


FORUM

Industrial policy and the green state: Forging a world after growth

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(Received 20 October 2023; accepted 29 January 2024)

Abstract

The resurgence of industrial policy is reshaping the global political economy and creating emergent formations that could help create green states. Such green states can seed a world after growth. Growth is often taken for granted as a natural purpose of states and an appropriate basis of public policy. However, it has a recent political-economic and cosmological history. This suggests that an age after growth is not only possible but likely. In the current conjuncture of crises and challenges, industrial strategies that bring together environmental, social justice, and pro-growth coalitions offer the best chance to meet climate goals and improve the prospects for inclusive prosperity globally. In addition, there is evidence that industrial policy is providing a platform to build active states, rebalance state–business relations, forge new systems of calculation, and gather cosmological resources for new action.

Keywords: green state; growth; industrial policy; international order

Introduction

Each international order is premised upon a set of purposes that legitimate its rules and structure its institutions.¹ Those purposes, rules, and institutions are forged over decades as actors create new ideas and seek to embed them in treaties and organisations. Economic growth is often taken for granted as a natural purpose or structural imperative of states.² However, in its current form, the idea that states should pursue limitless growth emerged quite recently. It was established as a goal and built into the institutions of international order only in the twentieth century. Moreover, it was created and institutionalised under a highly specific set of historical circumstances: American hegemony, the two world wars, the rise of oil, the end of colonialism, and the creation of modern national accounting frameworks.³ As the whole nexus of cosmological, political, practical,

¹In this schema, international order refers to observable patterns of behaviour in international practices and transactions. Purposes, rules, and institutions shape those practices but also reflect them. John Gerard Ruggie, 'International regimes, transactions, and change: Embedded liberalism in the postwar economic order', *International Organization*, 36:2 (1982), pp. 379–415; Martha Finnemore, *The Purpose of Intervention: Changing Beliefs about the Use of Force* (Ithaca, NY: Cornell University Press, 2019).

²See John S. Dryzek, David Downes, Christian Hunold, David Schlosberg, and Hans-Kristian Hernes, *Green States and Social Movements: Environmentalism in the United States, United Kingdom, Germany, and Norway* (Oxford: Oxford University Press, 2003); Daniel Hausknost, 'The environmental state and the glass ceiling of transformation', *Environmental Politics*, 29:1 (2020), pp. 17–37.

³Matthias Schmelzer, *The Hegemony of Growth: The OECD and the Making of the Economic Growth Paradigm* (Cambridge: Cambridge University Press, 2016); Heloise Weber and Poppy Winanti, 'The "Bandung spirit" and solidarist internationalism',

technical, and institutional elements that constituted and maintained growth as a naturalised purpose shifts, so too will the aims of states.

The tectonic pieces of international order are all now shifting. Renewed geopolitical competition, the rise of large middle-income countries from the Global South, and the low-carbon energy transition are altering political dynamics and opening up space for new goals. Geopolitics pushes states to trade growth off with security and supply-chain resilience. The rise of large middle-income countries from the Global South is no longer conceived purely in terms of growth. The distinction, advanced by Herman Daly decades ago, between development and growth is now widely understood.⁴ The critical need for clean energy technologies has reinvigorated the role of the state in economic life and started vital conversations about public purpose.⁵

Economic imperatives are being actively rebalanced and reconfigured within a new global landscape. What will come after the growth-based liberal order? And what can be done today to build and position the many constitutive elements of a new configuration?

The political and economic challenges of this era are compounded by the scope and scale of action needed to address climate change. The rich, developed countries are simply not acting with the speed and urgency required to limit warming to 1.5 degrees. Developed countries must lead because there are deep challenges to concerted action in the other groups of countries: contested democratic countries, oil and gas producers, coal-dependent economies, and fragile states all face major barriers to robust climate action.⁶

While the growth imperative has been rightly identified as a key barrier to concerted action on climate change, there is a debate about whether degrowth is an appropriate political-economic response to this moment. Eckersley argues that degrowth 'is not the next best step with the greatest transformative potential because it would generate a significant political backlash, produce particularly harsh economic consequences for the most marginal members of society, and set back the transition process.'⁷ On this view, the climate crisis may demand a kind of rapprochement with growth-based politics in the form of industrial policies to drive decarbonisation.

Industrial policies have been identified as a critical tool in the fight against climate change.⁸ They not only serve as a source of directed technological change but also help to create the political coalitions that can create and sustain climate policies in the face of backlash and counter-movements by fossil coalitions.⁹ Nonetheless, industrial policy for climate action need not be seen merely as a second-best compromise. The current moment presents an opportunity for critical transformations in the configurations of power and purpose that underlie international order.¹⁰ If that is the case, then it is incumbent upon critical analysts to identify the political opportunities for advancing the green state.

The green state is a normative ideal: the existence of a government that actively manages environmental resources in a sustainable way while creating a just and prosperous society.¹¹

Australian Journal of International Affairs, 70:4 (2016), pp. 391–406; Timothy Mitchell, *Carbon Democracy: Political Power in the Age of Oil* (New York: Verso, 2011); Bentley Allan, *Scientific Cosmology and International Orders* (Cambridge: Cambridge University Press, 2018).

⁴Herman E. Daly, *Beyond Growth: The Economics of Sustainable Development* (Boston, MA: Beacon Press, 1996).

⁵Mariana Mazzucato, *Public Purpose: Industrial Policy's Comeback and Government's Role in Shared Prosperity* (Cambridge, MA: MIT Press, 2021).

⁶William F. Lamb and Jan C. Minx, 'The political economy of national climate policy: Architectures of constraint and a typology of countries', *Energy Research & Social Science*, 64 (2020), p. 101429.

⁷Robyn Eckersley, 'Greening states and societies: From transitions to great transformations', *Environmental Politics*, 30:1–2 (2021), pp. 245–65.

⁸Jonas Meckling, Nina Kelsey, Eric Biber, and John Zysman, 'Winning coalitions for climate policy', *Science*, 349:6253 (2015), pp. 1170–1; Bentley Allan, Joanna I. Lewis, and Thomas Oatley, 'Green industrial policy and the global transformation of climate politics', *Global Environmental Politics*, 21:4 (2021), pp. 1–19.

⁹Hanna Breetz, Matto Mildenberger, and Leah Stokes, 'The political logics of clean energy transitions', *Business and Politics*, 20:4 (2018), pp. 492–522.

¹⁰Ruggie, 'International regimes, transactions, and change.'

¹¹See Eckersley 'Greening states and societies'; Andreas Duit, Peter H. Feindt, and James Meadowcroft, 'Greening Leviathan: The rise of the environmental state?', *Environmental Politics*, 25:1 (2016), pp. 1–23; Daniel Hausknot, 'The environmental state

The environmental state, by contrast, is the functional unit that seeks to govern environmental problems using regulation, investment, and monitoring. The key question in the debate on these questions is when, or if, the environmental state will spawn the green state. Some argue this evolution is unlikely because the environmental state will not be able to compete with the power and imperatives of growth which are embedded in the logic of capital.¹²

However, there is strong evidence that a deep transition is underway. The United States, in response to Chinese industrial policy, has launched its own powerful green industrial strategy. Europe in turn responded with its own net-zero industrial plan, the Green Deal.¹³ Decarbonising states are also increasingly acting as owners, making investments in clean energy and net-zero manufacturing.¹⁴ Concerted, assertive state action in support of the energy transition is happening, albeit unevenly. Here, we have what might be seen as nascent green states. This marks a departure from a neoliberal age dominated by passive states that supported the growth imperative as a means of deferring to the aims and modalities of global capital.

This paper argues that the green rapprochement with growth via industrial policy is ushering in a new global political economy. Industrial policy advances the environmental state and presents the potential beginnings of a green state while supporting the transition. It does so by advancing three trends. First, it is rebuilding the strategic capacity of the state to induce technological change and create geopolitically resilient supply chains. Second, industrial policy requires the creation of new regulatory and policy systems of calculation centred on carbon management. Third, the transition is bringing in new cosmological resources related to long time horizons, circularity, interconnectedness, and a new humbled conception of human destiny. These are elements of a new global formation. The new formation will not eliminate pressures for expansionary capital, but it will be novel and as such it is worth accelerating and understanding more deeply.

The paper begins by reviewing the history of growth and the theory of formations. It then discusses the role of industrial policy in climate action. Finally, it reviews how a state invigorated by industrial policy might transform global order.

The recent history of growth

The origins of the growth-based order are relatively recent. Timothy Mitchell's work dates the rise of growth to the 1920s and 1930s.¹⁵ Adam Tooze and others suggest that perhaps the concept of growth was circulating as early as the 1890s.¹⁶ Either way, growth was not institutionalised in international order until after the Second World War. It was only in the articles of agreement for the International Monetary Fund and the World Bank that growth first emerged in international order.¹⁷ This suggests that a growth-based order is neither natural nor inevitable.

and the glass ceiling of transformation', *Environmental Politics*, 29:1 (2020), pp. 17–37; Roger Hildingsson, Annica Kronsell, and Jamil Khan, 'The green state and industrial decarbonisation', *Environmental Politics*, 28:5 (2019), pp. 909–28; Benjamin Braun and Daniela Gabor, 'Green macrofinancial regimes', unpublished manuscript available at: <https://benjaminbraun.org/research/green-macrofinance/green-regimes>].

¹²Hausknot, 'The environmental state'; Matthew Paterson, 'Political economy of greening the state', in Teena Gabrielson, Cheryl Hall, John M. Meyer, and David Schlosberg (eds), *The Oxford Handbook of Environmental Political Theory* (Oxford: Oxford University Press, 2016), pp. 1–17.

¹³European Commission, 'A Green Deal Industrial Plan for the Net-Zero Age', COM/2023/62 (2023), available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52023DC0062>].

¹⁴Milan Babić and Adam D. Dixon, 'Decarbonising states as owners', *New Political Economy*, 28:4 (2022), pp. 608–27; Milan Babić, 'State capital in a geoeconomic world: Mapping state-led foreign investment in the global political economy', *Review of International Political Economy*, 30:1 (2021), pp. 201–28.

¹⁵Timothy Mitchell, *Rule of Experts: Egypt, Techno-Politics, Modernity* (Berkeley: University of California Press, 2002); Timothy Mitchell, 'Economentality: How the future entered government', *Critical Inquiry*, 40 (2014), pp. 479–507.

¹⁶J. Adam Tooze, 'Imagining national economies: National and international economic statistics, 1900–1950', in Geoffrey Cubitt (ed.), *Imagining Nations* (Manchester: Manchester University Press, 1998), pp. 212–28.

¹⁷Allan, *Scientific Cosmology and International Orders*.

Growth emerged in a very particular time and place from the confluence of three movements. The first was a shift in global geopolitics and political-economy: the constellation of interests between the state, labour, and business in the United States and Europe.¹⁸ In this period, US policy-makers advocated for a productivist order supported by liberal trading rules because it promised to maintain the high levels of industrial output achieved during the war.¹⁹ Maximising American production would ensure full employment at home. But that production would need to be absorbed by European consumption. This would provide funds for the welfare state, ensure full employment, and underwrite American power.

The second movement was the establishment of a technocratic mode of governance supported by the spread of economic tools of calculation. In the 1950s, the United States promoted growth-based policy internationally. Even among its most dependent European allies, this could not simply take the form of hegemonic coercion. States had to be taught what national economic growth was and be persuaded that it was a legitimate goal. Thus, hegemony depended on an epistemic infrastructure provided by international organisations and transnational knowledge networks. These networks taught income accounting and economic modelling practices.²⁰ The rise and spread of national accounting brought the macroeconomy into politics. It made it possible for policymakers to imagine the national economy and to place this object in a broader economic order.

This conception of order-linked series of national accounts made possible a new Keynesian understanding of hegemony. American decision-makers had come to see the United States' role in the economic order as the provider of economic stimulus necessary to ensure the security and prosperity of the free world. The United States would provide the goods to fuel growth throughout the world, raising living standards and providing 'a sense of hope' that legitimated US hegemony.²¹

This in turn was linked to a third movement: a shift in cosmological ideas about time, the power of knowledge, and the shape of human destiny.²² The concept of growth itself merged 19th-century colonial concepts of progress with the idea that the social world was comprised of epistemic objects that could be controlled. The world, newly amenable to technocratic control, would be transformed by growth under the auspices of American hegemony. Newly decolonised states supported and adopted this vision.²³

Therefore, the growth-based order can be understood as a formation. I define a formation as a stable if dynamic configuration of interests, practices, and ideas that create durable patterns of state behaviour. The concept of a formation can help introduce a processual element into our thinking about order, while still allowing us to make structural arguments about its constitution and power. By noting that the growth-based order represents a coming together of political-economy, tools of calculation, and cosmological ideas, we can denaturalise the emergence of that order and explore the conditions under which they might come apart.

¹⁸Charles S. Maier, *In Search of Stability* (Cambridge: Cambridge University Press, 1987); Charles S. Maier, 'Alliance and autonomy: European identity and U.S. foreign policy objectives in the Truman years', in Michael J. Lacey (ed.), *The Truman Presidency* (New York: Cambridge University Press, 1989), pp. 273–98.

¹⁹G. John Ikenberry, 'A world economy restored: Expert consensus and the Anglo-American postwar settlement', *International Organization*, 46:1 (1992), pp. 289–321; Aaron Major, *Architects of Austerity: International Finance and the Politics of Growth* (Stanford, CA: Stanford University Press, 2014).

²⁰Matthias Schmelzer, *The Hegemony of Growth: The OECD and the Making of the Economic Growth Paradigm* (Cambridge: Cambridge University Press, 2016); Tomo Suzuki, 'The epistemology of macroeconomic reality: The Keynesian revolution from an accounting point of view', *Accounting, Organizations and Society*, 28:5 (2003), pp. 471–517; Daniel Speich, 'The use of global abstractions: National income accounting in the period of imperial decline', *Journal of Global History*, 6 (2011), pp. 7–28.

²¹Foreign Relations of the United States. Paper Prepared in the Bureau of Economic Affairs. 17 May 1954. PPS Files, lot 65, D 101, 'Economic Policy', FRUS, 1952–54, Volume I, Part 1, Document 22 (1954).

²²Allan, *Scientific Cosmology and International Orders*.

²³Joseph Hongoh, 'The Asian–African conference (Bandung) and Pan-Africanism: The challenge of reconciling continental solidarity with national sovereignty', *Australian Journal of International Affairs*, 70:4 (2016), pp. 374–90; Ahmad Rizky Mardhatillah Umar, 'Rethinking the legacies of Bandung conference: Global decolonization and the making of modern international order', *Asian Politics & Policy*, 11:3 (2019), pp. 461–78.

Industrial policy and the transformation of the state

The pathologies of growth are now well known.²⁴ Indeed, growth-based politics played a key role in slowing down climate action. Through the 1980s and 1990s, economists argued that climate action today would cost future generations much needed GDP growth.²⁵ The more efficient solution was to grow today and let our richer progeny handle the problem.²⁶ But at the same time, it was only when policymakers started to argue that climate action was compatible with growth that climate action actually gained traction.²⁷

The emergence of green growth and ideas can be traced to China's industrial policies for wind and solar. China's successes in building new energy supply chains were an inspiration and a competitive threat to many. Their responses have created a flurry of green industrial policies.²⁸ The United States, South Korea, the United Kingdom, the European Union, Australia, and others all now have clear green industrial strategies that seek to seize economic opportunities in the energy transition.

The argument for green industrial policy is that intentional efforts to build clean energy industries ease the politics of transition.²⁹ It builds up allies among the firms, communities, and workers that benefit from economic activity in new areas. It thus transforms climate action into a win-win.³⁰ Indeed, while other political and institutional strategies have failed, industrial policy has shifted the momentum. Industrial policy has set off a chain reaction among governments, markets, and technology developers that is driving unprecedented investments in clean energy and decarbonisation projects.³¹ The energy transition, bumpy though it may be, seems inevitable now.

Hence, there is an argument for a rapprochement between industrial policy and supporters of climate action. However, for many environmentalists this is a bridge too far. After all, industrial policy in places like the United States, Australia, the United Kingdom, and Canada may mean support for mining, blue hydrogen, carbon capture, and biofuels. Environmentalists and degrowthers may not be willing to accept the ecosystem damages these technology deployments may entail.³² But mining, carbon capture, and alternative fuels offer workers in fossil fuel industries and natural resource sectors a place in the net-zero future. In these and other countries, the politics of 'just transition' cashes out in off-ramps for incumbents and opportunities for these workers and rural communities.³³ Without such off-ramps, decarbonisation will face stronger opposition in these countries.

This debate between advocates of green industrial policy and degrowthers has stagnated for want of a strong theoretical and empirical basis to establish the conditions under which the green state could emerge.³⁴ Since the green state has not emerged before, it's difficult to specify such conditions. One key indicator is the emergence of active states that define and pursue environmental goals.

²⁴Stephen Macekura, *Of Limits and Growth* (Cambridge: Cambridge University Press, 2015).

²⁵Bentley B. Allan, 'Second only to nuclear war: Science and the making of existential threat in global climate governance', *International Studies Quarterly*, 61:4 (2017), pp. 809–20.

²⁶William D. Nordhaus, 'To slow or not to slow: The economics of the greenhouse effect', *The Economic Journal*, 101:407 (1991), pp. 920–37.

²⁷Bentley B. Allan and Jonas O. Meckling, 'Creative learning and policy ideas: The global rise of green growth', *Perspectives on Politics*, 21:2 (2023), pp. 443–61.

²⁸Bentley Allan, Joanna I. Lewis, and Thomas Oatley, 'Green industrial policy and the global transformation of climate politics', *Global Environmental Politics*, 21:4 (2021), pp. 1–19.

²⁹Meckling et al., 'Winning coalitions for climate policy'.

³⁰Paul Tobin, 'Economics from zero-sum to win-win', *Nature Climate Change*, 10:5 (2020), pp. 386–7.

³¹IEA, 'World Energy Investment' (2022), available at: <https://www.iea.org/reports/world-energy-investment-2022>}.

³²Greenpeace, 'Why We Oppose the Government's Biofuels Mandate' (2022), available at: <https://www.greenpeace.org/aotearoa/story/why-we-oppose-the-governments-biofuels-mandate-guest-post/>}; Maxine Joselow, 'Push for mining metals for electric vehicles splits Democrats, environmentalists', *Washington Post* (2022), available at: <https://www.washingtonpost.com/politics/2022/03/16/push-mining-metals-electric-vehicles-splits-democrats-environmentalists/>}.

³³Douglas Macdonald, *Carbon Province, Hydro Province: The Challenge of Canadian Energy and Climate Federalism* (Toronto: University of Toronto Press, 2020).

³⁴Hildingsson et al., 'The green state and industrial decarbonisation'.

Under neoliberalism, the state took on a passive role. Its purpose was to create the conditions for the market to achieve scientific and technological progress. Economic policy meant understanding what the market needed to achieve growth and profits. The state per se had little role in determining the goals of society, which were assumed to aggregate through the market.

To do this, states will have to take an active stance toward the creation of political interests. In the climate domain, the work of Meckling and Nahm is instructive.³⁵ They outline four strategic capacities that states use to manage interests:

1. Recruiting allies (coalition-building)
2. Aligning interests (use policy feedback)
3. Limiting access (insulating and delegating)
4. Quieting interests (compensation)

If states learn these strategies, either from transnational expert networks or by muddling through, they will have the means to reassert themselves in state–business relationships.

Indeed, there is evidence that states are learning precisely these skills. Decarbonising states have emerged as active agents of transformation.³⁶ Hildingsson, Kronsell, and Khan show how Sweden is using state-owned enterprises to usher in industrial transformation.³⁷ LKAB, the state mining company, Vattenfall, the energy company, and SSAB have jointly launched Hybrit, which has developed the world's first carbon-free steel. LKAB recently announced the discovery of Europe's largest rare earths deposit, which it plans to use as a means to counter China's dominance in clean energy supply chains.³⁸

States are more willing than they have been in decades to take an active role in the shaping the domestic and global economy. Perhaps more surprisingly, traditionally liberal market economies like the United States and Canada are now exploring ownership. The United States recently took an equity stake in a company developing a Brazilian nickel mine.³⁹ Canada recently announced that its new Growth Fund, which will be mandated to invest in net-zero supply chains, would be enabled to take equity stakes in companies.⁴⁰ With more willingness and capacity to act among the world's states, the state may have the power to contest capital and more deeply transform global order.

Another key indicator is the emergence of what Duit, Feindt, and Meadowcroft call 'an administrative apparatus' and 'corpus of ideas' for the environmental state.⁴¹ Industrial policy can help to rebuild the power of the state by providing the impetus to develop the systems of calculation necessary to exert real influence in the global economy. Coherent industrial policy can only be achieved by making carbon and political-economy more legible and controllable. In so doing, it enhances the power of the modernist state.⁴²

Duit, Feindt, and Meadowcroft also suggest that an environmental state requires the establishment of the state as an active site of contestation and decision. In this vein, industrial policy can

³⁵ Jonas Meckling and Jonas Nahm, 'Strategic state capacity: How states counter opposition to climate policy', *Comparative Political Studies*, 55:3 (2022), pp. 493–523.

³⁶ Babić and Dixon, 'Decarbonising states as owners'; Babić, 'State capital in a geoeconomic world'; Hildingsson et al., 'The green state and industrial decarbonisation'.

³⁷ Hildingsson et al., 'The green state and industrial decarbonisation'.

³⁸ Reuters, 'Sweden's LKAB finds Europe's biggest deposit of rare earth metals' (2023), available at: <https://www.reuters.com/markets/commodities/swedens-lkab-finds-europes-biggest-deposit-rare-earth-metals-2023-01-12/>.

³⁹ This was done through the US International Development Finance Corporation (DFC). See, 'Brazilian nickel begins production at Piauí-nickel-cobalt-laterite project', Mining.com (2022), available at: <https://www.mining.com/brazilian-nickel-begins-production-at-piau-nickel-cobalt-laterite-project/>.

⁴⁰ Government of Canada, 'Canada Growth Fund: Technical Backgrounder' (2022), available at: <https://www.budget.canada.ca/fes-eea/2022/doc/gf-fc-en.html>.

⁴¹ Duit et al., 'Greening Leviathan'.

⁴² James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven, CT: Yale University Press, 1998).

strategically stage the necessary confrontation of forces between the fossil and green coalitions, while tipping the scale in the latter direction. Without an active environmental state, the politics of the energy transition will get stuck on the power of incumbent interests and the array of subsidies and regulations that support their position. Incumbents will not cede this position easily, so staging a confrontation over climate is at some point necessary. In these decisive moments, the environmental state will either fold or emerge as greener and more powerful, buttressed by a green coalition of interests to sustain its actions.

This, of course, will not end the history of politics in the realisation of a rationalised green state. Rather, it will merely start the cycle of incumbent-induced state capture and pathology, but this time with entrenched green interests challenging evidence-based policy and societal consensus on key issues. Following Polanyi, and Blyth's extensions of Polanyi's arguments, the expectation here would be that green interests will seek to disembed green politics from the active state via green liberalism.⁴³ A green state would possess the strategic state capacity to hold its own in this double movement.

Future formations

This section aims to draw all the elements of the argument thus far together to argue that industrial policy may be able to accelerate the emergence of a world after growth. Returning to the second section, recall the three elements that came together in the post-war formation: political-economy, tools of calculation, and cosmology. What are the prospects for a similar coming together to produce a new formation? I highlight the potential of three elements to form the basis of a new formation: state–business relations; new policy and regulatory tools; new cosmological resources for alternatives to growth.

Global political-economy

Let's start by thinking through the prospects for a realignment of state power vis-à-vis business and capital markets. The post-war formation emerged on a wave of labour power. The state–labour alliance in the United States and Europe was able to contest and control business and financial interests. Today's workers are in a far different position. Although there are some signs of resurgence in the global labour movement, labour begins from a position of historic weakness.⁴⁴ The globalisation of production gave finance the upper hand in the business–labour relationship, and business has played its hand quite effectively.⁴⁵ Historically, labour strength in the West has been built on manufacturing centres. If industrial strategy returns jobs to the manufacturing sector, there could be a resurgence of unionisation. The Inflation Reduction Act contains several measures designed precisely to strengthen labour, which has translated into recent union victories in the United States. Under the wing of industrial policy, labour has been able to reassert itself in the American political economy.

There is also evidence that states are building the capacity necessary to control business. States now have strong geopolitical and climate reasons to wrest control from business. There are two factors here. One is internal to the West. Its geopolitical risk models will show that investment in and reliance on China and Russia is untenable. While sometimes the inability to source products without those countries will mean they must make exceptions, the rule will be to build supply chains inside the tri-continental alliance (East Asia–North America–Europe). This means rerouting firms' supply chains and inducing some higher costs in the name of supply-chain resilience.

⁴³Mark Blyth, *Great Transformations: Economic Ideas and Institutional Change in the Twentieth Century* (Cambridge: Cambridge University Press, 2002).

⁴⁴OECD union membership dropped from 20 per cent in 2000 to 16 per cent in 2017 but has stabilised in the last few years: available at: <https://stats.oecd.org/Index.aspx?DataSetCode=TUD>.

⁴⁵Greta R. Krippner, 'The financialization of the American economy', *Socio-Economic Review*, 3:2 (2005), pp. 173–208.

The second factor is that China itself is seeking to build geopolitical resilience through the Fortress China mission.⁴⁶ On this vision, a Chinese international bloc produces what it needs and circulates goods and capital within the bloc. China will produce its own consumer goods as the middle class reaches maturity and can, as the US middle class did, emerge as a market driver internally. This shift in China's political economy is bad news for firms that built their growth projections on expansion in China.⁴⁷

Neither development is transformative at this juncture. Nonetheless, both shifts suggest that firms will be more dependent on and responsive to state imperatives than they have been over the course of the neoliberal era. State–business relations are ripe for a realignment that would put the first piece of a new formation in place.

Systems of calculation

A system of calculation provides the information and administrative apparatus necessary for the state to exert strategic power in the global economy. If a wide range of environmental states take up these tasks, it will create the basis for a transnational management of the environment. By building an apparatus of carbon intensity, critical minerals traceability, and strategic management capacity, industrial policy creates the second pillar of a new global formation.

Early critics of the emerging climate policy regime noted the potential pathologies of carbon taxation.⁴⁸ Carbon taxation systems linked to systems accounting for sinks and credits were creating a system of global governmentality that would regulate and shift the use of land all over the world. However, the failure of the Kyoto project left these systems moribund, though exploitative and irrational ecosystem practices have continued. Instead, the dominant technology of carbon accounting is likely to be the carbon intensity score. Carbon intensity scores report the embodied emissions of battery metals, alternative fuels (biofuels and hydrogen), and kilowatt hours.

It is carbon intensity scores that drive the tiered credits in the Inflation Reduction Act, for example. The hydrogen credit is differentiated according to the embodied emissions in the product. The sustainable aviation fuel credit is similar indexed to the intensity reduction versus regular jet fuel. In Europe, carbon intensity scores are likely to be a key element of the European battery passport system. In terms of decarbonisation, incentives indexed to carbon intensity have the potential to create a race-to-the-top among technology providers. Geopolitically, these scores will help keep Chinese goods out of Western supply chains as long as Chinese production runs on coal. They have technological and geopolitical appeal.

Carbon intensity scores still count carbon and are still potential features of governmentality systems. Nonetheless, their reach is less all-encompassing. Carbon intensity scores are pioneering granular forms of intervention in technological systems that could be generalised to other domains.

How could these scores be used to help seed alternative systems? They represent a new form of regulatory and policy design that could be expanded to induce and regulate circularity and waste reduction. States could create extraction indexes which incentive recycled materials. This would achieve a long-standing goal of pricing natural capital implicitly. That could reduce extractivism long-term. Indeed, there is an intrinsic complementarity between the low-carbon goals of climate action and achieving circularity in critical minerals and other materials.

To succeed in the race for net-zero supply chains, states will have to get good at monitoring carbon intensity and incentivising it with creative policies. But they will also need to map supply

⁴⁶James Kynge, Sun Yu, and Leo Lewis, 'Fortress China: Xi Jinping's plan for economic independence', *Financial Times* (2022), available at: {<https://www.ft.com/content/0496b125-7760-41ba-8895-8358a7f24685>}.

⁴⁷Howard Mustoe, 'China threatens Volkswagen's export miracle', *The Telegraph* (2022), available at: {<https://www.telegraph.co.uk/business/2022/12/18/china-threatens-volkswagens-export-miracle/>}.

⁴⁸Eva Lövbrand and Johannes Stripple, 'Making climate change governable: Accounting for carbon as sinks, credits and personal budgets', *Critical Policy Studies*, 5:2 (2011), pp. 187–200; Matthew Paterson and Johannes Stripple, 'Virtuous carbon', in Benjamin Stephan and Richard Lane (eds), *The Politics of Carbon Markets* (New York, NY: Routledge, 2014), pp. 105–24; Chris Methmann, 'The sky is the limit: Global warming as global governmentality', *European Journal of International Relations*, 19:1 (2013), pp. 69–91.

chains in sufficient detail so that they can exert control over business. And as states make more active investments and take equity stakes, they will absorb more information about the market in ongoing ways. As the legibility of the world increases, so does the power of the state.⁴⁹

Cosmology

What resources can be drawn on for a new cosmology that supports goals after growth? The underlying theoretical model here is that major movements of scientific and technological ideas have been the constituents of state purpose for 500 years.⁵⁰ The central question then becomes, which scientific and technological ideas are being channelled into political discourses? The answer is, the cosmological resources which are attached to the ideas being used to solve problems across political domains.

What resources do we see deployed today? First, we saw above the importance of long time horizons to the strategic capacity of the state. To effectively position firms in global supply chains, industrial strategies must look to technology systems of the future and design interventions today. Taking the long-term view is supposed to be the purview of the state, but under neoliberalism it abandoned this function in service to business. Reclaiming the future provides a cosmological orientation to time that can provide the state with the basis of green purposes. The cosmological resources for this orientation to time have been in place since the green movements of the 1960s and 1970s.⁵¹ But now there is an opportunity for these resources to be attached to political-economic interests in a synergetic way.

Second, ontologically, new themes of circularity and interconnectedness emerge from engagement with ecosystems thinking in the climate crisis.⁵² Circularity emerges in the need for battery metals to be recycled. It emerges in the need for CO₂ to be captured and used in fuel conversions or steel-making. In steel, carbon capture can peel CO₂ off the stack and use the carbon to make the carbon inputs needed for forging hard alloys. In biofuels, capturing CO₂ and combining it with hydrogen can double output. The idea of circulation also emerges in the political-economy of a divided world, in which each side must manage circulation within its spheres.

Interconnectedness emerges in the lateral connections between agriculture, chemicals, and energy. The new energy economy that seeks to lower carbon intensity scores is an economy of carbon conservation. To achieve that conservation, new exchanges between previously separable systems must be realised. These connections will become apparent in industrial systems where fertiliser production is linked to clean fuels production and protein synthesis, which in turn is used to feed animals, which creates more fertiliser.

Interconnectedness also emerges in a world of supply chains in two ways. First, we see the connections between regions and countries in the concatenation and movement of goods. Second, we see more vividly how our world is put together when we all learn more about the industrial processes that we hid from view for decades. By disrupting this hidden world and rendering it visible, we all see anew the way things are made.

Finally, the energy transition could be used to combat idealised visions of technological progress and human destiny. In the 19th century, visions of infinite development were built on the idea of unending technological progress. This was contested by the critique of nuclear weapons and the environmental movements, which suggested a dark side of progress. But the premise of neoclassical economics, that technological progress would deliver unending growth, no longer has the cachet it once did. It is now commonplace to note the Science and Technology Studies (STS) maxim that it is not technology itself but policy and socio-economic systems that determine rates of technological

⁴⁹Scott, *Seeing Like a State*.

⁵⁰Allan, *Scientific Cosmology and International Orders*.

⁵¹Stewart Brand, *The Clock of the Long Now: Time and Responsibility* (New York: Basic Books, 2008).

⁵²Jasmin Cantzler, Felix Creutzig, Eva Ayargarnchanakul, et al., 'Saving resources and the climate? A systematic review of the circular economy and its mitigation potential', *Environmental Research Letters*, 15:12 (2020), p. 123001.

change. And the important role of cheap, calorie-rich energy in 19th-century development is now recognised, downgrading the importance of technology in the grand narrative.

Furthermore, there is growing recognition that technological sophistication does not mean control. This was the master narrative of the 17th to the 19th century in European thought. But if technologies must be carefully managed within socio-economic and political systems, then our power over nature is necessarily limited by our own incapacity to understand and intervene in our own systems. Any remaining dreams of control are easily dispelled by the dominance of risk and indeed uncertainty in any complex representation of our world systems.

The advent of out-of-control climate change and disease induces a new understanding of nature. Perhaps these events contain the lesson, which we avoided learning for so long, that our world overpowers us. We can see in these movements a more humble story of human destiny than those that dominated earlier centuries. All of this makes it at least possible that a new state purpose could finally emerge: the state must strategically manage a world of carbon, minerals, biomass, and electrons over long time horizons and in the face of considerable uncertainty. These are the potential cosmological resources for a new formation with green states at the centre.

Conclusion

The ongoing transformation of global political economy will not eliminate the fundamental expansionary tendencies of capitalism. But it will transform them, working them into new configurations of power and purpose. For the first time in history, green purposes seem likely to become ascendant as the world's leading states – the United States, the European Union, Japan, Canada, Korea, China, Brazil, India, Indonesia, the Gulf countries, and others – jockey to position their firms in net-zero supply chains. Industrial policy is creating the conditions under which deeper transformations could be generated. But to alter growth and expansion more fundamentally, major changes to the infrastructure of politics will be needed.

If the power relation between state and business is now rebalanced, it means the end of the neoliberal era. We now know that neoliberalism did not drain the state of power but made that power serve business and finance.⁵³ Neoliberalism drained the state of agency and purpose but left its regulatory tools in place to serve reactionary forces. So the economic capacity of the state does not have to be rebuilt, per se. But other capacities have been badly weakened. First and foremost, neoliberalism reduced the state to a passive agent of business. It thereby delegitimised the very idea of the state having interests that were somehow independent from business.

Industrial policy in an age of geopolitical and climate crisis gives the state purpose again. The climate crisis demands that the state create firms and supply chains that serve intergenerational interests. If only to save business from itself, states need to take the long view in order to position their political-economies in the energy system of 2050.

The key practical question is then, what are the projects that would create complementarities between emergent trends in political-economy, calculation, and cosmology and allow us to steer the forging of a formation that more deeply challenged growth? What kinds of political projects and experiments would draw together new practices of calculation and rule with new coalitions to support a more just and environmental state? And how can ideational resonances be achieved with broader structures of meaning?

Acknowledgements. The author would like to thank the forum editors, the journal editors, and the other authors in this volume, especially Michael Albert, each of whom provided valuable comments that improved the manuscript.

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⁵³Quinn Slobodian, *The Globalists* (Cambridge, MA: Harvard University Press, 2018).