

# INTRODUCTION

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## *FINANCING THE ENERGY TRANSITION: AN OUTLINE OF WHAT IS REQUIRED*

According to the International Energy Agency (IEA, 2023), on the basis of current public policies, global investment in energy should reach \$3.5 trillion by 2030 (15% more than in 2023), two-thirds of that devoted to low-carbon technologies. While this trend is indeed indicative of a transition (and even foreshadows an historic break), the pace is still too slow: to strive for carbon neutrality by the middle of the 21<sup>st</sup> century, \$4.7 trillion will need to be invested by 2030, and 90% of that amount in low-carbon technologies, according to the IEA. At the same time, final energy consumption will have to be curbed and the decommissioning or conversion of assets tied to fossil fuel production financed (de Perthuis, 2023). The costs of curbing energy demand and fossil fuel divestment are not addressed in this issue, which focuses on financing investments.

The current investment dynamic is not evenly distributed between countries or sectors: over 90% of the increase recorded since the start of the decade is concentrated in the advanced economies and China, while the rest of the world often has fragile institutions ill-suited to attracting capital. And, since carbon pricing only very partially covers economic activities, there is no “price signal” today making it possible to massively steer investment and consumption choices towards decarbonized products and services. Fossil fuel subsidies are far from having disappeared, and have even increased dramatically since the price surge triggered by the war in Ukraine.

The energy environment of recent years has been dominated by the return of conflict, even chaos—the energy crisis resulting from the war in Ukraine increased the European Union (EU) energy bill to over 9% of the gross domestic product (GDP) in 2022, compared with 2% in 2020, a level approaching that of the second oil crisis of 1979-1980. These disruptions have produced massive macroeconomic effects, leading to drastic intervention on retail energy markets in order to partially blunt the hysteria prevailing on wholesale markets: according to an estimate of the Bruegel think tank (Sgaravatti et al., 2023), in 2022 European states—including the UK—committed almost €700 billion in government spending to lessen the impact of this crisis on the most fragile households and businesses. And these effects were not limited to Europe: it’s necessary to go back to the second oil crisis at the end of the 1970s to find a moment in history when 100% of the world’s countries had to contend with high inflation, which had almost completely disappeared since the beginning of the 21<sup>st</sup> century.

Of course, this energy crisis raised the insurance value of decarbonized technologies, given the risk of disruption of oil and gas supplies and the instability of their prices. Fatih Birol, Executive Director of the IEA, argues that the conflict gave a boost to the energy transition: “Russia’s efforts to gain political and economic advantage by driving up energy prices have prompted governments, not only in the EU but in many countries around the world, to

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accelerate the deployment of cleaner, safer alternatives. [...] the repercussions of the war in Ukraine are reshaping the future of global energy, for the first time a peak in fossil fuel demand is clearly in sight and is expected to occur before the end of the 2020s.” (Biol, 2023). And, for every dollar spent on fossil fuels, \$1.80 is now devoted to clean energy; five years ago, the ratio was 1:1.

However, the violence of the socio-economic disruptions due to the conflict—a direct extension of the health crisis—has led to the increased polarization of opinion on environmental issues, raising fears of a backlash or, at the very least, more confusion on transition policies. This is particularly evident in the European Union, where the new European Parliament is less favorable to the Green Deal, given the context of rising public debt. Eurostat data on fuel insecurity sheds light on these tensions—one household in ten in the EU has a hard time paying household energy costs (3% more than in 2021, before the beginning of the energy shock). In some countries, the proportion is close to 20% (Bulgaria, Cyprus, Greece, etc.). This deterioration provides room for very simplistic proposals (lowering prices by reducing energy taxes) or for focusing on special equipment (wind turbines, electric vehicles, etc.), in order to denounce the pace of transition (Geoffron, 2024).

But changing course or slowing the pace would be detrimental to Europe: the ability to finance the transition is not only an environmental issue (both global and local, with improved air quality, preservation of water resources and biodiversity, etc.), but also a question of competitiveness, as Mario Draghi states forcefully by extending the analysis of Enrico Letta. “If Europe’s ambitious climate targets are matched by a coherent plan to achieve them, decarbonization will be an opportunity for Europe. But if we fail to coordinate our policies, there is a risk that it could run contrary to competitiveness.” (Draghi, 2024). For this to happen, the Green Deal mechanisms need to become more fluid: Enrico Letta’s report also emphasized the shortcomings of the European energy model, where investment signals remain largely the province of governments, without effective coordination, and subject to high administrative costs (Letta, 2024). This situation hampers the EU’s ability to compete with China and the United States, which are pursuing unfettered industrial policies.

This is the context for the analyses presented in this issue. Its aim is not to discuss the mechanisms and tools of “green” finance, but to shed light on the estimates of investment needs, illustrate the transitions at work in different sectors of activity, and conclude with a presentation of various innovative tools or financing schemes likely to contribute to reaching the target.

The first part of this issue deals with the need to finance the transition—at the same time the investments required to reduce greenhouse gas emissions, to adapt to the effects of climate change, and to cushion the redistributive effects of the transition. *Hadrien Hainaut* opens by presenting the current situation of financing needs in France and Europe based on analyses carried out by I4CE. These studies make it possible to assess the current financing base and its sectoral allocation (construction, transportation, energy, etc.), but above all the investment deficit for achieving climate objectives in 2030 (“Fit for 55”), i.e. over 2% of GDP per year, both in France (corroborating the estimates of the Pisani-Ferry and Mahfouz report of 2023) and in Europe. *Ivan Faucheux* insists on the investment horizon, essentially on long-term investments found mainly in production units characterized by high fixed costs. Consequently, the financing model adapted to this profile requires securing revenues on the markets and finding investors willing to accept these long-term risks. If these two conditions are met, the benefits will accrue to European players, particularly through better management of their savings and investment in transition assets. *Patrice Geoffron* emphasizes the need for adaptation, as a complement of mitigation efforts, to ensure the resilience of critical infrastructure in the face of the growing impacts of global warming, and to prevent substantial future losses. Since purely public financing models are not sufficient to meet the scale of adaptation needs, he believes it would be useful to develop hybrid models that include private sector funding, making it possible to tap into the “hidden value” of adapting. Finally, *Solange Martin* focuses on the redistributive effects of the

transition, which will potentially impact certain households, businesses, and regions negatively. She proposes, first, to clarify the concept by identifying the normative logic that will likely guide government action concerning a “fair transition” and, secondly, to explore the challenges of implementing these policies in the case of France. The article draws attention to the threat to households of having to bear the depreciation of their “brown” financial or material assets, and to the necessity of helping them out in this area, which will determine “fair transitions”.

The second part focuses on sector-specific developments. *Michel Derdevet* points out that, as a result of the electrification of uses, energy transition means doubling the volume of investment in electric grids in order to distribute the growing quantities of renewable electricity. To limit the resulting increase of these investments on regulated grid access rates, and therefore on electricity prices, several avenues are explored: a reduction in capital costs, better investment planning on a European scale, and a series of measures that make it possible to increase the efficiency of the capital employed. *Marie-Claire Aoun* focuses on green gases, from biomethane to hydrogen, in the context of the transformation of the European gas landscape brought about by the war in Ukraine and, in particular, on the REPowerEU plan, which aims to phase out Russian gas from the EU by 2027. The article presents both the financing needs of these two sectors and the obstacles to their growth (in view of their different maturities). The massive financing needs have to be weighed against the issues of security of fossil gas supplies and the potential costs to the European community. *Jean-Guy Devezeaux de Lavergne* proposes analyzing the financing of the new nuclear reactors, based on a balance between renewable and nuclear energies to minimize costs and maximize the robustness of the power grid. He stresses the role of the state not only in raising capital, but also in sharing risk, thus guaranteeing the viability of nuclear projects, and presents various scenarios to this end (Contracts for Difference, *Project Finance*, direct government financing, etc.). *Pierre de Montlivault* points out that 45% of our energy consumption is heat: heating, hot water, and steam for industrial use. Given this need, he analyzes the key role that wood energy can play in decarbonizing heat production, provided that funding is allocated on a regional scale to strengthen local industries, which are the only guarantee of long-term renewable use of the biomass. *Benoît Thirion* reminds us that the transportation sector is the biggest emitter of greenhouse gases in France (35% of emissions). Many decarbonization mechanisms can be employed: lowering the demand for transportation, a modal shift to active mobility and rail, filling up the seats of vehicles, and switching from thermal to electric power. To overcome the associated financial challenges, several avenues are being explored, including an increase in carbon pricing to a price of 100 euros per ton of CO<sub>2</sub> by 2030, but also promoting a public-private partnership framework that would encourage investments.

The final section is devoted to financing tools and plans. *Anna Creti and Coline Metta-Versmessen* study the scope of the new system of permits for diffuse emissions, ETS2, which will cover the transportation and construction sectors and will take effect in 2027. The article stresses the challenge of limiting the inequalities that may result from this new system by taking measures to avoid price extremes, as well as by creating a social fund financed by revenues from the sale of allowances. After a review of the fundamentals of electricity price formation on the wholesale and retail markets, *Jacques Percebois and Boris Solier* examine the new regulations being put in place at the French and European levels, their implications for financing the transition (in view of the massive needs in power generation facilities and grids) and the incentives that prices create for consumers. Finally, *Anne Rostaing* looks at the potential of carbon capture through diffuse ecosystems in regions, which can be achieved at costs that are much lower than those using industrial methods. Trading carbon credits can become an innovative means of financing these regional investments, which would include the socio-economic and environmental impact that these carbon sinks bring locally. The author shares her experience in creating regional carbon cooperatives that make it possible to bring together institutions, businesses, and citizens in shared local climate governance.

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