# Dancing to the rhythms of the fossil fuel landscape

## Landscape inertia and the temporal limits to market-based climate policy

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**ABSTRACT**

This article makes a contribution to the critique of market-based mechanisms for climate and energy policy. It explores the environmental effectiveness of market instruments by engaging a broadly-conceived 'fossil fuel landscape', or the material, social, and political inertia of fossil energy dependence, as a factor delimiting policy outcomes. The argument is developed through a focus on the idea of economic efficiency as a key ideological construct underlying market-based policy, and draws on examples from two different market instruments, namely the EU Emissions Trading Scheme, and the Flemish tradable green certificate scheme. I argue that an understanding of the shortcomings of these, and similar, policies requires acknowledgment of the political and socio-economic power that emanates from the temporal dynamics of fossil fuel capitalism, which are reproduced when economic efficiency becomes the key focus of climate policy.

**Key words:** Market-based mechanisms, EU ETS, tradable green certificates, fossil fuel landscape, landscape inertia, tradable green certificates

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**Introduction**

In formulating responses to climate change, policy makers are primarily relying on market-based mechanisms (MBMs) such as emissions trading and carbon offsetting. Proponents of this approach hold that this minimizes the costs of emission abatement and therefore reconciles environmental objectives with economic ones in a way that would be hard to achieve with other policies (Hedegaard, 2011; IETA, 2015). For all the political currency that has been expended on MBMs however, the results so far have been far from positive. The world's largest emissions trading scheme, the EU ETS, has been mired by controversies right from its inception in 2005 and continues to battle with a host of problems, including the widespread overallocation of emission rights; a crashed carbon price; and windfall profits for some of Europe's most polluting industries (Bailey, 2010; Elsworth et al., 2011; Morris, 2012; Reyes & Gilbertson, 2010). More sobering still is the track record of various carbon offsetting markets, providing as it does ample evidence of the inequitable, environmentally dubious and sometimes outright violent outcomes that are produced when emission reductions are relegated to developing countries (Bachram, 2004; Böhm & Dabhi, 2009; Leach & Scoones, 2015; Lohmann, 2006; Spash, 2010).

Critical scholarship has been instrumental in theorizing why market-based environmental regulation has tended to fall short of desired outcomes. In part, this literature scrutinizes MBMs as the latest manifestation of an ongoing, neoliberal turn in environmental governance that by itself is likely to produce "predominantly environmentally undesirable and socially regressive political and economic outcomes" (Heynen et al., 2007, p. 2). Hence, scholars have shed light on the many ways in which carbon markets encourage speculation and profiteering to the sole benefit of financial and industrial interests (Bond, 2012; Coelho, 2012; Reyes & Gilbertson, 2010). Others have shown how market-based policies depend on a form of commodification that fetishizes the creation of exchange value by unduly simplifying socio-ecological reality (cf Castree, 2003). Robertson's (2006) examination into wetland mitigation banking, for example, vividly demonstrates how the creation of new environmental markets often has more to do with rendering nature legible to capital than with an accurate representation of ecological complexity. Similarly, Lohmann (2011a) elaborates on how the production of carbon credits hinges on a process of technological, temporal, spatial, and chemical abstraction that sidesteps political choices about how, when, and where emission reductions are to be made. Apart from having clear social and economic consequences, the internal logics of market-based instruments are thereby believed to have far-reaching ramifications for the claims these instruments make to environmental effectiveness (Lohmann, 2012).

In the face of the intensifying roll-out of MBM's, critiques such as these mark an important effort to lay bare the contradictions of market-based environmental policy and therefore warrant increased attention. This article seeks to make a contribution to this debate. In line with the literature cited above, it aims to examine the concrete dynamics that predispose market-based mechanisms to undesirable environmental outcomes. However, where much of the existing critique has scrutinized the discrete dynamics of MBMs in terms of their faulty architecture or the internal contradictions inherent in the process of commodification itself, I here want to adopt a slightly different perspective. I want to argue that an understanding of the socio-ecological significance of market instruments also calls attention to the way these instruments relate to the broader dynamics of a (for the time being) fossil fuel-dependent capitalism, that is, the historically-specific socio-ecological relations that have shaped the economic system as it exists today. As I elaborate below, this relationship is characterized by a temporal dimension that has far-reaching implications for the environmental outcomes that MBMs generate. Put differently, the intention with this article is to shift focus from the contested production and consumption of new commodities under MBMs per se, to the role(s) that these markets perform within the broader context of fossil fuel capitalism, in order to then make a theoretical point on the alleged environmental effectiveness of market instruments.

In doing so, my emphasis is on the relationship between one of the key ideological constructs underpinning market instruments – the idea of economic efficiency – and what I here choose to call the fossil fuel landscape, or the historical, socio-ecological legacy of fossil capitalism. In line with recent work elaborating the relationship between fossil energy use and the historical development of capitalist social relations (Altvater, 2006; Huber, 2008; Malm, 2016), my aim is to shed light on the dialectical relationship that exists between the energy base of contemporary capitalism and the production of concrete outcomes under market-based climate policy. As I elaborate below, this relationship is usefully analysed through the concept of the fossil fuel landscape, in that the latter allows a theorization of fossil energy dependence as a socio-economic (and historically specific) condition and consequently avoids the potential pitfalls of 'fossil fuel-fetishism' (cf. Moore, 2014). At the same time of course, this focus enables only a partial explanation of why MBMs tend to result in certain environmental outcomes. Critical scholarship has demonstrated that the interface between socio-economic structures and concrete policy outcomes is a complex, contingent and multifaceted one, and I have no intention of contesting that here. What I do want to argue, however, is that the legacy of fossil capitalism exerts tremendous political power, often in ways that are not always immediately obvious, and that this power should be fully reckoned with when evaluating the performance of MBMs. The environmentally deleterious outcomes of market-based climate policy can therefore in part be seen as a concrete expression of the power relations with which the fossil fuel landscape is imbued. By elucidating this dynamic, I hope to provide an alternative perspective on the determination of MBM outcomes and thereby contribute to existing critiques of market-based regulation. At the very least, I believe this approach adds analytical clarity to the exact conditions that render market instruments environmentally ineffective (if and when they do), and promises to shed light on the way these problems become expressed.

The remainder of this article is structured as follows. In the following section the notion of the 'fossil fuel landscape' is developed as a conceptual tool for studying the structural relations between on the one hand market-based climate and energy policy, and on the other the fossil fuel dependence of contemporary society. This discussion is based on a selective reading of literature in landscape and energy geography and specifically focuses on the temporal dimensions of landscape change, or the idea of landscape inertia, as a relevant analytical framework. In the third section I briefly introduce the idea behind MBMs and give a short overview of the two market schemes that I use as examples throughout this text: the EU emissions trading scheme (ETS) and the Flemish tradable certificate (TGC) scheme. I then connect recent experiences with these two schemes to the discussion on the fossil fuel landscape, by engaging with one of the main ideological components underpinning any MBM, namely the focus on economic efficiency, materialized in MBMs through the multiple abstractions and equivalences (cf. Lohmann, 2011a) that these trading schemes construct. My argument here is that the prioritization of economic efficiency within current climate and energy policy is mediated through a broadly-conceived fossil fuel landscape and as a result tends to produce outcomes with specific environmental characteristics. The conclusion summarizes the argument and underlines the value that a broader, structural perspective on market instruments can bring to existing debates. Examples from the EU ETS are based on a selected literature review, while the analysis of the Flemish TGC system came out of a study of relevant policy and company documents and 10 interviews with key informants, all of which were carried out between March and December 2013.

**On the capitalist temporality of the fossil fuel landscape**

The history of industrial capitalism is, to a large extent, the history of fossil fuel extraction and consumption (Foster et al., 2010). This has been true for much of the 19$^{th}$ and 20$^{th}$ centuries, and to a large extent it is still true today. Despite the prevalence of discourses on decoupling and decarbonization, and despite a steady increase in the share of renewables, global primary energy consumption in 2014 was still comprised of 86,3% fossil fuels (BP, 2015). Even in the EU, arguably one of the most outspoken promoters of renewable energy technologies, energy consumption remains fundamentally reliant on the combustion of conventional fuels. For 2013 for example, the energy mix in the EU-28 consisted of 23% natural gas, 33% petroleum products, and 17% coal, or a total of 73% fossil fuels, a number that admittedly masks large discrepancies between individual member states (EC, 2015).

To analyze the implications of this condition in more detail, fruitful use can be made of the 'landscape' concept and the various literatures that engage with it. With respect to my concrete focus, this idea most directly invokes the various energy landscapes that have been produced in the wake of increasing fossil fuel extraction, production, transportation and consumption. From oil wells and coal mines to road networks, harbors, airports, power stations, manufacturing facilities and the landscapes of industrial agriculture, the omnipresent hardware of contemporary capitalism is distinctly representative of its carbon-intensive 'lifeblood' (cf Huber, 2013). Scholars working on energy and landscape geography have long highlighted this. Pasqualetti (2013) for example describes how the physical spaces around us have been transformed by our mining of coal, our drilling for oil, our hydrofracturing and oil refining, our construction of fuel storage, transportation and combustion facilities. This literature demonstrates how the extant mode of energy use has "a particular spatiality" that not only shapes many of our everyday activities, but that is also radically different from the spatiality that a full-blown commitment to renewable energy would entail (Bridge et al., 2013; Pasqualetti, 2011).

At the same time of course, society's fossil fuel dependence runs deeper than a mere focus on the physical landscapes of energy production conveys. It is also forcefully reflected in the geographies of everyday life. Much of what people in the industrialized world now take for granted - from the globalization of leisure, work, and trade, to current levels of labour productivity, consumerism, and urbanization, to such everyday consumables like electricity and plastics – became possible only through the expansive use of fossil energy, a process that was neither natural or straightforward (Huber, 2008). Understanding the root causes of our current predicament therefore requires an analytical perspective that also takes seriously, as Huber (2013) puts it, the "social relations, politics, and struggles over how life is lived that stretch far beyond the wells, pipelines, and refineries immediately stained with oil's toxic residues" (p. xii). It requires that the particularities of our energy use are expounded as deeply embodied in the "everyday processes of social reproduction" (p. 7) and the prevalence of fossil energy recognized as simultaneously a material and ideological condition, the implications of which extend far into the realm of norms, beliefs and values. Bridge et al. (2013) in this context speak of the 'spatial embeddedness' of fossil fuels, meaning the extent to which the specificities of the energy system have become internalized in the cultures and social practices of consumers. Huber's (2013) account of the way in which ideas about freedom and a specifically 'American way of life' have been constructed around a discourse of access to (cheap and 'secure') oil, or Timothy Mitchell's (2011) thesis on the relation between fossil energy and democratic politics, are revealing examples of this. I argue below that the prioritization of economic efficiency in climate change policy is another example of how the dialectical relationship between energy use and socioeconomic organization takes on this more-than-material dimension.

The landscape concept captures both these material and ideological aspects of fossil fuel dependence and thereby serves are as an analytical window onto the energy-specific organization of society. Indeed, the use of the 'landscape' concept to describe and analyze broader socio-economic processes has long been a key feature in geographical literature. Amongst Marxist geographers in particular, the focus on concrete landscapes has proven useful for studying the morphological, representational and signifying processes involved in the production of space. Don Mitchell (2005) for example describes the landscape as "actively incorporate[ing] the *social relations* that go into its making" (p. 49, italics in original), implying that the landscape idea connotes more than the materiality of specific places, indeed, more than that which is immediately observable. Landscapes can therefore be seen as "power materialized" (D. Mitchell, 2012, p. 399). They constitute the concrete representation of the historical labour relations through which space (or nature) is continuously produced, thus offering crucial insights on the way society is structured.

But more than a mere reflection of social relations, landscapes also fulfill an important normative function. As the materialization of existing social relations they easily become evidence of the 'natural' state of things, and thus of how society *should* be organized in the future (Duncan & Duncan, 1988). The mere material existence of specific landscapes in this way infuses them with a certain authority over "what is 'natural' or 'right' in a particular place" (D. Mitchell, 2005). In contemporary society the landscape thus reflected and naturalized is a specifically capitalist one, incorporating moments of commodity production, labour struggles, exploitation, resource extraction, ecological degradation, etc. (D. Mitchell, 2012; Walker, 2004). With respect to climate change and the use of fossil fuels, this argument can be extended to account for the historically specific socio-ecological metabolism that the landscape embodies and the social and political power that emanates from it. The 21st century energy landscape, in other words, embodies and therefore legitimizes a particularly fossil fuel-dependent mode of commodity production, resource extraction, ecological degradation, etc. through which historically specific socio-economic relations are reproduced. It is this that I here choose to call the 'fossil fuel landscape'.

The persistence of fossil energy use can thereby be seen through the lens of what Don Mitchell (2005) calls the "enormous inertia" that characterizes landscapes, or the power commonly embedded in landscapes to withstand action and resist change. The world 'inertia' is important here because it does not connote the impossibility of change, but rather asserts the delimiting role that material representations of power play in shaping processes of transformation. The notion of landscape inertia, in other words, establishes "what is already there" as a social, material and economic factor to contend with in discussing transformational processes (D. Mitchell, 2012, p. 166). With respect to the focus of this article, it allows for an understanding of the social and material ubiquity of fossil energy in itself, as a significant obstacle to the rapid transition away from fossil fuels. As Nadaï and van der Horst (2010) put it, "the past casts shadows on our future options, which are written into existing landscapes and energy infrastructures" (p. 153), meaning that past investment choices delimit the kind of energy technologies that currently seem appropriate or socio-economically feasible. Presumably this dynamic becomes more protracted the greater the socio-economic reliance on a given energy source has become. A society dependent on fossil energy for its most basic socio-economic functions will therefore have all kinds of internalized mechanisms that tend to work against a radical energy transition (Smil, 2010).

This understanding of inertia is perhaps more commonly summoned through concepts such as path dependency and carbon lock-in (Unruh & Carrillo-Hermosilla, 2006; Unruh, 2000). The advantage of enlisting the landscape literature in this debate, however, is that the latter pays attention not just to technological and institutional dynamics (as tends to be the focus on the transition literature) but also to the socio-economic and political dimensions of lock-in. As Don Mitchell (2005) notes, "[p]eople work very hard to maintain, to reproduce, the already existent landscape", meaning that landscape inertia is "made real not only in bricks and stone but also in people's livelihoods and homes" (p. 51). In a broader sense then, the landscape concept puts the focus on the historically specific set of socio-economic relations within which energy systems are embedded. In doing so it facilitates a reframing of landscape inertia as fundamentally the inertia of the capital that circulates through that landscape and allows us to see these processes as distinctively capitalist rather than universally applicable ones.

In this context it is worth highlighting a number of distinctly capitalist dynamics that (re)produce and reinforce the observed tendency towards landscape inertia. Interpreting Marx' (1977) notion of 'fixed capital', Harvey (2007) for example notes that in their drive for competitive advantage and technological innovation, capitalists need to take ever more capital out of circulation and invest it into fixed capital, i.e. in the commodities, machines, infrastructures and larger 'built environment' that enable the production of surplus value and the circulation of capital. This imperative results from increases in labour productivity and from the fact that fixed capital formation is an appealing if temporary solution to reoccurring problems of overaccumulation. In the process, capitalists commit themselves "to use [this fixed capital] until its value is fully retrieved" (p. 220), otherwise financial losses would be incurred and profitability undermined. But this also means that "production and consumption are increasingly imprisoned within fixed ways of doing things, and increasingly committed to specific lines of production" (p. 221). As Prudham (2004) puts it, "the stickiness or inelasticity of spatial configurations acts as a constraint on the circulation of capital" (p. 13), meaning that the fixedness of capital within existing landscapes checks future investments in certain directions and hampers others. Harvey notes that this is a concern particularly for large-scale and durable forms of fixed capital, such as those that make up the built environment. Applied to the current case we could say that, by having invested in the construction of road infrastructure, oil and gas production and transportation facilities, fossil fuel-driven power plants, etc., a capitalist society is economically committed to utilize these assets. It has a vested interest in the endurance of the fossil fuel landscape, indeed even in the reproduction of that landscape to the extent that the current trajectory of technological change entails a lesser risk of capital devaluation than any more radically low-carbon alternatives.

By itself however, processes of fixed capital formation and landscape inertia do not preclude the possibility of an energy transition. While the current condition can be interpreted as an "inherent and unavoidable dependence on fossil fuels" (Altvater, 2006, p. 39) that frames fossil energy as a "necessary aspect of capitalist production and circulation" (Huber, 2008, p. 105), the contradictory and dynamic nature of capitalist development also points in a different direction. The tendency for ever more capital to become 'fixed' in commodities, machinery and infrastructure is counteracted by the system's in-built need for flexibility and continuous technological innovation. Despite the landscape's deep inertia, therefore, some degree of fixed capital devaluation is inevitable for innovation and subsequent capital accumulation to occur. As Buck (2006) points out, "economic landscapes are frequently swept away in periodic rounds of creative destruction[, a process that is] internal to the dynamisms of capitalism itself" (p. 67). This process is determined in part by the material limitations (i.e. the physical lifetime) of fixed capital items, but for the most part arises from the creation of socioeconomic obsolescence. In other words, if inertia is defined as an inherent resistance to change (and not its impossibility), then that resistance can be overcome through a socially mediated process of devaluation, i.e. a process dependent on revolutions in technological innovation, capitalist competition, changing social needs and norms, etc. (Harvey, 2007).

In this way, a focus on landscape inertia moves the debate away from questions about the respective (in)ability of capitalism to bring about the decarbonization of society, and towards considerations on the temporality within which such a decarbonization process can occur. From this perspective, the deep socio-economic entrenchment of fossil energy in industrialized society does not so much block the uptake of renewable technologies, as it provides an argument for why the transition is likely to be a protracted and drawn-out process. Ultimately this is because a rapid and uncontrolled decommissioning of the fossil fuel landscape would entail a "mesh of contradictory forces associated with technological change, disequilibrium, crisis formation, overaccumulation and devaluation" (Harvey, 2007, p. 222), all of which would have significant negative social and economic consequences for society at large. To relieve this tension between on the one hand the necessary devaluation of fixed capital (here externally induced by the desire to mitigate climate change) and on the other the imperative to fully retrieve the value 'fixed' in the fossil fuel landscape, the obsolescence of that landscape can be planned and the pace of technological change regulated to some extent. This creates a degree of predictability and security with respect to future technologies that allows capitalists to “manage the circulation of fixed capital according to some rational plan” (p. 221). As Harvey (2007) points out, this can be done at the level of the individual firm, or it could occur through monopoly formation, but for some forms of fixed capital it is likely to involve government interventions in research, taxation, patenting laws, etc. In what follows I argue that market-based mechanisms fulfill a similar role.

**A market-based approach: The EU ETS and the Flemish TGC system**

The following sections draw on experiences with the EU ETS and the Flemish tradable green certificate (TGC) scheme, two examples of market-based climate and energy policy. The EU ETS is by far the best known of the two. It is one of the main pillars of the EU’s climate change mitigation efforts and currently the largest operational emissions trading scheme anywhere in the world, covering the greenhouse gas emissions from Europe’s large industries and power plants or about half of the EU’s total emissions (EC, 2012b). Its history and *modus operandi* is well-documented in the literature (Bailey, 2010; Convery, 2009; Ellerman et al., 2010; Skjærseth & Wettestad, 2009). The Flemish example on the other hand is probably less well-known. It is a regional example of a tradable certificate scheme, a popular incentive instrument for renewable energy production, and was introduced by the Flemish government in 2002 as a way to dramatically increase investments in renewable energy in Flanders (Belgium). It has since become one of the region’s key instruments for meeting the objectives of the Belgian renewable energy action plan (Belgian Government, 2009). A TGC scheme is similar to emissions trading in that it is a quota-based system in which a regulator creates the initial demand but pricing is left to the market. In short, under the TGC scheme the Flemish government sets a yearly renewable energy quota that energy suppliers must meet and at the same time hands out tradable green certificates to all renewable energy producers. In order to meet their quota, electricity suppliers then need to purchase certificates from producers, which creates the conditions for the actual certificate trading. By increasing the total quota every year, the Flemish government guarantees a gradually increasing demand for renewable energy while companies are at liberty to decide how that demand is filled.

In many ways of course, the EU ETS and the Flemish TGC are very different. One is an attempt to directly internalize the social and environmental costs of greenhouse gas emission, while the other is an incentive scheme that promotes renewable energy and thus only indirectly discourages those emissions. The EU ETS is a Europe-wide system covering multiple sectors, while the Flemish TGC is a relatively small regional scheme only focused on electricity production. An exhaustive description of the peculiarities of each scheme, and indeed of the problematic track records that has characterized both, is beyond the scope of this paper (but see Bailey, 2010; Carton, 2016; El Kasmioui et al., 2015; Ellerman et al., 2010; Morris, 2013). What matters here is that, beyond clear differences in design, proximate objectives and implementation, significant commonalities exist in the broader context, central logic and ideological assumptions underpinning both schemes. Most obviously, both the EU ETS and the Flemish TGC have been operating within a fossil fuel landscape, the transformation of which is part of the justification behind the two schemes. When the EU ETS was implemented in 2005, the primary energy mix in the EU-

27 consisted of 79,3% fossil fuels, while the European electricity sector in that year was 54.4% dependent on fossil energy sources (EC, 2015; EEA, 2012). Similarly, at the start of the Flemish TGC in 2002, electricity production in Belgium was divided more or less equally between nuclear energy and fossil fuel combustion, with renewables taking up a mere 0.7% of the total (Verbruggen, 2004). Importantly also, both schemes share a commitment to the economic efficiency of environmental policy, a concern that can be traced back to the work of economists such as Coase (1960), Crocker (1966) and Dales (1968) and that has become increasingly prominent since debates in the context of the Kyoto protocol (Hepburn, 2007; Shields, 2007). As Dales (2002) famously puts it in his classic treatise on the value of emissions trading, “the best way of implementing a policy is the least costly way” (p. 99). One could say that this focus on cost-effectiveness/economic efficiency is the common thread that ties different market instruments together, and indeed one of the main reasons why they have become so ubiquitous in the first place (Bailey et al., 2011; Lane, 2012; Voß, 2007). The EU ETS and the Flemish TGC are good examples of this. The European Commission (2003) expresses the need to “promote reductions of greenhouse gas emissions in a cost-effective and economically efficient manner” in the very first paragraph of the EU ETS Directive, while the opportunity to “steer the market towards the most cost-effective technologies” (VREG, 2011, p. 12, own translation) is repeatedly mentioned as a key reason for why the Flemish government chose to adopt a TGC scheme in the first place. I argue below that the implications of this focus on economic efficiency, as reflected in a market-based approach to environmental regulation, can partly be understood in the context of the tendential inertia of the fossil fuel landscape.

**The inertia of economic efficiency**

The idea of economic efficiency is internalized in market-based mechanisms through the opportunities they create for participating companies to trade permits or credits irrespective of the geographically, technologically and ecologically differentiated nature of the ‘externality’ they represent (Lohmann, 2011a, 2011b). For the EU ETS for example, the argument is that trading redistributes emission abatement to where this is least expensive. A company that is able to make carbon-saving investments in its own production chain for a cost lower than the EUA[1] market price can thus choose to do so and then sell its excess permits on the market. Other companies meanwhile could find that it makes more economic sense for them to buy EUA’s than to implement their own measures. The alleged overall result is a climate policy that is more economically efficient than when emission reductions would be spread evenly and everyone would simply implement mitigation actions of their own (cf. Coase, 1960; Dales, 2002; Montgomery, 1972). This mechanism is justified by the idea that, for a global problem defined in terms of excessive atmospheric greenhouse gas concentrations, it does not matter how or where emission reductions are made, as long as the end result is an overall decrease in emissions. Within this logic, prioritizing the cheapest emission savings makes perfect economic and ecological sense.

[1] EUA stands for EU Allowance, or the emissions right unit that is used under the EU ETS. 1 EUA corresponds to 1 tonne of $CO_2$-equivalent emissions.

As critics have pointed out however, economic efficiency is not the neutral aim that it is often made out to be. The long-term mitigation effects of any given carbon-saving measure can vary widely, depending on the kind of technology that is used, the timeframe over which it is implemented, and the kind of market dynamics it sets in motion (Lohmann, 2011a). Efficiency improvements to existing coal combustion installations for example might do a lot to decrease emissions in the short-run, but they simultaneously also ensure the continued economic viability of coal as an energy source and thereby actually prolong the lifetime of fossil energy use. Paradoxically, this might even lead to an overall increase in the consumption of coal as a consequence of the technology's improved efficiency hence its renewed attractiveness (Alcott, 2005; Clark & York, 2005). By contrast, investments in renewable energy stimulate the demand for, and research in, alternative technologies and therefore help to incentivize the long-term structural transformation of the fossil fuel landscape. These crucial nuances between different abatement techniques are lost in the quantitative equivalences created as a consequence of the commodification of emission rights (Gilbertson & Reyes, 2009; Swyngedouw, 2011).

Concerns over the kind of incentives that a focus on economic efficiency prioritizes are to different degrees borne out in the experiences with existing market-based mechanisms. For the EU ETS, determining the abatement choices that have been made as a result of the scheme is not altogether straightforward, mostly because the consistently low carbon price on the European market and the persistent EUA surplus has largely failed to induce emission reductions (Morris, 2013). Studies evaluating the EU ETS' first phase (2005-2008) – when EUA prices were initially higher (Ellerman & Joskow, 2008) – nevertheless do provide some evidence for the prioritization of certain types of emission reduction. In the power sector, the main strategy that companies employed was so-called 'fuel switching', or the prioritized use of installations with lower emission rates over installations with comparatively higher emissions. A country's electricity supply is made up of a network of power plants that are operational to various extents depending on fluctuations in energy demand. The order in which these plants are brought online depends on a host of factors including fuel costs, differences in energy efficiency and – with the launch of the EU ETS in 2005 - $CO_2$ intensity. An easy way for companies to respond to $CO_2$ prices is therefore to change the order in which certain power plants are brought online, which indeed is largely what happened (Ellerman et al., 2010). The initial implementation of a $CO_2$ price led to the widespread reordering of installation priority, in which gas-fired capacity was brought online before coal power plants (Delarue et al., 2008). This makes sense from an economic perspective because natural gas produces only about half the carbon emissions of coal and thus incurs only half the $CO_2$ cost. As Ellerman et al. (2010) clarify, fuel switching "requires no investment and no change in normal operating procedures, and the obvious differences in emission rates among existing power plants would seem to leave plenty of scope for this form of abatement" (p. 175). They go on to show that this logic was most pronounced in those countries with the highest levels of coal and natural gas in their energy mix and that it was probably responsible for the majority of emission reductions in the EU ETS as a whole during phase I.

Insofar as the capacity for increased gas combustion is already in place in many countries therefore, fuel switching proved to be by far the cheapest way of responding to EU ETS quota. But this strategy also implies that the corresponding carbon emission savings can easily be reversed by switching back to coal when conditions (fuel prices, fluctuations on the EUA market,…) change, as was indeed the case in Europe after 2011 (US Energy Information Administration, 2013). A somewhat related concern can be raised for the other major strategy pursued under the EU ETS' first phase, namely the pursuit of energy efficiency investments in both the power sector and various industries. This approach has the advantage that it not only reduces the carbon intensity of energy use but also decreases overall operating costs, therefore fitting in well with companies' general business logic. Ellerman et al. (2010) give the example of ČEZ, the largest electricity provider in central and eastern Europe, and describe how the company speeded up a number of already-planned energy efficiency investments in its power plants as a result of the introduction of the EU ETS. While the overall results of this kind of investments can be framed as a reduction in emissions, it hardly challenges the deep socio-economic embeddedness of fossil fuel dependence. Together then, the legacy of fuel switching and energy efficiency investments suggest that the EU ETS did indeed incentivize abatement during its first few years, but that it did so primarily through activities that required little or no additional efforts on top of what would have made sense for many companies to do anyway. To the extent that companies moved away from high-carbon mode of production, they did so entirely on their own conditions and in way that was compatible with broader economic imperatives. It is to be expected that any efforts to shore up the presently dysfunctional European carbon market would lead to the reemergence, in different forms, of exactly this logic.

Given the current difficulties with the EU ETS, it is useful to draw parallels with other market-based instruments to confirm the kind of dynamics that a pre-occupation with short-term and easy solutions gives rise to. The Flemish TGC scheme is one such parallel example. Much like the EU ETS, proponents of this system hold that it "allows involved actors to choose the optimal strategy according to their own situation," thereby creating "a clear impulse to produce renewable energy with the cheapest technology and on the most suitable location" (VREG, 2011, p. 14, own translation). Over ten years of experience with this scheme allows some conclusions to be drawn about the kind of strategies it has incentivized. By far the most successful technologies have been those based on biomass and biogas derived from waste-flows, agriculture or forestry, accounting for well over half of all certificates issued between 2002 and 2013 (Carton, 2016; El Kasmioui et al., 2015). Of these, the vast majority went to Flanders' (then) four coal power plants to support the co-firing of biomass (mixed in with coal) or, after 2009, the combustion of 100% biomass in fully converted coal power plants. Economically, this made perfect sense since co-firing and the full conversion of old coal power plants are some of the cheapest technologies under the scheme (Meynaerts et al., 2011; Moorkens et al., 2005, 2010). From a long-term RE investment perspective however, this focus can be seen as problematic because it revalorizes old and inefficient coal infrastructure and, for co-firing, in a sense subsidizes the continued use of coal. Environmental organizations thus complained that the disproportional incentive for biomass under the scheme was extending the lifetime of Flanders' coal power plants and therewith counteracting phase-out policies and diverting resources away from more sustainable alternatives (Claeys, 2009; Greenpeace Belgium, 2006; Minaraad, 2009).

The popularity of biomass in Flanders, and of fuel switching and efficiency improvements under the first phase of the EU ETS, points to a trade-off between economic efficiency and environmental effectiveness that is negotiated through the existing fossil fuel landscape. Put simply, certain technologies are more cost-effective than others not just because of their often-mentioned 'market maturity' (IEA, 2008; Verbruggen & Lauber, 2012), but also because they are more compatible with the existing energy infrastructure. This was an important reason for why biomass became the technology of choice in Flanders:

> *We are talking about an installation [i.e. a coal power plant] that is already there, that has been written off, since Rodenhuize, E.ON, Ruien*[2]*, those were already there in the 70s, they have been amortized long ago, and yes, you have to make some investments to burn wood pellets in these plants, but I would have to see how much that really is... Maybe you need to put in place some cylinders... But god, the oven stays, the turbine stays, the electricity line stays, the workforce stays, what do you actually have to do... Ok, there are sure to be some costs, but crudely speaking, none, at least not compared to building a new wind mill.* (Personal communication, VREG, 2013, own translation)

Underlying this competitive advantage of biomass is a resemblance to fossil fuels that is particularly convenient for energy companies. Fossil fuels can be easily stored and transported, are generally employable independent of weather variations and thus provide a reliable and predictable source of energy that can be easily adjusted to market demand (Huber, 2008). These biophysical properties of fossil fuels are reflected in the highly centralized and steerable forms of electricity generation that dominate the existing energy landscape. As a combustible fuel, biomass (and particularly the use of wood pellets) fits many of these characteristics, as of course does the natural gas used in fuel switching. Other renewable technologies meanwhile reflect radically different geographies, often much more dependent on environmental factors such as weather and location (Calvert & Simandan, 2010; Nadaï & van der Horst, 2010), and therefore tend to require more substantial up-front investments. By themselves, these differences need not make the uptake of renewables impossible, indeed there are plenty of examples to illustrate that they do not. The point, rather, is that the characteristics of the existing fossil fuel landscape, historically constructed as it is, have an inert materiality that plays an important role in determining why a certain renewable energy investment is cost-effective while another is not. A company's investment choices, overall energy prices, research and development costs, etc. are all significantly influenced by the ubiquity of a distinctively fossil fuel-oriented energy infrastructure and the centrality of fossil energy use to processes of socio-economic reproduction. In other words, the inertia of the fossil fuel landscape is fundamentally reproduced in the economics of technological development. This need not be a problem as long as politicians make policy choices that consciously confront and counteract landscape inertia. Market instruments that subsume climate policy to the goal of economic efficiency, however, deliberately refuse to do so. The choice for a MBM is a choice for the cheapest technology, which in a world burdened by landscape inertia implies a choice for technologies that are largely compatible with the prevailing fossil fuel landscape.

The apparent ineffectiveness of MBMs that critics highlight can thus partly be explained through a focus on the landscape-policy relationship, which demonstrates how market-based policy outcomes come to be influenced by historical fossil fuel investments. But the inert dynamics of landscape change can also

[2] These are three of Flanders' coal power plants.

be traced further back, into the policy-making process itself. Also from a political perspective, it is far less disruptive to come up with solutions that are compatible with "what is already there" (D. Mitchell, 2012, p. 166) than to force through radical landscape change. The interlinked material and immaterial aspects of landscape inertia are here in full play. The political logic behind the prioritization of economic efficiency have already been hinted at above, and come out clearly in accounts of how the European Commission attempted to craft support for emissions trading among key stakeholders in response to a failed carbon tax proposal, which had encountered severe opposition from businesses and member states (Ellerman et al., 2010; Skjærseth & Wettestad, 2009). Largely because of its apparent compatibility with the existing fossil fuel landscape, in other words, the EU ETS was welcomed as a more politically and economically feasible approach to emission reduction. The Flemish example as well illustrates that political considerations were an important reason behind the choice for a TGC scheme and consequently, for the prioritization of biomass:

> *You can implement that [technology] today, and that is also important from a political perspective, you can get political advantage out of it today: 'look, we have this amount of green energy'. You don't have to offend anyone by building a windmill in their street, because people will see that, but you can just say 'we are 'green' because we burned wood pellets in that coal power plant'.* (Personal communication, VREG, 2013, own translation)

The prioritization of biomass was constructed through the Flemish TGC system as a cheap and easy solution that was necessary for the achievement of Belgium's renewable energy targets. In part because of this, Electrabel, the operator of Max Green - Flanders' largest converted coal power plant - has been highly successful in securing favourable conditions for its biomass operation. The company has consistently stressed that the TGC support system is a crucial part of making its biomass plant economically viable. When the Flemish government in 2011 decided to reduce the amount of TGCs awarded for converted coal power plants to 70%, thereby taking a step back from the prioritization of economic efficiency it had been advocating, Electrabel managed to secure an exemption for its Max Green plant (Electrabel, 2010; Vlaamse Regering, 2009). Similarly, when a conflict erupted with the Belgian wood industry in 2014 over the use of wood pellets in biomass plants, and the Flemish government was forced to retract Max Green's eligibility for TGCs, Electrabel shut down its biomass plant for half a year, arguing that its continued operation was no longer economically possible. The plant was restarted only after the government changed TGC regulations, reducing the power of the wood industry to block TGC hand-outs and allowing Max Green to continue receiving certificates (Mortelmans, 2014). Asked why the company had been able to push through its interests on these occasions, one interviewee hinted at the legacy of the historical relationship between Electrabel – long the country's main electricity producer – and different government institutions. The Flemish biomass case, in other words, shows how an incumbent energy operator was able to insert its own interests, which for historical reasons are closely tied up with the reproduction of the fossil fuel landscape, into the design of the Flemish TGC. It thereby illustrates the different levels at which the political complicity with the fossil fuel landscape is found to operate.

**Conclusion**

The challenges industrialized countries are faced with in order to achieve, by 2050, the 80-95% emissions reduction target that the IPCC (2014) says is needed are momentous. They imply nothing less than the radical transformation of an energy landscape that has co-evolved together with modern society itself, and that is therefore deeply entwined with capitalist social relations and with the reproduction of socio-economically and culturally embedded material ecologies. In this article I have argued that any critique of existing climate and energy policy should fully account for these broader socio-economic conditions as a factor delimiting policy outcomes. The conundrum can be thought of in terms of the persistence of the fossil fuel landscape, that is, the combined material landscapes through which fossil fuels circulate as well as the complex socio-economic, cultural and ecological processes that continuously bring them into being. It is exactly this, the produced materiality of fossil energy, embodied in the built environment and in the 'lived geographies' (Huber, 2013) of people, that gives fossil energy its 'enormous inertia' (D. Mitchell, 2005) and invests it with political and socio-economic power.

Market-based mechanisms such as the EU ETS and the Flemish TGC scheme confront this inertia through a focus on economic efficiency. Enshrined in the cost-saving rationale of such instruments is an imperative to contend with that which is already there, simply because the least-costly approach to emissions reduction commonly follows the path of least resistance. The solutions that MBMs incentivize, from standard efficiency improvements, to fuel switching, to technologies such as biomass co-firing, clearly attest to this. They require minimum change to the existing fossil fuel landscape and therefore align well with the broader social and economic realities of the historical energy system. This, indeed, seems to be part of their appeal to policy makers - or to companies whose opinions are of concern to policy makers. While this might seem obvious, I believe the crucial point here is to situate the problem not just in the nature of market instruments, or indeed in the tendential inertia of the fossil fuel landscape itself, but in the peculiar relationship between the two. The market-based approach becomes problematic to the extent that it fails, indeed refuses, to confront the temporality and historicity inscribed in the fossil fuel landscape. As a policy framework, it purports to operate on a historical blank slate rather than within the actually-existing energy landscapes that we have inherited from the past and that in very significant ways continue to influence the socio-economic relations of 21st century capitalism. In this sense inertia is a good term here, because it connotes the necessity for some kind of external force to be applied in order to instigate change, something that MBMs explicitly avoid doing. Instead, by subsuming technological choices to a cost-saving rationale, the temporality of the inert landscape is transferred to climate policy and internalized in it. This puts the prioritization of cost-effectiveness directly at odds with the reality that the most cost-effective option is also the one that leaves the existing energy landscape largely unaltered.

Clearly this is not an innocent development. As critics have pointed out, the current focus on the low-hanging fruits of emission reduction risks postponing the more radical transformations that will inevitably be needed in the long run. Fuel switching is fully reversible and ultimately only replaces one fossil fuel by another. Experiences in the Flemish TGC scheme meanwhile demonstrate that even an ostensibly 'renewable' technology such as biomass combustion has the potential to prolong the lifetime of existing coal power plants and therewith divert investments away from other renewables. The alleged position of biomass as a carbon neutral and therefore sustainable source of energy, moreover, is highly contested and casts a long shadow on the enthusiastic embracement of this technology (EEA, 2011). The market-led prioritization of 'cheap and easy' technologies in this way acts as a barrier to the uptake of more benign and long-term alternatives and gives a decisively undesirable expression to policy makers' preference for seemingly neutral categories such as economic efficiency. To be clear, this does not preclude the possibility that MBMs could drive *some* degree of emissions reduction. As proponents are wont to point out, switching to natural gas or biomass[3] still entails a decrease in emissions compared for example to the combustion of coal. The conclusion that can be drawn from the critique of MBMs is therefore not so much that emissions trading is an altogether ineffective climate policy, as that it is a climate policy that is designed to function within a socio-economically restrictive framework that is out of sync with the pace of change that scientists say is needed. In other words, the problem is not that a scheme such as the EU ETS cannot, given a higher carbon price, incentivize decarbonization, but that it incentivizes a kind of decarbonization that is necessarily slow and gradual, and that is ultimately determined by inert socio-economic imperatives rather than environmental concerns. In this it is reminiscent of processes of planned obsolescence that Harvey (2007) deems necessary in order to resolve the tension between the contradicting demands of technological innovation and fixed capital devaluation. The immediate appeal of this approach, in political economic terms, is that it promises the decommissioning of the fossil fuel landscape through a measured and gradual process that avoids the social and economic upheavals that more radical climate change policies would inevitably spur (see also Carton, 2014).

Taking account of the concrete power of the fossil fuel landscape, in dialectical terms, thus sheds light on the geographical dimensions of policy makers' preoccupation with economic efficiency. It helps to bring out why exactly concerted attempts to reconcile environmental ambitions with the temporal logic of fossil fuel capitalism turn out to be problematic and what implications this has for the effectiveness of climate and energy policy. Reflecting on Marx' dictum that social and political choices are made not under conditions of one's own choosing but "under circumstances directly encountered, given and transmitted from the past" (Marx, 1959), one could argue that these circumstances are not merely socio-economic but pertain also to the character of historic energy use, hence to the socio-ecological relations that are materialized in the contemporary landscape. Due recognition of the temporal dynamics of capital accumulation as they operate through the existing energy landscape and through allegedly neutral market-based mechanisms in this sense can help formulate an answer to the timely question of why weak climate and energy policies persist.

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[3] Though for biomass this ultimately depends on the overall sustainability of the resource that is used (EEA, 2011).

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