



# Greening, climatizing, and decarbonizing: an inquiry into the transformation of productive sectors and activities

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## Abstract


The new post-COP21 climate regime is ushering in a range of reorientations and transformations of productive activities and economic sectors, based on their place in the global carbon cycle and carbon flows. This introductory article to the special issue on “The Politics of Decarbonization” explores how a focus on the promises of decarbonization observed in various productive sectors can contribute to our understanding of the current transformations of these sectors, their practices, and their production models in the face of climate change. We begin by (I) situating the special issue’s project in relation to the works on greening and ecological modernization published since the 1990s and particularly in relation to the critique of climate capitalism, so as to emphasize the continuities as well as the specificities that a focus on decarbonization policies entails. We then outline (II) the aims of the special issue in relation to the recent literature on climatization: far from seeking to standardize the treatment of the climate issue within a specific social science discipline, we feel it is important to contribute to a multidisciplinary and critical approach to the revival of productivism and the depoliticization of change often associated with decarbonization policies. This issue develops a range of perspectives anchored in different social science fields and disciplines, particularly looking at the forestry, energy, mining, agriculture, research, and bio-economy sectors.

**Keywords** Décarbonization · Productive sectors · Climatization · Transformation · Politics

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## Introduction

Carbon has become a major protagonist in environmental, energy, and industrial policies.<sup>1</sup> While collective and individual efforts to decarbonize in the name of fighting climate change pitch it as the enemy to defeat, all kinds of virtues are attributed to carbon when it comes to capturing and sequestering it in the sinks that oceans, forests, and agricultural soil constitute. Several authors have pointed to the spread of a new economy based on efforts and initiatives to measure, control, and optimize the carbon flows generated by human activities in a range of sectors, with a view to reducing emissions or increasing storage or sequestration capacities. For example, they have described the new hopes placed in the regenerative capacity of humus restored through better agricultural practices and the sequestration of carbon in farm soils (Kearnes & Rickards, 2020) and observed the host of virtues attributed to the development of carbon markets, credits, and instruments, even though these appear to have little concrete effect (Foyer et al., 2017; Paterson & Stripple, 2012).

This introductory article to the special issue on “The politics of decarbonization” explores how a focus on the promises of decarbonization observed in various productive sectors and activities can contribute to our understanding of the current transformations of these sectors, their practices, and their production models in the face of climate change.

The COP21 conference in 2015 in Paris heralded the development of a new climate regime (Dahan & Guillemot, 2015). The goal is to restore the balance of global carbon concentrations in the atmosphere, between on the one hand anthropogenic emissions and on the other optimized absorption by various natural carbon sinks. This new climate regime is giving rise to a range of re-evaluations and changes of direction and transformations of productive activities and economic sectors, based on their place in the global carbon cycle and carbon flows. This issue seeks to characterize and analyse these dynamics through cross-sector reflection on policies to decarbonize productive activities, drawing on examples and case studies from different sectors. In this article, the term “decarbonization policies” refers to the various strategies and agendas developed by policy makers, industry players, and professional actors to mitigate climate change. This can involve either a net reduction in the quantities of carbon released into the atmosphere as a result of different activities (including reduction through substitution within activities and products), or offsetting these carbon emissions through the capture, storage, or sequestration of carbon in natural terrestrial sinks (soils and subsoils, forests, etc.) or even man-made sinks (timber materials).

This article first situates decarbonization policies within the context of the more longstanding “greening” trend, understood here as the extension of environmental and now climatic concerns and issues to an ever-growing variety of activity sectors

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<sup>1</sup> “The EU aims to be climate-neutral by 2050 – an economy with net-zero greenhouse gas emissions. This objective is at the heart of the European Green Deal and in line with the EU’s commitment to global climate action under the Paris Agreement.” ([https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2050-long-term-strategy\\_en](https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2050-long-term-strategy_en), last accessed on 21 February 2023).

and communities of practice over the last several decades. We highlight the continuities with and departures from critical approaches to ecological modernization that characterize this issue's project, particularly situating it in relation to the critique of climate capitalism. We then outline the issue's contributions to the recent literature on climatization processes, emphasizing the value of situated investigations, centred on various industrial sectors and professional groups, for interrogating the transformative reach of changes of practices, organization, or productive models, and that of the technological and industrial investments made in the name of carbon. Rather than reducing the climate issue to a disciplinary approach focused, for example, on the construction and treatment of a specific public issue, we feel that it is important to contribute to a multidisciplinary and critical approach to the revival of productivism and the depoliticization of change often associated with decarbonization policies. This issue thus pays particular attention to the risks of rendering invisible the environmental issues and problems that cannot be "solved" with a carbon metric. More broadly, it examines how the promises of technical and managerial solutions conveyed by decarbonization policies and strategies may sidestep the political question of a more radical transformation of the production and consumption models that prevail today in the "Global North".

We begin by (I) situating the special issue's project in relation to the literature, before (II) presenting the articles, emphasizing their disciplinary and thematic diversity, and identifying two main analytical directions they follow. Eventually, we highlight the contributions and shifts afforded by a focus on the transformative reach of decarbonization policies in this special issue.

## **Conceptual genealogies and the positioning of the issue**

This special issue is guided by the hypothesis that the dynamics of the decarbonization of productive sectors and activities are part of a new stage of a more long-standing and broader process of greening practices and activities ("[From ecological modernization to climate capitalism: a literature review](#)"). The issue thus follows in the footsteps of existing work and reflection on ecological modernization and climate capitalism, investigating both empirically and critically the transformations of production activities and sectors brought about by decarbonization policies ("[From global climatization to the decarbonization of production and industries: continuities and shifts](#)").

### **From ecological modernization to climate capitalism: a literature review**

In this section, we first revisit the concept of greening, particularly developed within environmental sociology in France. Greening, which was initially defined as the integration of environmental objectives into sectoral policies (Deverre & de Sainte-Marie, 2009; Mormont, 2013), refers to the extension of environmental concerns to a range of sectors and activities, with actors thereby seeking to reduce and correct the negative impacts of production practices on the environment (water pollution;

depletion of stocks; soil, landscape, and biodiversity degradation; etc.). Greening encompasses a series of shifts and transformations “in the name of the environment” that vary from one activity sector to another (Bouleau et al., 2020; Candau et al., 2015) and which have given rise to a number of tensions and controversies in the sectors concerned due to the constraints they introduce and the threats they pose to the production conditions and work activities (Levrel & Missemer, 2020). Neither public authorities nor environmental activists have been the sole—or even most powerful—drivers of the greening of industries: on the contrary, many initiatives have contributed to the greening of the production systems (Chiapello et al., 2020). The combined efforts of policies, international conventions, knowledge production processes, and markets (eco-labels, certification, etc.) at different levels have turned greening into a vast “cognitive and normative reframing exercise” (Ginelli et al., 2020), even if the effectiveness and environmental purpose of the changes underway remain uncertain. This issue thus takes as its starting point the observation that the deployment of decarbonization agendas and strategies, particularly since the mid-2010s, has coincided with the emergence of new forms of instrumentation and regulation of production sectors and activities. Their continuities with and departures from the greening trend that has been shaping practices, professions, and sectors since the 1990s are ought to be examined.

At the same time, a more international literature at the crossroads of political ecology, human geography, and political economy has developed a critique of “ecological modernization” and climate capitalism, the development of which has been guided by a particular interpretation of greening. Whereas the political ecology that emerged in the 1970s involved a fierce critique of capitalism and technological progress, the greening policies that have been spreading since the 1990s are largely informed by the hope of reconciling the neoliberal vision with environmental critiques through science and technological innovation (Spaargaren & Mol, 1992; Mol, Sonnenfeld & Spaargaren, 2009; Murphy & Gouldson, 2000). “Ecological modernization”, which was developed in the Netherlands and Germany, is thus a pragmatic and reformist response that allows for integrating the environment into the heart of the economic system, to make it a factor of competitiveness, and ultimately one of the leading edges of what Frederick Buttel (2000) calls “sustainable capitalism”. For the German sociologist Joseph Huber, the founding father of this school of thought, the solution to environmental problems lies in “super-industrialization”: “the dirty and ugly industrial caterpillar will transform into a[n] ecological butterfly” (Huber, 1985, quoted by Mol, 1995, p. 37).

While Hajer (1995) considered “ecological modernization” less as a reality than as an attractive and strategic narrative leveraged by political and economic elites, others have observed that this school of thought, tinged with technological solutionism, has formed the ideological backdrop to international negotiations—particularly the Kyoto Protocol—since the 1990s (Jiang et al., 2022). Ecological modernization, the scope of which is as prescriptive as it is descriptive, is also clearly guided by an incremental-transition approach—as opposed to a project of radical transformation of society and production methods—that posits environmental problems “as politically, economically and technologically solvable within

the context of existing institutions and power structures and continued economic growth” (Bailey et al., 2011, p. 683).

Ecological modernization, which has become the contemporary frame of reference for environmental policies, has been widely criticized for its core premises and its tendency to downplay environmental degradations, reduce the options and pathways of greening (Ginelli et al., 2020), and carry environmental detrimental impacts over to Southern countries and less visible ecosystems (York et al., 2003). Environmental policies inspired by ecological modernization have thus been deemed disappointing, in terms of their environmental effects (Salles, 2009) but also their institutional conservatism (Bailey et al., 2011; Van der Heijden, 1999) and the fact that they overlook the social and North–South dimensions of ecological transition (Rudolph, 2013; Theys, 2000). By fully relying on the regulatory role of markets, the principle of individual responsibility, and a preference for technological fixes, ecological modernization focuses the attention—and action—on consumption practices and the ecological evaluation of their impact. It does not truly consider possibilities for more profound change that would impact lifestyles and production models (Le Berre & Chailleux, 2021) and account for the highly unequal distribution of vulnerabilities and responsibilities in different social groups (Deldrève & Candau, 2014). A similar critique has been voiced in response to the implementation of transition agendas and policies (Grin, 2016), in works pointing to a positivist, linear, and techno-centric approach to transition that tends to naturalize the political structures of the capitalist economy without unpacking the underlying power dynamics (Audet, 2015; Feola, 2020; Martin et al., 2020).

Building on these critiques, the concept of climate capitalism was proposed in the 2010s to describe—and criticize—the way in which the integration of climate issues into public policies and collective agendas effectively extends capitalist functioning to new horizons of productivist growth, particularly through the promise of a decarbonized economy. Climate capitalism, a concept first developed by environmentalist authors (Lovins & Cohen, 2011), highlights the establishment of “a model which squares capitalism’s need for continued economic growth with substantial shifts away from carbon-based industrial development” (Newell & Paterson, 2010). In fact, some authors have even gone so far as to suggest that the fight against climate change and the implementation of decarbonization can be reduced to “scaling-up what we already know how to do” (Pacala & Socolow, 2004, p. 968), without requiring any further efforts to reinvent modes of production and consumption. In line with the modernization paradigm, the driving force behind the change envisaged here is not effort or environmental constraint, but the reorientation of interests to support a low-carbon capitalism that offers opportunities for a renewal of the economic growth model.

In line with this literature, the present issue investigates how decarbonization policies are paradoxically a continuation of the greening trend, understood here as the extension of environmental (and now climate) concerns to a range of sectors, while also ushering in a new framework of transition which, by helping to avoid the question of substantial change to current modes of production, could constitute the very opposite of greening.

## From global climatization to the decarbonization of production and industries: continuities and shifts

This special issue also engages with the recent political science literature more specifically focused on climatization (Aykut, 2020; Hrabanski & Montouroy, 2022). This literature, at the crossroads of political sociology and international relations studies, points to the growing influence of climate issues on a range of actions and spaces that were not previously linked to the climate but are now approached through the prism of climate change. According to Aykut and his co-authors, the concept of climatization refers to the process whereby “climate change becomes the frame of reference through which other policy issues and forms of global activism are mediated and hierarchized” (Aykut & Maertens, 2021, p. 501), just as the concept of judicialization, for example, designates the process whereby justice and the law become the frame of reference for understanding and interpreting other themes and issues. The authors identify two simultaneous and complementary processes: while climatization refers to the transformation of the understanding of various issues as they are reinterpreted in connection with the climate, globalization consists of the extension of the climate issue to include a growing variety of other themes and issues as they take on a climate dimension (for example, transport or agriculture). Aykut stresses that climatization is “an open-ended social process whose content is determined by myriads of actors and organizations” (ibid., p. 501): it “can be good or bad” and “is large enough to encompass superficial and largely symbolic changes as well as much deeper transformations” (ibid., p. 506). On surface level, taking climate issues into account may seem like a positive outcome compared to denial or a state of ignorance. However, like the research programme proposed by Aykut, the studies on the climatization of productive sectors and activities in the present issue strive to shed light on the paradoxes and limits of the various current climatization trajectories. Like other studies on climatization that have found it to be incomplete or have pointed to the “declimatization” of the sectors investigated (see Montouroy et al. (2022) on the banana industry), the articles examine the often limited, incomplete, and highly heterogeneous nature of climatization, which can also be guided by opportunistic industrial, economic, and professional strategies to “increase organizations’ public profile, attract media attention, and tap into funding opportunities” (Aykut & Maertens, 2021, p. 509).

At the same time, the present issue departs from previous studies of climatization in two ways. The first relates to the types of arenas studied. The concept of climatization has been primarily articulated to describe the transformation of the causes defended and mobilizations that take place within the framework of international climate negotiations (Aykut et al., 2017). Marie Hrabanski’s work, which draws on that of Aykut, also explores the process whereby agriculture has been put on the agenda in climate negotiations over the last 20 years, as well as the discursive and symbolic transformations that enabled this climatization of the theme of agriculture, particularly within the framework of the Conferences of the Parties (COPs)

(Hrabanski, 2020; Hrabanski & Le Coq, 2022).<sup>2</sup> Moreover, the concept of climatization has been extended to the analysis of other types of arenas further removed from climate negotiations, particularly in the special issue edited by Stefan Aykut and Maertens (2021), which investigates the reframing processes at play in certain sectors, such as the military and the defence industry, and in certain institutions (United Nations Security Council) and transnational social movements.

Rather than the focus on the processes underlying the climatization of negotiations, causes, and themes, the present issue examines the forms and effects of the climatization of productive activities, in other words the emergence of a range of forms of “carbon rationalization” pushed by groups of industrial and professional actors, which are reconfiguring organizations, strategies, and productive and industrial models around decarbonization agendas. In this sense, we align with the approaches of the special issue edited by Hrabanski and Montouroy (2022), which investigates the “differentiated climatizations’ of a set of sectors, through the cases of aviation, agriculture and especially the banana production industry, as well as the management of natural flood risks and defence”.

The present issue’s approach to climatization also differs from that of previous works in a second way. In the research of Aykut and those who followed in his footsteps, climatization primarily describes a process of issue framing and symbolic reinterpretation of a host of themes and issues that were not previously approached through a climate prism: “a process through which an issue, actor, or institution is framed as related to anthropogenic climate change and relevant to climate politics” (Aykut & Maertens, 2021, p. 502). Aykut clearly emphasizes that climatization “does not primarily result from legal dispositions in climate treaties or formalized linkages [...] instead it is often brought about by the work of a myriad of actors and organizations engaging in climate-related activism, building networks or refracting their issues through a climate lens” (Aykut & Maertens, 2021, p. 502). As a result, the literature on climatization tends to focus on the symbolic (re)framing involved in the adoption of a “climate lens”. This special issue does not just seek to shine a spotlight on the forms of reframing of issues in strategic discourses and professional rhetoric: its originality also lies in the interrogation of the transformative reach of the dynamics currently affecting production “in the name of the climate and carbon”. In addition to analysing the symbolic reframing of the challenges and rationales of more or less climatized sectors, it also suggests the possibility of describing and characterizing the practical, organizational, and institutional aspects of the transformations underway in relation to different values:

<sup>2</sup> Through her study of the emergence and development of three concepts since the 1990s—agro-ecology, climate-smart agriculture, and nature-based solutions—Hrabanski identifies the role of international organizations and experts (particularly within the FAO) in promoting and (re)framing agricultural issues in international climate negotiations. She shows that, within the international climate-negotiation arena, the climatization of agriculture is associated with the framing of issues in terms of helping the agricultural sector to adapt rather than mitigating climate change (which would have involved identifying the agricultural sector’s responsibility for greenhouse gas emissions).

environmental values (the various types of pollution associated with mining activities: Buu-Sao et al., in this issue); professional values (the defence of academic professional models: Hardy); and social and political values (critique of the persisting privilege granted to certain categories of farmers as well as forestry and industrial actors: Magnin and Doré; Baysse-Lainé; Hrabanski et al.). The issue analyses industrial actors' and professional organizations' diverse range of decarbonization agendas and strategies, to examine their capacity to transform the modes of regulation and operation of productive activities beyond the mobilization of a carbon metric.

Finally, the literature on climatization features a cleavage regarding the singularity of the climate and climatization dynamics. According to Aykut (2020), climatization constitutes a “new human condition”, reflecting a key process of contemporary transformation of society, a “broad historical dynamics” (p. 505), whereby the climate is acquiring a gravitational pull capable of transforming a large number of social spheres: “living under a changing climate increasingly appears as a central feature of ‘our’ new, and highly unequal, human condition” (Aykut & Maertens, 2021, p. 514). In Aykut’s work, the concept of “climatization” thus constitutes both a general diagnosis of the singular power integral to the climate as a theme in contemporary society and a research programme geared towards the analysis of the diverse forms of transformation of “climatized” mobilizations and organizations.

In contrast with this position, the special issue of *Gouvernement et Action Publique* edited by Hrabanski and Montouroy (2022) shows that “in terms of contemporary public policy, climate change is just one of a number of issues; as a result, the actors championing this issue as a public problem must still ‘fight’ to prevail” (ibid. p. 1). It sheds light on “the political processes underlying climate change’s entry into ‘normal’ politics” (ibid.) which can—and must—be studied by mobilizing the range of existing political science tools and theories.

While we agree that climate and carbon issues do not spontaneously prevail and are addressed differently in different sectors of activity, we start from the premise that decarbonization is not just any public issue. We explore the particular effect of decarbonization policies on actor coalitions, the political work they conduct, and the resulting institutional reconfigurations. In line with the literature on climate capitalism (Newell & Paterson, 2010; Bailey et al., 2011; Lovins and Cohen, 2011), the present issue considers climate change as a singular emergency and crisis and specifically examines the singularity of decarbonization strategies compared with other processes and policies of greening, in order to suggest that carbon-centred policies entail a specific marginalization of other environmental issues and dimensions (such as water or biodiversity) as carbon tends to become a central indicator and standard to measure the value of environmental and climate-related initiatives and actions.

## Presentation of the contributions and key arguments of the issue

### Presentation of the contributions

With this in mind, the issue develops a range of perspectives and approaches anchored in different social science fields and disciplines—including political



science, geography, sociology, history, and economics. The articles particularly focus on the sectors of forestry (Baysse-Lainé; Sergent and Smith), agriculture (Magnin and Doré, Hrabanski et al.), energy production (Briday et al., Hrabanski et al.), mining (Buu-Sao et al.), academic research (Hardy), and the bio-economy (Ehrenstein and Rutge, Sergent and Smith). The different contributions are organized into two groups, that partly overlap. The first group addresses the promises and hopes for transforming conventional products and practices and adopting low-carbon ones; contributions show that new, decarbonized practices and products do not replace, but are rather being added to, the conventional ones—in line with Fressoz’s broader historical analysis that new sources of energy never replaced older ones, instead they have been developed and used in addition to the latter (Fressoz, 2022). The second group explores the role of sectors and professional mobilizations in decarbonization efforts and investigate the transformative power of the changes observed and the new rationales at play. Contributions scrutinize the shifting power relations between various sectors and the State; they address the rising, contested focus on carbon as a standardized metric to assess the virtue of the transformations of practices and production models.

### **Decarbonization as a promise: from hopes to non-materialization**

The contribution by *Véra Ehrenstein* and *Alice Rutge* examines the emergence of a bio-economic sector currently at the research and development stage, built on the processing and exploitation of agricultural waste consumption by microbial metabolisms to produce a range of products. This research is fuelled by the hope that with biotechnologies, it will become possible to replace a fossil carbon source with a source of renewable carbon derived from agricultural biomass. Drawing on interview-based research in R&D laboratories, the authors highlight the tensions experienced by researchers faced with the recalcitrance of living cells and competition from petroleum-based industries: these tensions strongly nuance the promises of bio-economic substitution outside the confines of laboratories.

*Régis Briday*, *Xavier Arnauld de Sartre*, and *Sébastien Chailleux* trace the history of official discourses on CCUS (carbon capture, utilization, and storage) techniques in French industrial and energy sectors. Drawing on archives, interviews, and observations, they describe four successive phases, starting in the 1970s. They suggest that although CCUS techniques have not replaced conventional organizations and industries as they remained marginal and relatively un-transformative in France, the justifications for adopting these techniques interweave recent carbon and climate issues with more longstanding concerns about national energy independence (in the wake of the oil shocks of the 1970s), concerns surrounding the increasing reindustrialization witnessed since the 2000s, and issues of international cooperation in the research and development sector.

Still on the topic of reindustrialization, the article by *Doris Buu-Sao*, *Sébastien Chailleux*, and *Sylvain Le Berre* deals with the mining industry. Focusing on four types of space (the global arena, Europe, France, and Andalusia), they study the circulation of discourses justifying the mining revival in connection with the European agenda for a “green” economy and show the variations across countries and between

actors. While more than a dozen mining projects were launched in Andalusia as a result of the interweaving of climatization and national reindustrialisation issues, in France, none of the mining projects, which tended to focus on reindustrialization in the name of national sovereignty, is ultimately materialized. The article shows that the climatization of the mining sector in Europe remains largely discursive and has involved little transformation of extractive activities and practices but paradoxically helps to legitimize their revival in the name of the climate, particularly in the hope of substituting fossil resources with certain minerals.

*Adrien Baysse-Lainé's* article examines the (still marginal) emergence of concerns with keeping carbon in the soil in forestry discourses and practices. Based on a study in the Morvan massif, it shows how environmental NGOs have reframed their criticisms of clearcutting around climate and carbon issues; the article characterizes the different ways in which knowledge about carbon circulates among actors in the forestry sector. The article highlights the strategic uses of the argument for maintaining forest carbon stocks, particularly surrounding the introduction of the low-carbon label, which can lead to carbon being conserved in the least productive forest areas in order to boost production in other areas.

### **The role of the various sectors and professional mobilizations: how transformative are decarbonization policies?**

The article by *Arnaud Sergent* and *Andy Smith* focuses on the wood industry in France, which is particularly mobilized to meet the objectives of the national low-carbon strategy in terms of the substitution and storage of materials. The authors take a meso-political economy approach to the industry to explore its governance, analysing the policy work undertaken by the public and private sectors. They show that the industry is caught in a tension between ecological and industrial planning, with a growing divide between the productive model promoted by policies driving ecological effort and interprofessional organizations, on the one hand, and, on the other hand, the conservationist model promoted by political and civil-society movements.

*Léo Magnin* and *Antoine Doré* propose a political sociology of the promise of greening agriculture, showing how this promise particularly relies on new private players or “start-ups” and their role in various efforts to assess agricultural carbon budgets. The study shows how the emphasis on CO<sub>2</sub> sequestration in agricultural soils, on the one hand, and the symbolism of the agile and innovative start-up, on the other, converge in the promotion of economic solutions to global warming—despite the highly heterogeneous status and functioning of the “start-ups” involved in this “decarbonization”. The authors document an optional and partial greening of agriculture, overseen by the State, implemented by private administrative service providers, and financed by companies seeking to improve their carbon footprint.

The article by *Marie Hrabanski*, *Sidonie Verdeil* and *Antoine Ducastel* develops a different stance on the role of agriculture and industries by looking at France’s policy of energy decarbonization through the development of agrivoltaism and unpacking the associated power relations between the agricultural and energy sectors. The authors show that while instruments to support agrivoltaism are helping to increase

the share of renewable energy in the French energy mix, their effects on governance, organizational models, and practices in the agricultural sector are more uncertain. They suggest that we are witnessing a proliferation of farmland-based agrivoltaic projects that prioritize the interests of energy players, with access to farmland seen as a means of achieving their objectives.

*Antoine Hardy's* article discusses the recent mobilization of certain research-sector professionals in France to quantify laboratories' "carbon footprint". Based on a qualitative study of the actors involved in the Labos 1.5 movement, it highlights how the decarbonization agenda is sparking tensions surrounding the ordinary functioning of research and its professional models, particularly regarding researchers' expectations around international travel and the claim of political neutrality in science. It traces the evolution of Labos 1.5 as a movement focusing on carbon as a new, contested, metric, and indicator of the "virtue" of professional practices.

### **Interrogating the transformative power of decarbonization policies**

To what extent do the decarbonization policies investigated in these various articles reconcile, nuance, or shift critiques of ecological modernization? How can we situate decarbonization policies in relation to the markers of climate capitalism, such as solutionism, the prioritization of technological innovation, and the challenging of States' regulatory instruments to advocate governance solutions that rely on private players instead? Few studies so far have examined the materialization of decarbonization strategies in productive sectors and activities. This special issue provides a series of detailed studies on a range of sectors, including not only primary sectors such as agriculture and forestry but also the mining industries, the energy sector, the bio-economy, and a service sector: academic research. While the idea of climate capitalism has emerged as a theoretical model to explain a range of observations, we investigate the modalities and effects of decarbonization agendas as articulated, promoted, and implemented by industrial and professional players themselves in diverse contexts and informed by different rationales.

### **The risks of depoliticizing the climate issue**

This special issue begins by examining decarbonization policies' tendency to depoliticize the climate question, by focusing essentially on technical solutions to the challenges of climate change. These solutions may involve the development of sectors, techniques, and materials to substitute petrochemical products with low-carbon ones, techniques to capture the CO<sub>2</sub> produced by certain types of industry, or the adoption of agricultural or forestry practices that sequester more carbon. In most cases, they also involve the development of metrological capabilities and forms of control to assess and certify the reality of decarbonization efforts. The focus of the issue therefore then turns to the limits of these metrological and regulatory capabilities, showing that they are geared more towards certifying the efforts undertaken (following a duty-of-care approach) than towards objectifying the reality of the quantities of carbon actually avoided or sequestered (based on a

performance-obligation approach) (see Magnin and Doré in this issue). Likewise, it highlights the technological, managerial, and accounting optimism of decarbonization promises, some of which seem to be self-sustaining without ever moving beyond the confines of research laboratories (see Ehrenstein and Rutge in this issue) or the stage of programmatic and technocratic statements (Briday et al. in this issue; Sergent and Smith in this issue).

We also, and above all, seek to show that decarbonization rhetoric and efforts foster hope of a technical, industrial, and accounting solutionism which is highly likely to render invisible or sidestep the possibility of other, more radical approaches to change that would more directly challenge the modes of production and consumption that have prevailed over the last few decades. Paradoxically, the heated debates that have pervaded academia regarding the promotion of an instrument to measure the carbon footprint of laboratories are rather evidence of the hyper-politicization of decarbonization policies (see Hardy in this issue). Nevertheless, the articles in this issue suggest that the promises of decarbonization could entail a broader reappropriation and reversal of the greening trend underway since the 1970s, stripping it of its meaning and instituting an avoidance of the political—in the sense of political debate regarding the type of change that the gravity of climate change requires.

### Shedding light on the blind spots of the carbon indicator

This issue also shares specific reflection on decarbonization policies, looking at their use of carbon as a metric and yardstick to measure the value of the transformations underway. Bensaude-Vincent and Loeve (2018) have highlighted the way in which “low-carbon” rhetoric and initiatives convey a “chemical gaze” that tends to reduce the diverse range of activities, processes, and behaviours at stake to a chemical element that serves as a universal unit of measurement: carbon. For Landecker, the “chemical gaze” comes into play when “materials and organisms are not seen in the way a naturalist might sort them out, into different species of plants, minerals, animals, fungi or bacteria: instead, under the ‘chemical gaze’ things are reduced to their chemical components and properties, like the carbon chains they consume, produce, store and are made of” (Ehrenstein and Rutge, in this issue). As Léo Magnin and Antoine Doré note in this issue, “[CO<sub>2</sub>] is no longer just a gas, but also a unit of measurement that makes it possible to convert other greenhouse gases into CO<sub>2</sub> equivalents based on their warming power. The focus on carbon dioxide and – through abuse of language – on carbon itself has allowed for the production of an imperative that can easily be exported to different sectors (‘decarbonizing’ mobility, culture, transport, etc.)”. This role given to carbon aligns with one of the promises of ecological modernization, which was precisely to develop non-monetary indicators to separate the environmental issue from economic questions. Yet, we feel that it is crucial to interrogate the methods and effects of this trend, whereby carbon, having become a unit of measurement and equivalence, is ultimately contributing to reducing the host of options and objectives for the transformation of activities to a single, quantifiable, and measurable indicator. Decarbonization policies thus constitute a dominant approach to assessing the “virtue” of investments and changes made for the climate in terms of the quantity of carbon not emitted or sequestered. From

this perspective, they therefore help to supplant other environmental issues that are not easily “solvable” with a carbon metric and indicator—such as the conservation of landscapes, biodiversity and soils, and water quality issues.

In contrast with greening, understood as the continuous extension of environmental issues to new territories, sectors, and organizations (Deverre & Sainte-Marie, 2009; Mormont, 2009; Ginelli et al., 2020), decarbonization policies could even contribute to new threats to the integrity of natural environments and their biodiversity. By establishing carbon as the main yardstick for assessing the environmental value of changes in production practices, they could also contribute to a variety of production stimulus effects, replacing “producing better” with “producing more” (more wood to replace cement: Sergent and Smith in this issue; more minerals to compensate for dwindling gas and oil resources: Buu-Sao, Chailleux, and Le Berre in this issue) in the name of the climate and carbon. More broadly, these risks are characteristic of investments in the revival of national industrial activities in connection with the development of carbon capture, utilization, and storage (CCUS) techniques (Briday et al. in this issue), as well as hopes of developing virtuous bio-economy sectors (Ehrenstein and Rutge in this issue). Production revival dynamics are also characteristic of efforts to sequester carbon and produce renewable energy in agricultural environments—efforts which tend to favour dominant agricultural players committed to productivist approaches (see Magnin and Doré, and Hrabanski et al. in this issue).

## Conclusion

Taken together, the different contributions in this issue suggest just how much the vision of “low-carbon” futures conveyed by the promises of decarbonization constitutes powerful galvanizing resources for the symbolic, strategic, organizational, epistemic, and practical work of actors striving to bring about low-carbon practices and forms of organization. This is well in line with the double, paradoxical, features of firms’ “overpromising” discourses of decarbonization analysed by Frisch (2023): he showed that these promises both entailed a high level of contradiction—in the extent that the actors tend to downplay and evade the tensions between decarbonization and continuity of economic growth—and a certain degree of commitment from these same actors to enacting new, low-carbon organizations and practices.

By focusing on a diverse range of sectors, the contributors to this issue highlight both the extent and the power of these decarbonization promises, as well as the various difficulties involved in realising them and the frequent failure to fulfil them. Whether due to the recalcitrance of microbial life (Ehrenstein and Rutge), tensions around professional models (Hardy), metrological difficulties, the limited weight of climate issues relative to concerns about industrial productivity, and the revival of production (Buu-Sao et al.; Sergent and Smith; Briday et al.; Baysse-Lainé), or the renewal of inter- and intra-sectoral power struggles—particularly in agriculture (Magnin and Doré; Hrabanski et al.) and the wood industry (Sergent and Smith)—the promises of decarbonization are struggling to materialize, and changes in practices often remain tenuous. This suggests just how limited the transformative power

of decarbonization policies remains given the urgency of the current environmental and climate crisis.

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## Declarations

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