

New extractive frontiers in Ireland and the moebius strip of wind/data

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Abstract

This article maps the interconnections between two emergent resource frontiers in Ireland: wind and data. Adding to literature about extraction and extractivism, we account for how these expanded extractive frontiers are mobilised within self-sustaining and automated formations. In Ireland, digital infrastructures such as data centres are developed by multinational tech companies to avail of a naturally cool climate and business environment friendly to their investment, part of a wider extractive system by which data are made valuable for their expansive operations. Wind farms similarly make use of Ireland's climate to generate energy, often used to power digital infrastructures, and are increasingly embedded within 'smart' energy and data systems. Wind and data are seen discretely as 'abundant' resources, their infrastructures built on terra or (offshore) mare nullius, and their operations 'green'. However, their infrastructures are entangled with non-renewable energy systems and tax evasive capital, and built across existing communities and environments through policy, planning logics and increasingly automated methods of maintenance and optimisation. Through what we call 'the moebius strip of wind/data', wind and data infrastructures are increasingly formidable in dictating our energy futures. In this article, we articulate how they are connected and how we can disentangle them, especially in their operation across urban and rural geographies.

Keywords

Data, frontiers, extraction, wind energy, Ireland

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Introduction

Historically, Ireland's economy has lacked the natural resource base to sustain itself without significant external factors. Looking at Ireland's current foreign direct investment (FDI)-driven economy, one would be forgiven for assuming nothing much has changed. In Ireland today, the most visible players are the global corporations that invest in headquarters in the country, lured by its corporate tax rate and location as a 'gateway to Europe'. However, the last couple of decades have seen a confluence of factors driving companies to invest in the country for a forgotten natural resource – the climate. Whether data centres locating in the country is due to the cool climate or wind farms dotting the landscape making use of abundant wind, Ireland's two most prominent resources today are arguably wind and data.

In popular and academic discourses, wind and data are posed as new 'frontiers' for valorisation. Wind is seen as an abundant, immaterial and sustainable resource that just needs to be 'harvested'. Related to traditional definitions of the 'frontier', always imagined (and constructed) as site of 'bountiful emptiness', 'empty but full' (Bridge, 2001), wind's unpredictable energy supply calls to mind histories of 'wildness' (Vannini and Vannini, 2019) that imposed colonial relations onto 'untamed' spaces, social forms and even weather and the climate (Cooper, 2009). However, the infrastructural systems required to capture and extract value from wind's atmospheric circulation are extensive and complex, tied into arcane public–private agreements, financial investments, global regulations and cultural disagreements over landscape and networked infrastructure (Franquesa, 2018; Howe, 2014; Siamanta, 2019). Many have also written on the 'raw resource' of big data, a source of value that needs to be 'mined' through modes of optimisation (whether via platforms, algorithms, analytics or the like) (see Kitchin, 2014a; Mezzadra and Neilson, 2017; Srnicek, 2016). This neocolonial epistemology relies, as always, on an occlusive logic of extraction that paints over the productive forces actually at the heart of the contemporary tech economy, and its multifarious actors, locations and social and labour practices (Couldry and Mejias, 2019; Thatcher et al., 2016). Cutting across the high-tech landscape are obscured modes of social cooperation, environmental relations and cultural factors that are differentially treated as frontiers for extraction or obstacles for regulation. In this paper, we consider how extractive logics are working to condition and control wind and data frontiers for the purposes of capitalist accumulation.

The conceptual reason for mobilising the converging logics of frontiers and/or extraction across wind and data comes from both an attunement to the spatial dimensions of contemporary capitalist operations and a recognition of the colonial lineages represented in current processes of valorisation. Across geography, anthropology, cultural studies and environmental humanities, discussions of extraction and extractivism have enjoyed particular prominence in recent years (see Gomez-Barris, 2017; Mezzadra and Neilson, 2017). Laura Junka-Aikio and Catalina Cortes-Severino articulate the juncture thus:

In this expanded sense, extraction and extractivism are no longer necessarily defined by certain types of industries and activities, or tied to questions of land and natural resources as given objects that are disconnected from others. Instead, 'extractivism' is increasingly understood also as an analytical and also political concept that enables the examination and articulation of deeper underlying logics of exploitation and subjectification that are central to the present conjuncture of capitalist globalization and neoliberalism. (2017: 177)

By this definition, geographies of extraction are more complex and intensive than traditional extensive frameworks of colonial core/periphery, especially in terms of its expanding

extractive frontiers. Ireland, the empirical focus of this article, has long stood as a paradoxical case within the European Atlantic periphery. Best understood as a semi-periphery, it occupies a special position within the uneven value chains of contemporary global capitalism and has long been a laboratory for experimenting with new forms of capital accumulation. In spite of recognisable aspects of old-school extraction within the logics of wind and data infrastructure, there is something unique about their networked operations across uneven geographies. Far from merely displacing the site of extraction outside of the metropole (as is the case in traditional colonial extraction), the extraction of wind/data requires a continuous activation across rural and urban spaces via 'smart' technologies.

In this article, we contribute to a lively discussion about the entanglements of energy networks with shifts in the global economy and its resource dependences and the emplaced and cultural implications of these shifts (see Lally et al., 2019; Watts, 2018; Wilson et al., 2017). These debates are integrally tied to literature in geography and anthropology tracing and disentangling the politics of infrastructural networks that undergird global supply chains and logistical provision (Cowen, 2014; Sheller, 2014; Tsing, 2005). Related to this work, there is a growing body of literature on the political economy of energy that charts how wind is and has been subject to the same corporate and capitalist logics that characterise the fossil fuel economy (Dunlap, 2017; Franquesa, 2018; Howe and Boyer, 2016). This work runs parallel to a similar focus in media studies on the physical networks and externalities of supposedly ambient infrastructural systems and the material and media ecologies of big data – the rare earth metals, energy footprints and e-waste that accumulates as 'smart' economies grow (Cubitt, 2016; Gabrys, 2011; Hogan, 2015; Parikka, 2015). Each of these bodies of work are important to our own. However, in bringing them together through discussions of extractive frontiers in Ireland, we draw out a series of entanglements operating across these empirical discussions. We are drawing attention to the pairing of wind and data in the infrastructural investment in high-tech and smart industries in Ireland, and thus to a cluster of cases that seem important to lay the groundwork for a deeper analysis of these developments in Ireland and abroad.¹

First, we argue that there is something distinct about the character and form of extractive logics that operate across and between data and wind that is worth considering. These are not like resources of old. They are not discrete, nor are they directly produced and organised by capital. They are widely distributed and require networked forms of mediation, enclosure and extraction for them to become valuable (Mezzadra and Neilson, 2017; O'Dwyer, 2013; Srnicek, 2016). Second, there is a dynamic, constitutive relationship between wind, data, and their associated infrastructures. Simply put, the impulse to create data-driven environments (5G, internet of things, automated transport) requires the harnessing of more ambient energy, which in turn depends on the creation of smart grids capable of networking unpredictable winds (and other ambient energies) with demand. The atmosphere is thus drawn *into the cloud*, through what we call the moebius strip of wind/data. In this process, data analytics is to ambient energy what geology is to the earth: both render the world legible to capital. However, in places across Ireland, this logic is being disrupted – not in perfect or ideal ways, but disrupted nonetheless. The key contribution of this paper is to show how theoretically and empirically mapping the connections between wind and data is crucial for a more integrated analysis of how capital is extracting value from them, how the state and private capital work together in their functional operation, and the importance of surfacing different points of friction and opposition across this widely distributed network of enclosures.

From postcolonial state to data haven

In order to understand how and why Ireland has become a location of choice for major US tech companies and their cloud infrastructures, it is important to know something about Ireland's economic trajectory within the world economy, particularly since the 1960s. Two decades of 'Celtic Tiger' boom times and a steady if uneven recovery to 2009 financial crash appears to position Ireland as one of the most successful economies in the European core (Beatty et al., 2016a). Yet, Ireland is not a core economy and has long stood as a paradoxical case within the European Atlantic periphery (Flaherty, 2013; O'Hearn, 2001). Best understood as a semi-periphery, Ireland has and continues to play a significant role in the emergence of different cycles of systemic accumulation, operating as a laboratory for new forms of expropriation, from 16th-century plantation to 21st century neoliberal austerity (see Deckard, 2016). Importantly for this article, such experiments have never just been about humans and their institutions, they have also always been ecological. To paraphrase Sharae Deckard, whether looking at financial service centres or pharmaceutical factories, dairy processing or data centres, these are all forms of environment-making that arrange people, technologies, animals, land, water and energy into new ecological regimes (2016). In this section, we provide a brief history of Ireland's shift towards an export-oriented economy reliant on FDI, and how this has involved the appropriation of ecological frontiers, particularly in rural parts of the country.

One of the first colonies in the British Empire, Ireland served as a site of world historical importance in the development of racial colonialism, dispossession and the intensive extraction of resources (Flaherty, 2013). With independence in 1922, the Irish State sought to break free of its political, economic and cultural dependence on Britain through a policy of import substitution and economic independence. But in the mid-1950s, because of trade deficits, external political pressures tied to Marshall Aid and European integration, and economic recession, the Irish regime changed the industrialisation program from import substitution to export-led industrialisation (O'Hearn, 2001). Besides being a disaster for indigenous industries, Denis O'Hearn argues persuasively that this shift towards export-led development in the context of radical free trade marked the beginning of Ireland's modern economic orientation up to the present day. In the words of an Irish Minister for Industry and Commerce in 1958: 'we aim to convince [U.S. industrialists] that Ireland is the best possible location because of its attitude to private enterprise... the more profits they make the better we will like it' (Dail Eireann 1958, cited in O'Hearn, 1989: 581). From the 1960s onwards, the role of the Irish State was to attract large foreign companies rather than nurturing new Irish enterprises (O'Hearn, 1989). Through agencies like the Industrial Development Authority (IDA), incentives were provided for industry to locate in Ireland and firms were sought out that would respond to such incentives. 'After that', O'Hearn writes, 'new foreign firms could avoid any kind of scrutiny' (1989: 580).

As we are keen to emphasise in our discussion of the political economy of wind and data in Ireland, the attraction of foreign capital to Ireland was not just about tax breaks and other financial incentives. While Ireland's historically low rate of corporate tax has rightly received criticism (since 1999 12.5%, third lowest in Europe), less attention has been given to the easy appropriation of Ireland's ecological frontiers in the expansion of resourceintensive and waste-generating industries (Allen, 2004; Deckard, 2016). It is no coincidence that US-based chemical and pharmaceutical companies, facing new, more stringent environmental laws in their own country, sought to relocate to Ireland in the 1970s. At this time, Ireland accounted for nearly 70% of pharmaceuticals output worldwide, and as of 2014 remained seventh in the world in pharmaceuticals exports (Deckard, 2016). As has been documented by environmental justice scholars, the offshoring of such polluting

industries to parts of the Global South in the 1970s was an effort to reduce costs associated with environmental laws and regulations (Pellow, 2007). Thanks to a stubbornly persistent ‘green’ image circulating in and about Ireland, and to its self-identification as part of the Global North (rather than ‘developing’ South), the history of polluting industries in Ireland has largely been missed. As Sharae Deckard writes,

Despite surges of public protests against industrial development in Ireland’s rural peripheries throughout the 1980s and 1990s, the state acted to suppress environmentalist discourses and awareness of pollution and resource consumption corresponding to the importation of toxic industries, thus creating a durable amnesia surrounding hydro-ecological crises in Ireland, whether pesticide pollution in agri-business, or dioxin contamination by pharmaceutical plants. (2016: 13)

This pattern continues to the present, with major water, waste and energy infrastructures planned across the country that serve to enrol largely rural areas into the urban, and global, metabolic flows of contemporary production in highly uneven forms (Bresnihan and Hesse, 2020).

Energy and wind

The political economy of Ireland’s energy sector tells a similar story. The highly contested Shell gas refinery project in West Mayo offers stark insight into both the ease with which the Irish state sold public hydrocarbon resources to a multinational corporation and then vigorously supported that corporation in their efforts to build a risky gas refinery in a part of Ireland heavily reliant on clean waters and land for the few local industries and livelihoods that exist there; Ireland, the semi-periphery, was once again a site of experimentation, this time for untested fossil fuel infrastructures (Garavan, 2007). The unjust distribution of environmental and health risks to parts of rural Ireland; an extraordinarily pro-corporate Irish licensing system (the government’s 30% take of oil revenues is dwarfed by the 75% take of a country like Norway (Deckard, 2016)); and the quashing of community response through state policing and a more general urban bias against ‘populist’ rural agitation, epitomise the key political economic relations supporting Ireland’s ecological regime.

The development of wind energy in Ireland is similar in many respects to the development of hydro-carbon energy: pro-corporate and dismissive of local opposition to wind farms. What differentiates it is its convergence with climate action and Ireland’s efforts to present itself as ‘green’. However, despite the apparently seamless integration of wind into the national energy framework, wind energy in Ireland has been developed on a largely patchwork basis, rather than on any coordinated, strategic state scale. It is instructive that Ireland’s first wind farm was opened in 1992 by Eddie O’Connor, then CEO of Bord na Móna, the state agency responsible for the peat industry. Eddie O’Connor would go on to become CEO of Airtricity, the Irish wind farm development company, before setting up Mainstream Renewable Power in 2008, now one of the biggest private developers of renewable energy in the world. Rather than coordinating Ireland’s state strategy to become a leader in sustainable wind energy, O’Connor went private, as did the majority of Ireland’s wind energy sector. While several semi-state agencies have public/private wind farm projects, the majority of wind projects in Ireland are financed and owned by foreign companies and investors. In such a competitive, open market there is virtually no room for community-owned wind energy – contrast this with Scotland or Germany, for example (NESC, 2014).

Nonetheless, since the 1990s, Ireland has halved its carbon emissions from electricity generation, mostly through the harnessing of wind. Despite these developments, Ireland is set to miss its EU emissions targets for 2020 by a wide margin, potentially resulting in EU fines of hundreds of millions of Euro. Ireland currently generates about 35% of its electricity through renewables (mostly wind) and is committed to 70% electricity supply from renewables by 2030. To meet these targets, Ireland is looking to scale-up wind energy generation. While climate targets are one pressure driving the expansion of wind energy generation in Ireland, the other less publicly visible one is the energy demand of data centres.

Big tech and data centres

As outlined above, foreign multinational companies have been able to leverage their power over Ireland's political economy to gain favourable tax conditions, but as cloud services expand and awareness of data centres' carbon footprint grows, leading tech companies are influencing Ireland's energy future. With some data centres requiring the same amount of energy as a moderately sized Irish town, Eirgrid, the semi-state company that manages Ireland's electricity transmission network, has publicly stated that its planning strategy is now 'heavily influenced' by the expected growth of data centres (Bresnihan and Brodie, 2019). The Irish Wind Energy Association (IWEA), a lobby group for private wind energy developers, produced a report predicting massive energy loads from data centres in 2020, conceding that estimates in the report are 'conservative' due to non-disclosure agreements presumably signed with big tech providers (IWEA, 2019: 3). A Sustainable Energy Authority of Ireland (SEAI) report, in partnership with data centre industry advocate Host in Ireland and energy solutions provider Bitpower, indicates that so-called 'sustainable' producers and advocates are always-already partnered with these highly profitable global industries, foreclosing reconsideration of the need for their energy demands (SEAI, 2017). Across these government reports and industry discourses, business – and tech specifically – is placed at the forefront of solutions to climate change.

One way in which the Irish state has justified its propensity for data centres, and thus painted over their complicity in the global inequalities of the tech economy, is through a public-facing green politics. As suggested above, 'greenwashing' has a longer history and significance in Ireland, as 'green' Ireland has been an integral part of the national brand since the 1960s. What is more, this 'green' image is rooted in a rural/urban imaginary within Ireland, one which positions the rural as 'backward' and pastoral even as it plays host to the activities and infrastructures that enable advanced modernity and overdevelopment that benefit the few and exclude the many (Deckard, 2016), including wind turbines and fibre optic cables.

Fast forward to the present and it is predictable to find prevailing public discourses promoting Ireland's 'cool' natural climate as a primary factor in reducing cooling costs, which are a huge factor in data centres' energy consumption. In the early days of the data centre boom, most publicly available materials heralded the climate as the primary factor in locating in Ireland to save on energy costs. Many tech industry and data centre companies – particular smaller colocation providers, but increasingly the giants like Amazon, Google and Microsoft – claim current or future goals to use 100% renewable energy. In addition, there are proposals, already widespread across the Nordic countries (see Velkova, 2016), to use the tremendous amount of excess heat generated from data centres to heat local homes and businesses, thus both utilising the 'cool' climate and heating the homes of people living in it.

While theories of ‘extractivism’ and ‘neo-extractivism’ articulate how governments and corporate actors cooperate to condition the earth and social environments for extractive operations, Ireland’s natural and business ‘climate’ are manufactured across this historically sedimented array of institutional, historic, social and cultural factors that facilitate extraction. Mike Hulme theorises what he calls ‘cultures of climate’, describing how climate becomes manifest not only in atmospheres and landscapes but in economic activities, social and cultural practices, and political environments (Hulme, 2016). The apparently ‘natural’ business climate of Ireland coalesces with climate conditions, which are considered and advertised as set in place (cool, damp, windy) despite anthropogenic climate change and increasingly turbulent weather conditions. However, weather is always unpredictable and from moment to moment, climate is about patterns of weather over time, taken for granted, that become embedded in cultural practices and norms (see Brodie, 2020a). Data centres crystallise these ‘climatic’ conditions by tying them to the climate itself and promoting the green and ‘clean’ energy aspects of climatic cooling and renewable energy, while discursively offsetting the long-term effects of their energy toll and infrastructural re-arrangements.

The tech industry thus greenwashes their operations by appropriating the language of environmentalism, even while continuing operations of extraction and unsustainable growth. Extraction under current conditions can only operate under these promotional conditions, as ‘the activation of discourses and practices of sustainability and corporate social responsibility...ensure that the world’s extractive activities continue along an open frontier’ (Mezzadra and Neilson, 2017: 193). The increasingly entangled networks of renewables and digital infrastructures require a greater focus on the networked conditions required for increasingly automated value extraction. Bringing together literature on infrastructure, logistics, critical data and the political economy of energy, we can see how these modulations are increasingly coordinated across these sectors through what we call the ‘moebius strip of wind/data’.

Networked extraction and the moebius strip of wind/data

Ireland’s particular role within the global circulation of data and capital, and the material goods, infrastructures, politics and labour around it, has yet to be confronted. Scholarship is starting to come to terms with the sheer breadth and power of big tech within the Irish state (see e.g. O’Neill, 2018). Critical geography, data and media studies scholars elsewhere have focused on the economic, spatial and environmental implications of the endless collection of data (Hogan, 2015; Kitchin, 2014a; Rossiter, 2016; Thatcher et al., 2016; Velkova, 2019; Vonderau, 2019) and the harvesting of labour that goes into these avenues of accumulation for an increasingly small number of tech conglomerates. Tech companies are given the reins and allowed to treat diverse contexts across the world as frontiers for the expansion of their extractive operations in a global race-to-the-bottom.

But in order to lay the groundwork to conceptualised the networked interconnection between renewable energy and data infrastructure, we must first identify the continuities and the ruptures between historical forms of extraction and their ongoing implications. Our contention is that in spite of recognisable aspects of old-school extraction within the *logics* of wind and data infrastructure, there is something unique about their networked operations across uneven geographies. Far from merely displacing the site of extraction outside of the metropole (as is the case in colonial extraction), the moebius strip of wind/data requires a continuous activation across rural and urban spaces via ‘smart’ technologies.

As Jason Moore (2015) has traced through his world-ecology framework, capitalism continuously expands through frontiers, and as it moves from one place to the next,

socioecological relations are transformed through developments in technoscientific knowledge, production and consumption. Emphasising further the role of colonial epistemological and ontological models and techniques, Katherine Yusoff (2019) identifies a double process at work within extractive logics: the making passive of certain bodies and territories (awaiting extraction and possessing of properties) and their activation through the mastery of White men. While we do not seek to conflate all histories and experiences of colonialism, we find useful Yusoff's definition of the extractive logic, particularly how it links modern, European epistemic practices with the violence of colonialism, rendering territories and bodies both inert and productive for capitalist accumulation. In this way, 'extractivism' emerges as a conceptual tool for researchers to understand the adaptive strategies of capitalism and governance that pervade these ongoing extractive relationships to resources and the natural environment. As Macarena Gómez-Barris outlines,

In its *longue durée*, extractivism references colonial capitalism and its afterlives: extending from its sixteenth-century emergence until the present day, and including the recent forty-year privatization and deregulation process . . . This also refers to the global intensification of new forms of extractivism, or what Saskia Sassen describes as the expulsion by advanced political economies which accumulates wealth off of resource rich territories for a few, while permanently squeezing the many. (2017: xvi)

In referencing intensified neoliberal relationships to land and expulsions from territory in the name of 'development', we are adding to this discourse by focusing on the increasing automation *of* these processes by the extraction – and harnessing – of value from atmospheric circulations. This emergent frontier of extractivism is administered through private technology platforms. But far from only 'atmospheric', they have a footprint and a geography as well as cultural legacy within postcolonial negotiations between rural and urban experiences.

Optimised extraction happens by connecting different sites of extraction. Discussing environmental sensors, the 'sharing economy' and the 'smart city' as itself opening frontiers for extraction, Mezzadra and Neilson argue that real estate and the expansion of extractive activities across 'new urban frontiers' scattered across the world, particularly around mining, represent the extremes of *urbanization* (2017: 196, our emphasis). These 'smart' technologies, which have been the subject of much discussion across urban geography (see Kitchin, 2014b; Mattern, 2017), are not solely concentrated in cities. However, as technologies of 'planetary urbanisation' (see O'Callaghan, 2018), they are seen as part of the expansive measures of urbanisation rather than in the context of their rural rollout, a spatial mechanism through which the world's resource frontiers are continuously exploited in diverse and separated milieus. Ongoing divisions between town/country, urban/rural, crunch these spaces into a logic of global capitalism and planetary exploitation in a way that may accidentally obscure the novel socio-political compositions that are emerging in response. The processes of planetary urbanisation are being unfurled in dispersed ways across the rural and urban divide, and the huge supporting infrastructures – whether wind farms or data centres – are developed similarly, demonstrating the need for a more rural focus to how they are built and operate. If 'geographies of the cloud are . . . dynamic and experimental' (Vonderau 2019: 700), then the assemblages of data and energy that arise out of ongoing experimentation exist on similarly shifting ground and across contentious divides inscribed within the spatial and historical make-up of the country across rural and urban spaces. Smart urbanisation also means controlling unruly spaces, environments, communities and populations outside of the urban fold. While these processes of

infrastructuring are making an automatic and circular relation between energy and data apparently natural, their actual spaces of experimentation and operation are filled with frictions.

With that in mind, however, the supply chain and displacement of these points of connection (from data centre to wind farm to city) are able to somehow contain some of the oppositional politics and frictions. Although such extractivism within the spatial development of wind energy and data infrastructures may appear physically and discursively discrete, they are in Ireland and globally part of coalescing projects of smart optimisation and entangled networks of extraction. As in other parts of the world where potential wind energy is generated, it is often peripheral populations (geographically and politically if not socially and economically) who are most affected by these developments, and who stand least to benefit (Dunlap, 2017; Franquesa, 2018). The moral (and calculable) justifications put forth by wind projects foreclose alternative politics of what counts, or should count, in making viable futures (Howe, 2014). Within such logics, wind is a resource that must be made legible to capital and governance in order to be valuable. But Cymene Howe argues that wind, unlike land, 'is, by definition, un-enclosable', and 'the corpus of the wind, its scant materiality, its mercurial existence, make for a different sort of commons – one that is perhaps particularly resistant to true enclosure' (2011: 8). But just as the earth had to be mapped vertically in order to be mined, so now the atmosphere is being mapped and operationalised in order to harness its powers. As Derek McCormack has written (2017), this latter arrangement differs from the past in so far as the infrastructures involved are making new kinds of use of the movement and materiality of the elements in order to generate and capture different kinds of value. Though the wind itself may not be 'enclosed', the infrastructures currently being developed to compensate for its 'mercurial existence' are performing their own form of enclosure through networked forms of private intermediation and control. It is the infrastructuring of wind through 'smart grids' that renders it as abstract work/energy, something more than local and thus exchangeable and investable.

If the energy potential of the wind across Ireland is to be 'realised' in order to accommodate the apparently contradictory goals of carbon energy replacement and increased data centre operations, there must then be a radical transformation in how the current electricity grid operates and, by extension, the users of electricity operate. At the heart of this problem is the aligning of unpredictable supply of energy with what has historically been a relatively fixed demand. To adapt the grid to the erratic qualities of wind will involve both an extension of the grid (incorporating diverse renewable energy sources) and a more fundamental transformation in the grid to align supply and demand in real time. Technology and governance struggle to contain and control unpredictable elements, which is why wind and data present such a problem for the state and private corporations. Wind is not consistent, but rather varies across time and space, and data, despite increasingly predictive algorithms designed to manage contingency, is also fundamentally reliant on often random consumer practices and events. But between wind and data, there is an infrastructural connection that ties their fates: wind energy can be better managed for extraction with a more optimised data infrastructure.

To incorporate intermittent energy resources, like wind, electricity networks will have to become 'smarter grids', with integrated communication systems, storage capacity and real-time balancing between supply and demand. This has a ripple effect in terms of energy infrastructure as the technologies and networks required to cope with ambient energy are re-designed or overlaid with smart devices capable of sensing and predicting real-time shifts in the supply and demand of energy. When we talk of a smart grid we are talking about flows of data as much as we are flows of energy (see Kragh-Furbo and Walker, 2018). One way of

conceptualising the specific logics of digital extraction being discussed in relation to wind and data is through ‘platform capitalism’ (Srnicek, 2016). The idea of the platform emphasises how advanced forms of capitalism today are orientated around the harvesting and use of data (rather than the production of goods or services). The platform thus describes the digital infrastructures that intermediate and connect users, facilitating forms of connectivity that have become more and more central to social and economic life. Referring to companies like Google, Facebook and Airbnb, the platform relies on ‘network effects’ (Srnicek, 2016): the more global users on the platform, the better it performs. This tendency results in the concentration of enormous power in the ownership and control of the platform itself. Once the platforms are built and established, these businesses can continually and monopolistically exploit and benefit from their users, their activities and the resulting data. These same features apply to the emerging smart energy grid, which seeks to incorporate not just users but atmospheric (and solar and geothermal) energies into the network. Rather than algorithmically sorting vast amounts of search activity or social interactions, the smart energy grid will record and sort data on energy usage and supply in a way that directly overlays the physical grid infrastructure that circulates energy from wind turbines to driverless cars to everything in between. As with platforms in general, the fantasy of the smart energy grid of the future requires scale: the more sources of renewable energy and the more users it incorporates, the more efficiently it will function. Washing machines operate when the wind blows, and mountain reservoirs fill when the population sleeps.

Within the discourse of EU eco-modernisation, smart technology will save us. This interconnected world of automation requires vast amounts of ambient energy, which in turn requires new digital infrastructure (including data centres). In Ireland specifically, the Government’s recent Climate Action Plan, generally praised by mainstream ENGOs and media commentators, takes the increasing energy needs of the tech industry as a given. At the same time, each household in the country will soon be equipped with a smart energy meter to help reduce energy consumption. Tech companies are pushing this data-driven dream, and state authorities and municipal governments are only too happy to support it (and its promise of financial savings and environmental improvements). As demands for renewable (wind) energy grow, driven by calls for data solutions and automation that deliver efficiency, so does demand for better data analytics for managing smart grids. The twin demands of climate action and data centres in Ireland are not, after all, unconnected.

This is what we call the moebius strip of wind/data. The expansion of data, and the infrastructures, ecologies and labours required for it, are becoming inseparable from the expansion of ambient energy, and the infrastructures, ecologies and labours required for it. Consider 5G networks and the smart energy grid: these are bigger, faster ways of connecting users, atmospheric energies and information (Dobbe and Whittaker, 2019), creating *a new networked atmosphere formatted for the purposes of capitalist accumulation*. This vast background of networked infrastructure is harder to see, more extensive and increasingly controlled/owned by a small number of enormously powerful companies. Wind energy and data require each other as part of this global growth machine, spanning public and private interests, but are primarily controlled and mediated through the platforms and infrastructures of private companies – a moebius strip of continuous, atmospheric value extraction via the coordination of wind and/via data.

The promise of aligning the erratic movements of the wind (and other intermittent energy sources) with the needs of energy consumers relies on the generation and sorting of real-time data. The need for greater quantities and more accurate data to better predict and align demand and supply of energy foregrounds the role of data infrastructures, networks of sensors and algorithms capable, for example, of forecasting wind speeds and plotting this

against predicted energy demands: meteorology meets energy security. The grid infrastructure is no longer just about *circulating* energy that is stored or generated in power stations, but more directly connected to (and thus productive of) the capture of energy itself. Predictably, leading global tech companies have begun positioning themselves within this emerging energy/data market. Microsoft recently entered a contract with GE to purchase 100% of the energy generated from a wind farm in the South of Ireland over 15 years (Kennedy, 2017). The idea is to use GE's industrial analytics software to make the wind farm's power output more consistent and predictable, moving towards an energy infrastructure provided by and for 'cloud' services.

As this initial case demonstrates, infrastructural systems developed within the private sector and supported by the state are already accommodating the shared demands of wind and data extraction, supporting the data-driven dreams of green capitalism and eco-modernisation that dominate environmental conversations. In the final section, however, we will lay out some of the moebius strip of wind/data's emerging infrastructural footprint and frictions. In doing so, we do not aim to paint a holistic picture of what this looks like in Ireland, nor do the granular community research that many of these sites merit. Rather, we identify a cluster of cases that appear crucial to how these emergent modes of extraction will operate in Ireland in order to lay the groundwork for future research.

Frictions across the urban/rural divide

The emerging moebius strip that operates across energy and data infrastructures is both a logic and a technological assemblage, requiring a vast networked environment that reflects grand projects of smart urbanisation as they extend across disparate spaces and contexts, across regional divides inscribed with histories of (under)development. Within Ireland itself there are regional differences and uneven experiences which shape economic development and politics. As Denis O'Hearn puts it: 'It may seem obvious to say it, but Kerry is not Donegal, nor is Cork Dublin' (Beatty et al., 2016b: 203). Infrastructural development must always navigate frictions as they are encountered on the ground, even if the ultimate extent is to ensure that they do not get in the way of productivity (see Tsing, 2005), and, on the flip side, local and regional specificities assume very particular political forms when confronted with technological infrastructures.

The interface between Ireland's energy grid and high-tech corporations has in the past few years constituted several highly publicised disputes between these corporations, the public and the state. The proposed, but aborted, €850mn Apple data centre in Athenry, County Galway would have strained the national grid for anywhere between 5–8% of its capacity on a daily basis. A €1bn AWS data centre facility in Mulhuddart, Dublin, if full plans for the 26-hectare site are realised, will consume an estimated 4.4% of Ireland's total energy demand by 2026. The total energy demand from data centres is predicted to be 31% of total electricity demand by 2027. Even current conservative reports from IWEA say that 'there is currently approximately 311 MWs of data centre load on the Irish Grid on a 24/7 basis. This is equivalent to 7% of current peak winter demand and 8.6% of summer load' (2019: 5). Greater Dublin's electricity demand could double in 10 years, mainly due to the number of data centres planned by multinationals for the region. This means that over the next decade, demand for power in the capital will grow by the same amount as it did over the last 100 years.

While data centres have primarily clustered around the T50 fibre optic cable ring around the city of Dublin (Figure 1), companies have begun to look elsewhere as potential energy shortages loom. The above-mentioned report by SEAI admits the same, that 'the provision

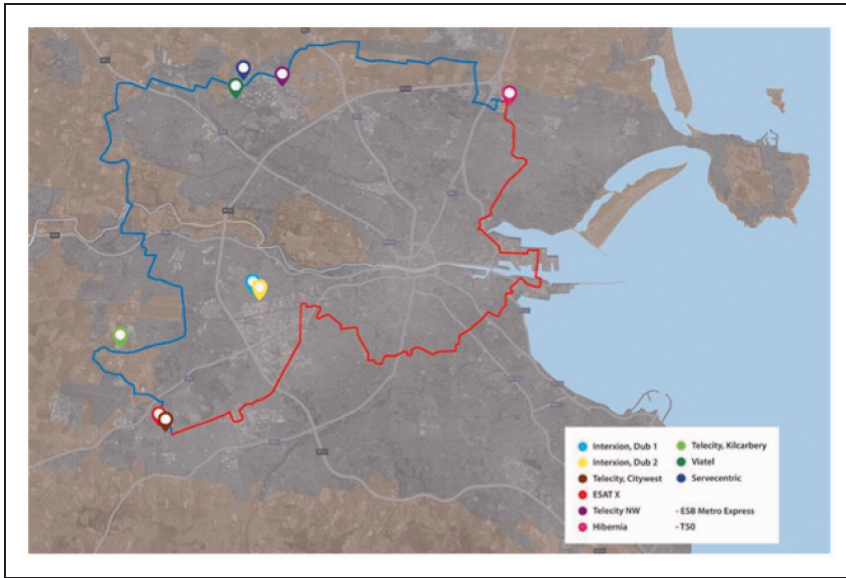


Figure 1. The T50 fibre optic cable route around Dublin (ESB Telecoms Ltd., available at: <https://www.esb.ie/docs/default-source/telecoms/esb-metro-express>).

of power through the national grid is struggling to match the global demand' (2017: 19), stressing the global digital ecology's force at local levels. The IWEA and Callaghan Engineering report states that, 'As the greater Dublin area approaches saturation, FDIs are looking to expand outside of Dublin in order to fulfil their growth plans. To do this, real estate, fibre connectivity and electrical power need to be present to support this growth' (2019: 2). New fibre optic links off the coast of County Cork and County Mayo are set to fulfil these capacities. In July 2019 in Arklow, South County Wicklow, Echelon Data Centres received planning permission despite initial objections, lodged by rival businessman Brian McDonagh, who has expressed concerns that there would not be enough energy availability in Wicklow to power two data centre campuses. T5 data centres, a digital realty company based out of California, is expanding to locations outside of Dublin and Cork, expressing particular excitement about this southern location due to the kind of infrastructural *terra nullius* they will have with the energy grid due to the lack of existing data centre development. Ennis, County Clare is also poised to become a data centre hub with the establishment of a campus in the outskirts of the small city, the first expansion of the data centre economy in the West of Ireland after Apple's failed project in Athenry. There has been both community support and objection to the Ennis project.

These frontiers across Ireland are revealing the spatiality and cultural stakes of data economies and their environmental implications. This expansion outside of the Dublin region has as much to do with energy availability as with land and infrastructural connections. But as these outer regions grow, energy availability will have to follow, and the social and cultural fabric of the communities they cut across will respond to these new developments. Wind energy expansion has already largely been stymied across Ireland due to effective local opposition, and there are a variety of cases to draw from in terms of environmental protests against rural energy infrastructures: from opposition to industrial battery farms and overhead pylons, to the Shannon LNG terminal, to the Corrib gas project. Wind energy and the cloud are not just about low carbon and connectivity. They are about landscape, real

estate, aesthetics, public resources, energy, equity and governance (Mattern, 2017), and these issues play out in tensions between transnational, national and local scales. A growing body of work has looked at the rural politics of data centres and tech developments in places like Iceland (Johnson, 2019), Netherlands (Mayer, 2019), Sweden (Vonderau, 2019) and Utah (Hogan, 2015), and where a variety of promotional and planning strategies – and community tactics – have been implemented in often novel ways. The cunning of greenwashing mechanisms like those that dominate the industry and cut seamlessly across public and private sectors is that they appear and are promoted to be acting for public benefit, deepening the reach of extraction into social cooperation and new resource frontiers. While recognition of this unequal relationship can be the opening for the articulation of anti-extractivist demands and politics (Siggins, 2010), it can also serve to garner support for industrial-scale installations that hold the promise of investment and employment even if this is a fantasy. From so-called ‘serial objectors’ to enthusiastic civil society boosters, the development of these private infrastructures operates within rooted environments with manifold actors, interests and cultural stakes. This is true whether we look at data centres or the energy networks that power them.

Athenry

The politics of these extensive geographies of extraction are diverse, complex and ambiguous. This was seen most spectacularly in the case of Apple’s proposed data centre project in Athenry, County Galway and its enthusiastic supporters and savvy objectors (see Brodie, 2020b). A number of competing imaginaries for what economic futures in rural communities might look like played out during the three-year struggle, from 2015 to 2019, to get the data centre campus plans approved. In 2016, 2000 residents took to the streets on the eve of a planning objection appeal to demonstrate support for the project, and local civil society rallied strongly behind the proposal, including an active and vocal group called Athenry for Apple. Ultimately, Apple announced it was abandoning the project in 2018, due to the lengthy process of appeals lodged by environmental objectors Sinead Fitzpatrick and Allen Daly. While environmental claims across the appeals process to An Bord Pleanála, the High Court, and finally the Supreme Court ranged from effects on badger and bat populations to light and noise pollution, the argument that stuck was that Apple’s Environmental Impact Assessment (EIA) had not been carried out to properly account for the full scale of the project, only assessing the impacts for one out of a total eight data centre sheds to be built over 15 years.

In places like Athenry, past and future politics of (under)development informed the state’s and the community’s responses to Apple’s potential investment. Rural regions of the country face economic stagnation, and there are few forms of work remaining to sustain local economies, especially since the 2007–2008 financial crisis. Apple appeared to most people in Athenry as a ticket to the tech services-focused recovery economy that they saw as succeeding in Dublin and nearby Galway. However, reasonable objections to an enormously powerful multinational tech corporation making use of a lax tax environment and lack of environmental oversight created conflict on the ground that ultimately compelled Apple to abandon the plan.

One of the primary objectors to Apple’s Athenry data centre, American engineer Allan Daly, has also objected to an AWS data centre in the Dublin region on the grounds of energy usage and faulty EIAs. The resulting court cases and legislative response from the Irish state further paved the way for deregulated data centre development in the country: in 2017, the Government amended the Planning and Development Act of 2000 to include data

centres as ‘strategic infrastructure’; and in 2019, the Supreme Court ruled that Apple had not been obligated to carry out the full EIA, setting a deregulatory precedent for partial data centre EIAs in the future. These state responses demonstrate the degree to which private corporations are poised within state and planning regulations to be beneficiaries of the public imaginaries of eco-modernisation. Green credentials, as argued above, significantly mask the political ecologies of data in the public eye. Apple repeatedly made claims that the data centre in Athenry would be powered by 100% renewable energy, but was determined by the courts (even though ultimately ruling in favour of Apple) to have provided no evidence that this goal could be met. But even in the best case, companies do not need to invest in proprietary green energy, nor do their operations lead directly to more renewable sources. To make these claims, in the eyes of Irish planners at least (and thus often in the eyes of the local public), they need only to buy existing renewable energy capacity off of the grid, meaning that neat statistics demonstrating renewable commitments are easily manipulable. These deals and maneuvers are made mostly outside of the public eye, making transparency around how these deals and negotiations actually work an ongoing problem.

Donegal

Local residents in County Donegal received a surprise in Spring 2019, when Taoiseach Leo Varadkar announced that he was happy to hear that Amazon was involved in the development of the Meenbog Wind Farm in their area. AWS in 2019 signed two contracts with wind farms in Ireland, this one in Donegal and one in County Cork. These are not Amazon-owned wind farms, nor is it even clear if Amazon is directly investing in the wind farm developments. Through an intermediary, Invis Energy, Amazon has entered into a purchase agreement to buy 100% of the energy supplied to the grid from these sites over a period of time. Despite this relatively minimal involvement in renewable energy infrastructures, AWS’ actions prompted Richard Bruton (2019), the Minister for Communications, Climate Action and Environment, to state that the contract with the Cork wind farm represents ‘[A]nother example of AWS’s commitment to renewable projects in Ireland, adding clean energy to the grid and supporting Ireland’s climate commitments’. The amount of energy projected to come from the Cork wind farm is 23.2 MW, with 93.1 MW from the farm in Donegal. A new AWS data storage facility in Dublin will require 209 MW when built to capacity, far outstripping the capacity of the two wind farms and ignoring that for every MW of installed wind capacity, the same amount of on- and off-site back-up energy powered by fossil fuels will be required.

In identifying the particular relationship between AWS as a global corporation and the localised effects of their energy usage, the Finn Valley Wind Action Group in Donegal has raised concerns that connect the different scales and operations of power that are shaping their landscapes and futures. The Group has brought an appeal against Meenbog Wind Farm, as it is proposed to be developed in an environmentally sensitive area designated by the National Parks and Wildlife Service (NPWS). The area is home to 7% of Ireland’s hen harrier population and there are currently two active nests in the locality. The Group’s ongoing planning appeal did not prevent Amazon from announcing it was set to purchase energy from the wind farm, nor the Taoiseach hailing this as evidence of the tech sector’s commitment to the low-carbon transition, demonstrating that little community consultation had occurred before the government and AWS communicated the details of this deal to the public. In statements to the media, the Action Group highlight the dubious nature of the planning process, the emptiness of statements about tech companies’ 100% renewable commitments, the huge drain that data centres have on the national grid (which must be backed

up by conventional power plants anyway), and local impacts on bird populations (Kiernan, 2019).

Unlike the residents of Athenry, who saw the establishment of an Apple data centre as a boon to local industry and an opportunity for visibility and knock-on prosperity, the Finn Valley Wind Action Group and other Donegal residents see AWS as an intruder, its partnerships with the state to be distrusted. It is not as though data centres provide any more permanent jobs than wind farms, especially as each are increasingly automated. These differing levels of support can partially be attributed to differing corporate strategies from Apple and AWS, the latter of which is notoriously secretive about its data centre operations, or even to the seductive vision of technological infrastructure conjured by data centres and their association with global connectivity and US tech wealth. Whatever the case, Athenry for Apple's reasons for overlooking the energy impacts of the data centre, which were made publicly available throughout the appeals process, demonstrate a much different vision of Ireland's industrial and energy futures than that of the Finn Valley Wind Action Group. However, both show how corporate visions of expansion to frontiers outside of the urban fold encounter unexpected frictions, struggles and alliances which disrupt smooth operations. Reconciling these differing experiences of underdevelopment is not possible through the obscured operations of the moebius strip of wind/data.

The Midlands

An emergent site of transition to a renewable and perhaps data-driven future is the rural Midlands of the country, which offer a final and crucial experience to analyse when projecting Ireland's energy futures. In 2015, Bord na Móna announced the phasing out of industrial peat extraction in Ireland by 2030, part of a commitment to reduce its reliance on fossil fuels. Peat burning power plants currently supply 6% of Ireland's energy, compared to wind's 32.5%. In the Midlands, the site of most of the country's industrial peat extraction for the past 60 years, there has already been a proliferation of wind farms situated on the same boglands which would be subject to the more direct kinds of extraction facilitated by industrial turf-cutting. However, over the next decade, thousands of industrial workers in the midlands will lose their jobs in peat industries, leading to public discussions about what a truly 'just transition' out of fossil fuel reliance might look like in Ireland. The urgency of solutions to climate change cannot change the fact that the livelihoods of thousands of workers are being affected.

Conflicting ideas of what rural economic futures will actually look like under eco-modernisation play out in the everyday lives of those left to wait for the benefits of these particular infrastructural and epochal shifts. In this vein, proposed data centres for Ireland's midlands are being negotiated by local communities and workers now seeking a 'just transition' after the phasing out of peat industries and energy generation. The eco-modernist promise of FDI-driven 'substitution', of replacing one energy source with another (coal with wind), of one industry with another (manufacturing with tech services), of one form of work with another (peat cutting with retro-fitting), has a firm hold not only in the rhetoric of governments and business elites, but in the public discourse. Without it the future looks very different, and it is not at all clear that such a radical, and radically disruptive, prospect currently has the media or culture in which to be meaningfully and collectively deliberated and addressed. Thus, there is a certain inevitability associated with the shift to alternative energy and data-driven society, echoing both proponents and critics of data centre growth in Ireland. This is an aesthetic challenge as much as a political one, with the shift from 'dirty' to 'clean' energies and industries: the transition from outright resource extraction

(turf-cutting) and carbon burning (peat power) to more complex forms of value extraction from technological and atmospheric assemblages which we have traced above. How can one puncture what Kath Weston (2012) calls in a different context the ‘salvation story’ of wind and data’s moebius strip, with its comforting grammar of efficiency and control?

More modestly, and perhaps more speculatively, thinking about a ‘just transition’ without the presence of transnational investment and big tech is a pressing political issue on an Irish and world scale. If the people of Galway, Donegal and the Midlands are to leverage their experiences of infrastructural underdevelopment and abandonment for practical aims, concrete proposals must be made out of an activist understanding of the complex and efficient operations of the state and transnational extraction. There are emergent experiences to draw from: whether the Finn Valley Wind Action Group; the activist organising and scholarship associated with indigenous sovereignty and resistance to industrial energy extraction (Powell, 2018); the ‘anti-eolic’ positions articulated by some local communities against wind farms in Oaxaca, Mexico, about ‘protecting lifeways and ecological spaces’ (Howe, 2014); demands for a new ‘culture of energy’ discussed by Jaume Franquesa (2018) in his book about Catalan energy politics; and struggles and debates about public determination of emergent energy sources like tidal power in the Orkney Islands (Watts, 2018). Here, the future is not limited to renewables-as-substitute, but on wider relations that energy transition is embedded in and can make possible.

The representational leap of scaling up these struggles, to make local politics global, has always been hard to make for environmental justice activists and campaigns (Nixon, 2011). But the practical project of finding stakeholders and sites of importance within these epochal changes confronting environmental politics must be scaled up from these localised instances of friction and struggle, and the regional histories of uneven development that they represent, in order to identify ways forward within the necessarily interdependent frontiers of big tech and energy capital. Infrastructural systems, bundled across routes determined by concentrations of resources, populations and strategic points of development, offer the opportunity to view apparently discrete sites of struggle over resources and rights within an interconnected system of corresponding or divergent desires and political aims. These struggles, which often appear as micro-histories or one-off moments of emergence, must be understood within longer histories of relationships with local landscapes and what is seen as common or public, in order to better account for how state and corporate actors endeavour to privatise who benefits from them. Only then will we have a full view of how interconnected smart systems work together to extract value, like the moebius strip of wind/data, and where to re-orientate our own imaginaries of what a more just infrastructural future will look like.

Conclusion

What the moebius strip of wind and data represents is a way in which new frontiers of extraction and struggle are increasingly dispersed, opaque and automated. In this paper, we only offer some reflections that may help re-orientate our categories and practices to account for these new resource and extractive frontiers by mapping the systems through which their value is generated and valorised. The analysis presented here demonstrates how multinational tech companies are at the centre of an interconnected web of extraction that is facilitated by the Irish state and its business and planning policies. Yet wind energy and data infrastructure are usually separated in the campaigns and demands of critics. The expansion of wind energy is inseparable from the expansion of energy demands for the tech sector’s global data storage services. Bathed in a green hue, this is the continued ideology of growth

linked to an extractive model of development that serves the interests of hugely powerful companies.

While the hold of these logics on the common-sense solutions to climate change, energy and tech solutions has a long history that we can start to trace through these ongoing developments, we hope that we can add to a conversation about places at which to push against these self-perpetuating processes at the level of government, policy and corporate planning strategies. We also have pointed to speculative politics on-the-ground that seem to not feed into logics of green capitalism and its handing over of environmental care to individual choice and/in the market through smarter technologies and consumption. For environmental organisations, it is vital that a progressive energy transition focus not just on the types of energy being used but also on what this energy is being used for and by whom. If data centre demand continues at the rate forecast, then the expansion of wind energy will not be about transitioning to a low-carbon economy but about fueling the growing needs of a small sector of the economy. As is clear, data centres have impacts that may not have been predicted by early planners and pro-tech policy makers. The Governments involved may not have even realised the implications, or the extent to which data centres would be required to power the global tech economy. With green energy and emissions targets are at risk of being pushed off or missed entirely, the current Government should take a long look at the data available: the data centre gamble is far from sustainable, and it cannot be left to the companies themselves to meet these energy demands.

What we have found, adding to the vibrant literature around the energy and data ecologies of digital systems, is that not only the material networks but also the *logics of policy and accumulation* behind these projects need to be further unpacked, disentangled and re-orientated. Drawing together a diverse scholarly literature across geography, anthropology, media studies and the environmental humanities, the case study of the moebius strip of wind/data in Ireland draws insights from across these fields by raising a different series of questions about the kinds of actors we need to focus on when studying the global entanglements and assemblages of data and energy. The extractive frontiers of the cloud, 5G and smart environments are not necessarily to be found in the kinds of data they collect, or the modes of social organisation that they capture. Rather, they can still be found in the more familiar sites of imperial expansion and resource extraction, thus opening up more diverse and situated forms of struggle.

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