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SUMMARY OF THE FRENCH TREASURY'S 2023 INTERIM REPORT ON THE ECONOMIC CHALLENGES OF THE NET ZERO TRANSITION

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"The economic challenges of the net zero transition" report from the French Treasury

- Report commissioned by the French Minister of the Economy, Finance and Industrial and Digital Sovereignty
- Inspired by the *Net Zero Review* published in 2021 by the UK's HM Treasury
- Analysis of the **key economic challenges of the net zero transition for the French economy**, adressing macroeconomic and sectoral dimensions, and outlining the main challenges for competitiveness, households and public finances
- Lessons from **international comparisons** and the **economic literature**
- The publication **follows work carried out by the taskforce led by Jean Pisani-Ferry and Selma Mahfouz** on the "Economic implications of climate action"
- 2023 interim report published
- Final report in 2024

Summary of the 2023 interim report

1. Understanding the economic challenges of the net zero transition
2. The principles of an effective and fair public action to achieve carbon neutrality
3. The economic challenges of private housing decarbonisation
4. Implications of the net zero transition for public finances (especially energy tax revenues) and the pricing of road transport externalities

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1. Understanding the economic challenges of the net zero transition

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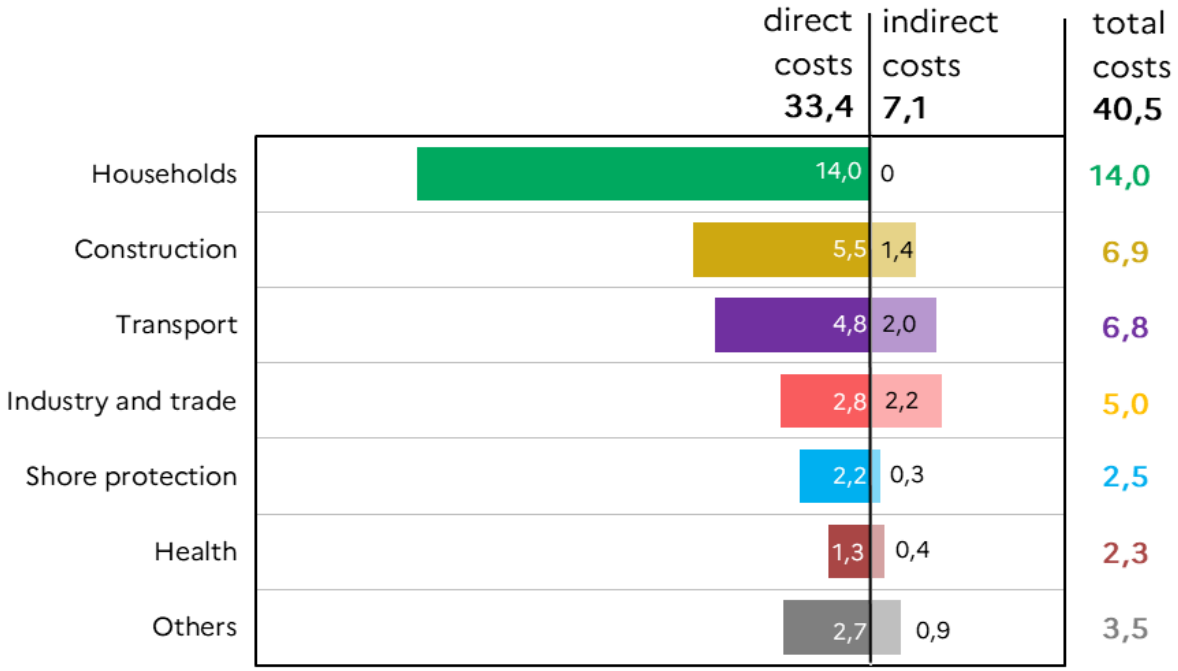
The effects of climate change can already be observed and would increase substantially by the end of the century without an acceleration of the pace of global decarbonisation

The July 2021 floods in Germany: distribution of direct and indirect monetary costs (in € billion)



The physical effects of climate change are diverse and can already be felt. The main effects are increased frequency and intensity of extreme weather events (heat waves, droughts, extreme rainfall, storms, etc.) and damage to ecosystems.

Global warming affects the socio-economic sphere, through productivity losses, disruption of value chains, destruction of natural and physical capital or mortality. Europe is already experiencing these consequences
(*e.g.* 2022 drought in France, 2021 floods in Germany).
According to the IPCC, a temperature rise of around +4°C in 2100 would reduce global GDP by 10% to 23%.

The economic effects of climate change for France are still insufficiently known, but could reach up to 8 points of GDP in 2050 according to the Network for the Greening of the Financial System (NGFS).

Sources: Trenczek et al. (2022), "Damage caused by flash floods and floods in July 2021 in Germany", Project "Costs of climate change" of the BMWK; NGFS (2023), Technical Documentation V4, Climate Scenarios Database.

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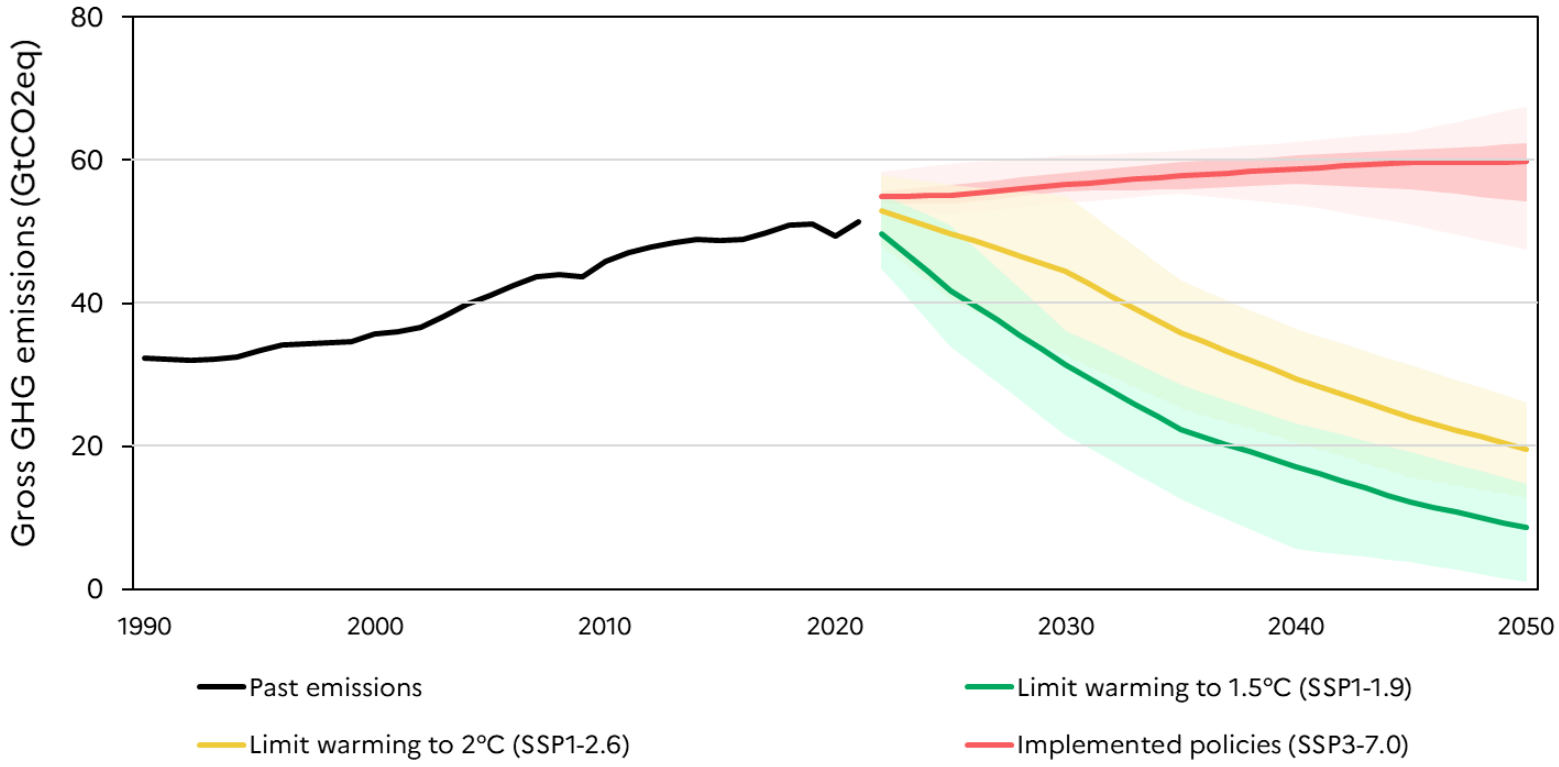
Limiting global warming to 1.5 or 2 degrees implies reaching a peak in global GHG emissions before 2025, followed by substantial emissions reductions to achieve carbon neutrality by 2050

Global gross greenhouse gas (GHG) emissions under different IPCC warming scenarios



Sources : IMF (past emissions), IPCC (projections)
Notes : emissions presented correspond to the Kyoto perimeter. For each projection, the central value represents the median while the uncertainties represent 5-95% of the available scenarios.

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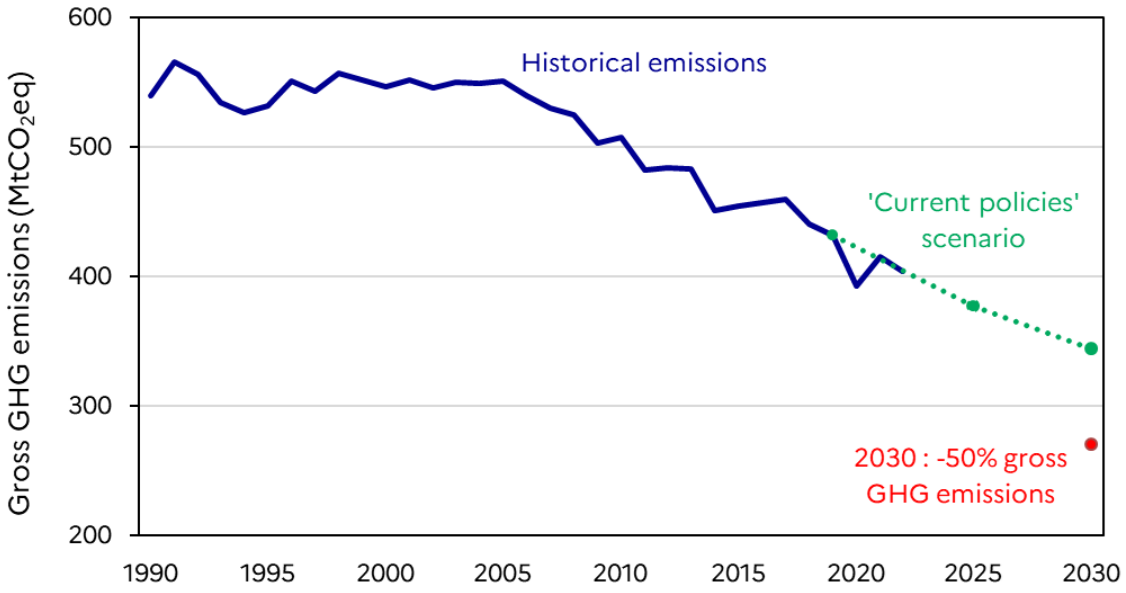
France has committed to achieve carbon neutrality by 2050, which requires an acceleration of efforts

France's gross GHG emissions and climate targets



To limit global warming to 1.5°C, France and the European Union have made ambitious commitments to reduce their net greenhouse gas emissions:

- -50% gross and -55% net in 2030 compared with 1990, an intermediary milestone towards achieving net zero in 2050.

Achieving these targets means accelerating decarbonisation efforts:

- The 2030 emissions reduction target requires doubling the rate of emissions reduction achieved during the 2019 – 2022 period
- Achieving carbon neutrality in 2050 will require continued efforts after 2030, even more so as land carbon sinks have been severely reduced in recent years

Sources : CITEPA and SDES for historical emissions; SGPE for projections
Notes : The "current policies" scenario integrates all measures adopted until the end of 2021. Emissions figures presented correspond to gross emissions.

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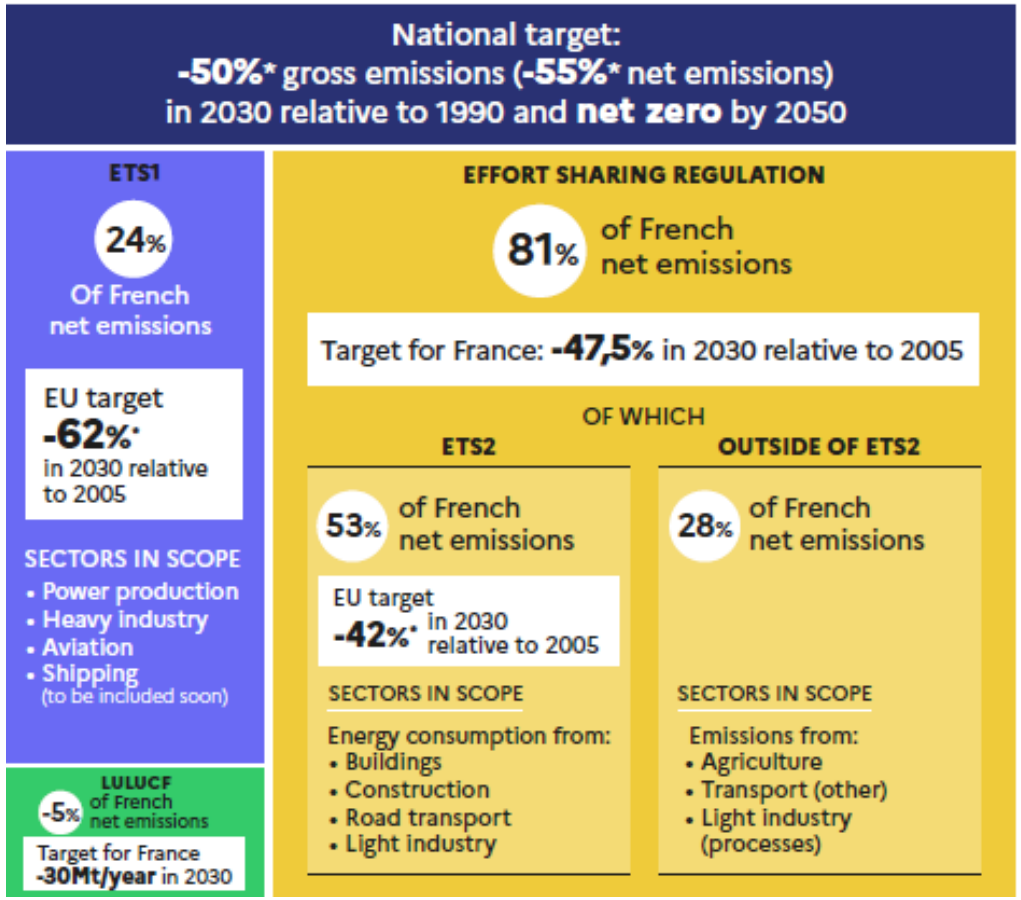
French mitigation targets and European policy instruments to achieve them



Notes: these objectives are based on the hypothesis that French emissions covered by European emissions trading system (ETS 1 and ETS 2) evolve at the same rate as the EU average. The surface area of each box is proportional to the share of French net emissions covered by the instrument. The sectoral scope of the ETS presented here corresponds to European directive 2023/959. Only flights within the European Economic Area are covered by ETS 1. The objective of capturing 30 MT CO_2 eq/year through natural carbon sinks is provisional and calculated based on current estimates of their absorption capacity.

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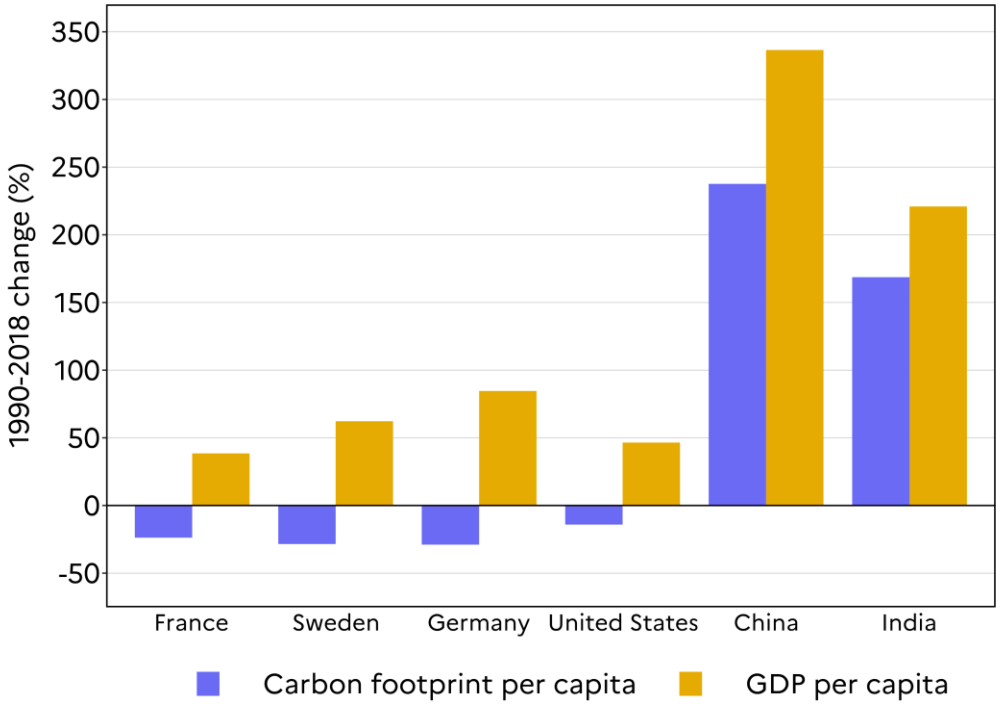
Decarbonisation could slow growth in the short term, but in the long run it will be beneficial for the economy and enhance well-being compared with a scenario of unmitigated global warming

Evolution of the carbon footprint and GDP per capita between 1990 and 2018



Decarbonisation is compatible with growth if GHG emissions can be sufficiently decoupled from economic activity:

- Decoupling has been initiated by France and other advanced countries…
- …yet at an insufficient pace to achieve carbon neutrality

During the transition, however, economic growth could slow down, due to the higher costs of low-carbon production.

In the long term, climate change mitigation policies yield benefits:

- Adverse consequences of unmitigated climate change averted
- Productivity gains in low-carbon technologies
- Improvement of some components of the trade balance, such as fossil fuel energy expenditures
- Potential improvements in well-being, especially health

Well-designed climate policies could reduce the costs and maximise the benefits of the net zero transition (see below)

The resilience of French industrial activity during the 2022-2023 energy crisis shows the ability of companies to adapt to increases in energy prices, through low-carbon and energy efficiency investments and the adoption of energy conservation practices.

Sources : OurWorldInData (2022); Pisani-Ferry J. and Mahfouz S. (2023) "The economic implications of climate action", France Stratégie report; Insee (2022), Insee (2022), « Les entreprises face à la hausse des prix de l'énergie : des situations et des réactions contrastées », Note de conjoncture de décembre 2022.
Notes: Countries are ordered from left to right by increasing change in the carbon intensity of GDP over the period 1990-2018. In relative terms, France is the country on this graph whose carbon intensity has decreased the most over the period 1990-2018.

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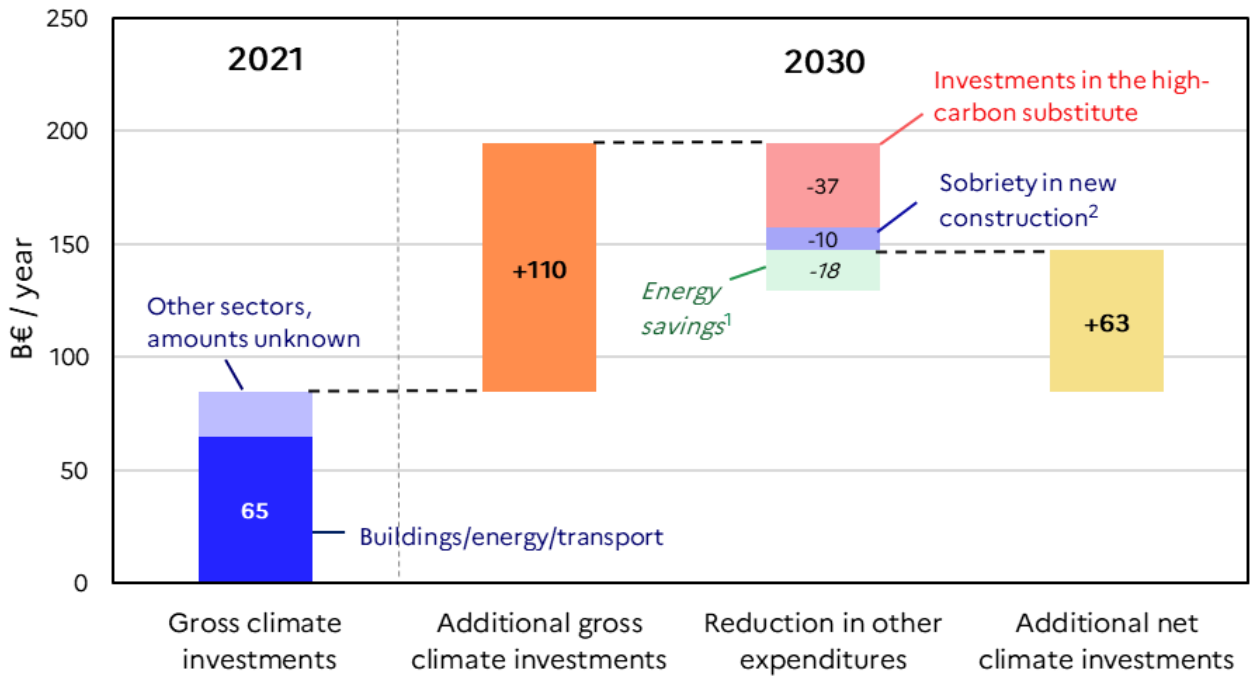
The mitigation trajectory planned by the national long-term decarbonisation strategy implies a significant increase in climate investments, partly offset by the reduction in other expenditures

Additional climate investment needs in the French national long-term decarbonisation strategy



- **Working paper on investment needs to be published** (Gourmand, 2023)
- **Orders of magnitude consistent with the task force led by Jean Pisani-Ferry and Selma Mahfouz, covers more sectors**
- **A substantial part of those investments should be carried by the private sector**
- **The French government is already investing large amounts in the ecological transition** : the 2024 budget shows an unprecedented increase of +€7 billion/year in green spending, which rises to €40 billion/year

Sources : I4CE, France Stratégie, Rexecode, Institut Rousseau, ADEME, DGE, RTE, Green Budget 2024, French Treasury calculations
Notes : 1. Energy savings compared to 2021 caused by the substitution of thermal cars with electric cars (excluding any changes in vehicule use) and building retrofits ; 2. Sobriety in new construction reduces climate investments associated with new construction compared to 2021;
For road transport and residential buildings, the authors computed those estimates based on the first run of the 3rd national long-term decarbonisation strategy. For industry, estimates were provided by the General Directorate of Companies. The authors have made their own estimates of the cost of forest renewal. For the remaining sectors, they conducted a literature review of the investment needs associated with the decarbonisation trajectory planned by the 2nd national long-term decarbonisation strategy.

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2. The principles of an effective and fair public action to achieve carbon neutrality

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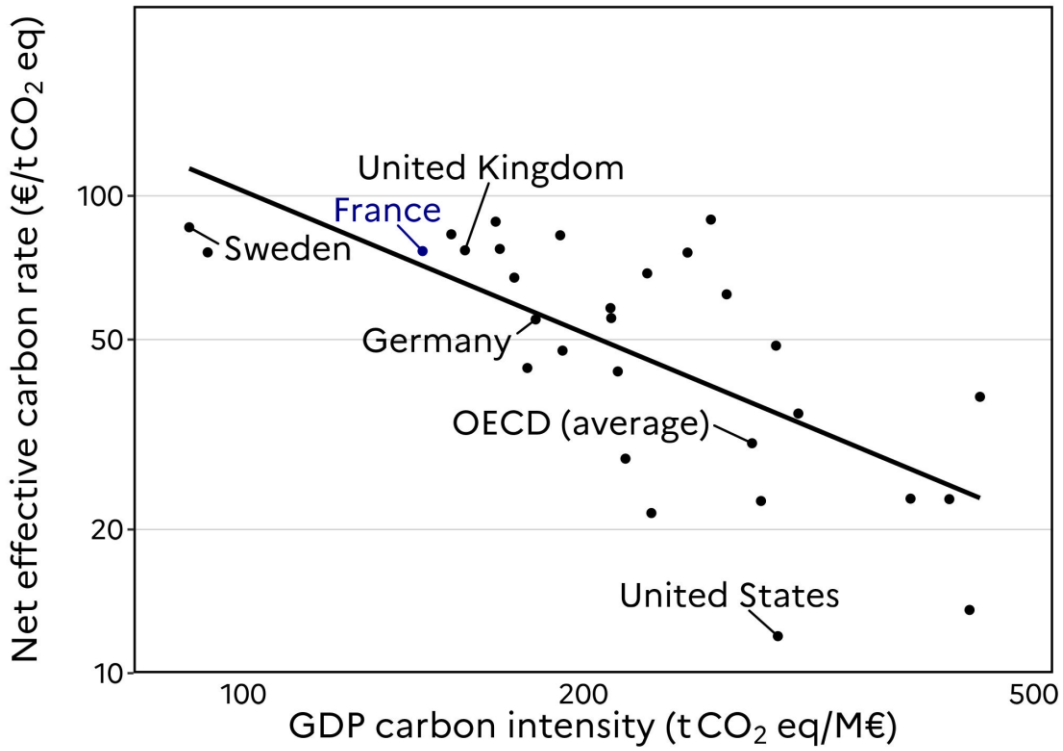
Putting a price on carbon is a powerful tool to decarbonise the economy at least cost

Global net effective carbon pricing and GDP carbon intensity, 2018



- **Empirically proven effectiveness** for reducing GHG emissions (*e.g.* EU-ETS, Sweden)
- The level of carbon pricing is positively correlated with a lower **carbon intensity of GDP** (see graph)
- Carbon pricing spontaneously triggers the **most cost-effective decarbonisation actions**, without public authorities knowing their costs in advance
- Stimulates low-carbon **innovation**
- Generates **revenues** that can be recycled (even though this is not the primary objective)

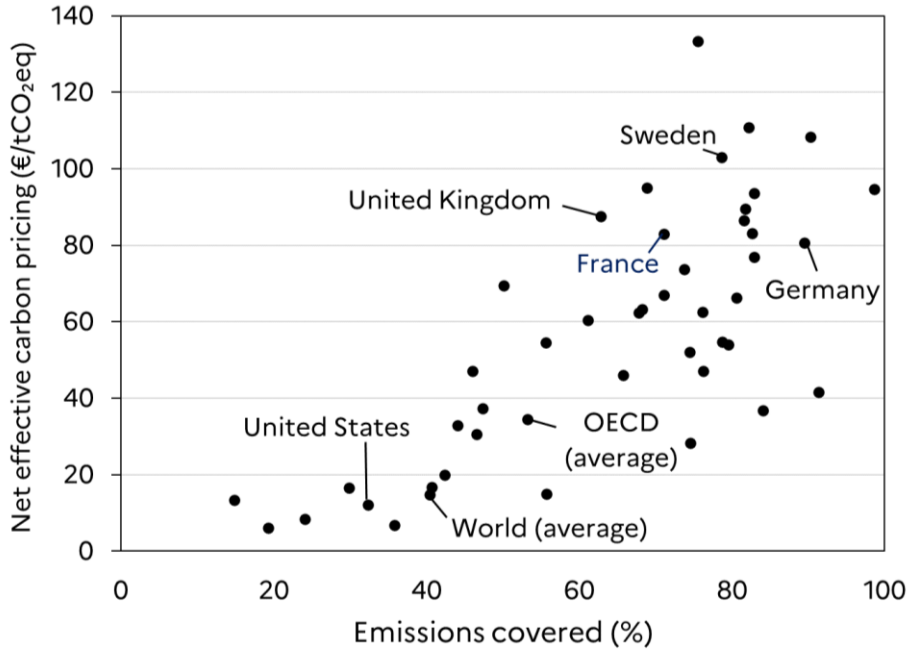
Sources : OECD; Blanchard, Olivier, Christian Gollier, and Jean Tirole (2023) "The portfolio of economic policies needed to fight climate change" Annual Review of Economics.

Carbon pricing in France is comparatively high, although heterogeneous and probably insufficient

Carbon pricing in France is comparatively high…

…but it is heterogeneous and probably insufficient to achieve decarbonisation objectives

Net effective carbon pricing across the world, 2021



Carbon pricing is heterogeneous…

- Between sectors (eg., agriculture)
- Between agents (eg., exoneration on fuel excise duty for heavy goods vehicles)

And probably insufficient : prospective modelling results for France (cf. Three-ME, Quinet) suggest a strong increase in carbon pricing will be necessary to achieve decarbonisation targets

Sources: OECD

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Decarbonisation must overcome several market and behavioral failures as well as other barriers, which calls for complementary instruments to carbon pricing

Several market and behavioral failures as well as other barriers stand in the way of decarbonisation…	…Public authorities have reacted and put in place several instruments to overcome them (examples)
Underpricing of climate externalities	**Carbon pricing** *See above*
Risk of carbon leakage	**European Carbon Border Adjustment Mechanism (CBAM)**
Obstacles to low-carbon innovation: knowledge spillovers, path dependence, long time horizon with high risk, coordination between players	**Subsidies for low-carbon innovation** : France 2030 program (€54 billion until 2030), European Funds (€67 billion for the EU between 2021 and 2027)
Information asymmetry	**Information:** Energy Performance Certificate
Behavioral biases : inattention to energy prices, household myopia, non-rational expectations	
Financing constraints	**Guarantees and risk sharing schemes:** green zero-interest rate loan, Bpifrance, concessional loans

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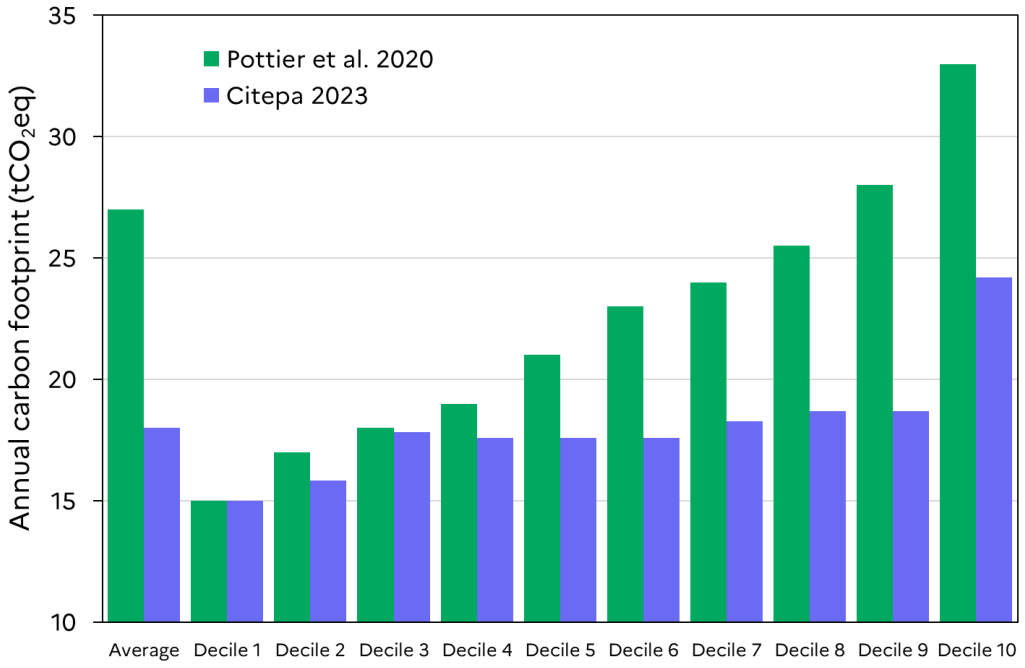
Decarbonisation policies have substantial distributive effects, which must be mitigated through support policies

Carbon footprint of French households



Carbon pricing has a direct regressive effect on households:

- Household carbon footprint increases with income…
- Nevertheless, a carbon tax leads to a greater direct cost as a proportion of income for low-income households, because they devote a larger part of their income to the consumption of emissions-intensive goods (in particular, heating and transport).

Regulatory measures, such as vehicle efficiency standard or bans, also have a distributive effect which must be analysed (*e.g.*, Low Emission Zones, regulations on fossil heating equipment)

Other sources of heterogeneity beyond income also affect households' exposure to climate mitigation policies (*e.g.*, place of residence). Understanding those is key to design measures effectively.

Implementing support policies makes it possible to partly offset the effects of certain measures on households, although it may be difficult in practice to target households effectively. They can take the form of direct support measures (*e.g.*, renovation subsidies) or indirect (*e.g.*, tax cuts, increase in social benefits).

Sources: Pottier et al. (2020) « Qui émet du CO_2 ? Panorama Critique des inégalités écologiques en France » ; Citepa (2023) « Répartition de l'empreinte carbone des Français ».

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The following analytical framework ("ABCDE" in French) would be useful to design climate mitigation policies effectively, in particular by taking into account abatement costs

Example: a subsidy for switching from an oil boiler to a heat pump

Criteria	Principle	Example: subsidy to support the switch from oil boilers to heat pumps
Abatement	What are the abatement costs and the abatement potential of the encouraged action?	Abatement cost : additional cost incurred due to converting an oil boiler to a heat pump, per tCO2 avoided Abatement potential : all emissions avoided by converting an oil boiler to a heat pump
Balancing	Does the policy increase the use of limited resources which are essential to the net zero transition?	Power : additional pressures on the power system, particularly during peak consumption in winter Biomass : no direct impact
Consistency	Is the policy consistent with other policy instruments already in place ?	Pre-existing or planned measures encouraging the switch from oil boilers to heat pumps: • Market-based instruments: upfront subsidies for heat pumps, white certificates, fuel excise tax • Regulations: ban on the purchase of new oil boilers, ban on the rental of energy-inefficient homes
Trigger effect	Will the policy actually trigger the expected actions?	Risk of windfall effects: market conditions could lead households to invest without being subsidised. To deal with this, the subsidy could primarily target low-income households for whom the triggering effect of public spending would be higher, since they are more financially constrained.
Indirect Effects	What are the other induced effects and are they desirable?	Risk of technological lock-in: the scheme may discourage a future connection to a district heating network in dense areas. Other indirect socioeconomic effects : distributive effects, reduction in energy poverty, reduction in pollution, summer thermal comfort, trade balance effects…

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3. Implications of the net zero transition for public finances (especially energy tax revenues) and the pricing of road transport externalities

Climate change and the net zero transition will have implications for public finances that remain to be explored in more detail

Mitigation policies

- Additional public investments or decarbonisation subsidies (see Chapter 2)
- Carbon tax revenue (see Chapter 2)
- Reduction in fuel excise tax revenues (see Chapter 4)

Physical effects of climate change

- Cost-sharing schemes with companies and households (*e.g.*, compensations for victims after extreme weather events)
- Damage to state-owned assets

Adaptation policies

- Public spending on reactive adaptation (*e.g.*, renovation of public buildings to improve summer thermal comfort) and preventive adaptation (*e.g.*, supporting the evolution of agricultural production towards practices resilient to climate change)

The policy mix will affect both the total costs of decarbonisation (see Chapter 2) and the way they are shared. In particular, it will determine the extent to which public finances are affected by decarbonisation.

Direct effects

Primary balance

Overall effect on public expenditures and revenues

Indirect effects

Macroeconomic variables

Overall effect on macroeconomic variables (GDP, inflation, interest rates)

Public debt

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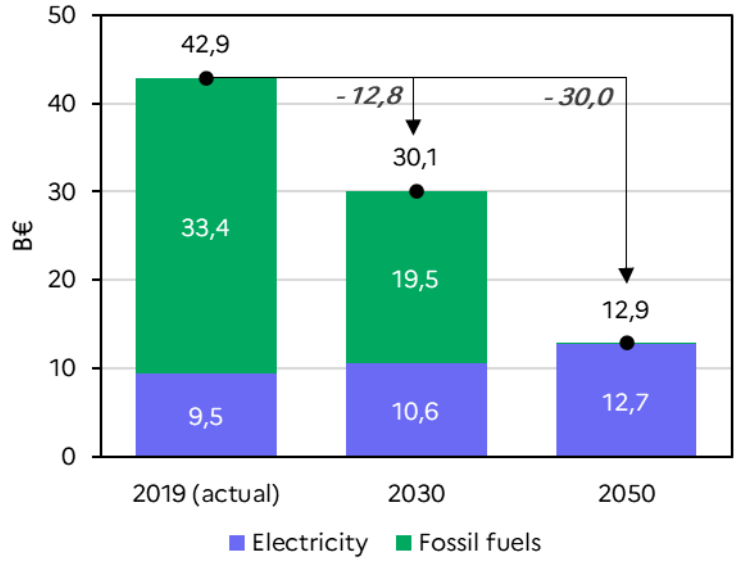
At unchanged tax rates, receipts from fuel excise duties would fall by ~€13 billion in 2030 and ~€30 billion in 2050 under the national long-term decarbonisation strategy. Road transport will play an important role in this erosion

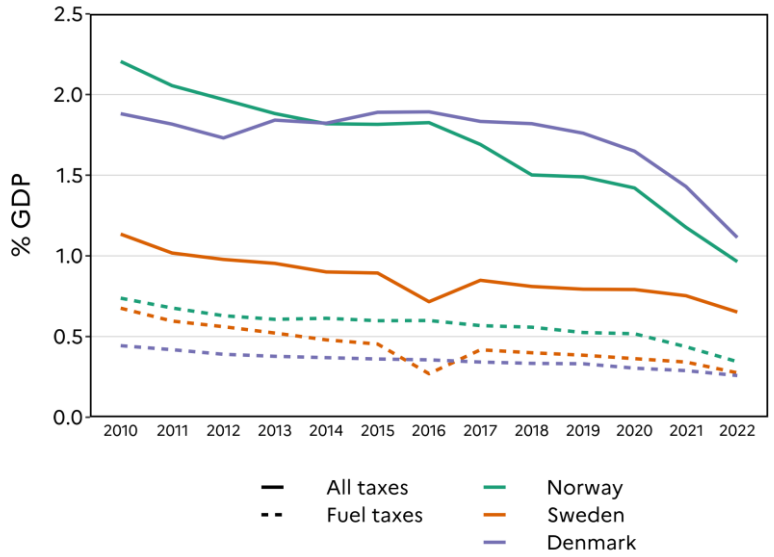
At unchanged tax rates, decarbonisation will lead to a gradual reduction in fuel excise duties, in particular due to electrification, through a rate effect (electricity is currently less taxed than fossil fuels) and a base effect (energy efficiency gains)

Fuel excise duty revenues under the national long-term decarbonisation strategy, at unchanged tax rates



The electrification of road vehicles plays an important role in the loss of fossil fuel excise duties. Excise tax duties from road fuels amounted to 1.2% of the French GDP in 2020.

Levies from road transport in Scandinavian countries from 2010 to 2022



Scandinavian countries, where a large proportion of road vehicles are electrified, are facing a **loss of revenue from taxes on road fuels as well as other road taxes** (although more research is needed to establish whether the effect is causal)

Sources: Ministry of Ecological Transition for projected consumption of petroleum products, natural gas and electricity; national data from Scandinavian countries; French Treasury; European Commission (2022): " Taxation trends in the European Union"
Notes: energy consumption projections underlying the long-term national decarbonisation strategy are currently being reviewed. Only final metropolitan energy consumption is taken into account. Projections use 2019 net weighted average fuel excise tax rates;; These estimates do not take into account the reallocation of consumption and activity, which could also have effects on public revenue.

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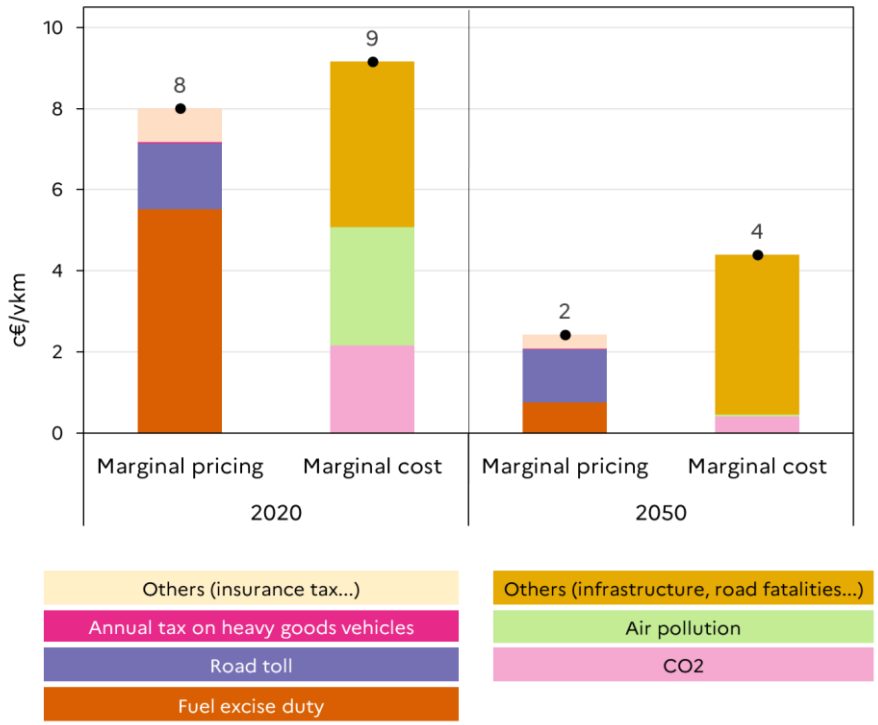
At current levels of road pricing, the electrification of vehicles would lead to a reduction in the marginal pricing of negative externalities from road transport from 90% in 2020 to 55% in 2050

Projected coverage of the external costs of road transport through pricing (all road transport modes combined)



- **In 2020, road pricing covered nearly 90% of its climate and non-climate negative externalities**: exhaust air pollution, road fatalities, infrastructure -- excluding congestion and non-exhaust pollution.
- **By 2050, at current levels of road pricing, only 55% of those external costs would be covered by road pricing, despite the electrification of vehicles**. Electric vehicles generate non-climate externalities whose social cost is poorly reflected in current road pricing schemes.
- **The pricing of negative externalities could deteriorate even further in the absence of electrification**, due to the increasing value of the shadow price of carbon.

Sources: Ministry of the Ecological Transition; French Treasury calculations
Notes: the figures presented correspond to the average marginal pricing and marginal cost of the different road transport modes, weighted by their share of distances travaelled.

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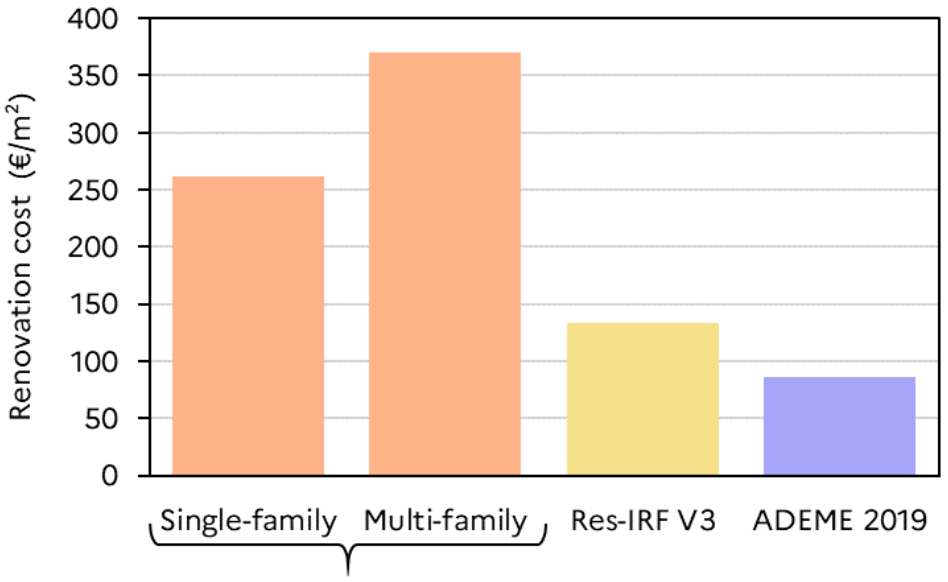
4. The economic challenges of private housing decarbonisation

Decarbonising the private housing stock plays a key role in achieving carbon neutrality in France, must but it must overcome heterogeneous abatement costs which are on average higher than previously anticipated

Average costs of retrofits leading to an upgrade of 2 EPC classes for an energy-inefficient home



Data from retrofits subsidised through MaPrimeRénov' (MPRS/MPRC)

Thermal insulation is characterised by high abatement costs for homes with intermediate energy efficiency but can be cost-efficient for very energy-inefficient homes:

- **Renovation costs** tend to be higher than anticipated by most technoeconomic models
- Actual reductions in energy consumption and emissions from retrofits tend to be **lower than predicted** by energy efficiency modelling
- **Insulation work** seems mostly effective for improving the energy performance of **very energy-inefficient homes**

The initial priority should therefore be to insulate very energy-inefficient homes and promote heat decarbonisation for others (e.g., installing heat pumps and heat networks), while ensuring low-carbon energy generation can keep pace with demand

Sources : MPRS/MPRC 2022 data, ADEME 2019, French Treasury calculations

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Increasing carbon pricing while implementing support measures for vulnerable households would be the most efficient policy mix for decarbonising the housing sector

Illustration of the effect of a carbon tax on investments: return on investment time (in years) of purchasing a heat pump rather than a gas boiler depending on household income, for two carbon price scenarios

	Current carbon price scenario	Scenario with carbon component of the fuel excise duty raised at 100€/tCO_2
Very low-income *Deciles 1 and 2*	No additional upfront cost, and the running costs of a heat pump are lower than that of a gas boiler, the return on investment is immediate	
Low-income *Deciles 3 and 4*	6	5
Intermediate-income *Deciles 5 to 8*	9	7
High-income *Deciles 9 and 10*	17	13

Sources : French Treasury calculations
Notes: both scenarios take into account existing renovation subsidies provided by white certificates and the MaPrimeRénov' scheme.

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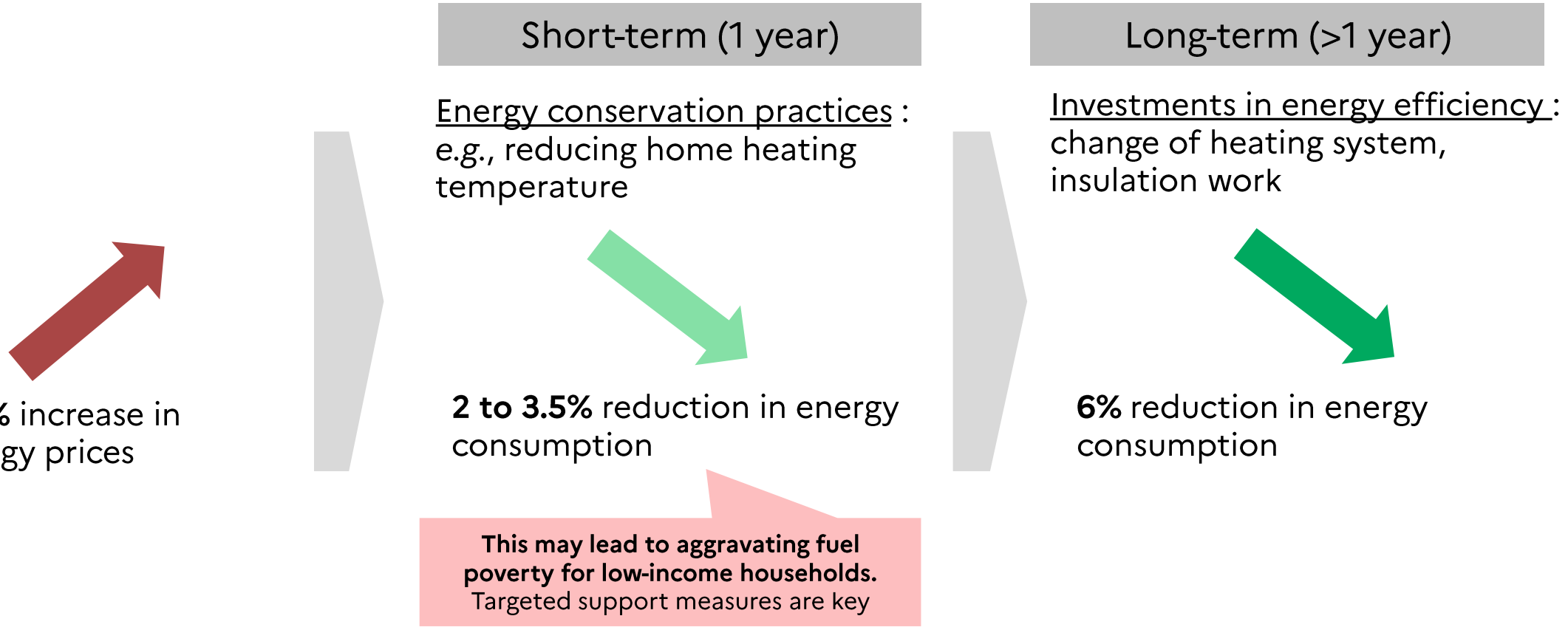
Increases in energy prices reduce energy consumption by first promoting energy conservation practices and then triggering energy efficiency investments



Sources : Labandeira et al. (2017); Douenne (2020); Berry (2019)

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Housing decarbonisation must overcome several market and behavioral failures and other barriers, for which instruments have been deployed

Several market and behavioral failures as well as other barriers stand in the way of housing decarbonisation…

Underpricing of climate externalities from energy consumption

Information asymmetries : owners vs. tenant, buyer, retrofit company, bank

Behavioral biases : inattention to energy prices, household myopia, non-rational expectations

Financing constraints

…Public authorities have reacted and put in place several instruments to overcome them (examples)

Carbon pricing: fuel excise duty (including a "carbon component")

Subsidies: MaPrimeRenov', white certificates

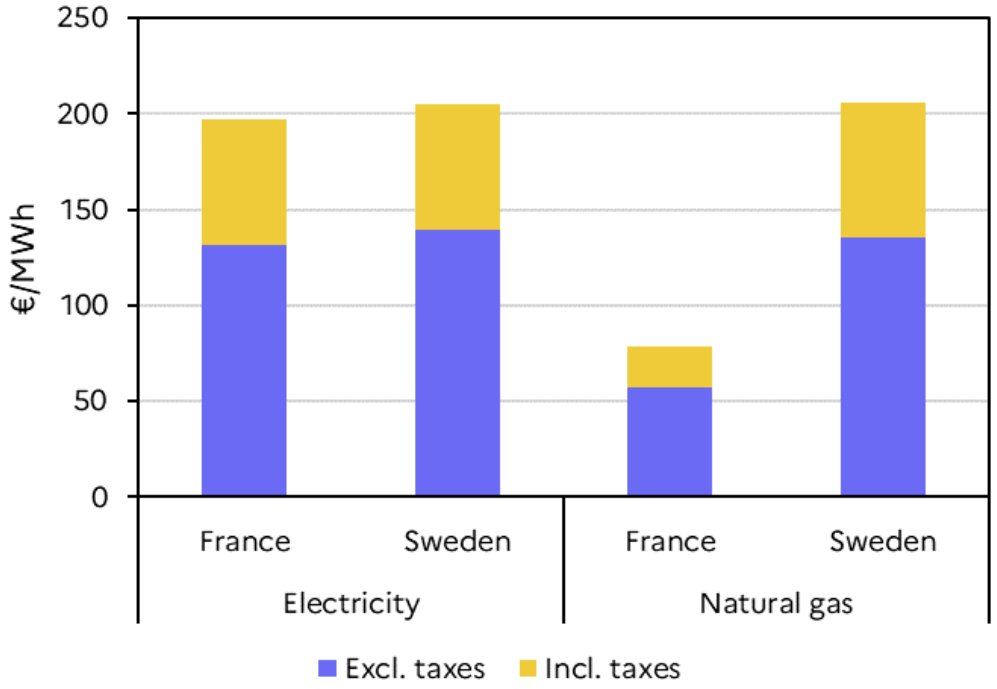
Bans: ban on the rental of energy-inefficient homes, ban on the purchase of oil boilers

Information: EPC, energy audits (mandatory in certain cases such as for multi-family dwellings), "RGE" label for certified renovation companies whose retrofits can benefit from renovation subsidies

Zero interest rate loan for renovation work

The Swedish example highlights the importance of a comprehensive policy mix to decarbonise the housing sector

Electricity and natural gas prices in France and Sweden for households in 2021



Sweden has succeeded in decarbonising its housing stock by relying on both market-based instruments and regulations:

- Sweden has the most low-carbon and among the least energy-intensive housing stock in Europe
- This performance can be attributed to the joint and early introduction of **market-based instruments** (*e.g.*, carbon tax from 1991; see attached graph) and **regulations** (*e.g.*, energy efficiency standards for new buildings as soon as 1960)
- Sweden has also relied substantially on **district heating** in urban areas

Sources : Eurostat, French Treasury calculations

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The "green value" of homes helps make renovations profitable by embedding energy efficiency into home retail prices

Home purchase green value in France (2021)

- **Green value** = price difference observed between energy-efficient and energy-inefficient homes
- **The purchase green value improves the profitability of renovations**, mainly for houses (whose green value appears sufficient to make their renovation profitable, even without subsidies) and to a more limited extent for flats.
- **In the rental market, green values on rents are lower and insufficient** to make renovations profitable for landlords.
- **Public policies have an influence on green value,** in particular, measures leading to higher energy prices (*e.g.* carbon tax) and regulatory measures (*e.g.* ban on the rental of energy-inefficient homes)

Sources : French Ministry of Housing (DHUP)