New Statesman

A clean growth future

The South-West Natural Powerhouse

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Why the South-West can be the UK's hub for clean growth

The region has huge economic and environmental potential, say Iain Stewart, professor of geoscience communication, and Ian Selby, director of sustainable geoscience

South-West England is a sprawling patchwork of forest and farmland hugging a heartland of granite moor and fringed by dramatic coastal cliffs and bay beaches. There is a sense of crossing time zones into a slower pace of life. A rural idyll perhaps, and certainly not a technological frontier land. And yet, beyond and below the wonderful "natural capital" of Devon and Cornwall, a renewable energy revolution is brewing – the sleepy South-West is emerging as the UK's "Natural Powerhouse".

Along its shores, the power of wave and wind is all too obvious. The nearshore waters have long been a testing ground for the deployment of new technologies like wave and tidal energy, but now on the horizon is the exciting prospect of offshore wind. Wind farms are an integral (and contested) part of the region's onshore landscape, but that potential does not stop at the beach.

For the past decade, the UK's renewable energy development target – now 40GW by 2030 – has focused on the North Sea. But now, as a marine energy infrastructure of interconnectors, oil and gas platforms and pipelines jostles with communications cables, mineral dredging, navigation and fisheries, sea space in the UK's eastern seaboard is at a premium. To satisfy the ambitions of our soaring appetite for clean wind power, we need to look to our less-congested offshore areas.

The marine extent of Devon and Cornwall measures over 88,000km^2 – almost ten times larger than the land area. The deeper seas of these Western Approaches do not allow for towering turbines to be anchored to the seabed, but instead require the deployment of new, floating, wind technologies. Deeper seas allow floating turbines to be sited nearer to shore (as close as 20km) and extend far offshore, accessing wind regimes capable of generating energy capacities of at least 15GW and perhaps more than 50GW.

It may be that distant offshore Devon and Cornwall wind fields will find more acceptance among residents and visitors than equivalent developments on land. But, as in the North Sea, exploiting the physical power of offshore wind will potentially bring renewable energy development into conflict with the biological ecosystems that sustain fisheries and aquaculture and underpin marine conservation as well as other maritime activities and coastal communities. To grasp this challenge we need to reframe natural asset leadership and bring together sectors that don't normally interact as a partnership, to deliver mutual benefit through sustainable development.

Onshore, the remnants of the region's last great technological leap forward litter the land. Derelict engine houses and foundries are the visible signs of a vast underground network – adits, tunnels, drives and shafts – that delve deep into the metal-rich roots of the peninsula's famous granite basement.

In the 18th and 19th century these long-abandoned metal mines (copper, zinc, lead) fed Britain's industrial revolution. That revolution ultimately ushered in the high-carbon fossil-fuel world of 19th and 20th century economic growth and led to the current climate crisis, but the same rocks may offer solutions for a transition to a decarbonised future.

Although Devon and Cornwall's once molten Cornubian granite is several hundred million years old, it's still hot down there. In fact, a few kilometres down are some of the hottest rocks in the UK, and the most promising geological conditions for generating a very different kind of renewable energy: geothermal energy. Heat from the Earth.

Stoked by natural radioactive heat from the granite, scalding waters circulate through natural fractures. Deep boreholes can tap into these superheated groundwaters, bringing them to the surface to generate electricity and liberate their heat. Last year, the UK's deepest onshore borehole was drilled near Redruth, Cornwall, as part of the £30m United Downs Deep Geothermal Power project. At the bottom of the 5km-deep well, the waters were at 188°C – hot enough to drive a turbine and generate electricity. The UK's first commercial geothermal power project has an agreement to offload around 4MWe to the local grid. But this is just a start. Within the past month or so, deep drilling for geothermal energy has started at the Eden Project in Cornwall, with much of Cornwall and west Devon sharing that same geology.

The ancient granite powerhouse offers the promise of a new energy renaissance. But there is another, more direct, way in which deep geothermal waters can aid the "energy transition" that is central to the UK's "green recovery".

Those subterranean thermal waters also carry a dissolved cargo of minerals, including the much-valued lithium. The lightest known metal and lightest solid element, lithium is a critical component of the batteries used in electric vehicles. It is currently mined in only a handful of countries around the world, but, following the Brexit free trade deal inked in 2020, UK carmakers have three years to source local electric car batteries. So the hunt for lithium is on.

Sampled deep geothermal waters from United Downs indicate lithium grades described as "globally significant". A local mining company, Cornish Lithium, plans to extract the battery metal from the thermal brines, as well as from a more conventional rock-drilling project near St Austell. Given this potential, it is possible that the UK could produce a significant percentage of its lithium demand domestically.

In a region in which mining is largely confined to the visitor attractions of Unesco's Cornwall and West Devon Mining Landscape World Heritage Site, this will have to be mining fit for the 21st century. And the reality is that our exploitation of the South-West's "hidden commons" – whether far offshore or deep below ground – will be won or lost through public consent.

Learning from all that's gone in the past, it will require the integrated, holistic management of competing – and, at times, conflicting – economic and environmental interests. It offers a unique opportunity to design and future-proof a new energy landscape, onshore and offshore, blending world-class research and jobs in science, technology and engineering with community-centred environmental and social governance – a "Natural Powerhouse" that is a genuine partnership of people and planet.

Technology can thrive on nature

Public consent must underpin energy policy

SHUTTERSTOCK/GORDON BALL

The blue economy

The planet's oceans must be respected, secured and nurtured, says Mel Austen, professor of ocean and society

Our oceans are an integral part of life support on the planet. They are crucial to the very air we all breathe and play a key role in defending us from climate change.

The biodiversity of the ocean and its intricate food web provides food security for billions of people worldwide, particularly in countries where seafood from wild capture and aquaculture is the only accessible source of dietary protein.

At the coastal interface of sea and land, marine plants and animals provide a natural and free coastal defence against floods and storms. For example, coral and shellfish reefs, mangroves and saltmarshes protect cities, rural towns and villages, and farmland by acting as giant barriers and sponges, absorbing and deflecting excessive water flows and waves.

Across the world the ocean supports people's physical and mental health and well-being. All of us can recall moments of tranquil calm and spiritual awe from watching smooth seas or crashing waves.

Yet we are demanding more of our oceans. They are the transport lifeline for globalised trade, and our global refuse bin absorbing human waste – most obviously carbon emissions from fossil fuels and plastics.

We are increasing our exploitation of marine resources, through fisheries and metal mining, which is now also occurring in open ocean areas beyond the jurisdiction of national governments. And our oceans are the new frontier for providing energy security by harnessing renewable energy from wind, wave and tides.

These increasing demands are challenging the biodiversity and natural habitats in the oceans, their so-called natural capital, and the life support systems provided through the ecosystem services and benefits that they deliver.

Both now, and for future generations, we must manage our activities in the ocean globally and locally to safeguard the natural capital that underpins economic and social sustainability.

The first pressure to address is climate change, a key focus of the G7 leaders. Associated ocean warming, acidification, and de-oxygenation are already affecting marine natural capital and its functioning worldwide. We can reduce global greenhouse gas emissions, and governments are aware from many sources of the needs and the innovations to do this, but addressing climate change has to be integrated with addressing the parallel global biodiversity crisis.

As we look to the ocean to provide renewable, carbon-neutral energy we are rapidly urbanising the seas and coasts in pursuit of energy with a proliferation of built infrastructure and cables.

Considering the interface of ocean and society, that may not always necessarily be a bad thing, but we should acknowledge what we are doing. This transformation is not too dissimilar from how we have modified natural habitats on land, but that has taken place over thousands of years – through farming, forestry and urbanisation – and there has been a co-evolution to habitats that, by and large, most people like.

Our transformation of the ocean is much more rapid. It also includes opencast mining of precious metals from the deep sea to support our technological innovations; the large-scale harvesting of open ocean species (from fish to squid to Antarctic plankton) that have never been harvested before; and the introduction of noise from the building works associated with renewable energy development, and from the increased shipping that supports global trade and services this new coastal infrastructure.

We urgently need interdisciplinary research – from environmental, economic, social, health and well-being, and governance perspectives (to name a few) – to understand and explain the impacts on natural capital, ecosystem services and the functioning of the ocean.

Wildlife must be managed carefully

We also need to know how these impacts will affect economies and societies, who will be the winners and losers, what the trade-offs could be, and to identify solutions that create equitable and sustainable outcomes globally from our use of the ocean and its natural resources.

Engineers, researchers and industry can work together to develop approaches and strategies that will minimise associated environmental damage, especially at the seabed.

They also need to focus on producing offshore renewable energy structures that can both maximise safe, secure and durable energy production, and enable the enhancement of marine biodiversity and associated sustainable production of food from shellfish aquaculture – and even leisure and recreation via tourism, wildlife watching and sea angling.

Careful design of artificial structures can create habitats that enhance the type of biodiversity naturally found in rocky and reef habitats, including climate-regulating species such as kelp, providing nature-based solutions to the climate crisis. These habitats will be artificial, but so are the generally admired semi-natural grasslands and woodlands that have been carefully cultivated over thousands of years on land.

Alongside our encroachment into, and transformation of, the ocean, we need to ensure that we have genuine and well-managed marine protected areas to enhance biodiversity and maintain ocean resilience in the face of change.

The evidence base concerning our transformative use of the oceans is developing, but it needs to grow as rapidly as the blue economy that is driving it. The G7 leaders and other policymakers, in addition to business and industry, and environmental managers, can only make decisions based on the best understanding and consideration of all of the trade-offs. Interdisciplinary approaches are the only way to ensure that our global ocean can remain the powerhouse of global sustainability.

The race to 2050

SHUTTERSTOCK/TEBNAD

Innovation must be matched by investment, says Deborah Greaves, head of the School of Engineering, Computing and Mathematics

The global demand for energy shows no sign of slowing. Across the world, nations are using power in ever-expanding quantities and in new sectors, such as the widespread electrification of transport. But growing awareness of our climate crisis has resulted in national and international agreements around clean and renewable energy generation. That is prompting science, governments and industry to increasingly cast their nets towards the oceans.

Offshore renewable energy (ORE) has long been recognised as having huge potential. Since the 1970s, for example, wave energy has been seen as a sustainable and clean way of powering our homes, industries and communities. And our own research now suggests it could provide at least 15 per cent of the UK's annual electricity. Similarly, the UK has the second-highest tidal range in the world and there are estimates that around 50 per cent of Europe's tidal energy resource lies in UK waters.

The UK's offshore wind infrastructure, meanwhile, contributed 9.8 per cent of the UK's power in the third quarter of 2019. The 2019 Offshore Wind Sector Deal committed the UK to building up to 30GW of offshore wind by 2030, with an ambition of increasing exports fivefold to £2.6bn. It has recently been superseded by the UK government's *Energy White Paper*, which increases this target to 40GW.

To help the country meet its net-zero greenhouse gas emissions target by 2050, all these forms of ORE will be required. So although they are at different stages of maturity, the need to maintain and accelerate research and development is paramount.

The conditions right around the UK coastline – particularly in the Shetlands, Pentland Firth and Orkney, Hebrides, Pembrokeshire, South-West England and the North Sea – remain more than capable of supporting the necessary wave and tidal energy developments. As an early leader, the UK wave energy sector has accumulated considerable experience, expertise and knowledge from the development and deployment of various prototypes and has a strong community of academics and industry. And there are estimates of up to 8,100 new jobs in wave energy by 2040.

To make that vision a reality, we need to cut current technology unit cost, which will – in turn – unlock further investment and development. It is high on the majority of ORE priority lists, while we ourselves are pursuing projects investigating innovative wave energy converter concepts using new materials that can reap the renewable rewards in a cost-effective and sustainable way.

Perhaps at the opposite end of the scale is offshore wind. The majority of existing offshore wind turbines are fixed to the sea floor in water depths up to 60m. And such sites are in limited supply. However, there is growing recognition of the need for floating offshore wind technology and the need for government to support its advancement. In that regard, the University of Plymouth recently secured funding to create the UK's first Floating Offshore Wind Turbine Test facility to enable physical modelling experiments with wind, wave and currents simultaneously. It will greatly improve understanding of how future technology advances could be impacted by atmospheric conditions, and provide a low-risk environment in which researchers can test new concepts.

Cornwall – which will host the G7 leaders in June – is home to projects fast-tracking and scaling up the development of floating wind energy, potentially creating thousands of jobs and generating hundreds of millions of pounds for local economies.

With the massive acceleration in deployments expected over the next 30 years, it is also essential that we prepare the workforces of the future. So as well as leading the academic and innovation responses for the UK, through the Supergen ORE Hub, we are also using University of Plymouth research facilities and partnerships to educate the next generation of offshore renewable energy engineers.

The Sixth Carbon Budget and Balanced Pathway, recommended by the Committee for Climate Change, would require an investment programme worth around £50bn each year from 2030 to 2050. But, more than ever before, future emissions reductions will require people to be actively involved and that must be embedded throughout policy.

Through its presidency of the 26th UN Climate Change Conference of the Parties (COP26) and the G7, the UK has a once-in-a-lifetime opportunity to be a global game-changer in this field. If it does so, the benefits for not just the nation – but the planet as a whole – could be huge. ●

NewStatesman
Standard House
12-13 Essex Street
London WC2R 3AA
Tel 020 7936 6400
Subscription inquiries:
Stephen Brasher
sbrasher@newstatesman.co.uk
0800 731 8496

Special Projects Editor
Dimi Reider

Special Projects Writers
Jonathan Ball
Rohan Banerjee
Samir Jeraj

Design and Production
Henrik Williams

Cover image
Getty Images

Commercial Director
Dominic Rae

Account manager
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Professor Deborah Greaves, OBE

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