Reindustrialising France by 2035: needs, constraints and potential effects

Working Paper

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EXCUTIVE SUMMARY

This prospective study by France Stratégie is part of the mission commissioned on 16 November 2023 by the Minister for the Economy and Finance and the Minister Delegate for Industry on the future of France's industrial policies to Olivier Lluansi.

The primary objective of this working paper is to set out various reindustrialisation scenarios identified by Olivier Lluansi and to analyse their impact in terms of resources potentially required to achieve them – labour, energy, natural resources such as water or land, etc. – and the possible effects on CO_2 emissions and on a number of macroeconomic variables needed by Olivier Lluansi for his report.

This prospective work should help public authorities to determine the feasibility and desirability of each of these scenarios, in order to select the most appropriate reindustrialisation levers to achieve the chosen outcome.

Scenarios construction

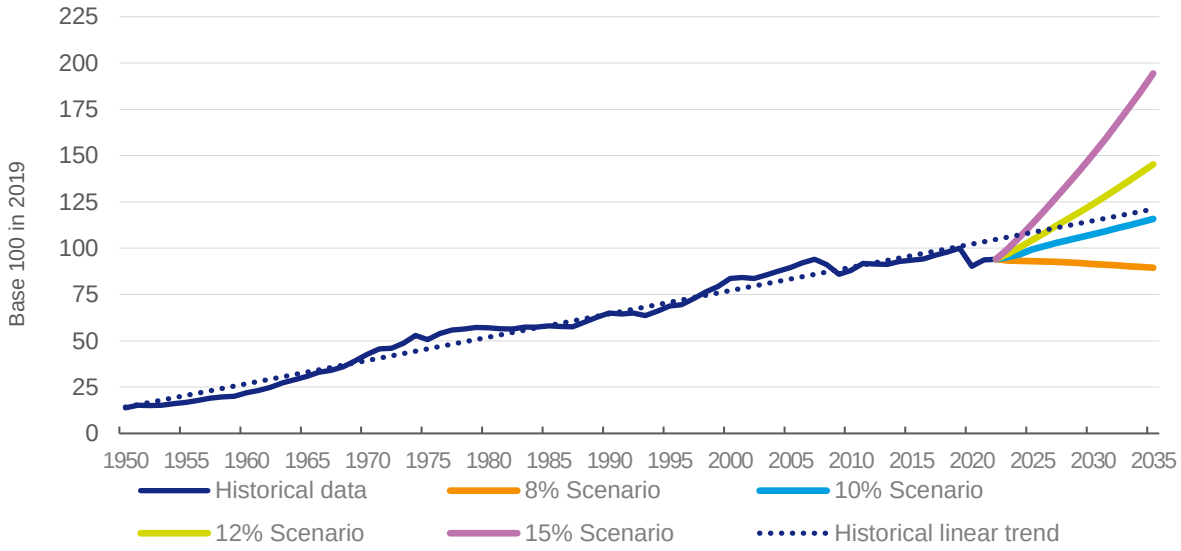
Based on existing prospective work by RTE (Réseau de transport d'électricité), eight scenarios have been drawn up covering the period 2022-2035, focusing on different levels of reindustrialisation. These scenarios differ in terms of the share of manufacturing value added as a percentage of GDP in 2035 – 8%, 10%, 12% or 15% – and in some cases in terms of the importance attached to manufacturing branches perceived as technological, "upstream" sectors (those furthest from the end consumer) or "downstream" sectors (those closest to the end consumer). The scenarios of greater reindustrialisation go hand in hand with higher GDP growth, which encompasses the "mechanical" knock-on effect in certain services associated with the manufacturing industry.

Given this knock-on effect, manufacturing activity in the 12% scenario would be 25% higher in volume than in the 10% scenario (and not just 20%), and would be 45% above its 2019 level (see Figure next page).

However, our scenarios do not take into account the potential negative macroeconomic effects of strong reindustrialisation on activity in the rest of the economy, related to substitution effects or price effects. To take these effects into account, it would be necessary to model these different scenarios in a general equilibrium macroeconomic framework,

which we lacked for this research. It is crucial that French public authorities with such models address this issue to incorporate feedback effects into reindustrialisation scenarios.

Manufacturing value added trend in volume and extension in the four scenario families



Reading: the historical trend in manufacturing value added, considered "in volume" (i.e. adjusted for inflation) and expressed in base 100 in 2019, is extended in different ways by the various scenarios.

Source: France Stratégie based on RTE's 2035 Generation Adequacy Report (for the central 10% scenario)

Our eight reindustrialisation scenarios up to 2035 provide a framework to answer the following questions: what would be the effects of an increase of manufacturing value added as a share of GDP on the resources needed? on energy consumption and CO_2 emissions? on various macroeconomic indicators? what would be the main differences based on the nature and level of the projected reindustrialisation?

Three challenges for desirable reindustrialisation

Workforce: what jobs will be needed?

The manufacturing sector provides 3.1 million jobs in 2022, representing around 11% of jobs in mainland France. Job requirements linked to reindustrialisation depend on growth of manufacturing value added and productivity gains in the manufacturing sector, which we assume to be on average 1.8% per year from 2022 to 2035. If reindustrialisation were to take place mainly in the downstream and technology sectors, a manufacturing sector representing 12% of GDP could require the creation of 740,000 jobs between 2022 and 2035. In the case of an upstream reindustrialisation, job growth would be slower, with potentially 580,000 jobs created between now and 2035.

As far as occupations are concerned, skilled workers, technicians and supervisors would be the main beneficiaries, in terms of numbers, of a reindustrialisation scenario at 12% of GDP.

Nevertheless, in relative terms, the growth in the number of employees would be strongest (over 30%) among engineers, managers and design and research personnel working in the manufacturing sector. The need for skilled jobs would grow much faster than the share of manufacturing value added in GDP.

These potential job creations are running up against the fact that there are already tensions in many industrial occupations today, and there is a risk that these tensions will increase over the next few years: many workers in the manufacturing sector are going to retire in the coming years – more than 35% in some blue-collar occupations by 2030 – and manufacturing jobs remains unattractive, particularly in the least skilled occupations, which are associated with a degree of arduousness.

Energy and CO_2 emissions: decarbonising while reindustrialising

In all our scenarios, decarbonising the manufacturing sector by 2035 is assumed, as a result of an increase in energy efficiency, of strong electrification and of an increase in the use of biomass where electrification is not possible. This applies to all manufacturing industry, including the production of basic materials1, which accounts for almost two-thirds of direct emissions in France, for less than 10% of its added value. Emissions reductions achievable through carbon capture and sequestration (CCS), which are necessary to further decarbonise the production of basic materials, are not included in the analysis.

Mechanically, these assumptions lead to a sharp reduction in the direct consumption of fossil fuels by the manufacturing sector between 2022 and 2035 in the central scenarios (-58% in “Tech 10%” and -45% in “Tech 12%”). Direct greenhouse gas emissions would also be significantly reduced (-46% and -32%, respectively).

As a consequence of this reduction in fossil fuels, electricity consumption by the manufacturing sector is set to increase: from 106 terawatt-hours (TWh) in 2022, it would rise to 135 TWh in the 10% scenario and 165 TWh in the 12% scenario by 2035 (to which should be added 25 and 28 TWh of electricity for the production of hydrogen for the manufacturing sector2). As the 2035 deadline comes before any new nuclear reactors may be in service, these additional electricity requirements can only be addressed with low-carbon energies through existing nuclear power and a strong growth in renewable energies. However, current scenarios already consider this growth as a maximum in terms of acceptability or industrial feasibility. The high demand for electricity in the scenarios of greater reindustrialisation could hardly be associated with additional low-carbon electricity production unless we assume, for example, a link between reindustrialisation and greater take-up of onshore wind power. All other things being equal, it would therefore result in a reduction in French electricity exports. In the 15% scenario, electricity consumption would

[1] Steel, aluminium, sugar, lime and clinker, glass, paper and cardboard, ammonia, chlorine, ethylene.

[2] RTE assumes that hydrogen consumption is half proportional and half independent of manufacturing production. Other assumptions would be possible: for example, full proportionality would slightly reduce direct emissions in the scenarios of greater reindustrialisation, but would greatly increase the need for electricity.

far exceed anticipated low-carbon electricity production: it would then be necessary to make greater use of fossil-fired power stations in France and in Europe.

Increased reindustrialisation, replacing foreign industrial production, should nevertheless help reduce emissions, if not at the French scale, at least at the global scale. This claim is difficult to quantify precisely, though, as it depends on a number of assumptions on the origin of substituted production and the comparative energy trajectories of industry in the various countries involved. The orders of magnitude discussed in this working paper suggest that relocating industry in France could help reduce emissions worldwide, because the emissions avoided abroad (especially if these relocations came from outside Europe) would more than compensate the increase in emissions in France.

Natural resources: soil and water, resources under pressure

Water and soil are both scarce natural resources, necessary for a wide range of human uses, and their pressure is likely to increase significantly over the next few years as a result of climate change. What they also have in common is that public policy objectives have been set to restrict their use (“Zéro artificialisation nette” or “no net land take” target enshrined in the 2021 Climate and Resilience Act) or at least to encourage more sober practices (with the “Plan for resilient and concerted management of water resources” in particular). All this means that we need to anticipate the potential needs associated with the reindustrialisation of France. In the 10% scenarios, these needs would change very little overall, but the location of jobs and new factories could have a different impact depending on the availability of these resources in the areas concerned. A reindustrialisation scenario at 12% of GDP would mean an increase in the need for land (from 23,000 to 30,000 additional hectares by 2035) and water. Water withdrawals and consumption by manufacturing industry could increase significantly if no improvements are made in operating processes between now and then (from 53% to 60% depending on the scenario). The type of reindustrialisation carried out will also be an important element in the use of resources, as some sectors require much more water than others (chemical industry, timber industry, agrifood industry, etc.).

Overview - The eight scenarios of more or less strong reindustrialisation

		2022 *(Level)*	2035							
			Tech 8% Scenario	**Tech 10% Scenario**	**Upstream 10% Scenario**	**Downstream 10% Scenario**	**Tech 12% Scenario**	**Upstream 12% Scenario**	**Downstream 12% Scenario**	**Tech 15% Scenario**
Manufacturing value added	Value (Bn € by 2022)	*252*	**239**	**311**	311	311	**389**	389	389	**522**
	CAGR (%/year)	-	**-0,39%**	**1,64%**	1,64%	1,64%	**3,41%**	3,41%	3,41%	**5,76%**
Jobs and skill levels	Net job creation/destruction in manufacturing industry, including temporary work (thousands of jobs)	*3.103*	**-157**	**0**	-135	7	**744**	579	743	**1.984**
	incl. low-skilled workers in industry	*334*	**-39**	**-19**	-28	-18	**55**	45	56	**180**
	incl. skilled workers in industry	*759*	**-66**	**-42**	-54	-44	**130**	117	125	**416**
	incl. technicians and supervisors	*513*	**-7**	**5**	-14	-5	**130**	107	116	**338**
	incl. engineers and managers in industry and research and analysis staff	*268*	**25**	**32**	2	24	**104**	67	93	**224**
	incl. non-industrial occupations	*1.229*	**-69**	**24**	-41	50	**324**	243	352	**825**
Direct GHG emissions ($MtCO_2eq$), before CCS	Direct emissions	*69*	**31**	**38**	46	36	**48**	59	46	**66**
	reduction compared with 2022	-	***-57%***	***-46%***	*-35%*	*-49%*	***-32%***	*-16%*	*-35%*	***-6%***
Effect on global GHG emissions ($MtCO_2eq$) (pivot = Tech 10% scenario)	Difference in direct emissions		**-7**	**0**	8	-2	**10**	21	8	**28**
	Additional emissions for electricity generation		**-7**	**0**	3	-1	**8**	11	7	**21**
	Emissions avoided abroad		**-19**	**-**	2	-1	**28**	42	19	**77**
Energy consumption	*Direct electricity consumption by manufacturing industry (TWh)*	*106*	**107**	**135**	145	133	**165**	179	163	**215**

		2022 (Level)	2035							
			Tech 8% Scenario	Tech 10% Scenario	Upstream 10% Scenario	Downstream 10% Scenario	Tech 12% Scenario	Upstream 12% Scenario	Downstream 12% Scenario	Tech 15% Scenario
	Effect on total electricity consumption in 2035 (TWh, relative to Tech 10%)	-	***-34***	***0***	*32*	*-2*	***36***	*56*	*34*	***96***
	Biomass (TWh)	*22*	**53**	**64**	73	63	**78**	90	77	**101**
	Fossil fuels (TWh)	*238*	**80**	**100**	125	96	**131**	164	125	**183**
Industrial land needs	Difference between 2035 and 2022 (ha)	*225.000*	**-6.300**	**0**	-5.400	300	**29.700**	23.200	29.700	**79.000**
Water: trends in withdrawals and consumption between 2022 and 2035	Water withdrawal (and consumption) without efficiency gains in 2035 (millions m³)	*1.860 (360)*	**1.840 (350)**	**2.330 (450)**	2.260 (430)	2.380 (460)	**2.990 (570)**	2.840 (550)	2.980 (570)	**4.000 (770)**
	Water withdrawal and consumption) with moderate efficiency gains in 2035 (millions m³)	*1.861 (360)*	**1 680 (320)**	**1.810 (350)**	1.910 (370)	1.790 (360)	**2.240 (440)**	2.390 (460)	2.230 (440)	**2.970 (580)**
	Water withdrawal (and consumption) with high efficiency gains in 2035 (millions m³)	*1.862 (360)*	**1.450 (270)**	**1.540 (290)**	1.650 (310)	1.520 (290)	**1.910 (360)**	1.960 (380)	1.950 (360)	**2.090 (480)**
Trade balance	Energy BC in (Bn € by 2022	*-116*	**-8**	**-11**	-12	-10	**-14**	-15	-13	**-19**
	Manufacturing BC in €bn by 2022	-78	**-67**	**-29**	-29	-29	**13**	13	13	**84**
Manufacturing GFCF	in Bn € by 2022	*75*	**71**	**92**	92	92	**115**	115	115	**155**
	CAGR (% / year)	-	**-0,4%**	**1,6%**	1,6%	1,6%	**3,4%**	3,4%	3,4%	**5,8%**
Manufacturing R&D expenditure	in Bn € by 2022	*19*	**18**	**24**	24	24	**30**	30	30	**40**
	as % of GDP	*0,73%*	**0,6%**	**0,8%**	0,8%	0,8%	**0,9%**	0,9%	0,9%	**1,2%**

NB: the table shows the 2022 level and the 2035 projections for the main factors studied in the eight scenarios. For example, manufacturing value added is €252 billion in 2022, and could represent around €239 billion in 2035 according to the Tech 8% scenario.

Source: France Stratégie and RTE (for the VA of the "Tech 10%" pivotal scenario, direct emissions and energy consumption).

However, by 2035, both water and land could be used more thriftily (thanks to the mobilisation of brownfield sites, urban renewal, densification of existing business parks) and the water extraction processes of certain industries (food processing, chemicals and pharmaceuticals in particular) could be improved, which would largely contain the increase in demand from the manufacturing sector.

Illustrating the effects of reindustrialisation on certain macroeconomic indicators

The final section of this study aims to illustrate the effects that reindustrialisation would have on certain macroeconomic factors discussed as part of Olivier Lluansi's mission.

France's trade balance, and in particular its manufacturing trade balance, has deteriorated in recent decades, along with the country's deindustrialisation. The impact of the change in the manufacturing value added share of GDP on the manufacturing trade balance (expressed as a percentage of GDP) is estimated to predict the evolution of the trade balance in our scenarios. A crude econometric analysis suggests that an increase in manufacturing value added has a positive and significant impact on the manufacturing trade balance: an increase in manufacturing value added of 1 percentage point in GDP would improve the share of the trade balance in GDP by around 0.7 percentage points, all other things being equal. The manufacturing trade balance would then become slightly positive again by 2035 in the 12% scenario. In order to estimate the evolution of the trade balance in the 15% scenario, we would need to take into account the negative effects of potential price effects not taken into account in our scenarios, which would harm the international competitiveness of French products.

Finally, with regard to investment and R&D spending in manufacturing, the economic literature generally uses a mid-term unit elasticity in relation to value added in manufacturing. Hence in the 12% scenario, an increase of around 45% by 2035 compared to 2019 is a reasonable assumption.