Earth, wind and fire: island energy landscapes of the Anthropocene

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Carbon-based systems of energy are rapidly unravelling. The imperative of climate emergency is reshaping energy landscapes, in some instances leading to the reappraisal of energy options hitherto sidelined. This paper deals with the emerging energy landscapes of the Netherlands and Iceland through historically informed tales that focus on islands. While vastly different in historical and geographical context and scale, these cases reveal the necessity of geographical nuance facilitated by the ways insular places offer insights into energy imaginaries of the Anthropocene. The former is a historicised narrative about the reinvention of wind energy as natural gas is being ousted. It focuses on the proposed Dogger Bank Power Link Islands, the first of which is scheduled to emerge in the coming years. The latter, also historically informed, identifies the context for current large wind energy proposals in Iceland, and then contrasts these with the authors' empirical observations from the small peripheral island of Grímsey. There wind energy is also being reinvented for ousting the predominant oil infrastructure on the island. These cases represent experimental opportunities for envisioning Anthropocene futures intended to destabilize imaginaries of growth in ways that open spaces for negotiation and contestation. They problematize dominant narratives that render wind energy development visible and knowable as a necessary intervention. Emergent from this is wind's decentred energy landscape in the Anthropocene; an epoch where energy is revealed in its importance to our societies, dispelling the human exceptionalism implicit in the nomenclature whilst at the same time showing how our actions come to matter. The collision of the Earth and ourselves under the terms of climate emergency begs the question whether our differences are the only ones that matter? But also, if it matters what we have done, then surely it matters what we have not done and chosen to ignore.

Keywords: Iceland, Netherlands, Anthropocene, islands, energy, wind

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Introduction

New energy landscapes are taking shape, animated by the imperatives of climate change. This paper deals with the emerging energy landscapes of the Netherlands and Iceland through historically informed tales that focus on islands. While vastly different in historical and geographical context and scale, we contend that these cases reveal the necessity of geographical nuance facilitated by the ways insular places offer insights into energy imaginaries of the Anthropocene. The former case is a historicised narrative about the reinvention of Dutch wind energy as natural gas is being ousted, through the forming of artificial islands channelling electricity from immense offshore wind turbine arrays to the mainland. The latter example, also historically informed, identifies the context for recently tabled large-scale wind energy proposals in Iceland, and then describes in some detail the peripheral island of Grímsey, where small-scale wind energy is being promoted for ousting the predominant oil infrastructure on the island. Although vastly different in most aspects, these island-centred proposals represent experimental opportunities for imagining Anthropocene futures and landscapes.

'Landscape' is of course a staple concept of geography, albeit one which has given rise to myriad interpretations, which we do not dwell on here (but see e.g. Wylie 2007; Benediktsson & Lund 2011; Kolen *et al*. 2015). For us, landscapes are at once material and non-material: they are the result in the present of past imaginings of the future, embodying choices that have been made, and, importantly also, alternatives that were suggested but not chosen. Nowhere is this more obvious than in energy landscapes – the spatially variegated physical manifestations of energy systems together with the imaginaries that have brought them into being. The concept of the 'imaginary' has indeed gained much attention in recent studies of sociotechnical systems (Jasanoff & Kim 2009, 2015). It has proved particularly productive for understanding how energy systems come to be assembled in particular ways (Benediktsson 2021), resulting in a range of 'scapes'.

The particular energy landscapes this paper focuses on is inspired by recent geographical work on islands. An example is Bonnett (2020), who claims that the world has entered the "age of islands". Similarly, Pugh and Chandler (2021, 1) assert that "There are only islands after the end of the world", placing emphasis on the island as increasingly important for both policy orientation and critical imaginaries as the looming climate catastrophe is becoming evident. Drawing on the island's liminal and disruptive capacities, especially readily observable relational entanglements and sensitivities, these authors encourage a geographically nuanced focus on its peoples and modes of life. Seen from this perspective, the island space provides grounds for interrogating new energy infrastructures proposed in response to the climate crisis. Indeed, "[o]ur power to reshape the planet is stark on new islands" (Bonnett 2020, 4), but also on older ones. The reshaping and making of island spaces is thereby bound with hope, as much as with the fact that islands often manifest disasters and dynamics of climate change playing out with particular intensity. Moreover, in the energy transition, islands have come to be seen as important laboratories for putting new socio-technical imaginaries into practice (Skjølsvold *et al*. 2020).

The title of the article draws attention to the dominant harnessing of earthly fires of fossilised hydrocarbon in the two cases narrated, and how these are supposed to be replaced with wind under the current climatic regime. This is a climatic regime dominated by humans and our ever-growing powers to transform the face of the Earth with our ingenuity and technology. The earth-shifting geo-power of our technology and its Earth System impacts, has prompted the naming of a new geological epoch, that of the Anthropocene, or the geological epoch of Man (Pálsson 2019). However, this epoch is one where certain 'men' in certain places, and not humanity as a whole everywhere, have brought about transformations to various Earth systems on a planetary scale. While we do not want to recount how the ways in which Europe amassed its wealth through rather violent and morally dubious means of appropriation that heralded this era (Lewis & Maslin 2018), the Anthropocene represents to us a story of how the 'end of the world' is spatially differentiated (Wakefield 2020), drawing attention to plurality and the importance of scale (Tornel & Lunden 2022). At the same time, global political and technological arrangements have developed into what Mitchell (2011) labelled 'carbon democracy'. The resulting energy landscapes based on fossilized carbon – or 'carbonscapes', to use the term of Haarstad and Wanvik (2017) – require scrutiny, but so do the ideas and proposals for their alternatives. Through the recognition of this differentiation, allowed for through the analytical lens of islands, this paper will attempt to 're-story' the Anthropocene. The departure point is that the global energy system and its concomitant geographies are structures we can historicise, which reveals that "the extraction, conversion, transportation and consumption of energy are unstable processes that we use significant resources to contain, control and put into order" (Haarstad & Wanvik 2017, 445).

As a consequence, energy landscapes need to be seen as place-specific, open-ended, emergent assemblages, where events are generative of a plurality of times and futures and wherein choices made matter. Beyond the necessary analysis of aesthetics and acceptance (e.g. Sepänmaa 2010), this article focuses on looking back at the formation of two particular carbonscapes and reappraising them. The paper will attempt to create a rupture in the current way the energy systems of the Netherlands and Iceland are perceived and chart a more geographically nuanced vision of the future. The two different stories are intended to destabilize imaginaries of growth in ways that open spaces for negotiation and contestation, problematizing dominant narratives that render wind energy development visible and knowable as a necessary intervention. The specificities of the spaces described accentuate the need to geographically diversify the meaning of the Anthropocene and the moral imperative of going green to save the world.

Energy and the Anthropocene

Steffen and colleagues (2015) label the massive post-war economic and consumptive boom, evident through several socio-economic indicators, the 'Great Acceleration'. Moreover, in their proposal they hinge the onset of the Anthropocene on the 'drafted consumption' of the people of the affluent North, to keep the productive capacity of the war machine churning (Lebow 1972) through demonstrating its decisive Earth System effects. Their proposal was meant to address the debate on the start of the Anthropocene, a new geological epoch superseding the Holocene, representing a move beyond the geologic conditions characteristic of the last 10,000 to 12,000 years and a shift into a novel and perilous epoch whose signature is irreversible human impact on Earth and life processes.

Many have further speculated on the meaning of the Anthropocene, but more importantly, upon which pivotal event this human epoch in geology can be hinged. The proposals are numerous in a geological sense (Biello 2016, 44–46; Chwałczyk 2020; Faber 2018, 52–54) but also conceptually (Castree 2014). The debates around stratigraphic markers which can represent a decisive epochal shift are addressed in detail by Zalasiewicz and colleagues (2019). They claim that the Anthropocene indeed represents a distinct chrono-stratigraphical unit but conclude that the only 'golden spike' marker possibly representing a shift measurable on geological time is the global dispersion of radionuclides after mid-twentieth century nuclear testing. However, in accordance with the elaboration of a 'geology of mankind' as presented by Crutzen (2002), one of the clearest Earth System indicators identified by Steffen and colleagues (2015) is the extremely rapid increase of atmospheric CO_2. This particular greenhouse gas is a by-product of the pervasive use of fossilized hydrocarbon fuels, not least for generating electricity. The particular resulting carbonscapes have become dominant, not only in the affluent global North, but also around the planet in emerging economies, most notably China, which today tops the charts in total CO_2 emission. Strategies for moving away from this fossil fuel dependency were the primary bone of contention in the most recent Conference of the Parties (CoP) of the United Nations Framework Convention on Climate Change in Glasgow. With such strategies now considerably accelerated in Europe due to perceived need of energy independence from Russia, the primary candidates to replace fossil fuels for energy are wind, solar and water power, whilst nuclear power has been sidelined by popular concerns, not least after the Fukushima Daiichi nuclear disaster (Wang & Kim 2018).

Appropriating wind and solar energy to counter fossil fuel hegemony is, however, a particularly volatile and spatially demanding enterprise, making for unsolved challenges of long-range distribution and storage of accumulated energy. Hydropower partially addresses this, but is also rather land-use intensive and reliant on particular topographies which are either too remote to be feasible or in densely populated areas requiring population displacement and dispossession. Moreover, very often hydropower development has substantial impacts for fragile ecosystems and habitats. On the global scale, Jacobson and colleagues (2019) claim that total land area needed for a complete energy transition to wind, water and solar is 0.65 per cent of the Earth's total land area, or roughly 1.85 times the size of the US state of California. Yet, due to the challenges associated with these sources, these will be concentrated where the energy is needed. The future energy landscape is thus one where

> "[r]enewable energy technologies are no longer endemic, singular plants or facilities, but almost omnipresent landscape elements. Thousands of tall wind turbines, millions of roof-mounted solar panels and thousands of photovoltaic parks cannot be hidden; societies are challenged by new elements, new sceneries and new landscapes" (Stremke & Schöbel 2019, 17; see also Owens 2019).

Whilst this reshuffling of the global energy infrastructure and carbonscapes is underway in a range of guises, such as the US Green New Deal and the EU Green Deal, it is important to highlight that the current ways in which energy systems are developing under the climate imperative can be characterised as 'eco-modernization', effectively not breaking in any way with the global system of economic growth, consumption, wealth generation, and fundamental inequalities arguably responsible for our current Anthropocenic predicament (Lewis & Maslin 2018). Current proposals to reanimate wind come uncomfortably close to Swyngedouw's critical description of the *Zeitgeist*:

> "[A] global intellectual and professional technocracy has spurred a frantic search for 'smart', 'sustainable', 'resilient', and/or 'adaptive' socio-ecological management and seeks out the socioecological qualities of eco-development, retrofitting, inclusive governance, the making of new inter-species eco-topes, geoengineering, and technologically innovative – but fundamentally market conforming – eco-design in the making of a "good" Anthropocene" (Swyngedouw 2019, 253; see also Parikka 2014).

The problem is that the rollout of renewable energy infrastructures is emulating the same processes which brought about the climate crisis to begin with. This can best be exemplified in ideas of geoengineering, where scientists in the hearths of the affluent North in pursuit of the 'good Anthropocene' see it fit to suggest experiments with the global atmosphere to fix a singularly identified problem, for the benefit of humankind, also singularly defined. Apart from the obvious lack of global consultation on the currently proposed experiments, the perceptions of the Earth System and humanity as uniformly rationalised entities are particularly concerning (Gupta & Mason 2014). They rely upon certain culturally conceived, humanistic notions of the unity of the subject, and the Earth System as manipulable and almost linear – like a machine that just needs fixing. According to Swyngedouw (2019), this type of thinking is 'obscene'. In the context of this paper, this obscenity lies in neither recognising the flexible and multiple identities and subject positions of a variegated humanity nor the locally specific conditions of weather and the capacity of particular topographies along with marine and terrestrial ecosystems to allow for renewable energy generation and the cultural and societal acceptance that needs to come with that.

The cautioning words of the potential obscenity associated with the pursuit of the 'good' Anthropocene urges a geographically nuanced and critical valuing of the future prospects of the energy transition. Following Stengers (2015) we propose looking back towards the future from the present. This serves a particular purpose:

> "To characterize is to go back to the past starting from the present that poses the question, not so as to deduce this present from the past but so as to give the present its thickness: so as to question the protagonists of a situation from the point of view of what they may become capable of, the manner in which they are likely to respond to this situation" (Stengers 2015, 34).

Stengers advocates for cultivating the art of paying attention to the possible, starting with attending to all the manners in which we can escape the pervasive grip of modern-day consumptive capitalism. Inspired by this standpoint, we grapple in this paper with the ways in which we can revalue human and material relations towards a plurality of Anthropocene futures, through the simultaneous production of the present by the past and the future in geographically variegated island settings (Kallis & March 2014). Heeding Castree (2021), we contend that dissonant forms of knowledge and argument about the Earth in the present and future will be key to forging a 'good Anthropocene', informing an open, honest and wide-ranging debate around what constitutes the 'good'.

Doggerland – an emerging island of the Anthropocene

As Bonnett (2020, 27) points out, humanity has gained more land than has been lost since 1985, despite measured sea-level rise. This is largely due to land reclamation efforts and literal island-building. The planet is veritably studded with artificial islands. The Dutch are at the forefront of many of these land reclamation efforts and island building projects worldwide, building on their long-standing expertise in negotiating with the encroaching North Sea on the 'Low Lands'.

During the last period of glaciation, the current British Isles and what is now the Netherlands and Belgium were connected by a land-bridge named 'Doggerland'. This was a consequence of water tied up in the ice sheets covering the North and South hemispheres, which at the last glacial maximum, about 20,000 years ago, meant that sea levels were lower by about 100 metres on average globally (Pillans *et al*. 1998, 7). However, as the ice receded and melted at the end of the glaciation period, sea levels started to rise. From 12,000 BCE until 7,000 BCE, Doggerland was slowly submerged by rising sea levels. A tsunami (5,500 BCE), generated by an undersea mudslide off the coast of Norway, dealt the penultimate blow, leaving only a small archipelago of the coast of modern-day Skegness. These islands were soon to disappear and what now remains are only submerged sandbanks, called the Dogger Bank (Walker *et al*. 2020). That name is derived from 'dogger', a mid-17th century word used for a two-masted boat of the type that trawled for fish in the area in medieval times, exploiting the banks' fertile fishing grounds.

During its time, Doggerland would have been a flat prairie-like landscape, ideal for the seasonal lifestyle of the hunter-gatherers of the time (Graeber & Wengrow 2021). This plain can be seen as extended through the Netherlands and then ringed by the hills of the Ruhr, the Ardennes and the Pennine foothills. As the land was slowly eaten away by encroaching seas, the hominid tribes would relocate, settling further and further 'upland' on the now British Isles and mainland Europe, as they got decimated or absorbed into the advancing *Homo sapiens* species emanating from the African heartlands in waves (Hajdinjak *et al*. 2021). The eventual tribal structure to emerge developed a particular relationship with the land in the Low Lands, setting up villages and means of transport navigating a bog-infested landscape, waterlogged and under constant threat from further encroaching seas (van Beek *et al*. 2019). The Low Lands were mostly a flat sandy glacial outwash plain continually transformed by the meandering Rhine and Maas rivers and smaller effluences through complex eustacy dynamics to which people adapted. More importantly, this sandy plain does not have much to offer in terms of readily minable wealth or natural resources, apart from clastic deposits and biomass, accumulating since the end of the last glaciation period. Gravel, silt and clay aside, the accumulated biomass made for peatlands and raised bogs (*hoogvenen* in Dutch). The emergence of early medieval cities, growing population density and excessive forest harvesting in the western parts of the current Netherlands led to the excavation of these peatlands (van Beek *et al*. 2015). As a result, the peatlands in the western and central parts of the Netherlands subsided by a total of six metres in the period between 1,000 and 2,000 CE (Groenewoudt 2012). The mining activities left the landscape potholed and further waterlogged (van Bavel & Luiten 2004, 505, 521). The peat, however, was cheap and ready for the taking by those who were permitted to do so. Its use was a necessary condition for the emergence of the Netherlands in the 'long sixteenth century' (1451–1648) as a world power and cradle of capitalism (de Zeeuw 1978; Moore 2015). This 'brown gold' was easily transported by canals, emerging partly as effects of the mining, and sustained the economy of the growing cities. But as the cities grew, peat became scarce and more expensive and was gradually replaced by cheaper imported coal (Patel & Moore 2018, 168–171). Today, only experts will recognise the legacy of peat mining in the landscape and landscape of former peatlands is considered natural by contemporary Dutch. This 'polder' landscape is even celebrated as the idyllic countryside and an icon of Dutchness.

Due to the land subsiding in the already Low Lands, these mined-out peatlands required sophisticated techniques for water management. These included the building and maintenance of dikes and the development of wind- and watermills. To counter the unfolding process of 'drowning' (Groenewoudt 2012), harnessing of wind power was of pivotal importance for propelling pumps that would drain water from behind the dikes and eventually out to the sea beyond the dunes, which traditionally protected the Netherlands, most of the time, against floods. Intricate socio-technical assemblages and institutions were developed for cooperation in dike maintenance and water management to achieve this protection (Kaijser 2002). While the main institutions are still important, today's water pumps are powered by electricity from the grid, or in some instances, by diesel engines. The iconic windmills that represent the Netherlands now are mostly relegated to heritage status, the preeminent example being the mills of Kinderdijk, which is an established UNESCO World Heritage site.

The windmill-studded polder landscape is thus the Dutch *ur*-energy landscape, having emerged due to the intensity of use of particular parcels of land, that led to more intense use and management, which required ever more ingenuity and knowledge application. As a source of energy however, wind was always secondary to the 'brown gold' of peat that fuelled the birth of mercantile capitalism in the emerging cities of the Low Lands. This in turn fuelled the colonial enterprise, albeit using vessels that were propelled by wind. As the peat supplies dwindled, and with a brief intermezzo of reliance on coal from the Ruhr and the southern and eastern parts of the Netherlands, oil exploration started in the late 19^{th} century, eventually yielding several fields with mainly gas around the country (van Hulten 2009). Largest of these was a natural gas field near the city of Groningen. Much cheaper to exploit than coal, and with the added price hike of oil in the wake of the 1973 OPEC oil crisis, the gas represented an abundant source of domestic and relatively clean energy. Following the gas find in 1959, the whole country was rigged with gas infrastructure in just over a decade. Gas pipelines and boreholes in the northern province of Groningen therefore quickly replaced the polder windmills and peat pits as the energy landscape of the Netherlands.

With Netherlanders cosily relying on the abundant gas fields of the North and other energy infrastructure relegated to heritage status, the drive for alternative energy sources in the wake of the OPEC oil crises halted, with no domestic market for such alternatives. Domestic companies, for instance in wind turbine production, lost out to Danish and German competition (Faber 2018, 131–132). Most recently though, and due to earthquakes as the gas fields subsided, the Dutch government decided on 17 January 2014 to cut output from the gas field, and on 29 March 2018 announced its complete termination by 2030 for safety reasons, although this decision is begin revised due to the current war in Ukraine and the urgent need to wean Europe off Russian gas and oil. The announced closure re-sparked the alternative energy debate that had followed in the wake of the post-OPEC crises. The search for alternatives is further bolstered by the goals set out in the Paris Agreement, calling for 42 per cent reduction of electricity generation from fossil fuels by 2030. To meet this, a total of 84 TWh need to be generated per annum with renewable energy in the Netherlands. Up to 60 per cent of this can be met with offshore windfarms in the North Sea and visions are already being promoted to this extent (van Hattum 2021). Bonnett (2020) describes how Dutch engineering and dealings with the sea have thereby become animated by 'going with the flow' of wind and water and the need to bring nature back, on land at least. Although any such exercise will "look fake and feel clumsy", it is the "right thing to do", Bonnett (2020, 56) claims. In this context, Faber (2018) refers to the North Sea as an 'Anthropocene park' (Fig. 1).

Seeking to harness the winds of the North Sea to combat climate change and its concomitant threat of sea level rise represents effectively a 'u-turn to the future', in the sense that traditional means of managing the energy landscapes of the Low Lands are being reinvented under the climate imperative. The 'cultures of energy in the twenty-first century' (Strauss *et al*. 2013), have brought to the surface our voracious energy needs, causing the Netherlands to step up its efforts of claiming land from the sea. Scaled up, the challenges of ending fossil fuel use on a global scale call for new energy infrastructure and expanded collaboration. Land reclamation and associated technological development are going into overdrive, reclaiming the submerged Doggerland as the 'Dogger Bank Power Link Islands' where artificial islands will be created at the northeast end of the Dogger Bank, just outside the continental shelf of the United Kingdom and near the point where the borders between the territorial waters of Netherlands, Germany, and Denmark come together.

At the North Seas Energy Forum in Brussels on 23 March 2017, the Dutch and German arms of transmission system operator TenneT together with the Danish Energinet.dk signed a trilateral agreement to cooperate in further development of the project promoting it as a contribution to meeting commitments of the Paris Accord. These partners hope that Norway, the United Kingdom, and Belgium will also join them, but so far only the Dutch Gasunie and the port of Rotterdam have joined the consortium. The aim of the project is to help develop a cluster of interconnected offshore

Fig. 1. Dogger Bank Island Link island. Source: Vaughan (2017).

wind parks. These will replace the current radial setup of wind farms, where each individual country draws on their own, with a modular 'hub-and-spoke' setup along with the supporting infrastructure required to transport the energy and use it directly or feed so-called 'power-to-X' (P2X), such as for converting electricity into gas to balance different national energy systems based on real-time demand and stored energy capacity. According to the results of the project's assessment phase, presented in July 2019, the network of linked islands in the North Sea would operationalise 180 gigawatts offshore wind. This could be achieved by 2045 by the consortium's approach, with interconnections to the North Sea countries by undersea cables which will make international trade in generated electricity possible. The first Power Link island is scheduled for completion 2030–2050. It will be an artificial island of about 6 square kilometers, located at the centre of some 10,000 wind turbines spread out over the North Sea (Fig. 1). In other words, "[t]he North Sea is being reimagined: turned from an empty in-between space into a heartland" (Bonnett 2020, 222).

Currently the question is if the social practices of dike and canal maintenance, of which the windmills stand as an iconic testimony to all over the country, can be reanimated at the current juncture. However, the Dutch, as used as they are to energy coming from 'nowhere', most ardently reject wind turbines on land and would like to see them pushed to the sea. This is perhaps at its clearest in the case of the proposed data centre of Meta, the mother company of Facebook, near the town of Zeewolde. There the municipal authorities have approved (in December 2021) a 166 hectares plot to build the centre, which will need 1380 GWh a year to run. The amount of energy needed by the data centre is comparable to the total energy use of the Dutch dominant railway company, the NS. If built, it will be one of five 'hyperscale' data centres in the Netherlands, three of which are already in operation. The difference is that the one proposed by Meta comes with the demand that all energy provided is 'green'. The energy needed can be provided by 115 windmills of the biggest sort, ones that rise 175 meters above the ground. This is the same height as the iconic Euromast landmark in Rotterdam, which resonates as a scale figure with the Dutch. But that green energy cannot be sourced locally on land due to opposition, the solution proposed by the local authorities is to push it to the sea.

Capitalising on the skills developed through centuries, Anthropocene islands will thereby emerge that link together offshore wind turbines and channel their energy onwards to the mainland. The impetus for this energy need are mainly places like the Meta data centre – serving a company at the core of the obscene wealth concentration and growing inequalities in the age of 'platform capitalism' (Srnicek 2016). In cahoots with the local community council of Zeewolde, which has the planning mandate, the promise of economic growth, jobs and prosperity is pushing the demand for wind from the North Sea, although the locals resist. The social practices that brought the iconic windmills into being are not animating the current development of wind energy, as it is dissociated from society. Wind is primarily a means for profit and an engine for growth, fuelling capitalist aspirations that most people have lost touch with in their everyday life, as clear from the rationale for approval provided by the municipality of Zeewolde. A modern wind turbine in the backyard does not have the same socio-cultural resonance as a heritage windmill.

The dominant Anthropocene imaginary in the Dutch case is one of Doggerland to be reclaimed as sea levels rise, but this time transformed from prairie to airy energy through a forest of wind turbines to be planted at the seabed for energising further growth and capital gains. While Doggerland was a heartland for hunter-gatherers before, it is re-emerging as a heartland for growth-driven aeolian hunter-gatherers of the obscenely wealthy 1 per cent tribe. It will thereby return to the centre as Faber (2018) postulates, as the cross-roads today. The question is whether our descendants will find our bones at the bottom of the sea, as we are finding still today the bones of the hunter-gatherers of past, as a current exhibit at the University of Leiden, entitled *Doggerland*, demonstrates (Faber 2018, 204–205). The energy that the Dogger Bank Power Link Islands are supposed to channel is really destined to feed a growth engine that will see no end to the rise in sea levels.

Iceland and the island of Grímsey

Very different natural conditions and historical particularities are revealed when we turn the attention to Iceland and its energy situation. Although endlessly promoted for its 'wilderness' landscapes (Sæþórsdóttir *et al*. 2011), more or less the whole island country can in fact also be considered a landscape of ruin – albeit not the 'managed ruin' of mercantile capitalism as the Dutch former peat pits, but of pre-capitalist exploitation of indiscriminate deforestation and grazing. Pastoral land use has turned a good part of the country into grassland, and severe overgrazing has contributed to tremendous soil loss (Arnalds 1987; Barrio *et al*. 2018). Much of the birch forest dominating the settlement and medieval landscape was also cleared to obtain building materials and fuel. Wood, charcoal and peat were the most important energy sources for a subsistence society that for a long time seemed to be perpetually teetering on the brink of disaster, or until economic changes ushered in capitalist industrial modernity during the latter part of the 19th century (Karlsson 2000).

When capitalism finally arrived in Iceland, several domestic energy options were untapped and available. However, at the very start of the modernist economic development trajectory, the easiest solution had been taken: imported coal – the defining commodity of the carbon democracies of the time (Mitchell 2011). Later oil, by then a globally traded commodity, became the energy source of choice. Energy from fossil fuels has continued to play a substantial role to this day, but two forms of renewable energy eventually came to dominate as industrialisation picked up pace, notably hydropower for electricity and geothermal energy for heating (and later also for electricity). Looking at the primary energy mix today, these two sources provide by far the largest part, or about 90 per cent (Statistics Iceland 2021). Seen from the outside at least, Iceland therefore seems to be in an enviable position regarding energy. The transition to renewables has advanced further than in most other countries, although some important sectors of the economy, such as transportation, fishing and shipping, are still fuelled by oil.

Particularly noteworthy is the extensive harnessing of geothermal energy from both low- and high-temperature fields. Its use was at first very local and small-scale, making use of hot water available at the surface and thus readily accessible, for purposes such as bathing and later also the heating of greenhouses. Large-scale exploitation of the resource started in the 1930s in Reykjavík, where a municipal hot water distribution system was installed for piping water from boreholes both within and outside the urban area. This involved major infrastructural investments over several decades, but eventually geothermal hot water reached all buildings in the city. Other towns and some rural areas followed the capital's successful example, first those with known geothermal fields close by. As in the Netherlands, the oil crises of the seventies then led to a partial rethink of the energy situation in Iceland. In particular, much effort was expended into searching for new geothermal sources for heating to replace oil, with considerable success. Gradually more and more towns and villages could take advantage of this precious resource (Pálmason 2005). Now about 90 per cent of the housing stock is heated geothermally (Orkustofnun 2021).

In addition to direct use, high-temperature geothermal fields have in recent decades increasingly been put to work for producing electricity. This is somewhat problematic, however, as the long-term renewability of such use is by no means certain (Arnórsson 2017). Moreover, the conversion of geothermal steam into electricity is quite inefficient, with much of the initial energy dissipated in the process. Nevertheless, geothermal technology is considered among the fields where Iceland has a competitive edge, and there has been much enthusiasm for developing this resource further (Clark 2019). Articulated by geoscientists, engineers, politicians, and businesspeople, a distinct 'geothermal sociotechnical imaginary' (Benediktsson 2021) with clear ecomodernist characteristics, can be identified in the country, striving for the 'good' Anthropocene and contributing to a 'new Nordic extractivism' (Kröger 2016).

But because of ample hydro- and geothermal energy, wind – for sure a ubiquitous resource on an island where calm weather is a scarce good – has never been utilised as an energy source to any significant extent. This is about to change. Resistance to further development of hydroelectric stations has been growing, and a national planning procedure put in place to ease the tensions between conservationists and developers is considered too lengthy and cumbersome by the latter. Despite Iceland already topping the global list of electricity production per capita, many developers and investors have indicated an interest in establishing wind parks. Whereas the hydro- and geothermal sectors are mostly in the hands of domestic companies, many of the wind proposals are backed by international players in the wind sector, including the France-based Qair Corporation, the Norwegian company Zephyr, and wind turbine manufacturers such as Vestas and Siemens Gamesa. Numerous large wind park projects are entering the environmental impact assessment stage, with planning authorities somewhat ill-equipped to deal with this new category of land use (Skipulagsstofnun 2017). The tourism sector views this with some trepidation, as wind development would inevitably alter visitors' perception of much of Iceland as 'wilderness' landscapes (Sæþórsdóttir *et al*. 2021). If experience from other countries is considered, opposition by local people should also be expected.

But Iceland still is very much an island in the physical sense. The national grid is not hooked up with the European one, which makes it impossible for electricity producers to participate fully in the vigorous energy market of mainland Europe – upon which the Dogger Bank Power Link Islands are set to capitalise. Additional electricity would therefore be used domestically, either by heavy industry (which now gobbles up almost 80 per cent of all electricity produced in the country), or by new users such as data centres, which have already made some inroads. Also, there are ideas of establishing large-scale facilities to produce hydrogen or synthetic fuels that might then be exported. All this seems to fit rather closely the characterization by Swyngedouw (2019) that we referred to earlier. Wind energy is entering Iceland in a technocratic and market-driven manner.

The picture becomes somewhat more complicated when we shift from the national level to a more fine-grained scale of analysis. Some isolated places have remained stubbornly dependent on fossil fuels, such as Grímsey, a small (5.3 km^2), cliff-ringed island, located just north of the mainland of Iceland. It is home to perhaps one million birds, but also some 40–50 people. For centuries the human presence on the island has been supported by small-scale fishing. This is still very much the case, but now tourism has additionally become a source of employment in summer. The tourists come for example to gaze at the ubiquitous puffins, although the main attraction of the island is an invisible human construct, namely the Arctic Circle. Most tourists arrive either on the ferry from the mainland or on cruise ships, the exhaust fumes from their large diesel engines sometimes giving a yellow tinge to the sky in the vicinity of the island.

But diesel fuel has long played a different and fundamental role in the daily life of the people in Grímsey. Electricity is provided by a diesel-powered generator that sits in the middle of the small village, humming relentlessly around the clock, all year round. Moreover, every back yard is graced by a fuel tank, the contents of which provide warmth for the inhabitants. The extra cost of having to use oil boilers for space heating is partially compensated through state subsidies. Grímsey is, in other words, one of the very few places remaining in Iceland that are neither linked up with the national electricity grid nor has access to any geothermal sources. The islanders' surprisingly many vehicles, ranging from tractors to snowmobiles to pickup trucks, are of course also dependent upon fossil fuels. The contours of the carbonscape are thus still very much in evidence on this small island, which remains linked to the global fossil fuel trade – to oil derricks, refineries, pipelines, commodity trading markets and other material and immaterial things in faraway countries that are part of the carbonscape assemblage. Fossil fuels still reign supreme, whereas the wind blows freely without being interrupted by turbine blades.

So why not wind? Some interesting experimentation with wind energy did in fact take place on the island in the early 1980s. Scientists from the University of Iceland erected a rather small experimental wind turbine, albeit not for generating electricity, but to heat water directly through friction (Dagur 1982). Some similar experiments were also being done in other places at this time, mainly by individual enthusiasts and tinkerers. The novel idea was apparently proven to be workable, but the friction mechanism in the Grímsey turbine was prone to failure (Dagur 1985, 1986). After a few years the trial was wound down, and similar experiments taking place elsewhere in Iceland also faded away. It contributed to the lacklustre interest that oil prices eventually dropped again, so the incentive to continue with the development of the technology was removed. The turbine is still standing at the southern end of the island, its silhouette visible from the village, although upon closer inspection it is not looking particularly attractive after years of disuse and neglect – if it ever did (Fig. 2).

Fig. 2. The experimental windmill on Grímsey. Picture by Huijbens, 23 July 2021.

Wary of this original enterprise and its results, the islanders seem to have not shown particular interest in wind power since. The current climate anxiety is, however, creating new openings for change. With gradual outmigration from this marginal fishing community, the islanders finally decided in 2009 to join a much larger municipality, Akureyri. A town of some 18,000 people, Akureyri has since taken an active stand in climate politics, for example by participating in the Global Covenant of Mayors for Climate and Energy (see Global Secretariat Office n.d.) and by adopting an ambitious goal of carbon neutrality (Akureyrarbær n.d.). In collaboration with other municipalities in the region, a local ecopower company, Vistorka, has been set up to work towards this goal (Vistorka n.d.). And what better location to put words into action than the microcosmic Grímsey?

A new trial project is underway, which will involve the installation of two 9 meters tall wind turbines (similar in height as that on Fig. 2), each with 6 kW installed power, in a plot where radio and mobile phone masts are already located. The electricity from these small turbines will be fed into the local power grid, possibly with solar cells and batteries added later. The Vistorka protagonists of the experiment see Grímsey as a potential showcase of the world situation in miniature, where distributed production and consumption of electricity has the potential to radically alter the centralized structures that undergird current energy regimes and carbonscapes. Grímsey is thus being mobilised as yet another 'island laboratory', which is intended to bring new energy imaginaries into material existence (Grydehøj & Kelman 2017; Watts 2018; Skjølsvold *et al*. 2020).

The islanders are somewhat divided in their opinions about the imminent new trial project. Some point to the failure of existing infrastructure (Fig. 2), others worry about noise, which seems rather far-fetched, as the new (and very small) wind installations will be placed in the middle of the island, far from the village. In any case, the constant hum of the old diesel generator has been part of local lives for a long time. More substantial concerns perhaps are those that relate to adverse effects on the island's extremely rich birdlife. The charismatic puffin seems an unlikely casualty though, as it lives on the coast, from where it flies out to sea in search for food. Another winged summer inhabitant might be more at risk: the Arctic tern. However, to what extent this supremely agile bird – which nests in dense colonies around the island – would fall prey to the rotor blades is not certain. Wind energy development can certainly affect not only human, but also non-human, lives.

The windmill experiment of the 1980s came to Grímsey as an outside intervention and technological trial. In a similar way, the current proposals are driven by 'mainlanders' climate concern and are not unreservedly gaining local support. The main lesson to be drawn, so that the proposed wind turbines will not to suffer the fate of neglect and disinterest as their predecessor, is that it would probably have been best if the initiative had come from the local inhabitants. At least, local traction needs to be gained and invested in before the project proceeds much further. Whilst the large-scale wind park proposals on the mainland are designed to create profit for corporate capital, the Grímsey project is much more modest and small-scale. Still, it is motivated by outside aspirations that seem somewhat removed from the main daily concerns of the local community.

Conclusions

Brought together, these two rather divergent island energy landscapes and associated imaginaries demonstrate to us two things: firstly, that local involvement in, and attachments to, proposed energy infrastructure matters, and secondly, that choices made before have strong bearing on the present. These rather commonly professed points however gain traction when employed to problematize the dominant narratives that render Anthropocene imaginaries of wind energy development singularly visible and knowable as a necessary intervention under the climate imperative. Gaining such 'thickness', in the words of Stengers (2015, 34), the examples show how it is possible that we do not all set out for the same future trajectory, but opt for myriad imaginaries of futures on one planet, at different times and in different places.

The two cases presented, and the ways in which their histories were engaged with, can inform current proposals for emerging new energy landscapes and counter the seemingly pervasive eco-modernising imaginaries evident in large-scale corporate-driven energy projects. The gigantic Dogger Bank Power Link wind project is the clearest example, but also many of the Icelandic energy projects, existing and planned, fit this image. Countering these, the cautioning words of Swyngedouw (2019) call for a geographically nuanced and critical valuing of the future prospects of the energy transition, through looking back, re-appraising the future from the present. What is clear is that through the emerging transition, renewable energy is fast becoming an omnipresent and even dominant part of our landscapes. It is in the distributed network of energy options, maintained by reinvented locally arranged socio-technical assemblages, that we see a more promising future, providing geographically variegated imaginaries to inform the ongoing debate of the 'good' Anthropocene. For this, we see the case of Grímsey as a potentially promising indication of where to head, if worked from the ground up rather than imposed from the top down.

The history of energy is replete with bifurcations, where suddenly the course is taken towards a particular energy source or technology whereas other sources or technologies are neglected or abandoned. Our two landscape tales hint at just such lost opportunities or greatly delayed transitions. In the Netherlands, the sudden abundance of cheap natural gas, searched for and exploited under the terms of the dominant global carbonscape, furthered the abandonment of an age-old socio-technical assemblage of wind power. In the meantime, other countries continued to develop wind turbine technology and work towards their placement in a new energy landscape. In the Netherlands, interest in wind has only recently been resurrected, in a form which perfectly fits the ecomodernist imaginary, feeding the hubris of platform capitalism and the growth imperative, and actually sustaining active local resistance to wind energy generation. In Iceland, the abundance of hydro- and geothermal power meant that hardly any interest at all was shown in other renewable energy forms. Brief experimentation with novel wind technology in the 1980s faded out, with nothing to show for it, except a decaying structure in a small and marginal community right at the Arctic Circle. One could speculate what might have happened if the direct friction heating technology would have been paid continued attention and developed further. In its derelict guise it seems only to provide for a cautionary tale for locals about outside intervention.

Underscored by the two landscape narratives are the geographical specificities of emerging energy landscapes of the Anthropocene: an epoch where energy is revealed in its importance to our societies. Once historicised and scrutinised in their specific geographical contexts, the emerging energy landscapes of the Anthropocene can dispel the human exceptionalism implicit in the naming of the epoch, whilst at the same time showing how our actions come to matter, inspiring hope at our current climatic juncture. The collision of the Earth and ourselves under the terms of climate emergency begs the question whether we humans are the only ones that matter? But also, if it matters what we have done, then surely it matters what we have not done and chosen to ignore. Sidelining wind has played a part in keeping the world stuck on a trajectory of carbon dependency. Charting a more geographically nuanced development path into the future through reinventing wind is part of unmooring this dependency, but that needs to happen through the involvement of people in each locality that is entering the future landscape of distributed renewable energy generation.

The prevailing eco-modernist imaginary countered with the two cases is the latest reincarnation of a tenacious universalism, which, true to its Enlightenment origin, entails a technocratic negation of diversity, and is based on a sharp distinction between humanity and the Earth. Warnings about the perils of such 'purification' (Latour 1993) have proliferated. Davis (2021, 1) asserts that "geographic scholarship in island environments is a particularly effective nail in the coffin of modernist thinking". In this she echoes recent arguments made about the 'Anthropocene island' condition (Chandler & Pugh 2021; Pugh & Chandler 2021). Islands are best understood as "potential amplifying sites which hold differences and relations often in tension or contradiction: thus, the traces, hauntings and spectres disrupt easy separations between pasts, presents and futures" (Pugh & Chandler 2021, 143).

Our account of two islands – one of these being a piece of volcanic rock in the Arctic ocean; the other a not-yet-materialised sandbank in the North Sea – have sought to reveal some of these 'tracings, hauntings and spectres'. Both have entered into present energy imaginaries, albeit in quite divergent ways. Those who plan for these and other new energy landscapes being formed in the present, would do well to draw more explicitly on what has happened in the past and what is imagined as a desirable future. Such landscapes remain hybrid; they consist not only of matter in itself, but also of imaginaries that reveal what is being thought to matter, and/or what *can* come to matter – can be materialised under the conditions of the Anthropocene. Indeed, "the Anthropocene can very well be seen as The Great Hybridization, in that it fuses together humanity and nature under the impulse provided by human aggressive adaptation" (Arias-Maldonado 2015, 125).

Global challenges associated with the current carbonscapes are manifested in land-grabbing, war, climate change and petrol price riots (Tynkkynen 2019). The way forward will entail coming to terms with geographical specificities and dissonant knowledges and voices in different places of the critical zone of Earth, wind and fire, where our lives unfold.

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