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# The Coal Renaissance and Cosmopolitized Low-Carbon Societies

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## **The Coal Renaissance and Cosmopolitized Low-Carbon Societies**

David Tyfield

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Current efforts at 'low-carbon transition' are marked by a striking paradox: the 'phenomenal' and 'historically incredible' resurgence of coal. Exploration of the source of this conundrum opens up an analysis of current trends regarding low-carbon energy transitions in terms of the forging and emergence of 'cosmopolitan climate risk communities'. Such an analysis is a case study in a broader shift to a methodologically cosmopolitan social science that involves empirical examination of processes of cosmopolitization and associated social, and not just technological, challenges of low-carbon transition.

**Working Papers Series**

# The Coal Renaissance and Cosmopolitized Low-Carbon Societies

David Tyfield

Juillet 2013

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## The text

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## Abstract

Current efforts at 'low-carbon transition' are marked by a striking paradox: the 'phenomenal' and 'historically incredible' resurgence of coal. Exploration of the source of this conundrum opens up an analysis of current trends regarding low-carbon energy transitions in terms of the forging and emergence of 'cosmopolitan climate risk communities'. Such an analysis is a case study in a broader shift to a methodologically cosmopolitan social science that involves empirical examination of processes of cosmopolitanization and associated social, and not just technological, challenges of low-carbon transition. This leads to exposition of an emerging constellation of energy and political regimes connecting 'clean coal' with a 'liberalism 2.0' centred on a rising China. The low-carbon society emergent from these developments, however, is shown to be marked with intra-national inequality, violence, absurdity and a haunted schizophrenia more reminiscent of coal's previous Dickensian heyday than the progressive and normatively cosmopolitan visions of much 'low-carbon transition' literature. The implications and possible emerging configurations of such a 'clean coal'-based liberalism 2.0 are explored with particular reference to the changing natures and social definitions of techno-nationalism and cosmopolitan innovation.

## Keywords

clean coal, CCS, carbon capture and storage, China, methodological cosmopolitanism, liberalism 2.0

## La renaissance du charbon et les sociétés cosmopolitisées sobres en carbone

### Résumé

Les efforts actuels en direction d'une « transition vers la sobriété en carbone » sont caractérisés par un paradoxe saisissant : la résurgence « phénoménale » et « historiquement incroyable » du charbon. L'exploration des sources de cette énigme conduit à analyser les tendances actuelles de la transition vers une énergie sobre en carbone en termes de création et d'émergence de « communautés cosmopolitiques de risque climatique ». Une telle analyse constitue une étude de cas dans le cadre d'un mouvement plus large vers une science sociale méthodologiquement cosmopolitique qui implique l'examen empirique des processus de cosmopolitanisation et les enjeux sociaux - et pas seulement technologiques - inhérents à cette transition vers la sobriété en carbone. Ceci conduit à mettre en lumière une constellation émergente d'énergie et de régimes politiques mettant en relation le « charbon propre » avec le « libéralisme 2.0 » centré sur une Chine en plein essor. La société sobre en carbone qui émerge de ces développements, cependant, apparaît marquée par des formes d'inégalités infra-nationales, de violence, d'absurdité et une schizophrénie qui rappelle davantage l'âge d'or du charbon avant Dickens que les visions progressistes et normativement cosmopolites de la majorité de la littérature sur la « transition vers la sobriété en carbone ». Les implications et les configurations qui pourraient émerger d'un tel libéralisme 2.0 basé sur le « charbon propre » sont explorées en faisant particulièrement référence aux changeantes natures et définitions sociales du techno-nationalisme et de l'innovation cosmopolitique.

### Mots-clefs

charbon propre, capture et stockage du carbone, Chine, cosmopolitisme méthodologique, libéralisme 2.0

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## Resurgent Coal and Low-Carbon Transition

Energy has recently surged up policy agendas worldwide, responding to multiple, overlapping crises: of energy supply and demand; of political turmoil at sources of key energy resources; and of climate change generated by fossil fuel emissions. Policy discourse of 'low-carbon transition' and a shift to 'low-carbon' (usually renewable) energy technologies is now ubiquitous. Yet one shocking trend challenges this picture: coal, the most polluting and high-carbon (i.e. simply 'carbon!') of fuels, is not merely stubbornly maintaining its absolute or relative level, but is undergoing a 'phenomenal' (Smil, 2010:144) and 'historically incredible' resurgence (Economist, 2012).

Nor is this trend decelerating. '[B]y 2006 [coal] had become the world's fastest growing fuel' (Montgomery, 2010:95). And the Fukushima nuclear disaster has prompted several high energy-consuming countries, including Japan and Germany, to expand coal-powered electricity (Washington Post, 2011; Smil, 2010:94). The biggest source of the growth of coal, however, lies in the developing world, especially China and India. As the cheapest, most abundant and highly calorific of fuels, coal's attractions for energizing their national development is clear. Coal is forecast to surge back into the global no.1 spot, overtaking oil in 2020s-2030s; and, of course, at absolute levels dwarfing its commanding heights in the late 19<sup>th</sup>/early 20<sup>th</sup> centuries.

Given slow energy transitions (Smil, 2010; Montgomery, 2010), which must *themselves* be energised, therefore, coal confronts us with a paradox: the central role of fossil fuels in powering the transition to low-carbon societies. A paradox, moreover, that is all the more excruciating when a trilemma is acknowledged: the largest source of emissions growth in coming decades will be the large developing economies; low-carbon innovation and deployment will not happen there *without* further development; and there is no historical precedent of economic development without commensurately increased emissions (Edenhofer, 2010; Ockwell, 2008). Yet the urgency of low-carbon transition remains. Nothing exemplifies this paradox better than the emergence of a powerful new discourse of 'clean coal', focused on carbon capture and storage (or sequestration) (CCS).

The International Energy Agency (IEA) calculates that CCS could contribute over 15% of the global GHG emission reductions needed for the mid-century target of 450 ppm of CO<sub>2</sub> (Tollefson, 2011). This will need some 3200 CCS projects sequestering 150 GtCO<sub>2</sub>. Meanwhile, CCS is, in fact, dragging along, with virtually no progress in the past 5 years and not a single full-size coal-fired power plant with CCS in operation. Yet 'clean coal' remains a policy dream that is very much alive, with a powerful and growing group of supporters. 'Clean coal' thus provides a window into political and socioeconomic trends that will underpin low-carbon transition efforts in the coming decades; and, thus, into the form of the 'low-carbon' societies likely to emerge from them.

Such an investigation, however, reveals that the paradoxes of coal's resurgence extend far beyond the technical questions of the 'energy' sector. In particular, studying 'clean coal' from the perspective of a methodologically cosmopolitan (Beck, 2006) social science illuminates the essentially cosmopolitized reality of low-carbon innovation and the seemingly contradictory prospects of 'cosmopolitan innovation' (Tyfield & Urry, 2009) that addresses the quintessentially global challenge of climate change. For such an analysis affords exploration of possible regimes of (cosmopolitized) power relations that could underpin and emerge alongside any such low-carbon transition. In this regard, this paper discusses one emerging possibility, namely a revitalization of the classical 19<sup>th</sup> century liberalism that attended coal's original dominance; a 'liberalism 2.0'. This, in turn, affords some initial and speculative notes on the nature of such a low-carbon society. As we shall see, however, this vision bears little resemblance to the normatively cosmopolitan and 'everyone's-a-winner' scenarios that much policy work on low-carbon innovation seems to propose. Rather, a liberal 2.0 world will again be marked by the Dickensian inequality, violence, absurdity, squalor and thus haunted, schizophrenic zeitgeist that came with its original 19<sup>th</sup> century variant.

## Cosmopolitan Climate Risk Communities and Low Carbon Transition

As Ulrich Beck (and colleagues) has argued at length elsewhere (e.g. Beck 2006), grappling with the profound global challenges of climate change (amongst others) demands a wholesale redesign

of the social sciences: from a methodological nationalism, which presumes the ‘naturalness’ of nation-states as the boundaries of social processes, to methodological cosmopolitanism; and to studies of empirical processes of cosmopolitization, as opposed to a philosophical assessment of normative cosmopolitanism. Such a change in perspective is essential if we are to be able to imagine alternative and promising low-carbon futures, not least through the study of emergent social forms, responding to a ‘world at risk’, suitable for such transitions. These social forms may be called ‘cosmopolitan communities of climate risk’ (Beck et al., 2013).

Analysing low-carbon innovation in terms of cosmopolitan risk communities proves especially illuminating, set against the intensified transnational circulation of those mediat(iz)ed scientific and socio-technical knowledges central to the process of low-carbon innovation. For low-carbon transition involves a chicken-and-egg trilemma of the construction of mutually dependent certainties: scientific certainty that climate change actually demands a response, by government and business, as a matter of self-preservation; regulatory certainty to incentivise low-carbon innovations (e.g. viably high carbon prices, emissions standards etc.), without which such investment is deemed too risky or unprofitable; and certainty of identifying those low-carbon innovations that will shape the future, without which policy-makers cannot design policies that can coordinate the extraordinarily complex assembly of diverse changes that will be needed for low-carbon transitions (see below).

Construction of such interlinked certainties is an essentially social process, involving the parallel construction of new coalitions, constituencies, associations, affiliations and social identities. In short, the problem of the emergence of cosmopolitized climate risk communities is *the* problem of low-carbon transition; yet most literature continues to treat the latter purely in terms of the technological and/or economic problems of investment and development of new technologies. Conversely, a growing innovation studies literature is stressing the *socio-technical* nature of innovation and transition (e.g. Geels 2005, Steward 2012) and acknowledges the parallel processes of *constructing* certainties and socio-technical systems. However, thinking in terms of cosmopolitized communities offers further

insights and questions regarding the specifically *cosmopolitized* challenges of global low-carbon transition.

For instance, in the domain of low-carbon innovation, the production of such novel certainties, and their ability to foster new collaborations, seem particularly acute, given the ‘experimental’ character of the socio-technical change called for. In other words, the ‘certainties’ needed for a low-carbon transition are of an unusual kind, set against a specific kind of non-knowing that relates not so much to a *lack* of scientific knowledge, but rather to the *proliferation* of knowledges and associated uncertainties. Similarly, regarding ‘certain’ futures that can be depended upon for public and private investment decisions, these must somehow emerge *even as* it is acknowledged that such certainty is effectively impossible. As a result, the certainties demanded for low-carbon transition are not simply contingently *constructed*, but must be somehow deliberately *manufactured* (cf. Beck, 2008), possibly against strong countervailing evidence. Such manufactured certainties would be needed, for instance, to convince drivers to buy electric cars, reassured in knowing they will be able to reach home at the end of a long working day.

Cosmopolitization, however, is a crucial element of this process, in at least two respects. First, the manufacturing of certainties is a more general response to the mass *uncertainties* of world risk society (Beck, 2008), epitomized by climate change and global low-carbon transition. Secondly, cosmopolitization poses particular challenges regarding the construction of new interdependent groups, discourses and cognitive-affective bonds (Beck et al., 2013). In short, a cosmopolitan perspective highlights how ‘global’ low-carbon transition seems to demand a wilful suspension of disbelief on an unprecedented scale via manufactured certainties, tying together elite planners and everyday users.

Furthermore, in highlighting such mass conversion to emergent visions of low-carbon systems, i.e. *before* and *as* they are materially constructed, a cosmopolitized perspective on low-carbon innovation necessarily also opens up key questions regarding the politics and competition intrinsic to such transition; questions that have long been noted to be insufficiently prominent in much of the socio-technical transitions literature (Shove & Walker, 2007, Smith et al., 2010). This is true

both geopolitically, e.g. in terms of global standards that may benefit one nation's industries in particular, and intra-nationally, e.g. regarding the balance of benefits accruing between genders, classes, ethnic groups, and other status groups (Cf. Stirling, 2009).

Moreover, attention to politics opens up more generally the crucial issue of world-making power relations, in the Foucauldian sense (e.g. Foucault, 2004, 2009, 2010), in the construction of massive systemic transformations in society, such as would be any low-carbon transition worthy of the name. Analysis of low-carbon transition, and its prospects – e.g. regarding clean coal – thus demands analysis of the complex systemic positive (and negative) feedback loops: between production and consumption of negentropy; development of negentropy sources and sinks, hence entire socio-technical systems (Smil, 2010) and their 'energy sector'; 'common sense' trajectories of change and development; materialized discourses and relations of control thereof (Mitchell, 2009); and, of course, between cosmopolitan climate risk communities and broader regimes of power relations.

## Liberalism as Dominant Power Regime

The most important, i.e. dominant, political regime of recent centuries is liberalism of various types. By 'liberalism' we here connote a power regime not a political philosophy. Nor, crucially, is liberalism to be identified with (liberal, representative) democracy. Rather, liberalism consists of 'living dangerously' (Foucault, 2009:384) and minimal government, i.e. government by and through (construction of) freedom(s), and hence an elite politics capable of achieving popular acceptance and active participation, even of the disenfranchised and burdened. The crucial question regarding liberalism, therefore, is 'how is this possible'?

Foucault's key insight here is to stress liberalism's two faces, their mutual dependence and co-production, as well as their tensions. On the one hand, productively, liberalism must be interrogated in terms of the regimes/systems of productive growth, as new (socio-technical) techniques and practices emerge that (unpredictably, *a posteriori*) reinforce each other in positive feedback loops – this being precisely the process of transition and emergence. Liberalism *works* therefore through

(construction of) new *freedoms*, but always and only for (the benefit of) some. Key elements of this process are thus the new (enabling) truths/knowledges and associated institutions/groups, both of techno-scientific expertise and new knowledges of legitimation.

Yet, on the other hand and negatively, liberalism is also and always establishing the 'security' pre-conditions that are necessary for intelligibility/stability of the former. This thus establishes the 'paradoxes of liberalism', an essential split (Foucault, 2010: 61-70). Again, going beyond abstract political philosophy, this is not merely a matter of, say, the problems of the limits of tolerance (e.g. tolerate the bigot?). Instead it is a political reality that elicits an intrinsic fear and aggression but is *itself* produced by liberal power technologies. The key question of/for liberalism is the (known and knowable) real/true limits of state power. Liberalism is thus concerned with knowledge of the true/real/natural and/or naturally self-regulating/optimizing, so that 'to govern well' *really is* 'to govern less'. The necessary flipside of such concern for natural limits, however, is the limits of the natural, the definition of that which is 'unnatural', which compromises the 'natural self-regulation' and so is an existential threat; and so should be delegitimized, feared and destroyed. In governing by producing freedoms, therefore, liberalism also necessarily involves the ('rational') delineation of and active *construction* of system-existential security threats. Liberalism is thus marked by an inherent social binarism, or rather, 'racial' struggle to 'defend society' against its mortal, eternal and unnatural foes (Foucault, 2004). And as such it is characterised by a schizophrenia, haunted by an unreconcilable shadow side that it itself produces.

This thus sets up two key questions regarding the 'negative' face of liberalism. First, *what* are the unnatural/limits/dangers? Hence: what should the state (expand its power to) legitimately coerce/do in order to 'defend society'?; *who* should protect society and how?; who are the legitimate losers (racial other)? And secondly, *how* is this shadow world constructed? How does liberalism (succeed in) get(ting) losers to capitulate or, preferably (adding to the system's entropic advantage vs. other *systems*), wilfully accept? As for the productive aspect, this involves analysis of the new (materialized/practised/institutionalized) truths/knowledges. Yet here the focus is on

the new truths/knowledges of *delegitimation* and definition of 'racial' other; the new delegitimated subjectivities; and the new practices, groups and institutional forms associated with these. As an emergent system, however, these two faces are not to be investigated separately but precisely in their mutual interaction and co-construction.

To these two faces, however, a third issue must also be added. This is the crucial contradistinction, being an historical process, of the emerging dominant regime to that which preceded it. This socio-historically situated contrast represents critical conditions of intelligibility for the success of the former; what may be called the disciplinary lessons of history. Most importantly, this takes the form of the newly knowledgeable definition (and hence responsible, rational acknowledgment of) the 'security' threats 'of the age', which thereby accords various virtues to the new liberal regime as 'real'/true' as well as 'progressive', 'contemporary' etc...

## Neoliberalism and After

In the present case, the importance of the context of these 'disciplinary lessons of history' necessitates attention to the latest (radical) incarnation of liberalism, namely neoliberalism. The key dimensions of the globally dominant neoliberal regime have been elaborated in detail elsewhere (e.g. Arrighi, 2008; Birch & Mykhnenko, 2010; Crouch, 2011; Harvey, 2005; Mirowski & Plehwe, 2009), including with notable prescience by Foucault (2010). For our purposes, of most importance is that neoliberalism is undeniably a form of liberal power regime in the central importance it accords the market in limiting 'rational' state government. Yet, neoliberalism is also strikingly different from the classical liberalism described above. The characteristic truth/ knowledges of neoliberalism (Mirowski, 2011) concerns the epistemic regime of the 'market of ideas'. This conceives of the market and its virtues *primarily* as an epistemic, and not economic and allocative, phenomenon. The market optimizes, as automatic outcome of the spontaneous interaction of (negatively) free individuals, the social aggregate of all human knowledge, in the form of materialized/technologized knowledges; namely both the technological commodities (and technoscientific knowledges) that are the winners of market competition *and* the knowledge of their social value that this success (or failure) represents. The

trans-personal and automatic epistemic mechanism of the market thus necessarily instantiates wiser and better-informed decisions than could possibly be made by any rational planner, whether individual or collective-institutional.

The implications of this market foundationalism (if not 'fundamentalism' *qua* zealotry) are profound. For, in the absence of any rational gainsaying of the market, there are simply *no knowable, true/real limits* to the market or to that which may be optimized by subjecting it to market disciplines; a market will always and in principle reach a better decision regarding the government of a phenomenon than any amount of 'rational' policy. *Apparent* limits or the emergence of new threats and risks – the proliferating risks of cosmopolitized, techno-scientific society – are thus definitively *not* existential security threats but rather welcome new opportunities for Promethean entrepreneurship. Conversely, the essential characteristic of classical liberalism is precisely to demarcate and then police the natural limits and necessary preconditions of liberal, free-market government. A particular instance of 'market failure' for neoliberalism thus does not represent the legitimate task of a limited state power but rather a task for the state to *construct* the conditions, using *unlimited* power if necessary, such that the market *does* 'work'. This radical strain of liberalism is thus also its negation in its crucial (and self-contradictory) dependence upon the unfettered expansion of state power in the project of marketizing all aspects of society.

This is evident in a specific model of innovation involving the state-sponsored accumulation by dispossession of public and common knowledges through strong global intellectual property rights (Tyfield, 2008). This model also focuses on innovations that: yield the promise of high, short-term returns, especially as financial(izable) assets; yield products that service the market demands of corporate/individual consumers, rather than publics or states; and are compatible with the corporate enclosure of bodies of knowledge and so promise to maximize the global corporate control of particular markets, such as food (e.g. genetically modified crops) or health (e.g. biotechnology/pharmaceuticals).

Conversely, innovation in energy – involving large, public infrastructures that are dependent upon broad knowledge-sharing and take many years to develop – would typically meet few if

any of these characteristics. And, indeed, there has been an almost complete lack of progress in energy innovation since the 1970s (Smil, 2010:121), when investment was booming in response to the OPEC oil shocks and the seeming 'limits to growth' (Meadows et al., 1972). This is primarily due to the striking collapse in energy R&D investment from the 1980s onwards, with the advent of neoliberalism's global dominance, for at least two further reasons. First, neoliberalism is systematically disinterested in any ecological-entropic or energy resource limits to market-based economic growth, except insofar as these are opportunities for further entrepreneurial profit. Secondly, following the monetarist 'counter-revolution' (Arrighi, 1994) and the global reassertion of (now neoliberal) American dominance, the processes of financialized creative destruction, the defeat of OPEC and then the demise of the USSR all conditioned the return of the 'good times' of cheap, seemingly unlimited and dependably secure oil that corroborated the neoliberal rejection of limits to growth.

Yet this process has now come to a crashing halt, in the form of the multiple, overlapping crises of the day that a generation of neoliberal financialized globalisation has conditioned. What next, then, regarding both meaningful attempts at low-carbon transition and the global(izing) capitalism (and its associated political regime of a re-emergent liberalism) that, in the total absence of viable alternatives in the short-term, must underpin such innovation (Cf Newell & Paterson, 2010)? It is to this question we now turn using the case study of coal.

## 'Clean Coal', China and Liberalism 2.0

Given that coal will be a, or even *the*, key energy resource as the slowness of low-carbon transition unfolds, how can coal be redefined socially such that common sense is that it is 'indispensable' for low-carbon transition? What must be constructed for this new understanding to be intelligible? We here set out four key dimensions of contemporary challenges of coal and responses thereto, all of which are in emergent evidence, by way of 'notes on an emerging political regime'. This affords a preliminary and speculative formulation of a 'liberalism 2.0' in terms of the three dimensions of liberalism: a productive regime; its shadow of 'security' and 'racial' binarism; and

the disciplinary lessons of history. In doing so we focus on the cosmopolitized construction low-carbon societies and the insights from assuming a methodological cosmopolitan perspective.

### China

The first, and most evident, issue for the future of 'clean coal' is the global rise of China, the epochal development of recent decades likely to propel the world's most populous country to new heights of global dominance in coming decades (e.g. Jacques, 2010). (The rise of) China is inseparable from (the resurgence of) coal and *vice versa*. China today represents 47% of global coal consumption, likely to rise to 53% by 2030, while constituting 80% of growth of world coal demand 1990-2010 and an expected 77% 2010-30 (BP outlook, 2011). China mines 3 billion tonnes a year (three times the amount in the US, global no.2) and is the no.1 importer (ahead of Japan since 2011). Between 2000-2008, China more than doubled its coal extraction to 40% of global output – more than that from the 2<sup>nd</sup>-7<sup>th</sup> largest combined (Smil, 2010:97). Similarly, domestically, 'no other country, is as dependent on coal as China' (Smil, 2010:97), coal representing 70% of electricity generation (95% of all fossil fuels used to produce electricity) and 64% of total primary energy supply (2008).

China is also thus the single most important issue regarding the future of coal and its global environmental impact (or mitigated lack thereof) on climate change; itself immediately a total repudiation of any Euro/Western-centric analysis and a demand to examine cosmopolitized relations of low-carbon innovation and international collaboration. By 2020, on the back of its coal consumption, China's GHG emissions are set to overtake the entire OECD excluding the US (Montgomery, 2010:47) and to be double those of the EU (Climate Group, 2009). In short, cleaning Chinese coal is arguably the *sine qua non* regarding prospects of global mitigation of GHG emissions to mid-century (e.g. Friedman, 2009; Watts, 2010). China is also therefore the strongest argument for CCS, such 'low-carbon coal' seemingly 'crucial' given the disparity between the capacity of the atmosphere to absorb CO<sub>2</sub> for a target of 450ppm and the volume of emissions from known coal resources (400 Gt vs. 11,000 Gt) (Edenhofer, 2010). While, conversely, CCS seems to be crucial for China as one

of only 'two possible' options for meaningful and relevantly rapid absolute reductions in Chinese GHG emissions (Jaccard & Tu, 2011), the other being roll-out of renewable energies at an historically and technologically incredible rate.

China is also central to the future of coal as the most dramatic example of the tensions of environment and development, raising another key concern for a cosmopolitan examination of low-carbon transition. Coal is central to the continued economic development of many large developing countries for the reasons detailed above. To be anti-coal, therefore, can easily be portrayed as to be pro-poverty or even racist, the obsession of the Western environmentalist happy to kick away the ladder to levels of economic prosperity that they themselves enjoy. Moreover, the energy-development-emissions trilemma effectively makes development, and the (risk of) concomitant growth in emissions, a prerequisite for global low-carbon transition and the dramatic *reduction* in such emissions. The prospects of, and barriers to, China developing a 'clean coal' sector, however, illustrate a number of other *socio-political* dimensions of the contemporary coal challenge that flesh out the specific social and cultural meaning of 'clean coal' and the likely political regime that will be developed in parallel with it.

### A resurgent state and newly defined security threats

The first of these socio-political dimensions is the likely resurgence of industrial policy and the importance of the state in business, industry and innovation. This, in turn, is inseparable from the forcible reappearance amongst political elites of the acceptance of new security threats that the state alone seems able to address. China, its rise and international perceptions thereof (not least in the 'West') will undoubtedly be central to these dynamics.

First, as the pervasive global sense of ontological insecurity from the multiple overlapping crises of the neoliberal era deepens, with increasing protest and unrest, a new dominant dynamic is likely to emerge demanding serious account of and urgent action regarding these crises. Furthermore, there is also the possible wild card of a global military situation, given the positive feedbacks amongst the various crises, the global sense of ontological insecurity and an increased systemic sensitivity to political 'shocks'. There is, after all, no shortage

of plausible candidates as the spark of a much bigger global conflagration (e.g. the vast band of countries from Pakistan to, now, north west Africa; North Korea; the South China Sea). This would have major implications regarding not just popular political acceptance of the importance of energy security, but also regarding the fortunes of coal. Oil is concentrated in the 'difficult' places that are the most likely theatres of any such war, while coal is concentrated in the large developed and developing countries. Coal could thus easily be redefined as 'secure' and 'ethical' against unreliable, 'addictive' and 'terrorist' oil.

The acceptance of these new 'security threats' thus is also the acceptance of a redefinition and expansion of the *legitimate* role of the state in limited liberal government. And while state mobilization for war is the most obvious manifestation of such expanded power, the 'need for massive investment in infrastructures to extract, harness, process, transport and covert energies' (Smil, 2010:125) – and for the low-carbon innovation needed to decarbonize energy – is itself a major argument for such expanded state power (and associated forms of enterprise) *given the context of the new 'normal' of pervasive security threats* in which energy (security) plays such a central role. At the intersection of triple economic, energy and environmental crises, this would include, for instance, the national importance of incubating emerging clean-tech industries, such as clean coal. To the extent that state support is increasingly acknowledged (albeit maybe *sotto voce*, in the government-phobic US (Block, 2008)) as crucial for the success of such industries, this also provides the argument for expansion of the state and a revitalized industrial policy across the world, in both 'developed' and 'developing' countries. China is again central here; the nation-state whose global rise, using a model of massive state-owned enterprises especially in core national interests such as energy and telecoms, is the global exemplar of this new paradigm.

This suggests the first set of ways in which the political regime of 'clean coal' is likely to mark a definitive break with neoliberalism. First, it provides and is fundamentally built upon a new discourse of the security threats and the possibilities of market failure while neoliberalism accepts no such existential challenges or limits. In short, intensifying global crises will utterly upend the neoliberal logic of embracing and even cultivating

risks as opportunities for, not threats to, the *market* and, instead, many of these risks will be redefined as existential 'security' threats to *society*. Secondly, this new liberalism also thereby accepts and is premised upon an explicit argument for the legitimate, but limited, expansion of state power. Indeed, in both respects, this new liberalism can therefore present neoliberalism as *itself* a constitutive element of the security threats and the inability of the prior regime to address them; while the re-empowerment of states may also afford the necessary counterweight to bring financialized, neoliberal elites finally to heel. Such a liberalism, therefore, is also a revised form of 'classical liberalism', which was also perfectly compatible with, and indeed dependent upon, growth of the state as the vehicle for 'defending' emergent bourgeois society.

Yet it is *revised* ('version 2.0') given precisely the transformation of the state, over the preceding neoliberal period. The expanded state is thus also a qualitatively transformed one. China is again an exemplar in this regard, with coal mining itself a key example. For even though this is an industry that certainly remains in the hands of the state, precisely as a security priority, these are no longer simply monolithic hierarchical and centrally-planned enterprises. Rather, the organization of business is increasingly subjected to neoliberal market disciplines, the concentration and part-privatization of its mines (Wright, 2006) and the destruction of public and/or collective forms of ownership and the associated socialist/social democratic connotation of the 'state'. This is also increasingly true regarding the role of the state in innovation. Against the worn out neoliberal refrain of the ineptitude of the state in 'picking winners', the Chinese state is slowly developing just the capacities of the 'flexible state' (Mazzucato, 2011) now being counselled by Western scholars of innovation as the route out of economic stagnation. In short, economically China is increasingly the exemplar of a new (classical) liberalism precisely *because* of its strong, but neoliberalized, state-owned enterprises.

### An emergent socio-technical regime of electrified, low-carbon transition

A key dimension of liberalism is the productive socio-technical system and its positive feedback loops, which generate its dynamism and

social power vis-à-vis contending regimes. In this case, clean coal, as clean coal *electricity* (no longer steam power and heating), forms a central node in an emerging system of 'low-carbon' electrified technologies and practices, of both use *and innovation*, that also make central use of the web 2.0-enabled social media of the (increasingly smart-phone hosted) internet.

China, once again, is likely to be a central player in these developments in coming decades. This is not only because of the enormous and growing social importance of Chinese social media (Yang, 2009), with the world's largest on-line population and a whole generation of young, on-line Chinese entrepreneurs committed to getting their piece of a vision of growing Chinese prosperity. But in major 'sectors' of the economy, the improving capacity for and specific technological focus of Chinese low-carbon innovation offers crucial self-propagating dynamics. For instance, regarding urban mobility, China stands alone in its commitment, at national and local levels of government and from major national corporations, to the development of electric vehicles (Tyfield, 2012). These initiatives will continue to increase significantly demand for clean electricity, while reducing consumption (and imports) of GHG-emitting oil. But meeting these demands for increased electricity will simply mean other and possibly increased pollution and GHG emissions; unless, that is, China's 'black', coal-fired electricity generation is transformed into 'green' clean coal.

China is also to be crucial to the emergence of such a new socio-technical system given the key question of the source of (consumer) *demand* for low-carbon innovations (Bhidé, 2009) and the 'opportunities for growth' needed to attract the massive levels of investment (including from Western private finance). A crucial element of any emergent low-carbon regime, therefore, will be the rise of the materially aspirational billions that constitute the emergent 'middle class' of the large, fast-developing countries, China in particular (Cheng, 2010; Guo, 2009). Coal will have a central role to play in constructing their material prosperity and the growing consumerism for all *other* commodities, including the electrified platforms of 2.0-connectivity. But the growth of this class is also likely to strengthen domestic political demands for pollution control and clean coal; an issue already attaining new levels of political

importance given the emergence of 2.0-enabled protest, particularly by the urban, young and 'middle class' (Xiao, 2011).

The totemic centrality of the Chinese middle class to this political regime also provides a further way in which it breaks with neoliberalism. Instead of being a political project increasingly rejected by Chinese society for benefitting only a tiny elite, notably the cadre-capitalist class (So, 2003; Dickson, 2008) with its rampant corruption and financial and speculative real-estate profits, the incorporation of a broader Chinese middle class would represent a re-legitimization of the political regime. Prosperity itself will also, thereby, be re-legitimized as the hard-earned fruits of tough, competitive work, most probably in 'productive' sectors of the economy; including, of course, knowledge-based work and (green) innovation. And of course, such a growing constituency is also likely to be online and deeply woven into social media-based (and most probably cosmopolitized) risk communities. Moreover, while neoliberalism instituted a financialised global political economy and regulatory architecture that was fundamentally a radical reassertion of American power, the rise of Chinese middle class and the 'rebalancing' of the global economy would signal a repudiation of this 'imperialistic', 'racist' – and 'self-defeating' – political economic model.

In terms of the emergence of clean coal, and CCS in particular, here too *socio*-technical conditions offer key insights into a political regime capable of supporting its systemic emergence. Key elements of the global discourse of CCS are already apparent, in terms of being a 'triple win' for environment, economy and energy, resulting in 'phenomenal' levels of business interest in the UK, for instance (Black, 2012). Hence, the UK's CCS competition is portrayed as a 'route out of the [economic] crisis', with the CCS industry's potential value to the UK economy estimated at £6.6bn per annum by 2020 (Morgan 2012).

Yet, while meaningful impact on climate change mitigation needs fast and massive deployment (see above), in fact CCS innovation is currently stalled around the world. Only 74 projects have been actually announced (*Cf* 1500 the IEA estimates to be needed to be operational by 2035) and the 'trend is in the wrong direction' (Watts, 2011). For example, the US flagship CCS project, FutureGen, was abandoned in 2008, then restarted by the Obama administration but with little

and uncertain progress since then. Similarly, in the UK, whose government is amongst the most supportive of CCS, its competition for CCS projects and research was relaunched in 2012 after an earlier attempt from 2009 finally came to naught in 2011 with the cancellation of the only remaining project at Longannet.

There are many problems with CCS that explain this slow progress. First, the capture, transportation and storage of CO<sub>2</sub> impose a significant energy penalty, adding approximately 25-40% to the cost of power plants (Montgomery, 2010:107). Secondly, and of major significance regarding cosmopolitan innovation and international collaboration dynamics, CCS is motivated by a global problem but there are political and economic tensions between major powers, including over distribution of the responsibility for dealing with climate change, so global political will to provide a regulatory architecture supportive of CCS is lacking (Edenhofer, 2010). Thirdly, while based upon technological steps all of which are established, together it represents a controversial and unproven solution. There are thus widespread concerns that CCS may simply act as greenwash affording a new generation of coal power stations, which lead to massive but, in fact, unmitigated carbon lock-in (Unruh, 2000; Markusson et al., 2011).

None of this paralysis, however, appears to be diminishing the governmental support for CCS as a crucial element of low-carbon transition. Hence the most plausible reading of CCS is that initiatives are likely to continue but developing the capacity for 'clean coal' much slower in reality than suggested by the rhetoric which will be needed to support it. The problems of CCS thus also provide a window into the conditions under which it begins to succeed. And while the US, Canada and the EU are currently leading in terms of the number and progress of CCS ventures (Worldwatch, 2012), it is again in China that the most significant developments have been in recent years.

Key to these has been a seeming change of heart around 2009/10 regarding the interest of the Chinese government in CCS (Friedman, 2009; Watts, 2011). As CCS emerged onto the policy agenda in the 2000s, it was clear that China was reluctant to take any lead in developing the technology, given perceptions of its expense as a penalty on development and of the responsibility

for mitigation resting primarily with the global North. In recent years, however, the explicit concern of the Chinese government for CCS seems to have changed. For instance, a report by the Worldwatch Institute (Carbon Capture Journal, 2011) argues that 'China could become a world CCS leader (and technology exporter) within the next two or three decades', a conclusion supported by the IEA (China Daily, 2011). The Worldwatch report notes the 'significant and encouraging progress' even as 'Chinese CCS development still lags behind the world leaders'. Technologically, China already has existing strengths in 'coal gasification technology, which produces more pure, capture-ready CO<sub>2</sub> flue gas streams' and has concerted R&D programmes yielding major improvements in CO<sub>2</sub> capture technologies. Moreover, returning to the importance of a resurgent (but neoliberalized) state, Worldwatch notes (Carbon Capture Journal, 2011): 'The speed of planning development, construction, and regulatory approval for all types of projects in China, especially energy, is unparalleled in the world. Likewise for CCS.' Evidence of progress in the flagship Greengene project corroborates these conclusions (Tollefson and van Noorden, 2012).

If CCS does become a viable prospect in China, both commercially and technologically, and an industry that offers genuine prospects of global Chinese dominance, however, the global fortunes of CCS innovation will be utterly changed. Such is the importance of coal to China that a China that is doing CCS will make it a globally viable technology, thereby stimulating the commercial competition and investment currently lacking. This, of course, would be another crucial positive feedback loop in the emergent clean coal-electricity system. Implications of such innovation for the emergent political regime, however, are mediated by the new knowledges and truths of such a system.

## Knowledges

CCS innovation provides an excellent example of the constellation of uncertainties that beset low-carbon transition more generally (Tyfield, forthcoming). Markusson et al. (2012), for instance, list 7 key uncertainties that are currently major obstacles to CCS take-off. These include technoeconomic uncertainties regarding choice amongst a variety possible CCS pathways (pre- vs.

post-combustion; solid state vs. gasification), the challenges of long-term 'safe storage', the 'scaling up and speed of development and deployment', and the 'integration of CCS systems'. But there also key uncertainties associated with 'economic and financial viability', 'policy, political and regulatory uncertainty' and 'public acceptance'. These latter uncertainties – which may require the reciprocal manufacturing of certainties, as described above – in particular may be discussed from a power perspective in terms of truth discourses that will legitimize such innovation and the government policies to support it.

It is noticeable that even to acknowledge the latter three issues is, again, to make a distinct break with neoliberalism. For example, there should be no question marks over the economic viability of an innovation since it is up to the market to decide if it should succeed and this is precisely what *will* happen. And public acceptance, too, is not a matter of political deliberation but is and should be simply a matter of sufficient consumer demand (or not) for the product. Furthermore, the solutions implied by such questions – namely, the need for 'additional policies [i.e. state intervention] to support CCS' (Markusson et al., 2012:909) – also display significant shifts away from a free market radicalism.

But, the types of knowledge and institutions of knowledge production to tackle these uncertainties of CCS innovation also illuminate what this new political regime *is*, as well as what it categorically is not. While increased state involvement to some extent seems necessary, even this is not enough given the exceptional challenges of coordination for a socially engineered, highly time-pressured and global transition (Tyfield, forthcoming). These challenges are fundamentally ones of the knowledge of policy-makers and their all-too-apparent limits in the face of the complex, non-linear, multi-factorial challenges they are hoping to tackle. As a result, management of these problems demands new types of knowledge (technical and political/legitimatory) and new institutions of knowledge production. In both respects, the emergence of web 2.0-enabled networks is absolutely central.

On the one hand, regarding technical knowledges, the challenges of the multiple uncertainties of CCS described above entail at least three new keywords in the discourse of, and (more-or-less purposeful or 'manufactured') reorganisation of

the institutions of, knowledge production. First, these uncertainties highlight precisely the *complexity and non-linearity* of the problems – of climate change, of energy systems and of coordinating their multi-agent transition – from which CCS springs. Secondly, a further irreducible complicating factor is developing CCS in specific geographical *places*, against the presumptive universality of neoliberal globalisation. Thirdly, CCS itself is only being pursued *at all* to the extent that it promises to solve (or at least mitigate) an existential security threat, not purely as a self-evident opportunity for profit. It is thus an example of the new age of ‘*responsible*’ *innovation* needed. But the very *model* of this innovation is also ‘*responsible*’ in that it takes seriously precisely the complexity of problem and solution; for instance, in acknowledging the importance of and informational gains in 2.0-enabled professional knowledge-sharing networks and ‘public engagement’. This process is, of course, precisely to manage the new crises and risks through an *expansion* of freedoms, the acme of (classical) liberal government. Taken all together, then, CCS is thus being pursued in order to – responsibly and precisely *because* of the threat of climate change – ‘explore all possibilities’. As Markusson et al. (2012: 910, emphasis added) note, ‘the dominant framing of CCS as *one important option in the mitigation portfolio* is judged to be reasonably robust, enjoys widespread support in international climate and energy policy circles and appears to *broaden the coalition in favour of long term climate mitigation efforts*.’ Such a discourse thus explicitly downplays any ‘magic bullet’ discourse, associated with the irresponsible techno-optimism and techno-fetishism of neoliberalism, as opposed to its more sophisticated and complex understanding of (real) ‘limits’. And it does so precisely in order to facilitate construction of a CCS climate risk community.

Regarding the technical knowledge networks, for instance, Markusson et al. (2012: 908) note for CCS the crucial ‘importance of information sharing for speed of development’ and the ‘need to fashion a knowledge community to support successful and rapid up-scaling’. Moreover, these networks are almost inevitably forms of international collaboration (or even possibly ‘cosmopolitan innovation’ (Tyfield & Urry 2009)): tackling a global problem that is inevitably manifest in locally specific ways, and reflecting the international dispersion and unequal distribution

of necessary expertise and potential synergistic knowledges. Yet in CCS, international collaboration efforts (e.g. separate ventures between China and the UK, EU, US and Australia) have to date remained as primarily academic collaborations that have done little to spur meaningful development of the technology.

The reasons for this are not hard to seek. For in the context of a neoliberal globalisation and innovation model, dominated by zero-sum international technological competition and the means for such domination through strong, global IPRs, neither the stronger nor the weaker party (e.g. the EU, UK or US and China respectively) has any reason to participate meaningfully in a genuine commercial collaboration. In these circumstances, the techno-nationalism of both countries, but particularly that which is committed to a national project of (technological) ‘catch-up’, is intrinsically opposed to meaningful international collaboration.

An emergent Chinese leadership in CCS and in the altered circumstances of globally acknowledged security threats, however, drastically alters this calculation, setting up positive feedback loops that could progressively accelerate collaboration. First, such technological leadership will be demonstrative proof of a rebalancing of the ‘international division of labour of innovation’ (Tyfield & Urry, 2009) towards China, putting both parties to such collaboration on a more even footing, setting the stage for genuinely mutually beneficial collaboration. Secondly, definitive commitment to CCS in China would provide a huge spur to further investment, R&D and market opportunities in CCS *in China* amongst Western businesses. Thirdly, whereas a single microchip factory can service the whole world, energy infrastructures are necessarily relatively immobile and located in a particular place (Smil, 2012). Accordingly, the gains in terms of economic development are also much easier to keep in a specific location, reducing the potential for appropriation of these gains overseas (after the hard work of development has been done) and thereby also mitigating the international zero-sum of such growth model. This, in turn, also eases the collaboration between transnational corporations and (competitor) states. In all of these ways, therefore, the techno-nationalist project of competitive innovation in a key ‘growth industry’ becomes simply the inseparable flipside

of international collaboration, all built on complex and responsible innovation networks.

On the other hand, regarding knowledges of legitimation, the neoliberal transformation of the state itself, described above, is one crucial step in this process in that it multiplies the connections between the state and the professional management of (hi-tech) businesses. But these changes limit the connections to distinct managerial class, that itself embodies the assumptions of the neoliberal period and hence act to compound the crises. Conversely, the problems and their solution extend far beyond this group, but this complexity of the problems and their solution can be harnessed through web-2.0 social media, opening up the resulting knowledge production to a much broader (set of) public(s), and thus a broader climate risk community. This is a process that is already well underway not only in the global North but also increasingly in authoritarian and one-party state China (Xiao, 2011); a form of 'consultative Leninism' (Tsang, 2011) that both contains but also employs web-based popular expressions of outrage to manage risks and complexity.

Moreover, this new empowerment of Chinese society precisely benefits the class that is to be the symbol of the new emergent socio-technical and accumulation regime. For it is the emergent 'middle class' – overwhelmingly in large and developed cities, young, educated and engaged in 'knowledge work' – who are online and participate in such political protest. Yet, as the Chinese internet best exemplifies, this construction of new freedoms is not only the construction of new avenues for the conduct of conduct and management of societal threats, but also entirely compatible with a commensurate increase in powers of state surveillance and coercion. In short, therefore, just as China exemplifies a classical economic liberalism precisely *because* of the strength of its state-owned enterprises, so too China in fact increasingly exemplifies a classical *political* liberalism (regardless of whether or not there is the oft-anticipated 'Chinese Spring') precisely *because* it is an *anti*-democratic, elite-bourgeois regime. The construction of clean coal and Chinese global leadership in CCS exemplifies, and could construct, precisely this form of government.

## The new 'spectres'

CCS will thus succeed to the extent that intra- and inter-national 2.0 knowledge networks – cosmopolitan climate risk communities – emerge, but also networks that are crucially conditioned by the central acknowledgement of new security threats to 'society'. *These* networks are the very embodiment of a new form of liberal political regime, built upon government through new and expanded freedoms (2.0-enabled networks and publics) *alongside* expansion of state powers of exclusion and security. For liberalism, however, the latter interact productively with the former by defining the limits not only of government, but also of the exercise of these new freedoms; hence legitimating the expansion of new state powers to manage the new freedoms, and delegitimizing those excluded from the new productive regime and on whom these new state powers will be deployed in order to police their 'unnatural' behaviour. This account of liberalism 2.0 thus illustrates how the key challenge of manufacturing the interlocking certainties needed for low-carbon transition involves a new interpretation of some *risks* as *existential security threats*, in critical contradistinction to the 'dangerous' neoliberalism of 'world risk society' – revelling in the proliferation and deliberate accelerated cultivation of risks – that has preceded it.

Moreover, the manufactured certainties and cosmopolitan risk communities of low-carbon transition are also thus inseparable from new social definitions, stratifications and exclusions that are then just as actively constructed. What then is this new shadow world? We briefly outline one key example regarding cosmopolitanism of the newly excluded subjectivities thus constructed.

This follows from discussion concerning the major changes in the dynamic of and nature of technonationalism (vis-à-vis cosmopolitanism) from neoliberal era due to the progressive rebalancing of the international division of labour of innovation. Central to this dynamic is the coal-driven rise of a Chinese (or more generally, 'BRICs') knowledge-working middle class. For this development will not only signal a rise and equalisation in global wages, hence diminishing off-shoring threats, generating new sources of demand and opportunities for 'win-win' economic growth, including investment in Chinese (CCS) innovation. But the emergence of this new 'global' and systemically pivotal class also allows for its

redefinition as the historical bearer of ‘development’, of technological, material, environmental and cultural progress. Regarding techno-nationalism, this class is thus the new vanguard of national prosperity, the key to national prosperity and security, global standing and national pride. As such, those lower down the ladder, the workers (aspiring, of course, to be amongst the new middle class) are delegitimized in their ‘selfish’ demands that threaten such development; which, in turn, further facilitates the distinction between *legitimate* winners and losers, the new social ladder and its carrots and sticks. Techno-nationalism thus shifts from being a matter of international cut-throat competition (between a victimized China and its oppressors in the global North) to being a power technology of *intra*-national class subjugation. Notably, this is a process that was equally apparent regarding the liberal nationalisms of the nineteenth century, as displayed in the ‘world fairs’ with class-denying demonstrations of *national* industrial prowess (Johnson, 2010; Nye 1998: 91-94).

This dynamic, however, is precisely liberalism’s inherent social binarism, played out in redefinition of the new *intra*-national losers as a racial other who are to be ignored, contained and repressed. For instance, the growth of clean, dependable but relatively more expensive electricity from clean coal conditions growth of hi-tech knowledge jobs, especially for the BRICs middle class; which, in turn, affords their green consumerism and creates new win-win profitable opportunities for Western businesses too in new re-regionalized growth models. Intrinsically excluded, therefore, are those doing the expanded industrial labour that is an irreducible concomitant of increased middle class consumerist prosperity and accumulation and now employed in hugely powerful quasi-state enterprises that are evermore highly automated and mechanized; those unable to afford elite, ‘green’ consumer products (e.g. electric vehicles); and those now in comparative energy poverty given unsubsidized national energy markets subject to the carbon taxes/prices that make CCS/clean coal commercially viable. While their possible forms of organized mass protest are also delegitimized: as a security threat to social stability (on which a premium is placed given the recent experience of deepening crisis); as selfish and short-sighted, jeopardising the national interest of national economic development and of developing capacity

to tackle complex (e.g. environmental) challenges that demand ‘innovation’; and as *passé* and regressive as against the increasing opportunities for 2.0-enabled short-term issue public outrage, which privileges the online, young, urban-cosmopolitan and middle class.

These dynamics thus condition the emergence of a self-confirming feedback loop regarding *intra*-national imposition of the (entropic) costs of accumulation and delegitimation of objections to this imposition. Moreover, with the new systemic losers both newly encumbered and delegitimized, this demands greater policing, thereby making the militant ‘rabble’ that *constructs* the truth of the ‘enemy in our midst’, wishing destruction of ‘society’, that perpetually haunts the new system and constitutes the new common-sense of ontological insecurity and security threats. A ‘clean coal’ low-carbon transition thus suggests a future of continued graphic *intra*-societal inequalities and violence, reminiscent of Dickensian (and liberal) London.

This liberal political regime is thus explicitly *not* concerned with *democratic* governance by the population as a whole, but only government by, of and for the new freedoms of the emergent ‘middle class’. Rather, given the nature of the ‘global’ security threats (thus defined) and the advantages of massive state-supported corporations, this also presages a *political*, and not just economic, convergence between the West and China towards various systems all of which *de facto* rule by and on behalf of the (globally) connected knowledge ‘middle class’ – viz. the current exacerbation of the EU’s democratic deficit by imposition of technocratic government from Brussels, or the raging culture war between ‘grass-roots’ (left- and right-wing) and US federal government.

## Conclusion: The Paradoxes of Low-Carbon Coal Society

This paper has explored the emergence of cosmopolitan climate risk communities regarding ‘clean coal’ through the lens of the power regime of liberalism. Such an analysis highlights the *essential* social binarism, inequalities and anti-democratic pressures that may well be constitutive of the manufactured certainties presupposed by low-carbon transition, suggesting a ‘clean coal’-based low-carbon future may well be significantly less ‘progressive’ (and less normatively cosmopolitan)

than that which is presented in many high-profile policy visions.

In this way, we can appraise clean coal – as a key case study of cosmopolitized low carbon innovation, more generally – as the paradox it is, namely as:

1. ‘Green’ *and* the most polluting of fossil fuels, massively accelerating GHG emissions as CCS roll-out slowly catches up;
2. ‘Clean’ and light, especially as mediated by electrification and identified with new, hi-tech knowledge industries *and* heavy, dirty and discredited/invisible industrial labour;
3. An ‘essential’ part of global low-carbon transition *and* hugely deepening structural dependency on fossil fuels vs. decentralized renewable energy networks;
4. The technonationalist vanguard and bearer of civilizational progress and development *and* a mass employer of an exploited and delegitimized industrial workforce;
5. A condition for equitable economic development of non-‘Northern’ countries and ‘innovation catch-up’ *and* for intensified and expanded economic exploitation of the ‘Southern’ working class;
6. A ‘responsible’ innovation trajectory, as one element in a ‘portfolio’ of measures to tackle complex global environmental challenges *and* a reckless experiment, at unprecedented scale, with accelerating emissions and anthropogenic climate change;
7. Constructing and legitimating a new expanded set of capitalism’s winners – economic, political and ecological – *and* constructing and expanding, but denying and delegitimizing, its losers; and
8. Energizing and empowering a new, more populous and seemingly progressive class – of 2.0-networked, BRICs-inclusive, green knowledge-workers – *and* conditioning a global *de*-democratization, including in the liberal democracies of the global North, towards a bourgeois-elite, liberal regime.

These characteristics are thus both the reprise of 19<sup>th</sup> century liberalism and its profound transformation, as if reflecting a political regime on the ‘way up’ and the ‘way down’, tragedy and farce respectively. The trends that are here synthesized in

speculative prospect, however, are inevitably open to multiple forms of resistance, so that the trajectory of the future presented is by no means written in stone. Indeed, the very success of liberalism 2.0 is likely to construct (and be constructed by) new powers of resistance. And energy will continue to be a key issue in this case. For it was precisely the concentration of organized mass labour forces in control of key strategic flows of energy that emerged in the latter half of the liberal 19<sup>th</sup> century – miners, dockers, railwaymen – that ‘powered’ the democratic radicalism and ‘real’ socialist alternative, which in turn achieved the economic and political concessions of the twentieth century social democratic state (Mitchell, 2009). The emergence of similar forces of organized and empowered resistance to a Sinocentric liberalism 2.0 and global low-carbon capitalism is thus surely a key question for future consideration and a matter of hope for a progressive future, albeit in the longer-term.

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