Energy Research & Social Science xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Energy Research & Social Science

journal homepage: www.elsevier.com/locate/erss

Original research article

Spatialities of the energy transition: Intensive sites making earth matter?

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ARTICLE INFO

Keywords:
Energy transition
Renewable energy technologies
Large-scale development
Intensive and extensive site
Critical zone
Earth politics

ABSTRACT

An increasing number of quantitative works stresses that a main driver of land use change is the on-going large scale development of renewable energies. Taking this observation seriously, the paper's aim is to investigate the critical interactions with earth forces (soil, climate, ocean, air, etc.) that ensue from the progressive dissemination and scaling up of wind power projects. It is to assess how the wind power expansion makes earth matter and if innovative earth politics emerge from these entanglements with these forces. The paper assumes that sites have a strategic role as it cannot be learned from these entanglements everywhere. To this end, it proposes to articulate Simondon's spatial approach to the emergence of technological objects (from 'intensive' to 'extensive' sites) with Latour's approach to the politics of Gaïa through the notion of 'critical zone'. Two onshore and offshore wind power cases (France and Germany) are studied. Their spatial expansion interferes with polymorphous earth intensities (e.g. strong marine currents, coastal fish highways, moving seabed, large bird migrations), and raises critical issues about the fragmentation of the ecosystems. They point out the fact that these earth forces when observed, monitored and discussed could open the way to local experiments that provide them with a new relational existence and a new political status. Drawing on these observations, the paper challenges Simondon's approach to extensive diffusion of technological objects and emphasises that intensive relational work could as well underpin the expansion of technological objects. It also expands Latour's notion of critical zone in pointing out that projects scene are related to broader large scale environments.

1. Introduction

"For at least the past decade, satellites have spotted white dots cropping up in the North Sea. If viewed from Earth's surface, you would see that these dots are actually wind turbines—huge arrays of towers rising from the sea and topped with electricity-generating rotors. But they're doing more than harvesting the wind. They appear to also be giving rise to sediment plumes" [1]. The satellite image from Landsat 8–Open Land Imager makes visible a phenomenon that is otherwise hard to experience: the large-scale expansion of new energy technologies on the earth's surface. In this particular case, the 'London Array' offshore wind farm, located in the North Sea, just outside the mouth of the River Thames, spans more than 100 km^2 and is flanked by two other offshore wind farms – one on the north and the other on the south. This Landsat image shows a spatial expansion that stretches far beyond a clear-cut wind power area. The tidal currents moving around the turbines' foundations generate clearly visible comet tails of suspended sediment. These 'plumes' of sediment make their way forward in the North Sea and raise fresh issues with respect to sandbanks and the migration of fish. It shows how renewable energies, in their spatial expansion, give rise to energy spatialities that are not bounded and may confront what we will name here "earth's forces" or "earth's matters". We mean by this term material or living cycles – such as ocean or air currents, climate or soils dynamics, animal migrations, etc. – which connect us to our large scale environment, pertain to the earth as a living envelope and, ultimately, point out at its geopolitics (our responsibility in answering to climate change issue, for instance). This, in turn, raises the issue of how to attend to these spatial interactions and account for their role and consequences amid the expansion of renewable energies.

In order to tackle this question, the paper proposes an alternative to existing, mostly quantitative, efforts to assess the spatial expansion of renewable energy technologies. These efforts used to attribute standard land areas to a given renewable energy technology[1] in order to calculate the share of land that may be covered by these technologies in the future [2–6]. These works flesh out at different scales the idea previously assumed by authors like Walker [7] and Smil [8,9], through the

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[1] For instance, turbines' land use depends on the dimensions of their blades. At most, 20 turbines with blades 25 m in diameter can fit into an area of 1 km^2.

https://doi.org/10.1016/j.erss.2017.11.006
Received 20 March 2017; Received in revised form 23 October 2017; Accepted 7 November 2017

concept of 'power density'[2]; for the latter, that renewable energy developments are highly land intensive. From a different angle, Scheidel and Sorman [10] suggest that the land rush associated with the global energy transition effectively contributes to the current phenomenon of land grabbing. Taken together, these approaches have made us aware of the ongoing and profound spatial restructuring associated with the expansion of renewable energies, whose various effects and qualitative implications remain however hard to describe.

To boost understanding in this field, this paper takes inspiration from relational thinking. As many authors have shown [11–14], approaching space in a relational way goes beyond the idea of space as a container or a geometric form in which social life unfolds. A relational understanding conceives of space as material, active and contingent and shines a light on the processes and dynamics of emergence – in our case, the processes of development and deployment of technological innovations and the associated emergence of energy spatialities. STS scholars have devoted a lot of attention to the geographical materiality associated with the emergence of sociotechnical networks [15–18]. Nevertheless, this strand of analytical works has not addressed – in the same way that the quantitative approaches mentioned above point out – the 'criticality' and the political dimension of the issues that could result from scaling up and expanding new (energy) technologies, and the way in which this could end up confronting earth's forces. Such a gap calls for further exploration of the intersection between the relational dimension of technological change and the emerging concern of the earth's crisis (climate, ocean, soil, air, etc.).

In order to venture in this direction, this paper develops a cross-perspective between the work of Simondon on the genesis of the technical object [19] and that of Latour [20,21] on the earth as a living assemblage whose 'critical zones' allow us to experiment with new entanglements between technological development and earth's untamed forces. These works allow us to tackle the relational character of contemporary energy spatialities while jointly addressing the scaling up of renewable energy technologies and their interactions with recent environmental concerns. The view that stems from this approach is that the process of technological innovation is relational, but some places, which Simondon calls *haut-lieux* ('intensive sites'), prove to be highly relational in that they foster the apprenticeship about how a technology may suitably be adapted to earth's singular forces. Following Latour, such 'intensive sites' are like 'critical zones': places where it is possible to connect and experiment with innovative earth politics. The geographical expansion of renewable energy technologies proceeds with a relational process that attempts to deploy the innovative entanglements that have been stabilised at 'intensive sites' at new (which Simondon calls 'extensive') sites.

The first part presents our articulation of Latour's and Simondon's approaches. The second part draws on two case studies: the first one is about offshore wind power development in the North Sea (Germany) and the Western Channel (France), the second one about an onshore wind power development in the Narbonnaise (Southern France). Using qualitative methods (face to face interviews and participant observation), it analyses the processes' spatial intensities and their relation to extension. The third part of the paper proposes a critical appraisal of Simondon's notions and a characterisation of the relational criticality of renewable energies' geographical expansion.

2. "Critical zone": turning the earth into a (geo)political notion

One of the paper's goals is to develop propose a way of jointly seizing and analysing the intertwined spatial changes produced by the contemporary energy transition – in particular, those associated with the large-scale expansion of renewable energies. Such endeavour questions our capacity to overcome the inherited and modern figure of the earth – a globe, a physical whole – and find new figures that more finely bear witness of the earth crisis as situated processes of technological change (to fight climate change) in which earth forces matter. The paper goes ahead with this idea and examines two case studies in which the development of wind energy takes place in sites (in France and Germany) in which the reordering of the earth forces – as entangled in a living and changing membrane – is at stake.

The framing of the energy transition that resulted from the international scientific conference "Our Common Future under Climate Change"[3]; bore witness to a predominant vision that called for developing large scale technological solutions to fight climate change. While acknowledging climate change as a (stabilised) scientific fact and the 2 °C threshold as a desirable target, this statement confirmed that the time of action has arrived and directed attention to big "scalable" – albeit contested – solutions as the only way forward. Straightforward in appearance, with the scale of the solutions appearing to be congruent with that of the problem, this approach to the energy transition may fall short of its ambitions for several reasons. In framing certain solutions (and not others) as (readily) "scalable", it ends up endowing the "big vs small" distinction with a natural and strategic character and enticing us to believe that only such solutions constitute the rational answer to the climate issue. Restricting our attention to such contested solutions – indeed, carbon capture and storage (CCS), nuclear and even big-scale (onshore and offshore) wind power are contested [22] – and calling on the social sciences to alleviate the barriers to their development is misleading. It reduces contestation to (local) opposition to project development without acknowledging that there are multiple ways of scaling up, each of which has distinct spatial, political, social, economic and environmental implications, and that opposition may as well target the politics of energy transition enshrined in *certain* ways of scaling up [23]. In any event, energy technologies, just like any other technology, not only have an impact but also reshape the world around them (society, environment) in order to come into existence [15,19].

The way of consolidating quantified visions that is most common in policy processes is to naturalise the resource – for example, to reduce it to its physical dimension, like a kinetic flow, solar radiation or a water stream – in order to quantify both a 'deposit' and an associated 'technological potential'. Thus, there is a strong coherence between the way of framing the problem – attaching it to the notion of the earth as a constituted whole – and that of framing and scaling up the solutions. Stated differently, envisioning the earth as a constituted whole shrinks the number of solutions we allow ourselves to explore: It limits our ability to account for the material and relational spatialities that help to harness and scale up energy resources [23,24]. For this reason, it is urgent that ways be found to acknowledge the diverse ways of scaling up that current processes of energy change follow and to jointly analyse their spatial and political dimensions.

Current debates about the Anthropocene offer stimulating perspectives to proceed in this direction. In his recent discussion of James Lovelock's notion of 'Gaia' [20], Bruno Latour invites us to go beyond the idea of the earth as a globe. The globe, so the author's argument goes, refers to a pre-existing totality, a bounded system made up of interactions between man and nature. Such a vague appreciation of the earth as a super-organism, however, is a too cursory a metaphor and unduly encapsulates the diversity of the living into a single stabilised entity. By suggesting that humans and non-humans are unified by such a bounded system, it paves the way for a modernist approach to science and its instrumentalist avatar – such as the current re-engineering strategies as an answer to climate change [25]. It falls short of addressing the 'global' issue of climate change, defined as how we might

[2] Power density is the power per unit of land area and is expressed in watts per square metre. It usefully fleshes out the claim for land that results from the progressive shift from fossil fuels' high power density to renewable energies' low power density.

[3] This conference preceded the twenty-first session of the Conference of the Parties (COP) that had been held in Paris (July 2015).