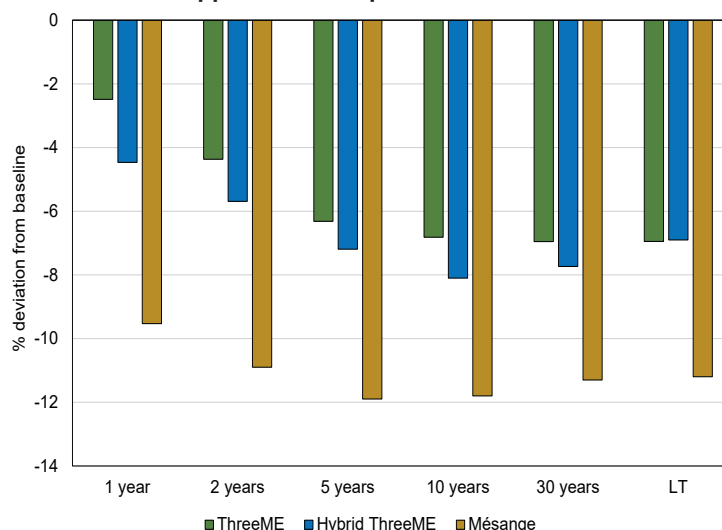


The Green Macroeconomic Model ThreeME Expands the Tools Used to Assess the French Treasury's Climate Policies

Chloé Derouen, Romain Grept, Pierre-Louis Girard and Marie Cervoni

- Since 2023, the French Treasury has used the macro-environmental model ThreeME (**M**ulti-sector **M**acroeconomic **M**odel for the **E**valuation of **E**nvironmental and **E**nergy policy), developed by the French Economic Observatory (OFCE) and the Environment and Energy Management Agency (ADEME). This model rounds off the French Treasury's suite of economic and climate policy evaluation tools, combining an in-depth approach involving energy systems which is broken down by sector, with macroeconomic feedback effects factored in.
- This model evaluates in particular the impact of climate policies, whether at the economy or sector level, such as incentives for households to make green investments in thermal retrofitting work on their homes and electrification of their passenger cars.
- The model provides a great deal of flexibility in its application as it can be used to adjust, based on specific needs, the modelling of the following factors: the number of sectors and goods modelled (particularly energy products), the activation of so-called technical-economic modules for a more in-depth modelling of housing investment and vehicle purchase decisions made by households, and the international environment.
- In collaboration with the OFCE, the French Treasury developed a shock scenario logbook (cahier de variantes). This logbook compares in particular the effect of standard macroeconomic shocks modelled using ThreeME and Mésange (a model developed by INSEE and the French Treasury) and details a set of shocks that only ThreeME can model, primarily relating to sector-specific elements.

Comparison of various model versions for the same carbon price shock of 1 pp of GDP – Impact on GHG emissions



Source: Authors' calculations and the ThreeME, Mésange and Mésange Vert models.

How to read this chart: Hybrid ThreeME is a ThreeME model with the additional technical-economic modules on transport and housing for households activated. With these modules, the complementary dynamic of energy products with other goods (cars, housing) can be factored in by granularly modelling the retrofitting and vehicle purchase decisions made by households. The GHG emissions figures for the Mésange bars actually come from the Mésange Vert module, and are larger given the higher elasticity of substitution between energy sources compared to ThreeME.

1. ThreeME enhances green modelling at the French Treasury

1.1 ThreeME, a hybrid, multi-sector macro-environmental model

ThreeME simulates the French economy on a yearly basis, modelling it in the form of a small open economy: it trades with the rest of the world, the economic conditions of which are supposed to be exogenous (foreign demand for French exports, exchange rates, foreign reference prices).

ThreeME is based on a theoretical neo-Keynesian framework in which in the short term, the economy is shaped by demand patterns while long-term behavioural patterns are determined to a greater degree by supply factors.

ThreeME is a multi-sector model in which each business sector sets its demand in four factors of production (capital, labour, energy and non-energy intermediate consumption) in order to maximise profit. While the number of sectors and goods can be easily adjusted to accommodate certain needs, the “standard” version used in this paper covers 30 or so sectors and goods. One single representative household is modelled. This household sets its consumption of each good and service based on its income and the relative price of the good/service, taking into account any consumption that cannot be reduced (e.g. essential goods).

ThreeME also comprises a hybrid module in which a microeconomic approach is used to model vehicle purchases and housing investment decisions made by the household. This module provides a detailed representation of household energy consumption. The vehicle fleet has two vehicle categories – electric and internal combustion engine – and both of them have their own classes based on the vehicle’s purchase cost and energy costs. Similarly, the housing stock is subdivided into various classes based on construction, retrofitting and energy costs.

1.2 This model serves to complement the tools already at the French Treasury’s disposal

ThreeME is used in conjunction with other French Treasury models to evaluate environmental policies.

Compared to the Mésange model, which is used by the French Treasury to evaluate shocks and economic policies on a macroeconomic basis, ThreeME is able to assess sector-specific and energy policies with greater granularity (e.g. subsidies for housing retrofits). The French Treasury recently developed the Mésange Vert module,¹ which can determine the effect of policies and economic shocks on France’s final energy consumption and related emissions. This module is used to enhance the standard evaluations carried out using Mésange, but the analysis is less granular than that of ThreeME. Lastly, to model the shock and public policy scenarios at a global scale, the French Treasury employs the Oxford Economics world macroeconomic model. The model’s outputs can then in theory be incorporated into the Mésange and ThreeME models to factor in the effect of the world’s response on the French economy, such as in the report “The economic challenges of the transition to carbon neutrality”.²

1.3 Application of ThreeME in various assessments

The ThreeME model is already used to evaluate the macroeconomic and environmental effects of transition policies. It was implemented in the ex ante macroeconomic evaluation of the National Low-Carbon Strategy (which sets out the pathway and roadmap to attaining France’s goal of carbon neutrality), in the assessment of energy transition scenarios (the Multiyear Energy Plan and ADEME’s “Outlook” [“*Visions*”] reports) and for the task force headed by Jean Pisani-Ferry and Selma Mahfouz on the economic implications of climate action.³ The model was also used to determine a pathway for the value of climate action under the Quinet Commission⁴ which constitutes a theoretical carbon price trajectory for ultimately achieving carbon neutrality that is in line with the assumptions of the third National Low-Carbon Strategy. The ThreeME model is used by the French Treasury in preparing the third National Low-Carbon Strategy, a draft⁵ of which was published to coincide with 10 years since the Paris Agreement, with oversight from the Directorate General for Energy and the Climate (DGEC). The strategy’s economic evaluation

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- (1) M. Boullot, P.L. Girard and N. Tokay (2024), “[Présentation du module Mésange vert](#)”, DG Trésor Working Paper No. 2024/4 (in French only).
 - (2) French Treasury (2025), “[The economic challenges of the transition to carbon neutrality – Final report](#)” (in French only, executive summary available in English [here](#)).
 - (3) J. Pisani-Ferry and S. Mahfouz (2023), “[The economic implications of climate action](#)”, Summary Report.
 - (4) A. Quinet (2025), “[The new trajectory for the value of climate action](#)”, France Stratégie, Summary Report.
 - (5) French government (2025), “[Projet de rapport d’accompagnement de la SNBC3](#)” (in French only).

was conducted in collaboration with the Sustainable Development Agency (CGDD). The model is also used by the French Treasury, much in the same way as the Mésange model, to evaluate environmental policies from a macroeconomic standpoint. Because of this, in addition to the shocks set out in the shock scenario logbook, ThreeME has also been adjusted so that it

can model certain environmental policies consistent with the third National Low-Carbon Strategy, such as energy saving certificates, subsidies for thermal retrofits of buildings, prohibition of the sale of new internal combustion engine vehicles, the Renewable Heat Sources Fund and subsidies for decarbonising industry.

2. A shock scenario logbook for ThreeME, compared against Mésange, was developed in collaboration with the OFCE

2.1 The model underwent several adjustments to acquire standard macroeconomic properties consistent with the Mésange model

A series of adjustments⁶ were made to the initial model by the French Treasury, in collaboration with the OFCE, to align its properties with those of the many institutional macroeconometric models, particularly the Mésange model. A series of standard analytic shocks⁷ (or alternate scenarios) were modelled (see Table 1) and compared against the Mésange model. Sector-specific and environmental scenarios specific to ThreeME were also developed: an across-the-board increase in fossil fuel prices, a sector-specific VAT hike,

a change in the electricity mix, an increase in subsidies for thermal retrofitting of housing, etc.

The shock scenario logbook reports macroeconomic results that are consistent between the two models.⁸ For example, an ex ante 1 pp of GDP increase in generic government expenditure would result in a business activity multiplier of 0.7 (and 0.9 for Mésange) over one year, just under 0.9 (Mésange: 1) over five years and 0.4 in the long term (Mésange: 0.2). A permanent 1% increase in the efficiency of labour results in an increase of growth of 0.8 pp of GDP in the long term (Mésange: 0.9).

Table 1: Summary of main results from the ThreeME shock scenario logbook: Effect on GDP, expressed as the deviation from the baseline scenario

	Magnitude of shock	1 year	2 years	5 years	10 years	30 years	Long-term
Government expenditure	+1 pp of GDP	0.68	0.79	0.90	0.80	0.46	0.45
Labour productivity	+1%	0.02	0.04	0.24	0.51	0.76	0.76
Fossil fuel prices	+13% (+\$10)	-0.18	-0.24	-0.31	-0.35	-0.34	-0.34
Fossil fuel prices (hybrid)	+13% (+\$10)	-0.14	-0.13	-0.19	-0.38	-0.22	-0.16
Carbon tax	+1 pp of GDP	-0.51	-0.63	-0.87	-1.03	-1.00	-1.00
Carbon tax (hybrid)	+1 pp of GDP	-0.30	-0.01	-0.52	-1.13	-0.73	-0.66
Subsidies for housing retrofitting (hybrid)	+50% in subsidies	2.21	2.62	0.93	-0.36	0.08	-0.04
Subsidies for electric vehicle purchases (hybrid)	Twice as many bonuses	0.00	0.00	0.01	0.09	0.24	-0.03
Carbon tax in industry	+0.1 pp of GDP	-0.07	-0.07	-0.10	-0.11	-0.09	-0.09
Electric mix: wind power vs coal	+1 pp in wind power	0.01	0.02	0.02	0.02	0.01	0.01

Source: Authors' calculations and the ThreeME model.

How to read this table: None of the hybrid modules have been activated for the version of the model used for these shocks (the standard version), except in the case of shocks where "hybrid" is specified.

- (6) These adjustments were particularly made to (i) the foreign trade module so that import prices respond to the domestic shocks and in order to incorporate overreactions in import volumes to changes in short-term domestic demand, and (ii) investment, with an eye to improving the model's long-term stability and enhancing its accelerator effect.
- (7) The method first involves developing a baseline scenario based on economic growth, population and price assumptions that is then compared to the simulated results that factor in the shocks.
- (8) See B. Largier, M. Cervoni, C. Derouen, P.L. Girard, R. Grept, F. Reynès, A. Saumtally and L. Sequeira (2026), "Comparaison des propriétés des modèles macroéconomiques français ThreeME et Mésange", *DG Trésor Working Paper* No. 2026/1 (in French only).

2.2 Compared to Mésange, ThreeME enhances the analysis of channels for responding to a carbon price shock

To cite an example, the same carbon price shock of 1 pp of GDP (i.e. an increase of €62.5/tCO₂ for the year of the shock) was simulated using the two models. The scope of application of this tax covers the emissions linked to intermediate consumption, materials, production and household consumption. There is no EU Carbon Border Adjustment Mechanism (CBAM) in place, and the proceeds from the tax are not recycled but rather are fully allocated to the reduction of the government deficit which does not affect the rest of the model.

The carbon tax hike triggers a price increase (for final consumption, investment and intermediate consumption) in carbon-intensive goods in both the ThreeME and Mésange models, and represents both a negative supply shock and a negative demand shock. Households are directly affected by an increase in the cost of energy products, which reduces their actual disposable income, while the carbon tax triggers a rise in intermediate consumption costs for businesses,

cutting into their margins. Businesses pass on this tax to consumer prices, further reducing the actual disposable income of households. In the medium to long term, the increase in production costs hampers the competitiveness of businesses, shrinking exports. Growth deteriorates over the long term, triggering unemployment. According to these channels, both Mésange and ThreeME (with no hybrid module activated) show a negative effect across the entire period (see Table 1 and Chart 1). In the long term, the recessive effect is greater in the ThreeME model given the longer lasting inflation.

Activating ThreeME's hybrid modules produces different results: the shock has a less recessive effect in this case than in the standard version because fossil fuel price increases triggered by the tax prompt households to carry out retrofitting work and purchase electric vehicles. The explicit modelling of this decarbonisation expenditure in the hybrid version results in Keynesian effects over a timeframe of two to three years and additional energy savings that improve the balance of trade (as the majority of fossil fuels are imported).

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