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Limits of Power: Wind energy, Orkney, and the post-war British state

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The Limits of Power: Wind energy, Orkney, and the post-war British state

In the days leading to the opening of the Exhibition of Industrial Power, Kelvin Hall in Glasgow buzzed with activity. Installations designed to document the 'conquest of power' by heavy engineering were unpacked and put in place.[1] The exhibition was the major Scottish display of the 1951 Festival of Britain, commissioned by the Labour government as a celebration of victory in the Second World War and proclamation of national recovery.[2] Visitors moved through the story of Britain's industry towards the Hall of the Future.[3] But there was a piece of this linear narrative of industry, progress and power that the public would never see: a 'mobile made of metal representing energies capable of being harnessed by the wind'.[4] Light and bright, it was meant to contrast with the symbols of heavy industry around it. Installed in good time, the maker, Allan W. Farmer, was asked to dismantle it the day before the exhibition to allow other work to be installed. George Campbell, Director of Finance on the Festival Executive Committee, explained what happened next: 'it was put against a wall and a packing case was unfortunately placed on top of it, with the result that it was wholly destroyed… the dismantled mobile had the

[1] *Exhibition of Industrial Power. Kelvin Hall, Glasgow* guide catalogue (H.M.S.O. 1951) The National Archives (TNA) WORK 25/230/E1/A1/5

[2] Becky Conekin, *The Autobiography of a Nation: The 1951 Festival of Britain* (Manchester, 2003), 4.

[3] The suggested route took visitors through the Halls of Power, Coal, Steel, Power for Industry, Electricity, Hydro-Electricity, Irrigation and Civil Engineering, Railways and Shipbuilding, and finally, the Future. *Festival of Britain 1951: Exhibition of Industrial Power* guide (H.M.S.O. 1951), TNA WORK 25/230.

[4] A.W. Farmer, 'Energies harnessed by the wind' contract, TNA WORK 25/279/g2/c3/1713

appearance of being nothing but a heap of scrap metal and the workmen were therefore understandably misled into thinking that it was so'.[5]

From art to scrap, in one blow the capabilities of wind power were less visible than they should have been. However, they had not disappeared completely: a model of an Orkney wind turbine stood in the Hall of Hydro-Electricity, representing an experiment that, if successful, 'will be able to produce in Scotland by wind-power alone as much electricity as is being produced in the country at present by any other means.'[6] It was operational at full scale that summer in Orkney. On the islands, electrification was a work in progress, and parts of the archipelago had yet to be connected to the local electricity grid. Orkney would wait until 1982 for connection to the mainland grid by seabed cables.[7] Yet here, 16km north of the mainland, rose Britain's first wind turbine for the generation of electricity for public supply.

The Festival of Britain was a state-orchestrated performance of nationhood through the arts, architecture, and industry. The post-war programme of industrial nationalisation embarked upon by the Labour government redefined nationhood in economic terms. Electricity was bound up in both. But attempts to bring electricity to the people encountered the troublesome edges, peripheries, and outliers of 'nation'. The grid did not reach many parts of Britain in the late 1940s and early 1950s. Where electricity was lacking,

[5] Correspondence from G.A. Campbell (Festival of Britain) to P.E. Stephenson (Treasury) 22 November 1951 TNA WORK 25/279

[6] *Exhibition of Industrial Power* guide catalogue, 30-31 TNA WORK 25/230/E1/A1/5

[7] 'Orkney to have mainland power', *The Guardian* 2 October 1981; W.G. Stevenson, 'The work of the North of Scotland Hydro-Electric Board in the Field of Wind Turbine Generators', in John Twidell, Fiona Riddoch and Bill Grainger (eds), *Energy for Rural and Island Communities III: Proceedings of the Third International Conference* (Oxford, 1983), 99.

consumer demand was strong, and alternative solutions were sought. This article identifies the environmental components of the limits of nationalisation between 1945 and 1956, and with it the spatial dimensions of state power, through a study of wind power experiments on the Orkney islands.

To meet the post-war promise of electricity provision for all, within a context of contracted imports, material shortages, and wartime economic controls, the government supported industrial experimentation in places where the grid failed to reach the consumer. In Orkney, the potential of wind to provide public electricity supply aligned with a drive toward self-sufficiency that suited an archipelagic community, but also echoed state aims of post-war recovery. Increased self-sufficiency in agriculture, and the quintupling of electricity production, are 'less readily invoked in histories' than the creation of the welfare state, argues David Edgerton, but were 'epochal changes'.[8] The arrival of wind power in Britain over a still-unfolding timescale could prove significant to Anthropocene-framed understandings of epochal change, as the need to transition away from fossil fuels is met.[9] Wind's emergence as an alternative energy source in a context of post-war industrial development shows that, with coal in decline and civil nuclear power yet to establish, it seemed to offer an energy prospect particularly for geographically isolated communities.

[8] The history of wind energy underscores the major argument made by Edgerton in *The Rise and Fall of the British Nation*, that the United Kingdom shifted focus away from empire and Commonwealth to internal industrial and economic transformation from 1945 onwards. David Edgerton, *The Rise and Fall of the British Nation: A Twentieth Century History* (London, 2018), 282

[9] For discussions of the Anthropocene and History, see Dipesh Chakrabarty, 'The Climate of History: Four Theses', *Critical Inquiry* 35 (2009), 197-222; and Julia Adeney Thomas, 'History and Biology in the Anthropocene: Problems of Value, Problems of Scale', *American Historical Review* 19:5 (2014), 1587-1607

In the attempts to bring electricity to the edges of the British nation, we find the discourse of electricity as a modernizing force that is central to energy histories in Britain Ireland, and elsewhere.[10] This article builds on arguments made by economic historians that the nationalisation of the electricity industry was hampered by material shortages. But it expands those arguments by identifying landscape, geography and distance as material factors limiting the provision of electricity to people in the north of Scotland and Orkney, far from centralised political power and centres of energetic power production. In doing so, it engages with James C. Scott's concept of high modernism as an ideology flowing from central states to peripheries, deploying scientific and technical knowledge to expand production, increase control over nature, and direct social order.[11] The British state's attempts to connect the populace to electric power in the mid-century can be fitted within such a high-modernist ideology, but localized environmental factors demand recognition. The North of Scotland Hydro-Electric Board (NSHEB) linked social and environmental responsibility to view Scotland's mountains, rivers and winds as resources for, rather than obstacles to, modernization, and the arrival of wind power to Orkney resulted from state and industrial cooperation. While Scott argues that high modernism rejected local knowledge as irrelevant, Orkney suggests that the experiments in using wind to feed public

[10] John Sheail, *Power in Trust: The Environmental History of the Central Electricity Generating Board* (Oxford, 1991); Leslie Hannah, *Electricity Before Nationalisation* (London, 1979); *Engineers, Managers and Politicians* (London, 1982); Sorcha O'Brien, *Powering the Nation: Images of the Shannon Scheme and Electricity in Ireland* (Kildare, 2017); Thomas Hughes, *Networks of Power, Electrification in Western Society, 1880-1930* (Baltimore, 1983); David Nye, *Consuming Power: A Social History of American Energies* (Cambridge, 1998).

[11] James C. Scott, *Seeing Like A State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven, 1998)

electricity supply succeeded because of attention to local environmental knowledge and traditions.

To explain why wind turbines came to be tested on Orkney, when the focus of state energy policy remained on coal and the promise of civil nuclear power, requires us to put nature at the core of the project of electricity provision.[12] The inclusion of natural forces and non-human actors has been the major contribution of environmental history to the ways in which historians conceptualise, research, and write the past. British history lacks a comprehensive overview of the role of the environment in the political, social and cultural development of the nation comparable to, say, David Blackbourn's work on Germany.[13] Environmental historians of Britain have arguably paid closer attention to local and global scales of change than national.[14] John Sheail's work on British electrical infrastructural development examined the role of the state and industry in relation to land use and amenity issues, cataloguing ways in which decision-making determined environmental change.[15] This article takes a different approach, highlighting the influence of the material environment on processes of policy making and technological development. As Andrew

[12] Here I paraphrase Tina Loo, 'High Modernism, Conflict, and the Nature of Change in Canada: A Look at *Seeing Like a State*', *The Canadian Historical Review* 97:1 (March 2016), 34-58. Coal and nuclear power both have an extensive historiography. But for the large overview works, see the multi-volume *The History of the British Coal Industry* (Oxford, 1984-1993); and Martin Theaker, *Britain, Europe, and Civil Nuclear Energy 1945-62* (London, 2018).

[13] David Blackbourn, *The Conquest of Nature: Water, Landscape and the Making of Modern Germany* (New York, 2006).

[14] See Harriet Ritvo, *The Dawn of Green: Manchester, Thirlmere, and Modern Environmentalism* (Chicago, 2009); Peter Coates, David Moon and Paul Warde, *Local Places, Global Processes: Histories of Environmental Change in Britain and Beyond* (Oxford, 2016). Thomas Christopher Smout takes a regional-national focus in *Nature Contested: Environmental History in Scotland and Northern England since 1600* (Edinburgh, 2000).

[15] Sheail, *Power in Trust.*

Seaton identified in this journal, 'environmental history's prioritization of both physical and social factors is especially valuable at a moment when scholars are reconsidering materialism after the linguistic turn'.[16] Here, human-made environmental changes are shown to be not just the results of political action and ideology but deeply entangled in notions of nation and progress.

In Part One, we see how conditions of remoteness shaped perceptions of progress and development in policy formation, and materially challenged policy implementation at the national level. Part Two shows how the Scottish environment was identified as a productive natural resource, but one which required technological solutions. Part Three argues that the Orkney environment shaped the wind experiments in ways both physical and social, with the result that the turbines were welcomed as productive presences. Ultimately, this article argues that wind energy was developed by state and industry in post-war Britain as an energy solution for remote communities, in the gaps created by the limits of the national electricity grid. Environmental factors challenged the implementation of equitable electricity provision, but, in Scotland, and especially Orkney, also provided resources for alternative models of power generation.

i. Nationalisation and electricity

The nationalisation of British industry that followed the Second World War defined the British economic and political system for the next thirty years. Faced with the transition to a peacetime economy, and mindful of lessons learnt post-First World War, the Attlee government retained wartime economic controls to combat unemployment, limit imports

[16] Andrew Seaton, 'Environmental History and New Directions in Modern British Historiography', *Twentieth Century British History* hwy001 (20 February 2018) https://doi.org/10.1093/tcbh/hwy001

and promote exports in order to stimulate recovery. The scale of the challenge was vast and taking infrastructure into public ownership had clear merits: it provided the possibility of exploiting scale economies and regulating industry according to the priorities set by government.[17] Between 1945 and 1951, gas, electricity, coal, railways, inland waterways, road transport, airlines, iron and steel were remade as public corporations.[18]

The electricity industry was on its way to nationalisation prior to the Attlee government. Interwar development had resulted in a proliferation of local monopolies and inefficiencies. To illustrate, Martin Chick explains that in the 1920s, London's electricity needs could have been powered by four of the most modern power stations but were in fact supplied by seventy undertakings. The Baldwin government established the Central Electricity Board in 1926 to streamline the industry, oversee power stations, and set about building a national electricity transmission 'gridiron' system. [19] With generation under CEB control, output increased from 631 units of electricity per ton of coal (the main source of fuel) in 1920 to 1,566 units per ton by 1930.[20] But distribution remained piecemeal with multiple undertakings distributing relatively small quantities of two different types of current. The McGowan Committee, charged in 1935 with reviewing the distribution system, called it 'chaotic', and recommended reorganisation to achieve public ownership of all

[17] Robert Millward and John Singleton, 'The ownership of British industry in the post-war era: an explanation', in Millward and Singleton (eds), *The Political Economy of Nationalisation in Britain, 1920-2000* (Cambridge, 1995), 313.

[18] Martin Chick, *Industrial Policy in Britain 1945-1951* (Cambridge: Cambridge University Press, 1997)

[19] Sheail, *Power in Trust,* 3.

[20] Chick, 'The political economy of nationalisation: the electricity industry', in Millward and Singleton (eds.), *Political Economy of Nationalisation,* 258.

undertakings.[21] The 1947 Electricity Act brought the entire electricity supply industry (which comprised of some 560 undertakings in England, Scotland and Wales) fully under government control.[22] A central British Electricity Authority oversaw and coordinated the distribution of supply by twelve regional Area Boards.

Historiographical debates focus on whether the ideological underpinnings of the nationalisation project were political or economistic.[23] The inclination to attribute nationalisation to the socialist Labour government is complicated by internal party discord over the nature of industrial policy, and support by the Macmillanite wing of the Conservatives for nationalisation during the same period.[24] But Martin Francis and Stephen Brooke argue that there has been too much emphasis on political pragmatism, to the detriment of the ideological dimension – apparent in the form as well as the ends of nationalisation – of the post-war Labour government. Moving from broader studies of nationalisation across industry to those that examine electricity, even economic historians cede the importance of social and welfare arguments to the political debate over electricity provision. For example, Chick identifies the importance of shifting public expectations about access to electricity that emerged during the period of total war as critical - against his economic inclinations (he describes references to 'public interest' as 'elusive and

[21] Report, proceedings and memoranda of Cabinet Committee on Electricity Distribution 1936-37, 6, TNA CAB 27/617.

[22] Electricity Nationalisation Bill: Establishment and Constitution of British Electricity Authority, memoranda, TNA POWE 38/17

[23] See Michael Brech, 'Nationalised Industries' in Derek Morris (ed.) *The Economic System in the UK* (Oxford, 3rd ed. 1985); Stephen Brooke, *Labour's War: The Labour Party and the Second World War* (Oxford, 1992); Martin Francis, *Ideas and Politics under Labour, 1945-51* (Manchester, 1997)

[24] John Singleton, 'Labour, the Conservatives and nationalisation', in Millward and Singleton, 13-34

distasteful', but nonetheless, necessary).[25] He cites Sir William Jowitt, Paymaster General, as reflective of the general view that 'the Public have increasingly come to regard electricity as a necessity and not a mere luxury: and it should be regarded from the same point of view as sewerage and water'.[26] From a different methodological position, Chick arrives at Brooke's core argument that the war fundamentally shaped post-war Labour ideology and policy, by aligning belief in economic efficiency, and a 'common spirit in the people'.[27]

The issue of rural electrification, a major theme in wartime planning for post-war recovery, highlighted 'the well-being of rural communities' alongside economic imperatives for change.[28] The Scott Committee identified the potential for mass 'drift' from rural areas to urban due to low wages, poor prospects and poor standards of living. The committee noted that in 1939 'one third of all dwellings in rural district areas were not yet electrified' and recommended that 'the supply of electricity is an essential service which in due course should be available in the home of practically every citizen in town and country alike, at no higher price to the consumer in the country than in the town.'[29] The electricity industry objected but the case for nationalisation was strengthened with socialist principles prominent alongside economic factors.[30]

[25] Chick, 'The political economy', 266. See also, Chick, *Industrial Policy in Britain*, 79-81.

[26] Chick, *Industrial Policy,* 81.

[27] Brooke, *Labour's War*, 108.

[28] *The Report of the Committee on Land Utilisation in Rural Areas* [Scott Report]*,* Cmd. 6379. (HMSO 1942), iv. TNA CAB 117/140.

[29] The Scott Report*,* 19, 50-51. TNA CAB 117/140.

[30] Letter from the Joint Committee of Electricity Supply Associations to Lord Portal, Minister of Works and Planning, 2 September 1942, HLG 80/90.

The process of rural electrification was long and uneven.[31] Katherine Button has undertaken detailed mapping of electricity provision in the south west of England, using South West Electricity Board records. Her work shows clear prioritisation of urban areas in the early regional rollout of electrification by private and municipal companies in the late nineteenth and early twentieth centuries, with Plymouth and Devonport the first areas to electrify in 1889. By 1926 and the establishment of the CEB, towns including Exeter (1923), Torquay (1924) and Dawlish (1926) were also connected.[32] But the rural hinterland of Devon remained unconnected to supply for some time. Typically, farms without electricity bought generators to provide power, but their size and expense made this unfeasible for domestic consumers. By 1953, post-nationalisation, an estimated 42% of the South West Electricity Board area was without electricity, including large areas of West Devon, Exmoor, Dartmoor, the Quantocks and the Mendips. It took a period of about 80 years for electricity to be made available to the whole population of South West England.

Button's study indicates the scale of the challenges faced by the industry from 1945 onwards. The National Union of Agricultural Workers lobbied government for the extension of electricity to rural areas as 'an urgent national necessity'.[33] But while urban households could be connected at relatively low cost (the economy of scale at work), electricity bodies argued that the quantities of timber, copper, steel, and manual labour needed to connect isolated and rural households were prohibitively expensive and in short supply. The

[31] Paul Brassley, Jeremy Burchardt and Karen Sayer, 'Introduction', in Brassley, Burchardt and Sayer, *Transforming the Countryside: The Electrification of Rural Britain* (London 2017), 1-11.

[32] The 1953 Mortonhampstead agreement set SWEB targets to connect 85% of farms to electricity (reached in 1964) and 93% of rural properties (reached in 1967). Katharine Shillabeer Button, 'The Environmental History of the National Grid', DPhil thesis, University of Cambridge, 2017, 206 - 208.

[33] 'Electricity in Rural Areas,' National Union of Agricultural Workers (January 1947), TNA POWE 38/13.

electricity industry had 'priority' status and received a larger share of domestic machinery and materials than many other industries, but managers still felt 'captive' thanks to import restrictions and pricing rings in other industries (eg. steel).[34] Material concerns could moderate the socialist principles underpinning policy, as correspondence between Emanuel Shinwell, Minister for Fuel and Power, and Michael Young, secretary of the Labour Research Department, shows. Martin Francis identifies Young as a particularly influential and idealistic thinker within the Labour Party at this time.[35] Young drafted 'Electricity Transformed', a pamphlet to publish alongside the 1947 Act, and sent it to Shinwell for comment. It presented the case for nationalisation by connecting economic efficiency with social benefits such as 'cheaper electricity' for all.[36] But Shinwell displayed a pragmatism that reined in Young's iteration of nationalisation. Shinwell advised the replacement of the promise of 'cheaper electricity' with 'cheap electricity', as due to the required expansion combined with high cost of materials, 'it is at least doubtful whether even under nationalisation it will be possible in many areas to reduce the current cost'.[37] Shinwell's adjusted wording conveyed to the consumer that the electricity they received *was* cheap.

The pamphlet develops a detailed case for rural electrification. But Shinwell cautioned against placing 'undue emphasis' on this. Young should be aware 'of the very great difficulty in obtaining the necessary materials (in particular poles) for urgent extensions, and of the present deficiency in generating plants. Unfortunately it cannot be

[34] Chick, *Industrial Policy,* 139-141.

[35] Martin Francis, 'Economics and ethics: The nature of Labour's socialism, 1945-51', *Twentieth Century British History* 6:2 (1995), 222.

[36] *Electricity Transformed* (Labour Party draft pamphlet), 4-9, TNA POWE 38/58.

[37] Draft letter from the Minister for Fuel and Power to Michael Young, Labour Party Research Department, 17 December 1946. TNA POWE 38/58.

claimed that even under nationalisation these deficiencies will be made good and it is suggested that the rural electrification section might be toned down a little'. Shinwell and Young's exchange demonstrates the challenges of implementation, distinct to the formulation of nationalisation as policy. In the electricity industry, material concerns limited the rate and reach of state provision of power to the nation.

A look north, to Scotland, shows that the materiality of highland and island landscapes added to these more general challenges. Leslie Hannah notes that prior to the Second World War, the CEB had decided not to pursue a grid north of Dundee – a huge swathe of country – due to 'poor market prospects': sparsely populated, the cost outlaid the prospective return.[38] Attempts in the 1930s at hydropower development in Scotland had been mostly thwarted by landed and coal interests. Six hydro-electric developments had been rejected by Parliament since 1929.[39] In Scotland socialist ideology remained at the forefront of discussions around electricity provision, largely thanks to MP Tom Johnston (appointed by Churchill as Secretary of State for Scotland in 1941), who drove the establishment of the North of Scotland Hydro-Electric Board (NSHEB).[40] In 1943 parliamentary debates over a Bill to empower the Grampian Electricity Supply Company to erect hydro-electric works at Glen Affric and Glen Cannich, Johnston resisted the presence of competitive private industry in the Scottish landscape. By its very nature, he argued, 'the production of power from the torrents and waterfalls, rivers and dams must be a monopoly… There cannot, in fact, be competitive turbines or competitive storages for

[38] Hannah, *Engineers, managers and politicians*, 150.

[39] Hannah, *Engineers, managers and politicians,* 149.

[40] After the war, Johnston would leave politics to become the NSHEB's part-time chairman.

electrical power from the same water'.[41] In the interests of keeping such natural assets in the public domain, Johnston argued that the monopoly should be public. Where Shinwell erred on the side of pragmatism, Johnston's position gives weight to Francis's argument that Labour did not express its motives for public ownership solely in terms of promoting rationalisation and productivity. Johnston displayed a distrust for economic interests that would be echoed in later Labour publications such as the 1950 pamphlet *Keeping Left*.[42] But landscape protection had to align with social improvement. When challenged with the potential threat to amenity value, he responded that 'the chief amenity I should like to see carried into the life of the North of Scotland is the amenity of social security, the right to work, and the amenity which derives from remuneration for a useful service in the world'.[43] Hydro-electricity, he argued, was not as disfiguring as 'hideous pithead monstrosities', and beauty was to be found in a prosperous population.[44]

Johnston's push for a publicly-owned electricity provider for the north of Scotland succeeded with the formation of the NSHEB by parliamentary act in 1943. The NSHEB provided a practical arm with which to implement socialist principles in energy provision on the ground. Under the 1947 Electricity Act the NSHEB became the Area Board for northern Scotland and took over the Grampian Company and other undertakings to control electricity supplies for nearly three quarters of Scotland's area, and a quarter of its population.[45]

[41] HC Deb (24 February 1943) vol. 387, col. 180. The turbines are for water, not wind.

[42] Francis, *Ideas and Policies,* 74.

[43] HC Deb (24 February 1943) vol. 387, col. 188. Concern over the threat of energy infrastructure to landscapes and amenities was growing. See Sheail, *Power in Trust,* 30-44, 153-163.

[44] HC Deb (24 February 1943) vol. 387, col.189

[45] Hannah, *Engineers, managers and politicians,* 151.

A dominant image of Scotland as an industrial nation emerged in technocratic politics from the 1930s onwards, with coal-mining, steelmaking and shipbuilding at its core, and its spatial heart in the West Central region – as reaffirmed by the Exhibition of Industrial Power.[46] But socialist thought was not as restricted to the urban and industrial as the wider historiography would have it. Clare Griffiths argues that relationship between Labour and the countryside prior to the Second World War was more important than often acknowledged.[47] In the post-war years British socialism was open to the needs of the countryside, and other forms of energy beyond coal, though also challenged and constrained by the materiality of the rural. Johnston and the NSHEB show that the rural Scottish environment shaped a political formulation of Scottish distinctiveness that connected rural landscapes to development, but not along traditional industrial lines.

The NSHEB pursued an expansion project dominated by hydro-electricity. This deviated from the (coal-powered) thermal models of production in the rest of the UK but mirrored efforts by the Irish Free State in the 1920s to bring electricity to rural Ireland via the Shannon hydro-electric scheme, and the work of the Tennessee Valley Authority in the USA.[48] In the debates over the final wordings of the 1943 Act, Johnston argued that 'there are special conditions and circumstances in the North of Scotland which require special experiments' to ascertain the most productive and reliable energy sources for electricity generation.[49] Rather than viewing the challenging terrain of the highlands as an obstacle to electricity supply, the NSHEB identified it as a source. The 'special experiments' were to

[46] Jim Tomlinson and Ewan Gibbs, 'Planning the new industrial nation: Scotland 1931 to 1979', *Contemporary British History* 30:4 (2016), 593.

[47] Clare Griffiths, *Labour and the Countryside: The Politics of Rural Britain, 1918-1939* (Oxford, 2007)

[48] O'Brien, *Powering the Nation,* 36-40.

[49] HoC Deb (6 May 1943) vol. 389, col. 403.

include wind power, demonstrating that wind was being included in considerations of future energy provision. Indeed, the Members for Parliament for Orkney and Shetland (Neven Spence), and the Northern Isles (McCallum), sought assurances from Johnston in the Commons that wind power would be 'laid down as part of the activities of the new board', because the terrain of the islands was 'such that the development of water power might be impossible' (due to low-lying topography and an absence of sizeable rivers), there was 'not an earthly hope of getting any electricity out of any Grid scheme', and that 'Atlantic gales [are] more frequent than breezes'.[50] Johnston agreed that experiments by NSHEB in wind power were 'vital', and revealed that he had experimented himself, lighting a small cottage by wind power. The NSHEB identified Scottish landscape, hydrology, and wind regime not as barriers to modernisation, but as natural resources.

ii. Energy at the edge

Due to its mountainous landscape Scotland was considered to have distinct energy needs to the rest of Britain. It was omitted from the Scott Committee's wartime consideration of land use as 'the conditions of the Scottish countryside … differ so widely from English conditions'.[51] The establishment of the NSHEB formalized an energy 'tradition' for the north, in which dependence on hydro-power and willingness to experiment with alternative power sources was supported in law, and driven by a mission to modernize rural communities.[52] Within the British context this is distinct, but within a global context the example soon finds

[50] HoC Deb (24 February 1943) vol 387 col. 230-231; HoC Deb (6 May 1943) vol. 389, col. 404-405.

[51] Letter from N.P. Hamilton to Alfred Hurst, 14 August 1942, TNA HLG 80/90.

[52] It is worth noting that NSHEB did not only generate hydro-electricity or wind-powered electricity. It also built coal-fired and diesel generating stations, including the latter in Orkney in 1951.

comparisons in energy infrastructure projects in North America, Africa and Asia. James C Scott has identified such projects as outputs of 'high modernism',

> a strong, one might even say muscle-bound, version of the beliefs in scientific and technical progress… at its core was a supreme self-confidence about continued linear progress, the development of scientific and technical knowledge, the expansion of production, the rational design of social order, the growing satisfaction of human needs, and not least, an increasing control over nature.[53]

The Labour government connected grid expansion to its broader projects of economic recovery and welfare provision. But the challenge of implementing the policy lay with the NSHEB. The NSHEB had been empowered by the state to develop new technologies to reach consumers and relied on localized environmental knowledge to do so. The British Electrical and Allied Industries Research Association (ERA) ran a series of tests in 1948 to determine the windiest place in the British Isles, taking readings from 50 weather stations around Great Britain and Ireland, all but a handful of which were on the coastal edges of the islands.[54] The ERA was founded in 1920 as a private research organization that, due to its work during the Second World War on projects such as the development of radar, was recognised by the Ministry of Labour in 1941 as 'an essential undertaking'.[55] It provided the research lead for wind power after 1947 thanks to the work of Edward Golding, who

[53] Scott, *Seeing Like A State,* 89.

[54] 'Electricity from Wind Power', *The Times* (London, England) 10 November 1950. The article cited E.W. 'Goldring' (sic). Golding provides a basic map of the test locations in his book, *The Generation of Electricity by Wind Power* (Trowbridge, 1955), 73, which became well known in engineering and renewable energy circles.

[55] Trevor J. Price, 'Edward Golding's influence on wind power', *Wind Engineering* 29:6 (2005), 519.

became Head of its Department of Rural Electrification and Wind Power. It found Costa Head, Orkney, to have the strongest and most consistent wind regime. Wind speeds exceeded 10mph for approximately 80 per cent of the time; over the testing period, the mean wind speed was 19.5mph.[56] Some industry figures, such as Donald Miller, felt Orkney was too distant and difficult for company engineers to access, and advocated for testing on the Ayrshire coast instead.[57] For the NSHEB the confirmation that Orkney was the windiest place to test turbines was greeted as an opportunity. A contract was placed in 1949 with John Brown and Company, Ltd (JB&C), Clydeside shipbuilders used to manufacturing massive ship's turbines, to build a 100KW wind turbine for testing at Costa Head. It would be the largest tested in Britain, and the first to feed into a public supply grid.[58]

The significant 'first' of feeding into a public supply grid was born out of necessity. When the turbine was erected in 1951, Orkney derived its electricity from a new diesel power station opened the same year in Kirkwall.[59] That year outlying islands in the archipelago including Shapinsay, South Ronaldsay and Burray were not receiving electricity and petitioned Orkney council for connection.[60] Orkney's islandness created an energy poverty that sat at odds with the access to power experienced by those in urban centres, or even those across the Pentland Firth on mainland rural Scotland.

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[56] 'Costa: Windiest Place in Britain', *The Orcadian* 15 December 1949.

[57] Interview with Sir Donald Miller, 'An Oral History of the Electricity Supply in the UK', British Library Sounds C1495/16 (2014).

[58] University of Glasgow archive (UoGA) UCS1/104/48; John Ventners, 'The Orkney windmill and wind power in Scotland', *The Engineer* 27 January 1950, 106-108. The first electricity-generating turbine is attributed to Scottish engineer and academic James Blyth, who built a small windmill to supply electricity via battery storage to his holiday home in Marykirk, in 1887. A later modified design provided the Montrose asylum with electricity.

[59] Orkney council minutes 7 November 1950, Orkney Archive (OA) CO3/1/14

[60] Orkney council minutes 27 March 1951; 4 September 1951. OA CO3/1/14

The efforts of state and industry to connect Orkney to power do not mirror the oppressive actions of the state as identified by Scott in, say, Soviet Russia. We can see that the demand was coming from the bottom up, as well as the top down. The council worked closely with the NSHEB and was represented on the North of Scotland Local Authorities Hydro-Electric Committee.[61] Orkney and Shetland Member for Parliament Basil Neven-Spence (Unionist Party, 1935-1950) raised island concerns that distance would prevent connection to the mainland grid in the House of Commons in the 1940s; his successor Jo Grimond (Liberal, 1950-1983) followed suit in the 1950s when he argued that there were still 'big landward areas in Orkney, Shetland and other islands and on the mainland which are clamouring for the light. But none of these areas can pay high capital charges.'[62] Orkney voices were audible in the discussions over connecting rural communities to electricity.

Though localised concerns were not shut out from national-level discourse, Orkney offers a perspective on the relationship between the central state and the rural periphery that complicates discussions of nationalisation, and of nation. In the parliamentary debates that bookend the creation of the NSHEB and the turbine testing there was continuity in the concern that the specific material and geographical obstacles faced by islands were not being recognised in broader notions of the rural and remote. 'They are totally different and need different treatment', argued Grimond, 'I sometimes fear that they are in the grip of a machine and that it is a Whitehall machine. Over roads, transport, land development, water and light I have the feeling that the machine is determined to treat Shetland like Sussex, and

[61] Orkney council minutes 23 May 1950.

[62] HoC Deb (15 December 1952) vol.509, cc1154-1156.

Kirkwall like Manchester.'[63] The specific needs of the islands were identified, but not solved, by discussions focused on Scottish hydropower and the extension of the grid.

By 'mapping' the transmission of power in a grid system, the state and electricity industry attempted to make visible and legible the complex engineering of supply and demand, at national level. In failing to reach the edges of the nation in that process, the grid left large parts of the periphery unconnected and untranslated. This was unintentional, the result of the challenges to laying networks and cables posed by geography and cost. Mountains challenged the grid-makers. Crossing the ocean stopped them entirely: instead of connecting to the mainland grid, Orkney had its own grid. If grid-making is, as Scott argues, a key part of the modernization process, which renders 'the terrain, its products, and its workforce more legible – and hence manageable – from above and from the centre', then Orkney, at the edge, remade its own version of the grid emanating from the central state.[64] Its inclusion in the definition of the British nation-state affirmed its right to electricity, but its islandness challenged the ability of the state to provide it.

Orkney demonstrates simultaneously the extent and limits of the spatial organisation of the British state around its own shores. It *is* state space, in that it participates in parliamentary democracy, taxation, and state-organised systems of education and agriculture. But using a lens of energy provision, it is *not* a state space in that the national transmission system could not yet cross the waters that separated the islands, despite the political intent to do so. This literal gap opened up an opportunity for the state-owned NSHEB to experiment with wind. Orkney's islandness was a spatial challenge to modernity, *and* an opportunity for new technologies to be tested.

[63] HoC Deb (15 December 1952) vol.509 col.1156

[64] Scott, *Seeing Like a State*, 2.

Many of the insights into extensions, and limitations, of power between cities and rural areas, and of constructions of nation-states, have come from colonial histories. This paper does not present Orkney as a 'colony' of the metropole.[65] It argues that perceptions of distance, rurality and remoteness influenced state policymaking and implementation in ways that fit with the concept of high modernism. But Britain's status as a multi-national polity complicates the movement of high modernist principles in one direction from the central state to the rural edge. Scotland was distinct from England and Wales and was able to leverage political power in order to address its particular requirements. Johnston planned for post-war recovery without the Scott Committee; Scotland's education and legal systems were distinct from their English counterparts; the NSHEB set out Scottish energy needs. Orkney relates to arguably three national entities: Scotland, England, and Britain. Simon Schama imagines memory as 'strata'; in the energy geographies of Britain, we can consider contours of identity and environment that layer to inform notions of distinctiveness that emerged in planning and policy.[66] To do so can be an act of connection, rather than disconnection: mapping the wind regime redrew Britain according to its most exposed edges. Scott argues that the resilience and durability of localised knowledge offers hope where high modernism and monoculture fails. This article shows that in post-war Britain, localized environmental knowledge was used not to reject the modernist project of energy provision, but to provide solutions in the gaps created by the limits of nationalisation.

[65] See, Laura Ann Stoler and Frederick Cooper, 'Introduction: Between Metropole and Colony', Cooper and Stoler (eds), *Tensions of Empire: Colonial Cultures in a Bourgeois World* (Berkeley: California University Press, 1997), 1-37.

[66] Simon Schama, *Landscape and Memory* (London, 2005), 7.

iii. Indigenous energy traditions

Once the contract was placed in 1949 with JB&C, Orkney's turbine was reported positively in the local press. *The Orcadian* noted that 'in northern and western Scotland, a considerable volume of power could be produced from the winds if economical and reliable machines were available and this experimental windmill has been designed as a first step towards solving the mechanical and aero-dynamic problems involved.'[67] This optimism was echoed in industry publications. *The Engineer* ran a three-page feature on the experiment, framing the pursuit of wind power by identifying that 'coal supplies are not inexhaustible and for Great Britain as a whole the known reserves are sufficient for another 400 years at the present rate of consumption…we should, therefore, conserve our coal supplies and bring into use other indigenous sources of energy'.[68]

The identification of wind power as 'indigenous' energy is unusual, and pertinent. Like inhabitants of the Western Isles and Shetland, Orcadians had always lived with challenging weather. Orkney is situated at the meeting point of the North Sea and Atlantic Ocean and their respective weather systems, which create tempestuous seas and winds for much of the year. The islands have no major water courses. To process grain, the population used the wind. By the 1790s windmills were relatively common, occurring in Sanday, Holm, South Ronaldsay, Papa Westray, and Orkney, with the earliest known source a deed of partnership for a windmill erected outside Stromness in 1763.[69] The windmills, known as 'windy gear', used cloth sails. A series of undated photographs in the Orkney Archive

[67] 'Power "windmill" is first in Britain', *The Orcadian* 26 January 1950.

[68] Ventners, 'The Orkney windmill', 107.

[69] Alexander Fenton, *The Northern Isles: Orkney and Shetland* (Edinburgh: John Donald Publishers Limited, 1978), 399-400.

documents the existence of windy gear on Orkney crofts into the early twentieth century (Figure 1). The (typically, but not exclusively) six-sailed mills are fixed on the roofs of farm buildings – themselves built low to the ground to survive the frequent gales.[70] Farms on islands without electricity by the mid-century wired their windy gear to dynamos to power lights and, later, televisions, with such devices in use on the island of Hoy until relatively recently (and long after connection to the grid).[71]

With or without the possibility of wind-powered television, the presence of windy gear establishes a tradition of harnessing wind power on Orkney that must be considered alongside the arrival of more sophisticated wind technologies. The NSHEB and ERA were not the first to identify wind as a limitless resource. Wind was already a familiar, traditional, power source on the islands.[72] While at state and corporate level the advent of wind was perceived as an energy resource of the future, on Orkney wind was an energy resource with a long history. This indigenous use of wind was not used by the NSHEB or ERA to frame their experiments. Their emphasis was on the national narrative, the progressive planning for an energy future. To an extent, local newspapers followed suit, emphasising size, newness and future potential. Articles ran in both the *Orcadian* and *Orkney Herald* in 1950 that previewed artist's impressions of the wind turbine and announced that it was the 'first large

[70] undated and unattributed photographs, OA L9829/1, L2549/4, L3868/3, L6198/2, L4431/3. L2870/3, L1743/1.

[71] Anecdotal evidence supplied by the librarian to the author, Orkney Archive, September 2017.

[72] The seas were also exploited for industry, most notably by fishing, sealing and whaling. Paul Warde notes the contribution made by the burning of seaweed in Orkney and the Hebrides to create soda, shipped south to the Clyde, Mersey and Tyne and used to supplement timber-based ash products in the early modern potash industry. Warde, 'Trees, trades and textiles: potash imports and ecological dependency in British industry c.1550-1770', *Past and Present* 240:1 (2018), 48.

scale windmill in Britain for the generation for public supply'.[73] The research that proved Costa Head to be the 'windiest place in Britain' was similarly headline news.

It would be wrong to assume that positive articulations of the near-omnipresent wind in Orkney were routine. When a hurricane hit in January 1952, it was followed by a piece titled 'Orkney and the Wind', which said that 'although the wind has never really been loved in the islands, we have always tolerated it…we have been rather proud of our capacity to endure and at times even enjoy the gales that reach us in such numbers each winter'.[74] But following the storm damage, 'the wind has become Orkney's bitterest enemy'. By reading the articles receptive to wind turbines with knowledge of the complex relationship between islanders and the wind, and also in light of the negative responses to wind turbines that would occur shortly afterwards in North Wales (and again when wind turbines became more common on mainland UK), we can recognize the groundwork done in Orkney by historic energy uses in presenting wind as a useful resource, and the wind mill or turbine as a familiar technology.

The identification of wind as an indigenous power source by *The Engineer* acknowledged the islands' history of harnessing the wind. It also works metaphorically to differentiate Orkney from mainland Britain. In this history, we see enacted by state and industry the 'push and pull between the metaphoric and material' that Brian Russell Roberts and Michelle Ann Stephens identify as characteristic of understandings of islands and archipelagos in Europe and the Americas.[75] The solid and liquid materiality of geography

[73] 'Power windmill is first in Britain', *The Orcadian* 26 January 1950; 'Wind Power', *The Orkney Herald* 31 January 1950

[74] 'Orkney and the Wind', *The Orcadian* 24 January 1952

[75] Brian Russell Roberts and Michelle Ann Stephens, 'Introduction', in Roberts and Stephens (eds), *Archipelagic American Studies* (Durham, 2017), 7.

saw the islands both included in, and exempt from, conceptions of nation as constructed by energy infrastructure. The imagining of Orkney as distant and distinct, but within the NSHEB's remit, also complicates the narrative of islandness. The rise of island and archipelagic studies has developed useful conceptual tools with which to unpick complex relations between islands and other land- and sea- forms. Roberts and Stephens encourage scholars to 'decontinentalize', that is to reimagine 'insular, oceanic and archipelagic spaces as *main*lands and *main*waters, crucial spaces, participants, nodes and networks within planetary history.'[76] To some extent, Orkney enacts its own decontinentalization: on the islands, the 'mainland' refers to the largest island of Orkney, rather than the Scottish mainland. But in energetic terms, too, Orkney decontinentalized. Separated by water from the mainland grid, an island grid was built and sustained, from the 1950s through to the laying of cables in the early 1980s. Today, Orkney produces more energy than it consumes, much of it by wind. It feeds mainland Britain power, via the grid. Electricity is a product of 'island-continent energetic interchange', made possible by the infrastructure of state and industry.[77] So while the *Engineer's* identification of wind power as indigenous perpetuated a colonial perspective of development, it also offers a way out of the colonial appropriation of islands that constructs them as isolated, empty, and always in relation to the 'continent', or in Britain's case, the other, bigger, island. Orkney and Britain became connected nodes in an energetic network. Furthermore, while island scholars define islands as a (shifting) relationship between land and water, by adding wind to our conceptual framework we

[76] Roberts and Stephens, 'Introduction', 14.

[77] Roberts and Stephens, 'Introduction', 33.

recognise an environmental force that moves across, and responds to, both.[78] Orkney's gales come from the Atlantic and North Seas that surround it; their strength could be an affliction, but in putting them to use, islanders and the NSHEB recognised them to be a resource of value.

The testing of the 100KW turbine at Costa Head was an important step in scaling wind energy up from the work of individual engineers, entrepreneurs, and practical farmers, towards a national-scale industry capable of providing significant energy contributions. The experiment was not without setback. The Orkney wind regime took an early toll on the device when the 1952 hurricane hit. The turbine measured the storm and recorded gusts of 115 mph.[79] Storm damage devastated the islands, nearly wiping out the poultry industry and damaging farms and houses throughout the archipelago. The turbine was also damaged and the books of JB&C in 1952 are peppered with requests from their overseers in Orkney for more money to pay additional labourers hired on short notice to repair the machine.[80] On 26 September 1952 an attempt was made to run the turbine at full speed, causing the plywood skin of a blade to crack from oscillation.[81] The NSHEB and JB&C determined to undertake repairs again and persist with the testing. The warning of *The Engineer* in 1950 that it was unknown 'whether a large windmill can be built which is efficient and reliable' proved prescient. The magazine reported again on the project in 1955, following the release of technical details by the NSHEB (Figure 2). Generation of 100KW had been achieved with a

[78] See, Peter Hay, 'A Phenomenology of islands', *Island Studies Journal* 1:1 (2006), 23; Marc Shell, *Islandology: Geography, Rhetoric, Politics* (Stanford, 2014); John R. Gillis, *Islands of the Mind: How the Human Imagination Created the Atlantic World* (New York, 2004).

[79] '120 mph Hurricane Hits Orkney; £1 million damage: families homeless', *The Orcadian* 17 January 1952.

[80] John Brown and Company, Ltd papers, Glasgow University Archives (GUA)/UCS1/104/48

[81] Progress Report no.19, John Brown and Company, Ltd Papers GUA/UCS1/104/48

wind speed of 30mph.[82] When this 'rated wind velocity' was increased to 35pmh, the size of the blades had been reduced from 60ft diameter to 50ft. A small 'pilot' windmill sat on top of the blades, measuring the average wind speed over a number of minutes to prevent the machine being started by a gust in an otherwise calm period. Crucially, should a fault occur, the machine had been engineered to automatically stop and not restart until fixed – a modification borne of real-world testing.

But here, the trail runs cold for the 100KW turbine tested in Orkney. The tests encouraged the BEA to conduct its own test of a 100KW turbine at Mynydd Anelog (north Wales) in 1953. This was delayed by objections from the Air Ministry which planned to put a radio mast on Mynydd Anelog.[83] When news of the testing became public, the National Farmers Union objected to the interference of grazing rights on the mountain; members of the public wrote to the local council to complain of the aesthetic impact on an area identified by the Hobhouse Report as being of outstanding natural beauty.[84] One letter accused the BEA of visual 'vandalism'.[85] The Council for Protection of Rural Wales denounced the idea as a 'barbarous desecration' of a sacred Celtic Christian site.[86] Eventually the BEA persuaded the farmers that grazing could continue around the turbine, and the Air Ministry that the turbine would not interrupt its radio mast.[87] Protests at the

[82] 'Wind Power Electric Generator', *The Engineer* 8 July 1955, 43-44.

[83] Correspondences between the Air Ministry, Ministry of Fuel and Power, and British Electricity Authority, 14 August 1951, 11 September 1951, 26 September 1951, TNA POWER 14/516

[84] Correspondence from National Farmers' Union Caernarvon Branch to Ministry of Fuel and Power, 10 October 1951, TNA POWER 14/516

[85] Correspondence, C.E. Fage to Caernarvonshire County Council, 30 January 1951. TNA POWE 14/516.

[86] 'Windmill would be 'barbarous'', *The Manchester Guardian,* 15 November 1952.

[87] Correspondence, Ministry of Fuel and Power to Air Ministry, 18 February 1952 TNA POWE 14/516

visual impact of wind turbines, and debate over the presence of energy infrastructure in protected landscapes, would continue and increase in the 1980s and 1990s.[88]

A *Manchester Guardian* report on the Mynydd Anelog turbine concluded that 'the long-term view was that wind power would become essential to eke out our diminishing irreplaceable fuel resources'.[89] Yet despite the successful testing of the two 100KW turbines in the early 1950s, government files show no more serious research and development into wind by the state for decades – until the 1973 fuel crisis triggered widespread political debate over energy security.[90] In the 1950s, the electricity and manufacturing industries were relatively optimistic, contracting and trialling new technology in Scotland and Wales (where the turbine was made by Enfield, with de Havilland propellers). Within the electricity industry there were individual advocates for wind power, such as Golding. Public interest, too, stirred. The Ministry of Fuel and Power fielded enquiries in the early 1950s from individuals about the possibility of buying a wind turbine, and the patent office sent copies of new patents sought for wind technology.[91] But government support waned. Even in 1951, year of the tests and Festival of Britain, political will to explore wind at scale was limited.

[88] Sheail discusses the early amenity implications of energy infrastructure in *Power in Trust;* see also the contributions by academics, artists and landscape professionals in Peter Coates, Paul Warde and David Moon (eds), *Local Places, Global Processes: Histories of Environmental Change in Britain and Beyond* (Oxford, 2016); and Button, 'The Environmental History of the National Grid', 213-259.

[89] 'Second Electric Windmill: Eking Out Our Fuel', *Manchester Guardian* 20 March 1952

[90] John Campbell Wilson, 'A history of the UK renewable energy programme, 1974-88: some social, political and economic aspects', DPhil thesis, University of Glasgow, 2012.

[91] Correspondence between A.A. Carlton, Whitstable, Kent, and the Ministry of Fuel and Power, 12 October 1951; and W.J. Farmer, Helston, Cornwall and the Ministry of Fuel and Power, 12 - 28 November 1954; TNA POWE 14/269. Patent for Emile Cavaudeau, a French citizen resident in Germany who applied for a patent in 1953 for 'apparatus for generating electrical power from wind'. TNA POWE 14/269; correspondence from Institute of Patentees to Ministry of Fuel and Power, 23 March 1953 TNA POWE 14/269.

Philip Noel-Baker, then Minister for Fuel and Power, responded in the House of Commons to a query about the government's programme for harnessing wind and water for electricity. He replied that the BEA, NSHEB and ERA 'are all experimenting in the use of wind for power… But much the greater part of our electricity must be supplied from thermal stations using coal. I hope that 1,100 megawatts of new capacity will be commissioned this year.'[92] This was in line with government commitment to support the coal industry and ensure consistent sources of power. But, the quick deflection from wind to coal acted rhetorically like the packing case to the wind mobile in the Exhibition of Industrial Power: flattening it from potential serious policy to tangential science.

The energy industry could see which way the political wind was blowing. When *The Engineer* reported in 1955 on the Orkney test results, it also ran a 'Ten-Year Forecast of Electricity Generation in Britain' by the deputy chairman of the Central Electricity Authority which failed to mention wind energy at all. It identified the government White Paper 'A Programme of Nuclear Power' (February 1955) as pointing the way forward.[93] The paper stated that 'our future as an industrial country depends both on the ability of our scientists to discover the secrets of nature.' It determined that 'nature's secrets' were atomic, and though 'the exact lines of development in nuclear energy are uncertain… it is only by coming to grips with the problems of design and building of nuclear plant [sic] that British industry will acquire the experience necessary for the full exploitation of this technology.'[94] The UK Atomic Energy Association was established in 1955, closely followed by the reactors at Caldwell Hall producing nuclear-powered electricity for the grid in 1956 (a world energy

[92] Hansard record for 23 July 1951, kept by the Ministry for Fuel and Power. TNA POWE 14/269.

[93] J Eccles, 'Ten-Year Forecast of Electricity Generation in Britain', *The Engineer* 8 July 1955, 41-42.

[94] Cmd. 9389 'A Programme of Nuclear Power' (H.M.S.O. 1955), 1.

'first'), the same year that the Suez Crisis highlighted the geopolitical and security weaknesses of oil.[95] When Macmillan inherited the crisis from Eden, he responded by trebling the civil nuclear power programme.[96]

When the NSHEB and JB&C tested the 100KW turbine at Costa Head, Orkney, it was bigger by some margin than the 70KW turbines in operation in Denmark.[97] For a brief moment, Britain was at the vanguard of renewable energy technology. The wind-pummelled coastline provided an ideal testing environment. But Cold War geopolitics favoured the demonstration of (not so soft) power that was a civil nuclear power programme. While Britain retreated from wind power, Denmark developed the technology (with, for example, experiments in aerodynamics from 1957 to 1968 by Ulrich Hutter).[98] Meanwhile, the ERA's Wind Power Group was left unfunded. A mooted International Wind Power Association never materialized, though UNESCO took an interest in wind energy in its Programme for the Development of Arid Zones.[99] While in the immediate post-war period the British government had collated records of wind energy developments occurring around the world, by 1963 the best advice they could pass on to an inquiry about wind technology from Sierra Leone was to consult Golding's book (almost a decade old), and the papers of

[95] Jonathan Hogg, *British Nuclear Culture* (London: Bloomsbury, 2016), 79.

[96] Martin Chick, *Electricity and Energy Policy in Britain, France and the United States since 1945* (Cheltenham: Edward Elgar, 2007), 23.

[97] Price, 'Edward Golding's Influence', 522.

[98] Matthias Heymann, 'Signs of hubris: The shaping of wind technology styles in Germany, Denmark, and the United States 1940-1990', *Technology and Culture* 39:4 (1998), 641-70.

[99] Price, 'Edward Golding's Influence', 524.

the UN Conference on New Sources of Energy, Rome (21-31 August, 1961).[100] The expertise was to be found elsewhere.

iv. Conclusion

By taking wind as its central subject, this article has demonstrated the use of environmental history as a methodology for British history. It has enhanced the work of economic and political historians on the limits of industrial nationalisation and the challenges facing the post-war electricity industry, by demonstrating the push and pull between socialism and economic pragmatism in relation to electricity provision. It argues that notions of distance and environmental distinctiveness influenced the formation of policy and limited its implementation on the ground. It shows that an environmental lens produces new thinking on the spatial constructions of the state that recognises the influence of geographical edges as materially and imaginatively capable of disrupting a narrative of one-way power emanating from the centre. This is important especially in relation to the place of islands in national histories. Wind joins other natural forces able to exert agency in narratives of technological development and modernism, that augment our understanding of energy, nature, and nation.

Though small-scale and technologically limited, wind power developed in the gaps created by the limits of the nationalised electricity supply. Wind power in the 1950s was not a rebuttal of large-scale energy projects and the high-modernist ideology behind them, but rather an exploration of alternative models of power generation and supply that could work where those larger installations would not. Orkney's claim to the significant 'first' turbine to

[100] Correspondence between the Secretary for Commonwealth Relations and Electrical Research Association, 8-22 April 1963, TNA POWE 14/269.

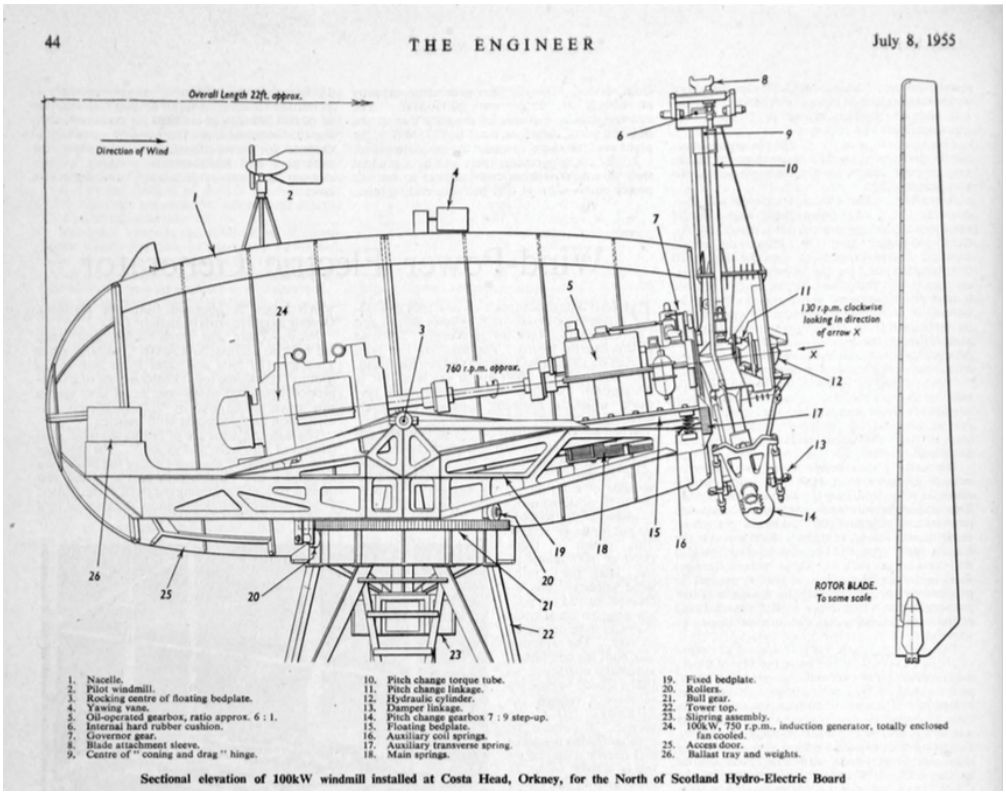
feed a public supply grid, and the key role of the NSHEB in developing the turbine, grounds this history in the social and economic mission of post-war recovery and nationalisation of industry. But where nationalisation was envisaged and mapped out confidently from the centres of political power, the environmental realities of the geographic peripheries limited government and industry's reach. The limits of electric power in the Orkney Islands created an ideal test environment for wind power. On the islands, as well as connecting to the local grid, the 100KW turbine connected with local traditions of harnessing the wind as a productive, if tempestuous, power source. However, without the long-term backing of government and with policy focus elsewhere, wind power faded from government policy.

In Orkney, wind had a more lasting legacy. Renewable energy spoke to island narratives of survival and practicality. When wind re-emerged in the 1980s, the industry looked again to Orkney as a testing ground.[101] Orkney would develop its status as a renewable energy hub further with the arrival of the European Marine Energy Centre in 2003, a test centre for wave energy technology. In 2015 the NM92 windmill on Burgar Hill became the first UK wind turbine to generate over 100,000,000kwh of electricity.[102] In Orkney, and in Britain, the making of a wind-powered future began in 1951.

[101] In 1982, NSHEB tested a 250KW turbine at Burgar Hill, Orkney – at the time, the most powerful turbine ever built in the UK. 'Orkney wind power agreement signed, *The Orcadian* 25 March 1982

[102] Alistair Munro, 'Orkney Wind Turbine Spins into Record Books', *The Scotsman* 16 April 2015

Farmers outside a croft with 'windy gear' attached, Orkney. Undated, unattributed photograph, Orkney Archives L/3868



'Sectional elevation of the 100KW windmill installed at Costa Head, Orkney, for the North of Scotland Hydro-Electric Board'. The Engineer, 8 July 1955.

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