Sufficiency, a new driver for **business** transformation



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CHAIRMAN'S MESSAGE

The "Milestone 2030 of the green transition" study showed that to meet French and European environmental targets, economic development must rely on circularity, a renewed connection with nature, and sufficiency.

Technical progress is compelling businesses to continually improve the efficiency of their products and services in terms of the consumption of energy and natural resources. However, the advancements that lower costs and, consequently, prices are nearly always offset by rebound effects, resulting in increased usage. This hampers the decoupling of economic growth from material impacts, greenhouse gas emissions, resource consumption, and pressures on biodiversity. Only sufficiency from all stakeholders – businesses, citizens, governments – in their lifestyles or activities can effectively prevent these rebound effects.

Sufficiency consists of conscious behaviour, whether voluntary or accepted, to consume less than one could, and to do so in the spirit of moderation. For example, during the winter of 2022-2023, French energy companies and the government urged the public to practise sufficiency to avert power outages. Indeed, French households reduced their consumption by 5.5%, although this was partly due to rising prices. However, unlike this episode, sufficiency must be sustainable and embedded in our lifestyles to function as a true pillar of the green transition. As long as some individuals continue to live in poverty under 'forced sufficiency' conditions, this will only be achievable if sufficiency is collectively built, embraced, and positively integrated into our development model. Streamlined, lighter products, materials and structures, along with the proper sizing of everything we manufacture, are integral to this shift.

This brochure highlights the wealth of sufficiency practices and experiments within EpE member companies. It showcases a variety of solutions, along with the complexities of this transformation. We hope it will be beneficial to all participants eager to leverage the value of sufficiency as part of their contribution to the green transition of our societies.

Patrick Pouyanné
Chairman, Entreprises pour l'Environnement
Chief Executive Officer, TotalEnergies

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Sufficiency: a new driver for the green transition

The context of the energy crisis at the start of the Ukraine war prompted French business leaders to advocate for sufficiency[1] for the first time, a call echoed a few weeks later by the President of France. A few months earlier, the sixth IPCC report[2] had recommended including this approach among the various drivers of climate change mitigation, characterising sufficiency policies as *"a set of measures and everyday practices that avoid unnecessary demand for energy, materials, land and water, while guaranteeing the well-being of all within planetary boundaries"*. How is sufficiency becoming a key driver in reducing the environmental footprint? Several available benchmarks will illuminate this issue.

In 2009, the Stockholm Resilience Center described planetary boundaries as *"the safe limits for human pressure on the nine critical processes which together maintain a stable and resilient Earth"*[3]. Since then, six of the nine limits have been crossed[4] by human activities, leading to the over-extraction and over-consumption of natural resources for producing and consuming goods and services. This is associated with further greenhouse gas emissions, pollution, land take, disruption of natural cycles, and more.

In 2015, the UN established 17 Sustainable Development Goals (SDGs) as part of Agenda 2030, which *"charted a course for a better and more sustainable future for all. They address the global challenges we face, including those related to poverty, inequality, climate change, environmental degradation, prosperity, peace and justice"*[5]. The issue of resources is cross-cutting, with several SDGs focusing on:

- social organisation (production, consumption, key infrastructure, territorial organisation, etc.) and ensuring decent living conditions for all, meeting resource needs;
- sustainable management of natural resources (energy, water, ecosystems, biomass, etc.).

Lastly, the *"doughnut economy"* theory, proposed by economist Kate Raworth in 2011, illustrates the concept of a *"safe and just space for humanity"* within planetary boundaries, where essential needs are met for all people. These frameworks urge our societies to contemplate how to use and share resources across different regions of the world, regardless of differing lifestyles. However, the research conducted in 2021 by the Doughnut Economics Action Lab to assess the application of this theory revealed that most economies, as well as the global economy overall, are increasingly encroaching upon the *"safe and just limits"* outlined by the doughnut[6].

- low-income countries remain well below the social floors defined by the SDGs;
- middle-income countries often exceed several planetary boundaries, even though they have not yet attained those social floors;
- developed countries continue to utilise proportionally far more resources than their fair share.

Sufficiency, as defined by the IPCC, appears to be a key determinant in achieving the SDGs for all and converging societies towards their "safe and just space". This conclusion aligns with the findings of the "Milestone 2030 of the Green Transition' study[7] (ETE 2030). Conducted by thirty or so EpE member companies, the study identifies the achievement of long-term sufficiency as an essential collective priority to be secured by 2030 to establish an appropriate green transition pathway that meets French and European climate and biodiversity commitments. Yet, its translation into everyday activities and lifestyles remains tentative. Therefore, it seems necessary to further comprehend the concrete meaning of sufficiency.

1 https://www.lejdd.fr/societe/tribune-le-prix-de-lenergie-menace-notre-cohesion-par-les-patrons-dengie-edf-et-totalenergies-9401.
2 IPCC (2022). Summary for policymakers of the IPCC Sixth Assessment Report.
3 https://www.stockholmresilience.org/research/planetary-boundaries.html.
4 https://www.planetaryhealthcheck.org/planetary-science.
5 https://www.un.org/sustainabledevelopment/fr/objectifs-de-developpement-durable/.
6 https://doughnuteconomics.org/news/new-analysis-reveals-that-no-country-is-living-in-the-doughnut.
7 EpE (2023). Milestone 2030 of the Green Transition.

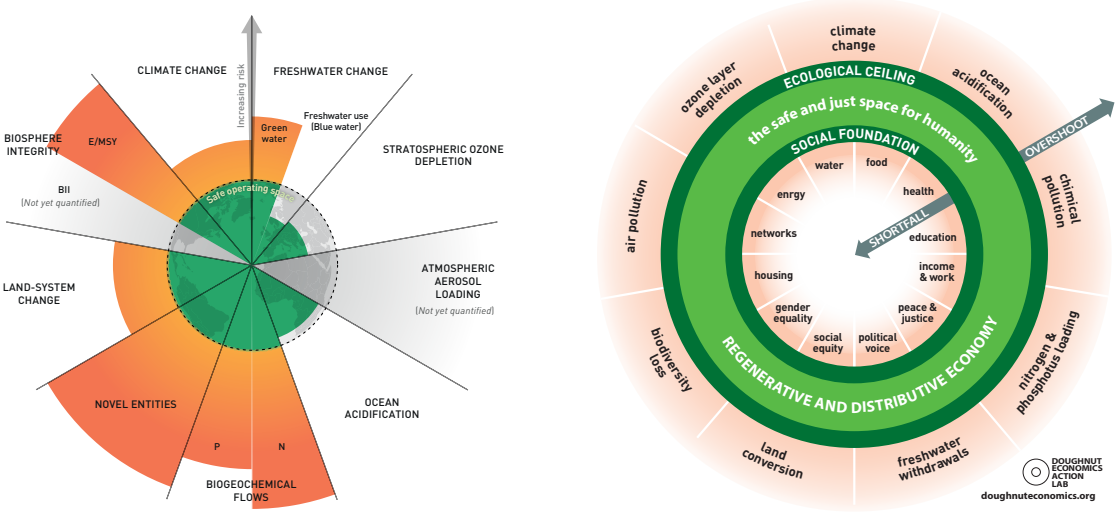


Figure 1 / Left: representation of planetary boundaries in 2023. (Source: Stockholm Resilience Center)
Right: representation of the Doughnut Theory. (Source: Wikipedia)

Proposed definitions of sufficiency

Before the term appeared in the IPCC report, ADEME produced a summary of the various connotations of sufficiency: "*sufficiency approaches called into question the level of consumption of goods and services and lifestyles, beyond minimising the resources used to produce a given good or service*"[8].

In recent years, particularly in France, numerous studies – summarised in Attachment 1 – have explored the concept of sufficiency and its implications for social actors such as consumers, individuals, households, public authorities, and economic participants. These studies are primarily grounded in the IPCC definition and seldom refer to that provided by ADEME. Upon reviewing the various contributions, sufficiency emerges, depending on the circumstances, as both an extension of and a complement to efficiency, encompassing a wide variety of behavioural changes (waste reduction, sustainable supply, adoption of the circular economy, absolute reduction in demand, etc.). Accordingly, it is essential to clarify the distinction between sufficiency and efficiency before proceeding to define sufficiency from the standpoint of individual consumers, communities, and businesses.

In markets and associated value chains producing goods and services for end consumers, **efficiency involves producing – and consuming – the same thing with fewer resources. It can be a feature of the product or service (e.g. a fuel-efficient car) or the production process (e.g. the same car manufactured at a lower cost)**. This driver, essentially stemming from technical and organisational progress, is crucial to the green transition, although its ability to deliver the expected goals is limited:

- obvious "rebound effects" in the use of goods and services, as improvements in energy or material efficiency reduce costs and increase demand;
- raw material recycling can only be repeated a limited number of times. Each recycling loop results in some material loss, leading to a decline in the performance of recycled materials. For instance, degradation of wood fibres limits paper recycling to no more than seven cycles;
- the circular economy is difficult to mainstream worldwide[9].

8 ADEME (2019). Panorama sur la notion de sobriété.
9 The Circularity Gap Report estimates that the overall circularity rate of materials was only 7.2% in 2023, compared to 9.1% in 2018.

Efficiency and rebound effects

Victor Court, Associate Professor

In many scenarios, gross domestic product (GDP) is regarded as exogenous, underpinned by a widely accepted assumption of typically 2-3% annual growth until 2050, even in IPCC scenarios. The related assumptions of either relative or absolute decoupling between GDP and final energy consumption ascribe a significant role to energy efficiency in decarbonisation, accounting for 37% of the overall effort to cut emissions in the IEA World Energy Outlook 2019 scenario. In contrast, sufficiency-related actions contribute only 11% as part of "Other actions". IPCC 2°C capping scenarios necessitate relative decoupling (slower GDP growth coupled with lower growth in final energy consumption), whereas those aligned with 1.5°C require absolute decoupling (GDP growth and a decrease in final energy consumption).

In fact, energy efficiency gains are systematically offset by various rebound effects. Some direct rebound effects are as follows:

- A 5G antenna consumes less energy than a 4G antenna per unit of data transmitted; however, the overall consumption of the service increases (e.g. high-definition smartphone streaming);
- over time, after insulating their homes, households may be willing to pay the same amount for heating and exceed 19°C;
- automotive: increased mileage for the same budget, larger vehicles, more cars per household.

Rebound effects are also observed when savings are allocated to other, more polluting uses that are harder to track, such as car fuel savings being used to cover air travel costs. Both direct and indirect rebound effects also occur in B2B contexts (e.g. less energy-consuming steel production reduces car manufacturing costs, leading to increased production). Lastly, there are longer-term macroeconomic rebound effects, such as growth or economies of scale (e.g. building more motorways in response to increasing car use), over which businesses have no direct control. These more complex rebound effects also pose challenges for public policy.

Various studies have sought to quantify the aggregate rebound effect at a macroeconomic level. They converge towards an aggregate long-term rebound effect of 50%. However, the most recent and robust studies raise this average closer to 100%,1 while the majority of integrated assessment models on which the main energy scenarios are based generally consider only direct rebound effects, thus overestimating actual gains from energy efficiency and underestimating future energy demand.

1 Brockway, P. E., Sorrell, S., Semieniuk, G., Heun, M. Court, V., "Energy efficiency and economy wide rebound effects: A review of the evidence and its implications", Renewable and Sustainable Energy Reviews, 2021, Vol. 141.

Sufficiency differs from efficiency. It consists of players voluntarily limiting their consumption or use of a product or service to below what they could use. This concept of "voluntary limitation", which is not explained in the IPCC and ADEME definitions, is essential for a better understanding of the implications of sufficiency for each type of player.

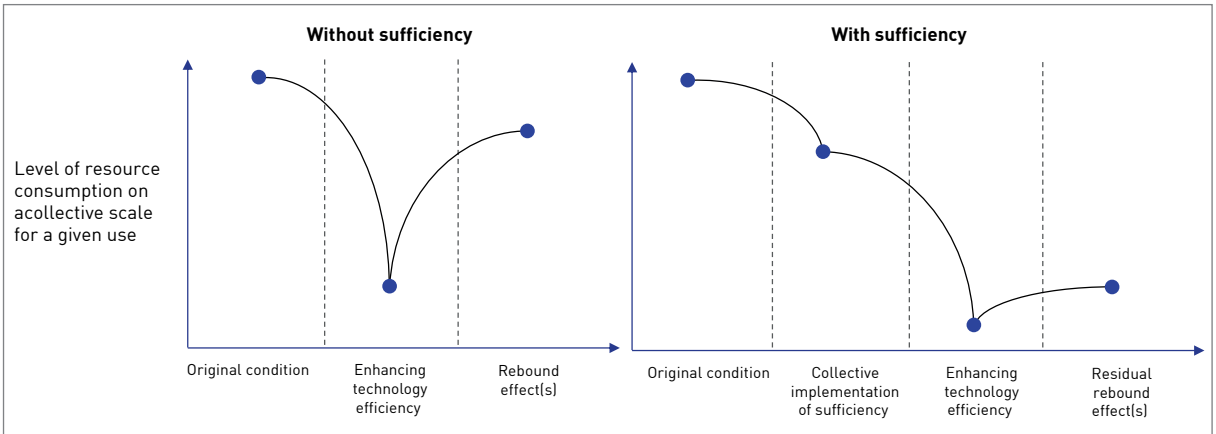


Figure 2 / Illustration of rebound and sufficiency effects on resource consumption. (Source: EpE)

Individual consumers perceive sufficiency differently depending on whether it arises from an economic constraint. A "sufficient" person consumes little or reduces their consumption, even when they can consume more. Conversely, when sufficiency results from an economic constraint, it is viewed as forced rather than voluntary. Consumers are compelled to alter their choices and make other trade-offs. In the worst-case scenario, imposed **economic sufficiency** may lead to cutting consumption below basic needs, the consequences of which were highlighted during the 'yellow vests' traffic blockade movement in France.

Collective sufficiency hardly makes sense as merely the sum of individuals, voluntary sufficiency-oriented behaviours. Historically, the term has sometimes been used in religious contexts (the Reformation) or for economic reasons, such as the recourse to rationing during post-war reconstruction periods. Therefore, unlike individual sufficiency, which involves moderating one's consumption, it is not necessarily spontaneous. For the incipient green transition, which requires frugality to reduce the consumption of numerous resources and pollutant emissions, collective sufficiency is essential to meet French and European commitments on climate and biodiversity. Accordingly, public authorities must design collective living environments where total volumes consumed or used are reduced, including:

- sufficiency in fossil energy resulting from EU ETS 1[10] and soon 2[11] ;
- sufficiency in land use under the net-zero land take rule (ZAN).

While sufficiency does not come spontaneously to all citizens, these frameworks must be understood and accepted for collective sufficiency to be effective. Furthermore, sufficiency serves as a vital complement to efficiency. The more efficient a product or service is, the greater the sufficiency it requires from consumers to ensure that its overall consumption does not increase despite the efficiency-driven cost savings. Depending on how they are managed, these environments can present opportunities for investment and actions to meet the essential needs of the underprivileged by reducing their forced individual sufficiency, while paving the way for **structural sufficiency**. Under such arrangements, a city could develop more compactly by redeveloping detached housing areas into semi-detached housing, reusing urban wastelands, and adopting soft mobility to lessen the need for individual motorised transport or land use, thus improving access to services, jobs, and shops. Similarly, farming directed toward food programmes at a regional or local level based on quality local produce can promote structural sufficiency by adapting collective eating behaviour to local and seasonal resources. In this regard, the third Quinet[12] report (2025) on "climate action value" (VAC), a tool for prioritising public action on decarbonisation, concludes that collective sufficiency actions would lower the VAC and consequently alleviate transition costs.

For companies, ensuring sufficiency across business models paradoxically results in overall efficiency, i.e. one that is not confined to economic performance. Marketing smaller or lighter products or employing pricing strategies that encourage only strictly necessary consumption are ways in which a company can eschew the maximisation of economic return alone. Consequently, it can be satisfied with "sufficiently profitable" sales and perform better on its non-financial indicators. This was the thrust of Eric Lombard's argument, then CEO of Caisse des Dépôts, when he suggested that, to be sustainable, investors should be satisfied with a 4% return on invested capital above the risk-free rate rather than 8% in a context of negative long-term yields[13]. In principle, this management method has the advantage of reducing risks to the business and enhancing its resilience.

Across-the-board implementation of sufficiency, from internal operations to product and offering design, often requires more than just technical resources; it necessitates a complete overhaul of mindsets and behaviours. Contributions from the entire spectrum of stakeholders within the ecosystem will be essential to achieve this. The ISO 59004[14] standard, adopted in 2024 to describe the principles of circular economy, includes actions such as "refuse", "rethink use", "reduce", and "share to extend use" in its hierarchy of drivers to maximise the value of goods produced. Consequently, it provides an operational sufficiency guideline to optimise resources and maintain activities within planetary boundaries.

10 Which covers energy suppliers and suppliers of fuels for consumption by household and business consumers, other than those covered by EU ETS 1.
11 Which covers emissions from large industry, and the energy, aviation and shipping sectors.
12 France Stratégie (2025). La valeur de l'action pour le climat - Une référence pour évaluer et agir.
13 https://www.epe-asso.org/la-lettre-n-60-mars-2021/.
14 https://www.iso.org/fr/standard/80648.html.

However, the SDGs recognise that reducing consumption is not a linear process and must be tailored to the needs of underprivileged populations who still cannot maintain decent living standards. Depending on the starting point considered (whether the population is above planetary boundaries or below decent living standards), sufficiency can entail reducing the consumption of resources or capping their increase within acceptable limits to ensure that meeting the basic needs of all is compatible with planetary boundaries. The English term sufficiency appears to be an appropriate translation of the French "sobriété" as it connotes satisfaction with what is necessary by limiting the goods and services produced and consumed to a "sufficient" - not superfluous[15] – level to ensure the well-being of all, as proposed by the IPCC.

These few examples demonstrate that sufficiency at the local, regional, or national level results from a combination of individual and economic sufficiency (via price and efficiency mechanisms in the products and services consumed), achieved through public or private investments, technical progress, or organisational innovations.

To complete the picture, it is helpful to define waste limitation, which constitutes a grey area between efficiency and sufficiency. Waste can be perceived as the lack– voluntary or consented – of a search for efficiency by the product or service user. However, waste limitation is generally based on voluntary action, and hence sufficiency. For ADEME, "waste limitation is part of a continuum between efficiency and sufficiency, depending on whether it involves, for example, avoiding a waste of energy and materials for a given service, or avoiding consumption perceived in itself as "wasteful"[16]. That is why this publication includes the concept of waste limitation.

Businesses and sufficiency

Is it realistic to believe that for-profit enterprises can be sufficiency-driven and transcend traditional efficiency? Profits are traditionally based on growth in the quantity of products and services sold. While these can be made more sustainable through ecodesign, improvements in energy efficiency, and the circular economy, there is no guarantee that the outcome will be fully compatible with sustainability objectives due to rebound effects. For instance, aviation fuel consumption has fallen by 2% per year over the past 50 years, but the increase in air traffic caused by this reduction has resulted in a 5% rise in annual global emissions.

The durability of an offering primarily depends on the resources consumed. A so-called sustainable offering of products and services addresses a demand that can arise from social norms, corporate marketing strategies, or public policies. These factors can significantly drive demand beyond essential needs, placing a substantial share of responsibility for achieving collective sustainability on individual behaviours. Furthermore, there is no assurance that end consumers' use of products and services will be optimised. While sufficiency-led behaviours can be promoted during times of crisis and price inflation, they are seldom designed to endure. An offering is typically sustainable only if a collective living environment supports it. Purchasing a bike is a sustainable solution only if a collective living environment (such as a low-emission area, fuel prices, etc.) restricts car use and ensures the bike is not relegated to the garage.

Sufficiency requires businesses to take an unprecedented step back and reconsider how to produce and sell in a world where technological progress offers only a partial solution. It involves making investment decisions that benefit the environment and people, even if their short-term return on investment is lower than in a business-as-usual scenario. Thus, sufficiency can be viewed as a tool for developing business models combining the following features:

- **inclusion of issues related to sharing resources essential for creating value to boost business resilience amid energy and climate constraints;**
- **sustainable products and services that prevent rebound effects while remaining competitive and more appealing than conventional options.**

15 ADEME (2019). "Panorama sur la notion de sobriété". P.20.
16 ADEME (2019). "Panorama sur la notion de sobriété".

By examining the source of the corporate value proposition, it reevaluates product and service functions and uses, associated outcomes, and how to optimise both negative and positive externalities and their valuation. When combined with other drivers (efficiency, circular economy, etc.), sufficiency could enable companies to fully decouple their financial growth from their emissions and material footprint.

With this aim in mind, EpE members meeting in the Climate Change Commission, chaired by Isabelle Spiegel, Vinci's Environment Director, have been working for the past few years to share various sufficiency practices within their businesses. This publication outlines the questions raised, describes the initial experiments conducted, and offers possible answers to the following questions: what is the business case for sufficiency? How does it enhance efficiency and circular economy strategies? What are the conditions for the success of systemic sufficiency in corporate and market environments?

Instead of proposing a sufficiency-centred method or report, this publication reviews the challenges encountered, suggests solutions, and shares feedback on how companies integrate sufficiency into their decision-making processes. It is not comprehensive and emphasises actions that incorporate sufficiency within a broader spectrum of complementary sustainable practices, rather than treating it in isolation from efficiency and the circular economy. This collection of best practices illustrates the scope and diversity of actions already undertaken, thereby promoting the shift towards potential – and desirable - individual and collective practices.

This report is aimed at companies looking to initiate or speed up their transition towards sufficiency, as well as the transition of their value chains and their broad array of stakeholders keen to address this transformation's systemic aspects and challenges. The purpose is to demonstrate corporate sufficiency at three stages of action.

The first two chapters outline the environmental and economic challenges, difficulties, and benefits associated with various forms of sufficiency in the company's operations, as well as its product and service offerings. The third chapter examines the collective and structural dimensions of sufficiency, emphasising that collaboration and dialogue with both internal and external stakeholders are crucial for establishing competitive, desirable, and sustainable sufficiency.

1

In-house: different sufficiencies for different purposes

How do companies adopt different sufficiency approaches to using resources in their operations and the design of their products and projects? These resources include energy, water, and both mineral and renewable raw materials. Given the high digital content of numerous resources, digitisation is a significant issue for sufficiency efforts. Lastly, sufficiency has repercussions for anything nearing their planetary boundary, including GHGs, land use, various types of pollution, and product waste, among others.

While practices such as energy efficiency, recycling, and eco-design are now recognised, or even well-established, in companies, sufficiency introduces a new realm of possibilities with numerous and diverse long-term benefits, which can result in efficiency gains.

1 Energy: boosting efficiency to enhance competitiveness

In October 2022, the French government called upon all stakeholders (citizens, communities, businesses) to pursue energy sufficiency by achieving a 10% reduction in final energy consumption. While most of the reduction stemmed from plant shutdowns due to rising energy costs, the government's sufficiency plan proposed saving an additional 50 TWh of energy to avert the risk of power outages on the grid. Fifteen recommendations were made, primarily focusing on consumption related to employee activities (lighting and heating in buildings, business trips) rather than production plants[17].

While this sufficiency plan proposes various efficiency-related actions - such as replacing bulbs with LEDs, installing insulation, and adopting anti-waste initiatives like smart management and turning off lights during unoccupied periods - it also includes both individual and collective sufficiency measures. Under this scheme, capping the temperature at 19°C in winter accounts for nearly half of the total expected energy savings.

Energy curtailment contracts between certain companies and RTE could enhance such measures. The curtailments involve delaying energy usage to alleviate daily consumption peaks in winter and ease the strain on the electricity grid. Although this practice was already established before the recent energy crisis and does not amount to a reduction in overall corporate energy consumption, it contributes to ad hoc collective sufficiency by decreasing energy production, particularly where it is powered by fossil fuels.

Collected data indicates that France's energy consumption fell by 12% during the winter of 2022-2023[18] compared to the baseline period of 2018-2019. An INSEE sectoral report estimated a 22% decline in electricity consumption for energy-intensive industries between December 2022 and December 2023, about half of which was attributed to sufficiency practices. The data suggests that voluntary corporate sufficiency-led behaviours[19], when embraced by employees, tend to be long-term and do not exhibit a rebound effect. Observed consumption levels were maintained over the winter of 2023-2024[20], albeit due to mild weather. For example, reduced heating in office buildings, facilitated by widespread teleworking, has now become a well-established practice.

These results are significant in terms of both the absolute reduction in energy consumption at the national level and stakeholder compliance at each company site. Businesses have also demonstrated their ability to exceed government calls for action by extending energy efficiency initiatives beyond office buildings, as illustrated by Groupe ADP and SNCF.

17 https://www.ecologie.gouv.fr/sites/default/files/documents/dp-plan-sobriete.pdf.
18 https://www.ecologie.gouv.fr/sites/default/files/documents/121023_DP_Sobriete%20energetique_un%20an_apr%C3%A8s_VF.pdf.
19 https://www.insee.fr/fr/statistiques/7634643?sommaire=7634660&q=sobri%C3%A9t%C3%A9%20%C3%A9nerg%C3%A9tique.
20 https://www.ecologie.gouv.fr/presse/chaque-geste-compte-economisons-lenergie-lancement-troisieme-edition-campagne-communication.

GROUPE ADP

Three years on, energy sufficiency remains the key to minimising energy consumption

With rising energy prices amid geopolitical turmoil, 2022 was marked for ADP by the implementation of an energy sufficiency and load shedding plan under the French government's proposals for Paris' airport hubs. Accordingly, the Group signed the Ecowatt (RTE) and Ecogaz (GRTgaz) responsible company charters, confirming its commitment to long-term energy efficiency and load shedding plans, particularly aimed at reducing electricity consumption on days when the power grid is under strain. The package of measures includes:

- limit heating to 19°C in offices and airports, and to 16°C in areas with low traffic;
- refrain from using separate auxiliary electric heaters;
- keep doors and windows shut to prevent heat loss;
- meet regulatory limits on summer air-conditioning;
- reduce and optimise lighting;
- optimise air renewal on a zone-by-zone basis.

The successful implementation of this sufficiency plan depended on its dissemination throughout the entire airport community, which comprises 700 companies and 90,000 employees at the Paris-Charles de Gaulle hub, as well as the effective involvement of the Group's employee representatives. The first requirement has been met through existing communication channels with the airport community. The second involved regular discussions with employee representatives to address issues such as the adjustments needed from all employees to meet relevant government targets (temperature levels), operational implications (security lighting for parking lots and roads), and commercial implications (restrictions on illuminated displays during peak consumption periods). A regular progress reporting mechanism has been established with employee representatives to monitor the energy savings achieved through the sufficiency plan. Feedback has indicated acceptance, particularly concerning the more sensitive issue of lighting reduction. Additionally, ADP has employed generic messaging to provide passengers with relevant information. Compared with the 2019 eco-measures initiative launched by the Group among its employees, the new emphasis on sufficiency practices was met with much greater enthusiasm. We were thus able to build on our previous work, which included seven eco-measures in response to the government's recommendations to date.

This low-energy approach enhances commitment to ongoing improvements in energy performance, bolstered by an ISO 50001-certified energy management system across platforms in Paris, Amman (Jordan), and Ankara Esenboğa (Turkey).

In 2025, this energy-saving plan, which a fuel consumption management mechanism has since supplemented, remains very much active. In conjunction with the energy management system, it will enable us to:

- improve our electricity consumption performance in 2025 compared to 2019;
- improve our heating consumption efficiency in 2025 compared to 2019.

This integrated energy sufficiency and efficiency approach is also applied at the Group's international platforms in Ankara, İzmir, Antalya, and Enfidha, Turkey, as follows:

- installation of advanced energy management systems;
- real-time monitoring of energy consumption;
- refit of outdated infrastructures;
- integrating green building principles into new construction and refurbishment projects.

France's largest energy consumer prioritises energy sufficiency

SNCF is one of France's largest energy consumers, using an average of 9 TWh per year. Traction, buildings, and stations account for the bulk of this consumption. SNCF is committed to responsible consumption, with CO_2 emissions reduction targets for buildings and traction set for 2030 compared to 2015.

In June 2022, an energy-saving action plan was initiated, built upon a three-pronged strategy aimed at reducing the energy consumption of trains:

- **Eco-parking** involves turning off engines as soon as the vehicles come to a stop. This alone achieved savings of 270 GWh over a three-year period, which is equivalent to the annual consumption of a town the size of Annecy. SNCF Voyageurs' standstill energy consumption has thus fallen from 16% to 11%, and the operator is on track to make further reductions on a consistent basis.
- **Technological innovation** aims to reduce traction energy requirements. Various "eco-modes" have been introduced on trains to minimise consumption, both when stationary and while in motion. For instance, the new generation TGV M, featuring enhanced aerodynamics, will optimise on-board energy use based on passenger numbers and is expected to achieve 20% energy savings compared with current trains. The results will be monitored in 2025 with the first metered test trains.
- **Eco-driving** is an algorithm-supported system that adjusts speed to ensure timely arrival while minimising fuel consumption without compromising safety. This *Opti-conduite* application has been deployed across all lines and rolling stock in daily use to facilitate driving. Thanks to its ergonomic features, it has received support from drivers and achieves energy savings of up to 3–6%, depending on the track and trains employed.

To conclude, SNCF delivers on its commitments to the green transition and meets its GHG emission reduction targets. Energy sufficiency is one of the most effective and fastest ways to reduce operating costs, particularly in the context of highly volatile energy markets.

While generally having a minor effect on the overall corporate carbon footprint (including that of the value chain), these actions have enabled businesses to measure the substantial benefits of energy sufficiency for their operations, involving little or no investment and delivering immediate economic gains. Despite the lack of public data on reductions in corporate energy bills, other figures provide indicators. For example, the French government announced savings of €150 million[21] on its buildings, while some local authorities reported savings of millions of euros[22/23].

It is important to note that, although energy sufficiency often focuses on buildings, some companies have extended its application to their employees' professional travel by imposing restrictions on non-essential trips, setting lower speed limits for company vehicles, and more.

Integrating sufficiency from the outset into corporate energy strategy can generate co-benefits. This is the case for BIC lighters. The group has reviewed the architecture of its buildings and occupied areas, including production plants and offices, to reduce its energy bill and minimise exposure to the risk of rising energy costs. The work undertaken ensures that its offices are heated in winter using the heat from production machines and are shielded from summer heat waves without recourse to air conditioning[24].

21 https://www.tours.fr/actualites/le-plan-de-sobriete-des-usages/.
22 https://www.lyon.fr/actualite/transition-ecologique/la-ville-de-lyon-engagee-pour-etre-sobre-en-energie.
23 https://www.tours.fr/actualites/le-plan-de-sobriete-des-usages/.
24 ADEME-EpE (2024). "How to embark your company upon its climate change adaptation journey?"

2 Water: preventing short-term risks to business continuity

Unlike energy, the risks associated with water resources for businesses lie less in their cost than in their availability or lack thereof. Although the cost of water often constitutes a small percentage of an industrial site's operating expenses, its true value becomes apparent only when it is scarce and becomes critical during shortages. Restrictions or even a complete shutdown of a plant can indeed lead to significant costs. It is estimated that the cost of water treatment is ten times greater than the cost of water, whereas the cost of water scarcity is a hundred times higher, plainly underscoring the financial consequences for companies of water shortage[25].

In France, the droughts of 2022 and 2023, along with the associated restriction orders, caused shockwaves similar to those from the energy crisis, underscoring the need for companies to reduce and better manage their water withdrawals. The resulting actions follow a rationale akin to the circular economy: reducing withdrawals, reusing untreated water of lower quality, and recycling through treatment. Several companies, including Solvay[26] and Arkema, have anticipated these climate risks with a multi-site strategy that prioritises locations based on the criticality of the risk and the actions to be implemented. The introduction of an internal water price, akin to an internal carbon price, is becoming an increasingly common practice for assessing investment priorities.

ARKEMA

Water efficiency and industrial performance: the success of the Optim'O system

Arkema's primary focus is to safeguard the environment through effective water management, which entails minimising water usage and enhancing wastewater quality.
Launched in 2016, the Optim'O system monitors the Group's water management initiatives, which encompass a thorough initial assessment using key indicators and the implementation of customised technical solutions.

An internationally deployed scheme
Optim'O accurately monitors water usage and discharges at all Arkema plants, becoming a global driver of optimised solutions.
Group water management experts rely on consultants to enhance infrastructure safety and minimise industrial hazards. Furthermore, Optim'O invests in annual plans aimed at reducing water consumption and improving wastewater quality. It has achieved overall water savings of 50 million cubic meters during the reporting period compared to 2019.

Optim'O's ten fundamentals:
1 Advanced technologies for filtering suspended solids and substances of concern.
2 Water reuse via suitable recycling systems.
3 Optimising processes to reduce water consumption.
4 Real-time monitoring of consumption and discharge.
5 Employee awareness of sustainable management practices.
6 Collaboration with stakeholders, including suppliers and partners.
7 R&D innovation developed by the "membrane" technology platform.
8 Management of water-stressed areas through site-specific adjustment strategies.
9 Alternative uses of non-drinkable water and rainwater.
10 Sharing best practices.

The Optim'O initiative has significantly reduced Arkema's water footprint, with withdrawals falling to 82 Mm^3 in 2024 compared with 100 Mm^3 in 2019. Furthermore, the chemical oxygen demand (COD) fell by 69% during the 2012-2024 period.



25 EpE-IFD (2025). « Actes du colloque Dialogue Entreprise-Finance 2024 ».
26 ADEME-EpE (2024). "How to embark your company upon its climate change adaptation journey?"

Among the solutions discussed, the reuse of treated wastewater (RWW) for industrial applications highlights the dilemmas that may arise among various environmental issues. While this solution reduces the volume of water withdrawals and is preferable when it eliminates the need for drinking water, it also consumes more energy and requires chemical additives, thereby necessitating additional consumable materials[27]. As circumstances vary from plant to plant, companies must assess a combination of solutions on a case-by-case basis to optimise their multidimensional sufficiency. An integrated approach to the various issues increases the likelihood of achieving consumption reduction targets.

Combining energy and water efficiency

Séché Environnement employs sufficiency as a strategic lever to minimise its environmental footprint. It coordinates water and energy sufficiency through various transition plans to achieve the combined benefits of decarbonisation and environmental preservation.

In the field of energy sufficiency, Séché Environnement achieved its 10% GHG reduction target in 2024, one year ahead of schedule, by cutting its fossil fuel energy consumption. Current initiatives include process optimisation, particularly the installation of gas cans, as well as producing and consuming its own energy through waste-to-energy conversion, solar panels, and waste heat recovery from industrial processes. This is expected to result in 300% energy self-sufficiency by 2026, with over 1,200 GWh of energy produced annually.

This action plan is coordinated with measures to reduce water consumption. The group launched a water action plan in 2022, aiming to reduce water consumption by 2025. The reduction target was revised upward in 2024, following an 8% decrease, and is now set at 15% by 2030. The Saint-Vulbas plant achieved a 13% reduction in water withdrawals during the 2021-2023 period by introducing softeners in the feed water for cooling towers, treating and reusing wastewater and rainwater, and improving metered water usage. In areas facing severe drought risk, Séché Environnement injects surplus water to alleviate pressure on the natural environment and conserves resources by returning water to the natural cycle.

Séché Environnement's integrated management of water and energy efficiency has yielded results, strongly supporting the case for a comprehensive approach to resource conservation. For instance, several plants achieved both their water and energy consumption reduction targets, with each target contributing to the attainment of the other. The facility in the Strasbourg area, one of the group's most energy-intensive operations, achieved a 5% reduction in energy consumption alongside a 4% reduction in water usage. Similarly, the plant in the Lyon area recorded a 2% reduction in water usage and a 6% reduction in energy consumption. Lastly, the facility in the Saint-Vulbas area attained a 9% reduction in water usage and a 7% reduction in energy consumption. The coordinated execution of Group sufficiency measures and the subsequent resource savings are at the heart of its environmental commitments in line with SBTi and SBTN international standards.

Collectively, all these actions and strategies also alleviate the pressure on biodiversity, which is one of the primary users of water. Accordingly, many companies have committed, for example through the act4nature international[28] initiative, to implement a freshwater conservation plan, occasionally reflected in a group-wide target for reducing water withdrawals.

27 https://igas.gouv.fr/nos-rapports/sante/Faciliter-le-recours-aux-eaux-non-conventionnelles-Mission-flash.
28 https://www.act4nature.com/entreprises-engagees-depuis-2020/.

3 Non-renewable raw materials: reducing resource dependencies and related risks

Many companies already rely on ecodesign to enhance the material efficiency of their products and services. ISO 14006 defines ecodesign as a "methodical approach that considers environmental aspects of the design and development process to reduce negative environmental impacts across the life cycle of a product".

The ecodesign process can cover different stages of a company's value chain, including supply (upstream), direct operations such as industrial processes, and use of the product or services (downstream). In practice, this process is all too often incomplete. An ADEME study of 25 different-sized companies from all sectors explains that "companies' efforts to implement their ecodesign policy almost systematically concern the supply of raw materials. In this case, the ecodesign process consists in sourcing lighter raw materials to obtain lighter final products and reduce their environmental impact during the transport phase, or sourcing raw materials of better environmental quality (certified, local, recycled, etc.). However, some corporates have implemented an ecodesign process to reduce the impact of products or services during the usage phase or when reaching the end of their life[29].

Given this situation, how and to what extent can sufficiency enable this process to advance and conserve raw materials beyond circularity? At BIC Lighters, sufficiency has long served as a tool for trade-offs in product strategy, helping to create a stable product shape rather than trendy new designs, or to discontinue certain product lines (e.g. mini-lighters) voluntarily. The traditional value chain policy has also been reinforced by the desire to accelerate the implementation of the circular economy by combining product design with consumer incentives to operate a used lighter collection network. This has created another sufficiency paradox: making lightweight, reusable and recyclable product components sometimes requires strengthening materials, which contradicts the weight reduction policy. In another sector, a similar situation applies to glass bottles intended for reuse, which are slightly thicker than conventional bottles (the glass of which can be recycled).

Factoring sufficiency into the value chain approach

Since its inception, BIC has focused on streamlining its products. The number of components in its lighters has decreased from approximately 30 in 1973 to 19 today, resulting in a more reliable product. In contrast, competing products now contain between 30 and 50 parts.

BIC is switching to larger units offering, on average, twice as many flames or more than competing lighters[1], thereby significantly reducing the environmental impact per flame.

Sufficiency is also relevant at the operational level:

- BIC traditionally focuses its R&D efforts on optimising raw materials. In the lighter business, vertical integration of manufacturing, from raw materials to the final product, delivers significant benefits in terms of both sustainable development and understanding one's value chain.
- Production facilities are situated near end-markets, leading to a considerably reduced transport-related environmental impact compared to competitors.
- Closed-loop circular economy practices will further reduce the group's overall environmental impact and enhance its business resilience. A pilot project to collect used lighters from tobacconists is currently under way in Spain and France. Lighters are disassembled by BIC using a machine that preserves the purity of the raw materials, optimising their reuse, recycling, and recovery.

1 Internal source.

29 ADEME (2022). « Analyse des bénéfices économiques de l'écoconception pour les entreprises ».

At Nexity, the ambition of sufficiency shapes the design of real estate projects at various levels: aesthetic, by simplifying the architecture of façades; energy, by constructing buildings that require neither heating nor air conditioning (with stable thermal comfort and natural ventilation providing health co-benefits for occupants); functional, by developing urban regeneration and mixed-use areas. Renault explores dimensional sufficiency by marketing two so-called "intermediate" electrically powered vehicles. The Bento (micro-utility) and Duo (micro-urban) models are presented as both affordable (around €10,000) and better suited to urban uses than SUV-type vehicles, which are very resource-intensive to produce and use.

Design and land use sufficiency to create living spaces

Nexity is a developer of residential and commercial real estate, including student accommodation and coworking spaces. The Group does not partake in real estate activities but operates as a project manager for real estate ventures, thereby playing a significant role in the decarbonisation of the real estate and construction sectors.

Nexity applies sufficiency to both the materials and systems used, as well as land use - particularly the intensity of that use - and collaborates with local authorities to establish the desired level of density. Nexity's construction methods encompass a comprehensive range of sufficiency solutions for new buildings:

- *Bâtiment Essentiel:* a building that requires no heating or air conditioning, thanks to a low-tech approach to insulation (triple glazing, thick hollow brick), orientation, and natural ventilation. This solution has been well received due to its affordability. The flats in the first project in Lyon will be offered under a social solidarity lease.
- Ywood: prefabricated two-dimensional modules made from wood, designed for quicker construction, reduced water usage, and a smaller carbon footprint.
- Nex'step: affordable bio-based materials such as hemp concrete.
- Low-carbon communities.

Rehabilitation projects, which combine material and land use sufficiency, are more challenging to execute than other projects. In 2023, Nexity signed a partnership agreement for the redevelopment of 76 Carrefour sites at town entrances or centres, aiming to achieve 20% of its sales from urban redevelopment by 2030. By 2024, ten per cent of building permits submitted concerned redevelopment projects. The company's business model is undoubtedly shifting towards greater sufficiency and sustainability.

Bâtiment Essentiel project, Lyon Confluence
© Baumschlager Eberle

Other companies are focusing on voluntarily phasing out certain unsustainable raw materials. Depending on the circumstances, this may involve substituting another, more durable material that provides the same functionality and/or altered uses and behaviours (for instance, bulk retailing to reduce individual product packaging). The Nexity example above, with the Ywood and NEX'step projects, demonstrates how sufficiency can lead to the elimination of concrete where it is not essential to a structure. The EpE publication "Combating plastic pollution: a collective effort"[30] draws on company practices to define a strategy that includes a plastic review across the value chain and a reduction pathway. Similarly, "chemical" sufficiency has emerged as a solution to minimise exposure to chemicals and their associated health and environmental hazards.

30 EpE (2024). "Combating plastic pollution: a collective effort".

For some materials, however, completely eliminating or substituting them with another raw material poses challenges. In the circumstances, companies opt for "decarbonised" versions, which are generally more expensive for the same quantities. Sufficiency emerges as a solution to optimise the shapes, lines, and architectures of components, while reducing the amount of required materials. This 'frugality' is implemented by Forvia, which aims to reduce the overall weight of its products sold by 17% by 2030, while increasing turnover from 20% to 30%[31]. The search for "just what is needed" through the development of sub-assemblies designed to lighten vehicles provides the brand with a competitive advantage. Concrete is also the subject of such initiatives. For example, Vinci's use of shapes (e.g., hollow beams) and alternative architectures (e.g., reducing the number of layers in a dam) ensures the same level of performance as conventional solutions that are more resource-consuming yet spontaneously preferred by customers.

4 Biodiversity, land, and renewable raw materials: alleviating pressures to avert conflicts of use

Biodiversity loss is one of the nine planetary boundaries. The recent IPBES[32] Nexus report explores the interlinkages and interdependencies among five issues - biodiversity, water, health, food, and climate - through sixty scenarios. This report shows that scenarios demonstrating synergies between these issues are best suited to achieve the goals of the Paris Agreement, the Kunming-Montreal Global Biodiversity Framework, and the SDGs. The relationship between human activities and biodiversity, along with related ecosystem services (biomass, water, carbon sequestration, etc.), is crucial; therefore, adopting policies to promote resource use sufficiency is likely to yield benefits across many areas. Consequently, the report's Food First and Climate First scenarios are the least appealing as they negatively impact other issues.

Biodiversity conservation generates ecosystem services that are essential for the survival of all living beings, including humans, as well as for the economy[33]. In some cases, the estimated value of these services may exceed the value derived from investing in the development of the sites and their land. In such instances, companies may choose to abandon the project and/or shift to less economically optimal initiatives. This approach could, for instance, align with the "A" of the ARC (avoid-reduce-compensate) sequence, enshrined in French law[34], which might lead to a no-go decision by the project owner. For example, many companies have made commitments in this regard under the act4nature International initiative (non-exhaustive list):

- Technip Energies: not participating in projects located in the most sensitive IUCN areas: I, Ia, Ib, and II[35].
- Natixis and Société Générale: excluding funding for projects at sites of high ecological value (e.g. IUCN I to IV sites, RAMSAR wetlands, UNESCO World Heritage, Alliance for Zero Extinction) that materially impact those sites.
- Crédit Mutuel: safeguarding ecosystems from fossil fuel development and reducing pressures on biodiversity, including alterations in land and sea use, climate change, and various forms of pollution, along with a commitment to zero funding for new oil and gas exploration, production, and infrastructure projects.

Following the introduction of France's Net Zero Land Take law (ZAN), companies in the construction sector are now incorporating this aspect into the design of their land projects and evaluating their relevance. ICADE, a Caisse des Dépôts et Consignations subsidiary, undertakes real estate development projects exclusively on already urbanised land. The principle of land sufficiency also pertains to production facilities. For instance, Renault has dismantled and reorganised some assembly lines to reduce the surface area of its plants. Marsh is committed to reducing land take as part of its real estate redevelopment projects at former industrial sites with the aim of securing 600,000 square meters of unbuilt land by the end of 2025[36].

In other cases, exploiting these resources is conceivable, and often already organised, through agriculture and agroforestry for the production of renewable raw materials. According to ISO 14021, a renewable raw material is composed of biomass from a living source that can be continuously renewed in a certain quantity

31 https://www.forvia.com/sites/default/files/2024-05/Slideshow%20FORVIA%20General%20Meeting%20May%202024.pdf.
32 IPBES (2024). "Nexus assessment report on the interlinkages among biodiversity, water, food, health and climate change".
33 European Central Bank (2024). "Economic and financial impacts of nature degradation and biodiversity loss: over 72% of businesses and 75% of corporate loans in the euro area rely on at least one ecosystem service".
34 Loi du 10 juillet 1976 relative à la protection de la nature.
35 https://uicn.fr/wp-content/uploads/2010/11/Espaces_proteges-Partie-7.pdf.
36 https://www.act4nature.com/wp-content/uploads/2020/10/MARSH-VF.pdf.

through annual growth. Even if such renewables are considered inexhaustible, their availability actually depends on society's pressures on resources and their environment (pressures on water, land use, use of plant protection products, etc.). Like the rest of biodiversity, renewable raw materials are sensitive to the effects of climate change (droughts, floods, etc.), which can introduce significant variations in the quantities produced. Lastly, the same raw material can be assigned to different uses (food, energy, materials, etc.) at the risk of overexploitation should all those demands increase[37].

Companies may voluntarily restrict their withdrawals at various operational levels. Engie, for example, limits the amount of material from dedicated energy crops in methanisers to 10% (compared to 15% under French regulations), even in areas not subject to regulation[38].

Food sufficiency plays a crucial role in biodiversity conservation by reducing changes in land use due to deforestation and in climate change mitigation by cutting GHG emissions. For instance, the average land footprint of a French person is estimated to be between 1,200 m² per year for a purely vegetarian diet and 5,300 m² for a meat-rich diet (170 g/day)[39]. Companies, primarily through their private canteens, can significantly promote land-sufficient eating habits among employees. Nine EpE companies have signed a charter of commitment to initiate discussions in 2024 about "menus of the future" at company restaurants[40] that will deliver health and environmental benefits. BNP Paribas has already begun trials to reduce the proportion of meat on menus and to increase local sourcing. Such decisions may not take priority if based solely on profitability. Thus, they can be regarded as sufficiency actions.

BNP PARIBAS

Collective catering to trial and promote desirable food sufficiency

BNP Paribas has its own catering organisation, GAM-Restaurant, which serves approximately 2.2 million meals annually at its 16 sites in the Paris region. Aware of environmental issues, GAM-Restaurant offers meals prepared on-site, emphasising seasonal and local produce. Meats are of French origin, and organic fruit, along with two vegetarian dishes, are available daily. Many of our products hold certifications such as Label Rouge and Bleu Blanc Coeur. Firmly committed to the environment, GAM-Restaurant has launched several initiatives aimed at raising awareness among its guests about the need for more environmentally friendly food consumption. To increase the proportion of vegetarian dishes selected, an inter-restaurant contest is organised each year, the Veggie Challenge, which has been highly successful. Additionally, an experiment is currently underway in collaboration with INRAE to display information on the environmental impact of the dishes available, thereby helping diners become more aware of their choices.

GAM-Restaurant's commitment extends well beyond its kitchens. In the fight against single-use plastics, it was decided to stop selling plastic bottles from 2019 and to phase out all food and beverage plastic containers. A simple yet rigorous waste sorting system (including for bio-waste) has also been implemented at the venue's exit. Additionally, to reduce food waste, the quantity of foodstuffs is adjusted daily based on attendance. Since 2022, nearly 30,000 packed lunches have been delivered to numerous BNP Paribas employees, thanks to "Too Good To Go", an app that saves unsold food.

Agriculture exemplifies another case of the sufficiency dilemma. Agroecology, for instance, helps reduce inputs while enhancing biodiversity and the production of various ecosystem services (absorption, erosion avoidance, etc.)[41]. However, it necessitates more arable land for equivalent output. Consequently, the model's sufficiency relies on the sufficiency of the entire downstream value chain.

37 EpE (2021). « La ruée vers l'or vert : quelle gouvernance de la biomasse ? »
38 EpE-IFD (2025). « Actes du colloque Dialogue Entreprise-Finance 2024 ».
39 ADEME (2020). « Empreintes sol, énergie et carbone de l'alimentation ».
40 https://www.epe-asso.org/engagements-entreprises-initiatives-collectives/.
41 EpE-IFD (2024). « Actes du colloque Dialogue Entreprise-Finance 2023 ».

5 Digitalisation: anticipating indirect and multi-resource challenges

In the digital sector, the concept of sufficiency emerged earlier than in other sectors. Back in 2008, the GreenIT.fr collective described sufficiency in the sector as an "approach consisting in designing more sufficient digital services and moderating one's daily digital usage"[42]. Cigref and the Shift Project, in their 2020 report, supplemented this with digital sufficiency as a process of "knowing how to make the right choices based on the value delivered by digital technology to corporations versus the risks to the environment", which "links the technical, economic and societal/behavioural aspects'"[43]. This reproduces the concept of efficient decisions based on non-financial criteria.

The digital transition is driving a massive increase in IT usage among companies and, consequently, in the inputs needed to manufacture and operate terminals, software, and infrastructure (networks, data centres). Consumption of energy, water, land, and raw materials, particularly metals and rare earths, is rising sharply. In 2022, ADEME estimated that digital activities accounted for 4.4% of France's carbon footprint[44]. It also projected that by 2050, France's digital sector will consume nearly three times as many materials (metals, biomass, etc.) and require the extraction of 59% more metals and minerals than in 2020, taking into consideration the entire life cycle of digital equipment[45]. Digital technology consequently encompasses all these issues, although most of its environmental impacts are transferred along the company's value chain.

These issues[46] have gained renewed relevance due to the growing use of Artificial Intelligence (AI) by businesses, particularly generative AI. However, there is no evidence to suggest that AI systematically contributes to reducing emissions or resource consumption. Its use could jeopardise the green transition (e.g. improve targeted marketing to increase material consumption), while its environmental footprint could outweigh the benefits generated. The International Energy Agency anticipates, for example, a doubling of electricity consumption by data centres as a result of AI's deployment between 2022 and 2026[47]. In its recent opinion, France's Economic, Social and Environmental Council (CESE) observes that AI's current uncertain and poorly documented environmental record could be exacerbated by the risks associated with rebound effects[48].

New methods are being developed to manage these risks due to the allure of intensive AI use for boosting competitiveness. Companies such as Sopra Steria are creating tools and techniques that assist organisations in better understanding the impacts and utilising digital technology more effectively in their operations.

More broadly, businesses and their stakeholders are working together to define trade-offs that guide AI towards applications capable of meeting the needs of the green transition. One such initiative is the recent creation of the Coalition for Sustainable AI, which comprises 37 companies including Capgemini, EDF, Engie, Schneider Electric, Sopra Steria, Total Energies, and Veolia[49]. Lastly, AFNOR has developed a general standard for "frugal AI"[50]. Frugality is defined as "the ability to be satisfied with an outcome deemed sufficient by redefining uses and needs" where "resource constraints prevail", aligning it more closely with the definition of sufficiency.

42 https://www.greenit.fr/2008/05/21/glossaire/.
43 Cigref-The Shift Project (2020). « Sobriété numérique : une démarche d'entreprise responsable ».
44 https://infos.ademe.fr/magazine-janvier-2025/numerique-quel-impact-environnemental-en-2022/.
45 ADEME-ARCEP (2022). « Evaluation de l'impact environnemental du numérique en France et analyse prospective ».
46 EpE (2022). "The digital, ally or enemy of the ecological transition?".
47 International Energy Agency (2024). "Electricity 2024: Analysis and forecast to 2026".
48 CESE (2024). « Impacts de l'intelligence artificielle : risques et opportunités pour l'environnement ».
49 https://www.sustainableaicoalition.org/members-and-supporters/.
50 https://www.boutique.afnor.org/fr-fr/norme/afnor-spec-2314/referentiel-general-pour-lia-frugale-mesurer-et-reduire-limpact-environneme/fa208976/421140.

Designing digital technology within planetary boundaries

The sleek aesthetics of the digital sector struggle to conceal its expanding environmental footprint. High-tech companies can no longer disregard their physical impact on the environment. Responsible digital technology, therefore, is crucial for ensuring both development and sustainability throughout the value chain.

Reducing the environmental impact of digital technology

From real-time communication and resource management to demand forecasting, digital technology has become a key driver for developing sustainable business models. To ensure that it does not undermine these models, eco-design must be built into digital service design from the outset. This involves:

- enhancing the efficiency of software engineering processes,
- engaging all stakeholders to develop a comprehensive, systemic overview of impacts,
- assessing requirements and redesigning end-user processes.

Accelerating the shift to sustainable business models for customers

Tech companies must now accurately assess both the negative and positive impacts of their digital solutions to better inform customers about the consequences of their choices. This involves developing stricter industry standards. Sopra Steria's contribution in this area takes the form of roundtables with various stakeholder groups and the development of open-source impact assessment applications.

- Green For IT (G4IT) is committed to the life-cycle analysis of current IT systems and digital services.
- EcoMindAI's predictive impact calculator targets generative AI and recommends "restraining" or even abandoning the use of AI due to its environmental footprint. For instance, halving the model training period nearly halved the overall carbon footprint, with negligible loss of accuracy.

Designing digital operations that respect planetary boundaries, contribute to global sustainable practices, and meet identified needs is a challenge which can only be tackled with the best technical support.

The application of sufficiency measures to a company's scope of operations can take many forms, from "no regrets" local action with low investment costs to the policy of excluding or capping impacts deemed acceptable at the project level. When used as a precondition for other drivers, these measures can generate economic quick wins and mitigate short-term reputational risks related to the availability or cost of inputs essential for the business's continuity and/or competitiveness over the long term. In some instances, sufficiency primarily focuses on eliminating waste. Some resource-saving opportunities that were previously considered not worth pursuing under normal conditions were later recognised as significant due to changes in the economic and/or environmental context and were subsequently integrated into the process. In other cases, businesses have effectively relinquished certain investments or employee practices in favour of less economically optimal solutions. The table below summarises the features of the different types of in-house sufficiency studied in this chapter.

"In-house" sufficiency is a crucial first step; however, it does not address customers' needs and uses. The application of sufficiency to the value proposition will be explored in the next chapter.

Type of in-house sufficiency	Benefits of sufficiency for company	Criticality level for company	Appeal of voluntary corporate action
Energy (buildings)	• Immediate financial savings • Less exposure to energy price variations • Protection against heat waves	+ +++ +	Anti-waste: high, but with the challenge of employee onboarding Retrofit: high investment
Water	• Reduced risk of business disruption • Immediate financial savings • Reduced reputational risk associated with resource sharing • Conservation of biodiversity (and related ecosystem services)	+++ + ++ ++	High
Non-renewable raw materials	• Compensation for additional cost of using more sustainable materials • Less exposure to resource price variations • Less exposure to risk of lack of availability of critical resources (scarce raw materials, resources derived from the circular economy) • Reduced health and pollution risks associated with the use and/or degradation of some substances (and related reputational risk)	++ +++ ++ Varies according to sector	Varies according to criticality of raw material
Biodiversity - renewable raw materials	• Less exposure to risk of conflicts of use • Reduced reputational risk associated with resource sharing	++ ++	Complex: depends on existing governance between users
Biodiversity – land projects	• Reduced medium to long-term risk of stranded assets • Conservation of biodiversity and related ecosystem services • Reduced reputational risk associated with resource sharing • Immediate financial savings	+ + ++ ++	Medium
Biodiversity - Food	• Employee health benefits	+	Complex: employee onboarding issue
Digital	• Immediate financial savings	+	Limited: competitiveness driver

2

Sufficiency: a driver of competitive advantage

Sufficiency raises questions about established sales and consumption habits. New business models are being tested with the dual objective of satisfying customers by meeting their needs (as opposed to their slightest desire) and enhancing the added value of offerings.

1 Promoting usage sufficiency behaviours

Acceptance among most customers, particularly mass consumers, of minimum service or usage is seldom spontaneous outside periods of crisis when increasing costs compel people to reduce consumption by adjusting trade-offs. Businesses could create various incentives to guide customers towards more frugal use of their products and services, for instance by minimising waste, and to assist in ingraining those habits over time.

During the 2022-2024 energy crisis, French energy companies EDF, Engie, and TotalEnergies urged the entire French population to practise sufficiency. To promote this behaviour, they offered bonuses in the form of rewards or gift cards to households that reduced their electricity or gas consumption by a few per cent. The bonuses incentivised reductions in consumption over the winter season or on peak days, depending on the circumstances. Here, sufficiency is a win-win, generating savings for consumers and energy suppliers alike, whose competitiveness and supply capacity were severely tested by rising energy prices fuelled by the Ukraine war.

TotalEnergies

Incentivising users to cut their electricity and gas consumption

Tailored services to further minimise consumption
TotalEnergies provides all its customers with a comprehensive package of "consumer services" that includes:

- a mobile application for tracking energy consumption, setting goals, and receiving personalised tips on saving energy;
- monthly reports for monitoring consumption;
- annual consultations with an energy-saving specialist;
- the Éclaireurs network for sharing tips on how to use less energy.

On average, users of consumer support services save roughly 5% on their energy bills compared to non-users.

Rewarding energy savings
During two consecutive winters (2022-2023 and 2023-2024), TotalEnergies implemented the Bonus Conso scheme to reward energy savings.
During the first winter, over 1 million customers reduced their electricity consumption by approximately 380 GWh compared to the previous year, resulting in energy savings equivalent to the monthly consumption of a city like Marseille.
The following winter also involved gas consumers. A total of 450,000 customers realised annual savings of 150 GWh in electricity (equivalent to the monthly usage of a large city like Bordeaux) and 150 GWh in gas (comparable to the monthly consumption of a city the size of Dijon).
The second winter clearly demonstrated that the best practices from the first winter had been properly assimilated while emphasising the need for dedicated support to enhance energy savings.

Gamifying the kWh hunt
For the winter of 2024-2025, TotalEnergies launched the "Conso Master" initiative designed to assist customers in managing their consumption more effectively through consumer services, as well as through fun contests and prize draws via the mobile app. This initiative has significantly boosted the popularity of the mobile app's consumption management functions.

In its recent "water sufficiency contracts", Veolia has embedded progressive pricing, contrasting it with quantity discounts commonly practised under traditional regressive pricing models (where large consumers pay less). For domestic consumers, the first few cubic metres corresponding to their basic needs are now charged at a low rate, while beyond a certain volume, the price per cubic metre increases for uses deemed to be comfort-driven. This approach has the benefit of protecting the most disadvantaged consumers who are likely to be in a situation of forced sufficiency.

An exceptional water sufficiency contract between Métropole Européenne de Lille (MEL) and Veolia

At a time when water resources in the European metropolis of Lille are both scarce and further constrained by climate change, MEL's contract with its water distributor, Veolia, signed in 2023 and effective as of 1 January 2024, addresses MEL's water sufficiency issues.

The contract centres on water savings and is aimed at households. It promotes water sufficiency by reversing the traditional volume-based economic model and encouraging lower consumption. Accordingly, if Veolia exceeds the agreed water volumes, it will incur a higher charge for the water produced by the public utility, thereby promoting water-saving strategies.

The aim is to save 65 million cubic meters of water over the 2024-2033 period, which is equivalent to more than a year's worth of withdrawals. To achieve this, the Group plans to deploy remote reading devices equipped with leak alerts, along with a distribution kit, by 2027. Additionally, significant improvements in network efficiency will be achieved through the implementation of 5,000 probes designed to detect leaks. Consequently, 1,200 water-saving contracts will be signed with key users, including landlords, condominium managers, businesses, and local authorities, to optimise water-saving practices.

This innovative approach, unparalleled in Europe, demonstrates MEL's and Veolia's commitment to adapting water management to climate change by raising awareness among all local stakeholders about the importance of preserving this resource.

In mobility, Renault provides several digital tools to encourage sufficient driving, as so-called "dynamic" (or aggressive) driving can consume up to 40% more energy than the average. One of these tools is the Eco-Monitor, which offers real-time driving assessments and advice, energy-optimised driver assistance, gamification, and loyalty through an off-vehicle application to promote behavioural change. Air France continues to strengthen its long-standing partnership with SNCF to encourage the use of trains over planes for transit journeys on long-haul flights. Loyalty schemes serve as incentives to travel, but now offer rewards beyond flights (e.g. hotels, trains).

AIRFRANCE

The Train + Air alliance to reduce the carbon footprint of long-distance travel

For short-haul journeys, such as within France, low-carbon transport options are available. Today, however, air travel remains the only feasible option for undertaking long-distance journeys within a reasonable timeframe. Accordingly, one must combine low-carbon alternatives for short trips with energy-efficient flights for longer routes to achieve an overall reduction in the carbon footprint. The partnership between air and rail is therefore crucial, as demonstrated by the "Train + Air" deal offered by Air France and SNCF Voyageurs, which has enjoyed tremendous success for over 30 years and still presents substantial growth potential.

This package, currently available from 22 train stations across France, enables passengers to access either Roissy or Orly airports by train within 30 minutes (Reims-CDG) or 3 hours and 30 minutes (Nîmes-CDG) and has generated over 600,000 bookings by Air France customers since 2019. In 2024, the most popular routes were Lyon, Lille, and Strasbourg, with flight connections primarily to destinations in North America and the West Indies.

This deal has seen swift growth in recent years:

- 2022: combined purchase of Train + Air tickets, along with end-to-end web-based check-in;
- 2023: addition of new stations to the network;
- Since January 2025, Flying Blue customers (loyalty programme) can use their airmiles for SNCF train vouchers, a world first for an airline;
- In the latter half of 2025, the Train + Air deal will be expanded to include Ouigo trains.

For Air France, this deal offers multiple benefits:

- it feeds the hub:
  - enabling the airline to increase its market share among train passengers departing from the 22 regional stations and gain a competitive advantage over rival airlines;
  - offering a supplementary service for flights that allows passengers to access the hubs without car-related emissions;
  - enhancing customer loyalty among train passengers travelling to Paris Charles de Gaulle airport.
- it contributes to decarbonisation while meeting stakeholders' expectations:
  - Travellers can reduce their overall carbon footprint during the journey while enjoying additional benefits, such as guaranteed connections in the event of unforeseen circumstances, the option to purchase a combined ticket up to one year in advance instead of just four months for a train-only ticket, and the ability to accumulate miles throughout the entire trip;
  - the arrangement has been well received by French and EU public authorities;
  - it has met with the approval of NGOs[1] and non-financial rating agencies.

A shared strategic goal of Air France, SNCF, and ADP is to widen the popularity of the Train + Air deal and improve customer experience.

1 Pour un réveil Ecologique (2024)." Full report - aviation sector". P. 64.

The circular economy also presents significant challenges regarding behavioural change. While many sectors within the circular economy are already organised by companies, often through partnerships, their viability hinges on end consumers altering their behaviour and adopting best practices applicable to the end-of-life of purchased products and the consumption of circular economy goods. AXA, for example, is making repairs and reconditioning more appealing to its policyholders in the event of damage. Suez relies on local partners to support the behavioural changes necessary to achieve the goal of reducing the volume of incinerated waste in various ways, such as lowering waste volumes produced in Montauban under a waste performance contract[51] or promoting reuse through substantial resources in Manchester, with the provision of turnkey social co-benefits for disadvantaged households.

Arkema organises the pooling and sharing of recyclable raw materials, the available volumes of which are limited due to product renewal, among players from various sectors through its Virtucycle® programme. This approach is exemplified by the partnership with the sports shoe supplier On Running, which offers a subscription package to its end customers, allowing worn shoes to be replaced every six to nine months and fully recycled by Arkema[52].

Promoting material efficiency through reuse

SUEZ places resource conservation at the heart of its priorities. This ambition is reflected in actions to promote material efficiency through waste prevention and reuse, which includes awareness campaigns, the creation of resource centres, and innovative local partnerships. One of the Group's flagship projects, based in Greater Manchester (UK), perfectly illustrates this approach.

Renew Hub: an industrial reuse model

In collaboration with the Greater Manchester Combined Authority (GMCA), SUEZ launched Renew Hub, a groundbreaking project redefining standards for large-scale reuse. Opened in 2021, Renew Hub has become the largest reuse warehouse in the United Kingdom, spanning over 5,000 m² and giving hundreds of tonnes of items a new lease of life each year.

Dedicated containers have been installed for Greater Manchester residents to drop off toys, appliances, bicycles, and other unwanted items at recycling centres. Once collected, these items are sent to Renew Hub to be sorted, repaired, restored, or upcycled. The restored items are then resold at affordable prices through the Renew network of shops or online via a dedicated eBay platform. Since the project's launch, over 260,000 items have been reused, preventing them from ending up in landfills.

A socially-oriented and solidarity-based approach to sufficiency

SUEZ's approach goes beyond simply reusing items; it fosters social value that directly benefits local communities. Through this initiative, over £1 million has been raised to support local charities. Additionally, free furniture donations are made to organisations aiding disadvantaged groups.

The Renew Hub represents one of 54 social commitments included in Greater Manchester's waste management contract. It reflects the shared commitment of SUEZ and the GMCA to promote a more responsible and sustainable consumption model.

51 EpE (2024). "Combating plastic pollution: a collective effort".
52 https://www.arkema.com/global/fr/social-responsibility/innovation-and-sustainable-solutions/circular-economy/.

Settling claims differently to foster behavioural change

When handling claims, AXA prefers repair to replacement and, in the event of replacement, encourages the use of reconditioned parts:

- **Car claims:** since the introduction of the "Energy transition for green growth" law, car repairers are required to offer their customers reused parts. As a result, the network of 1,700 AXA France partner garages provides customers with a choice between new and used parts.
  AXA has developed the Alpha Scale platform to streamline the supply of quality auto parts, particularly used spares, to its partner garages. This application is compatible with most costing tools and monitors repair costs, thereby limiting their impact on policyholders' premiums and deductibles, while preserving repairers' margins and offering top-class service.

  In a favourable regulatory environment, the Alpha Scale platform has significantly boosted the growth of reused spares. AXA France[1] posted a 19%[2] increase in used parts in 2024 compared to 2023.

  To further promote the utilisation of reused parts, AXA France focuses on educating customers and communicating the emissions avoided through the use of recycled parts[3].

1 Including Direct Assurance.
2 As a percentage of automobile claims for vehicles that can be economically repaired
3 Details on https://www.axa.fr/qui-sommes-nous/actu-reemploi-pieces-auto.html: "Thanks to our customers, who have chosen to reuse automotive parts, we have avoided emitting 724 tonnes of CO_2 into the atmosphere in 2023, equivalent to 5,526 Paris/Nice flights".

- **Telephones:** as part of its damage, theft, or breakdown insurance for smartphones sold in partnership with Free or Fnac, AXA France recommends replacing damaged devices with reconditioned ones. To promote this initiative, AXA France published a white paper on sustainable telephony, which includes a study quantifying CO_2 emission savings resulting from the services offered in its mobile phone insurance policies. Based on ADEME's environmental impact assessment, each service was compared with that offered to the policyholder with a new phone. The analysis revealed that repair led to a 91% reduction in environmental impact, and replacement with a reconditioned product resulted in an 87% reduction, highlighting the benefits of changing practices and adopting a circular economy model.
  In 2024, as part of its key partnership schemes with Free and Fnac, AXA France cut overall CO_2 emissions (based on over 16,000 smartphone claims).

  This arrangement is a win-win situation for all: the average cost of claims is lower, allowing AXA France not to raise premiums for the past three years despite significant increases in service costs, and to extend its range of cover (all-cause breakage instead of accidental breakage, all-cause theft, etc.).

ARKEMA

Introducing a recycling value chain for high-performance polymers through the Virtucycle® scheme

Following the 2021 acquisition of Agiplast, a specialist in recycling high-performance thermoplastics for over 30 years, Arkema offers its customers a comprehensive solution for managing circular materials.
The Virtucycle® scheme enables Arkema and its collaborators to be at the core of a sustainable cycle focused on supply, recycling, and certification of high-performance polymers. It allows manufacturers, both upstream and downstream, to collaborate with Arkema on recycling initiatives for post-industrial and post-consumer polymers such as polyamide 11, polyamide 12, Peba, and PVDF. It also addresses the supply of grades that are partially (at least 30%) or fully (100%) recycled, exclusively produced using mechanical methods and renewable energy sources. Currently, over 26 grades hold certification from the SCS Global Services accreditation programme.

The Virtucycle® scheme connects manufacturers' needs by assisting them with the eco-design of their products made from recycled materials. This reduces the overall environmental impact of polymers and minimises the extraction of raw materials.

The scheme offers an opportunity for true circularity: some customers feed their polymers into the recycling loop, while others source polymers with recycled content. Many focus on both aspects, seeking through Arkema full recovery of their production offcuts and end-of-life products, while using recycled materials in their range of finished products.

Such practices, while capitalising on conventional economic models, call into question the habits of customers and their prescribers. They generate energy and resource savings through quick wins and deliver added value to the existing offering through a "sufficiency-focused after-sales service".

2 Implementing the functional economy

Confronted with the challenges of planetary boundaries, the usage sufficiency approach described above offers only a limited solution, as it frequently promotes a business-as-usual mindset that views a quantitative increase in the consumption of products and services as the primary driver of value creation. To tackle this clash of priorities, some companies are exploring innovative business models centred on either use or outcome, i.e. the functional economy.

The first type of business sufficiency model is the sharing economy, in which the company retains ownership of the goods and bears responsibility for their maintenance, while targeting a relevant customer ecosystem with its offering, typically at a regional or local level. This model is primarily utilised for non-consumable manufactured goods with limited use intensity, exemplified by the car-sharing schemes operated by Renault and Crédit Agricole in urban and rural areas, respectively. SEB has also adopted a similar model with Eurécook, a scheme for sharing cooking appliances for occasional use on a three- or seven-day lease[53]. Such models significantly increase the value generated per unit of goods and provide affordable solutions to meet essential needs for people's well-being. However, initial feedback from businesses indicates that merely making a deal available is insufficient to spontaneously increase its intensity of use. While a deal's profitability and environmental benefit may be proven, its desirability presents a different challenge best addressed by facilitating access. For example, customers appreciate having their vehicles available at all times rather than organising every trip and are willing to pay the price for that freedom.

53 https://www.groupeseb.com/sites/default/files/2018-03/eurecook_dossier_de_presse.pdf.

CRÉDIT AGRICOLE S.A.

Agilauto Partage: guaranteeing the right to electric mobility in rural areas and on company premises

In rural areas, 97% of people over 65 depend on their cars for at least one daily trip (Ipsos 2023 survey), with most essential services (health, employment, culture, administration) located in towns. Following the introduction of Low Emission Zones (ZFE) and rising vehicle prices, many residents find themselves in a "mobility desert", lacking an accessible alternative. This exclusion is even more pronounced regarding access to electric vehicles, the starting price of which exceeds €25,000.

With this in mind, in 2023, Crédit Agricole launched Agilauto Partage, a fully electric car-sharing service that delivers electric mobility to residents of rural and suburban areas through simple, affordable access to self-service vehicles. Its stated objective is to enable everyone in France to travel while adhering to new environmental regulations and taking economic constraints into account.

Agilauto Partage operates a mixed business model in which Crédit Agricole covers the costs of the vehicle, car-sharing technology, maintenance, and electric charging, as well as payroll for vehicle management and customer service. The average hourly rental rate for a user is €5, inclusive of VAT and energy costs. This rate is adjusted based on contributions from public authorities. Generally, local authorities will pay a fixed amount per vehicle each month. This model also receives support from Crédit Agricole's regional banks in the form of project funding and organisation.

In just one year, Pays de Fayence has delivered tangible benefits to 30,000 rural inhabitants, including 350 active users, over 1,000 rentals, and a 5-star rating on Google. These figures reflect the rapid uptake of electric car-sharing, particularly for business, medical, and leisure purposes. Seventy per cent of users had never driven an electric vehicle before, demonstrating the service's role in encouraging people to adopt this new form of mobility.

Finally, as part of the collaboration between Agilauto Partage and BiPPoP, a portal connects beneficiaries who require voluntary drivers due to their inability to drive. The volunteer car-sharers can utilise vehicles free of charge for their voluntary work. Simultaneously, Agilauto Partage Pro supports companies and local authorities in optimising their vehicle fleets and reducing costs. The objective is to manage the ever-increasing automotive budgets and decrease vehicle fleets while ensuring smooth, sustainable mobility for employees.

In other instances, the functional economy is enhanced by a cooperative element. For businesses, this entails adopting a preventive, customer support approach and relying on partners (public players, service providers, etc.) to minimise resource consumption through new services. Sufficiency, therefore, translates into a contractual performance target that can take two forms:

- Remuneration is determined by the profit generated by the customer, rather than being directly linked to the quantity of products consumed.
  - Xarvio, a subsidiary of BASF France, sells guaranteed healthy crop areas instead of supplying specific quantities of plant protection products. The reduction in treatment frequency can be as high as 20% compared to the conventional model.
  - Engie Solutions provides comfort-driven building maintenance solutions (temperature, air quality, etc.) rather than selling MWh of energy or billing the hours worked by technical staff on heating system maintenance.
  - Michelin sells miles driven to its truck customers rather than tires.
  - Holcim has changed its model from selling cubic metres of concrete to selling square metres built.
- Remuneration is directly linked to volume reduction targets. Veolia and Suez oversee community water consumption and waste management contracts.

Sufficiency as a driver for enhancing the positive impact of public waste management services

For Veolia, promoting sufficiency offers an excellent opportunity to redesign local public waste prevention and management strategies, based on three key concepts: less, better, and differently.

Less

The primary goal is to collect and process as little residual waste as possible by promoting waste prevention and reuse, establishing bio-waste recovery channels, and, of course, continuously enhancing the efficiency of selective sorting.

This also means travelling fewer kilometres. Consequently, door-to-door collection frequencies are increasingly adjusted to the volume of actual waste streams and to the opportunity of combining them with a larger network of voluntary drop-off points. Vehicles are increasingly powered by biofuels or even electric motors.

Better

The quality of the various flows collected is enhanced by supporting users of voluntary drop-off points and using artificial intelligence to inspect the contents of containers. Optimising existing infrastructures reduces their land footprint, thereby lowering both their environmental impact and operating costs. Veolia is achieving this by merging its water and waste operational sites locally whenever possible.

As innovation is an integral part of the service, Veolia allocates a portion of its annual budget to pilot projects for evaluation before they are implemented on a larger scale. This approach was supported by Métropole Européenne de Lille and involves using artificial intelligence as well as cameras in the hoppers of recycling centres to assess the contents of collection bins.

Differently

Sharing information contributes to the establishment of new service governance. Participative approaches based on the "zero residual waste" objective identify the expectations of citizens and users, facilitating a quicker change in their behaviour. For example, users would prefer to have an individual composter installed at home and receive guidance on optimising its use, albeit at a cost, rather than obtaining it from an operator and failing to utilise it effectively. The development of open data in this domain also enables information to be shared with all stakeholders.

To address these challenges, it is essential to implement regulatory adjustments regarding service quality and pricing, often involving a shift from a commitment to provide resources to a commitment to deliver results. This approach informs performance contracts, as exemplified by the Le Touquet urban community and the joint-venture company established between Veolia and the Vierzon community of municipalities.

Selling acres of healthy crops instead of fungicides

Faced with the increasing challenges of reducing the use of plant protection products in agriculture, Xarvio Digital Farming (the digital farming subsidiary of the BASF Group) is exploring a novel economic approach to more sustainable farming. Rather than selling plant protection products, the company is proposing a fundamentally different strategy: selling acres of healthy crops managed by a digital disease risk assessment solution.

An approach focused on results not products

This innovative model, grounded in the principles of the functional and cooperative economy, is based on a paradigm shift: the farmer no longer purchases a crop protection product but rather a service that guarantees the health of their crops. By moving from a traditional transactional model to an integrated service offering, Xarvio assumes the risk of managing plot protection on behalf of the farmer. To achieve this, the company employs advanced digital tools (satellite remote sensing, disease risk analysis, etc.) that facilitate the optimised and responsible use of phytosanitary products.

Promising results

Initially tested five years ago on fungicides, the model is now undergoing significant development and demonstrating promise.

- more than 98% of farmers obtain the promised results;
- optimisation of spraying operations on the farm, including travel and fuel consumption;
- a reduction in the quantity of fungicides used and the frequency of treatments (between 5% and 20%, depending on the year and climatic conditions);
- high renewal rate from one year to the next due to farmer commitment.

Innovation creates new challenges

While this approach addresses the challenges of agroecological transition and promotes more cooperative commercial relations among sector players, it also presents certain difficulties:

- **Resistance to change:** for this model to be adopted, it necessitates a complete overhaul of the network of stakeholders (agri-suppliers, agricultural distribution, farmers) in terms of both skills and internal organisation.
- **Coexistence of business models:** implementing this new approach involves reconciling different sales and marketing strategies with conventional business practices.
- **Regulatory framework:** the functional and cooperative economy requires a clearer regulatory framework for marketing plant protection products, as this new paradigm no longer involves the sale of products.

The new approach, which eliminates the risk for farmers adopting low-fungicide agricultural practices, seems promising for the agroecological transition of the French crop production model by integrating economic with environmental performance.

Energy performance contracting to exemplify the functional economy

Engie Solutions' Energy Performance Contracts (EPC) guarantee energy savings and a decarbonisation rate while maintaining a consistent level of comfort. This comfort is typically defined by ambient temperature and, at times, by air quality. The challenge lies in integrating sufficiency, energy performance, and decarbonisation drivers to meet contractual objectives.

The EPC is an agreement between a customer and Engie Solutions, designed to reduce their energy consumption against a benchmark. Remuneration is linked to improvements in energy efficiency achieved through investments in works, supplies, or services. Penalties are imposed if targets are not met, and gains are shared if the outcome surpasses the target.

Transparency and cooperation are facilitated by the **Measurement & Verification Plan** (MVP), which centralises the elements necessary for analysis. This 13-point plan provides a common foundation for definitions, methods, and responsibilities. The IPMVP protocol and associated statistical measurements promote consistency and safeguard against risks such as weather hazards or occupancy issues. Systems digitisation, with interfaces monitored in real time, enhances trust among stakeholders. Furthermore, these new business models encourage Engie Solutions to raise occupants' awareness of risks that cannot be controlled technically.

Integrating sufficiency into the group's diverse business models

In addition to targeted actions related to energy efficiency - such as optimising energy consumption in industrial activities and buildings, switching to LED lighting, and using equipment sensibly at construction sites and in offices - sufficiency is integrated in various ways into the VINCI Group's business models:

- VINCI deploys solutions for its customers aimed at reducing energy consumption. Global performance contracts increasingly include measurable commitments to cut consumption, allowing not only the management of actual energy demand but also the attainment of customers' decarbonisation targets. New digital tools developed by VINCI Energies, such as Wave and WiseBMS, enhance real-time management by optimising the use of commercial buildings. To date, over 600 buildings are managed via Wave with an emphasis on performance.

- With regard to materials, VINCI Construction's Environment in Design approach seeks to prevent unnecessary consumption from the design phase. It is based on a three-step principle: avoid, reduce, replace. This method has been effectively implemented in several major projects, including Line 15 of the Grand Paris Express, the HS2 programme in the UK, and the City Rail Link in New Zealand. For example, as part of the City Rail Link project in New Zealand, VINCI Construction undertook a series of actions that received praise from the Infrastructure Sustainability Council of Australia and led to a significant reduction in the site's environmental footprint, including 11% fewer mined tunnels, an 18% overall reduction in concrete use (the equivalent of over 7,000 trucks avoided), increased adoption of lower-carbon solutions (bored tunnels, cut-and-cover at Maungawhau), and an 80% reduction in energy-related emissions due to the utilisation of the electricity grid instead of diesel generators.

Implementing sufficiency initiatives often requires a cultural shift, particularly when it involves rethinking usage or investing in sufficiency-friendly equipment. It is also essential to coordinate the actions of a wide range of stakeholders and adopt a regional approach, enabling a systemic method of energy efficiency development. Discussion, gradual cultural transformation, and the demonstration of tangible results are the primary drivers for overcoming these challenges.

The table below is based on feedback from companies experimenting with these business models[54] and summarises the benefits and drawbacks identified for the commercial, economic, and financial solutions provider. While the functional economy offers many advantages, the constraints on its implementation present a significant barrier to access, particularly if the starting point is a traditional linear business model encumbered with the added cost of managing change.

Thus, commercial innovation by a single company appears insufficient to reverse the business model. For a company to succeed in this transformation, particularly in addressing the identified shortcomings, it must mobilise all its internal resources and external stakeholders. This is the focus of the final chapter.

Benefits	Drawbacks
Sustainability of activity • Recurrence — and therefore predictability — of revenues • Exit barrier due to high degree of customer intimacy based on cooperation • Reduced reliance on resources	**Corporate risk management** • Transfer of risk to solution provider under a model based on results and not supply of resources • Different cost structure due to maintenance of equipment ownership by provider • Longer return on investment due to maturity of offering and building of new relationship with customer and partners
Appeal to customer • Differentiation of value proposition through additional high-value services and intelligence; distinctive design and aesthetics (e.g. *Shibui*'s simple and understated elegance) • Competitiveness by limiting consumption and waste • Potential for co-benefits (e.g. health, avoided emissions, safety, social ties, etc.) • Reduction of negative externalities and potential cost sources (e.g. carbon price) • Removal of intermediaries allowing for cost reductions	**Ownership by customer** • Cultural and behavioural/organisational change • Marketing and commercial consistency if "sufficient" and traditional offerings coexist in the same company • Difficulty in quantifying and therefore monetising co-benefits for customer or third party

54 The information in the table is based partly on the feedback presented in this publication and partly on the report by the report of the Conseil National de la Consommation (National Council of Consumer Affairs) working group entitled "Développement et sécurisation de l'économie de la fonctionnalité" (2024).

3

Valuation of sufficiency within the company and its ecosystem: a collective response

Implementing sufficiency across corporate value chains – from operations to offerings, manufactured products and procurement – requires collective action.

Embedding sufficiency into corporate strategy transforms business models. Various corporate functions contribute to creating a coherent end-to-end approach. Involving businesses in developing living environments that promote collective sufficiency enhances the appeal and competitiveness of sufficiency solutions.

1 Incorporating sufficiency into corporate strategy

Integrating sufficiency into the company's business model presents a complex challenge that raises structural issues related to value creation and sharing. Firstly, the IPCC's definition, along with the examples presented above, indicates that sufficiency approaches should be differentiated according to the type of resource (energy, water, raw materials, etc.) and form (dimensional, usage, structural, substitution), while considering their interdependencies. Secondly, sufficiency encompasses issues of environmental impact reduction, competitiveness, and resilience, necessitating diverse perspectives and viewpoints regarding corporate performance targets.

Many companies have a defined carbon neutrality strategy. The publication "Companies and carbon neutrality: a collective transformation"[55] outlines various approaches adopted by businesses to establish their level of ambition and the drivers for reducing GHG emissions, while considering risks, uncertainties, and non-climate issues. These tools and techniques can be applied directly to sufficiency when supplemented by other benchmarks, such as resource availability scenarios or transition pathways (e.g. ADEME scenarios, Milestone 2030 of the Green Transition study). On this basis, businesses may conduct audits and create roadmaps along with associated indicators as part of a value chain approach. The "Strategic ownership of sufficiency by companies" report, prepared by ORÉE for the General Commission for Sustainable Development, proposes methods to implement a sufficiency policy that addresses the various stages.

To successfully embed it into their strategy, businesses now include sufficiency in their interactions with stakeholders, such as employees, administrators, shareholders, suppliers, customers, and the jurisdictions in which they operate. This dialogue may occur at the global company level or may be conducted, or even initiated, at a more local level. Depending on the sectors and levels involved, it may address issues ranging from remunerating sufficiency and new value sharing to anticipating and managing the impacts of resource scarcity on business. For example, ten EpE member companies are committed to bringing together stakeholders to design and discuss desirable and realistic goals or pathways for implementing sufficiency and to identify the conditions for success[56]. This discussion may take various forms:

- a stakeholder committee plays an advisory role in corporate governance. At Primagaz, the primary goals are to share the company's achievements, provide foresight and anticipation, and nurture as well as challenge the strategic vision;
- regional think tanks (TotalEnergies);
- consultation as part of a project (Air France, Vinci);
- suppliers' club (EDF);
- etc.

The transition towards robust business models may result in changes to the company's business lines, requiring not only the acquisition of new skills but also new forms of collaboration and/or new partners. For instance, Suez and Veolia rely on partnerships for their waste prevention systems for residents and shopkeepers, as does EDF for energy poverty. Meanwhile, Michelin and Xarvio have changed the way they negotiate and collaborate with their service providers.

55 EpE (2022). "Business and carbon neutrality: a collective transformation".
56 https://www.epe-asso.org/engagements-entreprises-initiatives-collectives/.

Renault Group

Integrating sufficiency across products, offerings and uses

To tackle environmental (climate, resource) and societal (supply, mobility access) challenges, Renault Group has implemented strategies to mitigate pressures and impacts at every stage of the vehicle life cycle. These various forms of sufficiency promote the circular economy and decarbonisation through engine efficiency and the electrification of vehicles and plants.

On the production side, the group has recently launched, via its subsidiary Mobilize, two intermediate vehicle models suitable for daily commuting:

- Duo, a fully electric two-seater city car available with or without a licence, starts at €9,750 and £10,510 respectively. This model is 1.30 metres wide, offers a range of up to 161 km, and can achieve speeds of 80 km/h (in the licensed version). Furthermore, 40% of the materials used for its construction come from the circular economy, which is twice the usual amount used in a conventional electric vehicle. The production of all Duo's parts and components generates 66% fewer greenhouse gases than that of an A-segment electric vehicle. At the end of its life, the Duo is at least 95%[1] recyclable, weighs approximately 500 kg, but has three times fewer parts than most vehicles. Duo's commitment to greater respect for the environment extends to its assembly process at the Tangiers plant, an ISO 14001-certified facility. This plant adopts a low-carbon approach, with 90% of its energy needs covered by renewable sources.
- Bento, a single-seater micro-utility variant of Duo, is capable of carrying 80 kg of payload within a modular space.

Mobilize is also developing mobility-as-a-service offerings to better meet mobility needs without introducing new vehicles onto the roads, such as the Zity by Mobilize self-service carshare offering. This service has been trialled in several major European cities in recent years (Paris, Lyon, Milan, Madrid), yielding mixed results. While the model quickly achieved profitability in Madrid, the offering was discontinued in Paris due to factors external to the company, such as repeated widespread damage to the fleet, resulting in reduced vehicle availability and a decline in service quality in the eyes of users.

Finally, during the usage phase, the Group supports its customers in adopting low-impact behaviours. Drivers are encouraged to develop suitable eco-driving reflexes (acceleration, appropriate speed, and anticipation) in two ways: by directly involving them through engaging interfaces (Eco score, Eco challenge, and coaching), or by allowing them to delegate lower consumption tasks to the vehicle via eco-mode. These measures significantly reduce the gap between their actual energy consumption and the theoretically approved values.

1 Calculated in accordance with Directive 2005/64 EC.

Mobilize Duo model

Engaging and supporting customers and suppliers to control energy and resource consumption

EDF Group has stepped up its efforts to assist customers in reducing their energy consumption since the energy crisis, with the aim of reconciling carbon footprint reduction with initiatives to combat fuel poverty.

Controlling consumption involves sharing information through energy services that monitor usage for professionals, as well as through the EDF&Moi platform for private customers. Targeted communication campaigns help customers understand how and why to reduce their energy consumption. Over 5 million customers utilise the application, which has seen a sharp increase in usage since 2022. More broadly, 10 million customers use EDF's consumption monitoring tools.

For underprivileged customers, local support initiatives encourage the establishment of a local dialogue, utilising partnerships such as Ashoka and MSMIP (Multi-Service Mediation Information Points) to assist economically disadvantaged customers. This includes, among others, the eco-habitat network for thermal upgrades to large underprivileged homes through a dedicated Energy Saving Certificate programme, and the Crésus association for helping people struggling with over-indebtedness.

In 2024, EDF inaugurated its first supplier club dedicated to CSR issues. Comprising 200 suppliers, the club discusses various roadmaps for water sufficiency, raw materials, and carbon emissions reduction. By collaborating with participants along the value chain, it aims to tackle tomorrow's sufficiency challenges and develop a profitable and sustainable business model for all stakeholders. EDF targets registered suppliers in France (95.4% of tier 1 suppliers) and fosters relationships through the club to generate joint solutions and ideas. For instance, a study is currently underway to supply personal protective equipment via a French linen supply chain. Conducted in collaboration with the Procurement Club of France's State Shareholdings Agency (Agence des Participations de l'État), the initiative aims to standardise outfits among various companies in an effort to reduce the ecological footprint. In this manner, sufficiency becomes a concern not only for the businesses involved but also for the broader cooperative ecosystem.

Rethinking uses: the key role of stakeholders

Aware of its responsibility in light of the ecological emergency, Air France is taking action to reduce its CO_2 emissions by 30% per passenger-km by 2030, compared to 2019. Over the past 15 years, the airline has cut its total CO_2 emissions by 6%. However, emissions from air transport have increased by 40% due to substantial traffic growth, which has offset the reductions in CO_2 emissions per passenger achieved through technological advances. Therefore, addressing traffic issues is key to the structural reduction of the sector's emissions.

Simultaneously, the way we travel is shifting towards embracing greater frugality and moderation. Air France is actively involved in supporting these changing habits and lifestyles. Firstly, it has enhanced the transparency of information and, alongside KLM, is the first European airline to display the CO_2 emissions of journeys on the flight selection page of its website. Secondly, it has gone further by promoting a global rethink of travel, with moderation as a prime consideration.

How can we offer our customers an alternative vision of travel that is based on a more thoughtful approach, while maintaining clarity and credibility? Engaging stakeholders is central to this reflection and takes various forms:

- Active collaboration among internal departments (CSR, customer experience, and communications) to define the strategy and establish the objective of creating an awareness label.
- Consultation with the French advertising regulator (ARPP) to ensure that the message complies with relevant recommendations.
- Joint construction of the message with various stakeholders. This collaborative effort has involved sharing guidelines with customers and diverse opinion leaders, including associations, think tanks, CSR professionals, and academics. Their insights have deepened our understanding of perceptions, refined expectations, and ultimately reinforced our approach.

At the conclusion of these discussions, the slogan "*For travel in the future, let's rethink how to get around today*" emerged prominently. Initially published in July 2024, it continues to feature in Air France's advertising campaigns and on its website.

Urban recycling is the new model for city building

Urban sprawl has become an unsustainable model, with over 20,000 hectares of natural, agricultural, and forested areas developed each year in France, disrupting the natural functions of soils (biodiversity, permeability, carbon storage).

This model must give way to **urban recycling** as the new development paradigm focused on maximising the potential of **existing assets** by **recreating value** and prioritising **land sufficiency**.

Asset conversion is a real estate development approach that differs significantly from the traditional new-build model and requires substantial fine-tuning to be industrialised. **VINCI Immobilier's dual objective** is to achieve net zero land take by 2030 and to ensure that **urban recycling's share of sales exceeds 50%** by the same year.

Operationalising urban recycling

The shift towards business-to-business real estate development necessitates changes in organisation and skills. Being a partner developer requires key account organisation and expertise in asset enhancement.

Multiple skills must be mobilised at an early stage of the project to manage an evolving balance sheet. Estimating the costs of asbestos and lead removal and optimising the project to minimise pollution clean-up expenses are crucial elements.
The core shift involves a **return to design**, essential for tackling current realities.

Back to the future

These developments are evident in their **social acceptability** and in how stakeholders perceive them. Elected representatives and residents view urban recycling projects more favourably and show less opposition to them, despite their technical complexity.
In environmental terms, VINCI Immobilier's projects stand as living proof that they renaturalise more than they artificialise. In 2022, the increasing number of urban recycling operations (22 out of 44) and the cessation of the largest land-take operations reduced the amount of built-up developments by half compared to 2020. The results are satisfactory, although the most challenging work remains to be done.

VINCI continues to adapt its operating models to safeguard the soil and promote land sufficiency.

TotalEnergies

Engaging in dialogue with civil society (and local authorities) on how to achieve energy sufficiency

Since their creation in March 2022, the regional and local "Energies and beyond" think tanks (Territoires: des énergies et au-delà), convened 29 times in 2024 by TotalEnergies France management, have brought together 800 local players, including members of the business community, civil society, public authorities, and elected representatives. Their aim is to engage in dialogue with stakeholders on local and regional issues related to energy and the energy transition (acceptability of renewable energies, skills, sufficiency, technological issues, energy choices, and a fair transition, to name but a few). The recommendations produced and actions implemented have been published by region and disseminated to stakeholders.

In 2024, the issue of sufficiency was addressed in conjunction with the subject of energy during several think tank meetings. To raise awareness and encourage open debate, TotalEnergies commissioned OpinionWay to conduct a survey on the issue of 'sufficiency and a fair transition' among a representative panel of French citizens. The Group's management in France presented this survey by OpinionWay at TotalEnergies' stand at the French Mayor's Forum last November. A mayor and a representative of an association providing sufficiency incentive programmes to local authorities were present to witness the exchange. A round table on the theme "**Energy sufficiency: what drivers of action?**" was held at the same event by Jean-François Vigier (Vice-Chairman of the French Mayors' Association) and Sylvain Waserman (Chairman of ADEME).

Following the survey, TotalEnergies decided to dedicate at least one session of each of its regional think tanks to the concept of sufficiency. The first session took place in the Centre-Val de Loire region at the end of 2024 and featured a sociologist to discuss the impact of individual and collective behaviour. Eleven meetings, in various formats, have been scheduled for the first half of 2025 to engage as many participants as possible.

Summary of the Opinionway survey on "Sufficiency and a Fair Transition"[1] (November 2024)

Sufficiency is essential, yet it is often perceived as a limitation. We must, therefore, support elected representatives and businesses, as well as encourage collaboration between the public and private sectors, to help those in greatest need.

1. **A step yet to be taken:** energy sufficiency remains chiefly a matter of submission, as its primary objective is to reduce energy bills.
2. **Social issue:** sufficiency is perceived as mainly attainable by the wealthiest, creating winners and losers based on financial resources.
3. **Efficiency indicator:** energy bills serve as the main yardstick for 85% of citizens, highlighting the success of sufficiency when it results in savings.
4. **Small steps method:** citizens have embraced simple personal gestures; subsequent steps require greater personal investment and involvement from professionals.
5. **Perception of sufficiency:** product or service that is affordable, straightforward, and offers immediate benefits.
6. **Key factors:** cost and simplicity, as well as habits, complexity, lack of knowledge and time, are the primary criteria for adopting sufficiency measures.
7. **Role of suppliers:** the need for improvement in customer support, particularly in understanding offers and support channels.
8. **Local councillors' expectations:** providing aid, supporting renewable energy projects in their areas, and acting as information channels between developers and citizens.

1 https://www.opinion-way.com/wp-content/uploads/2025/01/OpinionWay-pour-TotalEnergies-Sobriete-et-transition-juste-Novembre-2024.pdf

2 Involving the company's various business lines

Incorporating sufficiency into the company's business model involves reviewing the operations of its value chain. The various functions surrounding the core business all contribute to facilitating this transformation, with operational practices already emerging.

As demonstrated in the publication "Driving the green transition through procurement"[57], the purchasing department plays a vital role in corporate environmental performance. The study outlines three key lines of procurement action to ensure sufficiency in the supply chain:

- questioning supplier practices, particularly with regard to energy efficiency;
- identifying resource risks. For instance, if a supplier's production facility is situated in a water-stressed area, they could be encouraged to adopt water-sufficiency measures, adjust their production, or even temporarily relocate their facility;
- identifying and promoting supplier innovations related to sufficient or frugal products, alongside offerings that can encourage internal innovation.

Negotiating with suppliers within the context of sufficiency-based business models is also a key area for procurement action. Indeed, the shift towards a model not centred on volume growth is likely to affect the purchasing methods for intermediate products and, consequently, the supplier's business model, as exemplified by Xarvio and Michelin.

Information systems (IS) actively collect and manage various types of data while optimising offerings with a focus on customer experience, operational control, and environmental performance. The "Product as a Service to accelerate cooperation and circular transformation (PACCT)"[58] initiative, co-founded by Michelin and Xarvio among others, highlights the role of IS in implementing functional business models. IS functions also promote the sufficient use of digital and AI tools in internal operations.

Finance serves as the foundation for all our economic interactions. Financial data, including universal indicators like profit and profitability, is used to assess organisational performance and the broader economy. Consequently, the finance department plays a vital role in establishing a new common language that connects environmental and social performance with purely financial performance and, in doing so, acts as a lever for the transformation of business models.

Embedding CSR issues into the financial decisions of companies and financial institutions aims to align investments and financial assets with sustainability goals. As described in the publication "Finance: a driver of the green transition?"[59], this requires corporate finance to take ownership of these new challenges, along with substantial work regarding internal structure, skills, and change management to commit financial institutions and companies to the path of the green transition. It also entails the finance department funding the implementation of these new models or their transition from a linear economic model based on a new cost structure[60].

57 EpE (2024). "Driving the green transition through procurement".
58 PACCT (2024). "White Paper 2024: Business Model Innovation for Sustainable Impact in Europe".
59 EpE (2024). "Finance: a driver of the green transition?"
60 PACCT (2024). "White Paper 2024: Business Model Innovation for Sustainable Impact in Europe".

Engaging customers and service providers in a new digital business model

As a pioneer in the functional and cooperative economy, Michelin has operated a "Tire-As-a-Service" model for over 50 years. This model has been commercially successful among large transport fleets that appreciate not only the products and maintenance services, but also the variability of their expenditure (invoiced in €/km).

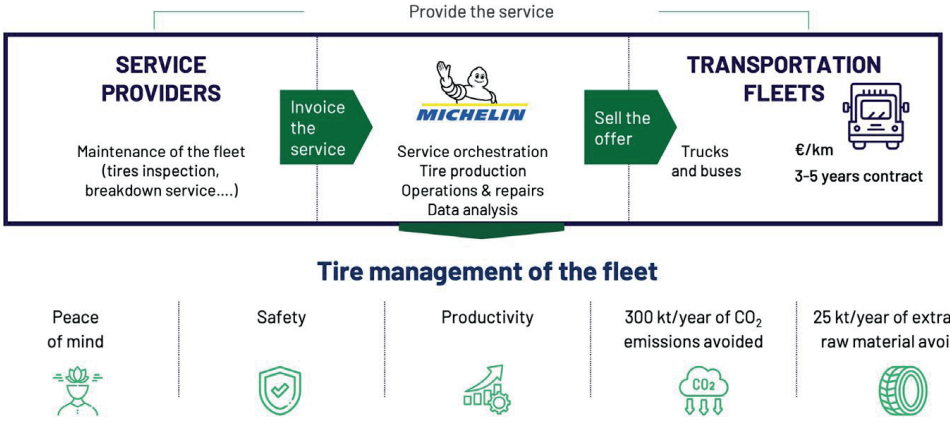
Long-standing issues have needed to be addressed, including complex manual processes, potential misalignments of interests between Michelin and its service providers, risk-taking in the contracting process, and difficulties in valuing benefits beyond financial considerations.

Despite these challenges, Michelin has continued to refine this model, enabling it to manage the product use phase, which, according to life-cycle analysis, accounts for over 80% of its environmental footprint. Our customer service-focused approach aims to minimise raw material consumption.

The various drivers involved include:

- adjusted sales management: price increases and portfolio management;
- new collaboration with service providers: bonuses linked to the amount of rubber remaining during dismantling, aimed at preventing premature renewals.
- Digitalisation not only underpins operational re-engineering (such as remote tyre condition monitoring and vehicle geolocation) but also enhances our value offering. Customers recognise that we provide safer, more sustainable mobility, along with productivity and cost savings.

In 2024, Michelin reaffirmed its commitment to the functional economy by supporting the PACCT collaborative and learning ecosystem, which promotes the sustainable transformation of the economy.



Source: White Paper PACCT

OCTO TECHNOLOGY
Part of Accenture

Reprioritising software tool optimisation to reduce resource consumption

Can an IT department embrace sufficiency? In the 1970s and 1980s, every developer faced with the limitations of their hardware had to be creative and optimise their code as much as possible to ensure it consumed minimal computing resources. Moore's Law (which doubles the power of computer chips every two years) has, however, pushed back these limits and encouraged the addition of non-essential functionalities, contributing to increasingly cumbersome and unoptimised software.

Moore's Law has gradually slowed due to increasing awareness of the environmental impact of digital technology. A significant portion of this impact (over 80%) arises mainly from the manufacture of computer hardware (including the extraction of minerals, production of chips, casings, screens, etc.) rather than from usage, particularly in France, where electricity is predominantly low-carbon.

There is a straightforward way to reduce the environmental footprint of digital technology significantly: by making equipment last as long as possible, thereby depreciating its environmental cost over an extended period. To achieve this, we must concentrate on software optimisation, which has been neglected for some time, not by rewriting the entire software, but by pinpointing areas where developers have been particularly ineffective. Indeed, certain parts of the software, often yet to be identified, consume vastly more resources than they should, sometimes by a factor of 10, 100, or 1000 (some software has been optimised by a factor of 400 million after rewriting).

Particularly effective in this regard is the PLASMA (Portfolio-Led Application Sustainability Management) approach, which involves surveying the IT department's applications, selecting those that consume the most resources, and employing various technical tools to specifically identify sub-optimal modules. Once identified, the next step is to optimise these modules to enhance performance. This process frees up previously underutilised IT resources, allowing for their reallocation to other uses and innovations while operating within the constraints of the existing hardware.

This software optimisation, known as EROOM, resembles Moore's Law in reverse, promoting hardware sobriety and leading to a significant reduction in an IT department's environmental footprint.

OCTO Technology, an Accenture subsidiary, is currently implementing this approach with a major retailer, using a previously developed measurability tool. The aim is to identify the applications that require the most resources and, within these applications, the modules that can benefit most from optimisation, in order to reduce the cloud expenses associated with running these applications.

The Research & Development department spearheads the effort to integrate sufficiency into ecodesign practices. For instance, some companies use Integrated Assessment Models (IAMs) to improve project assessments through life cycle analysis[61]. These tools amalgamate knowledge from various fields to assess interactions between human and natural systems within planetary boundaries. Consequently, they assist in prioritising the most sufficient uses of a given resource type.

This is in line with the "technological discernment" approach advocated by the French Academy of Technologies: 'Innovation selected by the market is not always positive for society, especially in a world of finite resources and in the face of climate change. There is therefore an urgent need to change the way decisions are taken on future technological developments to ensure that a form of sufficiency is factored in from the outset. Today, the "try, enter the market and remedy later" approach is no longer acceptable (especially if the remedy has to be found and financed by others)[62].

Once this initial trade-off is established, design-based approaches function as supplementary tools to promote the adoption of sufficiency solutions.

61 These practices are being studied by the EpE Research & Innovation working group and will be presented in greater detail in a future publication.
62 Académie des Technologies (2023). « Matières à penser sur la sobriété ».

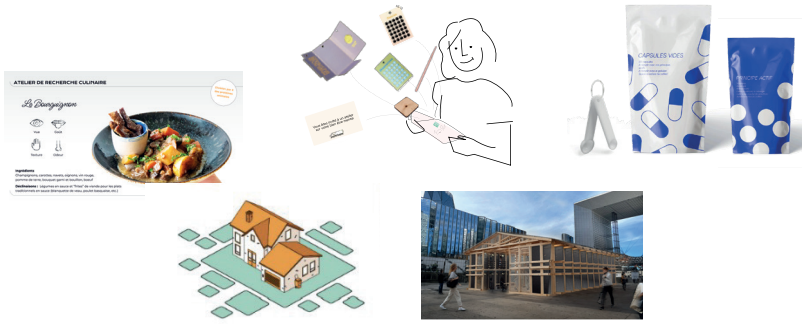
Innovation through sufficiency-focused design

While the benefits of sufficiency approaches are well documented, their implementation still raises numerous questions. For example, how can desirability, profitability, and sustainability be combined while minimising environmental impact? Moreover, how can we integrate technical solutions, enhanced collective frameworks, and behavioural changes?

Design, as an innovative approach, enables businesses to explore and create sufficient business models by envisioning real-life situations through objects, services, or concepts.

At the end of 2024, EpE and the Strate design school formed a partnership to encourage companies to innovate around sufficiency. Drawing on interviews with experts, professionals, and users, as well as workshops and usage scenarios, approximately thirty students envisioned and designed innovative devices.

- Food: a reimagined catering menu inspired by the visual elements of a meat-centric diet, promoting the idea to "eat less meat, but better".
- Mobility: individual work hubs near stations to give transport users greater flexibility and help them avoid peak hours.
- Housing: Modulco is a collaborative planning platform created for dense, desirable neighbourhoods.
- Health and Prevention: Point à pas offers an enjoyable educational tool for companies to track and modify their daily habits, such as boosting physical activity.
- Human-Nature Connection: The Euphytose Lab is a kit designed to enhance consumer awareness of the origins of their products by fostering a personal connection with nature.



Illustrations of sufficiency concepts developed by Strate students.

Benefits of the design approach

1 New imaginations and design

The issue of new imaginations is essential for the green transition, which undoubtedly necessitates spiritual, philosophical, and marketing transformations.
Beyond the question of imagination, the issue concerns standard values and norms, as reflected in the language and role models that influence behaviour. Emotional experiences frequently override reasoning and drive decisions. Therefore, to encourage new behaviour aligned with sustainability, we must invent and share new images where sufficiency becomes a desirable goal for the majority.
Today's economic actors are finding it difficult to convey a vision of a sufficient and appealing future.

2 Showcasing the practical applications of sufficiency models

The break with prevailing economic models, role models, and lifestyles thus relates to our relationship with consumption, property, objects, space, lifestyle, and perceptions of time, among other aspects.
By their very nature, ecological transition issues are systemic and interdependent, and do not lend themselves to standardised solutions, whether at a sectoral or corporate level. The design approach thus enables companies to explore and design their own sufficient business models, taking into account their local specificities, resources and cultures.

Communication teams also play a crucial role in fostering a new "culture of sufficiency"[63-64]. The publication "Milestone 2030 of the Green Transition" highlights two drivers drawn from new narratives[65]:

- developing green advertising and marketing that "conveys other stereotypes", promotes positive representations of sufficiency, and emphasises products and services with a low environmental impact;
- participating in creating and sharing positive role models for the transition, such as support for audiovisual production, increased airtime, diverse models, popular culture, positive narratives, and so on.

The first advertising initiatives to put a positive spin on sufficiency are starting to emerge. TotalEnergies, for example, has launched an advertising campaign to promote its consumption management application[66], while Renault is presenting medium-sized vehicles as an alternative to SUVs with the slogan "No need to be big to be bold"[67]. Nevertheless, advertising as a driver is generally still underdeveloped due to contradictory demands: on the one hand, advertising campaigns are required to produce a return on investment in the very short term, while on the other, they need to promote new imaginations over the long term. The luxury industry also serves as a cultural vehicle for promoting sufficiency. The 'quiet luxury' look, which aims to propose sleek and timeless designs using sustainable materials to evoke less desire for renewal, has been fashionable for a few years.

PUBLICIS GROUPE

Communication as a lever for encouraging low-impact behaviour

Publicis Group in France is committed to ensuring that communication can and must drive environmental and societal transition. We have been actively involved in a positive transformation process for many years and are recognised as the leading communications group in terms of the number of agencies holding the Active Agencies CSR label (AACC-Afnor).

Indeed, **communication represents a product of popular culture and contributes to the construction of collective imaginations**, the representations with which we identify, and the societal models in which we project ourselves.

When conceived in an enlightened manner, it can act as a **powerful lever** to raise awareness of the significant issues of our time, making **new narratives** appealing and positively transforming mindsets and behaviours. Our customer approach is grounded in this conviction, as the following ideas and campaigns illustrate:

- Renault's "*Ce n'est pas parce que elle est électrique que vous devez la prendre tout le temps*" (Just because it's electric doesn't mean you have to use it all the time) encourages users to reconsider the role of the car in their lives and reminds them that sufficient mobility is still preferable;
- Darty's "*les avis longue durée*" (long-term feedback) allows consumers to make sustainable choices when purchasing;
- Back Market's "*Mettons fin à la fast tech*" (Let's put an end to fast tech) highlights the climatic urgency associated with digital over-consumption; ultimately, the best technology is the one we already possess.

These stories, grounded in principles of sustainability and respect for planetary boundaries, foster collective imaginations that encourage more mindful behaviour.

63 EpE (2023). "Lifestyle representations and the ecological transition".
64 ADEME (2020). « Le guide de la communication responsable ».
65 EpE (2023). "2030 Milestone for the Ecological Transition".
66 https://www.youtube.com/watch?v=kEg3wlFGKMU.
67 "You don't have to be big to be cool". https://www.youtube.com/watch?v=6lqcVkxrNVs.

All these developments may be undertaken as part of a broader change management initiative aimed at adopting new skills, performance and remuneration indicators, and implementation tools, with the support of the human resources department. These developments will be particularly relevant for the marketing and sales departments responsible for designing and making sufficiency offerings attractive. Sufficiency requires rethinking all processes, including innovation, training, and product reorientation, as well as altering business models[68] to foster new imaginations.

Assisting marketing and sales teams and customers in achieving outcomes

Sufficiency lies at the heart of Holcim's decarbonisation strategy and has prompted the company to thoroughly rethink its business model. It no longer focuses solely on new construction, but now pursues sustainable refit solutions aimed at enhancing the value of existing buildings. This shift enables us to meet the growing demand for land and energy sufficiency while adopting a circular economy approach. Rather than encouraging urban sprawl, the Group favours vertical solutions that limit the land-take associated with new infrastructure.

The Group is accordingly involved in a major transition from a volume-based approach to a results-based one in which sufficiency is a key performance criterion. To support the transition, it is shifting its focus to direct involvement with its customers, sales teams, and marketing departments. The company seeks to promote resource optimisation by fostering innovative technical solutions that address the growing demand for energy and material efficiency.

Holcim assists its customers with the eco-design of their projects by providing innovative solutions tailored to today's performance and sustainability challenges. Sales and marketing teams receive training to promote strategies centred on resource optimisation and sufficiency, rather than merely on the volume of materials used.

These dynamics are reflected in the field. For instance, Holcim has initiated a structured plan to reduce water consumption at its La Malle plant, exemplifying its commitment to better manage natural resources. The plan includes the installation of metering systems, the detection and reduction of losses, particularly leaks, and the recycling of used water (process water, cooling water, rainwater). These efforts have already resulted in a nearly 35% reduction in water consumption.

Initiatives in energy efficiency, the circular economy, and sustainable resource management enrich our sufficiency approach.

Corporate legal departments will be responsible for adapting these new terms of sale in contracts, particularly to mitigate specific risks related to customer service, insurance conditions, or the use of personal data[69].

Lastly, transport and logistics must contribute, particularly in terms of equipment sharing models, reverse logistics, interlinking with circular economy loops where necessary (reuse, repair, recycling, etc.), inventory management, and more.

68 EpE (2023). "2030 Milestone for the Ecological Transition".
69 Conseil National de la Consommation (2024). WG report « Développement et sécurisation de l'économie de la fonctionnalité ».

Function	Drivers of sufficiency action
Procurement	• Questioning suppliers' internal sufficiency practices • Identifying resource risks in the supply chain • Identifying and developing sufficiency innovations • Negotiating contracts based on new usage or outcome metrics
Information systems	• Collecting and managing data related to process, product and service performance • Promoting digital usage sufficiency
Finance	Ensuring consistency in investment patterns related to sufficiency actions or offerings, driven by new funding and insurance arrangements for economic models, alongside a potentially more substantial *Capex* for functional economy models
Research & Development	Prioritising the development of technologies facilitating usage sufficiency for given resources
Communication	Proposing positive and appealing representations of sufficient lifestyles
Human resources	Incorporating sufficiency into organisation and business lines (training, indicators, pay incentives)
Marketing & commercial	• Shifting offerings towards material footprint reduction models based on outcomes • Developing partnership relationships with customers
Legal	Derisking new forms of contracting in usage- or outcome-based economic models
Transport & logistics	Organising and managing an available pool of equipment

3 Participating in scarcity and sufficiency governance

The "Milestone 2030 of the Green Transition" study identifies the implementation of collective sufficiency governance as essential for translating planetary boundaries into relevant limits for stakeholders (see Attachment 2). Companies participate in such studies within various existing frameworks at different geographical levels.

1.1 Regional and local level

The regional and local levels are particularly pertinent for collaboratively developing sufficiency frameworks and solutions that promote the well-being of citizens and users, including vulnerable communities or those disadvantaged by their geographical situation. Dialogue at the regional or local level helps to optimise infrastructure and ensures that potential co-benefits or negative externalities are considered. This approach is particularly evident in mobility (Groupe ADP, SNCF) and energy (EDF).

Introducing light trains for regional travel

SNCF Group is collaborating with its industrial partners, supported by France Relance, to enhance its current regional train offerings with new solutions designed to meet mobility needs in suburban and rural areas. The challenge is twofold: to create efficient, cost-effective solutions that will revitalise the lines serving these regions and to extend train services and collective mobility in general into sparsely populated areas.
Two "light train" projects are currently under development. They focus on reducing overall costs, adopting a systemic view of operations, and improving passenger services.

- **TELLi** is based on a systems approach that integrates operations, rolling stock, and infrastructure. The service targets mixed rail links with the main network and has experienced a significant increase in the number of trains (frequency and range). The train accommodates 74 passengers and can achieve speeds of 120 km/h. Its eco-design and battery-powered engine, which has a range of 200 km, minimise rail wear and reduce the carbon footprint, while its unique modular platform allows it to adapt to a wide array of passenger and micro-freight requirements. Telli's signalling system reduces equipment needs, carbon footprint, and investment costs.

- **DRAISY** offers a modular interior capable of accommodating up to 80 passengers, including 30 seated. The electric batteries have a range of one hour and can be recharged at the station. The train, which can travel at speeds of up to 100 km/h on semi-dedicated lines, was showcased at the 20th French Regions' Congress in Strasbourg at the end of 2024, with trials scheduled to commence in early 2027 on the Sarralbe-Kalhausen line. Draisy is regarded as one of the flagship projects of the Grand Est Region's Rural Pact (Pacte des Ruralités).

For the Regions, this translates into reduced investment, operational, and maintenance costs, as well as fewer CO_2 emissions and enhanced service quality, comfort, and regularity.

Telli and Draisy light rail projects.

Paris-Orly pioneers a new industrial project to promote low-carbon mobility and more fluid airport access

As one of the most urbanised airports in Europe, Paris-Orly is acutely aware of the pressing need to make further advances in the green transition. Since 2021, the hub has accelerated its efforts to achieve the ambitious goal of net-zero emissions on land by 2030.
In 2024, the Group unveiled its vision for the development of Paris-Orly Airport through a voluntary public consultation process. Paris-Orly 2035 is a development initiative that embodies a new airport model driven by the Group's environmental ambitions. Firmly focused on decarbonisation, hospitality, and green innovation, this project embodies a pioneering airport dedicated to serving passengers, employees, and local communities.
The Orly development project is based on stable air traffic forecasts of aircraft movements for 2035 and beyond, compared to 2018, and a projected increase in airport traffic (fewer short-haul flights and more medium to long-haul flights, resulting in more passengers per flight).
The project highlights the importance of airport accessibility for employees, passengers, and residents. Indeed, Paris-Orly 2035 has been developed against a backdrop of individual vehicle use as the primary means of accessing the airport (90% of employees and over 90% of passengers in 2024, prior to the commissioning of metro Line 14), resulting in regular traffic jams. Delays for flight crews due to this congestion can, in the worst cases, cause flight delays. Furthermore, the widespread reliance on cars has led to a noticeable decline in air quality.

The project has three mobility goals:

- Introducing an exclusive right-of-way public transport system within the hub to facilitate access to various business zones and improve last-mile fluidity.
- Creating parking lots and drop-off points at the northern and southern entrances to the hub, connected to the terminal by right-of-way public transport, to relieve congestion on the road network and distribute vehicle flows more evenly.
- Enhancing the public transport network and alternative modes, such as walking and cycling, to promote the adoption of low-carbon transportation.

In addition to the commissioning of Metro Line 14 in 2024 and Line 18 by 2027, along with the Sénia-Orly high-level bus service by 2030, a nationwide bus station will be built near the Paris-Orly terminal, establishing it as one of the principal multimodal hubs in the Île-de-France region. The new station will cater to a diverse range of users, including employees, air travellers, and daily commuters. The direct link to the Massy TGV train station via Line 18, coupled with the anticipated construction of the new Pont de Rungis TGV railway station, will also improve long-distance rail-air connectivity.

A voluntary public consultation on this development project received 10,335 responses, including 5,288 regarding the decarbonisation of mobility and enhancing access to the airport. Consequently, the project was enriched by the inclusion of the following proposals:

- create parking solutions that are well-connected to public transport;
- ensure a seamless journey to the terminal;
- offer flight details and baggage check-in services in upcoming car parks;
- develop an attractive pricing strategy to deter illegal parking in the communities surrounding the hub;
- prioritise access to the terminal as close as possible for sensitive groups (families, individuals with reduced mobility or disabilities, etc.);
- ensure that local access is available for transport providers (taxis, minicabs);
- participate in the studies conducted by IDFM to ascertain whether to retain Orlyval;
- examine the extension of right-of-way public transport to the east of the hub.

Corse: Feedback from the regional Climate Enterprise Convention (CEC)

In Corsica, EDF oversees the entire electricity value chain, from generation to consumption, in the absence of a local counterpart such as RTE or Enedis.

Energy sufficiency is vital for an island system as it alleviates the burden on an isolated, often strained power grid, reduces environmental impact, and saves money for consumers.On the ambition scale defined by the CEC, most companies currently find themselves between the "responsible" and "contributive" stages. The CEC encourages the exploration of alternative non-volumetric models, prompting, for instance, a shipping company to plan a fleet reduction by 2030.

The regional CEC emphasises the need to assess ecosystem resilience and the challenges faced by others to discover common solutions. By collaborating with local stakeholders, we aim to make moderation an appealing and enjoyable experience, rather than one fraught with urgency and constraint. Early calls for moderation over a few days can prove effective for businesses and individuals, particularly if educational efforts are implemented upstream.

The challenge of establishing a sufficient business model inherently relies on dialogue with the French Energy Regulatory Commission regarding innovative pricing approaches. The model's collaborative and systemic nature is evident in discussions initiated with local public stakeholders (development agency, French employment agency) to establish a CEC dedicated to Corsica. In addition, EDF engages with secondary school students through the "Entrepreneurship for Learning" (*Entreprendre pour Apprendre*) association to encourage them to address environmental issues raised by the Climate Fresk.

Alongside EDF Corse, 14 other EDF executives are participating or have participated in a CEC (regional or thematic), thereby creating a network for sharing experiences. Employees are also involved in improving the roadmap derived from the CEC and supporting its implementation.

1.2 National and international level

Planning at the national level is usually grounded in a long-term perspective. France offers numerous examples of public resource sufficiency strategies aimed at steering business actions. Consequently, the government's energy and water sufficiency plans outlined in chapter one encompass medium or long-term targets: a 40% reduction in energy consumption by 2050 and a 10% decrease in industrial water withdrawals by 2030.

It is reasonable to expect that consultations among transition players will intensify, inasmuch as the green transition remains highly energy- and resource-intensive.

- RTE's "2050 Energy Future" scenarios[70] for electricity forecast a sharp increase in consumption, particularly due to the electrification of industrial processes and transport. The "sufficiency" scenario would save 90 TWh of electricity by 2050 compared to the baseline trajectory, which is projected to rise from 449 TWh in 2020 to 645 TWh in 2050.
- Land use continues to pose a significant challenge for the transition and is increasingly exposed to competition among various uses, including biodiversity preservation, agriculture, reindustrialisation, and housing, to name but a few. France's net-zero land take (ZAN) law exemplifies the policy instruments employed to limit land consumption and establish an arbitration framework for diverse users.
- Both the "Milestone 2030 to the green transition" study and the "National Low Carbon Strategy (SNBC) under resource constraints"[71] emphasise the critical role of sufficiency in reducing resource needs.

Biomass, as previously mentioned, is critical to the energy transition. France and Europe are focusing on it due to the potential conflict between food and non-food uses. Bioenergy producers TotalEnergies and Engie are addressing this sectoral issue by collaborating with farmers, users, and public authorities. ADEME further believes that "annualised pathways of biomass use for energy decarbonisation will have to be designed in line with the objectives of the multi-annual energy programming (PPE) policy and the national low carbon strategy (SNBC) currently under consultation"[72].

70 https://rte-futursenergetiques2050.com/.
71 INEC-Capgemini (2024). « *SNBC sous contraintes de ressources* ».
72 EpE-IFD (2025). « *Actes du colloque Dialogue Entreprise-Finance 2024* ».

Initiatives aimed at assessing the resource needs of the green transition are gaining traction within international institutions, along with strategies to address the economic challenges faced by developing nations. Steel, whose decarbonisation is both complex and costly, is a case in point.

Carbon allowance policies are creating a level playing field among international competitors:

- at the European level, the EU ETS 1 and 2 emissions trading schemes aim to reduce greenhouse gas emissions by assigning a cost to the negative externalities associated with emitting activities;
- at the international level, the CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation) sectoral initiative is a global mechanism adopted by the International Civil Aviation Organisation in 2018 to offset the CO2 emissions of international aviation.

However, allowance systems alone may be insufficient for achieving collective and equitable reductions in consumption if they are not integrated into broader frameworks. In fact, rather than imposing a cap on individual consumption, they establish an economic barrier to overconsumption that the wealthiest end-consumers can circumvent.

Aviation, which is costly to decarbonise, highlights the need for a global collective framework to develop an effective and widely accepted sufficiency policy that influences both supply and demand. In terms of supply, aviation is a highly competitive and borderless sector. For instance, to travel from Stockholm to Los Angeles (not by direct flight), a passenger can fly via Paris, Frankfurt, London, New York, Istanbul, and so on, sidestepping regional regulatory constraints. Consequently, unilateral traffic reduction regulations in France or Europe would risk shifting – rather than reducing - CO_2 emissions to external hubs. Similarly, a unilateral reduction in landing and take-off slots for one airline would merely free up those slots for other airlines, resulting in a shift of CO_2 emissions instead of a reduction.

In terms of demand, emissions reduction is likely to increase ticket prices (mainly due to the requirement for European airlines to use sustainable aviation fuels), which will, in turn, dampen demand for airline tickets

Accordingly, travel (for tourism, family, or professional reasons) as a factor of cultural and social openness will become less accessible, prompting the question of how to achieve a fairer distribution of the social benefits of aviation.

Initiatives in the health sector can create opportunities for the joint development of collective and inclusive sufficiency. The actions to which Sanofi contributes highlight the significance of fostering dialogue at local, national, and international levels.

The rapid rise in the use of digital technology, particularly generative AI, among the general public, driven by widely affordable or even free deals, will also be a key factor in the joint development of collective national and international sufficiency frameworks.

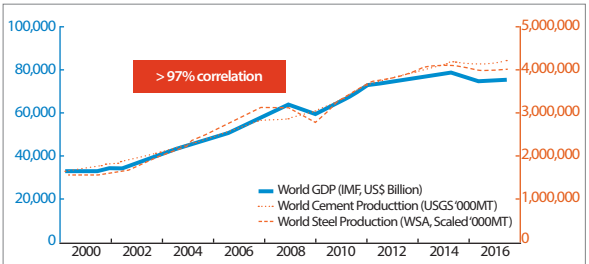
VESUVIUS

The challenge of global "steel sufficiency" in the context of growth and the energy transition

Steel is a heavy industry responsible for around 25% of global CO_2 emissions. By supplying consumable refractories for the continuous steel casting process, Vesuvius minimises production stoppages, thereby enhancing the economic and environmental performance of its customers. The company's offering is further supported by a service model that includes the provision of refractory handling robots.

However, the potential to reduce emissions through technological and industrial innovation in the short and medium term is limited. The possibility of substituting steel with alternative materials remains marginal. Furthermore, the decarbonisation of steel production, which has so far primarily relied on coal, may take several decades. Its pace will depend on the availability of decarbonised energy (a medium-sized European steel mill would require approximately 2 GW to decarbonise, i.e. the equivalent of one or two EPR-type nuclear reactors), investment capacity, the maturity of technologies, and the acceptance of additional costs by customers, meaning companies. Lastly, the proportion of recycled steel produced by electric arc furnaces varies by region. The figures for Europe and the USA differ from those in China, where the stock of used vehicles or deconstructed buildings is minimal.

Can sufficiency now be leveraged to complement these technical developments and advance towards carbon neutrality? Trends suggest that "steel sufficiency" may be challenging to implement. There is a strong correlation between GDP growth and increased steel consumption. No decoupling is anticipated in industry players' forecasts as long as economic growth remains the prime focus for most regions around the world. Europe is the only region that seeks to integrate sufficiency into its policy. Historically, economies first consumed long steel, which was relatively undemanding in terms of quality but produced in large volumes for infrastructure. As economies matured, they shifted to flat steels, designed for higher-performance consumer products such as automobiles. The energy transition, particularly the switch to wind and solar power, is also a major consumer of steel. In the current economic climate, several hurdles must be overcome to achieve sufficiency in steel use.



Correlation between GDP growth and growth in heavy industries (steel, cement)

Source: http://www.anfre.com/global-refractories-facing-the-next-production-revolution/

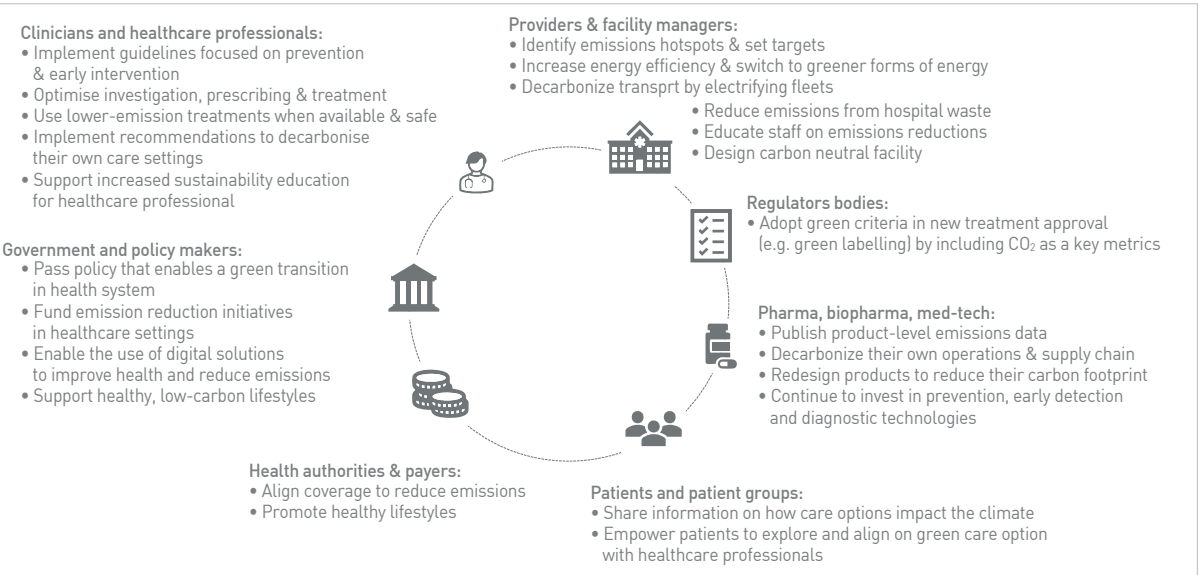
Collaborating with public and private stakeholders to enhance the sufficiency of healthcare pathways[73]

Healthcare systems are responsible for approximately 5% of global GHG emissions, which is equivalent to the emissions of the fifth-highest emitting country in the world. Fifty percent are generated by product manufacturing and supply chains, 45% by patient care pathways, and 5% by research and development, including clinical studies. Opportunities for decarbonisation exist at every stage of the care pathway. However, the equation is complex: each stakeholder has a specific role to play and must be involved in designing and adopting what are often highly innovative solutions while accelerating the implementation of "carbon-neutral" healthcare systems that are equitable and prioritise patient well-being.

Reducing risk factors and preventing the onset of disease are the most effective means of alleviating the burden of morbidity that weighs on our societies, particularly due to non-communicable diseases. These actions also help to reduce the carbon footprint of healthcare. A study conducted by Sanofi in the UK highlighted the co-benefit of health prevention and environmental protection by selecting an early immunisation scenario for bronchiolitis in all newborns, as opposed to other immunisation programmes. By streamlining the care pathway and decreasing hospitalisations and primary care visits, the "all newborn" immunisation approach could achieve a 68% reduction in emissions compared to the current situation.

Providing both remote and local care, where appropriate, is an alternative that warrants further exploration. Indeed, utilising solutions such as telemedicine and portable diagnostic and monitoring devices can reduce patient travel and enhance access to specialist care, thereby decreasing emissions without compromising the quality of care. A study carried out in Egypt on a cohort of patients suffering from asthma and atopic dermatitis indicates a reduction of nearly 74% in emissions during their monitoring period due to telemedicine (after factoring in the impact of digital technology on the environment), along with an increase in comfort for patients who no longer need to travel, thus avoiding exposure to air pollution or stigma related to their skin's appearance. Local care provided by chemists, community nurses, and local bodies during the study also contributed to lowering emissions.

The mobilisation of healthcare manufacturers, including Sanofi, is unprecedented. In addition to their commitment to reducing their own emissions, they are actively engaging with stakeholders in the healthcare system to raise awareness and promote the exchange of best practices, data, and even technical expertise through recommendations and evaluation guides. In particular, the collection of real data serves as a key driver for informing strategic decision-making processes among healthcare stakeholders and public policymakers, as well as enhancing collaborative efforts in prevention and the development of healthcare solutions.



Source: Healthcare Without Harm, WHO, academic literature, BCG analysis.

73 This text is a summary of an article published in FACTS No. 27, "Health and the Environment: Understanding, Anticipating, and Acting in the Face of Climate Change" published by the Veolia Institute.

Future of mobile networks: what role for citizens? Prospects for the ecological redirection of mobile networks[1]

Maxime Echêne, CSR Manager, Orange Business France[2] and Alexis Nicolas, Digital Adaptation and Redirection Consultant, Octo Technology

What are the uses and expectations of mobile networks five years after the rollout of 5G? Not surprisingly, the survey reveals that 5G is primarily an infrastructure project lacking significant innovations in usage. A survey of 14 telecoms experts reveals trends toward ever-greater scalability (i.e. expansion) and self-referentiality (i.e. referring to oneself) within networks, which underscores the industry's difficulty in addressing citizens' needs. These trends are encouraging a headlong rush to:

- traffic growth to render licence purchases profitable, with operators advocating increasingly data-hungry applications that escalate traffic;
- even more power through the internationalisation of the specification process, which locks the industry into intense competition;
- controversies (Roussilhe, 2020) that remain unaddressed in public debate, while the promotion of 6G adheres to the same promises and supply rationale.

Citizen involvement is often restricted to acceptable consultation, following the example of European projects on 6G, such as Hexa-X-II and 6Gforsociety, where citizens are frequently perceived as lacking knowledge of these technologies. In a departure from this headlong rush, both citizens and experts desire mobile networks to become a stable commodity rather than an ever-evolving technology. Indeed, of the 14 experts on the study panel, five advocate for the expansion of mobile networks, four wish for their stabilisation, and five even prefer a reduction in their scope. This is in line with the findings from the online citizen questionnaire: of the 135 replies received, only four seek an increase in throughput, while 95 anticipate some form of stabilisation or slight improvement in coverage. In other words, citizens prioritise reliability over speed. The 14 experts in the study were nearly unanimous (13 in favour, one opposed) in their support for the need for greater citizen consultation. However, they were unable to envision its full implementation, echoing the views of 113 of the 135 citizens consulted.

The study concludes that a political turnaround is essential for the future of mobile networks to avert an increase in controversy and social protest. It proposes redesigning specification processes to incorporate the voices of citizens as early as possible. Finally, the study examines three perspectives for the ecological redirection (Bonnet et al., 2021) of mobile networks:

1. Draw inspiration from other infrastructures, such as the electricity grid, to envision the future of mobile networks.

2. End the fixation with network privatisation and expansion, and shift towards embracing the common good (who would accept building four roads of similar specification to link the same two cities?).

3. Consider and promote citizen participation in network management (see the Scani cooperative in the Burgundy region).

A parallel with generative AI suggests that everything is in place for the same technological arguments to play out (Butot & van Zoonen, 2024). To create a viable path for digital redirection, it will be essential to genuinely reflect on and mainstream democratic practices in digitisation.

Before facing the consequences of escalating social protests, digital companies that design, develop and maintain digital services should:

- enhance their human science skills to involve citizens more comprehensively in their development cycles, beyond marketing studies and social acceptability issues, based on a design approach that addresses genuine needs;
- cooperate with competitors, particularly regarding sharing infrastructure;
- organise hybrid forums (Callon et al., 2001) involving experts, citizens, elected representatives, and economic decision-makers before introducing a new technological development or digital service that affects large numbers of citizens;
- reconsider digitisation by pausing the current frantic rush to challenge the myth of technological neutrality and politicise (de) digitisation.

Ultimately, this study encourages companies to adopt more democratic practices, enabling citizens to play a greater role in fulfilling their environmental commitments and mitigating social risks.

Bonnet, E., Landivar, D., & Monnin, A. (2021). *Héritage et fermeture : Une écologie du démantèlement.*

Butot, V., & van Zoonen, L. (2024). *Contesting Infrastructural Futures : 5G Opposition as a Technological Drama. Science, Technology, & Human Values*, 49(5), 1017 1044. https://doi.org/10.1177/01622439221147347

Callon et al. (2001). *Agir dans un monde incertain. Essai sur la démocratie technique.* Le seuil.

Roussilhe, G. (2020, juillet 1). *La controverse de la 5G | Gauthier Roussilhe.* https://gauthierroussilhe.com/ressources/la-controverse-de-la-5g

1 Full study is available at : https://hal.science/hal-05038406.

2 Article authored in his own name and not on behalf of Orange Business France

CONCLUSION

EpE member companies are beginning to regard sufficiency issues as a vital element of the green transition and to integrate sufficiency into their strategies and operations. Initial feedback suggests that this approach is considerably more efficient and profitable for businesses and consumers when it relies on sustainably designed products and, therefore, on technical (efficiency, ecodesign, renewable energies, etc.) and organisational (functional economy, cooperative economy, collective living environments, etc.) innovations.

Implementing sufficiency, however, remains a challenge. On one hand, its issues are multifaceted (climate, water, land, and other resources) and sometimes contradictory, necessitating trade-offs without the appropriate tools. As the IPBES Nexus report has shown, no universal benchmark guides these trade-offs. Decision-makers must consider all issues simultaneously and tailor solutions to the local context. They must navigate complex trade-offs by operating at decentralised levels. Complementarities, nevertheless, can assist companies in generating a triple benefit in terms of resilience, competitiveness, and reduction of their environmental footprint, provided they are not trapped in a mindset of economic optimisation alone.

On the other hand, structural sufficiency in society cannot depend solely on the voluntary actions of businesses. The "Milestone 2030 of the green transition" study elucidates the need for collective action that mobilises everyone's efforts towards long-term sufficiency: "Currently initiated by voluntary actions, such efforts will need to be reinforced by measures to transform the individual and collective practices of businesses, citizens and public authorities. Measures may be incentives or subject to the rules of collective life. Those rules must be debated, understood and widely explained by diverse and consistent voices to be well accepted".

The feedback presented in this publication indicates that sufficiency raises many questions. Therefore, there is no point in rushing to address them. Otherwise, sufficiency could risk failing the desirability test or sliding into undesirable austerity. The need, though urgent, involves a complete cultural reversal. After all, the mass consumption model has over a century of success behind it. There are expectations that businesses could play a key role in fostering further social interactions by advocating sufficiency, modernity, and fairness as a sensible and attractive proposition.

Appendix 1 – Overview of identified sufficiency studies

Organisation and publication	Focus for sufficiency	Description
CCI Île-de-France (2025) Sufficient business models Business contribution to volume decrease	Economic models	Overview of sufficient economic models (demand limitation, supply limitation, pricing schemes) and sufficient marketing practices
Veolia Institute (2024) The social and economic challenges of sufficiency	Analysis of macro/societal issues	Interdisciplinary summary of the acceptability and mass adoption of sufficiency issues in different sectors
ORÉE (2024) The strategic integration of sufficiency by enterprises	Company specificities	Operational recommendations for embedding a sufficiency approach into corporate strategy and operations, in conjunction with the company's value chain and its local context
La Fabrique de l'Industrie (2024) What if sufficiency were no longer an individual choice?	Sufficiency in public policy	Proposed measures to implement desirable collective sufficiency
Comité21 (2024) For a sufficient Europe	Different types of sufficiency by resource category	Deciphering resource sharing challenges at European level, along with ongoing or suggested policies
CCI Île-de-France (2023) Sufficiency at the heart of tomorrow's business models	Corporate value chain	Overview of sustainable business models
EESC (2023) What policies to promote the evolution of society towards sobriety?	Structural sufficiency in society	Thinking on conditions of sufficiency and its inclusion in public policies
Académie des Technologies (2023) Food for thought on sufficiency	Analysis of macro/societal issues	Thinking on sufficiency's role in technological innovation
Comité21 (2022) Sufficiency, the green thread of transformation	Analysis of macro/societal issues	Monograph describing the concept of sufficiency and proposals to integrate it systemically in societies
BCG (2022) The sufficient company	Business case for corporate sufficiency	• Positioning sufficiency within an optimisation/transformation versus value chain/value proposition matrix • Identifying internal and external drivers to be mobilised
Prophil (2021) Enterprise & post-growth	Value governance, economic models, and measurement	Thinking on corporate purpose in a context of resource constraints ressources

Appendix 2 – Sufficiency governance in the "Milestone 2030 of the green transition" study

Sufficiency governance: collective frameworks and consultations

TRANSITION(S) 2050
CHOISIR MAINTENANT
AGIR POUR LE CLIMAT

S2 'regional cooperation', one of ADEME's four transition scenarios (2050), puts the issues of shared governance and regional cooperation at the centre of the transformation. Non-governmental organisations, public institutions, private sector and civil society are finding pragmatic ways to cooperate on driving the transformation and maintaining social cohesion

Challenges

Given the planetary boundaries and competition over limited resources, sufficiency appears essential. But how to achieve it? What to limit first: supply or demand?
Sufficiency policies are already in place for some resources: CO_2 allowance market, no net land-take pathway, protection of 30% of land and marine areas, etc. This governance method should unquestionably be extended to other resources, including imported ones. The structural sufficiency produced by investment could trigger rebound effects that would wipe out improvements. Mechanisms for regulating prices and uses are therefore not only important but could also be useful in financing transition investments.

Lines of action

Studies point[1] to a pathway towards planned and socially accepted sufficiency.

STEP 1: DEVISE A FRAMEWORK FOR SUSTAINABLE AND RESTRAINED USE OF NATURAL RESOURCES AT EUROPEAN OR NATIONAL LEVEL (PUBLIC AUTHORITIES)

- **Establish** resource utilisation ceilings consistent with scientific observations[2], together with monitoring indicators and flow control procedures.
- **Arrange** distribution mechanisms, sufficiency-friendly infrastructure investment and support systems (equipment grants, redistributive taxation, etc.).

STEP 2: ORGANISE REGIONAL AND (INTER)SECTORAL IMPLEMENTATION

- **Build on** existing governance practices and collective decision-making methods.
- **Raise awareness,** inform and involve consumers in collective decision-making so that they identify and adopt much-needed lifestyle changes.

Priorities to 2030

- Determine local, national and European ceilings for critical resources and sufficiency pathways for their use.
- Strike a fine balance between legal constraints and negotiated agreements to avoid exacerbating social tensions and unwanted rebound effects.
- Discuss acceptable compromises between stakeholders, potential contributions and each player's essential needs and how to meet them.
- Develop corporate ecological transformation plans which are consistent with this sufficiency goal.

2005

European carbon allowances system for big industry.

2021

No net land-take (ZAN) law establishing 'land-take' budgets for local authorities.

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Claire Tutenuit
Managing Director, Entreprises pour l'Environnement

Disclaimer

About EpE

The French association of Entreprises pour l'Environnement (EpE), established in 1992, comprises approximately sixty major French and international companies that exchange best practices and collaborate to integrate more effectively environmental considerations into their strategies and operations. Its *raison d'être* - **one planet and a prosperous world** - encapsulates the commitment of its members to spearhead their own green transitions as well as that of society, while ensuring that economic development compatible with planetary boundaries is socially accepted and, indeed, desired. EpE serves as the French partner of the World Business Council for Sustainable Development (WBCSD).

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