THE SHIFT PROJECT

HEALTH, CLIMATE, RESILIENCE:

DECARBONISING THE PHARMACEUTICAL INDUSTRIES

Summary - June 2025

AS PART OF OUR
ACTION PROGRAM FOR 2027

Sécurité sociale
L'Assurance Maladie
Caisse Nationale

Haut Conseil pour l'avenir de l'assurance maladie

With the contribution of
CHAIRE RESPECT
REsilience en Santé · Prévention Environnement · Climat · Transition

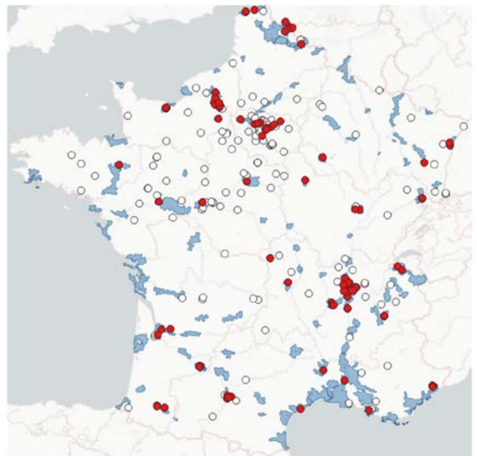
Decarbonising the production of medicines

After carrying out major work on the decarbonization of the French healthcare system in 2021, and then on the decarbonization of the long-term care sector in 2024, The Shift Project presents here the summary of its collaborative research on the decarbonization of the pharmaceutical industry. This work, conducted in partnership with the **Caisse Nationale d'Assurance Maladie** (CNAM), the **Haut Conseil pour l'Avenir de l'Assurance Maladie** (HCAAM), the **RESPECT Chair** (EHESP), and with the support of **MGEN**, also covered medical devices, for which a separate synthesis has been produced.

Context

Climate change and growing tensions over fossil fuel supply are threatening the pharmaceutical industry.
Its highly globalized value chain is becoming increasingly vulnerable to climate-related physical risks. At the same time, pressure on this industry will intensify, as ecosystem degradation and **the multiplication of climate crises will have increasingly severe health consequences.** On the one hand, there will be a need to meet **rising healthcare demand** in an increasingly unstable environment.
On the other hand, greenhouse gas (GHG) emissions must be r**educed and reliance on oil and gas phased out: this is the purpose of this report.**

Pharmaceutical production and climate risks



French pharmaceutical production sites (red dots) exposed to flooding.
Sources: The Shift Project 2025, based on Géorisque.gouv data.

Goal of the study

To understand where greenhouse gas (GHG) emissions from the pharmaceutical industry originate across its globalized value chain, and **to identify key pathways for decarbonization and resilience to energy shocks.** This is the first report to assess emissions and mitigation levers on the basis of physical and energy flows (amount of kwh of electricity, km for the freight, kg of api produced, etc).

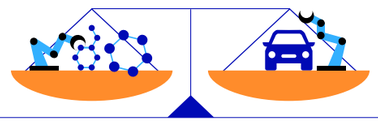
Scope: This report covers all stages of the pharmaceutical value chain for medicines produced worldwide and in France to meet French consumption. It excludes medicines produced in France and then exported.

Current situation

The production of medicines consumed by the French population generates approximately

9.1 $MtCO_2e$ per year,

which is equivalent to the greenhouse gas emissions associated with **the production of the 2 million fossil cars purchased annually in France**



Levers for action

This new report proposes to stakeholders in the pharmaceutical industry, both in Europe and worldwide, a set of quantified decarbonization levers and actions.

Decarbonization potential

The report assesses the potential for decarbonizing pharmaceutical production through various scenarios, the determinants of which vary depending on the sector's progress in terms of reshoring. With proactive measures, the pharmaceutical industry can become resilient to energy crises and reduce its emissions by 68% by 2050.

Volumes of medecines consumed in France

Understanding the link between energy, climate, and the pharmaceutical industry requires an assessment of their greenhouse gas emissions, which first entails quantifying the volumes of medecines produced. Our study evaluates the quantities of active pharmaceutical ingredients, excipients, and packaging intended for the consumption of medicines in France (exports of medicines produced in France are not included), and then converts these flows into carbon emissions.

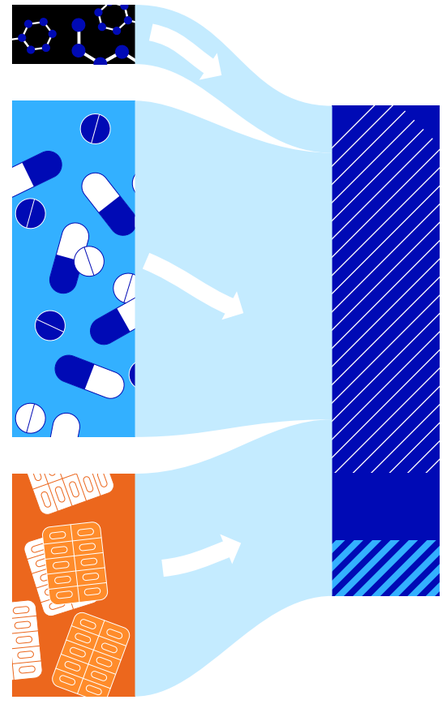
Definition

A medicine is composed of one or more **active pharmaceutical** ingredients formulated with **excipients**. It is then manufactured into a **specific pharmaceutical** form and **packaged.**

32,300 tonnes of active pharmaceutical ingredients,
equivalent to the mass of **three Eiffel Towers**[1]

187,000 tonnes of excipients,
soit l'équivalent de la masse de **18 Eiffel Towers**

121,500 tonnes of packaging,
equivalent to the mass of **12 Eiffel Towers**



3.3 billion packs of medicine[2]
produced annually to meet French demand

- **74%** dedicated to retail sales and reimbursed
- **14%** to hospitals
- **12%** to retail sales not reimbursed

1. With an average carbon intensity of 65 $kgCO_2e/kg$ of active pharmaceutical ingredients
2. Covers all pharmaceutical forms

These quantities are produced, processed, analyzed, transported, and stored throughout the value chain. **Such production and logistics activities account for**

60% of total emissions.

The remaining 40% is due to the research and development activities, corporate activities, the use of medical gases, and the end-of-life of packaging and unused medicines must also be considered.

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What is the carbon footprint of the pharmaceutical industry?

We estimate greenhouse gas emissions from **the production of medicines for human consumption** in France in 2023 at

9.1 $MtCO_2e$

The carbon footprint of the pharmaceutical industry is equivalent to the annual emissions of **1 million French citizens.**

Emissions are distributed as follows:

Excipients — **4%**

Packaging — **9%**

Active pharmaceutical ingredients — **25%**

These productions are globalized: **between 60% and 80% of active pharmaceutical ingredients are produced in India or China.** Moreover, they rely heavily on fossil raw materials: coal is used to produce industrial steam, and oil serves as a raw material for drug production. **For example, 1.3 kg of oil is required as an input to produce 1 kg of paracetamol.**

More than 65% of emissions come from **the consumption of electricity, gas, and industrial steam.**

Formulation and packaging — **11%**

1,5% — **Storage**

1,5% — **Retail and hospital sales**

7% — **Use of medical gases**

2% — **End-of-life**

Transport between each step of the value chain — **9%**

Emissions linked to logistics vary significantly depending on the mode of transport, vehicle load factors, and distances traveled.

40% of emissions come from air freight.

Emissions are linked to the release of medical gases (inhalers, halogenated gases used in anesthesia, and nitrous oxide) **after use.** For desflurane, 1 kg of this gas released into the atmosphere is equivalent to 2,500 kg of CO_2 emissions

Value chain activities indirectly involved in medicine production

Research & development — **13%**

Emissions are mainly linked to clinical trials, the purchase of goods and services, and business travel (conferences, fieldwork).

Corporate activities — **17%**

- Headquarters activities
- Field activities
- Other

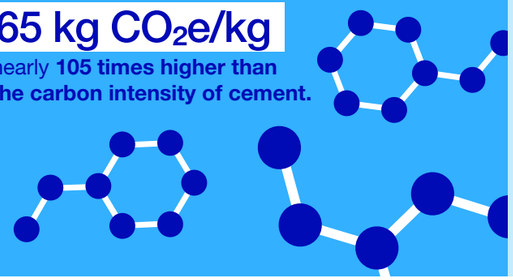
Key figures

On average, the pharmaceutical industry produces **48 packs** **of medicines per capita per year in France** corresponding to 140 $kgCO_2e$ per French citizen per year.

The pharmaceutical industry accounts for **1.4 %** **of France's carbon footprint.**

Approximately **55%** of emissions are directly linked **to the production of active pharmaceutical ingredients, research and development, and corporate activities.**

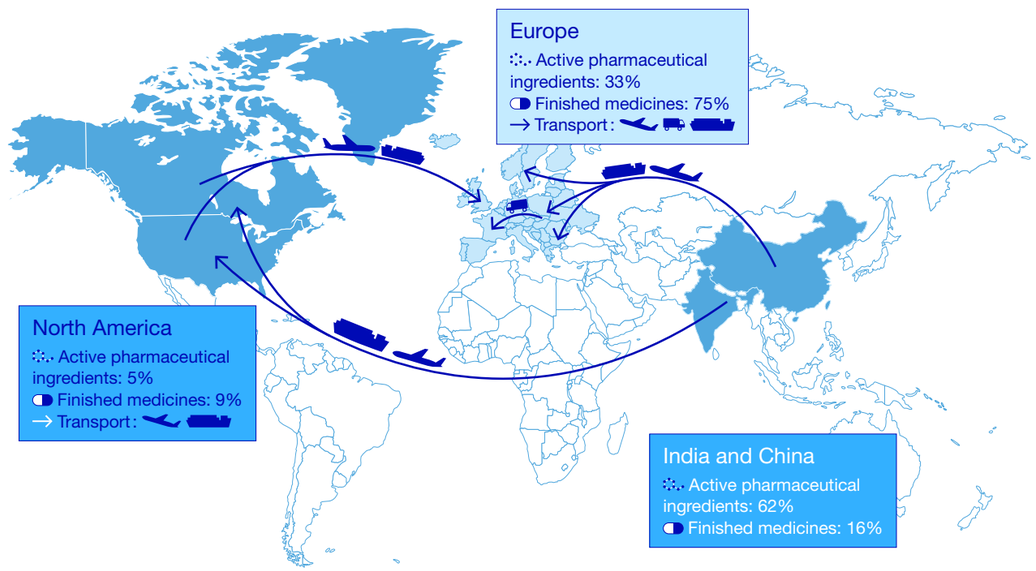
The carbon intensity of active pharmaceutical ingredient production is approximately **65 kg CO_2e/kg** nearly **105 times higher than the carbon intensity of cement.**



8% of emissions come from **packaging production.**

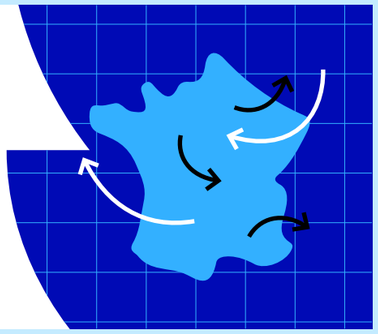
Package leaflet, which account for 10% of packaging mass, represent only 6% of the emissions from packaging.

Raw materials mainly produced in Southeast Asia



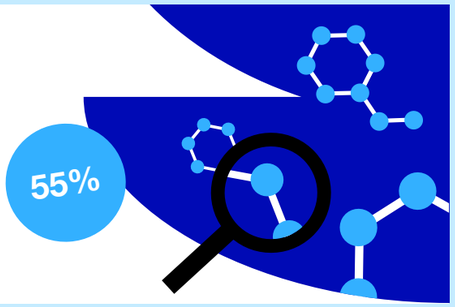
Key messages

Our work provides, **for the first time,** a carbon assessment of french medicine consumption based on physical flows. It takes into acount **production activities, corporate activities, and research and development.**



The pharmaceutical value chain is highly dependent on fossil fuels and has a significant impact on the climate. We estimate annual emissions from the pharmaceutical industry at 9.1 million tonnes of CO_2e.

The production of active pharmaceutical ingredients, corporate activities, and research and development represent the most emission-intensive stage of the value chain of medicines.



The decarbonization of this sector heavily involves manufacturers and their suppliers, **which makes greater data transparency essential:** country of production, supply chains, and reliance on fossil fuels.

Driving the decarbonization of the pharmaceutical industry to strengthen its resilience

If no action is taken, **annual emissions from the pharmaceutical industry could increase due to the growing consumption of medicines**, notably as a result of:

the ageing of the population

the increase in chronic diseases, linked in particular to pollution and climate change impacts

the evolution of available medicines (growth of biotherapies and advanced therapy medicinal products).

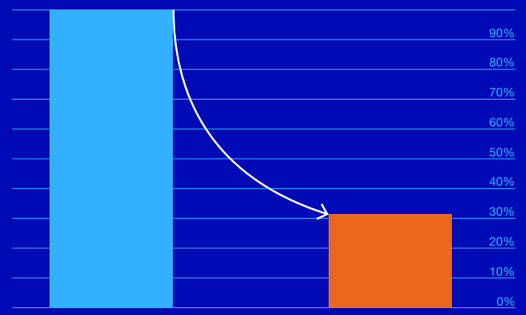
If the industry fails to end its dependance on fossil fuel and reduce its consumption of material ressources, emissions, are likely to rise sharply by 2050. **Ambitious action is needed, both in decarbonizing french and european industries and in establishing criteria for procurement and imports, in order to limit their impact on the environment. Such measures are also necessary to reduce their vulnerability to the consequences of climate change and to strengthen their resilience to energy crises.**

In this report, we are not able to quantify the changes in medicines consumption between now and 2050, as they may be highly unpredictable. Nevertheless, it calls for caution and for anticipating the need to reduce greenhouse gas emissions: **decarbonization must be integrated upstream, at the earliest stages of new manufacturing facilities or the development of new therapies, starting from the research, development, and design phases.**

If we implement the decarbonization identified in our report, industry emissions could be reduced by

68%

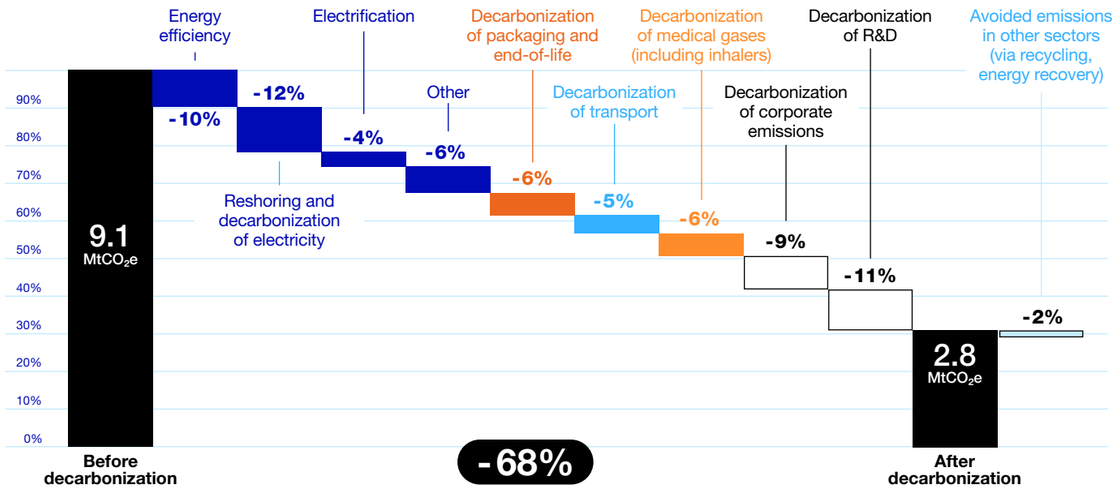
by 2050.



Decarbonization levers for each stage of the value chain

In our central decarbonization scenario, we estimate that the industry can reduce its annual emissions by 68% between 2023[1] and 2050[2].

Decarbonization potential of current medicine production between 2023 and 2050



Energy efficiency:
Better control of energy consumption, heat recovery, and optimization of cooling systems in clean rooms, industrial steam use, etc.

Reshoring and decarbonization of electricity with electrification:
With improved efficiency, electrification — when carried out in a country with a low-carbon electricity mix— reduces GHG emissions per unit of energy consumed, while also generating significant energy savings.

Other levers:
Solvent recycling reduces the volumes of raw materials consumed and therefore emissions. Recycled solvents have a carbon footprint between 2 and 10 times lower than virgin solvents.

Decarbonization of transport:
By reducing total distances traveled (optimizing vehicle load factors, selecting European suppliers), shifting from air freight to road and maritime freight, and progressively electrifying trucks.

Decarbonization of medical gases:
By ending the distribution of nitrous oxide through hospital networks and replacing propellants used in inhalers with alternative gases of lower carbon footprint, or by using dry-powder inhalers.

Decarbonization of corporate emissions:
Through the reuse and extended lifespan of digital equipment, the decarbonization of collective catering, the electrification of the corporate vehicle fleet, and the reduction of international travel for conferences.

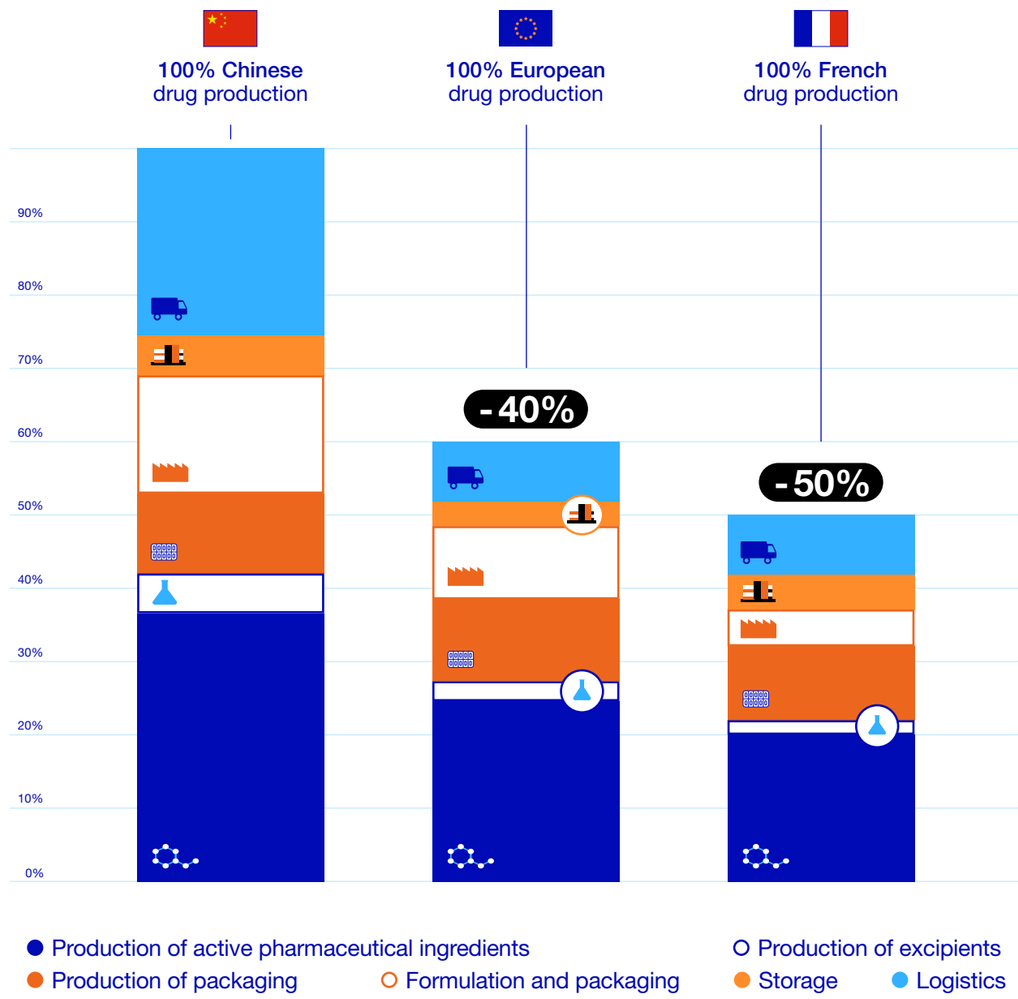
Decarbonization of R&D:
Decarbonizing clinical trials by reducing medicine waste, optimizing cohorts to limit visits and travel, using remote data collection, and improving data storage.

1. This is our baseline year
2. Corresponds to a change in emissions from the pharmaceutical value chain with partial reshoring and advanced decarbonization of electricity

Reshoring: the winning combination for climate, sovereignty, and resilience

Reshoring the production of medicines and their raw materials to Europe, in countries with a low-carbon electricity mix, makes it possible to significantly and rapidly reduce emissions associated with medicine production. With better control over supply chains, it also strengthens the overall resilience of the healthcare system. Our model estimates that, on average, medicines produced entirely in China would have 40% lower production emissions if manufactured in Europe, and 50% lower if manufactured in France.

Comparison of the carbon footprint of drug production in 2023 (from raw material extraction to delivery to hospitals or pharmacies) by country of production. Emissions have been normalized to Chinese emissions.



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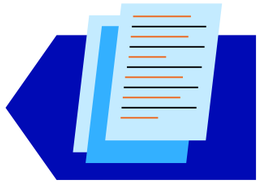
Cross-cutting levers to facilitate the decarbonization of the pharmaceutical industry

Given the regulatory, economic, and structural barriers of a complex and globalized sector, cross-cutting levers are required.

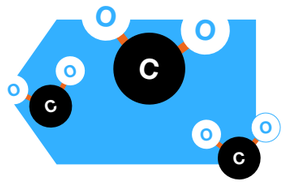
Definition

Cross-cutting lever: a lever that does not focus on one specific stage of the value chain but rather on its overall organization.

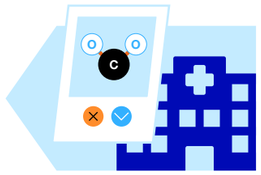
Establish a common and transparent methodology for assessing the carbon footprint of medicines:
to enable better monitoring and tracking of production emissions, as well as a clearer understanding of the decarbonization levers to be implemented.



Integrate a carbon criterion into the evaluation of medicines:
in the marketing authorization application, reimbursement listing (including re-evaluation), and price setting.



Include the carbon criterion in hospital tenders and in community pharmacy drug purchases:
carbon footprint criteria should account for at least 10% of the weighting in both public and private tenders.



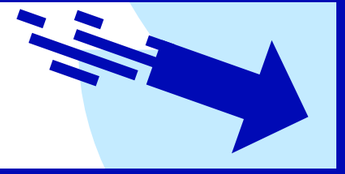
Facilitate variation requests in marketing authorization dossiers in favor of decarbonization:
relating to packaging changes without process modifications, or environmental process improvements that do not affect the healthcare product.

Involve all professionals in the pharmaceutical industry in decarbonization projects:
to be truly transformative, the transition must be driven by all key corporate functions and integrated into the company's overall strategy.

Conclusion

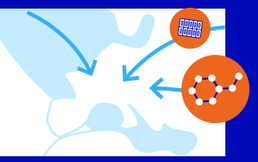
1 **The decarbonization of the pharmaceutical industry is achievable** and strengthens both the resilience of the healthcare system and France's energy sovereignty.

2 **Decarbonization must be rapid and proactive:** to limit its contribution to climate change, the sector must reduce its annual emissions by 2050 while also limiting cumulative emissions between 2023 and 2050. Gains in resilience and sovereignty will therefore be achieved more quickly.

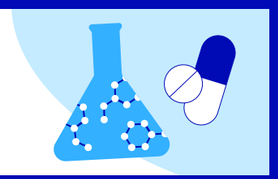


3 **In our central decarbonization scenario, we estimate that the industry can reduce its annual emissions by 68%** between 2023 and 2050.

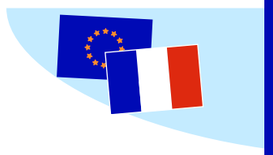
4 **Reshoring** part of the production of active pharmaceutical ingredients, excipients, and packaging to Europe plays a key role in decarbonising the industry while strengthening the autonomy of the healthcare system.



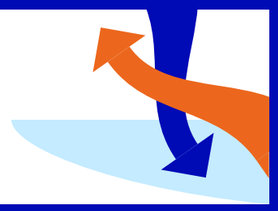
5 More than **half of the emissions reduction** comes from the decarbonization of drug production stages. The remainder comes from the decarbonization of logistics, medical gases, end-of-life, R&D, and corporate emissions.



6 The decarbonization of the pharmaceutical industry **requires supporting the decarbonization of production in France, in Europe, and also beyond.** While not everything can be directly decided by European governments, they can act on imports to encourage both European industries and the decarbonization of the rest of the world.



7 To facilitate and promote the decarbonization of the pharmaceutical value chain, **cross-cutting levers must be implemented: measuring the carbon footprint** of medicines, incorporating carbon criteria into medicine evaluation and procurement, engaging suppliers, ...



8 Decarbonization must cover **all stages of the pharmaceutical value chain, and all stakeholders** involved must act swiftly and decisively by mobilizing every lever: **none are optional, all are necessary.**

The Caisse Nationale de l'Assurance Maladie (CNAM), with its 200 employees, is the operational spearhead of the compulsory health insurance system in France.
It oversees, coordinates, advises, and supports the actions of the local bodies that make up its network (CPAM, DRSM, Ugecam, CGSS, etc.). CNAM conducts negotiations with healthcare professionals within the framework of the Union Nationale des Caisses d'Assurance Maladie (Uncam).
Through its risk management activities and the healthcare services it provides, CNAM contributes to the efficiency of the healthcare system and compliance with the national health insurance expenditure target (Ondam). It also takes part in implementing public policies on prevention and informs its beneficiaries each year to help them become active participants in their own health.
www.ameli.fr

Sécurité sociale
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Founded in 1946, MGEN is today the leading mutual insurance organization for public sector employees.
Its unique positioning enables it to manage health insurance, supplementary health coverage, and provident schemes for more than 4.6 million people. MGEN provides comprehensive support to its members, ranging from the prevention of risks to their physical and mental health to healthcare services delivered in medical facilities.
It makes available to all 1,800 mutualist healthcare and support structures that it co-manages and co-finances throughout France. MGEN also works with employers on workplace well-being, contributing to the performance and attractiveness of the public sector. Since 2017, MGEN has also been a founding member of the VYV Group, the leading mutualist actor in health and social protection in France.
www.mgen.fr

mgen

The Haut Conseil pour l'Avenir de l'Assurance Maladie (HCAAM – High Council for the Future of Health Insurance) is a body for reflection and proposals which, since 2003, has contributed to a better understanding of the challenges, functioning, and possible developments of health insurance policies.

Created in 2003, the HCAAM is composed of 66 members, representing at a high level the main organizations, institutions, trade unions, federations, and associations active in the field of health insurance and, more broadly, in the healthcare system.
www.securite-sociale.fr/hcaam

hcaam
Haut Conseil pour l'avenir de l'assurance maladie

The Shift Project is a think tank working toward a carbon-free economy.
As a non-profit association under the French 1901 law and recognized as serving the public interest, and guided by scientific rigor, our mission is to inform and influence the debate on the energy transition in Europe.
Our members are major companies that have chosen to make the energy transition their priority.
www.theshiftproject.org

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