p. 31).

4 **Recognition:** each year, the Planet Care Challenge encourages employees to submit innovative ideas to enhance the company's environmental sustainability. In 2025, the theme focused on the six stages of the drug life cycle, promoting the integration of eco-design as a prism for value creation.

5 **Tailored tools:** Sanofi has developed a robust tool box (see box p. 31).

6 **Comprehensive training programme:** to integrate eco-design in their daily work, "Sanofians" follow a four-tier training scheme, ranging from generalist roles to the most specialised, for those who create tomorrow's medicines. In 2024, a total of 3,974 courses were offered, including 261 by clinical development teams. Additionally, comprehensive training sessions (covering plastic pollution, recycling, greenwashing, etc.) and video tutorials fostered team empowerment.

Finally, investing in R&D and sustainable innovation is crucial for promoting and supporting eco-innovation from both business and financial perspectives. That is why in 2015, **BNP Paribas** started investing its own funds in sustainable innovation to support its development strategy.

20 See LinkedIn publications by **Brendan O'Callaghan**, Executive VP, Head of Manufacturing and Supply and **Florence Brunel Veilleux**, SVP, Global Head of MSAT.

BNP PARIBAS

Sustainable innovation investments - the bank's impact and trend forecasting driver

BNP Paribas (BNPP) invests across a diversified portfolio of innovative companies within the financial sector or in sustainable innovation. Its investments in the financial sector follow a strategic approach – typical for a corporate venture capital firm – of acquiring minority stakes in startups to help the banking group's businesses better understand and prepare for disruptive technologies.

BNPP's **investment in sustainable innovation** began ten years ago, following the signing of the Paris Agreement, when the bank announced it would provide a €100 million financial package from its own resources. Over the past decade, investments in sustainable innovation have grown to nearly €450 million through its own funds, capital raised from third parties via the BNPP Solar Impulse Venture Fund, and the expansion of its portfolio to include startups working in natural capital (biodiversity, oceans) or the circular economy.

This commitment addresses several key requirements. Besides the overall investment effort, BNPP must invest in sustainable innovation **to enhance the bank's understanding of trends and technological breakthroughs**. Through its various professional services and business finance activities, the bank is exposed to all sectors of the economy. Working closely with sustainable startups can help **anticipate and support major changes** in industrial sectors. For instance, investing in the German startup Klim[21], which aims to expand regenerative farming, offers a better understanding of upcoming shifts in the agri-food industry.

Furthermore, having a special relationship as a shareholder in certain startups provides opportunities to build bridges between them and their customers, adding genuine value in some sectors.

As an investor, the bank is also proactive in **implementing ESG and impact KPIs**. Some KPIs are company-specific, such as the number of tonnes of recycled plastic for Le Pavé[22], a plastic upcycling company. Others are more broadly shared by all parties, such as tonnes of CO_2 avoided, although the calculation methodology still needs to be robustified. BNPP believes that, in the long term, the quality of this kind of non-financial reporting will be essential for attracting other investors and showcasing the impact of startups. For some KPIs, developing methodologies may prove a daunting challenge, especially for biodiversity. In these cases, the bank can rely on investments like NatureMetrics[23], which measures biodiversity using environmental DNA.

21 https://www.klim.eco/en.
22 https://www.le-pave.com/.
23 https://www.naturemetrics.com/.

2 New forms of R&I: innovating within innovation

Eco-innovation and responsible innovation involve seeking new forms of expertise both in-house (R&D, purchasing, marketing, communications, IT, CSR, etc.) and out-house (suppliers, customers, universities, startups, even NGOs, etc.).

2.1 In-house: decentralise, mobilise, cross skills

Leveraging expertise across corporate departments fosters collective and integrated thinking about the organisation's current and future needs, as well as promoting the adoption of different innovation methods (such as designing, CK theory, etc.) to drive the ecological transformation of its activities. **EDF**'s testimony provides a clear example of how the innovation department, through foresight, harnesses the skills from the group's various departments to facilitate sustainable transformation.

"Game Changers" Futures: the innovation department's foresight tool to transform the company sustainably

EDF has developed an approach to identify future scenarios that, although inherently uncertain, could be transformative for the group if they materialise. Known as "Game Changers", they might significantly influence EDF's ambitions, strategy, business model, and organisation. The methodology aims to detect early-warning signals to implement hedging measures within the timeframe of the business project, manage risks, and seize opportunities. While not claiming to predict the future, recognising impactful issues and preparing for them increases the group's agility and control over its development.

An implementation-oriented process based on expert analysis of issues

The starting point is identifying subtle signs and emerging trends that affect the business model's structural variables. This phase, managed by the innovation and risk departments, primarily focuses on leveraging external, non-group data. It is followed by a stage known as "design fiction", where potential transformative futures (whether desirable or not) for EDF, called Game Changers, are developed using academic foresight techniques and collective intelligence. The issues are then ranked by a cross-functional team involving all EDF Group units and subsequently analysed by various groups of experts to identify the early signs of these Game Changers and define a group position. Monitoring them will help EDF prepare for the event by implementing appropriate measures, such as active standby, targeted research programmes, regulatory and communication actions, targeted partnerships, new offerings, or even new business ventures. These measures will be long term, even if the Game Changers are expected to occur in the medium or long term. Some actions could start immediately, since adaptation takes time.

A value that aligns collectively with EDF's positioning

The Game Changers process is strategically led by a task force made up of managers from entities, innovation, CSR, strategy, risk, and R&D. This approach is essential to ensure that entities share a common understanding of the issues and the actions needed, enabling all relevant Business Units to be involved subsequently. Consequently, initial activities such as exploratory studies, monitoring, and strategic or market analyses are often targeted at them. Monitoring each Game Changer over time helps to fine-tune the positions of the teams involved, aligning them with the overall business project.

Regularly harnessing these new skills can also help decentralise innovation, allowing it to be stimulated and managed across all or part of a company's departments.

For instance, at **Rexel** the Sustainability Solution team, set up in 2023, is integrated with the digital department to improve the effectiveness of the group's products. At the same time, the team collaborates with the sustainable development ecosystem, the data unit, AI and IT teams, and all those with technical expertise in Rexel products, ensuring the Group's environmental expertise.

At **Saint-Gobain**, the Product Sustainability team, which is part of the group's Sustainable Development Department, collaborates very closely with the company's various marketing departments to develop a comprehensive, strategic view of issues (see box p. 19).

Leonard[24] – **Vinci** Group's foresight and innovation projects acceleration platform – reports to the group's Deputy Chief Executive Officer, who also bears responsibility for the environment. This platform aims to anticipate trends and support innovation related to the future of cities and regions. To achieve this, the "Innovation" teams collaborate with Vinci's environment and sustainable development sectors, along with an ecosystem of stakeholders connected to these issues (e.g., ADEME, Hello Tomorrow).

At **Roquette**, the product evaluation team consists of eight members, each representing a department within the group (R&D, marketing, sales, etc.).

In 2021, **TotalEnergies** decided to pool all its engineers into a new division, OneTech, to tackle issues related to new energies and technologies, enhance skills sharing, prepare teams in the oil & gas sectors for new roles (CCS, offshore renewable energies, etc.), and improve the management of team allocations to emerging fields.

TotalEnergies

OneTech: mobilising multidisciplinary technical skills and innovation to design and support industrial projects

TotalEnergies invests over $1 billion annually in R&D and innovation, employing more than 3,500 staff. In 2024, 68% of the R&D budget was dedicated to new energies (renewable electricity, low-carbon molecules), batteries, and efforts to reduce the company's environmental footprint (methane, CCUS, lowering energy and water use, mitigating biodiversity loss, etc.).

The establishment of the **OneTech (OT) division** in September 2021, which combines R&D, industrial project design, and operational support, aims to supply all the technical and R&D expertise that TotalEnergies needs to implement its strategy in the short and medium term.

OT leverages all corporate technical and scientific skills to benefit all operational divisions, especially those related to exploration and production, and to support the growth of the Gas & Renewable Power division.

At OneTech, the Sustainability platform pools skills to support business lines, with the aim of anticipating sustainability needs, developing more efficient, real-time, and cost-effective environmental monitoring tools, and proposing assessment strategies and methods to minimise impacts. An integrated assessment team has accordingly been established to pool expertise in life cycle assessment (LCA), humanities, social sciences, and integrated assessment models.

The Sustainability platform has contributed to creating a shared knowledge base and toolkit that incorporate sustainable development from the outset of projects. For example:

- the AUSEA sensor, in collaboration with France's Scientific Research Council (CNRS) and the University of Reims Champagne Ardennes[25], detects and quantifies methane emissions from the company's facilities;
- environmental DNA measurement techniques have been developed to characterise the biodiversity of facilities or projects with greater accuracy and ten times faster;
- unified LCA tools have been developed to consolidate the primary data used and to ensure the consistency of the studies conducted;
- methodologies have been formulated to anticipate and understand societal debates on renewable energies so as to meet the expectations of civil society better when implementing projects.

In 2025, the R&D Sustainability platform will have undergone further changes to reallocate skills to better match projects and industrial plant requirements, integrating environmental impacts and sustainable development from the ideation and design stages.

24 https://leonard.vinci.com/.
25 University of Reims Champagne-Ardenne.

2.2 Out-house: identify synergies, reduce risks

Besides internal corporate reorganisation, some crucial innovations for the green transition depend on collaborative ventures with various third parties[26]. According to Thierry Rayna, a professor of innovation management at École Polytechnique, it is necessary to shift "from a concept of 'business ecosystem' [...] to a concept of 'value ecosystem' [...]: an informal network of different kinds of stakeholders [...] who jointly create, deliver, share, and capture value, with the governance of these ecosystems being ensured by a combination of complementary and interwoven business models"[27]. The 2021 EPE and ESCP Business School publication emphasised the importance of partnerships for the success of the circular economy. With the expansion of **open innovation**, the R&D and innovation professions can play a leading role.

According to the Ile-de-France Chamber of Commerce and Industry (CCI), open innovation "consists, for a company, in thinking about its innovation and its R&D, no longer from a closed loop standpoint, but by integrating collaborative ventures from outside the department dedicated to innovation, among collaborators, or even with other companies and partners"[28]. It is based on training, gathering teams of experts, and fostering collective learning and intelligence.

For example, **Renault Group** has a large number of Labs designed to bring together such players and resources to stimulate and promote innovation. Square Paris is a case in point. Set up in 2017, it explores the future of sustainable mobility and new working methods, enabling the group to co-build its Mobility Vision roadmap with this ecosystem, alongside other relevant players (Paris City Hall, researchers, architects, etc.). Furthermore, the Flins car plant, which became Refactory after its conversion, brings together an ecosystem of stakeholders (over 50 experts, partners, startups, and subsidiaries) around the circular economy applied to mobility. This open innovation hub allows the group to leverage collective learning on life cycle assessment (LCA) and eco-design, provide all stakeholders with access to industrial testing facilities, use recycled parts for vehicles, and capitalise on know-how.

EDF's R&D management has mobilised various external players in an exploratory way to imagine a positive future and feed the group's strategic R&D roadmaps.

Several other companies have adopted a combination of internal and external open innovation to develop and accelerate the deployment of sustainable innovations. This is the case for **Veolia**, which restructured its purchasing policy to make supplier relationships an innovation driver.

As well as drawing on an unlimited pool of knowledge and expertise, harnessing innovation-focused collective intelligence helps assess and enhance the social acceptability of projects and anticipate scientific uncertainties related to risks. This inspired the development of the **Team for the Planet** collaborative fund. **Ethical acceptability** can also serve as a catalyst for innovation.

Once the innovation strategy has been adopted, the innovation and R&D departments are responsible for its implementation, if necessary, in consultation with internal and external stakeholders. However, what tools and processes are available to promote sustainable innovation and R&D? How can one evaluate the environmental impact of projects from the early stages of innovation and across the product or service life cycle? The next chapter offers tentative answers to these questions.

> "In our digital age, to be successful, innovation must necessarily be part of a broad ecosystem consisting of a diverse range of stakeholders."
> *Thierry Rayna, 2024.*

26 See EPE and ESCP, "Partnerships: cornerstone of the circular economy", June 2021.
27 Rayna (T.), *"L'innovation à impact : symbole d'une nouvelle ère, mais pas celle que l'on pense"*, Innovations, 2024/6 n° 75, pp. 155-183.
28 https://www.entreprises.cci-paris-idf.fr/web/pme/qu-est-ce-que-l-open-innovation.

Envisioning a positive future together: a collaborative exploratory approach through narratives

The book *"Imaginer en commun un avenir positif"* (Envisioning a positive future together)[29] results from a collaborative effort involving CEREMA[30], CEA[31], ADEME[32], SATT Toulouse Tech Transfer[33], Strasbourg's École Nationale Supérieure d'Architecture[34], and a facilitator from the 2 tonnes workshops[35]. It was initiated in September 2022 by EDF's R&D to develop solutions for the various crises (environmental, social, economic, etc.) facing the company and to address widespread and growing anxiety. The four narratives published in 2024 depict the life paths of characters who, through personal and collective pursuits, embody the essential transitions of a country, a company, a public institution or a neighbourhood.

Inventing reasonable, positive narratives

Unlike some dystopian stories, the narrative approach yields outcomes that benefit society and the environment while remaining rooted in credible, tangible realities. They also emphasise what the transitions brought about by the Anthropocene can achieve in terms of human relationships, our connection with nature, and finding meaning at work and in daily life.

A trailblazing method

The tale's literary form, chosen for its simplicity and accessibility, has enabled amateur writers with professional support to collaborate within a limited timeframe. The narratives were illustrated by a graphic designer employing artificial intelligence (AI) for image generation, as part of a test. This carefully documented approach has helped clarify the connections between foresight, design fiction, and narrative. Several methodological challenges were addressed: converging towards a shared vision, collaborating on writing, and scripting technological developments while describing key psychological or sociological processes. It was also agreed to share exploration time and costs while dispensing with formal contracts.

Exploiting and bouncing back

The narratives aimed to inspire and challenge businesses, associations, communities, and citizens by encouraging them to take action rather than baulk at constraints. The distribution of the digital collection in March 2024 was highly successful, with the publication of 500 printed copies.

By promoting new collaborative ventures, this approach has since inspired other EDF research projects. The creation of written scenarios contributes at various stages to developing roadmaps on a range of strategic issues for EDF's R&D, involving operational entities and external partners. Fostering trust within teams, it helps generate innovation portfolios that are better coordinated, more efficient, and designed to deliver faster impacts.

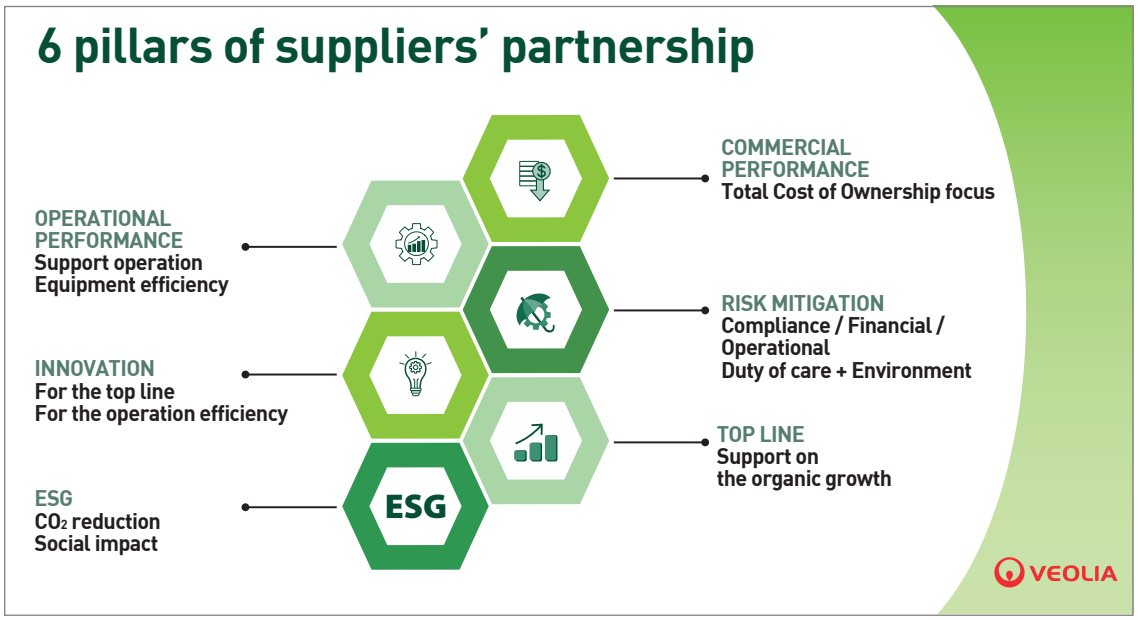
29 The free collection is shared under a Creative Commons BY-NC-CA license to be widely distributed and used. Contact: retd-discovery@edf.fr.
30 https://www.cerema.fr/fr.
31 https://www.cea.fr/.
32 https://www.ademe.fr/.
33 https://www.toulouse-tech-transfer.com/fr.
34 https://www.strasbourg.archi.fr/.
35 https://www.2tonnes.org/.

Open Innovation - a driver for transforming strategic company-supplier relationships

The launch in early 2024 of Veolia's new 2027 strategic plan, "Greenup", was an opportunity to rethink the role and organisation of Veolia's procurement policy, in particular by strengthening the link with its innovation policy and the group's all-round performance.

For Veolia, this transformation consisted in developing long-term relationships with its strategic partners in an effort to strengthen economic competitiveness and boost value creation through innovative, differentiating projects. The drive to create value and boost all-round performance delivers solutions to the water, waste and energy challenges faced by customers.

Partner suppliers commit to a contractual progress plan based on six pillars of value creation, including innovation. Veolia's business units test new products and equipment, and co-develop or benefit from the open innovation ecosystem of strategic suppliers and their industrial capacity.



For each business line (water, waste and energy), a partnership manager helps corporate category managers create and facilitate ongoing dialogue between Veolia's business units, corporate support teams and suppliers on innovation and operational performance. Group-level management scales up operations to offer customers the best solutions through in-house development of specific strategic applications, using existing cartons available on the market or those developed in partnership. This approach is a key component of the group's open innovation strategy.

Example: transforming the group's activated carbon procurement policy

New regulations and standards to eliminate PFAS are driving up activated carbon requirements. However, the bulk of activated carbon used in Europe is currently imported from Asia and produced from mineral coal or coconut shells. To secure supplies, gain sovereignty and reduce the carbon footprint, Veolia's Executive Committee has, as part of the beyond-PFAS offering, set up a team to develop regeneration and reuse in collaboration with partner suppliers:

- group and business units' purchasing teams, along with Veolia's technology centres, formalise the qualification process for regenerated coal suppliers at plants based in France, Germany, Belgium, the UK, Italy, and the USA, including specifications to enable suppliers to develop new products tailored to Veolia's customers' needs;
- innovation, Veolia's water technology activities, and the purchasing community coordinate sourcing and development of innovative technologies for PFAS treatment as an alternative or supplement to activated carbon, leveraging an open innovation approach with suppliers.

Team for the Planet

Collective intelligence - a driver for responsible innovation

Team for the Planet (TFTP) is a collaborative decarbonisation fund with 125,000 members that pays its shareholders a climate dividend.

For this, TFTP selects innovations that align with its investment philosophy based on four types of actions across five industrial sectors (see table below).

	Energy	Industry	Transport	Agriculture	Buildings
Zero emission	**Produce and store** renewable energy without rare metals	**Make materials** without fossil sources	**Travel** without using fossil fuels	**Grow** without nitrogen fertilizers	**Build** with low-carbon materials
Energy efficiency	**Improve** the energy return rate of renewable solutions	**Retrieve and use** waste heat	**Improve** vehicle energy efficiency	**Restructure** farmland	**Heat and cool** without fossil fuels or HFCs
Sufficiency	**Decentralise** energy production and make the grid smart	**Increase** product life and recycle	**Optimise** the movement of goods and people	**Reduce food** waste and develop alternatives to meat	**Refit** homes and buildings
Capture	**Capture** GHGs emitted by power plants	**Capture** GHGs emitted by factories	**Capture** GHGs emitted by vehicles	**Secure and develop** natural carbon sinks	**Sequester** carbon

Although innovation is part of this investment philosophy. TFTP uses **collective intelligence** by inviting **evaluators** – anyone willing to participate in the process, whether or not they are shareholders of the organisation – to assess six criteria. After citizen evaluations are completed, the files are examined by a **scientific and a market committee**.

Innovation has a rich ecosystem, but it is not well-suited to emergencies. Collective intelligence enables each person's knowledge and experience to be brought to bear in solving specific problems. This type of intelligence is creative and better suited to disruptive topics or areas where many aspects have not been fully understood. It also encourages reflection on the **social acceptability of the innovations** under review.

An important benefit of this process is the **collective embedding of evaluators** who become ambassadors of the company behind the innovation. Shareholder engagement, too, is a great strength of the organisation.

TFTP aims to quickly and globally distribute selected solutions and guide project leaders towards **collective innovation**, that is, towards an economic model and a consistent strategy that enable innovation to be shared (such as open-source patents, usage/functional economy, etc.).

Since the creation of TFTP, 1,600 projects have been received, with 712 selected (based on 25,000 assessments), 67 shortlisted and evaluated by two expert committees, leading to 13 innovations in which the fund has invested[36], including Beyond the Sea (traction kite), total plastic recycling, low-temperature heat recovery, object donation platform, and a hybrid vehicle (between bike and car).

36 https://team-planet.com/fr/innovations?status=star.

3

Driving the sustainability of an innovation across all stages of its development

Innovation is a multi-stage process in which different projects are evaluated and analysed:

- the **ideation phase** involves generating and collecting a variety of ideas from the company's internal stakeholders (employees) and external stakeholders (customers, business partners, start-ups, etc.). This can be achieved using a range of techniques such as brainstorming, prospective scenarios (see EDF boxes, p. 22 and p. 25), supplier mobilisation (see Veolia box, p. 26), in-house contests (see Sanofi box, p. 20), etc.;
- the **screening phase** aims to analyse ideas and assess their feasibility, market potential (including analysis of customer needs, market trends, and competition), and alignment with corporate strategy. Several tools are available for these assessments, including decision matrices;
- the **development phase** involves gathering all the resources required to create the innovative product or service. This phase consists of a sequence of steps: design, prototyping, testing, iterations, and marketing strategies.

There are several traditional tools used to measure and manage innovation: KPIs (key performance indicators) include both quantitative and qualitative data on the progress made and the impact of innovation initiatives, the number of new ideas generated, project success rate, technology readiness level (TRL), and return on investment (ROI) from profits. Typically, these performance indicators fail to consider the future environmental and health impacts of innovations, whether they are undesirable (such as diffuse and delayed impacts) or caused by rebound effects if the project succeeds.

Consequently, embedding innovation and R&D management in a long-term vision centred on preserving natural capital and health means these tools must be improved. The earlier the approximate impact of a project is evaluated within the innovation process, the more effective the action drivers are at reducing or eliminating adverse effects.

Some tools are already deployed or under development by companies that go beyond technical and economic project analysis. However, their development, use, and final decision-making remain intricate processes. These depend on the type of innovation (incremental or game changing), the project's maturity stage, the intended final use of the product, and the environmental criteria taken into account (such as climate, biodiversity, water, etc.).

1 LCA – a vital tool

1.1 A robust assessment method

Historically, the most common tool for businesses to assess the environmental impact of their products and services has been life-cycle assessment. ISO standards 14040 and 14044 define LCA as the "compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle". Inputs include water, oil, and gas resources. Outflows are outputs such as greenhouse gas emissions or effluents, or even effluents from product users (scope 3).

This comprehensive assessment method consists of five phases[37]:

- **design** and selection of raw materials (extraction, processing and supply);
- **manufacture** of finished product or service (assembly, packaging, construction, etc.);
- **release** of product or service (distribution and marketing);
- **use** of product or service (unpacking, maintenance, use, etc.);
- **end of life** (collection, transport, recycling, waste treatment, etc.).

LCA thus forms the basis for the development of **eco-design** and the **circular economy.** Combining LCA and eco-design, **Sanofi** has developed an approach to improve the environmental performance of its products.

37 See Bpifrance, *"Analyse du cycle de vie : définition, objectifs, étapes de réalisation"*, May 2024.

Eco-design tools and management

At Sanofi, eco-design aims to be **systemic** in the long term, enhancing the environmental performance of drugs and vaccines by minimising their impact **throughout the value chain**.

To achieve this, Sanofi has created a range of reliable tools and procedures, including:

- **DEFINE with eco-design standards:** integrated into Sanofi's in-house quality system, these standards guarantee that eco-design principles are automatically implemented.

  - in R&D processes: eco-design is gradually incorporated into stage gates of research & development, ensuring that environmental considerations are factored in from the earliest stages of development;

  - in manufacturing processes: eco-design principles are gradually incorporated into manufacturing standards, supporting ongoing improvements in environmental performance.

- **MEASURE and ANALYSE** with **EDDi (Eco-Design Digital tool)**. This innovative tool, developed with Sanofi's Digital teams, enables designers to assess the environmental impacts of products throughout their life cycle. It complies with ISO 14040 and 14044 standards, thereby ensuring the rigour and comparability of analyses.

- **IMPROVE and CONTROL** using the methodological guide. These resources offer R&D teams and industrial process experts detailed guidance on eco-design implementation at every stage of development and production.

This approach has proven successful on several occasions. For instance, with one of the group's most prescribed drugs (used by over one million patients worldwide), optimising the manufacturing process of the active ingredient reduced its carbon footprint by 53%, water consumption by 62%, and natural resource use by 30%[38].

To promote **industry-wide** harmonisation, Sanofi is co-leading a consortium of 11 pharmaceutical companies within the Pharmaceutical Environment Group (PEG) to develop pharmaceutical product category rules (PCR) and help sector companies meet their environmental footprint reduction targets. The aim is to establish a standardised life cycle assessment framework that measures and shares product environmental footprint data relevant to the pharmaceutical sector.

While very effective for comparing well-known products, LCA has many limitations when it comes to its application in the field of innovation:

- it is cumbersome and complicated to carry out, requiring the involvement of **experts** and often the use of generic data;
- it lacks **harmonisation** (what Sanofi is trying to remedy for the pharmaceutical sector);
- it provides an environmental assessment of a project at a **given point in time**;
- it is usually focused on the **carbon footprint**. Other criteria, such as biodiversity or health impacts, are more difficult to include;
- it is less relevant for **emerging technologies** or **new functionalities** due to the lack of reliable **data**;
- it is challenging to carry out at the very **early stages of innovation** (ideation and screening) due to a lack of quantitative data on the project under study.

LCA helps structure the discussion of a product's or technology's environmental impact assessment throughout its life cycle, but is less suitable for the upstream stages of innovation. On the other hand, the prospect of going through this stage can lead to insightful choices even at the early stage of innovation development.

38 Based on LCA studies in accordance with ISO 14040 and 14044 standards, reviewed by independent experts, ensures transparent and reliable results. For more information on LCA: planetcare@sanofi.com.

1.2 Enhancing the reliability of environmental databases

Data is a crucial element in sustainable innovation management. Where possible, innovation teams should compare the environmental impacts of products and services under development with those of existing solutions already on the market. For disruptive innovations, this process becomes more complex, requiring data that extends beyond industrial and commercial sectors, and which is sometimes still at the hypothesis stage.

Many companies rely on in-house **databases** to assess the environmental impact of various projects, innovations, materials, technologies, or solutions. This step is an essential prerequisite for developing tools and processes to measure and manage innovations in an environmentally sustainable way. **OPmobility**'s feedback emphasises this approach, along with the challenges involved in collecting and processing the data needed to carry out innovation LCA.

Structuring data to accelerate the environmental transition using LCA

Life Cycle Assessment (LCA) is a useful tool for assessing the carbon footprint of projects, provided:

- data on the main contributors — materials, transformation processes, energy sources, and logistics — is available and well organised in the company's in-house databases;
- this data is consistent with that submitted by suppliers.

Aware of the importance of data quality and consistency in ensuring the reliability of environmental assessments, OPmobility works daily to narrow the gap between the secondary data used in its LCA calculations and the carbon footprint figures provided by its suppliers.

To this end, the group has undertaken to develop two complementary in-house databases: one dedicated to scopes 1 and 2, and the other to scope 3 upstream. This initiative combined multidisciplinary experts, including innovation and purchasing teams as well as suppliers.

Scopes 1 & 2: towards precise measurements of energy consumption

To quantify energy consumption accurately, OPmobility relied on two key drivers:

- the implementation of **ISO 50001** certification in its factories;
- the installation of **specific meters** to analyse energy consumption by manufacturing process.

Electricity and gas readings, combined with production data, enabled the group to calculate **consumption factors** for direct (injection, painting, etc.) and indirect uses (heating, lighting, etc.) in accordance with LCA-specific allocation rules.

Scope 3: upstream: measuring to drive decarbonisation

OPmobility has a structured process for collecting environmental data from its suppliers aimed at making scope 3 upstream reliable and identifying specific decarbonisation drivers across the value chain.

This process is complex due to the volume of components and materials purchased, as well as suppliers' varying levels of maturity on environmental issues. The group engages and supports suppliers in areas such as exchanging environmental data files, holding follow-up meetings, and adjusting calculation assumptions before including the data in the dedicated database. To centralise and ensure reliable collection, OPmobility provides its suppliers with an in-house portal designed to meet increasing customer demands and regulatory requirements. This portal is the main tool for managing environmental data within the supply chain.

Results

These tools and databases enable OPmobility to enhance the reliability and accelerate the implementation of its carbon neutrality roadmap, and to:

- **identify energy optimisation drivers**, by comparing industrial processes from one plant to another and prioritising the commodities and suppliers to be improved;
- **respond accurately to customer requests** based on increasingly reliable and detailed environmental impact data.

The development of such databases can be time-consuming, costly and require cutting-edge in-house skills. The accumulation of environmental data on different technologies, solutions and products allows experts to conduct increasingly reliable LCA of innovative company projects and consequently foster discussions within teams. Indeed, in the case of AI, EPE reported a lack of reliable, transparent data as a major obstacle to controlling its environmental impacts[39].

2 Managing innovation projects and portfolios

Several methods have been developed to supplement LCA. ADEME, for example, has created "**Project footprint**" (**Empreinte Projet**), a "method to assess systemically whether or not the implementation of a project in relation to a so-called 'baseline' scenario is beneficial for the environment"[40]. In addition to assessing environmental performance, it assists project leaders in interpreting the results obtained. It has different assessment levels depending on the project's TRL (see Figure 1). The **Caisse des Dépôts et Consignations** now requires this method for assessing the environmental footprint of projects submitted to its TechSprint Challenge contest[41].

	LEVEL 1 QUALITATIVE	LEVEL 2 QuantiGES	LEVEL 3 SIMPLIFIED MULTI-CRITERIA	LEVEL 4 INTERMEDIATE MULTI-CRITERIA	LEVEL 5 IN-DEPTH MULTI-CRITERIA
Possible conclusions	Preliminary identification of environmental issues	Conclusion on an initial estimate of GHG emissions	Conclusion on relevant impact categories and trends observed for these indicators	Initial conclusion on environmental benefits. Quantified impact values with reliability rating	Conclusion in environmental benefits and quantified, communicable, justified and reviewed impact values
Skills requirement	Few specific skills	Basic skills in carbon accounting	LCA expertise necessary	LCA expertise necessary	LCA expertise necessary

Figure 1 / The five levels of ADEME's Project Footprint method[42]

Capgemini, for its part, has developed a method to assess and reduce the direct and indirect environmental impact of digital solutions.

The **Sustainable Portfolio Management** (SPM) tool, developed by **Solvay**, enables sustainable management of the group's solutions portfolio by assessing the environmental performance of the products used for a given application. The environmental footprint assessment of projects is based not only on LCA but also on other parameters, such as monetary values, vulnerability, risk analysis, and market alignment.

However, SPM has two drawbacks:

- its calculation methods are specific to it and may not always be aligned with those of its customers, which sometimes necessitates additional assessments (e.g. environmental product declaration);
- it has been designed for sectors of activity that are very far upstream in the value chain, such as chemicals and minerals. Its application to other sectors would need adjustments. **Roquette** is, in that capacity, one of the first companies from a further downstream industry to implement it.

39 EPE, "The environmental management of IT projects in the age of AI", November 2025.
40 https://infos.ademe.fr/lettre-strategie-octobre-2024/la-methode-empreinte-projet/.
41 https://www.innoverpourlatransitionecologique.fr/fr/challenges/techsprint.
42 https://infos.ademe.fr/lettre-strategie-octobre-2024/la-methode-empreinte-projet/.

Capgemini

Measuring the environmental impact of digital solutions: a method for innovating sustainably

While the digital sector accounts for 4.4% of France's carbon footprint, and 117 million tonnes of resources are used each year to produce digital equipment & infrastructures, the environmental impact of digital solutions is often poorly understood.

The **Digital Tech for Green (DT4G)** methodology, developed by Capgemini, evaluates the direct and indirect impacts of digital applications embracing a wide range of technologies (cloud, IoT, 5G, Digital Twin, IA, Blockchain, etc.).

A 2024 study examines a **"service for picking up orders via a mobile relay point based on a 5G network"**. The target scenario is compared to a baseline scenario (pickup by private car) in order to:

- **assess the potential net environmental benefit** of the digital application;
- **extrapolate the net potential benefit** of deployment at scale;
- **provide information about deployment contexts;**
- **identify the drivers for reducing** the environmental footprint:

  - by reducing the **direct impacts** arising from the physical existence of the solution (equipment, servers, etc.);

  - by increasing the **indirect impacts** associated with induced uses (travel avoided, energy consumption, etc.);

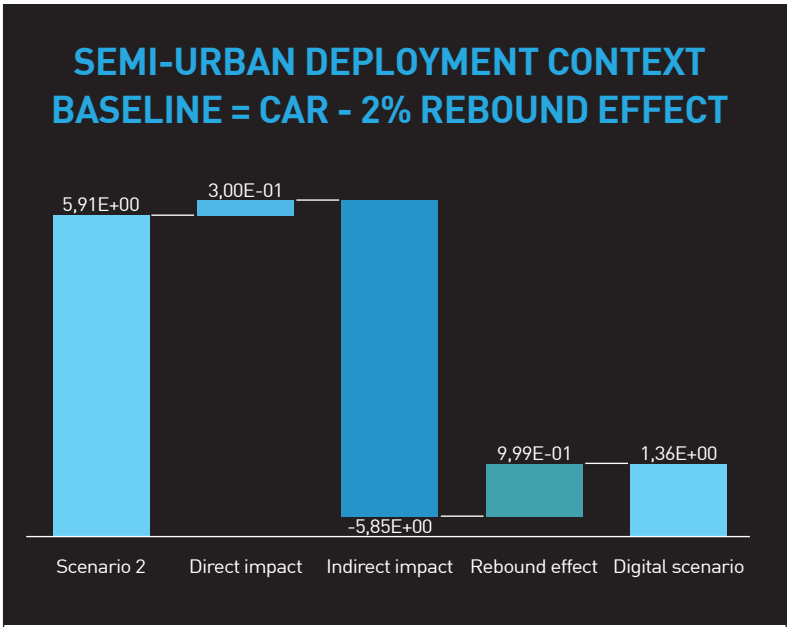
  - by containing the **rebound effect** and behavioural changes (higher impacts).

The assessment is based on six environmental indicators from the European PEF framework, reported per functional unit, which in this case corresponds to the delivery of a 15 kg shopping basket:

- climate change (kg CO_2e): 0.3 kg CO_2e;
- particulate matter (PM): 1,7 E-08 DO;
- primary energy consumption (MJ): 6 MJ;
- final energy consumption (kWh);
- water consumption (m^3 eq): 0.82 m^3;
- abiotic resource depletion – metals and minerals (kg SB eq): 0.05 g Sb.

A calculator that identifies an inventory of activities, based on sectoral databases (NegaOctet, ecoinvent, ADEME, etc.) and specific allocation rules, assesses these impacts, facilitating sensitivity analysis, 2030 projection scenarios, and optimisation driver identification.

In the context studied, the net benefit is 4.55 kg CO_2e per delivery, a 77% reduction compared to the baseline scenario.



Net benefit depending on the type of impact

Water consumption and abiotic resource use account for the main impacts, particularly due to extraction needs during the equipment construction and assembly phase. The additional part related to digitalisation quickly becomes insignificant when compared to overall system impact.

The risk of a **rebound effect** on an emitting sector other than the one initially studied **should not be overlooked**. For a 5% increase in orders, the net benefit would be halved.

This point highlights the need to implement a **systemic approach that embeds the entire value chain for an exhaustive impact assessment.**

SOLVAY

Understanding the SPM methodology: a strategic driver for sustainable innovation

In a context where societal and environmental challenges are vital, businesses must embed sustainability in their core strategy. Launched by Solvay in 2012, the Sustainable Portfolio Management (SPM) methodology is a strategic tool for assessing the sustainability contribution of products and guiding decisions across key corporate areas, such as investment and innovation.

The SPM methodology: a dual-axis compass

The SPM methodology assesses each product based on its commercial use ("product-application" pairing or PAC) and plots it on a heatmap along two axes.

1 **Vertical axis: operational vulnerability** This axis assesses a product's environmental footprint during its manufacturing phase (cradle-to-gate). The processes incorporate Life Cycle Assessment (LCA) based on 21 indicators, the monetisation of negative impacts through shadow costs, and the calculation of a vulnerability ratio by dividing shadow costs by the product's commercial value. A high ratio signals a significant risk compared to more sustainable options.

2 **Horizontal axis: alignment with the market.** This axis adopts a broader perspective (cradle-to-cradle) to evaluate whether a product provides solutions or causes issues in relation to market expectations. The assessment is qualitative and is based on a questionnaire organised around four themes (health and safety, climate change, resources, influencers). A decision tree then classifies the product from "Challenged" to "Star" (flagship product), enabling the identification of market signals.

By combining these two axes, the heatmap categorises products into four groups - Challenges, Transitions, Potentials and Solutions - providing a robust strategic management tool.

Application to Research & Innovation (R&I)

The SPM methodology is systematically used for all R&I projects. It takes a comparative approach: for each project, a dual assessment is conducted of the **benchmark product** (existing solution) and the **target product** (innovation). This comparison ensures that the innovation shifts the product into the "Solutions" quadrant of the heatmap, improving its environmental footprint and market alignment. Throughout the project's life cycle (stage-gate process), thorough assessments are conducted at each decision point, continuously improving its sustainability profile.

Conclusion

The SPM methodology is a dynamic decision-making tool that embeds sustainability in corporate DNA. When applied to R&I, it ensures that innovation efforts help build a more resilient, responsible, and profitable product portfolio.

This tool, created and publicly made available by **Solvay**[43], has greatly inspired other companies such as **Roquette** and **Imerys**. It has also been adopted by a working group of the World Business Council for Sustainable Development (**WBCSD**) to establish **Portfolio Sustainability Assessment** (PSA) as a standard within the chemicals industry and to extend it to other sectors[44]. In addition to portfolio management, SPM/PSA now serve as a guide for all business areas, including mergers & acquisitions, CAPEX, innovation, strategy, purchasing, and business development.

Finally, it is a tool for transparency and the promotion of sustainable solutions both internally and externally, applicable in reporting exercises such as CSRD. The approach offers sales teams a straightforward narrative to endorse the group's decisions and projects. This aspect is critical, as promoting sustainable innovations presents a substantial challenge for companies when engaging with their end customers (see Chapter 4).

These management tools are especially relevant at the innovation development stage, but are more challenging to implement at the ideation and screening stages. Others are better suited to these early stages.

43 https://www.solvay.com/en/sustainability/planet-progress/sustainable-portfolio-management.
44 https://www.wbcsd.org/resources/portfolio-sustainability-assessment-v2-0/.

3 Acting from the earliest stages of innovation

3.1 Simplifying and strategically using environmental impact assessments

At the ideation and innovation screening stages, LCA tools are difficult to use due to data constraints, skill gaps, and a lack of project maturity and tangible outcomes. During these first stages, the assessments are somewhat qualitative, encouraging players in the innovation decision-making chain to ask the right questions at the right time about the project's expected environmental performance, customer needs, and required resources. Above all, the aim is to develop and offer project leaders tools that they can use quickly and easily, without needing to be LCA experts.

In the early stages, therefore, experts will focus on identifying the operational issues that the project aims to address. As the project matures, they will be able to develop tools to hone in on the environmental pledge and the impacts. The consulting firm **Wavestone** provides guidance on developing and selecting innovation management tools and processes that integrate sustainability, including establishing a baseline.

WAVESTONE

Rethinking innovation: desirability, viability, feasibility and sustainability

Fully embedding sustainability issues in innovation assessment is no longer a mere option. However, adjusting performance benchmarks demands a comprehensive overhaul of practices.

1 Changing the paradigm: sustainability as the driving force from the ideation stage

Sustainability must no longer be a "layer" added on as an afterthought to tweak a 2.0 version of a product or service. It must become an assessment dimension on a par with desirability, viability and feasibility. This entails rethinking choices from the point of ideation. Embedding sustainability dimensions such as sustainable materials, low-carbon processes, and digital accessibility upstream helps avoid locking effects downstream of the development cycle, which are often hard to realign.

In fact, many companies are still struggling to identify the most relevant sustainability drivers for their projects clearly. Should we prioritise carbon emissions reduction, biodiversity, or the social conditions of production? Trade-offs are therefore necessary, particularly depending on the final impact.

2 The challenge of assessing the impact of sustainability drivers

At each stage of maturity, environmental and social indicators could supplement economic and technical assessments. Criteria such as reparability, modularity, energy intensity or material sourcing could be studied from the outset of the first plans or simulations. That would mean accessing such data during the upstream phase, which is a real challenge faced by sectors in their attempt to make their approach more reliable.

The choice of assessment methodology is just as strategic. A tool that is too simplistic will yield approximate results and be of little use for decision-making. Conversely, a method that is too complex is likely to be underused. A balance must therefore be struck between robustness, accessibility and efficiency, founded on a shared consensus within the company and across sectors.

3 Creating a baseline for objectivity and comparison

To ensure the indicators can be used, they would have to be compared, which implies establishing a baseline. Several approaches are conceivable, such as comparison with an earlier version, with similar products or with equivalent uses — a particularly relevant method for breakthrough innovations that do not yet have an equivalent.

Furthermore, defining ambitions from the very first phases enables objective decision-making on key Go/No-Go milestones. For low TRLs (Technology Readiness levels), ambitions could be qualitative and then gradually become quantitative, which would relax the constraints associated with assessment. For example, when formulating a product, in the upstream phase the presence of bio-sourced ingredients may be sufficient, whereas in more advanced phases their quantification could be assessed.

Embedding the environment in the early stages of innovation usually involves simplifying and automating tools for the quantitative assessment of the environmental impact of products, such as LCA, so that project managers can use them during these stages. The purpose is to embed the environment as early as possible in thinking.

Solvay's SPM Fast Track method illustrates how robust, successful tools for quantifying the environmental impact of a solution can be simplified and automatically applied to the ideation and screening stages of innovation by non-expert teams.

SOLVAY

SPM Fast Track: embedding sustainability in R&I project ideation

In the innovation cycle, decisions made at the early stages are the most crucial. The Fast Track version of the Sustainable Portfolio Management (SPM) methodology was created to ensure that sustainability is considered from the moment an idea is conceived. This agile, streamlined tool serves as a vital filter within Research & Innovation (R&I) processes.

A strategic guidance tool

SPM Fast Track is a quicker, simplified version of the comprehensive SPM assessment (see box, p. 35). While the complete assessment involves detailed quantitative analysis, Fast Track focuses on qualitative evaluation and is designed to be completed swiftly, often within a few hours. Its goal is not to provide a comprehensive assessment but to deliver initial strategic insights and identify key opportunities or major obstacles early in a project.

Comparative and efficient operation

The Fast Track approach is comparative, with the proposed innovation (**target product**) assessed against the existing market solution (**benchmark product**). The assessment is structured around the four main themes of the "alignment with the market" axis of the SPM methodology: health and safety, climate change, resources, and influencers (opinion leaders).

The result is summarised as a straightforward score on a scale of 1 to 10:

- **1 to 3:** the project encounters one or more significant obstacles;
- **4 to 6:** the project is regarded as neutral;
- **7 to 10:** the project offers considerable sustainability benefits.

A filter for the first stages of innovation

SPM Fast Track is used at the very start of the R&I process, during the ideation and screening phases. It helps sort a large number of ideas and retain only those with the greatest potential, not only in terms of economics but also in terms of sustainability. Providing clear guidance helps teams concentrate their efforts. A low-scoring project may be abandoned early or modified. In contrast, a high-scoring project is encouraged to progress to the next stages, where a comprehensive SPM assessment will further refine the analysis.

In short, SPM Fast Track serves as a practical tool for integrating sustainability into innovation's core processes, ensuring that future solutions are inherently more sustainable from the beginning.

Businesses can use other tools, such as the **Sustainable Business Model Canvas**[45]. This initially focused on the creation of new business models, but can be used to provide the innovation manager with insights into the social, environmental and economic performance of their project. The innovation advocate will then deploy this well-known tool for entrepreneurs in three areas: identification of the UN's Sustainable Development Goals (SDGs) to which a contribution is made, positive externalities, and negative externalities.

45 For example: https://www.sustainablebusinesscanvas.org/.

3.2 Using forecasting initiatives to broaden the scope of project environmental impact assessments

All previously developed models are typically based on environmental impact assessments performed for a given product or solution. Applying these insights on a more global, multisectoral and multiproduct scale would help factor in the planetary boundaries and current or future conflicts over resources. In this sense, **forward-looking scenarios** are additional tools for placing the project or product in the broader context of the shift towards more sustainable development.

Source: ADEME, "Prospective – Transitions 2050 – Infographies scénarios", 2021.

To this end, in 2021 ADEME published four forward-looking scenarios that outline contrasting economic, technical and societal options for achieving carbon neutrality by 2050 in metropolitan France[46]:

- **frugal generation,** which is based on a transition mainly driven by sufficiency (behavioural, organisational and technical innovations);
- **territorial cooperation,** which uses shared governance and territorial cooperation to transform society, with sufficiency and efficiency as the watchwords;
- **green technologies,** which rely on innovation to develop carbon-free energy systems;
- **repair wager,** which is based on society's ability to redress social and environmental systems.

The Milestone 2030 study, published in 2023, is the result of two years of work by 30 EPE member companies to answer the question: what do we need to do by 2030 to be on a green transition pathway that complies with French and European commitments? The study underscores the need for societal innovations, sufficiency, the circular economy, and a new link with living beings by relying on businesses and collective lifestyles to drive innovation in this direction.

Forward-looking scenarios can also be based on **Integrated Assessment Models** (IAM) that convey a techno-economic representation of our society. The core model comprises the energy system and heavy industries (chemicals, steel, cement, etc.), to which more specific representations, such as agriculture, mobility and transport, computer networks, and so on, can be added. The most comprehensive IAMs incorporate physical modelling of the environment: climate (atmosphere, oceans), land use, water, etc.

There are chiefly two types of integrated models:

- the "**bottom-up**" or "**techno**" version consists in optimising the overall cost of the energy system by accounting for infrastructure constraints, deployment, demand satisfaction, and the limit on global warming. The resulting scenario shows an optimum choice of solutions in terms of performance, economy and resource utilisation. In this version, however, future demand for products and energy must be defined in advance;
- in the "**top-down**" or "**economic**" version, it is possible to overcome this limitation. Based on global socio-economic trends (e.g. SSP – Shared Socio-economic Pathways, etc.), the model evaluates demand as well as the equilibrium price in the long term, up to 2050, for example.

Such models are developed and used by research organisations such as universities (Federal University of Rio de Janeiro, MIT, Mines...) and institutes (International Institute for Applied Systems Analysis, IEA, IFPEN...). They are used to test public policies at the national, regional or global level, as well as for sectoral studies. The IPCC, for instance, maintains a database of scenarios, selected and sorted by level of global warming effect.

46 https://www.ademe.fr/en/futures-in-transition/scenarios/.

Since integrated models and forward-looking scenarios are essential tools for informing public policy makers on sustainable development, their understanding also enables better analysis of possible changes and trends in regulations over the long term, and thus better identification of risks and opportunities, to define an informed strategy.

The use of integrated models can, for example, help better understand **conflicts over finite resources**. A topical example is the use of biomass. The amount of biomass usable for non-food purposes is limited by the surface area available, and is significantly smaller than would ideally be required to decarbonise all sectors[47]. An integrated assessment model that accounts for these physical limitations can be used to prioritise and select the best use from a collective perspective; it also enables risk to be assessed according to the product's position in the prioritisation process. The same applies to land use, materials (such as rare earths), water, etc.

However, integrated models remain predominantly the preserve of research organisations or public institutions that have developed them. Some businesses, such as **TotalEnergies**, have, however, created their simplified model for strategic purposes and the tools derived from this scientific field for more operational use.

Forward-looking scenarios as tools for technological exploration

The use of forward-looking scenarios by businesses enables them to test their technological roadmaps across different economic, regulatory, and institutional contexts on a local or global scale.

In the field of energy transition, forward-looking scenarios enable the projection of emerging technologies into markets that are not yet established, such as CO_2 capture and geological storage. The **IAM** method estimates the cost of the overall system in an optimum scenario that includes the deployment of the new technology, compared to a scenario without it. The gains in CAPEX and OPEX, energy consumption and environmental impact allow the value provided by new technologies to be assessed.

Other examples include the electrification of decarbonisation processes for cars, the generation of high-temperature heat, the use of green hydrogen, the production of carbon-free fuels, the capture of CO_2 from the air, and so on. Such projects require an electrical source with a sufficiently low carbon footprint, which is the case today only in a handful of countries (Norway, France...). Forward-looking scenarios can be used to provide more or less ambitious baseline carbon-free electricity pathways, and thus **to assess the overall impact potential of a project** over a long period of time (10-20 years). However, the use of scenarios requires detailed knowledge of technologies and their integration, such as market assumptions.

The forward-looking scenarios of the scientific community are also an essential benchmark to obtain a vision of energy development. TotalEnergies has produced **three visions of energy trends** based on supply and demand, which form the basis of its development: Trend, Momentum and Rupture Scenarios in TotalEnergies Energy Outlook 2024[48]. Regular reviews allow TotalEnergies to question the assumptions on which the growth rates of the markets targeted by the company are based.

Lastly, the company has developed **simplified tools** based on knowledge gained from existing integrated models, particularly to supplement LCA, which does not provide information on economic factors or prioritise solutions. This is one of the solutions developed at TotalEnergies thanks to the **Legotech** tool. The tool provides a straightforward methodology for creating multiple value chains for the same energy supply. It compares their performance in terms of CO_2 emissions and environmental impacts (water and land footprint). For example, a synthetic aviation fuel pathway was easily assessed in terms of costs, emissions, water footprint and land footprint. In doing so, it can be compared, under the same conditions, with the existing pathway based on petroleum or other technologies such as biomass fuels.

47 See EPE, "ZEN 2050: imagining and building a carbon-neutral France", July 2019.
48 https://totalenergies.com/fr/actualites/communiques-de-presse/totalenergies-energy-outlook-2024.

4

Promoting sustainable approaches and products

Although regulatory requirements and scientific evidence support the green transition, reaping the benefits of innovation is still largely dependent on markets. As discussed in Chapter one, innovation is perceived as necessary for improving the performance of existing products and, first and foremost, for creating economic value for the company that benefits from it. Sustainable solutions may have different cost structures than those they replace, typically with higher initial investment and lower operating costs (e.g. thermal retrofit, electric mobility, renewable energy...). Thus, if customers have not yet embarked on their own green transition and/or are not subject to regulatory, market (consumer) or investor requirements to do so, price will remain a sticking point and a decisive factor in their choice.

How does one promote an innovation-based approach among customers? The measures discussed earlier are key drivers. Developing an eco-innovation culture by training and raising awareness across all in-house departments, particularly marketing and communications, is invaluable for promoting this approach externally. In addition, there is data from the various environmental assessments conducted by businesses to ensure the sustainability of products placed on the market. This solution enables robust communication with customers and even supports their transition.

Saint-Gobain is leveraging its culture change, the reorganisation of its teams and the environmental impact assessment of its products to guide local marketing and communication teams.

Rexel's Carbon Tracker helps professionals in the electrical sector decarbonise their activities and thus promote the group's low-carbon products.

Carbon Tracker: a tool for promoting low-carbon products

Carbon Tracker is part of an ambitious approach to support professionals in the electricity sector in reducing their carbon footprint. Faced with the proliferation of regulations and the growing need to measure the environmental impact of purchases accurately, Rexel has developed a simple, precise tool that transforms environmental data into tangible action levers.

This tool centralises all carbon data for purchases in a single dashboard, verified by Bureau Veritas, and is ISO 14021-compliant. It enables instant viewing of the carbon impact of orders, simulation and optimisation of future projects, and easy comparison of products to identify low-carbon alternatives.

One of the major strengths of Carbon Tracker is its seamless integration with the purchasing processes of its users. Thanks to the automatic generation of customised carbon quotations, it is a real decision-support tool, facilitating optimisation of orders in line with defined climatic, economic and technical targets.

Simple to handle, Carbon Tracker embeds naturally in existing systems, facilitating its adoption and regular use. It becomes a key tool for managing the daily low-carbon strategy of Rexel's customers, thereby providing visibility and promoting eco-design approaches in the electricity sector.

The Carbon Tracker solution developed by Rexel measures carbon impact, optimises purchasing decisions, and drives sustainable change, thereby contributing to the electrical sector's carbon neutrality.

The development of unifying, positive narratives around the green transition can also be an effective driver in shifting customer expectations and needs. In this sense, IAM (see TotalEnergies box, p. 39), exploratory narratives (see EDF box, p. 25), and forward-looking scenarios (see EDF box, p. 22) are valuable tools both for convincing employees internally and for promoting sustainable innovations externally.

Promoting more sustainable offerings effectively through teamwork

Designing more sustainable solutions must be combined with effective promotion so that they find a place in the market, are understood and adopted, and reward the group's innovation efforts. To do so, an upstream marketing strategy is essential. Such a strategy must be based on a detailed understanding of environmental issues and rigorous management of technical data. Analysing market trends, consulting with customers, and evaluating future regulations are all key to shaping strategy and anticipating the creation of relevant and reliable marketing documents, even before innovative solutions are designed.

A solid argument, based on scientific data and recognised methods, is therefore essential. Life Cycle Assessment (LCA) is a vital tool for this approach, as it quantifies a product's environmental impacts across its life cycle and reports the results in environmental product declarations (EPDs). These documents highlight the environmental benefits of innovations. They provide a reliable foundation for clear, differentiating marketing messages aligned with the Group's CSR commitments. This assessment also involves relevant segmentation of the offering and highlights concrete customer benefits, such as energy savings, greater comfort, and a lower carbon footprint.

This groundwork then enables the development of credible, transparent communication free of greenwashing[49], which could damage the company's reputation and undermine stakeholder confidence. In particular, it must explain sustainability criteria, acknowledge product limitations, and promote continuous improvement strategies. Saint-Gobain relies on a best-practices guide to ensure objective, clear, well-founded (and timely) messages, including training on greenwashing and its associated risks, communication toolkits, recommendations on selecting visuals and messages, etc.

Support at national level is then provided by a dedicated central team tasked with guiding the local marketing and communications teams and ensuring consistency in messaging:

- definition of target segments and messages to be conveyed;
- identification of the solution's strengths in terms of sustainability;
- concise explanation of strengths;
- justification of claims with external evidence and choice of visual elements.

Particular attention is paid to packaging, the primary showcase for innovative solutions.

49 https://www.saint-gobain.com/en/magazine/responsible-communications-how-can-we-combat-greenwashing.

CONCLUSION

Innovating sustainably between continuity and disruption

Innovation and R&D are undergoing substantial changes as they are pressured on all sides by the various demands facing businesses: reaching physical limits that threaten the planet's habitability, geopolitical turmoil and renewed sovereignty issues, the race for competitiveness, particularly in the future systems of decarbonisation, and the shift towards more sustainable modes of production and consumption.

The previous pages and testimonials highlight the questions that arise and the transformations already under way in many businesses. The green transition, both as a necessity and an opportunity, appears to be a crucial element in addressing the challenges of competitiveness, sovereignty, and resilience through innovation rethought to be more responsible and sustainable.

The corporate practices described above point to three key drivers used by EPE member companies:

- **incorporation of the environment into the culture of innovation and R&D professions:** training, awareness-building, managerial incentives, team organisation, etc.;
- **design and implementation of tools and processes for measuring and managing the environmental impact of innovation** to reduce the environmental footprint of product portfolios and prevent rebound effects;
- **creation of conditions for the emergence of sustainable innovation:** human and financial investments, partnerships, development of standards, and changes in regulatory framework incentives, etc.

These approaches integrating sustainability requirements sometimes challenge traditional innovation methods that focus on technology and incremental improvements, increased efficiency, cost reduction, and maximum profit. Indeed, while LCA has played a key role in objectively evaluating impacts and identifying reduction drivers, it becomes less relevant when comparing a standard product not with an improved version, but with a disruptive solution.

Alongside innovation design and management, the main challenge remains the **scalability of solutions** and their dissemination to customers, where they will have a meaningful impact. The widespread adoption of virtuous solutions depends on many factors, both internal and external to the company. In 2023, the French Academy of Technologies noted that "by 2030, neither technological innovations nor carbon-free energy will be deployed at a sufficient pace to achieve Europe's climate goals". It therefore concluded that forms of sufficiency must also be developed, at least in the short term.

This, along with various other studies, explains the exploration of **different types of innovation** (behavioural, social, business model, organisational, production...), which raise new challenges such as: What new economic models should be designed? How do we adapt organisations? What new collaborative ventures should we create? What skills should we develop? How do we ensure that changes align with societal expectations and uses?

The drivers that businesses deploy to make their technological, product, and service innovations more sustainable are numerous, enabling them to explore new forms of organisation and innovation. This publication also outlines avenues for further thought beyond traditional forms of innovation.

Acknowledgements

This brochure is the result of studies carried out by EPE's Business Research and Innovation Committee between 2022 and 2025, under the chairmanship of David Meneses, Executive Vice President, People & Sustainability, and Alexandre Corjon, Executive Vice President of Innovation at OPmobility. Drafted by the EPE team, it draws on the experience and best practices of the association's members to measure and sustainably manage innovation. EPE thanks the representatives of member companies who shared their expertise and participated in work meetings. EPE also thanks the experts and representatives of public authorities or associations for their contributions, some of which have been reproduced in this publication, and for their work on the committee, which has stimulated the thinking and actions of member companies. Nathalie de La Falaise, Jean-François Mathieu and Claire Tutenuit are also thanked for their respective contributions. Special thanks are due to Marie Marchand-Pilard, who coordinated the study and wrote this report under the direction of David Laurent, and to Govind Bhinder of FEAT for the English translation.

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Cover photos: Shutterstock, Istockphoto, Unsplash
January 2026

Disclaimer

Entreprises pour l'Environnement (EPE)

The French association Entreprises pour l'Environnement (EPE), founded in 1992, brings together 60 major French and international companies to share their best practices and work together to better incorporate environmental considerations into their strategies and operations. Its raison d'être - "one planet and a prosperous world" - sums up the resolve of its members to lead their own green transition as well as that of society, and to ensure that economic development compatible with planetary boundaries is socially accepted, indeed desired. EPE is the French partner of the World Business Council for Sustainable Development (WBCSD).

EPE publications and studies are available on: www.epe-asso.org/en/documents-reports/

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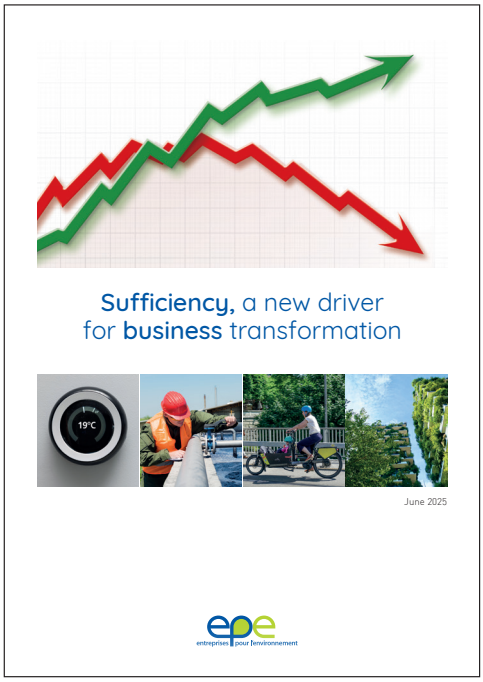
November 2025



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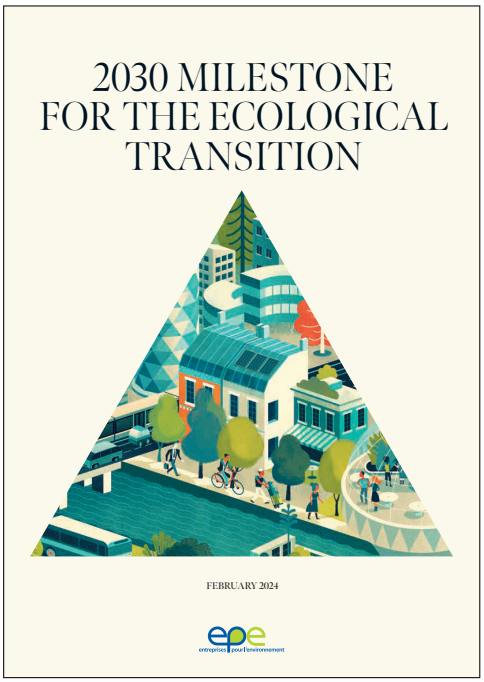

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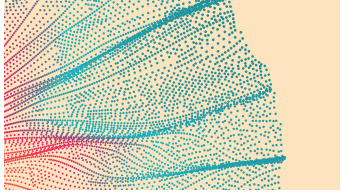

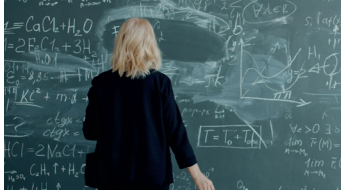


Leveraging **innovation** to accelerate the **green transition**

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