

ECOLOGICAL TRANSITION

EMPLOYMENT AND DECARBONIZATION: OVERVIEW OF EXISTING WORKS

May 2024

Work will not escape the consequences of climate change. In the face of this systemic phenomenon, a transition is underway and with it, economic and social effects that a growing number of researchers and organizations are trying to anticipate. **More and more work is being done on the effects of the decarbonization of the economy on employment. These reports take various approaches, making comparisons of their results and projections difficult albeit necessary to anticipate future changes.**

A number of common elements emerge:

- The studies considered are part of a decarbonization **perspective resulting from the objectives set out in the law or adopted at European level** in a context where France has set itself the ambition of achieving carbon neutrality by 2050.
- They all stress that the **consequences of the transition in terms of employment must be observed at the inter, intra-sectoral and geographical levels, and not by focusing on a balance of job creation or elimination for the whole economy.**
- These upcoming mobilities will require **dedicated support and suitable training.**

Introduction

Unédic, in its expertise role, aims to shed light on the implications of climate change and the ecological transition for Unemployment Insurance and employment in France, in order to guide the action of the social partners (trade unions and employer federations) on the subject.

In a study published in 2023¹, Unédic questioned workers on their perceptions of the ecological transition. It appears that 85% of workers are concerned about climate change and the state of the environment. A second edition, published in 2024², was devoted to the perceptions of business leaders. More than four in ten believe that the ecological transition already has a “strong” impact on their company.

This awareness of ecological issues by economic actors occurs in a context where new studies addressing the issue of employment and work in the context of a transition are published.

Three main axes of analysis can be distinguished on this subject:

1. the expected effects of decarbonization of the economy on employment in each sector (axis 1);
2. the development of so-called “green” jobs, involving taxonomy and skills classification issues (axis 2);
3. the effects of the damage caused by climate change on employment (axis 3): analyses at branch and territory level exist, but they are poorly documented at national level.

This publication thus offers a literature review of existing publications on axis 1. Axes 2 and 3 are objects of attention because of the challenges of training or retraining jobseekers (axis 2) and effects on employment at the local level or on the furloughing scheme (axis 3). These axes 2 and 3 will be the subject of further work.

Long-term prospective work reviewed

This note provides an analysis and comparison of selected national long-term prospective work recently published by:

- The Ademe: “Transition(s) 2050”, 2021. Presentation of 4 transition scenarios and all their effects.
- The Shift Project association: “Employment as a driver of low-carbon transformation”, 2021. Review of the employment aspect of the effect of the Plan for the Transformation of the French Economy developed by the Shift Project.
- The Ministry of Ecological Transition: “Macroeconomic Assessment of the National Low-Carbon Strategy”, 2022. Work carried out by the Ademe to assess the effects of the 2020 National Low-Carbon Strategy.
- The négaWatt association: “2022 négaWatt Scenario”, 2022. Implementation of an energy scenario on employment in 2017.
- France Stratégie: “Economic Impacts of Climate Action”, 2023. Report directed by Jean Pisani-Ferry and Selma Mahfouz, a thematic part of which is devoted to employment (“Labour Market”) and directed by the Dares. This is a literature review and a detailed presentation of the low-carbon scenario of the “Trades 2030” review.
- Economic Analysis Council (CAE): “Energy transition: should we fear for employment?”, 2023. Analysis of the effect of a carbon tax on employment and discussion around green jobs.
- The General Secretariat for Ecological Planning (SGPE): “Jobs and Skills Strategy for Ecological Planning”, 2024.

Many other more targeted projections, at the level of professional branches or on certain specific sectors (automotive, air transport, etc.), are not addressed in this note.

¹ Unédic, “Ecological crisis and transition: what impacts on work?”, April 2023

² Unédic, “Climate, IT, AI: employers in a time of transition”, March 2024

BOX 1 - THE MOBILISATION OF THE SOCIAL PARTNERS MATERIALIZES ON THE GROUND AND AT NATIONAL LEVEL

The social partners are at the origin of the National Interprofessional Agreement of 11 April 2023 on ecological transition and industrial dialogue. This text, signed by the MEDEF, the U2P and the CPME on the employer side and by the CFDT and the CFTC on the employee organizations side, appropriates the concept of “fair transition”³ and aims to support “a fair industrial transition to build responsible and sustainable growth”. It reminds that an “enlightened” industrial dialogue must make it possible to identify the “levers of change” of the ecological transition and highlights the competences attributed to the Social and Economic Committee in the field of the environment. It calls for “addressing environmental issues in territorial and sectoral industrial dialogue areas”.

In this context, the prospective observatories of the professions and qualifications of each branch can contribute to the identification of the issues resulting from the ecological transition, in particular in terms of training and skills.

Among the joint institutions, skills operators (Opco) are often engaged on these subjects, relaying the work of observatories and offering various resources. For example, the Industry Skills Observatory attached to Opco 2i (inter-industries) has produced work relating to its 32 branches⁴, reviewing the importance of issues on 5 axes far beyond the sole issue of greenhouse gas emissions to integrate related but crucial issues in terms of transition (biodiversity, consumption of raw materials, air quality, energy consumption, waste management). The Opco Atlas (financial services and consulting) relays Opiiec’s work on the environmental footprint of digital technology⁵. The Opco Constructys (construction) provides its members with diagnostic tools to enable them to “measure their level of ecological maturity”⁶.

The operator France compétences has created a “large library”⁷, listing the entirety of many works of the branches.

³ Recently developed in an Ademe opinion (Ademe, “Fair transition”, Ademe opinions, April 2024).

⁴ Industry Skills Observatory, “Impact of the Ecological Transition on Trades and Industry Skills - Interindustry Report”, June 2022

⁵ Opiiec, “The Digital Environmental Footprint”, March 2023

⁶ <https://www.constructys.fr/easy-diag-transition-ecologique-un-diagnostic-approfondi-et-sur-mesure-dedie-a-la-transition-ecologique/>

⁷ <https://www.la-grande-bibliotheque.francecompetences.fr>

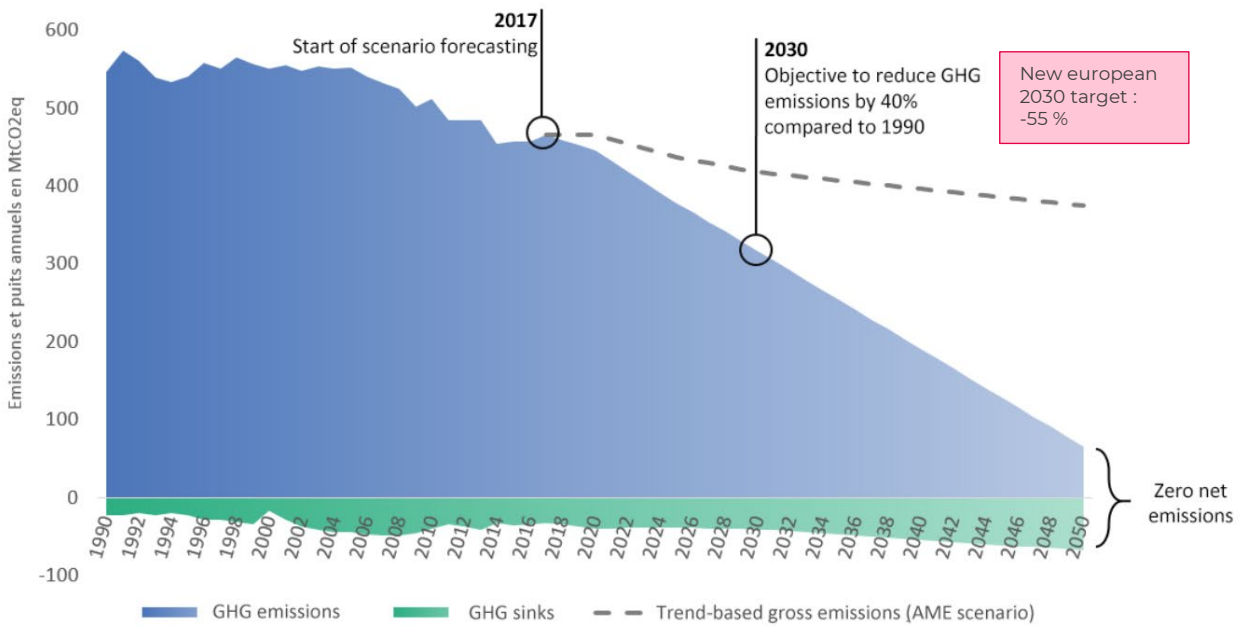
The carbon neutrality objectives of the French National Low-Carbon Strategy and the European “Fit for 55” plan

The National Low-Carbon Strategy (SNBC 1), resulting from the Law of Energy Transition for Green Growth (LTECV) of 17 August 2015, which precedes the Paris Accord, is a **roadmap** of the French government the goal of which is **carbon neutrality by 2050**, which corresponds to a level of net zero emissions, i.e. the remaining emissions are fully offset by carbon sinks. It defines the trajectory for reducing greenhouse gas emissions to achieve this objective and sets, in the short and medium term, “carbon budgets”, which are “ceilings on greenhouse gas emissions not to be exceeded at national level over five-year periods”. It was reviewed in 2020 with **SNBC 2**, which aims to achieve an intermediate target of -40 % greenhouse gas (GHG) emissions in France compared to 1990 by 2030 (Figure 1).

A third SNBC is soon to be presented with a view to bringing France’s roadmap into line with the intermediate objective adopted by the European Union in 2021: to reduce greenhouse gas emissions by 55% by 2030 compared to 1990 (“Fit for 55”).

The **National Low-Carbon Strategy** is the frame of reference for public decision-makers in France. **It is widely cited and taken as a reference by French studies on the economic impact of the ecological transition.** Referring to it is essential, especially since it also provides decarbonization trajectories by sector (Table 1).

FIGURE 1 - CHANGE AND PROJECTION OF EMISSIONS AND GREENHOUSE GAS EMISSIONS AND SINKS ON FRENCH SOIL BETWEEN 2005 AND 2050 FROM THE SNBC 2



**Business-as-usual emissions are calculated using a so-called “With Existing Measures” scenario (AME scenario), which takes into account policies already implemented or enacted in 2017.*

Source: Ministry of Ecological and Inclusive Transition, “National Low-Carbon Strategy - Synthesis”, March 2020; red annotations added by Unédic. Even if a carbon budget is not respected, **the objective of carbon neutrality by 2050 remains:** thus, the following carbon budgets become more restrictive as the objectives set are not achieved (Appendix 1).

Approaches that only consider emissions produced on the national territory, without taking into account imported emissions, have the disadvantage of not reflecting the real impact of countries’ consumption in terms of GHG emissions. It is for this reason that, even though the SNBC’s carbon budgets are considered at the national level, **the strategy explicitly aims to “reduce the carbon footprint of French consumption”** and not only to reduce the carbon emissions of the national inventory, meaning what is actually emitted on French territory. Considering only the territorial emissions target could be tantamount to simply offshoring greenhouse gas emissions⁸.

⁸ Ministry of Ecological and Inclusive Transition, “National Low-Carbon Strategy - Synthesis”, March 2020; red annotations added by Unédic.

The distribution of emissions by sector does not correspond to that of jobs

The SNBC 2 sets out the objective of carbon neutrality in 2050 by field of activity and includes medium-term objectives in 2030 expressed on the basis of 2015 emissions (*Table 1*). It thus provides that transport, for example, must decarbonize by 28% by 2030, and achieve full decarbonization by 2050, whereas it was the largest emitter in 2015 and 2021 (31% of the national total) among these 6 business areas considered by SNBC 2⁹. The next highest emitting sectors are “agriculture”, “building use” and “industry and construction”.

These sectors are those used in the Citepa Secten¹⁰ report, which “presents data on territorial emissions of greenhouse gases and air pollutants in France”. This approach is intended to be “the most complete estimate possible” of greenhouse gas emissions and therefore tends to be exhaustive. These sectors do not overlap exactly with sectors within the economic activity classification (NAF). Thus, in the Insee classification, the transport services sector covers that of warehousing, whereas this is not the case in SNBC 2. At the end of 2022, they together accounted for 5% of salaried employment in France. Agriculture accounted for 1% of salaried employment, construction 6% and industry 12% (*Appendix 2*). In addition, the Insee classification of employment does not have a category equivalent to the use of buildings or to the UTCATF of SNBC 2. It can still be concluded that **these emitting sectors cover a limited share of employment**, as noted by the Dares¹¹.

TABLE 1 - GHG EMISSIONS IN FRANCE IN 2018 AND DECARBONIZATION TRAJECTORIES FROM THE SNBC 2 BY FIELD OF ACTIVITY

	Greenhouse gas emissions (GHG) in France in 2018 Volume	Greenhouse gas emissions (GHG) in France in 2018 %	Expected decrease in GHG emissions (compared to 2015)	
			In 2030	In 2050
Building use	84 Mt of CO ₂ e*	19%	- 49%	Full decarbonization
Agriculture/forestry	86 Mt of CO ₂ e*	19%	- 18%	- 46%
Transport	137 Mt of CO ₂ e*	31%	- 28%	Full decarbonization
Power generation	46 Mt of CO ₂ e*	10%	- 33%	Full decarbonization
Industry & Construction	79 Mt of CO ₂ e*	18%	- 35%	- 81%
Forests/land sector	-	-	Maximising carbon sinks	
Waste	14 Mt of CO ₂ e*	3%	- 37%	- 66%
All sectors	445 Mt of CO ₂ e*	100%	-40%**	Carbon Neutrality

Source: Unédic from Ministry of Ecological and Inclusive Transition, “National Low-Carbon Strategy”, March 2020; Citepa, April 2023 - Secten Format
*CO₂e emissions (CO₂ equivalent) correspond to the aggregation of all greenhouse gas emissions (CO₂, CH₄, N₂O, PFC, HFC, SF₆, NF₃) presented in tonnes of CO₂ equivalent, taking into account their specific global warming potential (GWP) at 100 years.

**Excluding UTCATF: land use, change in land use and forestry.

⁹ excluding land use, change in land use and forestry (UTCATF). This sector is described as follows by the Citepa:

“This sector is currently the only one that makes it possible to achieve negative emissions thanks to natural carbon sinks: biomass (forests, hedges, agroforestry, etc.) and soils (agricultural soils, etc.)

¹⁰ Citepa, “Secten Report 2023 edition”, 2023

¹¹ France Stratégie - Dares, “Economic Impacts of Climate Action - Labour Market”, thematic report coordinated by Carole Hentzgen and Michaël Orand, mission chaired by Jean Pisani-Ferry, May 2023

ECONOMIC PROJECTIONS OF DECARBONIZATION ON EMPLOYMENT: COMMON POINTS, DIFFERENCES AND LIMITATIONS

Which objectives for which horizons?

The works considered here have one thing in common: they include decarbonization objectives that have been adopted by French or European legislators. Carbon neutrality by 2050 (“net zero emissions”) is the stated ambition of public policies in France and in Europe. It thus appears as the endpoint shared by the various approaches used in the most recent studies.

However, the projections do not necessarily share the same timeframe. Some focus on the year 2030, which is a milestone in the decarbonization goals. Depending on the framework chosen, the reduction in emissions that should be achieved in France in 2030 is 40% (SNBC 2) or about 50% (to meet the target of -55% at European level). Some review several trajectories making it possible to achieve the same objective of carbon neutrality by 2050, such as the 4 scenarios proposed by the Ademe in “Transition(s) 2050”¹², in order to compare very different paths in terms of efficiency.

While some studies integrate European objectives, most of the work on employment and the ecological transition is at the national level. However, in the fight against global warming, it does not matter whether a tonne of CO₂ is emitted in Paris or Beijing: it is at the global level that the measures must produce their effects. This issue is cross-cutting to all climate issues. However, work at national level is essential to reflect the economic and social effects of the objectives adopted by France.

The main assumptions and methods used in recent published reports on the long-term effects on employment of the decarbonization of the economy are summarized in the *Table 2*.

The difficulty of modelling the effects on employment of decarbonization

One of the main issues for this work lies in the articulation of climate objectives with their macroeconomic effects: how to assess the impact of reducing greenhouse gas emissions on economic activity and therefore on employment?

A widespread approach consists of integrating a decarbonization objective into an economic model via “standard” economic policy tools: for example, integrating a carbon tax or an investment shock in the construction sector. Several economic models predict these parameters, which makes it possible to use tools already known in the economic field to try to assess the macroeconomic impact of measures to combat climate change. These are macro-environmental models used to assess ex ante the effects of decarbonization. These analyses, as valuable as they are, give only a partial view of the effects of the ecological transition on the economy. Indeed, the range of resources that can be mobilised by States to achieve decarbonization objectives could not be reduced to setting a price or an investment shock. There are several types of macro-environmental models. The Directorate General of the Treasury lists and evaluates them in a working document¹³.

Some reviews focus on **physical flows and planetary boundaries:** it is a question of considering not only energy consumption, but also material or water consumption. This approach, which is based in particular on analyses of the life cycle of products and not on their price, has the advantage of focusing on the ecological impact of an activity. It also has its own limits. Modelling is not “closed” in the macroeconomic sense, that is to say that they do not offer a complete representation of the whole economy. As reminded by Jean-François Ouvrard¹⁴, “an only partial vision [of non-closed models] poses on the contrary the risk of highlighting the benefits (or costs) in one part of the economy, but forgetting the costs (or benefits) induced in the rest of the economy”. Moreover, because

¹² Ademe, “Transition(s) 2050: Choosing Now, Acting for the Climate”, November 2021

¹³ Directorate General of the Treasury, “Evaluation of the macro-economic impact of the ecological transition: review of the macro-environmental models, uses and limits”, September 2022. It emerges that the most widespread are computable general equilibrium models (CGE, such as ThreeME) and macroeconomic models (such as Nemesis). Used also for other types of economic policies than climate transition, they have been tried and tested and approved. However, they have limitations, starting with the lack of transparency, whether in the description of the mechanisms and/or in the presentation of the results. The Treasury notes that this is more or less marked depending on the type of model. In the case of models of CGE types, this is in addition to a lack of a common theoretical foundation, so that the results depend strongly on the modelling choices. Macroeconomic models have a very large number of equations, estimated separately and not jointly. Another limitation relates to coping mechanisms by agents. They are excluded in CGE-type models, which is a blindspot. Conversely, macroeconomic models assume adaptive expectations, which hinders the analysis of the adaptation mechanisms implemented by agents.

¹⁴ Jean-François Ouvrard, “A difficult yet essential macro-economic analysis of ecological transition”, *Revue d'économie financière* 2015/1 (No. 117), pages 63 to 73

of the complexity of the analyses to be carried out to describe developments in each sector, these projections are not exhaustive: some sectors are set aside, for lack of analyses to assess their impact in terms of GHG emissions (the Shift Project cites for example higher education and research, or defence and homeland security).

Most of the work, however, strives to present the employment impact at the sectoral level. Indeed, much more than the balance of job creation or destruction on the horizon considered, it is the movements between sectors and within sectors that characterise the transformations of employment expected in the context of the ecological transition.

Several institutions (Dares, Ademe, CAE) opt for the first approach described above (economic model) and adopt for all or part of their work¹⁵ the hypothesis of labour productivity (*Definition*) which continues to grow at the rate of 1% per year. This hypothesis is a continuation of the trend of the 2010s. This is a strong hypothesis insofar as the downward shock to labour productivity that occurred during the Covid crisis was massive and has not yet been reversed. The trajectory of labour productivity in the short and medium term is still being debated by economists. Whatever the conclusion, **assuming labour productivity gains identical to those known in the past is tantamount to assuming that the ecological transition would have no effect on labour productivity or that it would be offset by another growth factor.** The economic literature presented in one of the subsidiary reports of France Stratégie¹⁶ dedicated to productivity presents several existing reviews on the subject, specifying the limits and incompleteness of each of them. However, their tone is generally in the direction of less growth induced by the ecological transition¹⁷. Faced with this, either employment is declining, preserving labour productivity, or employment is maintaining or even increasing, cutting back on the pace of labour productivity. The Shift Project goes even further, considering zero productivity gains in the future given the physical and planetary constraints dictated by the ecological transition (second approach described above).

¹⁵ In the CAE note, "Energy transition: should we fear for employment? ", 2023, this is the ThreeMe model and concerns only the part on the simulation of the effects within the national economy of a carbon tax of €100 per tonne of CO₂.

¹⁶ France Stratégie, "Economic Impacts of Climate Action - Productivity", thematic report coordinated by Anne Epaulard of the mission chaired by Jean Pisani-Ferry, May 2023

¹⁷ This diagnosis is based in particular on the assumption that investments for the ecological transition would be at the expense of those for research, the slightest funding of which would affect labour productivity.

THE REAL ISSUE: INTER- AND INTRA-SECTORAL REALLOCATIONS

Despite the difficulties and differences in modelling on the subject, many observations are shared by all observers. *Table 3* collates the main results of the reports reviewed here.

Labour reallocations to be planned

If the low-carbon strategy is carried out, the major effect of the climate transition on employment lies in inter and intra-sectoral mobility, which could be massive and affect millions of workers. All reports reviewed share this finding of intersectoral mobility that would lead to the destruction of jobs in certain sectors or sub-sectors (for example, internal combustion cars, new construction, etc.) and to the creation of jobs in others (renovation of buildings, repair, soft mobility, etc.). The Economic Analysis Council (CAE), in recent work, also highlights the **very high degree of intra-sectoral heterogeneity** in terms of greenhouse gas emissions. “Surprisingly, the differences between establishments in the same sector are greater than those between sectors. This is a fundamental fact in the debates on future decarbonization efforts: certainly, the sectors are unequal in the face of the task at hand, but the entities that make them up are just as unequal, if not more so”, per the CAE¹⁸. Lastly, geographical reallocations are also to be expected because some high emitting territories would see their employment decrease while others, more peripheral, would have high labour needs.

Need for support and training for workers

Anticipation of high mobility between sectors and within each sector highlight the need to accompany the ecological transition with policies to support suitable careers and training. These findings run through most of the recent work on the subject, starting with the 2019 “Employment and skills programming plan” led by Laurence Parisot, which examined employment and skills issues sector by sector¹⁹. The General Secretariat for Ecological Planning identifies this topic as the “key” to successful ecological planning²⁰, noting however that three “challenges” will need to be addressed: “current and future sectoral dynamics that are sometimes unfavourable” (talent scarcities already at play, for example), “a process of destruction/creation induced by the ecological transition” and “employment/training and ecological transition strategies to be coordinated” (thus, the SGPE stresses that there are “different time horizons between actors in training (2-3 years) and the ecological transition (2030 and beyond)”). The scale of the transition thus goes far beyond the issue of “green jobs” (*Box 2*). Lastly, the Ademe²¹ stresses that securing the careers of workers in transition will require “bringing together those involved in employment, training and the environment”.

No massive job destruction overall

The scenarios rule out the fear of major job losses accompanying the ecological transition and even conclude for the most part to a positive overall effect on net job creation: the scenarios thus oscillate between +300,000 jobs and +900,000 jobs by 2050, with the exception of the “Frugal generation” scenario of Ademe’s “Transition(s) 2050”, with -1.5 million jobs by 2050 (*Table 3*). However, it can be considered that the uncertainty existing on the change in employment over such long timeframes puts these figures in perspective, making them a secondary issue.

- On the one hand, in relation to total employment, the anticipated net creation/destruction volumes, of the order of 10,000 to 40,000 per year, are low at the national level and over a long-term horizon. Let us remind that France has 27 million people in paid employment and that employment can vary by several hundred thousand persons per year (+320,000 in 2017, +380,000 in 2019, +875,000 in 2021 at the end of the Covid crisis).
- On the other hand, the margin of error surrounding projections so far away (several decades) is large. As reminded by the Dares, the final effects strongly depend on the assumptions in terms of investment and financing of the transition²².

¹⁸ Economic Analysis Council, “Energy transition: should we fear for employment? ”, Notes of the Economic Analysis Council no. 90, November 2023

¹⁹ Assignment entrusted to Laurence Parisot, “Employment and skills programming plan”, February 2019

²⁰ SGPE, *ibid.*

²¹ Ademe, “Fair transition”, Ademe opinions, April 2024

²² France Stratégie - Dares, “Economic Impacts of Climate Action - Labour Market ”, May 2023, p 15

Some sectors are expected to experience recruitment tensions

Comparison of review projections at the sectoral level is difficult (*Table 3*).

- Some sectors are still poorly reviewed, such as air transport or health. In addition, some analyses focus on only a part within a large sector (example: for construction, some works account for new construction, others are only interested in renovation).
- In addition, the reports are not always based on the same sector breakdown. For example: the Shift Project analyses the “bicycle” sector, whereas in the sense of Insee’s classification of French activities (NAF), the manufacture of bicycles ranks in industry, bicycle delivery in the Transport and Logistics sector, and the marketing of bicycles in commerce.

Faced with the difficulty of conducting systemic analyses across all sectors, the Dares recommends supplementing macro-sectoral analyses with monographic approaches²³.

It can be noted, however, that **a consensus is emerging that one of the biggest sources of employment will be the construction / energy renovation sector**, a sector where labour shortages are already present. Several reports thus raise the question of the attractiveness of these trades, which are about to be increasingly subject to scarcities in the years to come.

Also, all the recent reports cited here mention important transformations to come in **transport**, with job losses in certain sub-sectors (internal combustion cars, aeronautics) counterbalanced by job creation in other sub-sectors (electric cars, soft mobility).

Lastly, the **energy** sector employs relatively few workers nationwide. Thus, although logically very much impacted by the plans to limit greenhouse gas emissions, its contribution in terms of changes in employment as part of a decarbonization trajectory would be positive but limited.

Unlike the convergences of projections for the construction, transport and energy sectors, there is a **certain disagreement on the trajectory of the agricultural sector**: only the Shift Project projects significant recruitment in this sector while the other reports predict a slow erosion of the number of farmers.

At the international level, the adoption in 2021 by the European Union (EU) of a common target (55% reduction in greenhouse gases by 2030) was followed by work analysing the impact of this “adjustment” according to countries and sectors (*Box 3*). They conclude that the impact on overall employment in the European Union is limited, which echoes the conclusions of the work on France.

²³ France Stratégie, *ibid.*, p. 9

BOX 2 - THE GREEN JOBS ISSUE: SEE THE WOOD FOR THE TREES

The issue of ecological transition and employment is often initially considered in terms of “green jobs”, which are often said to be experiencing a significant boom. So-called “green” jobs actually cover only a tiny fraction of employment today.

What is a “green job”?

To understand the notion of green job, we must first look at the definition of green trades. The national observatory of green economy jobs and professions (Onemev) uses a very restrictive definition: “a green trade is a trade the purpose and/or skills of which contribute to measuring, preventing, controlling and correcting negative impacts and damage to the environment”²⁴. These trades are identified from the operational directory of trades and jobs (Rome). They correspond to 9 professions according to the socio-professional categories of INSEE (*Appendix 3*).

The Onemev also defines “greening” jobs as jobs “the purpose of which is not directly environmental, but the skills of which are changing to integrate environmental issues.” However, these trades are difficult to identify. Indeed, can the following trades be considered green /greening:

- A delivery person driving in an electric vehicle?
- A household electrical repairer?
- A farmer?
- A restaurateur who produces “homemade” products and uses products from his farm?
- An employee of a financial institution specialising in the financing of ecological projects?

A minimal weight in total employment

Green jobs within the meaning of the Onemev would represent only 141,000 jobs in 2019 according to the Statistical Data and Reviews Department of the General Commission for Sustainable Development (SDES), i.e. 0.5% of jobs. Despite this low weight, they are already experiencing recruitment difficulties: in 2019, companies indicated that 60% of recruitment projects related to the green economy were difficult, compared to 50% on average for the entire labour market.

The Ademe, for its part, adopted a different approach for its review “Markets and jobs contributing to the energy transition”²⁵, which considers about thirty sectors regrouped into three main sectors: renewable and recovered energy (EnR&R); energy-efficient and low-emitting land transport; residential construction. Ademe estimates that 426,000 full-time equivalent jobs fell into these categories in 2021. It also highlights recruitment difficulties in green professions, which are particularly significant in the construction sector²⁶.

The number of green jobs or jobs contributing to the energy transition remains minor compared to all the reallocations to be planned. Essential to the ecological transition, they are nevertheless poised to grow further, reinforcing the scarcities already at play on some of these jobs.

²⁴ The Onemev brings together the main structures involved in the monitoring and observation of the green economy or, more generally, the ecological transition: CGDD, INSEE, Dares, DGEFP, Directorate General of the Treasury, France Travail (formerly Pôle emploi), Céreq, France Stratégie, France compétences, Ademe, Afpa, Apec, CNFPT and Carif-Oref network.

²⁵ Ademe, “Markets and Jobs Contributing to the Energy Transition”, 2023

²⁶ Ademe, “Fair transition”, Ademe opinions, April 2024

TABLE 2 - SUMMARY OF THE MAIN ASSUMPTIONS AND CHARACTERISTICS OF THE PROJECTIONS OF THE EFFECT OF THE DECARBONIZATION OF THE ECONOMY ON EMPLOYMENT

Producer (Report Date)	Ministry of Ecological Transition - Ademe (2022)	Ademe (2021)				Economic Analysis Council (CAE) (2023)	Dares - France Stratégie (2023) Based on "Trades 2030" Low-carbon scenario	négaWatt (2022)	The Shift Project (2021)	SGPE (2024)
		S1 "Frugal generation"	S2 "Territorial Cooperations"	S3 "Green Technologies"	S4 "Repair Bet"					
Decarbonization targets (changes in GHG emissions compared to 1990)	2030: -40% 2050: carbon neutrality	2030: -54% (step) 2050: carbon neutrality	2030: -53% (step) 2050: carbon neutrality	2030: -47% (step) 2050: carbon neutrality	2030: -40% (step) 2050: carbon neutrality	2030: -50% 2050: Not reviewed	2030: -40% 2050: Not reviewed	2050: carbon neutrality	2050: carbon neutrality	2030: - 40% (based on "Trades 2030") 2050: Not reviewed
How is compliance with the trajectory attained?		Sharp decline in production of carbon-intensive goods	Moderate decline in carbon-intensive goods production and increased investment in renewable energy	Moderate investment in renewable energy AND more imports	Very strong technological advances make it possible to reduce the carbon impact	Carbon tax at 100 euros per tonne	Household and business investment shock in construction, transport and energy decarbonisation	Complete energy modelling that ultimately has consequences on employment	Several levers mobilised (reallocations, technological innovations, efficiency...).	
Type of tool	ThreeME Computable General Equilibrium Model (CGEM)	Combinations of several models: ThreeME Computable General Equilibrium Model (CGEM) and sector-specific models				ThreeME Computable General Equilibrium Model (CGEM) + microeconomic model	Macroeconometric model Nemesis	Physical constraint approach	Physical constraint approach	Based on various sources (Dares, Edec, Shift Project.)
Productivity assumptions	Gains of around 1% per year					Gains: 1% for ThreeMe	Gains of around 1% per year	0.5%	Consistent Productivity - (zero gains)	-

Sources: Unédic, from Ademe, "Macroeconomic evaluation of the National Low-Carbon Strategy (SNBC 2) with the ThreeME model", February 2022; Ademe, "Transition(s) 2050: choose now, act for the climate", November 2021; CAE, "Energy transition: should we fear for employment?", November 2023; Dares - France Stratégie, "Economic Impacts of Climate Action", thematic report of the mission chaired by Jean Pisani-Ferry, May 2023; The Shift Project, "Employment fostering low-carbon transformation", December 2021; négaWatt, "négaWatt 2022 Scenario", April 2022; SGPE, "Employment and skills strategy for the ecological planning (preliminary version)", February 2024.

TABLE 3 - SUMMARY OF THE RESULTS OF THE PROJECTIONS OF THE EFFECT OF THE DECARBONIZATION OF THE ECONOMY ON EMPLOYMENT

Producer	Ministry of Ecological Transition - Ademe (2022)	Ademe "Transition(s) 2050" (2021)				Economic Analysis Council (CAE) (2023)	Dares - France Stratégie (2023) Based on "Trades 2030" - Low-carbon scenario	négaWatt (2022 from a 2017 scenario)	The Shift Project (2021)	SGPE (2024)
		S1 "Frugal generation"	S2 "Territorial Cooperations"	S3 "Green Technologies"	S4 "Repair Bet"					
Timeframe	2030/2050	2030 / 2050				2030	2030	2030 / 2050	2050	2030
Employment impact in 2030	+ 540,000	- 2,000	+ 600,000	+ 510,000	+ 800,000	From - 167,000 to + 92,000	+ 200,000	+ 415,000	Unspecified	+ 150,000
Effect on employment in 2050 (or by default, 2030), including:	+ 880,000	- 1,500,000	+ 180,000	+ 160,000	+ 700,000	Not reviewed	Not reviewed	+ 613,000	+ 300,000	Not reviewed
Energy	+ 30,000	Minimal variation *	Slight rise *	Approx. + 100,000 *	Approx. + 100,000 *	Unspecified	Unspecified	+ 305,000 (renewable) - 140,000 (non-renewable)	+ 15,000 (power generation)	+ 114,000 electricity, gas and heat
Construction	+ 200,000	Approx. - 300,000 *	Approx. - 100,000 *	Slight drop *	Approx. + 100,000 *	Increase**	+ 126,000	+ 388,000 construction	- 90,000 including + 100,000 renovations and - 190,000 new construction	+ 160,000 of which + 210,000 renovation and - 50,000 construction
Merchant Services	+ 550,000	Approx - 300,000 *	Approx. + 800,000 *	Approx. + 500,000 *	Approx. + 500,000 *	Slight increase**			Not reviewed	Not reviewed
Industry	+ 50,000; + 15,000 (car manufacturing)	Approx. - 800,000 *	Approx. - 400,000 *	Approx. - 400,000 *	Minimal variation *	Decrease**	- 10,000	+ 85,000 (repair and efficiency of devices)	- 310,000 car manufacturing, + 230,000 bicycle; - 16,000 (cement)	- 60,000 automotive and - 60,000 other industries
Transport - logistics	- 17,000	Approx. - 100,000 *	Approx. - 100,000 *	Slight drop *	Minimal variation *	Neutral**	- 65,000	- 193,000	+ 6,000 long-distance mobility and - 3,000 freight	+ 45,000 rail
Utilities	+ 32,000	Approx. + 100,000 *	Approx. + 100,000 *	Slight rise *	Minimal variation *	Neutral**	Not reviewed	Not reviewed	Not reviewed	Not reviewed
Agriculture	+ 23,000	Approx. - 100,000 *	Approx. - 100,000 *	Slight drop *	Minimal variation *	Increase**	+ 16,000	Not reviewed	+ 450,000 (including agribusiness and food trade)	- 8,000

Sources: see Table 2.

* Note: the orders of magnitude of the effects estimated by ADEME on employment - for each of the 4 scenarios S1 to S4 - are determined graphically

** Effects according to the scenario integrating the full redistribution of the carbon tax

BOX 3 - EUROPEAN PERSPECTIVES

On 25 October 2023, the European Foundation for the improvement of living and working conditions (Eurofound) published a report entitled “Anticipating and managing the impact of change, Climate package “Fit for 55”: impact on employment in the European Union by 2030”²⁷.

This report presents projections based on a macroeconomic model on how the European “climate package” aimed at accelerating the ecological transition (e.g. energy efficiency, alternative fuels, the fight against soil artificialisation, etc.) could affect the territorial and sectoral employment structure in the EU by 2030.

A marginal impact on employment in Europe

It is projected that a total of approximately 200,000 jobs will be created in the EU Member States as a result of the Fit for 55 adjustment package, in addition to the trend employment growth estimated at 6.7 million net job creations (+0.5%) between 2019 and 2030. These creations **are very modest** compared to the scenario without ecological transition, because the jobs created in the green sectors would in fact be compensated by the losses in the other sectors of activity, in particular the carbon-intensive ones.

A differentiated impact by country, sector and type of employment

The effects on employment are, however, expected to vary from region to region and from country to country depending on the reliance of economies on certain sectors (e.g. carbon industries, agriculture, etc.) on the one hand, and on the ability of these countries to take advantage of green opportunities on the other.

- **Anticipated positive employment effects in southern European countries** (e.g.: Italy, Spain) and in regions with natural resources (wind and sun), or manufacturing capacities for energy equipment.
- **Negative effects on employment in some central and eastern European countries** (e.g.: Romania, Poland, Bulgaria) and in regions where the proportion of workers in the extractive and agricultural industries is relatively high.
- The sector likely to benefit the most from the ecological transition in terms of employment is **construction** (improvement of energy efficiency, development of renewable energy capacities). The market services sector is expected to grow by 0.2%, i.e. 146,000 jobs in 2030, and non-market services to decrease by 0.1%, i.e. 38,000 jobs related to the ecological transition.
- Conversely, according to this report, employment in certain sectors (agriculture, mining or industry) should suffer negative effects (job destruction).

The jobs created will tend to concern relatively low-skilled jobs (unlike the jobs created in the last decade which mainly concerned high-skilled jobs). Changes in employment are likely to favour male employment (growth in the construction sector).

²⁷ Eurofound (European Foundation for the improvement of living and working conditions) is a European Union agency which produces reports in the fields of working conditions, industrial relations, employment and living conditions. Its governance is composed of representatives of the Member States and the social partners. <https://www.eurofound.europa.eu/en/publications/2023/fit-55-climate-package-impact-eu-employment-2030>

Beyond the decarbonization of the economy, the effects of climate change on employment remain to be documented

In a context where the State, companies and the social partners are embarking on an ecological transition, studying the impact of this transition on employment is essential. If the anticipated effects on the overall level of employment are not massive, all the publications mentioned in this literature review agree that the inter and intra-sectoral effects will be significant. The issue of workers' skills appears to be particularly important in order to protect workers from unemployment.

Climate change raises other issues, which have not been addressed here. The damage caused by climate change, as well as the adaptation policies deployed to try to counteract it, could have effects on employment that might be of interest to the Unemployment Insurance. As close as possible to the field, the effects on tourism (via depletion snow cover, for example) could be reviewed from the point of view of the use of public policies (use of the furloughing scheme) and employment (business bankruptcies, periods of unemployment, retraining) (Box 4). Lastly, beyond the issues specifically related to climate change, the biodiversity crisis could also have an impact on employment and work. It therefore seems essential to continue the analysis and monitoring of the ecological transition on employment.

BOX 4 - A NECESSARY TERRITORIAL APPROACH

Some recent work deals with the link between employment and ecological transition at the local or trade level. In their report "Rising to the Challenge of Retraining - The case of French coal", the Veblen Institute for Economic Reforms and the Climate Action Network France thus consider, from the point of view of a very specific sector, that it is "urgent to anticipate and accelerate the exit from our collective dependence on fossil fuels"²⁸. This report also makes a number of general recommendations for workers **in sectors that emit the most greenhouse gases**, for example fossil fuels or petrochemicals. The authors of the report make four recommendations, three of which articulate territorial and national dimensions.

- "Providing **specific and sustainable funding** for the animation and operation of the **territorial platforms for professional transitions** [...] recently relaunched within the framework of the Collective Transitions mechanism [...]"
- "Systematically consulting the social and environmental actors of the territory when developing **alternative industrial projects.**"
- "Integrating **the impact on employment of climate/energy guidelines into territorial schemes** such as the Regional Planning, Sustainable Development and Territorial Equality Schemes (SRADDET) and the Territorial Climate-Air-Energy Plans (PCAET)."

In this context, **industrial dialogue at the territorial level** appears necessary to support a **fair ecological transition**, compatible with French climate commitments. Therefore, it seems desirable that the social partners, within the regions and territories, share their vision of local issues with employment and training actors as well as with ecological actors.

For the social partners managing the Unemployment Insurance, the **members of the joint bodies ("instances paritaires")** in particular could represent a useful local relay.

²⁸ Veblen Institute for Economic Reforms and Climate Action Network France, "Rising to the Challenge of Retraining - The Case of French Coal", 2022

Bibliography

- Ademe (2021), "Transition 2050: Choosing Now, Acting for the Climate"
- Ademe (2022), "Macroeconomic Evaluation of the National Low-Carbon Strategy (SNBC2) with the ThreeME Model"
- Ademe (2023), "Markets and jobs contributing to the energy transition"
- Ademe (2023), "Transition risks: multi-model analysis for France"
- Ademe (2024), "Fair Transition"
- CAE (2023), "Energy transition: should we fear for employment?"
- Citepa (2023), "Secten Report 2023 edition"
- Dares (2022), "Trades 2030"
- Directorate General of the Treasury (2022), "Assessment of the Macroeconomic Impact of the Ecological Transition: Review of macro-environmental models, uses and limits"
- Directorate General of the Treasury (2023), "Challenges of the transition to carbon neutrality - Interim report"
- Eurofound (2023), "Fit for 55 climate package: Impact on EU employment by 2030"
- France Stratégie (2023), "Economic Impacts of Climate Action - Labour Market"
- France Stratégie (2023), "Economic Impacts of Climate Action - Productivity"
- Veblen Institute for Economic Reforms and Climate Action Network France (2022), "Rising to the Challenge of Retraining - The Case of French Coal"
- Ministry of Ecological and Inclusive Transition (2020), "National low-carbon strategy - The ecological and inclusive transition to carbon neutrality"
- négaWatt (2017), "2017 - 2050 négaWatt Scenario: Making a success of the energy transition in France"
- négaWatt (2022), "2022 négaWatt Scenario: The energy transition at the heart of a societal transition"
- Onemev (2020), "Methodological Review of the Statistical Monitoring of Employment in Green Trades"
- Parisot, L. (2019), "Employment and skills programming plan - preparatory mission"
- Quirion, P. (2013), "The net effect on employment of the energy transition in France: An input-output analysis of the négaWatt scenario", CIRED working paper series
- SGPE (2024), "Jobs and skills strategy for ecological planning"
- The Shift Project (2021), "Employment: driving low-carbon transformation"

Glossary

Ademe	Agency for the Environment and Energy Management, a public establishment of an industrial and commercial nature, under the supervision of the Ministry of Ecological Transition
CAE	Economic Analysis Council, attached to the Prime Minister
CGDD	General Commission on Sustainable Development, within the Ministry of Ecological Transition and Territorial Cohesion
Citepa	Association, formerly “Interprofessional Technical Centre for Studies on Atmospheric Pollution”
CO2	Carbon dioxide
Dares	The Directorate for Research, Studies and Statistics, at the Minister of Labour
DGEFP	General Delegation for Employment and Vocational Training, at the Minister of Labour
Directorate General of the Treasury	Directorate General of the Treasury, within the Ministry of Economy and Finance
Edec	Employment & Skills Development Commitment
GHG	Greenhouse gases
IPCC	Intergovernmental Panel on Climate Change
CGEM	Computable general equilibrium model
NAF	Classification of French activities
OFCE	French Economic Observatory, an independent body hosted by the National Foundation of Political Sciences
Onemev	National Observatory of Green Economy Jobs and Trades, attached to the Ministry of Ecological Transition and Territorial Cohesion
Opcoc	Skills Operator, replaced the Authorised Joint Collector Operators (OPCAs)
Opiiec	Formerly “Joint Observatory of IT, engineering, survey and advisory trades”, now Observatory of IT, engineering, advisory and event trades
PCAET	Territorial Climate-Air-Energy Plan
SDES	Data and statistical reviews department, attached to the General Commission for Sustainable Development (CGDD), within the Ministry of Ecological Transition and Territorial Cohesion
Secten	Economical and Energy Sectors
SGPE	General Secretariat for Ecological Planning, under the authority of the Prime Minister
SNBC	National Low-Carbon Strategy
SRADDET	Regional development plan, sustainable development and territorial equality
EU	European Union
UTCATF	Land use, change in land use and forestry

Definition

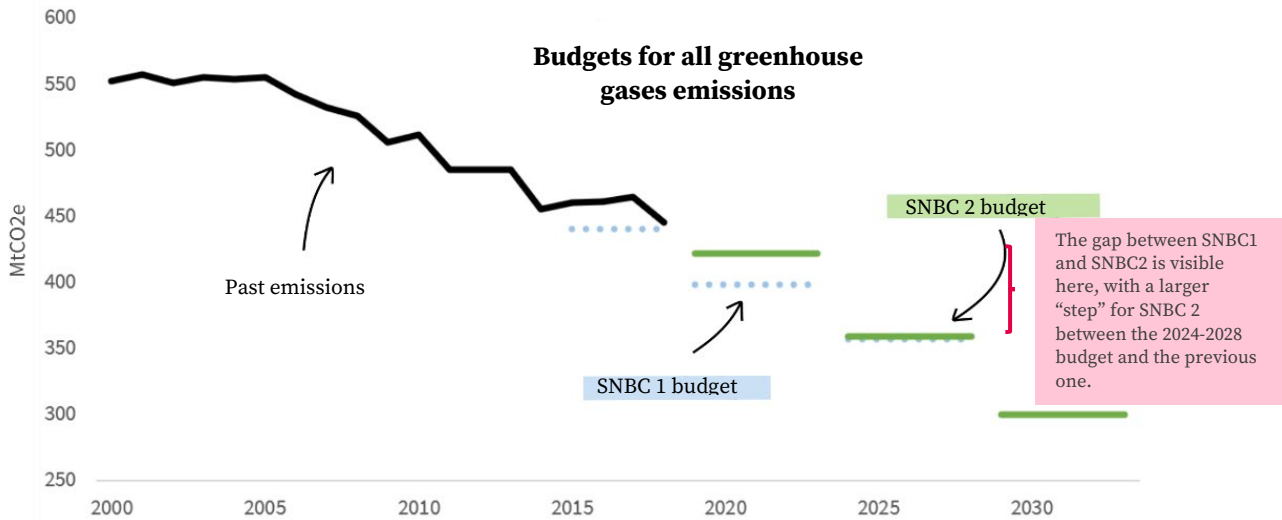
Labour productivity per capita is a ratio between value added and the number of employed people :

$$\text{labour productivity per capita} = \frac{\text{value added}}{\text{number of employed people}}$$

In practice, a slowdown (/ acceleration) in productivity per capita reflects faster (/ slower) employment growth than that of value added. The resulting productivity gain corresponds to the percentage change in productivity over the course of a given period.

APPENDICES

APPENDIX 1 - THE CARBON BUDGETS OF NATIONAL LOW-CARBON STRATEGIES (SNBC) 1 AND 2



Source: Citepa, "Formal adoption of the 2nd national low-carbon strategy and the next three carbon budgets", May 2020; red annotations added by Unédic.

APPENDIX 2 - SECTORAL BREAKDOWN OF SALARIED EMPLOYMENT IN FRANCE

	Employees in the 4th quarter of 2022	
	In thousands	As a proportion of total*
Total	26,893	
Agriculture	317	1%
Construction	1,599	6%
Industry, of which	3,238	12%
<i>Extractive</i>	21	0%
<i>Electricity, gas, steam and air conditioning</i>	175	1%
<i>Water, sanitation, waste, remediation</i>	205	1%
<i>Agri-food, tobacco</i>	638	2%
<i>Coking - refining</i>	9	0%
<i>Electrical, electronic, computer equipment; machines</i>	412	2%
<i>Transport equipment</i>	358	1%
<i>Other</i>	1,420	5%
Tertiary, of which:	21,740	81%
<i>Trade & repair of motor vehicles - motorcycles</i>	3,386	13%
<i>Transportation and warehousing</i>	1,437	5%
<i>Accommodation - catering</i>	1,240	5%
<i>Information - communication</i>	931	3%
<i>Finance - insurance</i>	902	3%
<i>Real estate</i>	268	1%
<i>Scientific, technical activities; administrative and support services</i>	3,826	14%
<i>Public administration, education, human health, social workers</i>	8,425	31%
<i>Other service activities</i>	1,325	5%

*Stable weights in the latest years. Source : Insee, employment survey

APPENDIX 3 - LIST OF GREEN PROFESSIONS IN THE CLASSIFICATION OF PROFESSIONS AND SOCIO-PROFESSIONAL CATEGORIES (PCS 2003)

PCS	Description
386d	Engineers and executives in the production and distribution of energy, water
387f	Environmental Engineers and Technical Executives
477d	Environmental and Pollution Treatment Technicians
485a	Supervisors and technicians in the production and distribution of energy, water, heating
533b	Forestry technicians, rangers of natural areas
625h	Skilled workers in other industries (water, gas, energy, heating)
628e	Skilled sanitation and waste treatment workers
644a	Household refuse collection vehicle drivers
684b	Unskilled sanitation and waste treatment workers



EMPLOYMENT AND DECARBONIZATION: OVERVIEW OF EXISTING WORKS

May 2024

Unédic

4, rue Traversière 75012 Paris
T. +33 1 44 87 64 00

 [@unedic](https://twitter.com/unedic)  [unedic](https://www.linkedin.com/company/unedic) [unedic.org](https://www.unedic.org)