
GREEN
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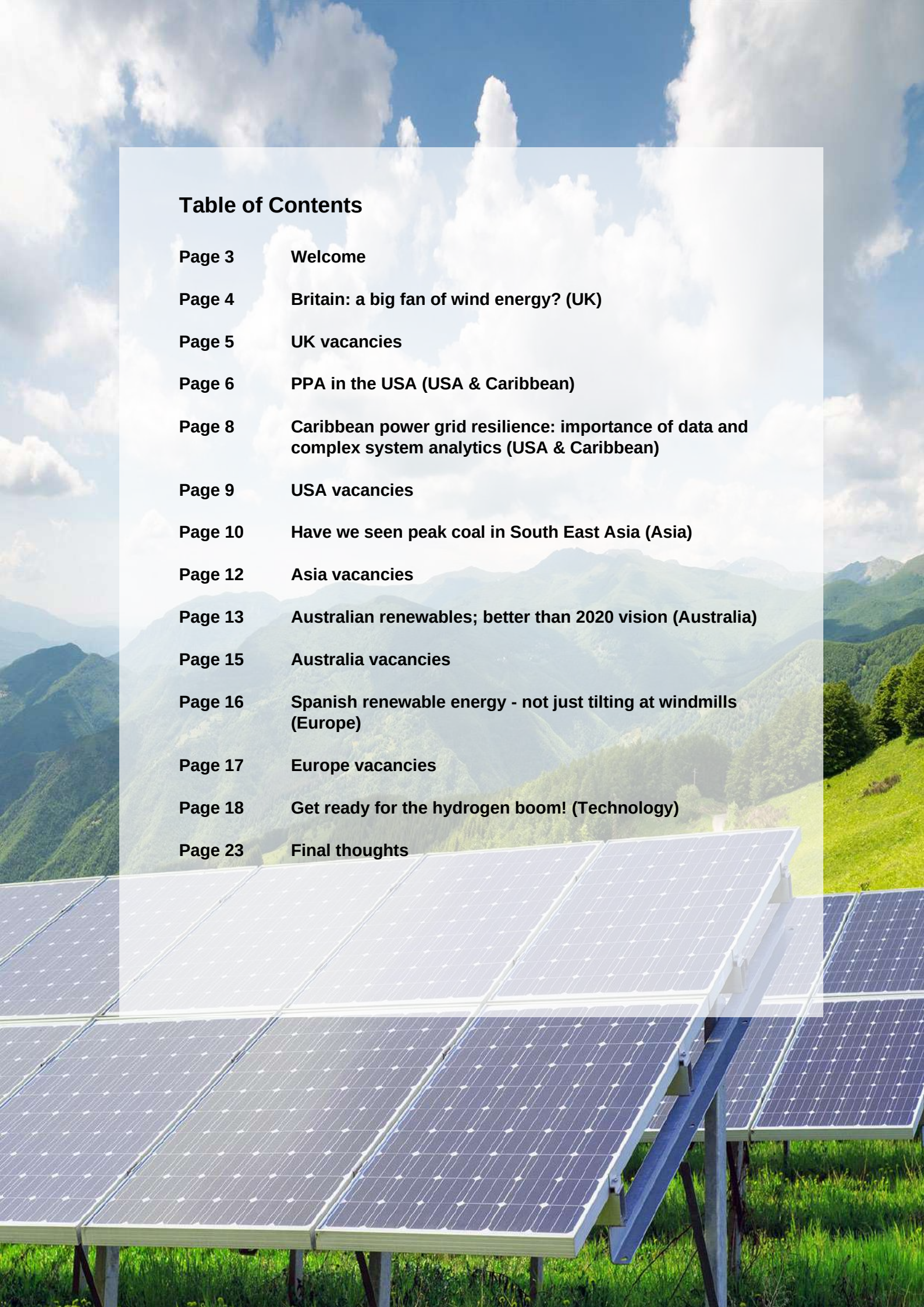

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# Welcome

By Dominic Wall, Director
dominic@greenrecruitmentcompany.com

Welcome to the Autumn edition of the Green Insider. This is the third edition of our quarterly newsletter. Our team continue to really enjoy discussing the latest developments and the future of the sector with you all and would like to thank you for all the encouragement and support they have received.

In this edition we've continued our geographic focus. We've recently launched a new office in the Caribbean and are pleased to invite our regional partner, Ian Gilmour to discuss grid resilience in the Caribbean. In the rest of the edition; Harry Davies examines the rise of PPAs in the USA, Qihan Geng looks at whether we've reached peak coal in South East Asia, Tim Hall looks at what Australia must do next having hit their 2020 target, Andrew Green checks the pulse of the UK wind energy sector, Harry Moncur discusses the state of Spanish solar and Tom Brookes provides an in depth look at the growing hydrogen market.

As ever we're keen to get your thoughts and feedback on the latest developments in the sector and on this current issue. If you have any ideas on future topics we can cover, please get in touch.

Yours Sincerely,

Dominic Wall

# Britain: a big fan of wind energy?

By Andrew Green, Head of Wind Energy & Energy Solutions, andrew@greenrecruitmentcompany.com

**Great weather, we're having…**

A few years ago, a survey found that nine in ten Britons had talked about the weather in the last six hours. It is a well-worn but true cultural trope that Britain is a country obsessed by the weather, Rhod Gilbert, the comedian, once joked "In the Bible, God made it rain for forty days and forty nights; and that was still the best summer we had!" In fact, in Britain our severe doubts about the existence of sunlight (we know it happens elsewhere) has led us to become active proponents of wind energy. By 2030 Britain plans to generate a third of its electricity needs from wind power, while Scotland, in keeping with its forward thinking on clean energy was able to generate double its domestic energy need from wind energy in the first six months of 2019. This article aims to have a look at the recent developments in the UK wind energy sector.

**Wind energy is winning the price war**

A long-term challenge for renewable energy in the UK has focused on cost. As with most things British there is a contradiction to resolve, most British people are willing to pay more for a better service, but we're also completely baffled by the concept of tipping even in situations where we have received a better service. For a long time, this was a problem for renewable energy – it was undoubtedly better for the planet but also more expensive, in an era of price comparison sites and lower quotes there was a real problem for consumers. However, wind energy has now turned a corner in the UK, the recent "contracts for difference" auction for Offshore Wind energy saw 6GW awarded with Forthwind consortium's Dogger Bank project and Innogy's Sofia Offshore Wind Farm winning 5GW of the 6GW. The major talking point was the winning price of £40 per Megawatt Hour. That was a third lower than the 2017 auction, the price takes it below the current wholesale cost paving the way for offshore wind energy to provide power cheaper than gas plants.

**Mixed results for offshore innovation and more investment needed.**

The UK has historically been a great centre for innovation in wind energy e.g. the Dogger Bank project will be home to the world's largest wind turbines, standing 220m tall with blades more than 100m long. However, there is a genuine fear that Britain has let an early advantage in floating wind energy disappear. Scotland is currently home to 56% of the world's floating wind capacity and the UK was the home of the first floating wind scheme. However, a recent report from Strathclyde University suggests that Britain has fallen behind in the technology and is in serious risk of limiting future floating offshore schemes. It would be very timely if this trend was reversed through significant government support. This support should also be linked to improving the accessibility of energy storage solutions for offshore energy, this would expand upon the great work already done by the ORE Catapult's Grid Connection Support Series.

**Don't forget onshore wind**

The UK is also not free of an issue that effects the wider European onshore wind sector, that of old wind farms. Much of the UKs onshore capacity was built in the late 1990s with an expected lifespan of 20-25 years, this is creating a potential energy gap the UK's 2030 renewable energy target. The situation is not too late, around 8GW needs replacing but with the time available there is scope to replace it with 12GW of new onshore wind. The positive aspect for the UK in this respect is that the new turbines would draw upon significant technological and energy efficiency improvements that have come to the sector in recent years.

However, the outlook isn't all bad for onshore wind. There are some exciting developments underway, in particular from the commercial sector. Amazon has just agreed the largest corporate wind deal at 50MW from the new wind farm on the Kintyre Peninsula while Tesco has signed three PPAs with EDF for clean energy from two wind farm schemes and several solar installations. Elsewhere Lidl, another retailer, is rolling out EV charging for its customers and using clean energy to power the facility. A general trend amongst business to promote clean energy will likely see PPAs help provide developers with the stability to build more wind capacity.

So, where does that leave Britain? As a country historically the UK has been a great advocate for wind energy, but there are challenges ahead. In particular there is a real need to make sure that the sector receives the right level of support to replace existing infrastructure and continue to grow.

# UK VACANCIES

**Head of Delivery – Battery Storage**
**Location: London**
**Contact: Nathan Quinn – nathan@greenrecruitmentcompany.com**

The Green Recruitment Company are pleased to be partnered with a leading renewable energy developer with a large focus on one of the most innovative new-emerging technologies - Battery Storage.

The compact nature of the business means that the candidate has significant opportunity to develop their career in a friendly, notable environment yet, taking a lead & ownership over a significant, flagship project for the business - with the hope of developing a blueprint to replicate around the country.

**Senior Commissioning Engineer**
**Location: Leeds**
**Contact: Louis Blaser – louis@greenrecruitmentcompany.com**

The Green Recruitment Company are working in partnership with an excellent energy services company that are looking to recruit a senior commissioning engineer. The Senior Commissioning Engineer will assist commissioning engineers in commissioning building energy management control systems within commercial buildings and overseeing complex projects and ensuring client satisfaction. The Senior Commissioning Engineer may work independently or part of a team, reporting to a senior manager

**Head of Sustainable Policy & Compliance**
**Location: London**
**Contact: Cory Rogers – cory@greenrecruitmentcompany.com**

The Green Recruitment Company are pleased to be working exclusively with one of the leading innovators within the Sustainability Consultancy space. With a heritage of 100+ years trading & deliverables across sectors from digital security, maritime, utilities & most significantly energy & sustainability – this business has successfully carved its way to the forefront of technical advisory, strategy design and assurance across over 30 different countries.

**Technical Lead – Wind**
**Location: Chester**
**Contact: Andrew Green – andrew@greenrecruitmentcompany.com**

With a primary focus on current projects, the role will include working on wind farm design and layout optimisation, wind resource assessment, meteorological mast data campaigns and associated wind data analysis, appointment and management of external consultants as required and providing advice to the Technical Team and other departments within the Company.

This is an exciting opportunity to work on full lifecycle wind farm projects in the UK and a candidate who has previous experience of working with onshore wind farms is essential.

# PPA in the USA

By Harry Davies, Country Manager (USA), harry.davies@greenrecruitmentcompany.com

**Once Upon a Time in American Clean Energy…**

In Hollywood, big business is often depicted as the villain. From Avatar to the Jurassic World series, there is a recurring theme, big business freed from the shackles of government makes for a terrible environmental impact. In some films the answer to the corporate malpractice is the government, who come in at the right moment to save the day.

The problem for the USA and other western countries in general that clean energy doesn't read like a Hollywood script. National efforts in several countries are falling victim to increasing levels of legislative paralysis making it harder for renewable energy to receive the support it needs. For many proponents of renewables, it feels like initiatives are stuck reading the script of Groundhog Day.

Luckily renewable energy can rely on a different solution from Hollywood. Where a hero can't be found, perhaps an anti-hero will do; enter big business, in 2018, American firms signed 60% of clean energy deals worldwide.

**Why Clean Energy PPAs Make Commercial Sense**

American firms are increasingly turning to PPAs (Power Purchase Agreement) to secure their clean energy needs. Whilst many firms will have a genuine commitment to environmental matters, the truth is that securing clean energy supply has significant benefits for corporate consumers. Beyond the obvious need for more energy for operations, there is a growing awareness of how a clean energy PPA can beneficial:

1. It's important if you want investment; 8 in 10 investors in the USA give serious consideration to sustainability issues when investing. That rises to 9 in 10 investors when the investing decision is made by millennials. Investors are likely to back their convictions over financial trade-offs when considering a sustainable investment.
2. You make what you can sell; consumers are become more aware of the impact of their purchases. Many want to purchase more environmentally friendly services, where one firm has a well-publicised PPA they hold a clear competitive advantage over competitors that don't.
3. Winning the talent war; numerous studies point to workers being motivated to work for and be retained by firms that take sustainability seriously. For many firms a clean energy PPA is a great expression of their commitment to their employees' values.
4. Price; until recently a firms with a cost focus may have avoided clean energy, but 2018 and 2019 have started to see

renewables compete and deliver cheaper energy than the alternative.

Clearly PPAs are also highly beneficial to developers and providers of renewable energy. The long-term stability allows for better investment decisions and potentially larger scale projects.

**Which Companies Are Setting Up Clean Energy PPAs?**

Traditionally the American market was driven by the tech sector, major players such as Microsoft, Facebook, Google and Amazon all have expanding energy needs meaning that they are consistently undertaking energy procurement. In 2018 Facebook alone did 2.6GW worth of deals.

Tech giants aren't however a great example of the growth of the PPA sector, because in their case demand is driven by need. Instead a good place to look is the growth of PPA activity in sectors where major firms are transitioning away from fossil fuel derived energy and switching to clean energy.

In fact to look at the success of clean energy PPAs, is to consider how much it touches the American way of life. Few would argue that there are any more American activities than driving a car, having a beer and watching (American) football. In the last year all three activities have seen clean energy activity; Honda has agreed the largest automotive PPA in the USA (320mw), by 2021 brewer Anheuser-Busch will be entirely powered by renewable energy and Enel are supplying clean energy to Gillette Stadium home of the New England Patriots.

Although we gave politicians a hard time in the introduction to this article, there is a lot of good work taking place at city level in the USA. Los Angeles provides a great case study in civic use of PPAs; the Los Angeles Department of Water and Power's Board of Commissioners voted to approve power purchase agreements for close to 600 MW of solar and energy storage from a massive hybrid project in California's Central Valley. The 25-year PPA essentially funds construction of the Eland Solar and Storage Center, which L.A. Mayor Eric Garcetti's office touted as the largest solar and battery storage system in the U.S. The agreements are still subject to City Council approval.

**What are the longer-term challenges to PPAs in the USA?**

There are two long term challenges for PPAs in the USA. The first one will be availability; this is because the situation isn't just about transitioning the power that is being used; it is about satisfying increasing demand. Outside of the USA, Denmark has experienced this problem with tech giants taking such a high proportion of new clean energy capacity that it has shut smaller firms out of buying renewable energy. The answer will be a complex mix of improved energy efficiency, increasing capacity and rules on access, the USA is a way off this problem, but it will encounter it at some stage.

The second problem is that renewable energy may become a victim of its own success. Earlier we discussed price as a factor in why clean energy's appeal, however prices keep falling and firms will become increasingly reluctant to sign up to long term deals that fix prices for 10 or 20 years if those prices are likely to fall. The future may see the rise of shorter term PPAs and alternative contract structures in the direction of merchant power.

Despite the challenges, PPAs represent a great opportunity for clean energy in America. They will help to drive forward the necessary infrastructure to support the sectors growth and give it the stability to continue to compete with more environmentally harmful alternatives.

# Caribbean Power Grid Resilience: Importance of Data and Complex System Analytics

By Ian Gilmour, Regional Partner (Caribbean)
Ian.gilmour@greenreruitmentcompany.com

Grid Resilience is an urgent priority, largely (1) due to anthropogenic crises impacting the ability of bulk power systems to withstand extreme weather, accelerated by:

- Changes in the physics of natural systems, leading to higher frequency and severity of extreme weather (storms, fires, flooding);
- Degradation of natural system buffers, which mitigate the impact of extreme weather (coastal - mangrove and wetlands; inland – floodplains, forests and jungles)

This article addresses the role of software techniques influencing infrastructure investment which is intended to increase Power Grid Resilience.

**Primer on Resilience**

The main definitions and standards in this domain are provided by the Electrical Power Research Institute (EPRI), and the nuances in measuring Resilience and Reliability:

- Resilience is defined as the ability for an element/system to return to its original form. In this context it is the "ability to avoid or withstand grid stress events without suffering operational compromise or to adapt to and compensate for the resultant strains so as to minimise compromise via graceful degradation"(2). It is a measure of what *didn't* happen.
- Reliability is a measure of what happens when resilience fails. Key metrics in measuring reliability are frequency of interruption in supply, and timescale for service restoration.

The traditional (EPRI) factors used to define Resilience are *Prevention*, *Recovery (3)* and *Survivability*, with Prevention a measure of system "hardness" and asset health and Survivability measuring capacity and efficacy of the Grid (4).

**Importance of Complex System Analytics**

Traditional strategies, when upgrading Power Grids, focus on infrastructure design, regulations and availability of finance. However, the delivery of improvements should be optimised by consulting sophisticated models. Inputs into these models require taxonomies to classify automated, real-time, granular data feeds e.g. SCADA, GIS Models, environmental data and human factors.

Models can measure the impact of different states of the system (e.g. asset health) and how that affects hardness, capacity and efficacy of the Grid under simulated states of Stress. These insights will then direct investment into physical infrastructure, improving Return on Investment as observed Resilience increases over time. Other simulations can be evaluated, including "natural climate solutions"(5), new Grid structures (e.g. micro grids), Smart Grid strategies, District Cooling, etc

Models are at their best when the inputs are in real-time and augmented by parallel domains such as weather. However, sophistication in modelling is expensive and often out of reach for all but the best resourced organisations.

**Best practice and the role of open source**

Complex System Analytics is a multi-disciplinary endeavour, with teams at Argonne National Laboratory providing an example of what is possible in this field (6). However, the sophistication seen in Argonne is not possible for utilities in the Caribbean, many parts of Asia and Africa. Fortunately, many tools are being open sourced (7) and with the growth in the availability of computer studies students in emerging markets, the cost of leveraging these techniques is falling year-on-year.

Footnotes: (1) Cyber security is another rapidly growing attack vector, (2) P3, Electric Grid Resilience and Reliability for Grid Architecture, March 2018, JD Taft, PNNL-26623, (3) Recovery is arguably more of a Reliability factor, (4) Page 7, ibid, (5) see Greta Thunberg and George Monbiot literature, (6) See Agonne's Hurricane Electric Assessment Damage Outage (HEADOUT) tool as an example, (7) examples include Waggle and Open-Source Distributed System Platform (OpenDSP)

# USA VACANCIES

**Senior Energy Analyst**
**Location: Minnesota**
**Contact: Harry Davies – harry.davies@greenrecruitmentcompany.com**

The Green Recruitment Company are working in partnership with a leading US Independent Power Producer based in the state of Minnesota. The company are looking to hire a Senior Energy Analyst. This role will be critical in project development, financing, sales, interconnections and due diligence.

**Supply Chain Associate – Solar**
**Location: Charlotte, NC.**
**Contact: Harry Davies – harry.davies@greenrecruitmentcompany.com**

This is a unique opportunity to join a successful international Renewable Energy developer and operator with core interests in Solar and Wind. They are currently developing a 1.4 GW portfolio across Europe and The United States. The Supply Chain Associate with work alongside the EPC team to ensure smooth coordination and relationship management across all parties, suppliers and contractors. Day to Day responsibilities will include purchase order management, material release, logistics and delivery management, supplier communications, RFP analysis and project status reporting for scope of work. This is an integral function where you will act as the interface with the engineering team, project controls, construction managers, and other team members to ensure a successful project execution.

**Senior Director of Regulation and Energy Markets**
**Location: Washington DC**
**Contact: Harry Davies – harry.davies@greenrecruitmentcompany.com**

We are representing a successful Renewable Energy Developer and Operator. Our client have a national footprint and a diverse customer, investor, and partner base. The Company has financed or developed over $2 billion (more than 850 megawatts) of solar energy assets to date. This position will work directly with the project finance and trading teams and the CEO to help cultivate business development opportunities in key states and to defend business interests through policy advocacy and lobbying.

**VP of Risk Management & Trading Operations - Renewable Energy**
**Location: Washington DC**
**Contact: Harry Davies – harry.davies@greenrecruitmentcompany.com**

Reporting directly to the CEO this is a superb opportunity to join a leading, dynamic and entrepreneurial solar PV development business. The VP of Risk Management & Trading Operations will focus on two key principles; managing risk and overseeing operations for the trading team. With over 800MW of Solar funded and developed and with 600MW under operation, this independent, employee owned IPP are looking for an individual who shares their passion for making a significant impact on climate change.

# Have We Seen Peak Coal in South East Asia?

By Qihan Geng, APAC Lead, qihan@greenrecruitmentcompany.com

South East Asia is an area that fascinates outsiders, an increasingly important trade and innovation hub, it is seen as an area of great economic opportunity. In the last year the digital economy of South East Asia grew 39% to hit the milestone of $100bn per annum. I've previously also written of the amazing boom in the solar energy market in Vietnam. However, it may shock a lot of people to learn that South East Asia is in fact the only place in the world where coal has a growing share of the energy mix. Three of the top 10 coal power pipelines are found in South East Asia and Indonesia, the world's fifth largest fossil fuel producer has built new coal power plants as recently as this year. Given the vulnerability of the region to climate change, this coal dependency for the region is quite stunning. In this article, we will look at two different countries in South East Asia (Indonesia and Cambodia) and how they are trying to transition to cleaner energy.

**Indonesia – Geothermal Energy**

Indonesia is a good place to start looking at renewable energy in South East Asia. Indonesia faces some of the most unique challenges for energy infrastructure. The fourth most populous country in the world and the largest island nation, the country is made up of over 17,000 islands. The country is home to significant natural resources which has probably contributed to a historic reluctance to abandon fossil fuels, in fact fossil fuels account for 88% of Indonesia's energy mix.

However, moves are being made to help transition the country to clean energy. A significant move came last year, Indonesia came up with an innovative move in Islamic Finance with the first sovereign green sukuk, a bond that complies with the sharia, Islamic religious law. The government has also secured funding from the World Bank to develop geothermal energy options which are seen as crucial if the country is to reach its target of 23% renewable energy by 2025. Indonesia is already home to 1.9GW of geothermal energy and will aim to add a further 4.6GW.

Beyond geothermal there has been some controversy surrounding a 200MW floating solar scheme at the Cirata Dam, with uncertainty over the results of a tender process for the project. More promisingly there are some interesting wind schemes coming to Indonesia. However, the country will continue to struggle because it is made up of so many islands and so many island grids. A long-term hope is that marine based energy systems develop better yields and efficiencies in the future which would play to the strength of Indonesia.

**Cambodia – Solar and Bioenergy**

I've previously written about Vietnam, another major coal user in the region, so thought it would be interesting to look at it's neighbour Cambodia. On the surface Cambodia might

seem a strange choice. Afterall Cambodia in 2018 generated 62% of its energy from renewable sources. However, most of that generation comes from hydropower, which is hard to expand beyond its current threshold and like most of South East Asia, Cambodia has a fast-growing economy and that requires energy, which has been satisfied by coal imports.

The Cambodian government should be credited with a forward-looking attitude to clean energy. The country has made undertaken several initiatives to increase its renewable energy capability. With solar energy there has been a scheme running since 2012 to bring solar power to rural homes. Support for solar has also been forthcoming from the Asia Development Bank which has previously funded a 10MW scheme and has recently provided funding for a 100MW scheme.
Elsewhere Cambodia has been very active in exploring biofuels and biogas. The UN is leading a biogas scheme to support rural areas, whilst Chinese and Malaysian investors are helping to develop biofuel from rice husks and old rubber trees.

It is likely that solar will make the biggest difference for Cambodia in moving away from coal.

**Conclusions**

The most encouraging sign for South East Asia is that new coal plants are being built at a decreasing rate over the last two years. The challenge for South East Asia is twofold, the first problem is a global issue, how do countries manage economic growth and do so cleanly. It's a significant problem, in more developed economies more data intensive industries are soaking up new renewable energy capacity and for developing economies the lure of coal to aid economic growth can be too strong to resist. The second challenge is more local e.g. Indonesia has unique challenges, no other country has to contend with so many islands. There are some common solutions, the first is good international support, loans and funding from the ADB and World Bank are helping to develop clean energy resources. The second trend is seen from Cambodia, where the country is engaging well with the private sector to help develop new projects. As long as the will remains to push forward with a clean energy transition then we have hopefully seen peak coal in South East Asia.

# ASIA VACANCIES

**Procurement Manager**
**Location: Shanghai**
**Contact: Qihan Geng – qihan@greenrecruitmentcompany.com**

Our client is a world leader in the global energy market. This is an excellent opportunity for a Procurement Manager with extensive Renewables experience, to be responsible for PV Module procurement activities in Asia for Solar Utility scale projects worldwide.

**Contracts Control Manager**
**Location: Beijing**
**Contact: Qihan Geng – qihan@greenrecruitmentcompany.com**

Our Client is a leading Renewable Energy Manufacturing Company. They design and manufacture wind energy equipment, including wind turbines & gearboxes. They also provide maintenance and reconditioning services. The Contract Control Manager is designed to assist the sales team with commercial opportunities, whilst preserving the group interests and ensuring group contracting and reporting guidelines are executed across the region.

**Technical Supervisor – Wind Turbine Production**
**Location: Shanghai**
**Contact: Qihan Geng – qihan@greenrecruitmentcompany.com**

Our Client is a leading Renewable energy manufacturing company. They design and manufacture wind energy equipment, including wind turbines, gearboxes, they also provide maintenance and reconditioning services.

The Technical Supervisor role is to ensure that customer requests for services can be supported adequately and efficiently. The principal responsibility will be ongoing assessment of skills required to support the regional market and identification of associated gaps.

**Finance Manager**
**Location: Shanghai**
**Contact: Qihan Geng – qihan@greenrecruitmentcompany.com**

Our Client is a leading manufacturing company in the renewable energy sector, currently looking to take on a Finance Manager to supervise the finance operation of a subsidiary company. The role is an exciting opportunity to work with a leading business in the sector.

# Australian Renewables; better than 2020 vision

By Tim Hall, Country Manager Australia, tim@greenrecruitmentcompany.com

**A Major Milestone**

In early September there was significant excitement in Australia for the renewable energy sector. A year ahead of schedule Australia had reached a milestone of 6,400MW needed to achieve the 2020 large scale clean energy target – a milestone that was passed on 30th August 2020. The achievement completed a target set out in 2001 (and revised in 2015), comes at a curious time for Australian renewable energy. When the target was first set and later revised there was a greater spirit of bipartisan political cooperation for renewable energy whereas now many would argue that politics hinders rather than helps the cause of renewables.

As a country that feels the brunt of climate change, Australia has struggled with drought and unseasonably early bushfires and there is perhaps an awareness that despite being ahead of target there is still a lot more to do. This article hopes to look at what is next for Australian renewable energy.

**Thinking Global but Acting Local**

Australians take climate change seriously. A poll from earlier this year saw 64% of Australians rank climate change as the biggest challenge facing Australia. The threat is viewed seriously enough that of the 64%, 61% feel that steps should be taken to combat climate change even if it involves significant costs. As regular Australia watchers will know, many considered this year's elections as a referendum on renewable energy, however that was a misconception, the election was a complex affair and issues such as tax played a much bigger role. However, the election did have a significant knock on effect for clean energy, it put a pro-coal government in power and effectively removed national level leadership for clean energy.

In most countries this national level attitude would be problematic, but Australia is blessed with a myriad of strong local identities – if you're not sure of this watch any game of Rugby League in the State of Origin series! Its fair to say that there is a healthy rivalry between Australian states and cities and that with a dearth of national leadership, it is local politicians who are putting down markers for clean energy. Key moves in this area include:

- On the 1st January 2020, Canberra the Australian Capital will switch to 100% renewable energy.
- New South Wales has become home to the first community owned social enterprise energy retailer in Australia; Enova Community Energy.
- New South Wales local government is taking a very different line from its national party and is pushing for

greater levels of renewable energy investment.
- The recent Future North report is pushing for Queensland to set up its own Green Bank to help develop the vast renewable energy potential of the north of the state.

Overall it is likely that local level actions will play a major part in driving the progress of renewable energy. What may be more significant in the longer term however is that this local action may make it harder for a national government to own strategy in the longer term. A good example of this is in Western Australia, where Horizon Power is a state-owned utility. Like many utility firms the major impact felt from a lack of national leadership comes from the lack of grid modernization (a similar problem is emerging in the USA). Horizon Power has found a way to beat grid connectivity issues, its pulling down the poles and wires and switching to microgrids and standalone power systems instead. This looks to be a long-term trend for Australia which has often struggled with a national grid given the remoteness of many communities. When the grid becomes decentralised through being dismantled, it is hard to see how federal government will be able to exert real influence on what will be local energy.

**700% Renewable Energy**

The famous painter Michelangelo was said to have remarked "The greater danger for most of us lies not in setting our aim too high and falling short; but in setting our aim too low and achieving our mark." It turns out that Alan Finkel (Australia's Chief Scientist) and Darren Miller (CEO of ARENA) are both advocates of Michelangelo's philosophy, in the recently unveiled National Hydrogen Strategy they have advocated for Australia to build towards 700% renewable energy capacity.

The key point here is that of hydrogen as a clean energy source if it is generated using solar and wind power. There is rapid recognition that Australia could become a major player in the wider APAC region for hydrogen exports since Australia has abundant land for large scale renewable energy projects required for hydrogen production whereas likely customers such as Japan and South Korea are land poor and are very interested in hydrogen to help meet their energy targets. Nor is Australia purely focused on hydrogen, a new scheme in the Northern Territory worth circa AUS $20bn seeks to connect Singapore to a major solar scheme outside of Tenant Creek.

What is clear is that Australia is charting a very different course for itself than what has been seen before in renewable energy. It will become a major global centre of low-cost energy in a zero-carbon global economy.

**A Long Term Vision**

It would be fair to say that Australia is succeeding in spite of some self-created obstacles. The medium-term challenge will be to see how the industry handles proactive negativity from individuals such as Angus Taylor (the energy minister) and what support will be offered to help develop the growing zero carbon economy. Ultimately the sector in Australia is mature enough to not need support in the form of subsidies, but a measure of certainty from federal level would go a long way.

# AUSTRALIA VACANCIES

**Project Development Engineer**
**Location: Sydney**
**Contact: Tim Hall – tim@greenrecruitmentcompany.com**

An international IPP, who have been operating in Australia for the past two years are seeking a Project Development Engineer for their growing Central Sydney team. The company have an impressive range of solar projects in various stages of development and want to expand their portfolio by hiring a Development professional.

**Property Manager**
**Location: Sydney**
**Contact: Tim Hall – tim@greenrecruitmentcompany.com**

An international renewable development company with a long history in Australia are seeking a Property Manager for their Sydney offices. You will sit across the wind, solar and storage teams providing property management expertise and leading by authority. You will lead on land agreement negotiation and will oversee managing the land acquisition process for the company, supported by a wider legal team.

**Project Manager**
**Location: Melbourne**
**Contact: Tim Hall – tim@greenrecruitmentcompany.com**

An international renewable energy company are recruiting for a Project Manager for their Melbourne office to work on their incoming Utility scale solar PV projects. This global leader in holistic Solar PV solutions has an impressive portfolio of solar projects across Victoria and are seeking a Project Manager who will be responsible for the delivery of solar PV projects project approval to handover. This is a brand-new role that has arisen due to new a growing project portfolio and it will provide fantastic exposure to a variety of solar projects in Victoria

**Asset Manager**
**Location: Sydney**
**Contact: Tim Hall – tim@greenrecruitmentcompany.com**

An international renewable development company with a long history in Australia are seeking an Asset Manager for their Operations team. As Asset Manager you will oversee several renewable energy assets in the company's Australian portfolio, ensuring adherence to practice for safety, compliance, quality and environmental performance, whilst maximising revenue and enhancing community and stakeholder engagement throughout the project lifecycle. This is a brand-new opportunity in a growing operations team and will provide exposure to a number of assets and technologies

# Spanish Renewable Energy - Not Just Tilting at Windmills

By Harry Moncur, Head of European Solar, harry.moncur@greenrecruitmentcompany.com

With the exception of the Netherlands, few countries can claim to have such an enduring love affair with the windmill as Spain. Cervantes' masterpiece of literature, Don Quixote, is famous for the protagonist tilting at windmills. From the 17th century to the 21st century Spain has continued a love affair with the windmill as is recognised as a major player in wind energy. So great is the association of Spain and wind energy that the success of Spanish solar is often been overlooked.

Spain was one of the first to pursue large scale solar projects and the first country to trial Solar CSP. It famously installed 2.6GW of capacity in 2008 and was at peak second only to Germany in installed capacity. After a lacuna of nearly a decade with very little new solar installation, Spain is once a hot market for solar.

**The Fall and Rise of Spanish Solar**

In 2018 Spain installed nearly 262MW of new Solar PV capacity, in context that was 94% more than in 2017 and over five times more than in 2015. Spain's emergence as a leading light of European solar, is a welcome change of direction. In the early 2010s, a decision to retroactively cut feed in tariffs left Spanish solar in a precarious position for a number of years. So the question is what has changed, that is enabling a solar renaissance in Spain?

**Behind the Meter Growth**

Spain has pushed an agenda of solar energy self-consumption. A change in regulation, means that homeowners are no longer charged for delivering energy to the grid, as a result self-consumption accounted for 90% of all installed solar capacity in Spain last year. A second boost to self-consumption came with the creation of the concept of 'communal self-conception' which allows consumers to use energy generated from nearby, removing the need for the solar panels to be on the building which uses it adding greater flexibility for these new energy 'prosumers'. The policy changes have proven popular with rural communities and the agricultural sector.

**New Technology**

The success of self-consumption has in part been driven by a restriction on PV operators through a higher fixed element (compared to the rest of Europe) for current power billing. The industry is levying the government for changes but in the meantime is benefitting from better technology which is delivering greater efficiency. Spain's previous peak solar market was pre-2010 and happily solar technology has come a long way since.

A particularly pleasing project for solar watchers in Spain is the 300MW Talasol Project in Talaván, Cáceres. The scheme being run by EPC Contractor METKA EGN has recently announced a module supply deal with Jinko Solar. Jinko are supplying their ultra-high efficiency module the Cheetah module. Spain is certainly benefitting from technology gains which are helping utility scale projects become more competitive.

**An Attractive Market for Foreign Ventures**

Spain's return to solar prominence has coincided with the emergence of a European market for subsidy free solar. The free market has been buoyed over the last few years by increasing impressive growth targets for Spanish solar. A sign of the faith in the sector can be seen in the recent announcement by Forestalia Renovables that it has a 3GW pipeline of projects in Teruel, split between Solar PV (55%) and Wind (45%); Teruel is renowned for its sparse population, half its municipalities have a population below 200 people and overall it has a population density of 9.36/km².

Equally important is the emergence of a PPA market in Spain. Notable recent deals include PPAs for Heineken, Encavis as well as several deals for Audax this last year. Long term PPA deals are bringing sustainability and a ready market for subsidy free solar schemes.

**Learning from the Past**

Perhaps the most reassuring aspect of Spain's solar resurgence is the maturity in which it is being approached. There is a clear awareness that Spain's solar sector has had a previous bubble burst and the industry is working hard to make sure this current boom operates in a more sustainable fashion

# EUROPE VACANCIES

**Project Development Manager**
**Location: France**
**Contact: Harry Moncur – harry.moncur@greenrecruitmentcompany.com**

This is a rare opportunity to join one of Europe's leading renewable energy development companies with a key focus on their continued expansion. This key hire will be focusing on the development of utility scale solar in France. It essential that prospective candidates have prior knowledge of the local market, speak fluent French and are able to lead on the full project development lifecycle.

**Specialist Wind Technician**
**Location: France**
**Contact: Andrew Green – andrew@greenrecruitmentcompany.com**

The Green Recruitment Company are working in partnership with a leading French renewable energy company. They work with multiple renewable technologies across the full project lifecycle. The group have a strong track record in emerging markets such as Africa & Central America as well as Europe.

The group are looking to hire a specialist wind technician with a minimum three years' experience.

**Project Developer**
**Location: Munich**
**Contact: Harry Moncur – harry.moncur@greenrecruitmentcompany.com**

The Green Recruitment Company is representing a leading renewable energy developer who has an impressive track record internationally. Further team growth has brought about an opportunity for a renewable energy developer to focus on both greenfield and brownfield opportunities. They will provide coordination for all development activity within the region & liaise closely with JV partners/external consultants in the planning process.

**Nordic Power Portfolio Manager**
**Location: Dusseldorf**
**Contact: Tom Brookes – tom.brookes@greenrecruitmentcompany.com**

The Green Recruitment Company are working with a multi-national Energy Supplier who are looking to recruit a Power Portfolio Manager to help change the world of energy. You will be working within a team of experts accountable for the commercial steering and optimisation of the Nordic Power portfolio. You will drive the profitability of the end-to-end power business in the Nordics, by understanding and influencing the commercial risk exposures.

# Get ready for the Hydrogen Boom!

By Tom Brookes, Head of Energy Supply and DSR
tom.brookes@greenrecruitmentcompany.com

On May 6 in 1937, New Jersey became home to one of the most widely known disasters in history – the Hindenburg disaster. The German passenger airship exploded with 36 fatalities and the most widely accepted hypothesis for the cause of the explosion was that the hydrogen used for buoyancy had been ignited by a static spark. A radio broadcast of the event was made famous by Herbert Morrison exclaiming on air “Oh, the humanity”. Aside from the significant human tragedy of the day, it was also a disaster for the reputation of hydrogen.

The world today however faces a new challenge; the serious negative effects of burning fossil fuels, and the need to use more environmentally friendly, clean energy. Among these technologies, Hydrogen Energy Storage and Fuel Cells seem to have the most promising future.

Recent technological developments are promising a better economic viability to the hydrogen production process, its non-pollutant fuel condition and its facility to storage and transporting are making green hydrogen highly attractive as an alternative to fossil fuels. Everything suggests that we are witnessing the start of a hydrogen-use boom. The aim of this article is to help provide a good introduction about hydrogen utilization as a reserve energy, as well as a non-polluting fuel. We will also look to briefly explain the key developments and limitations of the technology.

**What is hydrogen?**

Hydrogen is the most abundant chemical element in the universe. In its pure state, it is a non-toxic, odourless and colourless gas. Even though there are no hydrogen deposits in its pure state in the earth's crust, its combination of two hydrogen atoms with one oxygen atom produces the most abundant substance on the planet: water. It is highly flammable and has a high specific energy.

**What is Hydrogen Energy Storage?**

There are multiple methods of energy storage, which depend on the type of energy to be stored, which can be: Chemical, Biological, Electrochemical, Electrical, Mechanical, or Thermal energy.

Hydrogen Energy Storage is a chemical energy storage method that consists of obtaining Hydrogen from water, through the electrolysis process, and storing it in special containers or tanks, for future use as a fuel source. The stored hydrogen can then be used to produce electricity, either in large thermoelectric plants or in fuel cells for cars and other transports.

**Why it works as energy storage?**

Hydrogen works as an energy store because several reasons:

- It has a very high *specific energy* or energy value per unit mass (between 120 and 142 MJ/kg or 33.3 kWh/kg), almost 3 times the value of gasoline (44 MJ/kg or 12 kWh/kg) and other fuels.
- Its combustion with oxygen only produces heat and water as waste, so it is non-polluting. According to a study conducted by McKinsey, for the *Hydrogen Council*, hydrogen could reduce CO2 emissions by around 6 metric Gt, based on 2017 values.

- The main process used for its production, water electrolysis, is a relatively simple and technologically mature process. At present, technological advances have been developed that make this process more efficient and economical.
- Storage and transportation can be done safely. It can be stored in a gaseous state in high-pressure metal tanks, or in a liquid state (for which cryogenic equipment is used).

**What makes hydrogen "green hydrogen"?**
Although hydrogen is a colourless gas, the term "**green hydrogen**" is applied to the hydrogen produced using non-polluting energy sources (such as solar or wind) to generate the electrical energy required in the Electrolysis process.

**Hydrogen as a fuel**
Hydrogen can be used as fuel, either burned on a large scale (as in thermoelectric plants), or on a smaller scale in fuel cells for electric cars and other transportation.

As mentioned earlier, hydrogen has one of the highest specific energy values of all known fuels (between 120 and 142 MJ/kg). This factor, together with the absence of polluting emissions and the high efficiency of the fuel cells used in cars, make it very attractive as a fuel source.

According to the Alternative Fuels Data Center (AFDC) of the U. S. Department of Energy (DOE), a hydrogen fuel cell coupled to an electric motor is between two to three times more efficient than an internal combustion machine running on gasoline. There are several types of fuel cells that work with hydrogen, the Polymer Electrolyte Membrane (PEM) fuel cell type being the most used in automobiles.

**Key future developments in green-hydrogen economy:**

**Electrolysis improvements**
Existence of hydrogen in a natural state is very scarce. Expensive industrial processes are necessary to obtain it. Currently, these processes aren´t that efficient and mostly employ polluting energy sources. Water electrolysis is one such processes. It consists in circulating an electric current through water in a tank that causes evaporated hydrogen and oxygen to split, these are then collected and packed in pressurized vessels.

The main disadvantage of electrolysis is its high production cost. Electrolysis is energy intensive. It also requires the use of highly expensive and scarce metal catalysts, such as platinum and iridium. These catalysts aren't able to withstand for a long time the high temperatures or the highly acidic environment present in the process.

Technological advances in increasing efficiency and reducing the electricity cost production through photovoltaic cells and wind energy have improved the use of electrolysis. Many facilities are already using non-polluting solar and wind energies to generate the necessary electricity in this process.

One of the most ambitious proposals in this regard is that of the joint team between Tractebel Engineering and Tractebel Overdick. These engineering firms claim they have developed a technology to produce hydrogen through electrolysis, using reconditioned offshore platforms powered by wind farms near these platforms.

Recently, researchers from the School of Chemistry at *M*onash University, in Australia, led by Dr. Alexandr Simonov, have gone public

with the discovery of more economical and resistant catalysts than platinum and iridium. The researchers engineered a self-recovering system, in which it is possible to reuse the dissolved electrode-material. In traditional electrolysers, this material can't be reused.

A similar project involving a team of researchers from the University of Arkansas, United States, led by professors Jingyi Chen and Lauren Greenlee, recently published in the journal Nanoscale their discovery that the use of nickel and iron-based nanocatalysts help to weaken the links between oxygen and hydrogen, allowing their separation to be faster. This discovery and its subsequent scalability for industrial use would make the electrolysis process more efficient and less expensive.

**Commercial interest for green-hydrogen powered vehicles**

In the transportation sector there is an increasing interest in the reduction of carbon dioxide ($CO_2$) emissions by different players in the sector. This interest has been mainly motivated by the urgent need to meet the goals established in the 2015 United Nations Climate Change Conference, COP 21 (Paris Agreement). According to the United Nations Climate Change website: "*The Paris Agreement central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius."* One of the main leads in this regard has been the creation, in January 2017, of the Hydrogen *Council*, "*the largest industry-led effort to develop the hydrogen economy*". This Council has been constituted by the principal companies across the entire value chain associated with transportation, industrialization, energy sources, and hydrogen production and distribution.

By November 2017, this *Council* published a remarkably interesting report "Hydrogen Scaling-UP Study" that includes all the short, medium and long-term projections and actions necessary to meet the goals of the *Paris Agreement*. Among these projections, the following stand out in the transportation sector:

- Medium and large-sized hydrogen-powered vehicles will be available for sale in the next 5 years from 2017. Then, when costs go down, smaller vehicles will be marketed.
- *The Fuel Cell Electric Vehicles (FCEVs)* will be the most commercialized, since they are the ones that best meet the performance requirements.
- An equivalent percentage to 8,33% (1 in 12 ) of all cars sold in California, Germany, Japan, and South Korea could be powered by hydrogen by 2030. Likewise, the Council estimates that *"more than 350,000 hydrogen trucks could be transporting goods, and thousands of trains and passenger ships could be transporting people without carbon and local emissions".*
- By 2050, hydrogen would cover 18% of global energy demand; The CO2 emission will reduce by 6 Gt; Hydrogen and equipment sales would reach about US $ 2.5 trillion and up to 30 million jobs would create in the sector.

Germany's BMVI (Federal Ministry of Transport and Digital Infrastructure) has taken action that demonstrates the commitment to green-hydrogen development as a replacement for fossil fuels in the European transportation.

The BMVI recently approved €23.5 million to finance several hydrogen mobility projects such as a hydrogen-powered bus, a fuel-cell-powered street sweeper, forklift trucks and a fleet of 50 fuel cell vehicles to tap into a popular urban mobility concept: ride pooling, a comfortable and secure shared-trip service designed to decongest traffic in highly inhabited cities. Andreas Scheuer, Minister of BMVI, stated that clean energy sources such

as hydrogen and fuel cells would be fundamental elements in achieving the goal of a transportation system free from the use of polluting fuels.

Similarly, the Korean multinational Hyundai has taken a great step forward in the race towards the green-hydrogen economy, by publicly announcing at its FCEV Vision 2030" Conference that they expect to manufacture up to 500,000 fuel-cell vehicles by 2030, as well as another 200,000 vehicles for industrial use. According to their estimates, by 2030, "*the global market for hydrogen-powered road vehicles will be two million vehicles"*.

Chung Eui-sun, executive vice-chairman of the Hyundai Motor Group states that Hyundai will help hydrogen becomes an economically viable energy source and expands its use beyond the transportation sector, to achieve a global society based on clean energy.

There have been other smaller-scale actions, which confirm that, step by step, the green-hydrogen economy is occupying relevant spaces in the most important cities of the globalized world. One of them is that of the British corporate-taxi company Green Tomato Cars, which has just acquired another 25 FCVE Toyota taxis, to join them to its existent fleet of 27 taxis acquired in 2015.
Jonny Goldstone, founder and CEO of *Green Tomato Cars*, states that both passengers and drivers enjoy the trip and, above all, the pleasant feeling of acting responsibly with the environment.

**A short cut to hitting climate targets**

The election of the new European Commission's president, German minister of defence Ursula von der Leyen, in July 2019, opens up great opportunities to speed up the development of green hydrogen production technologies. Von der Leyen made it clear that climate and environment issues will have priority on her agenda. In the speech previously to her election, the minister promised to increase the short-term objective of reducing greenhouse gases by 2030 from a current 40% to at least 50%, respect to 1990 levels. Von der Leyen also announced the proposal of a "Green Deal for Europe", during her first 100 days. This Deal would include new legislation for Europe to be carbon-neutral in 2050 and the first continent in the world to be climate-neutral.

Experts suggest that, once she takes office in November 2019, one of von der Leyen's first actions would be the revision of gas legislation (gas package) to focus on the so-called "gas decarbonisation package" (GDP). In this new legislation, decarbonisation potential of gas would be prioritized. Replacing coal by gas in coal-fired power plants, as well as increasing the production of green gases, such as biogas and hydrogen produced with renewable energy (solar or wind) would be the GDP's pillars. Due to current high production cost of green-hydrogen, experts believe that the transition from fossil fuels to green hydrogen will be a gradual process.

Economics indicate there will be a transition stage, where blue hydrogen would be the main actor, since its production cost is cheaper than green hydrogen. Though there would be a greater emphasis on carbon capture technology for any blue hydrogen. However, recent and future technological advances to improve the efficiency of both electrolysers and renewable energies will significantly reduce the production cost of green hydrogen; in August 2019 *Bloomberg New Energy Finance* (BNEF) announced that the cost of producing green hydrogen could drop dramatically by 2030, reaching levels that

would make it competitive with the price of natural gas.

**Limitations of Hydrogen as a Technology**

The high production cost is the main obstacle that hydrogen has to overcome to replace fossil fuels.

As mentioned earlier, the electricity-intensive use and very expensive metal electrodes makes the hydrogen production process expensive. As already discussed, this limitation could be overcome thanks to current and future technological advances to improve the efficiency of electrolysers and wind and solar conversion equipment.

Another limitation is that the current hydrogen production process still produces $CO_2$ emissions at a level that is not compatible with future targets for reducing pollutant emissions by 2030, and zero-emissions by 2050. Though most experts remain optimistic that this limitation can be gradually overcome by applying $CO_2$ reduction technologies, such as carbon capture and storage.

It is likely that hydrogen is going to play an increasingly large role in our lives going forward and we should all get ready for the hydrogen boom!

# Final Thoughts

By Dominic Wall, Director
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**Thank You**

Thank you for taking the time to read the latest edition of the Green Insider. We hope you enjoyed reading it as much as we enjoyed putting it together. As a business our consultants are all keen advocates for the green economy and in particular green energy and technology.

**Whilst you're here**

Hopefully you've heard of us before you read the Green Insider. If you haven't then we're the Green Recruitment Company and we have a vision to be the premium provider of global recruitment solutions to the green energy and technology sector.

We remain committed to offering the best possible recruitment experience for our candidates and clients. We augment traditional recruitment methods with the best of new technology to offer an innovative hiring process. Our team can offer video interviewing, competency and psychometric testing as well market research alongside executive search, permanent and freelance recruitment.

The Green Recruitment Company have been successful placing industry influencing individuals literally all over the world. There have been placements in Berlin, Amsterdam, Madrid, Munich, Paris, Sydney, Dubai, New York, Sao Paulo, Beijing, Tokyo and Shanghai (just to name a few!) - we have completed retained search assignments for industry leading companies (big and small) in Energy Finance, Renewable Energy, Energy Storage and Electric Vehicles. We take great joy in facilitating the transition to a cleaner, greener international energy mix.

Once again, we'd like to thank you for reading and we hope to be in touch again in the future!

Best Wishes,

Dominic Wall
Director

# THANK YOU FOR READING

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