



The sustainability pivot: energy turns to the future

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Turn of the tide

The contribution of renewables to the global grid is growing – and at a rate that is taking many by surprise

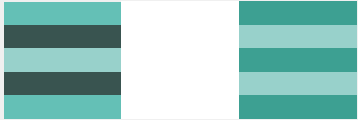


As Remi Eriksen, group president and chief executive of DNV GL, points out in the consultancy's latest energy transition report, issued mid-September: "Globally, policy developments despite some notable exceptions, continue to favour renewables technology. Last year, new renewable power capacity additions were more than double the new power capacity additions from fossil fuel."

Simultaneously there's a financing transition underway. As Eriksen explains, a reallocation of funds towards cleaner technologies is happening in the capital markets. Looking further ahead, he expects that from 2029 onwards more capital will be pouring into grids and renewables than into fossil-fuel projects in what amounts to a landmark turning of the tide.

The group is brave enough to predict the big moment – the pivot point when renewables begin to dominate the global grid. Subject to unexpected developments, DNV GL forecasts that the world's primary energy mix will be split equally between fossil and non-fossil sources by 2050. Thereafter, renewables will inevitably increase their share. Meanwhile, as electricity consumption doubles by mid-century to meet 45 percent of world energy demand, solar and wind will deliver more than two thirds of the total.

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More immediately, progress is being made on other technologies, albeit too slowly for the International Energy Agency (IEA) which has its eye on the timetable agreed in the Paris Accord. Of 38 clean-energy technologies tracked by the agency – that is, geothermal, ocean, concentration of solar, carbon capture and storage – progress is either deemed to require more effort, not be on track, or has stalled. Carbon capture and storage languish in the last category, according to the IEA's estimates.

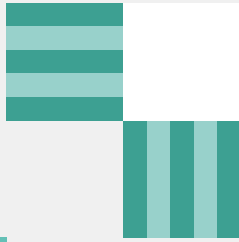
Factors of adoption

The momentum towards renewables is undoubtedly global, though it's occurring at different paces – even within regions.

In the Asia-Pacific region, China and India are backing up ambitious centralised targets with practical results.

Having been ordered by Beijing to boost production of electric vehicles (EVs) to 500,000 a year, China's automotive industry has followed up by beating the official targets – in 2017, reports the IEA, 580,000 electric cars were sold in the country, up by 72 percent over 2016. Meanwhile, nearly all of the world's stock of electric buses, which rose to 370,000 in 2017, is coming off assembly lines in China.

In tandem with the explosion in EVs, the current national plan calls for the proportion of non-fossil fuel sources employed in the provision of primary energy to hit 15 percent by 2020 and at least 20 percent by 2030.



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Solar and wind power are fundamental to these bold goals. The share of wind and solar photovoltaic in non-fossil energy is set to double to eight percent by 2020 and to 17 percent by 2030.

At the current rate of progress, wind and solar will reduce the consumption of fossil fuels by nearly 300m tons of standard coal by 2030. And as a definitive joint study by seven different research organisations, including the National Development and Reform Commission, pointed out, that's roughly equivalent to France's total primary energy consumption.

China has earmarked the budget for this transition. According to a study by Greenpeace, over the next 12 years nearly \$800bn will be deployed in wind and solar photovoltaic installations. The returns appear to more than justify the price of this epic shift – online journal Nature Energy estimated in 2015 that these two renewables will contribute \$2.1 trillion to China's gross domestic product in the 15 years to 2030.

Elsewhere in the region, Australia is moving rapidly towards a renewables energy future, despite political upheavals that threaten the National Energy

Guarantee (NEG). The guarantee was supposed to set power suppliers explicit percentages of the energy mix that must be provided by coal, gas, oil, hydro, batteries and renewables, but it looks like the NEG will become a victim of the toppling of prime minister Malcolm Turnbull, a believer in climate change.

The guarantee grew out of the "System Black" failure that knocked out parts of South Australia for two days in late 2016. "The driving force from this move away from the federal governments preference for renewable energy to fuel neutrality is the need for consistent and reliable energy to keep the lights on, full stop," explained law firm McCullough Robertson about the guarantee.

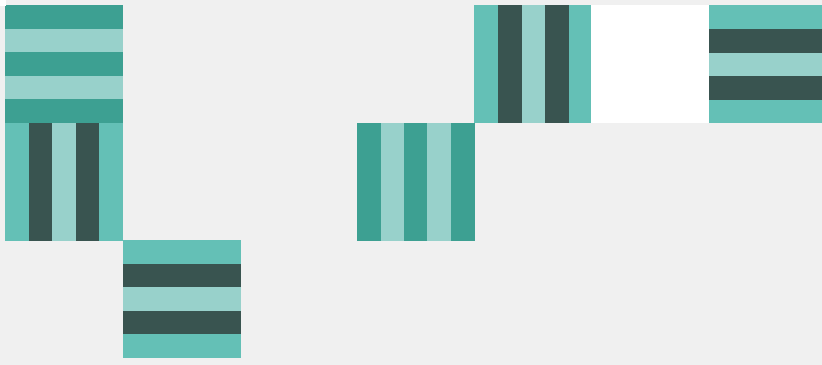
However state governments are ignoring the federal government and pushing ahead independently with renewables. As the chief executive of the Clean Energy Council, Kane Thornton, said in an interview in September, private money is following suit. Pointing out that the cost of renewables has plunged, with the long-run cost of large-scale solar plants coming down from \$200m to \$50-\$70m in the last three or four years, he said: "If we're building new power stations in this country, very clearly wind and solar are the cheapest form available. Indeed private investors are only interested in funding and building these kinds of projects."

In the European Union in 2017, wind added about 14 gigawatts of installed capacity, with offshore wind making an outsize contribution, and solar contributed a further seven gigawatts. Combined, wind and solar are on a trajectory to reach a combined Europe-wide fleet of more than 400 gigawatts by 2020.

As law firm Dentons points out in its latest European renewables survey: "Offshore wind was again a standout, with a further three gigawatts now turning in the northern seas, including the quintet of turbines making up the world's first floating array, the UK's Hywind Scotland."

While the tail wags the dog in the US, it's the other way around in the EU where Brussels is pushing its Clean Energy Package onto sometimes slow-responding member countries. The pace of the swing is uneven. Germany is steadily moving towards a target of 40-45 percent of electricity supply coming from renewables by 2025 as it phases out nuclear power plants, while a number of countries in Eastern Europe hardly figure at all in new clean energy investment.





Most analysts are equally optimistic, predicting a boom in storage in the next decade as capacity increases exponentially, from the current single-digit gigawatts of installed capacity to around 125 gigawatts globally

By contrast, the UK is turning into a global model for renewables. In 2017, capacity in renewable electricity generation jumped by 20 percent to 32 gigawatts despite cuts in subsidies.

In the US, the Trump administration appears to be out of step with many states as well as the oil and gas majors on the issue of clean, renewable energy.

In early September California governor Jerry Brown signed a law that would require 100 percent of the state's electricity to come from carbon-free sources by 2045. That makes California "the most populous state to go completely green in terms of energy production," pointed out law firm Foley & Gardner, in a recent briefing. Interestingly, unlike Hawaii which has also mandated an all-renewable grid, the California legislation "provides leeway to pursue resources beyond just wind and solar," explains Foley & Gardner.

Yet a month earlier – on August 21, under pressure from the president, the Environmental Protection Agency (EPA) unveiled draft proposals for the Affordable Clean Energy rule (ACE) that is intended to replace the Obama era's Clean Power Plan (CPP). Regarded by the renewables sector as a retrograde move, ACE reverses CPP's systematic approach to regulating greenhouse-gas emissions. Instead it limits itself to requiring onsite efficiency improvements at existing coal-fired power plants. These 'candidate technologies', as ACE describes them, can include anything from intelligent soot-blowers to improved maintenance practices. The requirement to adopt carbon capture technology has been removed.

As law firm Dentons pointed out in a late August briefing: "ACE represents a victory for some in the electricity sector who lobbied the Trump

administration not to merely repeal the CPP, but to instead issue narrower CO2 standards for power plants." The firm predicts though that states and environmental organisations will use litigation to block ACE until after the 2020 presidential election. In a repudiation of the president's policies, states, cities and corporations are forging ahead with their own policies to reduce CO2 emissions, encouraging the shift to renewables. "The power sector will continue to decarbonise even if the ACE rule is fully implemented," foresees Dentons.

In another contradiction, the forecasts for coal production produced by the EPA conflict with the evidence. While the EPA estimates coal production will increase by 2035 and natural gas production will actually decline, the US Energy Information Administration (EIA) and other sources say the opposite. The EIA's current projections are for 13.5 gigawatts of coal generation to be shut down in 2018 alone.

Technology

Rapidly improving technologies are behind the turning of the tide. As the director of America's National Renewable Energy Laboratory, Martin Keller, told this year's Global Smart Energy Summit in Dubai that new developments, notably in wind and solar, can now be delivered "at such a low cost that [they are] in many areas the cheapest way to create electricity."

Simultaneously, Keller points out, "Dramatic advances are being made in energy storage, which has long been seen as one of the biggest obstacles to the growth in renewables. The cost of storage is dropping so rapidly that suddenly the combination of storage and renewable energy is getting very interesting", he told the conference.

Most analysts are equally optimistic, predicting a boom in storage in the next decade as capacity increases exponentially, from the current single-digit gigawatts of installed capacity to around 125 gigawatts globally. Europe is slated to be a leading storage market.

With all this happening, renewables of all forms are becoming essential elements of the overall energy mix, completely overturning the historic grid system. "The whole model is completely changing, being turned on its head, so now suddenly customers will have more choice," explains Keller. "The grid will go bi-directional and [consumers] will have more influence on how we manage the grid."



A renewables powerhouse

UK attracts new wave of renewables investors

It used to be said of Britain that where there's muck there's brass. Today it's more a case of the brass being where there's wind, sun and biomass. We have spoken to Lloyds Bank, who has a public commitment to help finance UK renewable energy projects, that could power the equivalent of 5m households.

The level of public subsidies for renewables may be falling in the UK, as it is in the EU, but investors appear undeterred and are hurrying to plug the financing gap. Tenders for renewables have been fiercely competitive as the smart money sees the medium and long-term potential.

The secondary market has been particularly active as earlier projects are being refinanced or sold to new owners with a lower cost of capital. In tandem there's a move towards storage-backed projects, both new and existing. Although storage technology remains embryonic, the long-term financial benefits are significant. Such projects mean investors can benefit from revenue streams that would not normally be available to wind or solar projects, such as the capacity market or national grid ancillary services payments.

A big attraction of the UK renewables market remains its stability. That's in terms of availability of financing, integrity of the judicial system in, for example, contracts law, and stable cashflows. In short, unlike some other jurisdictions, there's comparatively little country risk.

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Guillaume Fleuti, Lloyds Bank



Jonas Persson, MD,
Head of Sustainable and
Natural Resources, Lloyds Bank



Guillaume Fleuti, MD,
Head of Infrastructure,
Lloyds Bank

“Investors are looking for maturing technologies and certainty of cashflows,” says Lloyds Bank’s Jonas Persson, Managing Director and Head of Sustainable and Natural Resources. “[They’re looking] for long-dated inflation protected offtake deals.”

Adds Guillaume Fleuti, Managing Director and head of the bank’s Infrastructure team: “In the UK we’re seeing legally binding, 10 to 15-year offtake contracts and/or long-term subsidy. There’s low political risk and low commercial risk. Investors like that kind of certainty.” Simultaneously, the market is consolidating as investors seek economies of scale. Just one example is the merger of two independent wind farm groups, Infinis and Zephyr, into Ventient Energy owned by institutional investors. Another is the £1bn Kingfisher strategic partnership formed between Blackrock and Lightsource in mid-2017 that is aiming for a gigawatt of installed solar capacity by 2020 in a series of takeovers.

In addition to the equity investors, institutional investors, such as Scottish Widows, LGIM and Aviva have become relevant debt providers to the UK renewables industry. This is especially true for operating projects, but we are now also seeing them taking managed construction risk if the debt is investment grade equivalent. Institutions such as Lloyds Bank, that can partner with insurance companies such as Scottish Widows, offer a unique proposition. There is also an increasing recognition by companies and banks alike that there is a corporate social responsibility to focus on the environment. This has fomented funds such as the Lloyds Bank’s £2bn Clean Growth Financing Initiative (CGFI). The initiative aims to be the most inclusive and ambitious UK green funding proposition in the market; incentivising businesses of every type to invest in a lower environmental-impact economy by providing discounted lending for green purposes.



Storage

The government has by no means stopped backing renewables. "Government subsidies are supporting larger-scale developments," explains Persson. "That's particularly true of offshore wind. The key is to get more renewables in the system and that needs complementary technologies such as batteries. Storage is absolutely the key. Britain increasingly needs large scale storage technology as well as reliable base load capacity to manage intermittent power. Storage is still in its infancy but there are signs upscaling is happening – we certainly think we will see big progress in the coming years."

Meanwhile, Fleuti adds that "we are seeing substantial cost reductions in solar and wind in the UK." He expects that solar, for instance, will halve costs again over the next ten years.

Brexit

Although the uncertainty of Brexit hangs over the UK economy in general, it is not seen as a threat to the long-term viability of the renewable sector, according to a consensus of analysts. Currently, government policy favours offshore wind, biomass from waste and other advanced technologies.

Further down the track, there's lucrative export potential in UK renewables technologies. Fleuti highlights floating offshore winds as a possible winner in the future, depending to some extent on how the Hywind farm or other pilots perform. With a total capacity of 30 megawatts, Hywind lies 25km off Peterhead, Aberdeenshire, and it's of high interest to the entire renewables industry.

The UK needs all the renewables it can get. Inevitably, demand for electricity will rise in coming years, "consumption will continue to increase in the near term," warns Fleuti, citing, for example, the proliferation of EV-charging stations. "They will put a lot of pressure on grids."

The government will also put pressure on consumers. Households will be expected to increase their reliance on solar power and install 'smart-home' technology. Fortunately, public attitude has turned a corner and we now expect power providers to do their bit for the planet.

This in turn puts pressure on the supermajors that have been built on last century's oil and gas boom. However, "The majors have certainly woken up," says Fleuti. "They are putting a lot of firepower and skill into renewables."

Thus Shell and Total are at the forefront of battery storage while BP is making big strides into solar power. "Will they support all technologies or will they choose

which one to concentrate on?" asks Fleuti rhetorically. "We don't know, but the supermajors have never been shy about making important decisions."

Adds Persson: "Also, we can't forget that some of these are national champions with obligations to meet official renewables targets. Overall, we're seeing a growing focus on cutting-edge renewables technology."

He continues: "Going forward, we will have a broader and more sustainable energy industry. We are moving into a transition period where all energy technologies will be better connected and no longer operate in silos."

In short, a new and more sustainable world.



Big Oil's dilemma

The largely unpredicted collapse in the cost of renewable energy has landed the supermajors in a dilemma about their future that some are only just beginning to tackle. As the International Energy Agency estimated earlier this year, the global average cost for onshore wind has fallen in the last five years from around \$11 per kilowatt hour (for US wind costs) to \$5, while the cost of solar has plummeted from \$17 to \$6 over the same period.

Further falls are on the cards. As the Oxford Institute for Energy Studies (OIES) pointed out in a recent report, in the case of wind power, further deflation to \$4 per kilowatt hour by 2020 is within striking distance. The report notes that "renewable energy's recent cost deflation has been nothing short of revolutionary for the global energy industry."

It's therefore likely that renewables have suddenly hit a deflection point from which their integration into energy supply will accelerate.

It's an interesting – and potentially very profitable – point of inflection for the majors. "The challenge for oil companies is the disruption of their business models, and how to integrate low-carbon assets into their portfolios," the OIES report concludes. "[They] need to gradually extend their business model rather than completely shift from hydrocarbons to renewables."

And Big Oil agrees. "The pace at which renewables gain share in power generation," summarised BP in its 2018 Energy Outlook, "is faster than any other energy source over a similar period." According to BP's numbers, renewables will capture around 40 percent of new demand growth by 2040, accounting for 14 percent of all primary energy.

Reading the tea leaves, some of the oil giants are moving further toward renewables adoption, and building their infrastructure as such. Of seven new projects brought onstream by BP in recent years, six are gas rather than oil-based – suggesting a strategic pivot. "Others such as Shell and Total are making a similar shift," notes the OIES report.

Along the way the giants have learned a lot about renewables. As Shell chief executive Ben van Beurden said late last year, the company "couldn't make any money out of [solar]." And in early 2018, BP chief executive Bob Dudley acknowledged the group's earlier failures with solar (in 2000 it was the third-biggest solar company in the world), saying BP would have to develop new models for future renewables projects.

Given Big Oil's track record for rapidly adapting its business models, it's unlikely it will make the same mistake twice.

Financing the rise of clean energy



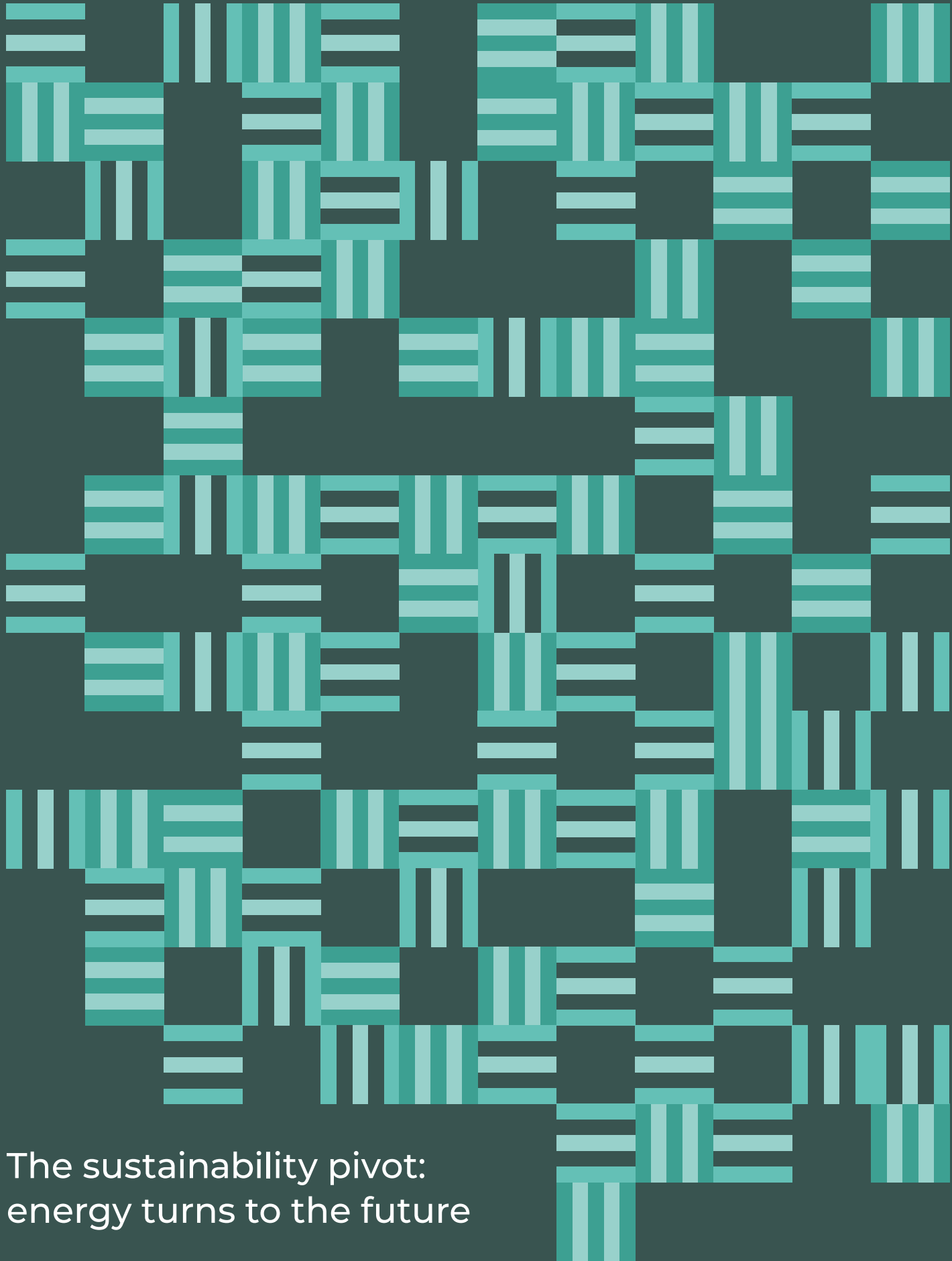
From innovations in energy efficiency to large-scale renewable infrastructure, we're by the side of businesses. Discover how our £2bn Clean Growth Finance Initiative can help your sustainability goals take off.

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