Airparif dossier
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#07
#08

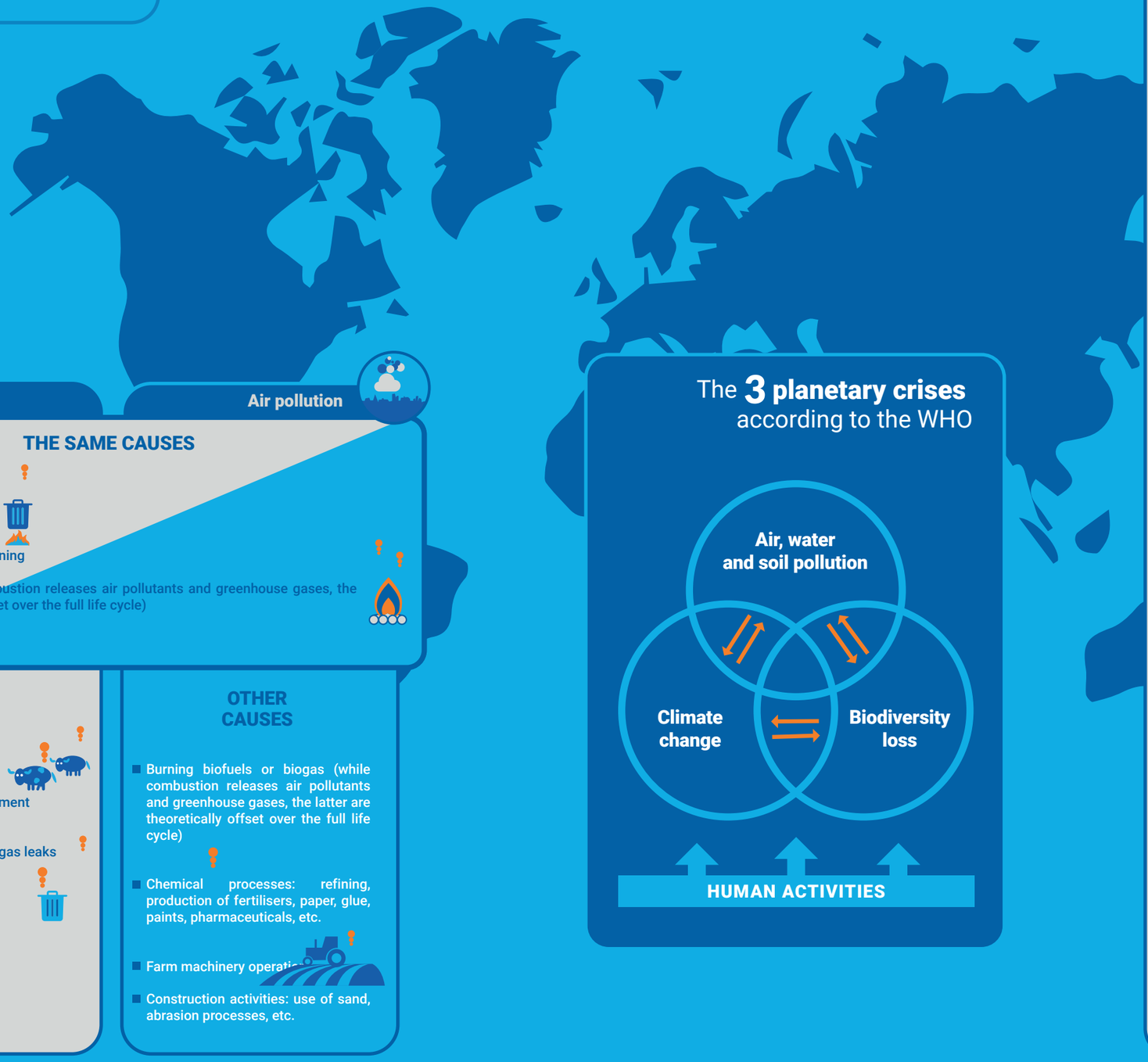
Air pollution and climate change: two sides of the same coin

AIRPARIF

EXPLAINED/ **What you need to know**

KNOW THE DIFFERENCE

WEATHER	&	CLIMATE
Assessment of current conditions or very short-term forecast (a few days) for a specific location.		Long-term average of these conditions (30 years) for a given region of the globe.



The **3 planetary crises** according to the WHO

Climate change

THE SAME CAUSES

- Burning oil, gas and coal
- Incinerating waste
- Deforestation and crop burning
- Wood burning (while combustion releases air pollutants and greenhouse gases, the latter are theoretically offset over the full life cycle)

OTHER CAUSES

- Ruminant digestion
- Chemical reactions in cement production
- Fugitive emissions from gas leaks
- Waste fermentation

Air pollution

THE SAME CAUSES

- Burning oil, gas and coal
- Incinerating waste
- Deforestation and crop burning
- Wood burning (while combustion releases air pollutants and greenhouse gases, the latter are theoretically offset over the full life cycle)

OTHER CAUSES

- Burning biofuels or biogas (while combustion releases air pollutants and greenhouse gases, the latter are theoretically offset over the full life cycle)
- Chemical processes: refining, production of fertilisers, paper, glue, paints, pharmaceuticals, etc.
- Farm machinery operation
- Construction activities: use of sand, abrasion processes, etc.

Climate change

WHAT'S IT ALL ABOUT?

A sustained change in the global climate caused by increasing concentrations of greenhouse gases in the atmosphere, due to human activities.

GHGs

IMPACT

GLOBAL — Greenhouse gases have the same impact on the climate regardless of where they are emitted.

SOURCES

LARGELY SIMILAR

COMBUSTION

- of coal
- of oil
- of gas

CONSEQUENCES

- ✓ Rise in temperatures and sea levels
- ✓ Worsening of extreme weather events
- ✓ Growing difficulties in accessing water
- ✓ Decline in agricultural yields

The consequences for global warming are the same for each of the greenhouse gases.

RESPONSIBLE SUBSTANCES

- Other greenhouse gases (GHGs): CO_2, N_2O
- Air pollutant & GHG: O_3
- Other air pollutants: HAP, Dioxins
- GHGs with impacts on air pollution: CH_4
- Air pollutants with impacts on the climate: PM, SO_2, COV, NH_3, NOx, CO

LIFETIME IN THE AIR

LONG
On the order of decades (methane) or centuries (carbon dioxide).

Air pollution

WHAT'S IT ALL ABOUT?

A range of pollutants in the air, linked to human activities, with harmful effects on health and ecosystems.

IMPACT

LOCAL — Air pollutants affect the area around and extending beyond their point of emission.

SOURCES

LARGELY SIMILAR

CONSEQUENCES

- ✓ Increased risks of respiratory, cardiovascular and neurodegenerative diseases
- ✓ Premature deaths
- ✓ Damage to buildings
- ✓ Decline in agricultural yields

The consequences for health and ecosystems vary from one air pollutant to another.

LIFETIME IN THE AIR

SHORT
From a few hours to a few weeks.

WHY
IT MATTERS

“In the years to come, due to ozone and particles, climate change will affect air quality”

Augustin Colette, Ineris, the French National Institute for the Industrial Environment and Risks

2022 was the hottest year ever observed in France since records began in 1900. Over the whole year, average temperatures exceeded 14°C. A grim milestone, indicative of climate change in France. And yet, Météo France warns that these exceptional weather conditions could become the norm by 2050.

Climate and air quality: an alarming trend

Climate change is increasingly felt across France. Effects such as heatwaves, droughts, wildfires, floods and heavy rainfall can be observed across the country.

Air pollution is evolving too. Its harmful effects on health are now recognised at lower levels than previously accepted. As a result, the World Health Organization (WHO) has lowered its reference thresholds for various atmospheric pollutants. Furthermore, levels of regulated pollutants are decreasing – except for ozone, a trend that is linked to climate change.

2nd hottest summer since 1900 (after summer 2003)

25% rainfall deficit across France

Awareness at every level

Whether from a political, economic or social perspective, the two issues can no longer be considered separately. The scientific consensus is clear: we require more committed action that addresses both issues together.

The sixth Intergovernmental Panel on Climate Change (IPCC) assessment report, published in 2021, supports this view, highlighting the interplay between climate and air quality. “This report goes further than previous ones by assessing the interconnected challenges of both issues in terms of environmental policy,” says Sophie Szopa, coordinator of a chapter in the sixth IPCC report.

The WHO also stresses the links between climate and air quality: to improve the former, action must be taken on the latter, i.e. we need to reduce air pollution. Similarly, in 2022, the United Nations adopted a historic resolution declaring that access to a healthy environment, including clean air and a stable climate, is a universal human right.

France’s Law on Climate and Resilience includes efforts to combat air pollution in the country’s ecological transition strategy. As of October 2022, if an individual’s fundamental right to live in a balanced environment that protects health is violated, legal action can be taken.

In 2021, the regional council and Sorbonne University set up GREC, the Regional Group for Studies on Climate Change and Environmental Impacts. This body is responsible for turning knowledge into usable advice and guidance that stakeholders can apply when deciding on the most beneficial land-use planning operations.

The climate is changing – and so is air pollution. The two issues are closely linked, alongside the threat to biodiversity, forming the triple planetary crisis that humanity faces, according to the United Nations. Concerted action is now needed to adapt and mitigate their effects as much as possible.

“Today, we are at a critical point where we can bend the curve”

The links between climate change and air pollution are gaining widespread recognition. Nathan Borgford-Parnell, Scientific Affairs Lead and Regional Assessment Initiative Coordinator for the Climate and Clean Air Coalition (CCAC), explains why this shift in mindset matters for achieving faster mitigation.

For a comprehensive, integrated approach

“When taking action on air pollution or greenhouse gases (GHGs), it’s best to ensure you’re reducing both pollutants and GHGs at the same time. Focusing on only one or the other may benefit the climate, for example, but could have negative effects on air pollution. However, once we recognise that these problems are interconnected, we can identify solutions with multiple benefits across different timescales, for air pollution, public health, ecosystems and the climate.”

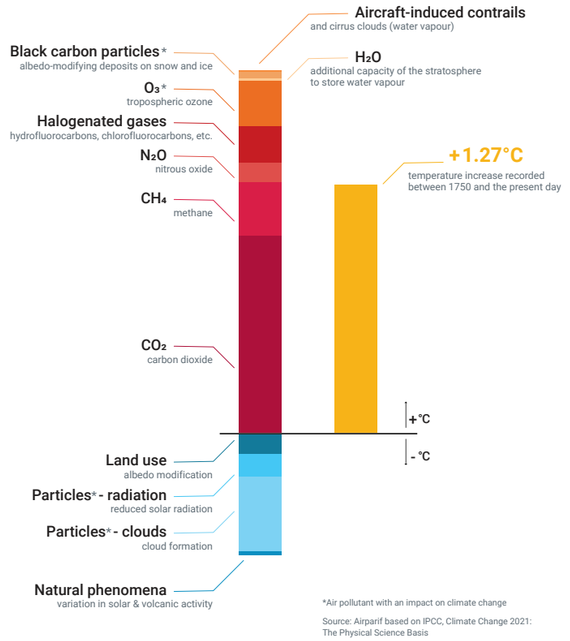
A coordinated political approach to these two issues is vital, offering real benefits: saving lives, saving money and reducing carbon consumption.

The potential for short-term positive effects

At first glance, the horizons of the two communities working on climate change and air quality appear to be quite different. “The climate community's focus extends much further into the future. Historically, the focus has been on stabilising the climate by the end of the century. Meanwhile, air quality management focused on the short term.”

So, how do we coordinate actions that benefit both climate and air quality? By focusing on short-lived greenhouse gases (also called short-lived climate pollutants, or SLCPs). Methane, black carbon, tropospheric ozone and hydrofluorocarbons have a stronger effect on the climate than carbon dioxide in the global warming process. Because their atmospheric lifetimes are shorter, reducing them can significantly limit temperature rises in the short term. But that’s not all. Some of these compounds, like ozone, are also air pollutants harmful to health, ecosystems and agricultural production. Reducing them will also bring benefits in these areas. “Some measures targeting SLCPs can achieve maximum air quality and short-term climate benefits.”

Contributions to **climate change** from 1750 to present day



Why it is essential to fight air pollution and climate change together

Two scientists, specialists in their respective fields, explain the need to tackle both problems together and highlight the multiple benefits to be gained.

SOPHIE SZOPA, COORDINATOR OF THE SIXTH CHAPTER OF WORKING GROUP 1 ON "SHORT-LIVED COMPOUNDS" IN THE LATEST IPCC REPORT, IS A RESEARCH DIRECTOR AT THE FRENCH ALTERNATIVE ENERGIES AND ATOMIC ENERGY COMMISSION, IN THE LABORATORY OF CLIMATE AND ENVIRONMENTAL SCIENCES. SHE DISCUSSES THE RECIPROCAL INTERACTION BETWEEN AIR POLLUTION AND CLIMATE CHANGE.

How does one affect the other? Air pollution involves many different compounds. Some, such as ozone, contribute to warming the atmosphere and thus exacerbate global warming. Others can have a cooling effect. For example, fine particles affect clouds and their properties. Nitrogen oxides also play a role by altering the lifetime and therefore the effect of methane, the second most important greenhouse gas contributing to global warming.

In turn, climate change has multiple effects on pollution. Heatwaves stimulate the chemical production of ozone. However, physically, a warmer atmosphere holds more water vapour which, through chemical reactions, leads to ozone destruction. Therefore, outside polluted areas, warming mostly causes a decrease in ozone levels. The quantity of fine particles is strongly influenced by rain, which removes particles from the atmosphere. With climate change, changes in precipitation are very unevenly distributed across time and space. This makes it difficult to identify a clear overall trend of systematic improvement or deterioration for this pollutant.

One significant uncertainty remains: how pollutant sources from non-urban areas (emissions from vegetation, wildfires, etc.) will evolve under the influence of climate change.

Does tackling air pollution locally worsen global warming, and conversely, do climate change mitigation efforts have repercussions on air pollution? Fighting air pollution is absolutely vital from a health perspective. The reduction of compounds like sulphur dioxide has been a public health win and has helped limit acid rain. However, from a climate standpoint, this reduction has meant fewer cooling particles formed by sulphur dioxide. There are now fewer of these particles to mask global warming, which has actually intensified in recent years. Of course, climate is not just about temperature – this reduction has also decreased the disruptions to rainfall and atmospheric dimming that these particles caused. Since the beginning of the industrial era, ozone concentrations in the lower atmosphere have steadily increased, making this gas the third-largest greenhouse gas contributor to current warming. So, fighting ozone benefits the climate, particularly if we target methane, one of its key precursors.

Addressing climate change will require far-reaching changes, many of which will also benefit air quality. For example, the widespread electrification of vehicles (especially cars) and a shift in people's mobility patterns to favour walking or cycling for short trips will have an immediate and positive impact on air quality. Nonetheless, implementing these changes requires infrastructure development beyond individual behaviour, which will take time.

WILL AIR SAVE THE CLIMATE?

WITH THIS QUESTION, **PATRICE GEOFFRON**, ECONOMICS PROFESSOR AT UNIVERSITÉ PARIS-DAUPHINE/PSL, HIGHLIGHTS THE CENTRAL ROLE OF THE ECONOMY IN TACKLING BOTH CLIMATE CHANGE AND AIR POLLUTION.

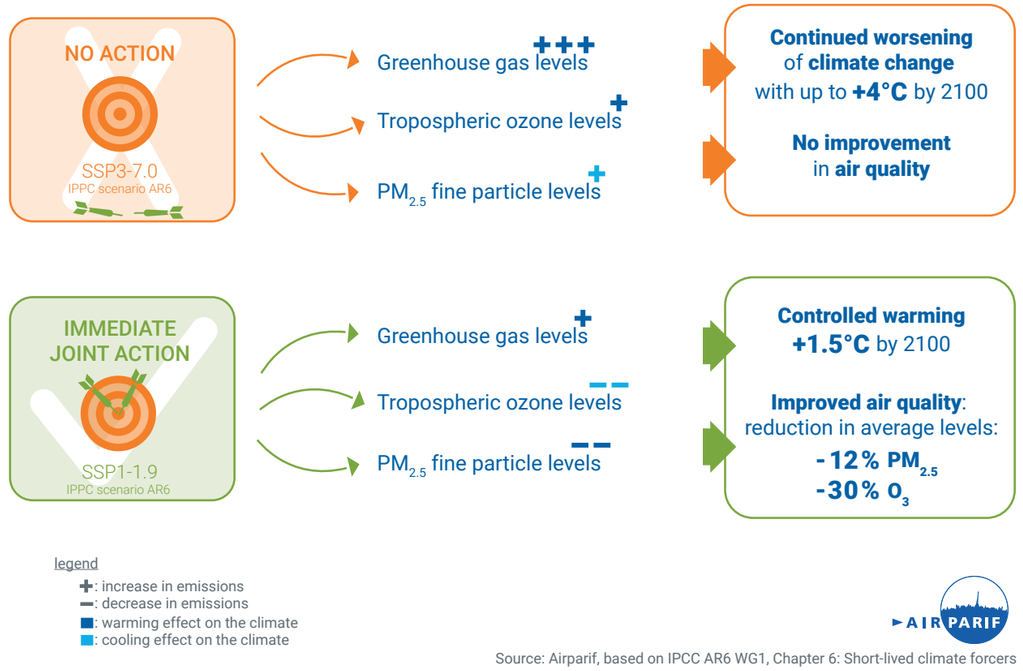
"Unsurprisingly, 2022 saw continued growth in CO_2 emissions, following the rebound observed in 2021 after the 2020 global economic shutdown. And COP 27 failed to deliver any conclusions to inspire optimism… Seen from France, with its emissions accounting for only around 1%, it's easy to see why some might feel "What's the point?", just as Europe commits to a 55% cut in emissions by 2030.

But this is where 'air' comes in: many measures that help reduce greenhouse gas emissions – from transport, industry, agriculture and buildings – also improve air quality. This means greater well-being, especially for public health (and less noise pollution too), as well as fewer economic impacts from air pollution. As the French Senate regularly notes in its assessments, air pollution costs France between 2% and 4% of GDP every year (some €50 to €100 billion) and is responsible for around 40,000 premature deaths annually.

In other words, even if one might harbour doubts about the success of the Paris Agreement, we need to remember that climate action leads to improvements in air quality – and those effects are directly observable. This matters because it can motivate local communities to make a positive change in their immediate environment. This is even more important now that it's widely recognised that air pollution increased mortality linked to Covid (through pre-existing health conditions that made people more vulnerable), adding to public debt – which grew by €500 billion in France during the pandemic.

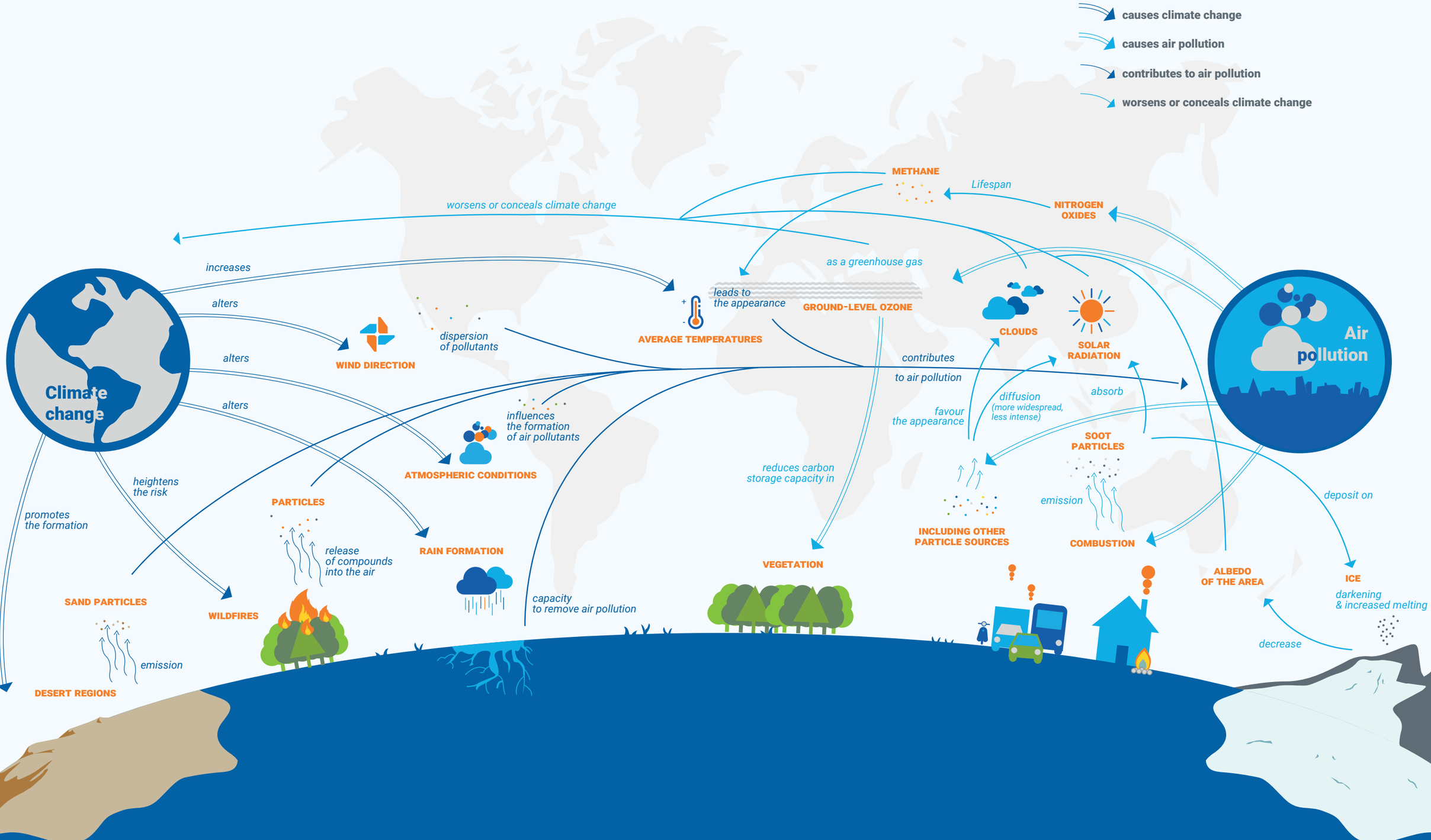
And what holds true for France in terms of the benefits of improving air quality is even more relevant for the Paris region. The fight against climate change stops feeling like a distant goal with uncertain outcomes when it brings very real improvements to both health and the economy, 'here and now'".

Climate change and **air pollution**: **the impacts** of **political decisions**



Source: Airparif, based on IPCC AR6 WG1, Chapter 6: Short-lived climate forcers

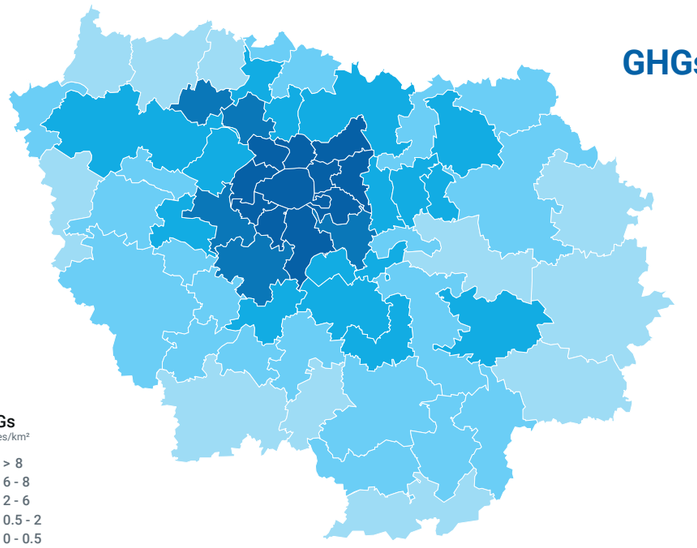
INTERACTIONS BETWEEN **CLIMATE CHANGE** AND **AIR POLLUTION**



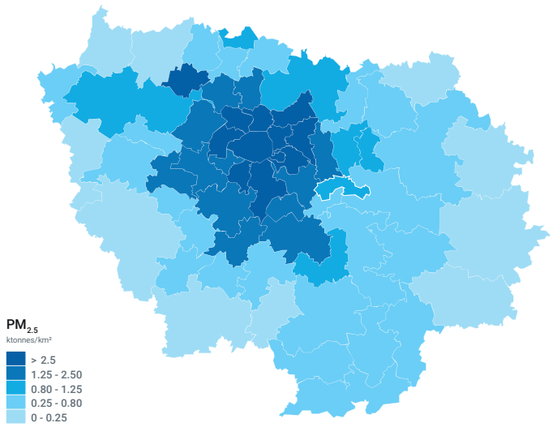
Common sources and locations of greenhouse gases (GHGs), nitrogen oxides (NO_x) and fine particles ($PM_{2.5}$) in the Paris region

Location maps showing **emissions** in the Paris region in 2022

GHGs



$PM_{2.5}$



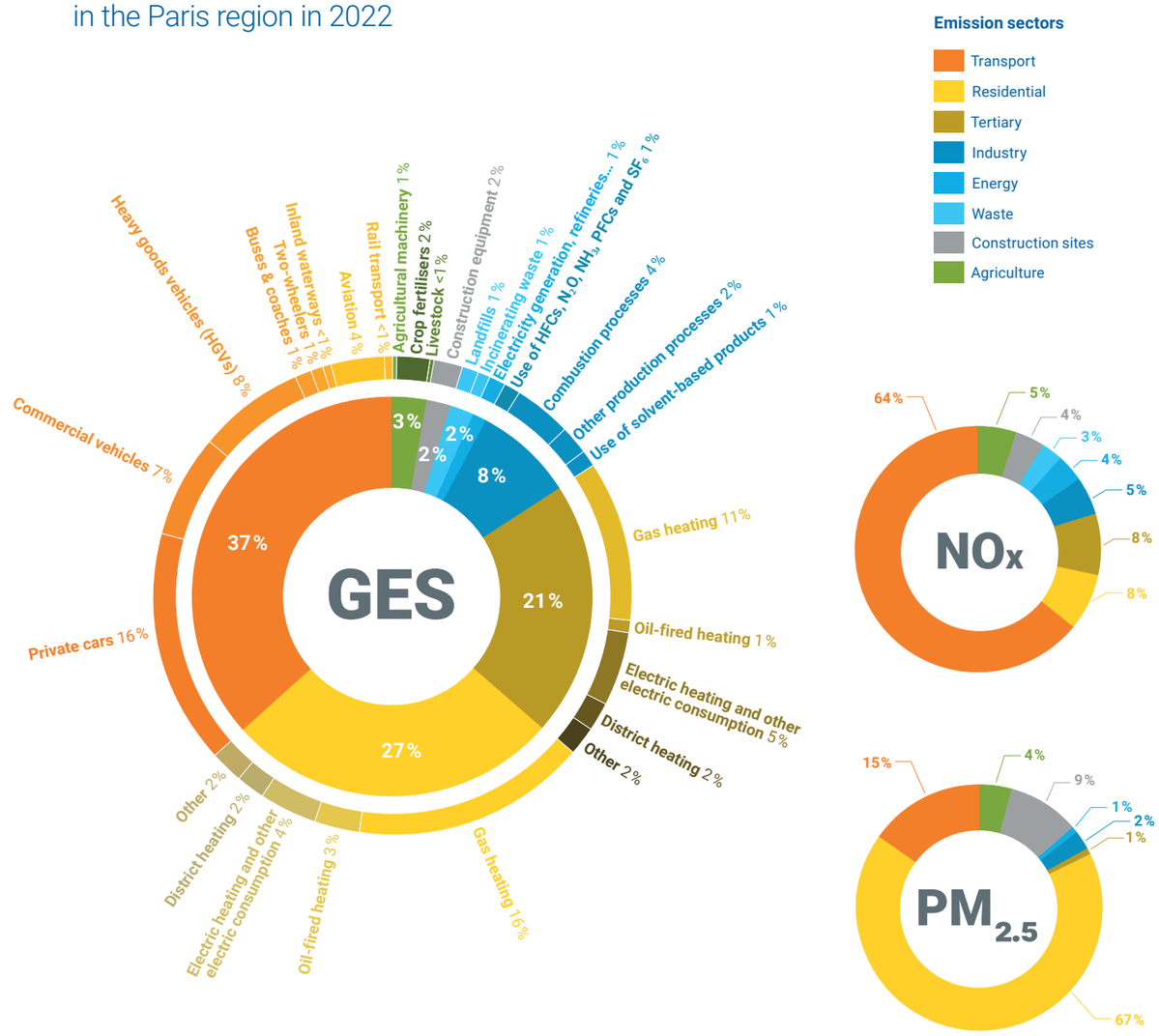
PROJECTIONS AND VULNERABILITY

- By 2050, nearly all residents of the Paris region will be exposed to an increased number of unusually hot days. In the most densely populated areas, the urban heat island effect will exacerbate the impact of heatwaves.

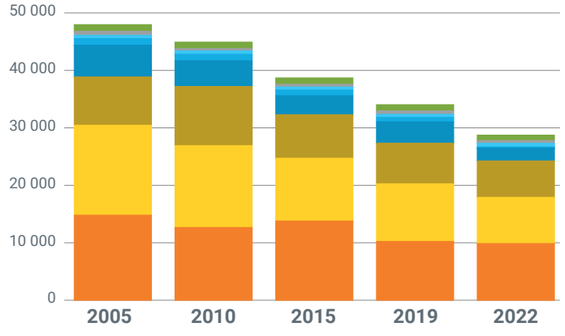
- The recurrence of hot days and nights raises health risks. Among the most vulnerable are the elderly, young children who may struggle to stay hydrated, lower-income groups who often live in poorly insulated housing, and outdoor workers such as agricultural labourers and construction workers. These groups are also particularly susceptible to the effects of air pollution.

(Source: Insee Première, No. 1918, 2022)

Different **sources of emissions** in the Paris region in 2022

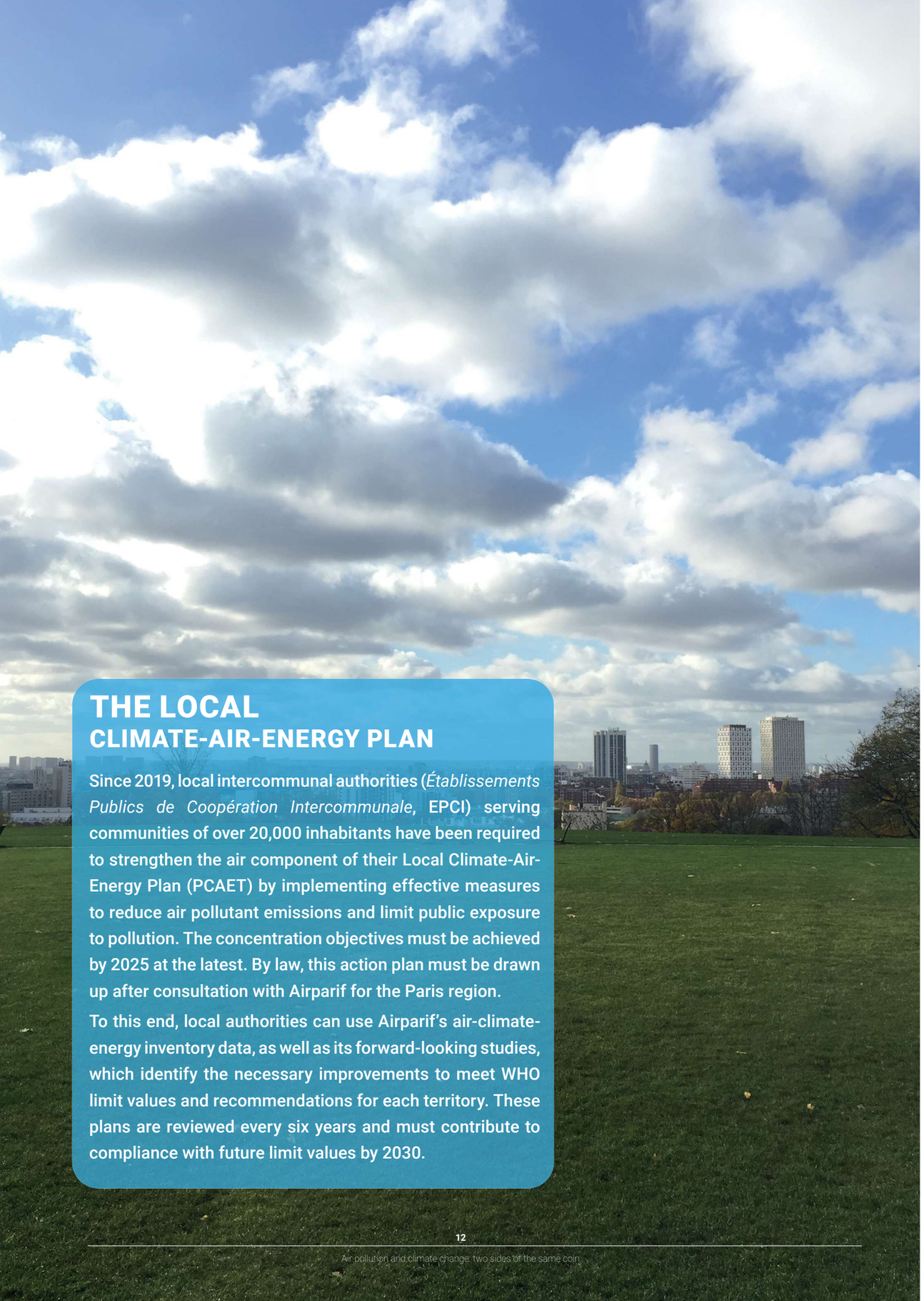


Trends in **greenhouse gas emissions over time** in the Paris region (ktonnes/year)



EMISSIONS INVENTORY

This data is available thanks to the greenhouse gas (GHGs) and air pollutants emissions inventory compiled by Airparif and covering across all areas of human activity. The latest Paris region inventory of GHG emissions for 2022 shows a 39% reduction in emissions compared to 2005. In recent years, the rate of decline, although faster than the national average, still falls short of the target expected at the national level under France's Low-Carbon Strategy.



THE LOCAL CLIMATE-AIR-ENERGY PLAN

Since 2019, local intercommunal authorities (*Établissements Publics de Coopération Intercommunale*, EPCI) serving communities of over 20,000 inhabitants have been required to strengthen the air component of their Local Climate-Air-Energy Plan (PCAET) by implementing effective measures to reduce air pollutant emissions and limit public exposure to pollution. The concentration objectives must be achieved by 2025 at the latest. By law, this action plan must be drawn up after consultation with Airparif for the Paris region.

To this end, local authorities can use Airparif's air-climate-energy inventory data, as well as its forward-looking studies, which identify the necessary improvements to meet WHO limit values and recommendations for each territory. These plans are reviewed every six years and must contribute to compliance with future limit values by 2030.

A WORD FROM OUR PARTNERS

HOW CAN WE TACKLE AIR POLLUTION AND CLIMATE CHANGE HEAD-ON?

REPRESENTATIVES FROM TWO LOCAL AUTHORITIES IN THE PARIS REGION SHARE THEIR VIEWS ON RESPONDING TO THESE CHALLENGES: **JOSÉPHINE KOLLMANNSBERGER**, VICE-PRESIDENT OF SAINT-QUENTIN-EN-YVELINES COUNCIL, RESPONSIBLE FOR THE ENVIRONMENT AND ECOLOGICAL TRANSITION, AND **DANIEL GUIRAUD**, VICE-PRESIDENT OF THE METROPOLITAN COUNCIL OF GREATER PARIS, OVERSEEING THE ECOLOGICAL TRANSITION, AIR QUALITY AND THE DEVELOPMENT OF ENERGY NETWORKS. TOGETHER THEY EXPLORE THESE ISSUES WITHIN THE CONTEXT OF THEIR TERRITORIES.

How do climate and air quality issues play out in your communities? ***Joséphine Kollmannsberger (J.K.)***: In Saint-Quentin, we take a broad-based approach to tackle these two challenges: energy renovation of public buildings, promoting alternatives to private car use, and supporting local agriculture through central kitchens (which deliver meals to care homes, schools, etc.) supplied by short supply chains. We also want to develop geothermal energy in all the communities within the Saint-Quentin inter-municipal area. To make this happen, we're leveraging various resources, such as the local climate-air-energy plans. Our membership of Airparif also provides us with the expertise required to roll out this plan.

Daniel Guiraud (D.G.): With the adoption of the metropolitan climate-air-energy plan in November 2018, the Greater Paris metropolitan authority set a strategy and ambitious targets for its member municipalities. In addition to reducing greenhouse gas emissions, restoring air quality emerged as a priority. 10 of the 41 actions defined therefore focus on improving air quality. Other framework documents also address these themes, most notably the Metropolitan Territorial Coherence Scheme (SCoT), for which a first approval was granted in early 2022.

Are the two issues seen to be related? ***J.K.***: Perhaps the issues are too often dealt with separately. But for there to be a real link, we, as elected representatives, have to keep reminding people of it. We need to communicate about the measures we take because, as we know, they can feel somewhat punitive. We have a key role to play in informing the public about the connections between these two issues.

D.G.: Yes, the two issues are seen to be linked, as most actions affecting air quality also bring benefits in terms of reducing greenhouse gas emissions. The recently reinforced air quality plan, produced with support from Airparif, shows that 32 actions in the climate plan have a positive impact on air quality, i.e. almost 80% of our actions; the remainder have no particular impact. The air quality plan was unanimously adopted by the metropolitan council on 21 October 2022.

Have you needed to arbitrate where measures have conflicting effects? ***J.K.***: Yes, actions can sometimes prove contradictory and therefore raise questions for the public. For example, creating cycle paths involves hard landscaping, which can impact the environment. Wood-fired heating is another sensitive issue. In the present economic climate, many people have started using their fireplaces again. That's not good for air quality. But we can't ban them, that's not our role. Instead, we prefer to help people make the necessary changes by going out to meet the community and running awareness-raising initiatives in schools. Both issues are closely linked, and I really want Saint-Quentin to be exemplary in this area.

D.G.: So far, there has been no need to make trade-off decisions involving measures with a positive climate impact but a negative effect on air quality. Instead, the work carried out as part of the metropolitan climate-air-energy plan has helped us prioritise actions with significant dual benefits – such as the introduction of a low-emissions zone (ZFE). The Greater Paris metropolitan authority will continue to pay close attention to these matters, for example, by promoting alternative fuels like biodiesel and exploring measures linked to wood-fired heating.

WHAT CAN WE DO?

All carbon-reduction plans must also address the issue of air pollution, and not just the climate.

As a general rule, this dual focus will highlight the expected co-benefits and avoid antagonistic effects that could undermine the desired environmental progress. If a carbon reduction policy has negative repercussions on air pollution or, conversely, if a policy to improve air quality has an unfavourable impact on the climate, it risks being judged as environmentally harmful overall. Against the background of the triple planetary crisis, this thinking can also be extended to biodiversity. For instance, we need to be particularly vigilant about the increasingly widespread use of biomass as a fuel, which is presented as a solution for carbon reduction, but can have negative impacts on air pollution and even biodiversity.

Decarbonisation and **pollution reduction** policies: **co-benefits** and **counter-productive effects**

IN FOCUS:

BENEFICIAL FOR **AIR QUALITY, BUT COUNTER-PRODUCTIVE** FOR **CLIMATE**

Pollution control systems for vehicles or industrial plants: effective against air pollutants, but little or no impact on greenhouse gas emissions; can even lead to a slight increase in energy consumption.

JOINT BENEFITS FOR **AIR QUALITY AND CLIMATE**

All energy-saving and energy-efficient actions that use less energy: renovating and reducing the temperature of buildings, switching from car to bike or walking, from plane to train, using lighter vehicles, etc.

Generally speaking, any action that brings about a switch away from coal, petrol and gas.

Switching to electric alternatives: heating, transport, industry, etc.

Use of hydrogen (with renewables)**:** industry, transport.

Electricity generation using hydro, wind, solar, geothermal or nuclear power: low life-cycle GHG emissions and zero air pollutant emissions.

Prevention of methane leakage. Reduced methane emissions linked to meat consumption.

Reduced fertiliser use.

BENEFICIAL FOR **CLIMATE BUT COUNTER-PRODUCTIVE** FOR **AIR QUALITY**

Wood-fired heating: low life-cycle greenhouse gas emissions, but high pollutant emissions, particularly fine particles. Negative effects on air quality can be reduced with the use of a recent, efficient heating system, but still higher than with other fuels (including fuel oil).

Use of biofuels and biogas: low life-cycle greenhouse gas emissions, but high degree of uncertainty over the quantity of air pollutants emitted.

Thermal insulation of homes with poor ventilation: significant fall in energy consumption and hence greenhouse gas emissions, but deterioration in indoor air quality due to lack of ventilation.

Poorly anticipated urban sprawl: significant reduction in energy consumption thanks to optimised mobility and heating but, if poorly planned, risk of high concentrations and poor dispersal of air pollutants.

IN FOCUS

DECARBONISING INDUSTRY

Achieving energy sobriety and efficiency is not the sole responsibility of the public sector, nor just a matter of individual changes in behaviour. Private companies are also required to cut their carbon emissions if we are to meet the environmental challenges. Decarbonisation, i.e. cutting CO_2 emissions, is part of France's Low-Carbon Strategy, which aims to achieve net zero emissions by 2050. Decarbonising the economy, meaning the phase-out of fossil fuels, brings benefits for the climate and air quality. For the industrial sector, it also offers advantages in terms of budget savings, cost efficiency and reputation.

KEY TAKEAWAYS

THE MAIN SOURCES OF AIR POLLUTANTS AND GREENHOUSE GASES ARE THE SAME.

REDUCING THESE SOURCES BRINGS CO-BENEFITS. THE SOLUTIONS ARE THEREFORE THE SAME:

- MODERATE ENERGY USE
- LESS RELIANCE ON FOSSIL FUELS: COAL, OIL AND GAS

SAME SOURCES = SAME SOLUTIONS

MODERATE ENERGY USE
ENERGY EFFICIENCY
DECARBONISATION

- **positive action leading to lower greenhouse gas** and **air pollutant emissions**

OZONE & METHANE

- **rapid reductions for**
- **better air quality** and **climate**

ADDRESSING AIR POLLUTION NOW WILL YIELD IMMEDIATE BENEFITS AT THE LOCAL LEVEL AND A POSITIVE OUTCOME FOR THE GLOBAL CLIMATE IN THE FUTURE

A **coordinated policy approach** =

- **COST SAVINGS**
- **LIVES SAVED**
- **CONTROLLED CLIMATE CHANGE**

This double issue focuses on the links between two of the three current planetary crises identified by the World Health Organization: air pollution and climate change. By unpacking the key concepts [pages 2-3], we better understand the value of a comprehensive approach to both challenges [pages 4-5]. Scientists discuss the co-benefits of tackling both issues together [pages 6-7] and explain how climate change and air pollution interact [pages 8-9]. The actions implemented by two local authorities shed light on the situation in the Paris region [pages 10-11] [pages 12-13]. Lastly, the issue looks at the joint solutions that can be applied and sums up the key takeaways [pages 14-15].

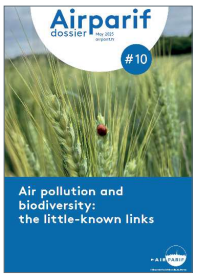
FURTHER READING:

International - Reports from the Intergovernmental Panel on Climate Change (IPCC), which assess the current state of knowledge on climate change.

Regional - Regional Expert Group on Climate Change and Ecological Transition in the Paris region (GREC). Regional Energy-Climate Agency (AREC), to accelerate the energy transition and adaptation to climate change.

Local - The local climate-air-energy plans.

Airparif dossier #09
"Micro-sensors: a solution for the future?"
November 2023



Airparif dossier #10
"Air pollution and biodiversity: the little-known links"
May 2025

Non-profit organisation, under the 1901 French law
7 rue Crillon 75004 PARIS / +33 1 44 59 47 64
www.airparif.fr

Director of publication: Philippe Quénel
Director General: Karine Léger
Head of Communications: Pierre Pernot
Senior Editor: Camille Martin
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"ACTING FOR CLEAN AIR
IN A MORE SUSTAINABLE WORLD"

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