Introduction to the Issue on

Green Transition: How to Make It Finally Happen?

Niko Jaakkola and *Riccardo Rovelli*

The world is not on track to stop climate change within safe limits (IRENA 2023). Despite the widely shared concern that the costs of inaction or of delayed action would be enormous, policies and public debates still fall short of what has been promised.[1]

Achieving the Green Transition, in a timely and orderly manner, is in the national interest of each and every country. With the disruptive effects of climate change becoming increasingly apparent, a future in which the Green Transition is not made poses very real risks to the economic well-being of nations, even if these risks are difficult to quantify or forecast precisely.

So, why is the world still failing to effectively tackle this collective action problem? Which constraints are slowing us down? How can we overcome them, and contribute to the formulation of feasible and acceptable climate policies? Which policy instruments can help unlock the path to the Green Transition?[2]

Economists often tend to isolate questions (including climate-related ones) into bite-size chunks so as to understand them better. But climate change and climate policies affect the economy and society through many different avenues – linking together many fields within and beyond economics. This includes environmental disciplines as well as the study of technologies and technological change, and of public policies, political choices, and international relations.

In October 2023, we convened a workshop – "Shared Perspectives 2023: How to Make the Green Transition Happen?" – assembling mostly economists and policymakers, to discuss such issues in relation to five specific questions:

1. Can the Green Transition be pro-competitive and market-friendly?
2. Will the pursuit of climate sustainability deter or spur economic growth?
3. Are public and private investors penalizing future generations by discounting the future too much, and if so, what should be done to change this?
4. How can the costs of the Green Transition be made politically and socially acceptable?
5. Will the Green Transition foster global cooperation or division?

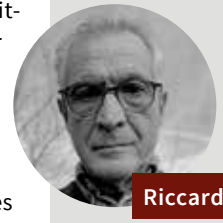
In this Policy Debate of the Hour, Lorenzo Forni (with Massimo Tavoni) reviews some debates focusing on question 1. Karen Pittel and Alessio Terzi (with Roger Fouquet) propose their views on question 2. Daniele Franco (with Luisa Carpinelli) re-examines question 3. Simone Borghesi (with Alberto Ferrari) examines question 4 in relation to the social dimension of the ETS and on the uses of revenues originated from that system. Niko Jaakkola, Rick van der Ploeg and Anthony Venables also consider political fea-

KEY MESSAGES

- **The Green Transition is in every country's national interest. "Business-as-usual" is no longer possible; the alternative is a future with costly climate impacts**
- **The Green Transition requires public investments and a sizeable increase in public debt**
- **Strong and coordinated policy signals and actions are required to shape expectations, and to thus avoid unnecessary delays and irreversible costs**
- **Economists should promote an interdisciplinary assessment on the growth implications of the Green Transition**
- **The transition will be more politically acceptable if seen to involve "green and inclusive growth" rather than stagnation**

Niko Jaakkola

is an Associate Professor at the Department of Economics at the University of Bologna. His work focuses on environmental and resource economics, in particular climate change and fossil resources.



Riccardo Rovelli

is Alma Mater Professor at the University of Bologna and Research Fellow at IZA. His current research focus is on the EU and all issues related to the Green Transition.

[1] Following the 2015 Paris Agreement (a legally binding international treaty), more than 70 countries, including the biggest polluters – China, the United States, and the European Union – have set a net-zero target, covering about 76 percent of global emissions. The EU and the US have set their goals to Net-Zero for 2050; China for 2060 and India for 2070.

[2] We discuss the Green Transition mainly in terms of a path toward a climate-neutral economy and society, which is further defined in terms of Net-Zero greenhouse gas emissions (GHG). The European Green Deal is a major example of such a transition, to be achieved by 2050. The Green Transition also involves tackling other pressing environmental problems.

sibility, emphasizing the centrality of expectations and how radical climate policy may be required to shift them in favor of a Green Transition. Gianmarco Ottaviano assesses question 5, focusing on the relations between and mutual implications of the EU's CBAM and the US's IRA. Finally, in this contribution, we pick up some of the remaining themes, and draw on some lessons learned from the extensive debates had during the workshop.

A COSTLY CHALLENGE, OR AN OPPORTUNITY TO GROW?

The costs of many clean technologies have fallen rapidly, even unexpectedly so, which has both contributed to, and been the result of, the widespread deployment of these technologies (IEA 2023). Current developments have continued to vindicate previous hopes that "renewables could easily become by far the cheapest electricity source in history" (IEA 2021).

It is still unclear how far this trend of cost reductions will continue, and what the costs of renewable energy are when the technology is implemented at very large scale. However, even in the favorable scenario of a continued reduction in the average cost of producing renewable energy, the Green Transition will require substantial investments: "renewables-based electrification would require massively expanded and strengthened power grids and the growing role of hydrogen would need pipelines, electrolyzers, and storage facilities" (IRENA 2023). In particular, the development and deployment of effective long-term energy storage solutions are critical to achieving the sustainability goals of the Green Transition (WEF 2023).[3]

In this scenario, the annual global investment in energy transition technologies could be of the order of USD 4–5 trillion by 2030, for a 1.5°C-compatible or net-zero pathway (IRENA 2023; IEA 2021). This is approximately equivalent to an astonishing 4–5 percent of today's global GDP.[4] Comparable estimates are available for many individual countries.[5]

It is clear that financing these investments will pose enormous challenges to the financial systems and to public finances (which we will briefly discuss in the next section).

Moreover, these are not the only costs of the Green Transition. To accompany these investments, educational systems will have to be upgraded and the incumbent labor force will require new training and re-skilling. The likely relocation of a lot of energy-related and agricultural production activity will require costly initiatives to help the orderly phasing out of old activities and the phasing in of the new ones. Older workers in obsolete sectors will be pre-pensioned, and this will add to the strain that population ageing poses to the pension and welfare systems.

We conclude this section with two observations. Even if the costs and challenges of the Green Transition may seem daunting, they need to be openly faced. By laying out what has to be done, and hence how much it will cost, policymakers must be able to speak and act clearly, and link current (individual and public) costs to the expectation of future benefits. In this respect, moreover, it is important to remark that the opportunity cost of doing nothing (that is, the cost of not actively pursuing the Green Transition) is not "business as usual" – rather, it would be a dismal scenario of ever harder to mitigate (and also to adapt to) adverse climate events.

Second, some regions and some countries will bear a greater share of the costs of the Green Transition – no matter what we measure the share against: population, GDP per capita, or in terms of how each region has contributed historically to the accumulation of pollutants in the atmosphere. In this respect, international cooperation will be essential, not only as an ethical requirement but also more pragmatically to acquire the support of those regions and countries to pursue their way to the Green Transition. Within the EU, for instance, this is happening with the Just Transition Mechanism and will happen with the Social Climate Fund (to be financed with funds from the new ETS 2). However, similar policies (supporting peoples and also investments) should be adopted worldwide, on a much larger scale.

PUBLIC POLICIES, FISCAL POLICIES, AND THE GREEN TRANSITION

In the previous section we argued that, even if cost reductions imply that "scaled up" green energy will soon be absolutely less costly than fossil energy, public policies will be still required to speed up the transition and to make it socially and politically acceptable. Path dependence and technological complementarities may require policies to break the historically determined reliance on fossil energy and technologies (Acemoglu et al. 2012; see also Jaakkola, van der Ploeg and Venables, in this issue).

In this vein, appropriate policy solutions are needed to support and orient renewables-related R&D; to build public infrastructures (such as electricity grids) that complement privately deployed renewable energy production; to achieve a gradual elimination of stranded assets and – in parallel with this

[3] Importantly, the Green Transition also involves protecting the world's biodiversity, something to be taken into account as the global search for raw materials critical to renewable technologies takes off around the world.

[4] However, not all of these investments would be "additional" – some would replace depreciating old capital.

[5] For France, Pisani-Ferry and Mahfouz (2023) estimate that the additional investment needed in the decade 2021–30 is EUR 60–70 billion annually, equivalent to more than 2 percent of GDP, only to replace fossil fuels with unchanged total output. For Italy, Noera et al. (2023) estimate the total yearly investment needed to adapt the Italian energy and industrial policies to the EU decarbonization targets over the current decade to be EUR 122–134 billion (equivalent to 1.7–2.4 percent of GDP) – which amounts to about 25–30 percent of Italy's total investments.

– a timely phasing out of fossil-fuel reserves;[6] and to provide solutions to mitigate the climate impacts from hard-to-abate sectors.[7] In all of these cases, powerful conflicts of interests may pose political obstacles to completing the Green Transition.

In this respect, we stress that the key to acceptability of such policies may be twofold: first, direct losers must be compensated or given a clear opportunity for improvement; second, imposing costs is only acceptable when clearly linked to future benefits. This is something that too many current political narratives seem reluctant to acknowledge.

In any case, the real and financial costs of the Green Transition should not be presented as part of a necessary package of "austerity" measures: firms can only be persuaded to take on their share of additional investments in the expectation of an expanding, not a stagnating economy.[8]

A probable consequence of the public sector undertaking its share of the necessary investments will be an increase in public debt ratios. In this case, this will be justified by the fact that this debt will bring no harm to future generations – indeed, it will be used to invest in more benign climate conditions – and that it will generate necessary public capital. Appropriate financial instruments are available for this purpose. Also, policymakers, public watchdogs, and public opinion must be prepared for such changes. Fiscal policy rules will need to allow for such increases.

A critical question thus naturally poses itself: how much more debt should we be prepared to accept? The answer depends, as often, also on how much (de-?) growth will accompany the Green Transition. We discuss this issue below.

THE PROSPECT OF GREEN GROWTH MATTERS

Most scholars, and indeed most educated people, would accept that (i) the Green Transition is necessary; (ii) given sufficient time, it would likely happen anyway for reasons of technological progress and resource scarcity; (iii) nevertheless, to avoid unnecessary and irreversible costs, strong policies are required to accelerate the Green Transition, so as to achieve climate neutrality at the world level by 2050 or as soon as feasible.

On the other hand, not everybody accepts the idea that the Green Transition is also an opportunity for growth. While the European Commission defines (correctly, in our view) the European Green Deal (that is, the EU's policies for the Green Transition) as "Europe's new growth strategy" and as a boost to the European economy,[9] not everybody shares this view. In this respect, there are two alternative views.

One is technological skepticism, the other is the belief that degrowth would be necessary to achieve sustainability. Technological skepticism accepts the fact that, by now, energy produced using renewable resources (especially solar and wind energy) has already achieved cost competitiveness relative to fossil energy. Nevertheless, skeptics remain unconvinced that these marginal cost advantages can be fully scaled up to become "systemic advantages" – and help us build an economy around clean and environmentally friendly energy that is also cheaper than fossil fuels. Agreement on whether this skepticism is founded or unfounded should be obtained as soon as possible. Economists should lead an interdisciplinary effort (including physicists, engineers, and scholars of technological progress) to jointly seek clarity, combining expertise from their diverse perspectives, and to help us (and policymakers) reach a confident answer as soon as possible.[10]

Why do we stress the importance of a rapid convergence of expectations on the likelihood that the Green Transition will actually promote growth? While we admit being captured by the notion that "renewables could easily become by far the cheapest electricity source in history" (IEA 20210), we may be at risk of falling into an alternative future, created by self-fulfilling expectations. Economic and technological progress depends on investments, which depend on growth expectations. By optimistically reaching for ambitious climate goals – net-zero by 2050, in a rapidly growing economy – we may encourage firms to invest more in rapid, green innovation and thus reach the future we seek. Instead, if pessimism or skepticism prevails, the Green Transition will be delayed. Then, the worsening impacts of climate change will lead to economic costs, including both direct damages and adaptation costs, which will reduce the resources available to invest in the Green Transition. Rent-seeking behavior in stagnant economies suffering from adverse climate events will further consume resources that could otherwise be used for investment, leading us into a climate poverty trap.

More prosaically, there are four reasons (at least) why growth will impact favorably on the path of the Green Transition:

(i) For a given path of public and private investments, the implied debt ratios would be lower

[6] Similar to what we argued in the previous section, we believe that also in this case international cooperation should seek to compensate, at least in part, those countries that have not benefited in the past but now stand to lose more from the phasing out of fossil "wealth."

[7] Sectors such as iron, steel, cement, and building materials. According to some estimates, these may account for about 20 percent of global GDP and 85 percent of global greenhouse gas emissions (McKinsey 2022).

[8] If the financing needs of the Green Transition were to lead to stagnation over a timescale of a decade or so, this would both discourage many necessary "green" private investments and also build substantial political discontent targeted at the transition.

[9] https://reform-support.ec.europa.eu/what-we-do/green-transition_en.

[10] Some academics and activists have been advocating a stop to economic growth, a view commonly called degrowth (e.g., Hickel et al. 2022). In our view, degrowth does not offer effective, pragmatic policy guidance; furthermore, it will not be politically or socially feasible, including in the international arena.

(hence, more financially sustainable) the higher growth is;

(ii) For a given path of total required investments, the share of private investments would be higher (and hence the burden on public finances would be lower) the higher growth expectations are;

(iii) Job transitions would be easier in a growing economy, and more generally the social costs of the Green Transition would be more widely acceptable;

(iv) The prospect of a "green growth dividend" would reduce the numbers of skeptics and supporters of degrowth.

POLICY CONCLUSIONS: HOW TO PICK THE "RIGHT" POLICIES?

Whereas the Green Transition would probably happen anyway, the need to strongly accelerate it to steer the world's economies toward a fast (by 2050) net-zero emissions path requires the adoption of strong policy packages. There is no single policy that can take on the burden of steering the economy in the right direction and with the required speed:

- Carbon pricing, or more generally Pigouvian taxes and subsidies, are necessary but will not be sufficient, especially in the beginning. The Green Transition will not get started by simply inducing consumers and producers to purchase or produce different bundles of existing alternative goods. It starts with the invention of new technologies and "commanding" their use to change the way we obtain our fundamental factor of production – energy.
- This change requires an enormous amount of "directed" and coordinated research and investments – and of policies targeted to these purposes, such as targeted subsidies, standards, and bans (see Blanchard et al. 2023).
- To the extent that these policies are intended to stimulate research and/or investments, it is important that they be perceived as long-term commitments, supported by adequate financial resources.
- In addition, specific policies are required to compensate the losers from the Green Transition and facilitate their transitions, whether to new jobs (and new skills), new locations, or both.
- As many policies that induce de-investments from fossil-fuel-related sectors will create losers, to ensure their social and political acceptability it is necessary that they be presented as part of a package that includes appropriate compensations over a sufficiently long horizon.

Again, we stress that, whereas almost every single policy creates winners but also losers, the social and political acceptability of policies will undoubtedly increase as the Green Transition will be perceived to be a recipe for "Green Growth," rather than for a "Green Stagnation."

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