This Month In Energy

Issue 1 | October-November 2022

A welcome from The Editor

Dear reader, it gives me great pleasure to welcome you to the first edition of This Month in Energy - Durham Student Energy's paper on all things energy. My name is Josh, founder and inaugural editor-in-chief. In this publication, we aim to provide updates and summaries on major stories across the sector; produce insightful explainers on fundamental concepts in the sector, and promote societies and events here in Durham that champion our transition to a sustainable future.

As a new project, we are always looking for contributors for future issues, so I urge you, to follow the links on our social media to add your expertise and enthusiasm to our team.

Lastly, a thank you to our first writers, who have taken time out of their especially busy schedules to research, write, and refine such excellent articles for something that, until this moment, has been a mere vision. I hope you enjoy the fruits of their labour and return for our next issue.

How Robots may soon revolutionise wind turbine repair

Offshore wind turbines (open licence - Pixabay)

By Ellie Krefting
Student

Today, the energy sector faces many challenges, the most relevant of late being energy security. The production of sustainable electricity from renewable sources such as wind is a vital part of our energy future, as evidenced by its significant role in the government's plan to meet the United Nations' Sustainable Development Goals [1]. With 13 UK offshore wind farms, the Hornsea 1 facility being the largest in the world, enough electricity is collectively produced to power over 7 million homes across the country [2]. However, to meet the UK government's plans to reach 50 Gigawatts of energy from offshore wind by 2030, the current operational capacity will have to increase four-fold [3]. The industry is undergoing a period of research and development in hopes of rapidly increasing the profitability of these assets, which would, in turn, make their construction a more enticing prospect. This aim is currently being developed through various means, for example, increasing the size of the blades to generate more energy, as well as making further optimisations to designs to minimise the cost of upkeep [4].

Larger turbine blades with larger rotor diameters 'capture' more wind, thus producing more electricity. Wind farm technicians are also under more pressure to carry out regular maintenance checks and repairs to ensure the wind turbines are performing as expected [4][5]. Alongside this development, wind farm technicians are required to carry out increasingly regular maintenance activities [4][5], including turbine servicing, foundation inspection, electrical and electronic control maintenance, performance analysis, upgrades, and breakdown repairs. For example, the Rampion Offshore Wind Farm, employs 60 full-time employees to maintain its 116 turbines in the English Channel [6]. Although this seems a modest workforce, with these jobs involving highly specialised rope-access technicians abseiling down the side of the wind turbines to access specific parts of the blade directly, much of their work is often to tighten or replace bolts, which degrade over time.

As the turbine blades grow, technicians face more significant risks due to working at greater heights and monitoring larger surface areas of the edges [7]. This arguably disproportionate risk for the complexity of the task is exacerbated by the remote nature of many of these facilities, especially in the case of offshore wind farms, which can cover vast areas of sea at least a dozen kilometres from the coastline. The previously mentioned Rampion plant is a prime example of this. Located in the English Channel between 13 and 20 kilometres (about 12.43 mi) from the Sussex

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A vision of the role of Hydrogen in the Energy Transition

By Christian Johnson
Student

The UK government's decarbonisation roadmap pledges net-zero by 2050 and commits to leaving the nation's natural environment in a state that leaves it fit for future generations. Current predictions by Deloitte state that hydrogen will play a crucial role in the UK's transition since it can provide a low-carbon mode of storage and transportation. The energy crisis we face, due to the Ukraine-Russia conflict, has further exacerbated the need for national energy security. This article will explain the different types of Hydrogen and their uses and analyse how it can become more attractive for investors.

Hydrogen can act as a low-carbon substitute for fossil fuels, particularly in sectors where greenhouse gas emissions are hard to diminish. However, electrification through batteries is not possible in some instances due to the need for high energy density. Lord Bamford, CEO of JCB, explains that although smaller machinery can be fully electrified, batteries cannot yet power the larger and more fuel intense machinery. Furthermore, the current charging times of batteries render them impractical for industrial activity. The development of hydrogen-compatible internal combustion engines could replace existing engines in these machines as a low-carbon substitute at a relatively low initial cost. Essentially, the same machinery with a different inside.

Pure hydrogen has an energy density nearly three times higher than natural gas (120 megajoules per kilogram (MJ/kg) versus 45.5 MJ/kg, respectively). This means it carries more energy and is easier to transport. Therefore, existing natural gas pipelines can be modified to transport large quantities of hydrogen. This method of transportation is economically advantageous as the networks are already widely available. Siemens predict the conversion cost will be 10-15% of constructing an entirely new

In the News:

A few of our favourite stories from the last month.

1. Government plans to decouple gas price from general energy prices -11th October
https://www.current-news.co.uk/news/government-sets-out-plans-to-decouple-power-and-gas-prices-in-new-energy-prices-bill

2. Wales to establish publically funded energy developer - 25th October
https://www.energyvoice.com/renewables-energy-transition/454744/welsh-government-to-create-state-owned-renewables-developer/

3. Despite £8.3 billion Q3 profit shell pays no windfall tax - 27th October
https://www.theguardian.com/business/2022/oct/27/shell-doubles-its-profits-to-95bn

5. Coventry to host Birtian's second energy superhub - 2nd November
https://www.energylivenews.com/2022/11/03/edf-renewables-building-50mw-battery-site/

6. National Grid demand-side flexability trial underway - 4th November
https://www.current-news.co.uk/news/national-grid-esos-demand-flexibility-service-goes-live

7. Households offered smart, zero-emission boilers for free in new trial - 8th November
https://www.energylivenews.com/2022/11/08/households-offered-smart-zero-emission-boilers-for-free-in-new-trial/

8. Understanding the carbon budget and its implications on climate policy -11th November
https://www.carbonbrief.org/guest-post-what-the-tiny-remaining-1-5c-carbon-budget-means-for-climate-policy/

Inside...

Events

Seminar and Network session

Join us for a night of talks from professors Peter Tavner and Sarah Knuth. Followed by Q&A and Networking Session.

Clean Energy: Are we making Progress & Energy Resources: Financial Innovation and Risk
24th Novemeber 6:00 - 8:30 pm - TLC117

Follow the QR code to book your FREE tickets!

Society Spotlight

ecoDU

A climate action group currently leading the fossil free careers national campaign here in Durham, with interests in taking on food waste and climate injustice.

Meetings regularly on Mondays 6pm. Follow their social media for details:

@ECoDUrham

@eco_durham

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Engineers hopeful remote turbine maintaince may save lives (and money)

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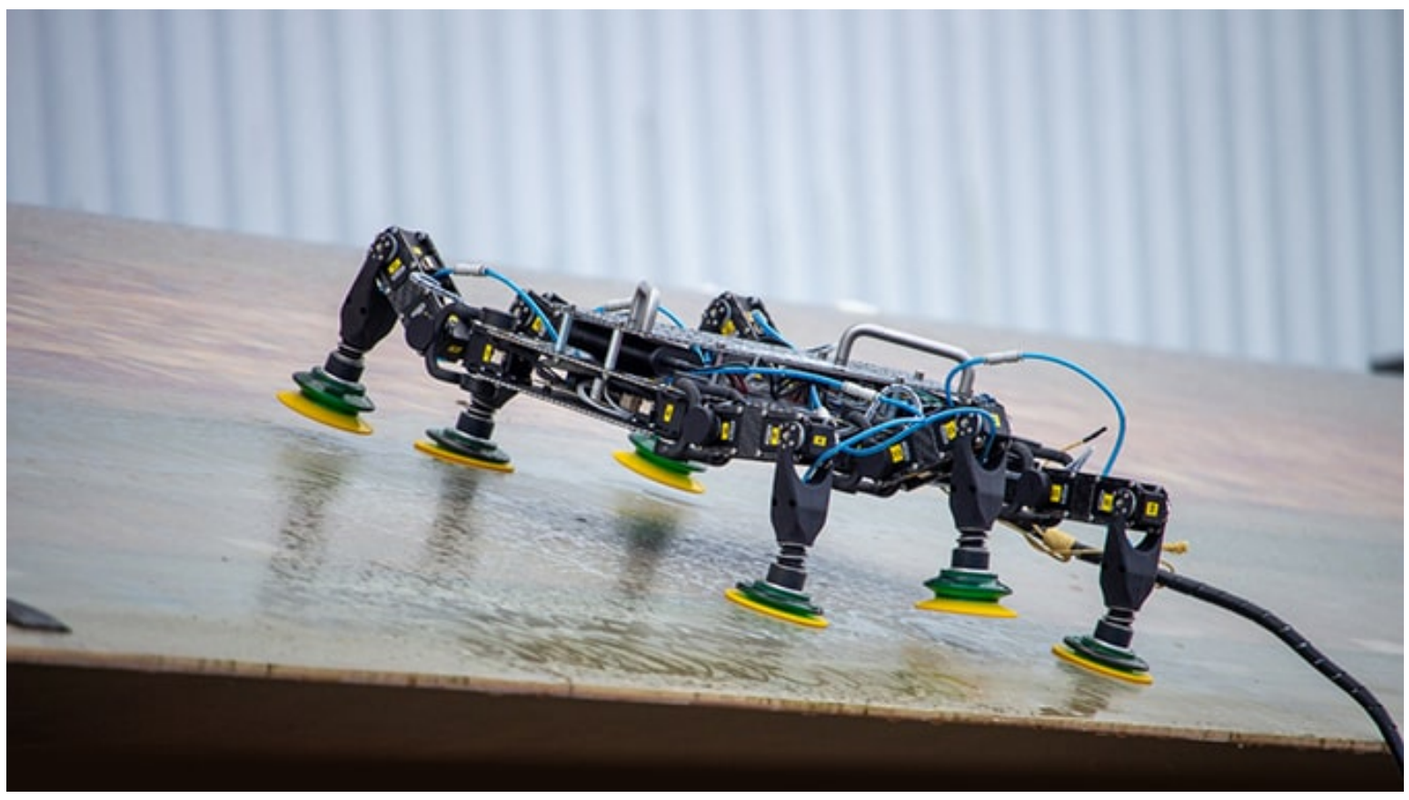
coast, it covers an area of 72 square kilometres, larger than the island of Guernsey in the English Channel [8]. This added factor complicates maintenance procedures even in the case of land-based turbines, requiring extensive planning, fail safes, and expertise for each process, an issue only getting worse with the greater blade lengths.

To overcome these challenges, BladeBUG ([pictured above), an innovative start-up concerned with offshore sites, is developing a robot to simplify inspecting and maintaining wind turbines [7]. The project, which started in March 2019 with funding from the ISCF Robots for a Safer World challenge [5], have been developed as multi-legged walking devices which use vacuum pumps to stick to the surface of the wind turbines. The robots can adjust their shape and movements to adapt to different surface angles and dimensions [3]. The founder of BladeBUG, Chris Cieslak, spoke on The Re-energise Podcast about how these devices could significantly reduce the cost of completing thorough inspections and even have the potential to be adapted by technicians to complete early-stage repairs [7]. The technicians will still be required in the maintenance activities to remotely control the BladeBUG's precise movements with a gaming control device from the top of the turbine [3]. This way, the risk to human life (and the expenses that come with protecting it) will be significantly reduced as there will be no more need for in-person assessment. A system of sensors on the robot allows direct communication to enable the technicians to see and gain an understanding of the surface on which the BladeBUG is positioned as they would if they were carrying out the inspections themselves [3]. BladeBUG argues robotic assistance technology will play a significant role in ensuring the offshore wind industry's safe, scalable growth. The wind turbines can be checked quickly and safely through the collaboration of technicians' expertise and the robots' precise movements to access hard-to-reach places. As a result, the wind turbine downtime will be reduced as defects will be anticipated, identified, and resolved on a much shorter timescale than is possible to do by a rope access team alone. Furthermore, these technologies will allow for more flexible repair, with technicians able to make more informed decisions about the work required. For example, a clearer view of a part may mean that only a small piece needs replacing rather than the whole part, which will reduce cost, maximise asset lifetimes, and push the UK to reach its 2030 renewable energy goals [5].



'BladeBug Prototype (JPEG Image, 675 × 378 Pixels)'. Accessed 7 November 2022. https://bladebug.co.uk/images/IMG_4148.jpg.

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[2] Our Offshore wind farms, Orsted, accessed on 16/10/22, <https://orsted.co.uk/energy-solutions/offshore-wind/our-wind-farms>
[3] BladeBUG: using robots to maintain offshore wind farms, YouTube, UK Research and Innovation, 14 Dec 2020
[4] The Economic Value of Offshore Wind, ORE Catapult, accessed on 16/10/22, <https://ore.catapult.org.uk/app/uploads/2017/12/SP-0012-The-Economic-Value-of-Offshore-Wind-1.pdf>
[5] BladeBUG Limited, accessed on 16/10/22, <https://bladebug.co.uk/>
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Immenient policy decisions may make or break the a Hydrogen future

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pipeline. Ongoing research calculates how effective hydrogen can be if mixed with natural gas in pipelines. If this proves possible, the transition to hydrogen is relatively cheaper than other low-carbon alternatives and can happen organically.

The issues with hydrogen come into play when considering how it is produced. Hydrogen is created in three distinct ways. Grey hydrogen is extracted from fossil fuels using a process called 'steam reformation'. This process requires a significant energy input and releases Carbon Dioxide (CO2). Blue hydrogen is created in the same way as grey but is a CO2-neutral process since Carbon Capture, and Storage/Usage (CCS/U) methods are employed. Green hydrogen is produced through water electrolysis. Electrical currents are passed through water, separating the hydrogen and oxygen molecules depending on their atomic charge. If the electrical input comes from a renewable source, the process is entirely CO2-free but this makes the process more expensive (2.5-6USD/kg for green versus 1-1.USD/kg for grey). However, most hydrogen (95%) is predominantly created using steam reformation (grey/blue hydrogen) and goes towards producing fertilisers. Almost no hydrogen goes towards power, transport, or shipping. If hydrogen can be considered an adequate substitute for fossil fuels, more research is needed to develop its use as energy. Moreover, green hydrogen must be the primary source of hydrogen to contribute to the UK's transition to net-zero effectively.

Substantial investment is required to build a prosperous green hydrogen-based economy to make the existing technology cost-competitive with other energy sources. Current predictions are that the cost of transitioning to a hydrogen-based market will be around 11.4 billion GBP. Large-scale applications and production efficiency have the most significant influence on future costs.

Green hydrogen has a direct relationship with the supply of renewable energy. It is expected that by 2030, 62% of renewable energy projects will be cheaper than a new fossil fuel plant. Thus, models predicting growth and future costs are vitally important to incentivise and determine where the investments should be targeted. Blue hydrogen will likely be cheaper than green by 2035 since the development of CO2 avoidance methods seems more cost-effective in the short term than electrolysis costs. However, there are currently no CCS/U plants in the UK; hence, the cost predictions range from £30 to £330/tCO2. For hydrogen to become more attractive to investors, models need to accurately prove that there will be high future demand for hydrogen, which gives confidence that they will see consistent returns. J.P.Morgan state that hydrogen-linked equities have quadrupled in value from 2019 to 2021 before falling 35% of peak levels. The hydrogen market has similar responsiveness and volatility to oil. But the greater lack of confidence in the hydrogen market` and the unpredictability of future demand makes significant investments deemed risky.

Gas Valve (open licence - Pixabay)

Effective Governmental policy and legal framework would help show state support for the hydrogen market, encouraging further investment. The hydrogen market in Europe is the fastest growing and potentially the largest energy market due to strong governmental support and ambitious CCS/U development plans (forecasts state it will be between 50-125bnEUR by 2050). The UK government has been criticised that its decarbonisation pathways to reach net zero are too broad and lack foundation. However, developing a targeted and focused path for the UK's hydrogen strategy could provide greater certainty and stability for investors. Furthermore, green hydrogen cannot be expanded without an increase in the supply of renewable energy. Therefore, the policies or frameworks created must work together and recognise interdependencies with other schemes.

The conversion of existing gas infrastructure for transportation and storage opens up the possibility of relatively quickly building a hydrogen-based economy. It will ensure energy security as the UK shifts to renewable sources to reach its goal of net zero by 2050. Immediate action plans and pathways must be made in collaboration with various stakeholders to ensure they are focused and effective. In turn, specific and meaningful investment can help the UK develop a hydrogen-based economy. Unfortunately, there is no golden bullet. The government will be required to work in collaboration with every stakeholder. The pathway they create needs to incorporate the complexities of the transition whilst still showing confidence for investors.

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The Energy Charter Treaty - An explainer

Louis Renouf
Student

The Energy Charter Treaty (ECT) was established in 1998 after the collapse of the USSR to integrate the energy sectors of formerly Soviet nations into the European and broader world markets. Given the uncertainty about these new emerging markets, external investors were cautious to invest in the former Soviet bloc, so the treaty was created primarily to protect energy investments. It has since expanded to promote trade, transit and provide means to resolve disputes. The ECT has more than 50 signatories, including the EU and its member states. According to the European Commission, the ECT is a 'multilateral framework for energy cooperation.

However, on Friday, 20th October 2022, France announced that it would withdraw from the Energy Charter Treaty (ECT) a day after the Netherlands' announcement to do the same thing. The trend is continued across Europe. It is likely that Germany will withdraw in the coming months, and partners Spain and Italy have marked their departure in years past, all to the praise of climate activists, including Greta Thunberg.

Why are nations moving away from this seemly historic agreement? The issues lie in its inherent disconnection with the Paris Climate Agreement. The problem stems from vague terminology in the treaty, particularly in Article 10 titled 'Promotion, Protection and Treatment of Investments' and Article 13 called 'Expropriation'.

The Trade Justice Movement provides a strong critique of the ECT. First, the country should provide 'stable, equitable, favourable, and transparent conditions' to investors, making it very difficult for countries to introduce new policies that could impact investors' profits. Article 13 gives investors significant power and limits the government's regulation freedom. For example, if a country brings in a law to phase out fossil fuels, investors in fossil fuel energy can argue that they are not creating 'favourable conditions' and sue governments.
Originally, 'Expropriation' was used to protect companies from nationalisation. However, Article 13 has been interpreted by many investors as meaning any measure which harms an investment. If an investor loses any money due to expropriation, they will be compensated promptly, adequately and effectively. The word 'adequate' is very vague as they could have been explicit and said that the investors would be paid back plus interest. Instead, it is left open for interpretation. The use of 'fair market value' means that companies are compensated for the profits they hope to make in the future, which means the companies are being paid significantly more than what they initially invested. Compensation comes from taxpayers' money, and the risk of being sued creates a regulatory chill where companies no longer make changes that would be necessary, for example, for environmental protection, as they could harm an energy company's profits.

The amount of compensation is decided through the arbitration claim called Investor-State Dispute Settlement (ISDS). Article 26 states that countries must 'give their unconditional consent to the submission of a dispute to international arbitration or conciliation following this Article's provisions. Between 2011-2020, 106 out of 697 known ISDS cases started in this period have used ECT.

Numerous investors have used ISDS to sue governments. For example, RWE wants the Netherlands to pay 1.4 billion euros due to the country's decision to phase out coal-fired generation by 2030. Uniper is also suing the Netherlands for the same reason but for 1 billion euros. In August, Rockhopper was successful in suing Italy for 250 million euros due to the banning oil drilling in the Adriatic Sea. Rockhopper had only invested 25 million euros. Even though Italy withdrew in 2016, the

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country is subject to a 'sunset clause' in the treaty, meaning it must follow the rules for 20 years after its withdrawal. Another UK corporation, Ascent Resources, is now suing the Slovenian government for over 500 million euros due to the country's ban on fracking. Even if the lawsuits are not successful, they are costly for states to fight.

In June, the European Commission put forward a 'modernised' treaty, following a few years of negotiation, which they believe makes it compatible with the Paris Agreement. However, even after this modernisation, The Netherlands, France, Spain, and Poland still withdrew. The modernised deal includes a 'flexibility mechanism' allowing countries to get rid of investment protection for fossil fuels when it goes against their climate goals. The UK and EU are the only two parties using this mechanism which carves out legal protection for fossil fuel investments 10 years after this reform was implemented and which gets rid of protection for new fossil fuel investments after 15th August 2023. However, investors can still sue countries over the coming decade.

The agreement also states that the ECT will no longer be applied to

Power Station (open licence - Pixabay)

intra-EU arbitration cases, meaning that EU investors can still use the ISDS in non-EU countries. Furthermore, any country wishing to withdraw is still bound by the sunset clause of 20 years, meaning that current investments will still be protected, and governments can still be sued for the next 20 years. Some argue against the withdrawal since the ECT also protects Renewable Energy investments, not just fossil fuel investments, however, this has been claimed to be partially true.
All signatories to the ECT are expected to ratify the agreement on 22nd November. However, it is still undetermined if the EU council will reach a qualified majority as Poland and Spain are reportedly voting against it, whilst Italy, France and Belgium are said to abstain.

The coming months will decide the future of ECT and if a new form respecting the unique challenges of our time could emerge or be left as a footnote in history.

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